THÜNEN

Innovative Research for Organic 3.0
Volume 2

Proceedings of the Scientific Track
at the Organic World Congress 2017

November 9-11 in Delhi, India

G. Rahmann, C. Andres, A.K. Yadav, R. Ardakani, H.B. Babalad, N. Devakumar, S.L. Goel, V. Olowe, N. Ravisankar, J.P. Saini, G. Soto, H. Willer

Thünen Report 54

Bibliografische Information:
Die Deutsche Nationalbibliothek verzeichnet diese Publikationen in der Deutschen Nationalbibliografie; detaillierte bibliografische Daten sind im Internet unter www.dnb.de abrufbar.

*Bibliographic information:
The Deutsche Nationalbibliothek (German National Library) lists this publication in the German National Bibliography; detailed bibliographic data is available on the Internet at www.dnb.de*

Bereits in dieser Reihe erschienene Bände finden Sie im Internet unter www.thuenen.de

Volumes already published in this series are available on the Internet at www.thuenen.de

Zitationsvorschlag – *Suggested source citation:*
Rahmann G, Andres C, Yadav A K, Ardakani R, Babalad H B, Devakumar N, Goel S L, Olowe V, Ravisankar N,Saini J P, Soto G, Willer H (2017) Innovative Research for Organic 3.0 - Volume 2 : Proceedings of the Scientific Track at the Organic World Congress 2017 November 9-11 in Delhi, India. Braunschweig: Johann Heinrich von Thünen-Institut, 323 p, Thünen Rep 54, Vol. 2 DOI:10.3220/REP1510908963000

THÜNEN

Thünen Report 54 - Volume 2

Herausgeber/Redaktionsanschrift – *Editor/address*

Johann Heinrich von Thünen-Institut
Bundesallee 50
38116 Braunschweig
Germany

thuenen-report@thuenen.de
www.thuenen.de

ISSN 2196-2324
ISBN 978-3-86576-178-1
DOI:10.3220/REP1510908963000
urn:nbn:de:gbv:253-201711-dn059308-2

Innovative Research for Organic 3.0
Volume 2

Proceedings of the Scientific Track
at the Organic World Congress 2017

November 9-11 in Delhi, India

G. Rahmann, C. Andres, A.K. Yadav, R. Ardakani, H.B. Babalad, N. Devakumar, S.L. Goel, V. Olowe, N. Ravisankar, J.P. Saini, G. Soto, H. Willer

Thünen Report 54

with support from
GOVT. OF INDIA
Ministry of Agriculture and Farmers Welfare
National Centre of Organic Farming
Hapur Road, Kamla Nehru Nagar, Ghaziabad-201002
Phone: 0120-2764-2764906, 2764212, Fax: 0210-2764901; Email: nbdc@nic.in
Website: http://ncof.dacnet.nic.in ; http://pgsindia-ncof.gov.in

Editors:
Gerold Rahmann,
Christian Andres,
A.K. Yadav, Reza Ardakani,
H.B. Babalad,
N. Devakumar,
S.L. Goel,
Victor Olowe,
N. Ravisankar,
J.P. Saini,
Gabriela Soto,
Helga Willer

Prof. Dr. Gerold Rahmann (Editor)
Thünen Institute of Organic Farming
Trenthorst 32
23847 Westerau
E-Mail: gerold.rahmann@thuenen.de

Thünen Report 54 - Volume 2

Braunschweig/Germany, im November 2017

Foreword

Innovative Research for Organic 3.0

The future challenges in food production and consumption appear clear:

- Feed 9 to 11 billion people in the next 30 to 80 years with enough, affordable and healthy food.
- Protect the environment (e.g. soils, water, air, biodiversity and landscapes) whilst increasingly under pressure to achieve greater levels of intensification.
- Mitigate greenhouse gas emissions and adapt to climate change in all farming systems and value chains.
- Incorporate novel ethics, food habits, demographics and lifestyles into the food chains.
- Produce food on limited farmland and fossil (non-renewable) resources efficiently and profitably.

Several findings from scientific research and practical applications suggest that organic food and farming systems can help in tackling these future challenges.[1]The 'low external input' approach, risk minimizing strategies and ethically accepted production practices of organic food and farming systemscan help to produce more affordable food for an increasing number of people while minimizing environmental impacts. However, resource efficiency, low-meat diets and reducing food waste are also essential factors that have to be considered.

From a global perspective, organic food and farming systems is still a niche sector, as less than 1% of global farmland is managed organically and only a small proportion of the global population is consuming organic food in significant amounts. Production yields are relatively low, and the goals of organic food and farming systems, described in the principles and standards, are not achieved on every farm. This needs further development based on scientific evidence and good management practices.

A lot has been done already to develop organic food and farming systems. Nevertheless, to assure, that organic food and farming systems becomes a significant part of the solutions for the future challenges in the food and farming sector, there is still much to do.

The Scientific Track at the Organic World Congress 2017 in Delhi, India, will contribute to the global discussion on Organic 3.0, and taking the opportunity to answers some of the challenges in the context of the Indian subcontinent in particular. After a double-blind review, done by 120 reviewers from various disciplines from many experienced research institutions throughout the world, about 183papers from 50 countries have been accepted.

All the papers in these proceedings can be also foundon the database "Organic Eprints" (www.orgprints.org).

The Scientific Board of the Organic World Congress 2017 Delhi, November 2017

[1]A review paper about the Organic 3.0 discussion can be found under Rahmann, G., Reza Ardakani, M., Bàrberi, P. et al. (2016): Organic Agriculture 3.0 is innovation with research. Org. Agr. 7 (2016):3, pp 169-197, doi:10.1007/s13165-016-0171-5.

Science Board for the Science Track of the Organic World Congress 2017

From International Society of Organic Agriculture Research (ISOFAR):

- Prof. Dr. Gerold Rahmann (Thuenen-Institute, Germany, chairperson Scientific Board)
- Prof. Dr. Reza Ardakani (Azad University, Iran)
- Prof. Dr Victor Olowe (IFSERAR, Nigeria)

From National Centre of Organic Farming (NCOF):

- Dr. Krishan Chandra (NCOF, India)
- Sh. T.K. Ghosh (RCOF, Ghaziabad, India)
- Sh. Jagat Singh (NCOF, India)
- Sh. R.S.H. Srivathsa (RCOF, Panchkula, India)
- Sh. S.R. Ingle (RCOF, Nagpur, India)
- Dr. Praveen Kumar Vootla (NCOF, India)
- Dr. Rashmi Singh (NCOF, India)
- Dr. Pooja Kannojia (RCOF, Ghaziabad, India)

From other sources:

- Dr. A.K. Yadav (APEDA, India, co-chairperson Scientific Board)
- Dr. H.B. Babalad (UAS, India)
- Dr. N. Devakumar (UAS, India)
- Dr. S.L. Goel (OFAI, India)
- Dr. N. Ravisankar (ICAR-IIFSR, India)
- Dr. J.P. Saini (HPKVV, India)

From Technology and Innovation Platform of IFOAM-Organics International (TIPI):

- Mr. Christian Andres (FiBL, Switzerland, co-chairperson Scientific Board)
- Dr. Gabriela Soto (COSA, Costa Rica)
- Dr. Helga Willer (FiBL, Switzerland)

Citation:

Rahmann *et al*. (2017): Innovative Research for Organic 3.0 - Proceedings of the Science Track at the Organic World Congress – Vol-II, November 9-11, 2017 in Delhi, India. Sprint/Delhi, pp 322

Reviewers:

ISOFAR reviewers:

Dr. Olowoake Adebayo	Nigeria
Dr. S. Adenike Adejumo	Nigeria
Dr. Jacobs Mobolade Adesina	India
Prof. Gideon Olajire Adeoye	Nigeria
Dr. Adebola Oluyinka Ajiboye	Nigeria
Dr. A. O.Akinwumi	Nigeria
Dr. Guy-Erick Akouègnon	Germany
Prof. Dr. Reza Ardakani	Iran
Prof. Dr. Ir Sandra Arifin Aziz	Indonesia
Dr. Adewoyin Oluyinka Benedicta	Nigeria
Dr. Subrahmanyeswari Bodapati	India
Dr. Jan Brinkmann	Germany
Dr. Stefano Canali	Italy
Dr. Carmelita N. Cervantes	Philippines
Dr. Mahesh Chander	India
Dr. Abderrahmsne Dahaliz	Algeria
Dr. M.R. Davari	Iran
Assoc. Prof. Carolyn Dimitri	USA
Dr. Ken Okwae Fening	Ghana
Dr. Ana Firmino	Portugal
Prof. Dr. Peter von Fragstein	Germany
Dr. Francisca George	Nigeria
Dr. Nithya Vishwanath Gowdru	India
Dr. Lucille Elna Parrene de Guzman	Philippines
Assoc. Prof. Dr. Mirza Hasanuzzaman	Bangladesh
Prof. Dr. Ulrich Hamm	Germany
Dr.ing. Elena Ilisiu	Romania
Dr. Mabel Omowumi Ipinmoroti	Nigeria
Dr. Md. Shafiqul Islam	Bangladesh
Dr. Afusat Toyin Jagun	Nigeria
Dr. Ji Li	China
Assoc. Prof. Dr. Fred Kabi	Uganda
Dr. I. Lawal	Nigeria
Dr. Anne-Kristin Loes	Norway
Prof. Nkiru T Meludu	Nigeria
Dr. Kurt Moeller	Germany
Prof. S.S. Narwal	India
Dr. Daniel Neuhoff	Germany

ISOFAR reviewers (continued):

Dr. Jaakko Nuutila	Finland
Dr. Hans Marten Paulsen	Germany
Dr. Giacomo Pirlo	Italy
Dr. Mahadev Pramanick	India
Dr. Oluwatosin Kennedy Oko	Nigeria
Dr. T. I. Olabiyi	Nigeria
Prof. Dr. Victor Olowe	Nigeria
Prof. Dr. Gerold Rahmann	Germany
Dr. Ilse Rasmussen	Denmark
Prof. Dr. Ewa Rembialkowska	Poland
Dr. Eduardo Lopez Rosse	Bolivia
Dr. Mohamed Fathy Salem	Egypt
Dr. Banake E. Sambo	Nigeria
Dr. Pallab Sarma	India
Ass. Prof. Dr. Srdjan Seremesic	Serbia
Dr. Sununtar Setboonsarng	Indonesia
Dr. P. Srinivas	India
Dr. G Suja	India
Assoc. Prof. Dr. Khaled Sassi	Tunesia
Dr. Jessica Shade	USA
Dr. A.K. Sherief	India
Dr. Debjani Sihi	USA
Prof. Dr. Charles Ssekyewa	Uganda
Prof. Dr. Carola Strassner	Germany
Dr. Leila Tabrizi	Iran
Dr.ss Alessandra Trinchera	Italy
Dr. M. Nazim Uddin	Bangladesh
Prof. Dr. Ahmet Uludag	Turkey
Assoc Prof. Dr. Christian Reinhard Vogl	Austria
Dr. David Wahyudi	Indonesia
Dr. Cory W. Whitney	Germany
Dr. Raffael Zanoli	Italy
Dr. Sabine Zikeli	Germany
Dr. Hui-Lian Xu	Japan

TIPI reviewers:

Uygun Aksoy	Turkey
David M. Amudavi	Kenya
Hamidreza Ansari-Renani	Iran
Reza Ardakani	Iran
Raymond Auerbach	South Africa
Khalid Azim	Morocco
Brian Baker	USA
Zohar Ben-Asher	Israel
Gülay Beşirli	Turkey
Else Bünemann-König	Switzerland
Mahesh Chander	India
Ravindra Chandra Joshi	Philippines
Daniel Chiumia	Switzerland
Nithya Daily	India
Mohammadreza Davari	Iran
Lieve De Cock	Belgium
Kursat Demiryurek	Turkey
Dóra Drexler	Hungary
Carlos Escobar	Colombia
Javier Fernandez-Salvador	USA
Bernhard Freyer	Austria
Isabelle Gangnat	Switzerland
Andreas Gattinger	Switzerland
Tessa Grasswitz	USA
Ulrich Hamm	Germany
Robert Home	Switzerland
Beate Huber	Switzerland
Hans Hummel	Germany
Anne-Kristin Løes	Norway
Mario Malagoli	Italy
Bram Moeskops	Belgium
Adrian Mueller	Switzerland
László Radics	Hungary
Kariyat Ramachandran Rupesh Ram	Switzerland
Mohammadreza Rezapanah	Iran
Amritbir Riar	Switzerland
Toralf Richter	Switzerland
Monika Schneider	Switzerland
Jessica Shade	USA
Arun Sharma	India
Laurence Smith	UK
Jo Smith	UK
Anja Vieweger	UK
Yue-Wen Wang	Taiwan
Qiao	China

Reviewers from other sources:

Dr. Ashok Kumar Yadav, Advisor, APEDA, New Delhi, India

Dr. N. Ravishankar, Principal Scientist, IIFSR, Modipuram, India

Dr. N. Devakumar, Associate Professor, UAS, Bangalore, Bengaluru, Karnataka, India

Dr. H.B. Babalad, Professor, UAS, Dharwad, Karnataka, India

Dr. J.P. Saini, Head, Centre of Excellence for Organic Agriculture, HPKVV, Palampur, Himachal Pradesh, India

Dr. Sujata Goel, Organic Farming Association of India, Goa, India

Dr. A.S. Kashyap, Professor (retd), HPKVV, Palampur, India

Dr. Akali Sema, Professor, SASARD, Medziphema, Nagaland, India

Dr. R.A. Ram Principal Scientist, CISH, Lucknow, Uttar Pradesh, India

Dr. A.K. Sharma, Senior Scientist, CAZRI, Jodhpur, Rajasthan, India

Dr. Mahesh Chander, Principal Scientist, IVRI, Izzatnagar, Uttar Pradesh, India

Dr. Dinesh Kumar Singh, Principal Scientist, IARI, New Delhi, India

Lay-Out

Prof. Dr. Gerold Rahmann

Ms. Sophia zu Lynar

Ms. Laura Oberländer

Ms. Martha Ballo

Ms. Mia Schröder

Compilation

Dr. Krishan Chandra

Sh. T.K. Ghosh

Dr. Praveen Kumar Vootla

Published by

GOVT. OF INDIA

Ministry of Agriculture & Farmers Welfare

National Centre of Organic Farming

Hapur Road, Kamla Nehru Nagar, Ghaziabad-201002

Phone: 0120-2764-2764906,2764212, Fax 0210-2764901; Email: nbdc@nic.in

Website: http://ncof.dacnet.nic.in ; http://pgsindia-ncof.gov.in

Content

Animals - Europe

Biorefining of proteins from grass clover as an innovative solution to a truly sustainable organic production

Erik Fog[1], NannaYtting[2], Mette Lübeck[3]

Key words: Leaf protein concentrate, biorefinery, yield, carbon sequestration, economy.

Abstract

To shape a common solution to challenges with low crop yields, proper protein supply and insufficient climate mitigation capacity, biorefining of protein feed from grassland crops for monogastric animals (including human) is introduced to the organic production system. Bio-refining using mechanical and natural fermentation techniques are compatible with the organic principles and standards. Crop yields from Danish field trials with alfalfa, clover and grass-clover mixtures demonstrate average yields around 12 tons dry matter per hectare yielding on average 700 kg extracted protein per hectare and 3000 to 6000 m^3 methane per hectare. With these yields the profitability of biorefining of organic protein feed is calculated and shows a positive economic result, especially when used as wet-feed saving the cost for drying. But it should be noticed that economy is sensitive to changes in yields and prices.

Acknowledgments

The results in this article are made possible by the project "OrganoFinery – Organic growth with biorefined organic protein feed, fertilizer and energy"funded by the Green Development and Demonstration Programme, GUDP under the Ministry of Environment and Food of Denmark and coordinated by the International Centre for Research in Organic Food Systems (J.no. 34009-13-0691).

Introduction

Organic farming is challenged by low yields and difficulties to produce enough protein for monogastric animals. This causes limitations in growth of the organic production.

In organic systems, grassland legumes can produce high yields in dry matter and protein and deliver nitrogen to the succeeding crops. But only ruminants can utilize these crops sufficiently and to fulfil the goal of less greenhouse gas emissions, the population of ruminants should not increase.

Modern biorefining techniques compatible with organic production standards can extract protein from grassland crops with feeding value similar to soy protein and the production residues can be utilized to roughage, biogas production and extraction of high value substances for the growing bio-economy sector (Kiel et.al. 2015)(Santamaría-Fernández 2017a).

By integrating biorefining into organic production systems, it will be possible to increase crop yields, the production of non-ruminant animal products and increase the climate mitigating capacity and thereby form basis for a considerable growth in truly sustainable organic production.

Research in Denmark is demonstrating the potentials of biorefined proteins in organic farming.

Material and methods

[1] SEGES, Denmark, www.seges.dk, erf@seges.dk;
[2] Copenhagen University, Denmark, www.ku.dk, karko@plen.ku.dk,
[3] Aalborg University, Denmark, www.aau.dk, mel@bio.aau.dk

The crop trials shown in table 1 are made in Denmark with field-plots of 5.5 x 1.5 m in 4 replicates. Two cutting strategies are implemented: three and four cuts per season. Fresh biomass, dry matter and crude protein content are measured for the second year of production.
The field trials presented in table 2 have been conducted on two Danish organic farms. On one farm (loamy sand) there were 4 cuts in the season, on the other (sandy loam) there were 3 cuts in the season. On both farms three crops: alfalfa, red clover and a clover / grass mixture, were grown in 15 m^2 field plots with 4 replicates. Fresh biomass yield, dry matter and crude protein content in the harvested crop are measured for the first year of production.

Protein yield in concentrate is estimated based on lab-scale extraction from the crop trials and technical tests in the OrganoFinery project (SantaMaria-Fernandez, unpublished) (Santamaria-Fernandez et al. 2017a). Methane yields from process residues (press cake and brown juice) are estimated based on methane potential analyses on similar crops (Santamaria-Fernandez et. al. 2017b).

Economic calculations on the bio-refining system are done in a spreadsheet divided in three sections for the actors: The green crop field on the farm, the biorefinery and a biogas plant receiving the residue products for gas production. The economic transactions between the three actors are visualized and the profitability of the biorefinery is calculated using average protein yields and estimated methane yields from the field trials and under the precondition that the field has the same margin coverage as cereals and the biogas plant has the same margin on treating the residues as other products. Outputs from the system are: Protein concentrate for feed, biogas and increased yields on the farm caused by the nitrogen in the returned digestate. Investment in the biorefinery plant is estimated to be 12.5 mill. Euro with a capacity to treat grass from 3000 ha. Transport costs (average distance 25 km) are paid by the receiving part throughout the system. The field is paying for the nutrient value of the recycled fertilizer from the biogas plant.

Results

Protein yield from the biorefinery process was dependent both on dry matter and protein yield in the harvested material and the efficiency of the screw press. Lab-scale experiments showed that it is possible to get a protein recovery in the green juice of 40 and 70 % of the protein in the biomass (SantaMaria-Fernandez, unpublished). Practice scale biorefining techniques showed a protein recovery of 40 to 60 % (Hermansen et.al. 2017). In practice 50 % is realistic. Of the protein in the juice, approximately 70 % can be recovered in the final concentrate (SantaMaria-Fernandez, unpublished).

Yields

Yields from trials in small plots with cut-strategies in three grassland crops (white clover / ryegrass; red clover; red clover / cock's foot) are presented in Table 1.

Table 1: Total dry matter yield of biomass and crop protein in grassland crops, estimated yield of extracted crude protein in concentrate and estimated methane yield from press cake and brown juice residues. Crop yields are mean of two trials with 3 and 4 cuts per year in 2016

Yield (ton ha^{-1})	Crop dry matter yield	Crop protein yield	Estimated protein yield in concentrate*	Estimated methane yield** (m^3 ha^{-1})
White clover / ryegrass	6.26	0.88	0.31	3,056
Red clover	8.82	1.47	0.51	2,392
Red clover / cock's foot	9.50	1.36	0.48	3,090
LSD	*1.51* ***	*0.23* ***		

*) Estimated protein yield in concentrate in table 1 and 2 is based on the assumption that 50 % of the harvested protein is recovered in the green juice and 70 % of the protein in the green juice is recovered in the protein paste (SantaMaria-Fernandez, unpublished).
**) Estimated methane yield is calculated multiplying the dry matter yield with the methane yield per tons dry matter from the residues press cake and brown juice of similar crops found in Santamaria-Fernandez, 2017b.

Yield in grassland crops (alfalfa; red clover; grass clover mixture) under farm conditions are presented in table 2. (Bertelsen, 2016)

Table 2: Total dry matter yield of biomass and crop protein in grassland crops, estimated yield of extracted crude protein in concentrate and estimated methane yield from press cake and brown juice residues. Crop yields are mean of two trials (3 and 4 cuts per year) in 2016

Yield (ton ha^{-1})	Crop dry matter yield	Crop protein yield	Estimated protein yield in concentrate*	Estimated methane yield** (m^3 ha^{-1})
Alfalfa	13.31	2.53	0.89	3,492
Red clover	16.45	2.86	1.00	4,460
Grass clover mixture[1)]	19.23	2.95	1.03	6,254
LSD	*ns*	*ns*		

1) 8 kg red clover, 1,5 kg white clover, 9 kg festulolium, 9 kg ryegrass seed per ha.

In both trials red clover and red clover / grass mixture gave the highest protein yield and the highest dry matter yield. In the farm trial no significant difference between crops were found.

Economy of the bio-refining system

Table 3 shows model calculations of the biorefinery's economic result under different economic conditions. The model calculations shown in table 3 demonstrate a positive economy in biorefining of protein feed under the selected conditions, especially when the protein concentrate can be used for wet feeding. It should be noticed that the crop yields and yields of extracted protein are high in the trials compared to expected yields in practice and that the economic results are sensitive to changes in yields and prices.

Discussion

Introduction of biorefining techniques in organic production to produce organic high value protein feed from grass clover can solve more important challenges in organic farming: Grass clover can get a prominent place in rotations on farms without ruminants and raise and consolidate the crop yields. The crop yield and yield stability are higher in grass clover mixtures than in grain legumes under Danish conditions. The protein supply for organic pig and poultry can be secured and locally produced – with the future perspective to produce high value plant proteins for human consumption. By using the residues for biogas production, the production system also contributes to repress the use of fossil fuels and the extended use of grassland crops will increase the carbon sequestration.

Table 3Economic results of bio-refining organic green crops (model calculation)

	Economic result (€ / ha)[1)]
Standard conditions[2)]	201
Without drying[3)]	540
20 % lower / higher protein price[4)]	-94 / 496
10 % lower / higher biogas price[4)]	24 / 378
10 % lower / higher protein yield[4)]	58 / 343

1) Calculated per ha harvested green crop for processing.
2) 0.7 ton protein per ha, 2,900 m^3 methane per ha, 0.8 € per kg dry protein concentrate, 0.6 € per m^3 bio-methane
3) The protein concentrate is sold as wet-feed.
4) Dried protein

The feed value of leaf proteins from clover and grass is promising as the amino acid profile with high content of methionine indicates that it can be a valuable supplement to other grain legumes like peas, faba beans and lupins (Santamaria-Fernandez et al. 2017a).

The demonstrated economic model calculations show that biorefining techniques are within the range of a commercial production. Especially if biorefined proteins can be used as wet-feed, and if the price of organic protein feed increases as a result of the enforcement of 100 % organic feed. Demonstration of biorefining on practical conditions is needed to confirm the yields and profitability found in the trials. Further development of the biorefining technique to produce protein and other high value products for human consumption could make biorefining of organic green crops very profitable.

References

Bertelsen, Inger (2016) Grønne afgrøder – dyrkning. In Oversigt over Landsforsøgene, 2016 (in Danish). SEGES, Aarhus N. p. 296.

Hermansen, J.E., Jørgensen, U., Lærke, P.E., Manevski, K., Boelt, B., Jensen, S.K., Weisbjerg, M.R., Dalsgaard, T.K., Asp, T., Jensen, M.A., Sørensen, C.S., Jensen, M.V., Gylling, M., Lindedam, J., Lübeck, M., Fog, E.(2017). Green biomass – protein production through bio-refining. DCA Report No. 093. National Centre for Food and Agriculture, Aarhus University.

Kiel P, Andersen M, Lübeck M (2015). A method of providing functional proteins from a plant material. PCT DK2015 050185. WO2015197078

Molinuevo-Salces B, Fernandez MS and Lübeck M (2015) Research report Organofinery protein extraction AAU,

Santamaría-Fernández, M., Molinuevo-Salces, B., Kiel, P., Steenfeldt, S., Uellendahl, H., and Lübeck, M. (2017a) Lactic acid fermentation for refining proteins from green crops and obtaining a high quality feed for monogastric animals. Journal of Cleaner Production, accepted

Santamaria-Fernandez M, Molinuevo-Salces B, Lübeck and Uellendahl MH (2017b) Biogas potential of green biomass after protein extraction in an organic biorefinery concept for feed, fuel and fertilizer production. Renewable Energy. doi.org/10.1016/j.renene.2017.03.012

Performance of organic free range broiler chicken fed germinated wheat in addition to either mash or pelleted feed

Lisa Baldinger[1], Ralf Bussemas[1]

Key words: chicken, fattening, germination, organic, feed form

Abstract

While pelleted feed provides balanced nutrients in each pellet, the lower production costs of mash feed ensure its widespread use. Germinated wheat is always fed in combination with a feed mixture, and in order to determine its preferable feed form, a trial with 320 slow-growing broiler chicken (ISA JA 757) in a mobile housing system compared mash and pelleted feed with and without germinated wheat. Based on the lack of interaction between feed form and offer of germinated wheat, both feed forms were found equally suited for the combination. Growth performance of the birds was not affected by feed form, but pelleted feed decreased feed consumption and improved feed conversion ratio. Germinated wheat was eagerly consumed, but replaced a considerable part of the feed mixture and thereby diluted the total diet, leading to slower growth and impaired slaughter performance. To ensure a balanced total diet, it is therefore necessary to adjust the accompanying feed accordingly.

Acknowledgments

We would like to thank the farm staff at our experimental station, especially Lena Weiß and trainee Martin Neumann, for their diligent work and resourcefulness during the experiment.

Introduction

The main advantage of pelleting feed is that each single pellet contains the intended mixture of components and nutrients, whereas mash feed allows the animals to select the most desired components. Also, it is well documented that feed intake of broilers is higher when pellets are fed instead of mash (e.g. Amerah et al. 2007). Due to the cost of pelleting, however, the use of mash feed is widespread. Feeding grains like wheat in germinated form is an old technique that has recently been rediscovered, due to its positive effects on amino acid digestibility, phosphorus availability and vitamin content (Finney 1983). When germinated grains are fed, they are usually mixed with mash feed directly before feeding. In order to determine the preferable feed form in combination with germinated wheat, a feeding trial with broiler chicken was conducted, examining the effect of mash and pelleted feed with and without additional germinated wheat on animal performance.

Material and methods

The feeding trial was conducted between April and October 2016 on the experimental farm of Thuenen Institute of Organic Farming in Trenthorst, Germany. Animal husbandry followed the rules of EU Directive EC 889/2008. In the trial, four dietary treatments were compared: mash feed alone, mash feed with additional germinated wheat, pelleted feed alone, pelleted feed with germinated wheat. The experiment consisted of two fattening periods (=replicates) of 160 broilers each, so each treatment was tested on a total of 80 broilers. Day-old chicks of a slow-growing strain (ISA JA 757, mixed sexes) were reared in a temperature-controlled indoor housing system and fed

[1] Thuenen Institute of Organic Farming, Trenthorst 32, 23847 Westerau, Germany, lisa.baldinger@thuenen.de, www.thuenen.de

pelleted starter feed for four weeks. On day 29, chicks were randomly divided into groups of 20 and moved to a mobile housing system for the feeding trial. There, each group had a straw bedded indoor area of 2 m² equipped with drinkers, feed trough and perches, and access to a green outdoor area of 80 m² during daytime. Grower feed was fed week 5-8, and finisher week 9-10, with two-day transition periods when feed was changed. Starting in week 3, additional whole wheat in the amount of 10 % of total dry matter intake (amounts adjusted weekly) was given in the outdoor range (week 3-4: in the litter) to encourage foraging behaviour. Wheat was germinated in a Keimrad® (Söllradl GmbH, Austria) for four days and offered fresh once a day, starting in week 5. Allowance of germinated wheat was increased up to a level of 25 % of total dry matter intake during week 7, and was kept constant thereafter (amounts adjusted weekly). At the end of the 72 days fattening period, half of the broilers (79 and 78 in replicates 1 and 2) were slaughtered. On the day after slaughter, chilled ready-to-sell carcass weight (without neck, feet, offals and abdominal fat pad) of all animals and the weight of breast on the bone (including skin) and whole legs of half of them (40 in each replicate) were documented. Other data collection included feed consumption per group and week, body weight of all individual broilers (once a week), documentation of animal losses, and analysis of feed samples at a commercial laboratory.

Table 1: Composition and nutrient contents of the diets, g kg^{-1} (as fed)

	Starter week 1-4	Grower[a] week 5-8	Finisher[a] week 9-10	Wheat, whole week 3-10	Wheat, germinated week 5-10
Wheat	270	445	490		
Maize / Triticale	250 / .	. / 100	. / 150		
Wheat bran	.	22	33		
Peas	50	100	100		
Soybean cake	200	170	70		
Sunflower / rapeseed cake	90 / .	. / 75	. / 100		
Rice / maize[b] gluten	50 / .	. / 60	. / 30		
Alfalfa meal	25	.	.		
Brewer´s yeast[b]	25	.	.		
Mineral mix / $CaCO_3$	40 / .	20 / 8	20 / 7		
Dry matter	894	879	880	880	455
Crude protein	177	186	166	108	92
Lysine	8.5	8.9	7.6	3.1	2.0
Methionine	3.0	3.1	2.7	1.7	1.4
Methionine + Cystin	6.2	6.3	5.9	4.4	3.5
AME_N, MJ	11.5	11.8	11.8	13.3	11.6

[a] including 10 % whole wheat [b] from conventional production

SAS 9.4 proc glm was used for statistical analysis, with a model including the fixed effects of feed form, germinated wheat, their interaction, replicate and week of life. Because the interaction was never significant, Tables 2 and 3 show lsmeans and P values (<0.05 indicating a significant difference) of the effects of feed form and germinated wheat separately. Feed consumption is given on 88 % dry matter basis.

Results

Feed form influenced neither body weight nor daily weight gain, but pelleted feed increased feed consumption and decreased total feed conversion ratio. The only effect on slaughter performance was a higher breast proportion when pelleted feed was fed.

Table 2: Feed consumption and fattening performance of broilers

	Feed form			Germinated wheat		
	Mash	**Pellets**	P value	**Without**	**With**	P value
Feed consumption day 29-72, g day^{-1}						
Feed mixture	148	135	0.008	158	125	<0.001
Germinated wheat	18.6	18.5	0.956	0.0	37.2	<0.001
Total	167	153	0.005	158	162	0.416
Body weight day 29, g	630	611	0.026	617	624	0.449
Body weight day 72, g	2729	2801	0.129	2926	2604	<0.001
ADG[a], day 29-72	49.0	50.9	0.276	53.9	46.0	<0.001
ADG[a], day 1-72	38.0	39.1	0.267	40.9	36.3	<0.001
Feed conversion ratio [b] day 29-72						
Feed mixture only	3.17	2.62	0.002	3.00	2.79	0.220
Total	3.60	3.02	0.002	3.00	3.63	<0.001

[a] average daily weight gain, g [b] feed consumption / weight gain

Over the 6-week experimental period, consumption of germinated wheat averaged 23.0 % of total feed consumption, which did not differ. Both body weight and daily weight gain were lower, and total feed conversion ratio was higher when germinated wheat was fed. Also all parameters of slaughter performance were adversely affected.

Table 3: Slaughter performance of broilers

	Feed form			Germinated wheat		
	Mash	**Pellets**	P value	**Without**	**With**	P value
Pre-slaughter BW[a], g	2917	2989	0.222	3127	2779	<0.001
Chilled carcass[b], g	1928	1978	0.239	2097	1808	<0.001
Carcass yield, %	66.0	66.2	0.782	67.2	65.0	<0.001
Breast on the bone, g	656	707	0.018	756	607	<0.001
Breast on the bone, %	33.4	34.4	0.020	35.1	32.7	<0.001
Whole legs, g	680	707	0.224	736	651	<0.001
Whole legs, %[c]	35.0	34.5	0.192	34.1	35.4	<0.001

[a] body weight [b] ready-for-sale [c] % of chilled ready-for-sale carcass

Animal losses were not affected by feed form (p=0.600) and germinated wheat (p=0.861), but by replicate: While in replicate 1 only 2.5 % losses occurred, in replicate 2 it was 20.6 %. All losses were due to birds of prey, mostly hawks.

Discussion

The broilers consumed more mash than pelleted feed, which contradicts previous reports by Amerah et al. (2007), but can be explained by our observation that more feed selection with accompanying feed losses was observed when mash feed was fed than pelleted feed. Despite differing feed consumption, body weights and daily weight gain were not affected by feed form. The efficiency of the birds´ growth, however, was considerably better with pelleted feed, as demonstrated by the lower feed conversion ratio. Except for a slight difference in breast proportion, slaughter performance was not influenced. To summarize, the same growth performance and largely the same slaughter performance could be achieved with both feed forms, but pelleted feed resulted in more efficient production. The economic excellence of each feed form therefore depends on the cost of pelleting, which must be less than the benefit of improved feed conversion ratio in order to make pelleted feed the better choice. But mindful of the fact that protein feeds from organic production are limited, feeding pellets is the more resource efficient choice.

Very little feed refusals of germinated wheat were recorded, allowing the conclusion that it is a palatable and attractive feed for broilers. However, germinated wheat replaced a considerable proportion of the feed mixture. Within their physical intake capacity, chicken are able to adjust feed intake to their energy demand, especially when being offered different feeds (Leeson et al. 1996). In our feeding trial, total feed consumption did not differ. In view of similar energy values both in germinated wheat and the feed mixture, it can be assumed that energy intake was similar as well and broilers adjusted feed intake to energy demand irrespective of dietary treatment. However, germinated wheat contained considerably less essential amino acids than the feed mixture. The high proportion of germinated wheat on top of a balanced diet therefore diluted the amino acid contents of the total diet and resulted in slower growth and poorer slaughter performance (Jeroch et al. 2013).

Based on the lack of interaction between feed form and germinated wheat, both feed forms are equally suited for combining with germinated wheat. Instead, the choice of feed form depends on considerations of economy and resource efficiency. Germinated wheat was found to be very palatable, but diluted the diet in a way that gives reason to recommend adjusting the accompanying feed to ensure a balanced total diet.

References

Amerah AM, Ravindran V, Lentle RG & Thomas DG (2007): Influence of feed particle size and feed form on the performance, energy utilization, digestive tract development, and digesta parameters of broiler starters. Poultry Science 86:12, 2615-2623.

Finney P (1983): Effect of germination on cereal and legume nutrient changes and food or feed value: A comprehensive review. In: Nozzolillo C, Lea PJ, Loewus FA (eds): Mobilization of Reserves in Germination. Plenum Press, New York and London, pp 229-305.

Jeroch H, Simon A & Zentek J (2013): Geflügelernährung. 1 edn. Eugen Ulmer KG, Stuttgart, Germany, p. 417.

Leeson S, Caston L & Summers JD (1996): Broiler response to diet energy. Poultry Science 75:4, 529-535.

Obstacles and solutions for the organic milk production in Italy

Giacomo Pirlo[1], Susanna Lolli, Simone Cogrossi, Paolo Bani, Luciano Pecetti, Beatrice Di Renzo, Simone Severini

Key words: milk, forage, proteinfeed, economics

Abstract

Preliminary results of a study concerning technical and economic aspects of organic milk production in northern Italy are presented. A survey on characteristics of organic dairy farms showed wide variation in size, productivity, and forage systems. Crimson clover and hairy vetch were used as cover crops in maize cultivation to improve feed availability. Both legumes showed effective contrast of weeds in the early crop stage, but also inconsistent maize yield results. Alfalfa silage can increase protein feed self-sufficiency of organic dairy farm without detrimental effects on milk productivity and quality. Comparing two organic farms, the best economical performances were observed in the larger one. On the other hand the smaller one appeared to be more flexible because it also exploits other activities based on agro-tourism services.

Acknowledgments

The Project VaLatteBio was funded by the Italian Ministry of Agricultural, Food and Forestry Policies.

Introduction

In Italy, organic milk consumption had a major increase from 2011 to 2015 (SINAB 2016)due to a consumers’ higher sensitivity to food safety and ethics of food production, particularly in the animal sector. Despite this trend and the wide difference of price between organic and conventional milk, only approximately 2.6% of dairy cows are raisedaccording to the organic system in Italy(SINAB 2016). There are a number of technical and economic factors hindering the increase of organic milk production and the Italian Ministry of Agricultural, Food and Forestry Policies funded the project VaLatteBio (Guidelines for organic milk production and feasibility of conversion) to overcome these obstacles. The project encompasses four different sub-projects: 1) technical and environmental analysis; 2) feed production; 3) improvement of self-sufficiency of protein feeds; and 4) economic analysis. Aim of the project is to provide dairy farmers with guidelines facilitating the conversion to organic milk production and some of its preliminary results are reported in this paper.

Material and methods

<u>Technical and environmental analysis</u>. The technical and management characteristics of a sample of six organic dairy farms in Lombardy, i.e. the Italian region with the largest number of dairy cattle, were gathered by face-to-face interviews. <u>Feed production</u>. This sub-project consisted of a pilot trial on the adoption of cover crops on maize cultivation to improve weed control with no mechanical operation. The legume species crimsom clover and hairy vetch were used as cover crops to be terminated by roller crimping in spring prior to maize sowing. <u>Improvement of self-sufficiency of protein feeds</u>. In an organic dairy farm, alfalfa silage was introduced in the ration of 80 dairy cows replacing wheat silage and part of high-protein concentrates of the control diet, to improve the self-sufficiency of organic dairy farms. The effects on milk production, milk quality, and animal health

[1] Council for Agricultural Research and Economics (IT), www.entecra.it, eMail: giacomo.pirlo@crea.gov.it;

were monitored. Economic analysis. It was conducted in two organic farms where detailed accounting were available and characterized by different size and strategies, to estimate their economic performances and robustness under different scenarios of milk price and subsidy levels.

Results

The current results refer to the first year of the project VaLatteBio and should still be considered as preliminary. Although a small number of organic dairy farms under examination, this sample can be considered representative, because of the low proportion of organic farms currently operating in Lombardy.

The main characteristics of these farms are reported in Table 1.

Table 1: Main characteristics of organic milk farms

	Unit	Mean	CV (%)
Cultivated area	ha	190.4	91.4
Dairy cows	n	174.2	86.3
Milk production	kg FPCM/yr head^{-1}	7736	18.0
Protein	%	3.38	4.8
Fat	%	3.90	3.1
Maize	% on total cultivated land	20.0	87.0

FPCM: fat-protein corrected milk

Cattle are on pasture for a short period and total mixed ration is the most adopted feeding system. Maize is a key crop, but there is a wide variation in its proportion of cultivated area. Only in one case are cattle fed fresh herbage all year round. Most of the concentrates are imported from the international market, because domestic feed production is not sufficient to satisfy the organic demand.

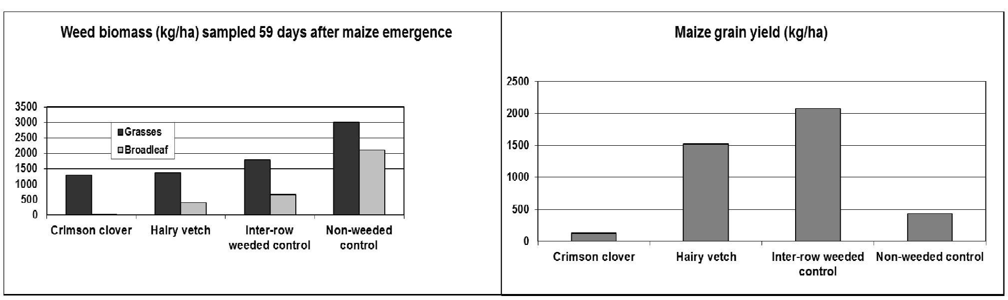


Figure 1. Weed control and maize grain production with two cover crops, relative to mechanically weeded and non-weeded check treatments.

Cover crops were comparable in weed control to the mechanically weeded check. However, no treatment seemed to be effective in controlling summer grass infestation, mostly including Johnson grass (*Sorghum halepense*), which may have hindered maize grain yield regardless of treatment. Nonetheless, maize yield results on hairy vetch were in line with those in the mechanically weeded check treatment. On the contrary, maize yield on crimson clover was unsatisfactory despite an appreciable weed control, suggesting possible negative effects by this legume species towards maize (e.g., excessive soil water depletion; unsatisfactory soil structure; competition of rolled mulch towards emerging maize plants).

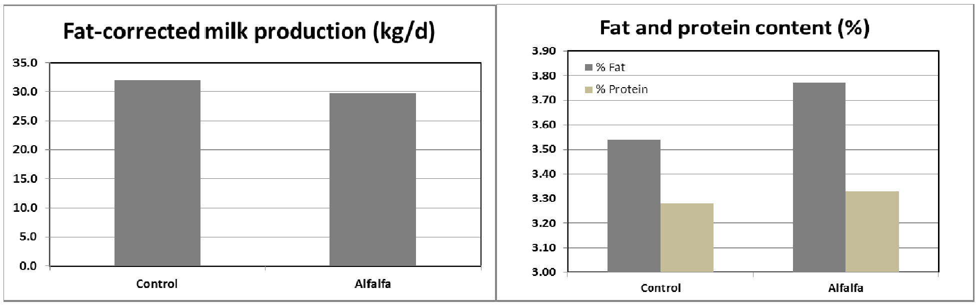


Figure 2. Effect of the substitution of wheat silage with alfalfa silage on fat-corrected milk production and milk composition (g/100 g).

The results of experiment where two iso-energetic and iso-nitrogen diets were compared are reported in Figure 2. When alfalfa silage was increased in the diet, milk production was reduced whereas milk fat percentage increased and production of fat-corrected (4%) milk was only slightly ($P<0.10$) reduced.

The main characteristics of the two organic farms examined in the economic analysis are reported in Table 2.

Table 2: Main characteristics of the two dairy farms considered in the economic analysis.

	Unit	Farm A	Farm B
Cultivated area	ha	260	45
Cows	n	300	45
Total milk production	t/yr	2818	333
Average milk production	kg/cow yr^{-1}	9390	7400
Maize cultivation	% of the total area	40.0	12.0
Alfalfa	% of the total area	40.0	8.0
Grassland	% of the total area	3.0	34.0
Other silages	% of the total area	13.0	31.0
Total revenues	€ 000	1945	280
Contribution of EU subsides	% of the total revenues	9.1	13.5
Contribution of other activities	% of the total revenues	0.17	20.0

These farms strongly differ in terms of size and production intensity. Farm A is larger and has a higher milk production per cow than farm B. Furthermore, these farms pursue two different strategies, namely: 1) aiming to increase the efficiency in feed resources, labour, and capitals, as in farm A; and 2) developing other activities based on ecological services that organic production can promote, as in farm B. Both farms result economically sustainable even if farm A reaches an higher remuneration of own capital. Because of this, farm A appeared to be more tolerant in case of reduction of milk price or EU subsides.

Discussion

This survey has given an initial snapshot of organic milk production in an important dairy area of Italy. These preliminary results show that organic dairy farms in northern Italy have different characteristics and strategies. In most of them, maize is a key crop, but its cultivation remains difficult without chemical weed control, although the tested cover crops were able to limit broadleaf weeds in the early crop stages. Alfalfa silage is a resource that can increase the self-sufficiency of organic dairy farm, without reducing milk production or quality. Nevertheless, particular attention is needed to the protein degradability level of the whole diet to optimize its use in large amounts in lactating dairy cows. Organic dairy farms in the study area have a good profitability level. However, economic results are influenced by other factors including farm size and productivity. According to our data, the larger and more productive farm performs better. Smaller organic dairy farms can reconcile milk production with other activities, such as provision of agro-tourism services, allowing them to be relatively less affected by possible future reduction of milk price.

References

SINAB, 2016. Bio in cifre. Available at www.sinab.it. Accessed on 1st March 2017.

Less avian influenza risk birds in poultry free range areas covered with trees

Monique Bestman[1], Jan-Paul Wagenaar, William de Jong, Thari Weerts

Key words: agroforestry, poultry, animal health, avian influenza

Abstract

Free ranging poultry can have contact with wild birds and become infected with avian influenza. Since most avian influenza risk birds are water birds that prefer to stay in large open areas, a negative relation was expected between tree cover in the free range area and presence of avian influenza risk birds. In two seasons wild birds were counted in poultry free range areas with different tree cover and on neighbouring plots on 11 farms. More than 24,000 wild birds were counted. Significantly more high risk birds were seen in free range areas with less than 5 % tree cover. Significantly more high risk birds were seen in the surroundings if the farm was located in an open landscape. However, it was not possible to conclude if either tree cover or openness of the landscape was responsible for the effects found. The results support to further investigate the role of trees as a measure to keep down avian influenza risk birds in poultry free range areas.

Acknowledgments

Observations were done within the project 'Trees for chickens', granted by the European Agricultural Fund for Rural Development, the Dutch Ministry of Economic Affairs and the Dutch Fund for Poultry Interests. Statistical analysis and publication took place within the project 'Low pathogenic AI on free range farms', coordinated by Wageningen Bioveterinary Research, granted by the Dutch Ministry of Economic Affairs. Writing this article is done within project 'AGFORWARD', EU 7th Framework Programme of RTD (Grant Agreement N° 613520).

Introduction

For several reasons poultry free range areas are planted with trees. A reason from an animal welfare point of view is that a higher proportion of chickens from a flock will use the free range area if there is cover by trees. If a higher proportion of the chickens is using the free range area, significantly less feather pecking damage (a welfare problem) is seen (Bestman & Wagenaar 2003; Green et al. 2000). Another reason for planting the free range area with trees is to combine two types of land use in order to 'save' land. However, free range chickens can have contact with wild birds and become infected with avian influenza (van der Goot et al. 2015). Water birds and waders are regarded as high risk birds (Veen et al. 2007). Since these birds are associated with open landscapes, we expected a negative relation between tree cover in the free range area and presence of these risk birds. Wild birds have been counted in 11 poultry free range areas with different proportions of tree cover.

Material and methods

Eleven organic and conventional free range egg production farms were selected based on their proportion of range area covered with trees (fruit trees, biomass willows or miscanthus[2]). This varied from 0 to 90 % cover. The farms were visited 4 times per season. The observations were

[1] Louis Bolk Institute, The Netherlands, www.louisbolk.org, m.bestman@louisbolk.nl

[2] Miscanthus actually is a grass, but it grows higher than fruit trees and biomass willows and it has a high fiber content. For simplicity in this paper we refer to all three vegetation types as 'trees'.

done in 2 seasons: early spring and autumn/winter. All observations started at 10 am. All birds in and above the free range area and in and above two selected neighbouring plots were counted. Observations started from the car and were continued on foot walking all around the free range area and the farm buildings. Based on large scale wild bird monitoring (Breed et al. 2011) and expert judgments (Veen et al. 2007; Slaterus personal information), wild birds were divided in 3 categories: high risk birds, low risk birds and no/unknown risk birds. High risk birds were all water birds and waders: geese, ducks, swans, storks, oystercatchers, et cetera. Low risk birds were birds that were not as vulnerable to influenza infection as the high risk birds, but who could carry the virus after they were in contact with infected birds. These were birds of prey and corvids, which are scavengers. The no/unknown risk birds were all other birds, mainly singing birds from sparrow tot woodpecker, that were rarely or not found with an avian influenza infection. Farms were divided into 4 categories depending on the proportion of tree cover in the free range area (0–5 %; 5–25 %; 25–50 %; >50 %) and into 2 categories depending on the openness of the surrounding landscape (half closed or open). Observations were divided in birds seen inside the range area (touching the ground or trees) and birds seen in the surroundings (flying above the free range area or seen in or above the 2 selected neighbouring plots). Bird counts were log transformed and data were analysed by General Linear Models using Genstat.

Results

Totally 24,053 birds were counted during 21 observations: 268 high risk birds inside the free range area (see table 1), 427 low risk birds in the free range area, 3372 high risk birds in the surroundings, 1639 low risk birds in the surroundings and all other birds being no/unknown risk birds in either the free range area or the surroundings.

Significantly more high risk birds were seen in range areas with less than 5 % tree cover (model: $p=0.026$; $R^2=35$; se=15.8). However, all farms with low proportion of tree cover were located in an open landscape (see table 1). Therefore it was not possible to conclude whether it was the low proportion of tree cover or the open landscape that was associated with higher numbers of high risk birds in the free range area.

No relation was found between the number of low risk birds in range areas and the proportion of tree cover, nor in open, nor in half closed landscapes (model: $p=0.613$; se=2.5).

Significantly more high risk birds were seen in the surroundings of the range area if the landscape was more open ($p=0.005$; $R^2=39$; se=1.3). However, 2 out of 3 farms in open landscape had 0 % cover with trees and 1 out of 3 had 90 % cover. Therefore it was not possible to conclude whether it was the open landscape or the absence of tree cover that was associated with higher number of high risk birds in the surroundings.

No relation was found between the number of low risk birds in the surroundings of the free range area and the openness of the landscape, nor in case of range areas with higher or lower proportion of tree cover, nor in half closed or open landscapes (model: ($p=0.58$; se=1.3).

Discussion

Explanations for higher numbers of geese and ducks in free range areas with a smaller proportion of tree cover could be that they prefer open areas in which they can see predators, they forage on the ground and eat mostly grass. Moreover, they prefer foraging in large groups, for which they need large open spaces.

The absence of a relation between low risk birds in the free range area and proportion of tree cover might have to do with the low number of birds of prey seen anyway. Corvids were seen on all farms. The corvids were attracted by other aspects than those related to the proportion of tree cover in the free range area. Moreover, corvids often live and roam in large groups, a reason why you see more of them, which is not the case in birds of prey.

Possible explanations for higher numbers of high risk birds in the surrounding if located in an open landscape, are that geese and ducks prefer open areas in which they can see predators, eat grass and need more space in periods in which they sojourn.

The absence of a relation between low risk birds and openness of surrounding landscape might have to do with the low number of birds of prey anyway. In case of more observations perhaps a relation was found. Concerning the numbers of corvids, they might feel at home in both half closed and open landscapes and they more often sojourn in larger groups.

Table 1: Avian influenza high risk birds seen in 11 range areas in 2 seasons

Farm	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**Total**
% woody cover	0	35	8	75	90	0	35	50	10	10	90	
Openness landscape	O	HC	HC	HC	HG	O	HC	HC	HC	HC	O	
Phalacrocorax carbo	1	-	-	-	-	8	-	-	-	-	-	9
Ardea cinera	3	1	-	-	1	8	1	-	-	-	-	14
Geese spec	26	-	-	-	-	-	-	-	-	-	-	26
Anser anser	25	-	-	-	-	49	-	-	-	-	-	74
Ardea alba	4	-	-	-	-	6	-	-	-	-	-	10
Vanellus vanellus	-	-	1	-	-	-	4	-	-	-	-	5
Cygnus olor	2	-	-	-	-	-	-	-	-	-	-	2
Anser albifrons	-	-	-	-	-	1	-	-	-	-	-	1
Anas strepera	-	-	-	-	-	5	-	-	-	-	-	5
Aythya fuligula	-	-	-	-	-	2	-	-	-	-	-	2
Fulica atra	-	1	-	-	-	4	-	-	-	1	-	6
Gull spec	9	-	60	-	-	-	-	-	-	-	-	69
Alopochen aegyptiaca	-	-	-	-	-	3	-	-	-	4	-	7
Haematopus ostalegus	2	-	-	2	-	-	4	-	-	-	-	8
Gallinula chloropus	-	-	-	1	-	-	-	-	-	-	-	1
Gallinago gallinago	-	-	-	2	1	-	-	-	-	-	-	3
Anas platyrhynchos	12	2	-	-	-	6	3	2	-	1	-	26
Total	84	4	61	5	2	92	12	2	0	6	0	268

O = Open; HC = half closed
- This species has not been seen at all in the free range area of this farm

Suggestions to tackle with the future challenges of organic animal husbandry

The results support to further investigate the role of trees as a measure to keep down avian influenza risk birds in and around poultry free range areas. Especially experimental research, in which the presence of these species before and after the planting of trees is being investigated, may show whether planting of trees can be advised as a measure. Reducing the number of avian influenza risk birds makes the free range area more sustainable from a veterinary point of view.

If trees are planted that have an economic value as well, like fruit or biomass trees, the free range area will be more sustainable from an economic point of view as well. Combined land use in such a way, agroforestry, makes sustainable free range areas more profitable and contributes to feeding the world in a more efficient way.

References

Bestman M, Wagenaar JP (2003): Farm level factors associated with feather pecking damage in organic laying hens. Livestock Production Science 80, 133–140. doi: 10.1016/S0301-6226(02)00314-7.

Breed C, Duncan D, Stroud D, Nicholson R, Edwards J (2011): Annual report on surveillance for avian influenza in wild birds in member states of the European Union in 2011. European Reference Laboratory for avian influenza, Weybridge, Addlestone, Surrey, UK.

Goot J van der, Elbers A, Bouwstra R, Fabri T, Wijhe-Kiezebrink M van, Niekerk T van (2015): Risicofactoren voor introductie van laag-pathogeen aviaire influenza virus op legpluimveebedrijven met vrije uitloop Nederland. CVI Rapport 15/CVI0078.

Green LE, Lewis K, Kimpton A, Nicol CJ (2000): A cross sectional study of the prevalence of feather pecking damage in laying hens in alternative systems and its association with management and disease. Veterinary Record 147, 233–238. doi: 10.1016/S0168-1591(01)00167-8

Veen J, Brouwer J, Atkinson P, Bilgin C, Blew J, Eksioglu S, Hoffman M, Nardelli R, Spina F, Tendi C, Delany S (2007): Ornithological data relevant to the spread of Avian Influenza in Europe (phase 2): further identification and first field assessment of higher risk species. Wetlands International, Wageningen, The Netherlands.

Phosphorus deficits by long-term organic dairy farming?

Anne-Kristin Løes[1], Martha Ebbesvik[1]

Key words: case study, farm study, P-AL, P budget, perennial ley, soil P

Abstract

Long term studies (1989-) on an organic dairy farm show decreasing topsoil concentrations of extractable phosphorus (P-AL), and a low P surplus on farm level. The average P-AL value, 100 mg kg^{-1} dry soil is still above optimal (70 mg), but has decreased by more than 50% since 1989. Perennial ley yields tend to decline, and variations in soil P concentrations contribute to explain ley yields. This may call for additional P application on fields with low P status. However, for soils with medium (30-70) or low (< 30) P-AL, no relationship was found with yield level. Further, in a field experiment located on this farm, on low P soil with low and high applications of slurry over 5 years, applied P increased P concentrations in plant material rather than in soil. Future farm management should utilise locally available P sources to close the P gap by bringing back P removed in farm products, to avoid long-term P deficiency in soil.

Introduction

Tingvoll experimental farm with 28 ha of cultivated land and 8 ha of grazing fields is part of the Norwegian Centre of Organic Agriculture (NORSØK), established in 1986. Organic milk production was established in 1989, initially with 12 cows, increasing to 22 cows when the tenant family got access to renting nearby land with associated milk quota in 2006. A new farm building and a biogas plant were set up in 2010. Whereas this reduced the everyday workload for the tenant family significantly, milk yields had to be increased to cover higher tenant costs. In common with most other Norwegian dairy farmers, the tenants at Tingvoll farm have replaced local resources (grazing) by purchased inputs (concentrates) to increase the economic output. Organic 3.0 aims to make organic mainstream, but mainstreaming organic agriculture causes trade-offs between productivity and other goals such as diversity and self-sufficiency, as demonstrated by the development at Tingvoll farm.

Phosphorus (P) is an essential macronutrient for plants, and is a restricted resource. Sub-optimal P availability in soil may limit crop yields, and low soil P concentrations are not easy to restore. This paper presents changes in soil P over time, and investigates relationships between soil P and perennial ley yields. A field experiment on low-P soil with different manure applications is presented as a case study within the Tingvoll farm-case. The aim is to discuss the need for closing the P gap in organic agriculture, based on a long-term farm level study.

Material and methods

Tingvoll farm (62°54′N, 8°11′E) is located in NW Norway, along the coast with a humid and cool climate, well suited for milk production form dairy cows. Annual farm-gate P budgets are available for 1994-2012, based on farm accounts and standard P concentrations. On all fields, topsoil (0-20 cm) was analysed for concentrations of ammonium acetate-lactate soluble P (P-AL) in 1989, 1995, 2002, 2009 and 2015. The same plots were used for augering 10-12 soil cores per composite sample at each sampling date (late autumn). For calculations, values below detection limit (20 mg P kg^{-1} dry soil) were computed as 15 mg.

[1] NORSØK (Norwegian Centre for Organic Agriculture), Gunnars veg 6, NO-6630 Tingvoll, Norway, anne-kristin.loes@norsok.no

Crop yields have been measured since 1994, by harvesting 5 representative plots of 10 m^2 on each field directly before the farmer's harvest. Dry matter (DM) content is determined, and since 2008 botanical composition. Perennial leys at Tingvoll farm are usually cut twice a year. Since 2010, fodder is conserved in round bales, the harvest occurs much more rapidly, the first cut is earlier and fields may often be cut three times, or grazed in the autumn. Complete records of all cuts are not available for all fields. 160 records of yields from the first cut are presented here as kg DM ha^{-1}.

An experiment was located on a field with low-P soil in 2010, with P-AL measured in spring 2011, 2013 and 2016. The study (SoilEffects) compared anaerobically digested cow manure slurry with untreated slurry, with low (30 tons ha^{-1} yr^{-1}) or high (60 tons ha^{-1} yr^{-1}) amounts of manure applied on plots of 3 m x 8 m in a block design with four replicates, totally five treatments: Control, Undigested slurry low (USL) and high (USH), Digested slurry low (DSL) and high (DSH). The low level mimics the local organic farming system, whereas the high level is representative for a conventional system in this region. The crop was perennial grass-clover ley established in 2009, re-established with a green fodder cover crop in 2014. In 2014, no manure was applied, but the after-effect of manure applied in 2011-13 was recorded. On average for the whole period, the P concentration in the slurry was 0.41 kg ton^{-1}. The soil organic matter content is 11%, and the average soil bulk density is 1030 kg m3 dry soil which implies that the topsoil dry weight is 2060 ton ha^{-1}. Soil P concentrations were converted to amounts of P in topsoil in kg ha^{-1} by multiplying with this number (Table 1). Soil sampling comprised 6 cores per composite sample from each experimental plot. During 2011-13, P concentration in the harvested plant material was analysed, and the average values were used to estimated amounts of P removed from each treatment over the whole period.

Results and discussion

The average P budget during 1991-2012 was a surplus of 1.6 kg P ha^{-1} yr^{-1}. During 1991-2004, the average annual surplus was only 0.16 kg P ha^{-1}, increasing to 4.1 kg ha^{-1} during 2005-12 when the herd increased (Ebbesvik et al. 2014). Former studies of organic dairy farms aiming at self-sufficiency with nutrients (Løes and Øgaard 1997) found decreasing soil P with farm level P surplus < 50 kg ha^{-1} yr^{-1}. This result was confirmed for Tingvoll farm. On average for 16 sites sampled in all years, the average P-AL value decreased from 203 to 100 mg kg^{-1} soil. The fields at Tingvoll farm had widely different initial P-AL status in 1989, ranging from 387 to 51 mg P kg^{-1} soil. A decline in P-AL concentrations from sampling to sampling has occurred on almost all fields, with more rapid changes for fields high in P.

At the farm, perennial grass-clover leys are re-established each fourth or fifth year with greed fodder, oats or barley as a cover crop. Yield levels vary significantly with time (Figure 1), but the long-term trend is slightly negative (r^2=0.12). One explanation may be that the first cut occurs at earlier developmental stage of the ley since 2010, when round bale harvesting was introduced. However, we cannot exclude that lower soil P concentrations have contributed to this decline. An assessment of crop yield levels in 2014, combining with all available records that could possibly explain ley yields, revealed that soil P concentrations had a significant and positive effect on first cut DM yields, along with the proportion of legumes and precipitation in April + May (Ebbesvik et al. 2014). A negative effect was found of number of years after establishment, proportion of weeds, and precipitation in June. Altogether, these factors explained 49% of the first cut DM yields. However, when splitting yield records in classes dependent on soil P-AL level, no relationship was found between P-AL and yield level for medium (30-70 mg P kg^{-1} soil) or low (< 30) P soil. For P-AL > 70, a positive relationship was found (r^2=0.20). The average yield level was 0.43 ton ha^{-1} with P-AL below 30, 0.42 with P-AL between 30 and 70, and 0.47 for soils with P-AL > 70.

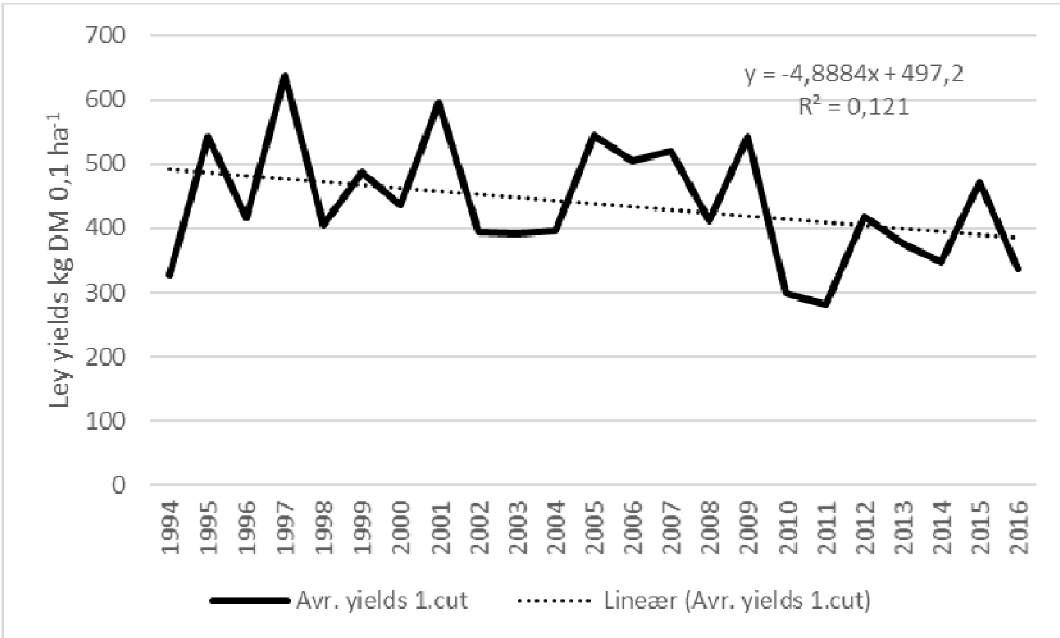


Figure 1. Yield levels of perennial ley, average values for 2-9 fields, on Tingvoll farm 1994-2016, first cut (during June).

Table 1: Changes in topsoil P contents (kg P ha^{-1}, 0-20 cm depth) from 2011 to 2013 and 2013 to 2016 compared with P budget (kg ha^{-1}, P applied in slurry minus P removed in yields) for low (30 t ha^{-1} year^{-1}) and high (60 t) applications of digested or undigested slurry in 2011, 2012, 2013 and 2015.

Period	Soil 2011 vs 2013	P budget 2011-12	Soil 2013 vs. 2016	P budget 2013-2015
Undigested slurry, low	+17.0	-6.8	-15.5	-19.2
Undigested slurry, high	+26.3	6.9	-13.4	-5.5
Digested slurry, low	+12.4	-6.9	-15.9	-20.5
Digested slurry, high	+18.0	7.2	-14.8	-6.7
Control, no slurry	+3.6	-20.5	-22.0	-24.6

In the field experiment, soil P concentrations increased from spring 2011 to 2013, and more with applications of high amounts of slurry (Table 1). From spring 2013 to 2016, the soil P status decreased, also in treatments receiving at least twice the amount of slurry that is available on average for Tingvoll farm. The accumulated P fertilisation during 2011-2015 was 49.2 kg P ha^{-1} with low manure application, and 98.4 with high. The average P content (% of DM) during 2011-13 was 0.17 in the Control treatment, 0.18 with USL and DSL, 0.21 with DSH and 0.22 with USH. During 2011-15, the accumulated yields comprised 26.5 ton DM ha^{-1} in the Control, 40.9 with USL, 42.6 with DSL, 44.1 with USH and 46.6 with DSH. Assuming that P concentrations for 2011-13 are relevant for the whole period, the P removal in yields equals 45.1 kg ha^{-1} in the Control, 75.2 with USL, 76.6 with DSL, 97.0 with USH and 98.0 with DSH. Significantly higher P concentrations with application of high amounts of slurry treatments, and weak effects on soil P-AL from manure application, indicate that the P applied was taken up by the plants, instead of adsorbed to the soil. No manure application in 2014, but removal of yields increased by manure applications in 2011-2013, and ploughing of the field in 2014 with a possible dilution of P-AL by some subsoil with lower P-AL, add to the explanation of reduced of P-AL levels from 2013 to 2016. Subsoil P-AL concentrations in the field surrounding the experiment were < 20 mg kg^{-1} in 2015.

Conclusion and outlook

This study shows that soil P concentrations decrease by long-term organic dairy farming, in spite of a small farm level P surplus. Relationships between soil P-AL levels and yield levels are not clear for soils with P-AL concentrations below the optimal value of 70 mg kg-1 soil. Increasing the fertilisation with P in animal manure may increase plant P concentrations instead of enriching the soil P. Future studies may clarify if this is a result of the crop being a perennial ley. The declining soil P values call for a closing of the P gap, to avoid reduced soil fertility in future. Locally available sources could be horse manure from a nearby riding school, or seaweed. Increasing the production may be required to keep track with social conditions for the farmers, but may reduce diversity and utilisation of local resources.

References

Ebbesvik M, Solemdal L, Løes AK, Serikstad GL, Strøm T (2014): Jord, avlinger og næringsbalanser ved økologisk drift. Langtidsstudier på Tingvoll gard 1991-2013 (Soil, yield levels and nutrient budgets by organic management. Long term studies at Tingvoll farm 1991-2013; in Norwegian).Bioforsk report Vol. 9 No.165.

Løes AK, Øgaard AF (1997): Changes in the nutrient content of agricultural soil on conversion to organic farming, in relation to farm level nutrient balances and soil contents of clay and organic matter. Acta Agric. Scand. Sect. B, Soil Plant Sci 47, 201-214.

Climate friendly organic milk production: a case study from Italy

Francesca Alberti[1], Sara Priori[1], Susanne Padel[2], Raffaele Zanoli[1]

Key words: organic, feed, milk, LCA, carbon footprint

Abstract

The study aims at evaluating the environmental performance of organic milk obtained from two different diets: a control diet, composed of both purchased and farm produced ingredients; and a home-grown diet, consisting almost solely of farm produced feed ingredients. The impact of the two feed systems on global warming was calculated in terms of kg of CO_2-eq per kg of fat and protein corrected milk (FPCM) produced. By means of an attributional and cradle-to-farm-gate LCA approach, we have estimated the carbon footprint of the two systems. The average daily milk production of the home-grown feed group was 3.86 kg lower than the control group. Consequently, the impact of home-grown system on global warming was higher than the control system. This is in agreement with literature showing that the milk yield per cow is one of the main factors affecting the carbon footprint of dairy farms.

Acknowledgments

This publication was generated as part of the SOLID Project (Agreement no. 266367 (http://www.solidairy.eu/), with financial support from the European Community. The publication reflects the views of the authors and not those of the European Community, who is not to be held liable for any use that may be made of the information contained.

Introduction

The livestock products are GHGs intensive (Garnett 2009): roughly, 80% of global agricultural GHG emissions are due to livestock (FAO 2006). Particularly, beef and cattle milk production represent respectively 41% and 20% of the sector’s emissions (Gerber et al. 2013). The most relevant GHGs are methane (CH_4 - coming from both enteric fermentation and manure management), nitrous oxide (N_2O - direct and indirect, due to manure management and feed production), and carbon dioxide (CO_2 – coming from feed production, processing, transport, energy consumption). We wanted to evaluate the possibility of reducing GHGs by feeding the cows with ingredients almost exclusively produced on the farm, to reduce the impact due to transport of feed and we wanted to monitor and compare the overall milk production using different diets. The carbon footprint using a Life Cycle Assessment (LCA) has been estimated.

Material and methods

The feeding trial involved 136 dairy cows (Italian Friesians) divided into two homogeneous groups (in terms of parity and days in milk) for 3 months (January and March 2014) at the Hombre farm in Modena, Italy. The composition of the two diets was:

- Control, based on purchased ingredients - crushed maize (7%) and protein (mainly based on sunflower and soya bean) meal (10%) - and on-farm produced ingredients - lucerne hay (60%), crushed barley (13%), crushed sorghum (10%);

[1] Dipartimento di Scienze Agrarie, Alimentari e Ambientali (D3A), Università Politecnica delle Marche, Italy, www.d3a.univpm.it, eMail: f.alberti@agrecon.univpm.it
[2] Organic Research Centre, Hampstead Marshall, UK, www.organicresearchcentre.com

- Experimental, based almost solely on feed ingredients produced on-farm: lucerne hay (64%), crushed barley (16%), crushed sorghum (19%), with protein meal (1%) as the only purchased feed.

The two diets are conformed to the EC Reg. 834/07 for concentrate/forage ratio, and are comparable in terms of both crude protein (control: 2.7 kg/day; experimental: 2.6 kg/day) and net energy content (control: 113.0 MJ; experimental: 114.3 MJ). Feed samples have been analysed for contents of dry matter (DM), crude protein (CP), ether extract (EE), fibrous fraction (CF- crude fibre; NDF- neutral detergent fibre; ADF- acid detergent fibre; ADL – acid detergent lignin) and ash, according to Martilotti et al. (1987). Protein meal has been fed to animals by an automated system, while the rest of the ingredients as total mixed ration. The milk yield of each group of cows has been obtained from monthly averages of total milk production per day per cow. At each milking, records based on automated milk weight measurements have been taken. Milk yields have been provided by APA, the local animal farmers association. Proteins, lactose, lipids and somatic cells have been analysed by APA laboratory in Modena. Proteins, sugars and lipids have been measured by the Milkoscan 13K (Foss Electric), while the somatic cells with the Foss-o-Matic (Foss Electric). We compared the means of the various quantitative characteristics of milk in the two groups.

LCA modelling study

Two different systems have been modelled to build the LCA study, both with the same number of animals. The two systems - named "control" and "experimental" - differ for the type of diet that have been administered to the lactation cows. The functional unit is 1 kg of fat and protein corrected milk (FPCM) (FIL IDF 2010). The attributional and cradle-to-farm-gate LCA approach has been used to estimate the carbon footprint (ISO 14040-14044). The on-farm processes (forages and crop production, manure and livestock management) and its emissions were included. Furthermore, processes related to the purchased feed were included (maize, soy, protein meal). Milk transportation and transformation phases have not been taken into account after milk production. Emissions of methane and nitrous oxide have been calculated according to IPCC (2006 a, b). For the carbon dioxide fossil emissions related to crop processing, the Ecoinvent processes - suitably modified - have been employed. The primary data have been collected using a specific questionnaire while the secondary data have been derived from Ecoinvent, Agri-footprint database and literature. We used the IPCC 2013 method (over a period of 100 years) implemented in Simapro 8.04 (Ponsioen 2014).

Results

The results of the milk production of the two groups fed with different diets are shown in Table 1. The average daily milk production of the home-grown feed group was 3.86 kg lower than the control group. Milk quality (fat and protein concentration, number of somatic cells) was not affected by the diets. The results obtained for the milk yield are in accordance with the existing literature on substitution of soybean with alternative protein plants on a dairy cow ration (Martini et al. 2008; Mordenti et al. 2007).

The total GHG emissions per kg of FPCM milk from the control and experimental systems are respectively equal to 1.05 kg CO_2-eq and 1.16 kg CO_2-eq. (Fig. 1). The impact of the experimental system on global warming, calculated in terms of kg of CO_2-eq, is higher than the control system. This is mainly due to the reduction in milk production in the home-grown feed system. This is in agreement with literature showing that the milk yield per cow is one of the main factors affecting the carbon footprint of dairy farms (Rotz et al. 2010; Hermansen & Kristensen 2011; Opio et al. 2011).

Table 1: Yield and characteristics of milk characteristics of dairy cows during the total lactation period: control (1) and home-grown (2) diets

	Diet	Mean	Std. Err.	P
Production (Kg/day)	1	31.28	0.7995	0.0006
	2	27.42	0.7269	
Fat (gm/100 ml)	1	3.51	0.0944	0.7239
	2	3.46	0.0804	
Protein (gm/100 ml)	1	3.49	0.0399	0.6681
	2	3.46	0.0440	
Lactose (gm/100 ml)	1	4.92	0.0223	0.0018
	2	4.82	0.0236	
Somatic cell (ccs/ml)	1	139.30	12.5925	0.9838
	2	138.93	12.2647	

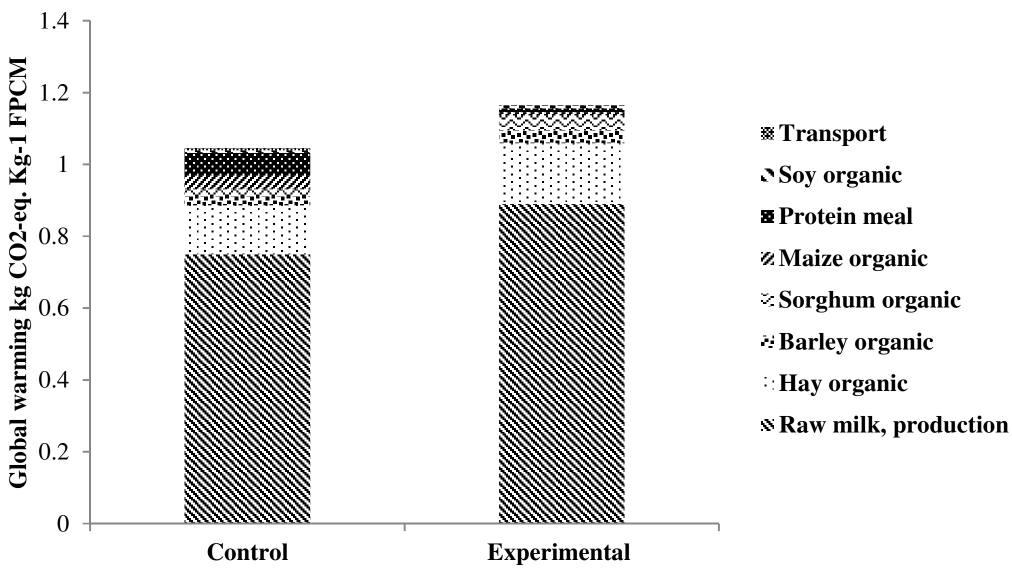


Figure 1. Global warming potential of control and home-grown feed systems and the contribution from different processes

Discussion

As with most case study analyses, some aspects of our study (for example crop rotation and herd management) limit the generalisation of the results. Despite these limitations, the results gave useful insights into the choices that a farmer must make before deciding to modify a diet. First of all, in addition to lucerne hay, we suggest the use of faba beans or peas to improve home-grown protein use at farm level. Those sources could be viable alternatives to soya based feeds. Secondly, as well as considering possible effects on milk yield, dairy farmers should also consider the environmental impact. This study demonstrates that lower milk production generates not only a lower profit for the farm, but also a higher environmental impact. Our study contributes to the debate on the role of organic livestock production on the climate change mitigation strategies. By means of a participatory on-farm approach, researchers and farm managers have agreed on a feeding trial to evaluate the possibility of introducing new practices on the farm. The results show that, using only the crops currently grown switching to home-grown feed does in this case result in lower yields and higher environmental impact. However, if the farmer were able to introduce other legumes (e.g. faba) in the rotation the results could be better.

References

FAO (2006): Livestock's long shadow. Available at: ftp://ftp.fao.org/docrep/fao/010/a0701e/a0701e.pdf.

FIL IDF (2010): A common carbon footprint approach for dairy. The IDF guide to standard lifecycle assessment methodology for the dairy sector. Bulletin of the International Dairy Federation, 445.

Garnett T (2009): Livestock-related greenhouse gas emissions: impacts and options for policy makers. Environmental Science & Policy, 12, 491-503.

Gerber P J, Steinfeld H, Henderson B, Mottet A, Opio C, Dijkman J, Falcucci A, Tempio G (2013): Tackling climate change through livestock – A global assessment of emissions and mitigation opportunities. Food and Agriculture Organization of the United Nations (FAO), Rome.

Hermansen J E, Kristensen T (2011): Management options to reduce the carbon footprint of livestock products. Animal Frontiers, Vol. 1, N. 1, 33-39.

IPCC (2006a): IPCC Guidelines for National Greenhouse Gas Inventories. In: Agriculture, Forestry and Other Land Use, vol. 4, pp. 1-87 Chapter 10: Emissions from livestock and manure management.

IPCC (2006b) IPCC Guidelines for National Greenhouse Gas Inventories. In: Agriculture, Forestry and Other Land Use, vol. 4, pp. 1-54 Chapter 11: N2O emissions from managed soils, and CO_2 emissions from lime and urea application.

ISO (2006): Environmental Management - Life Cycle Assessment - Principles and Framework. ISO 14040. International Organization for Standardization, Geneva, Switzerland.

ISO (2006): Environmental Management - Life Cycle Assessment - Requirements and Guidelines. ISO 14044. International Organization for Standardization, Geneva, Switzerland.

Martilotti F, Antongiovanni M, Rizzi L, Santi E, Bittante G (1987): Metodi di analisi per la valutazione degli alimenti d’impiego zootecnico. Ed. IPRA, Roma.

Martini A, Lorenzini G, Lotti C, Squilloni S, Casini M, Betti G, Riccio F, Giorgetti A (2008): Utilizzazione di proteine alternative alla soia nell'alimentazione di frisone biologiche. VI Convegno nazionale sulla Zootecnia Biologica "Zootecnia biologica e ricerca: investire insieme", Arezzo.

Mordenti A L, Merendi F, Fustini M, Formigoni A (2007): Effects of different protein plants in cows diet on milk for Parmigiano Reggiano production. Ital. J. Anim. Sci. Vol. 6 (Suppl. 1), 463-465.

Opio C, Gerber P, Steinfeld H (2011): Livestock and the environment: addressing the consequences of livestock sector growth. Animal biosciences, 2, 3: 601-607.

Ponsioen T (2014): Updated Carbon Footprint Calculation Factors. Available at: https://www.pre-sustainability.com/updated-carbon-footprint-calculation-factors.

Rotz C A, Montes F, Chianese D S (2010): The carbon footprint of dairy production systems through partial life cycle assessment. J. Dairy Sci., 1266–1282.

Effects of Iodine-based teat disinfectants on Iodine concentrations in organic milk

Konstantinos Zaralis[1], Nigel R. Kendall[2] and Susanne Padel[1]

Key words: iodine, milk, disinfectants, minerals, feed intake

Abstract

The most important factors influencing milk iodine concentrations are the dietary intake of iodine and the use of iodine-containing teat disinfectants. This study investigated how iodine concentrations in milk are affected by concentrations of iodine in forage in view of the use of iodine-containing teat disinfectants, at a farm level. Ten organic dairy farms located in the west-south of England were selected as case-study farms. The farms were categorised in terms of milk iodine concentrations as low (<60 μg/L), optimal (60<, >120 μg/L) or high (120< μg/L) and farmers agreed to a monitoring protocol that allowed data collection on iodine concentrations in milk, blood, urine and forage samples over a 6-month period. Urine iodine concentrations were significantly higher in the farms with high (i.e. 1.5 mg/kg) or optimal (i.e. 0.5 to 0.8 mg/kg) forage iodine concentrations compared to the farms with low forage iodine (i.e < 0.5 mg/kg) suggesting that urine iodine is indicative of dietary iodine intake. Milk iodine concentrations were 2.3 times higher in the farms that use iodised post-dip teat disinfectants (mean average 195 ± 13 μg/L) compared with the farms that do not use such as (mean average 85 ± 8.9). This study shows that the use of iodised post-dip teat disinfectant is the most important influencing factor for the iodine concentration in milk which suggests that iodine concentrations in milk are likely not to serve as a robust indicator in identifying shortfalls in dietary iodine intake.

Acknowledgments

This work was undertaken as part of the research project "Sustainable Organic and Low-Input Dairying; SOLID" that has received funding from the European Union's Seventh Framework Programmefor research, technological development anddemonstration under grant agreement No 266367.

Introduction

Iodine is an essential trace element for animals and humans because it is necessary for the synthesis of the thyroid hormones triiodothyronine (T3) and thyroxine (T4) which have multiple functions in energy metabolism, growth and brain development. The iodine requirement for dairy cows is estimated to be about 0.33 mg/kg DM or about 0.6 mg dietary iodine/100 kg of body weight (NRC, 2001). The iodine requirements for humans are related to age, body weight, physiological stage, and gender and can vary from 40 to 290 μg per day. According to the Scientific Advisory Committee on Nutrition (SACN, 2014) dietary iodine intake in the UK for the adult is 140 μg while for toddlers it is 70 μg per day. The maximum iodine intake level is only three times higher than the required which means there is also a risk of overdosing (Zimmermann et al. 2005).

It is well established that there is a linear increase in the iodine concentration of milk with increasing iodine intake of the cows but recent studies have shown that in addition to intake the most important influencing factor seems to be the use of iodine-containing teat dips (Flachowsky et

[1] The Organic Research Centre, Elm Farm, Hamstead Marshall, Newbury, Berks, RG20 0HR, UK.
[2]School of Veterinary Medicine and Science, University of Nottingham, Loughborough, LE12 5RD, UK.
eMail: kostas.z@organicresearchcentre.com

al., 2007; Franke et al., 2009; Borucki et al., 2012 Flachowskyet al., 2014) that are used to remove bacteria and other contaminants, particularly the pathogens which can cause environmental mastitis.

Concentrations of iodine in cow's milk normally fluctuate from 60 to 300 μg/L. Organic milk normally contains less iodine than conventional milk but the concentrations of iodine in organic milk are well within the optimal levels for human nutrition as it is evidenced by a number of European studies (Dahl et al., 2003; Payling et al. 2015; Jahreis et al. 2007; Rey Crespo et al., 2012).

Nevertheless, the relatively lower iodine concentrations in organic milk trigger discussions amongst stakeholders, farmers and researchers in view of the recent evidence that iodine intake has decreased due to a decrease in milk consumption in the UK. The objective of this study was to test the relationship between iodine concentrations in bulk milk samples with iodine concentrations in forage in case-study organic dairy farms in view of farm practices. We hypothesise that low levels of iodine in milk are related to nutritional shortfalls due to the farm management practices.

Materials and methods

Determination of trace elements in milk samples from more than 800 organic dairy herds throughout the UK have been carried out on behalf of the Organic Milk Suppliers Cooperative (OMSCo) during 2014 (data not shown). This initial data set was analysed and results were used as a basis to identify participating farms for the current study. Based on milk iodine concentrations the farms were categorised as low (L; <60 μg/L), optimal (O; 60<, >120 μg/L) or high (H; 120< μg/L). To facilitate farm visits and regular contact with the farmers, those farms that were located more than 200 miles from the ORC (Elm Farm, Newbury, RG20 0HR, Berkshire) were excluded from the selection. From the remaining farms, 4 farms from each one of the L, O or H groups were selected randomly for participation in the study. All the selected farmers (i.e. 12 in total) agreed to participate. However, two farms out of the twelve, one from the O and one from the L group, voluntarily withdrew from the study shortly after the start of the monitoring and no data were collected from these farms.

Data collection and monitoring of the case study farms lasted from June 2014 to January 2015. Monthly bulk milk samples were collected via OMSCo's routine farm milk collection and samples were analysed for iodine and other minerals. In addition, monthly samples of the grazed forage or diet (TRM, silage) were also analysed for mineral concentrations; these analyses were carried out by Thomson & Joseph Ltd, Albion Laboratory Services, Hoveton, NR12 8QN, UK.

Blood and urine samples from 10 milking cows were obtained from all farms under normal vet visits in three occasions during the monitoring period (i.e. August to September, October to November and December to January). Blood samples were analysed for glutathione peroxidase (GSHPx), which is a selenium dependent enzyme. Urine samples obtained from the same 10 cows were analysed for Iodine concentrations. The results are reported in μg/L and are standardised to a creatinine concentration of 5000 μmol/L to account for the different dilution of urine samples collected. All samples were dispatched from the farms within 48 hours of collection. These laboratory analyses were carried out by the School of Veterinary Medicine and Science, University of Nottingham, Loughborough.

Results

Calculated mean iodine concentrations over the sampling period varied across the farms. In four farms the mean iodine concentrations were below the optimal levels (60 μg/L), in four farms they were above (Figure 1, panel a) while in two farms they were within the optimal levels. The highest iodine concentration observed was 1025 μg/L and the lowest was 7 μg/L in two separate farms. On all farms, urine iodine concentrations were above optimal levels (i.e >100 µg/L) on all farms (Figure 1, panel b).

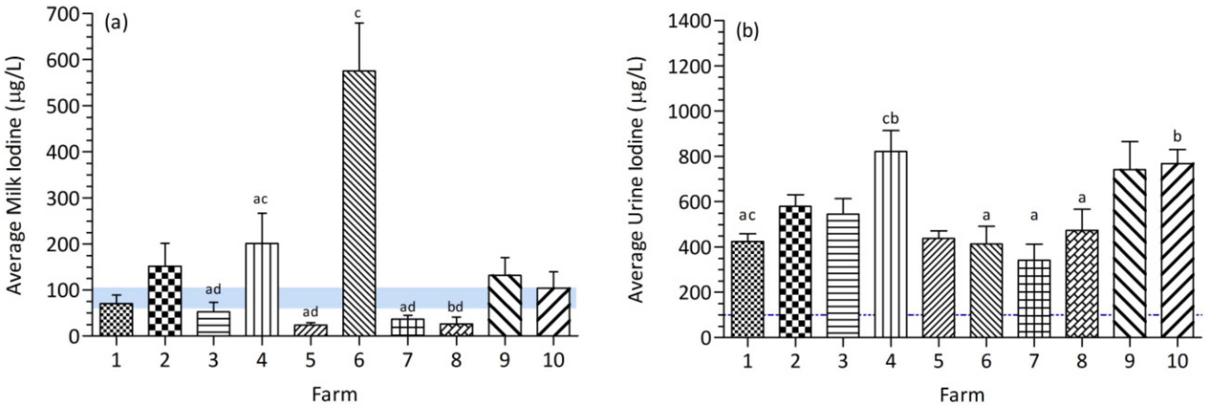


Figure 1.Milk iodine (panel a) and urine iodine (panel b) concentrations in each farm averaged over the sampling period.

Six out of the 10 case-study farms use iodised post-dip teat disinfectants, while the remaining 4 farms do not. Comparison between these two groups of farms indicated that milk iodine concentrations were 2.3 times higher (Figure 2, panel a; P<0.0001) on the farms that use iodised post-dip teat disinfectants (mean average 195 ± 13 µg/L) compared with the farms that do not use this practise (mean average 85 ± 8.9). Similarly, urine iodine concentrations were significantly higher on the farms that use iodised post-dip teat disinfectants compared with those that do not (Figure 2, panel b, P ≤ 0.01).

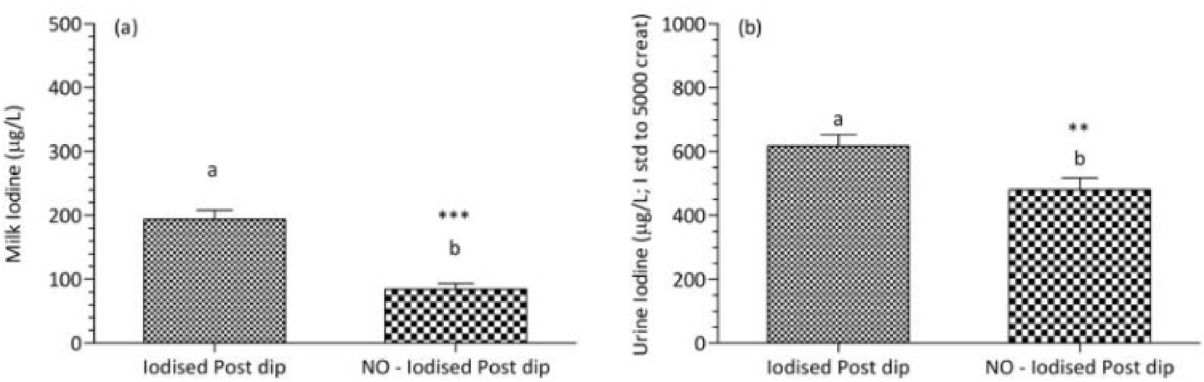


Figure 2: Effect of iodised post-dip teat disinfectants on bulk milk iodine (panel a) and urine iodine (panel b) concentrations.

Discussion

The results show that differences between farms in milk iodine do not follow the same pattern as the farm differences in urine iodine (Figure 1); an outcome that suggest that urine iodine concentrations are not indicative of milk iodine concentrations. The results show that urine iodine concentrations were significantly higher in the farms with average or high forage iodine compared with the farms with low forage iodine (P ≤ 0.001), adding to the existing body of evidence that iodine excreted in urine is indicative of dietary iodine intake (Flachowsky et al., 2007; Franke et al., 2009). However, this is not thecase with the milk iodine concentrations as farms with low or average forage iodine concentrations had higher milk iodine compared to milk iodine in the farms with high forage iodine. Although this can be viewed as a surprising outcome, it is explained by the significant positive effect of the iodised teat disinfectants on milk iodine concentrations. According to the review of Flachowsky et al. (2014) the content of iodine in the disinfectants is more important factor than the timing of the application (i.e. pre- or post- dip) in the increase of iodine concentration in milk (Flachowsky et al., 2014). The finding that urine iodine concentrations were also significantly higher in the farms that use iodised post-dip teat disinfectants is of particular importance as it can reflect the fact that iodine can be also absorbed in the lungs or via the skin (Flachowsky et al., 2014). This study show that the use of iodised post-dip teat disinfectant is the most important influencing factor for the iodine concentration in milk and that where post-dip teat disinfectant is used the iodine concentrations in milk do not serve as a robust indicator in identifying shortfalls in iodine intake. Iodine levels in organic milk in the UK are within the optimum range for human health. However, the present study shows milk iodine concentrations fluctuated within farms across samplings and in some farms they were systematically low and further investigation to ensure greater consistency is required.

References

Flachowsky G, Franke K, Meyer U, Leiterer M, Schöne F., (2014). Influencing factors on iodine content of cow milk. Eur J Nutr 14 53(2): 351-65. doi: 10.1007/s00394-013-0597-4

NRC (2001) Nutrient requirements of dairy cattle: seventh revised edition, 2001. The National Academies Press, Washington

Scientific Advisory Committee on Nutrition (SACN) 2014. Statement on Iodine and Health; http://bit.ly/1E4zOGd

Franke K, Meyer U, Wagner H, Flachowsky G (2009) Influence of various iodine supplementation levels and two different iodine species on the iodine content of the milk of cows fed rapeseed meal or distillers dried grains with solubles as the protein source. J Dairy Sci 92(9):4514–4523.

Borucki Castro, S. I., R. Berthiaume, A. Robichaud, and P. Lacasse (2012) Effects of iodine intake and teat-dipping practices on milk iodine concentrations in dairy cows. J. Dairy Sci. 95 :213–220

Flachowsky, G., F. Schöne, M. Leiterer, D. Bemmann, M. Spolders, and P. Lebzien. 2007. Influence of an iodine depletion period and teat dipping on the iodine concentration in serum and milk of cows. J. Anim. Feed Sci. 16:18-25.

Rey-Crespo F, Miranda M, Lo´pez-Alonso M et al (2013) Essential trace and toxic element concentrations in organic and conventional milk in NW Spain. Food Chem Toxicol 55:513–518.

Payling LM, Juniper DT, Drake C, Rymer C, Givens DI (2015) Effect of milk type and processing on iodine concentration of organic and conventional winter milk at retail: Implications for nutrition. Food Chemistry 178 (2015) 327–330

Jahreis G, Leiterer M, Fechner A (2007) Jodmangelprophylaxe durch richtige Erna¨hrung. Pra¨vention und Gesundheitsfo¨rderung 2(3):179–184.

Dahl L, Opsahl JA, Meltzer HM, Julshamn K (2003) Iodine concentration in Norwegian milk and dairy products. Br J Nutr 90(03):679–685.

Milk Quality of Podolian Cows from Organic Farming

Vladica Mladenović[1], Dragomir Lukač[2], Tibor Könyves[2], András Halász[3], Nikola Puvača[4], Milan Stojšin[2], Branislav Miščević[2]

Key words: Podolian cows, Organic milk, fatty acids milk

Abstract

Podolian cattle is a primitive indigenous cattle breed in Serbia which is suitable for organic production. Organic production methods have in the past been shown to have benefits for the environment, biodiversity, soil quality, animal welfare and reduced pesticide residues. In addition to these qualities they may also contribute directly to human health. Milk is a nutrient-rich beverage choice that includes all the macronutrients plus a good source of vitamins and minerals, including vitamins A and B and calcium. In our results, fat content was 4.31%, proteins content was 4.14 %, dry matter was 13.28 of which non-fat dry matter 8.96 %.About 46.86 % of the fat in milk is saturated of which 4.32% comprises short-chain fatty acids, almost half of which is butyric acid. Approximately 47.73 % of the fatty acids in milk are mono-unsaturated and 3.26% are poly-unsaturated fatty acids.

Introduction

The Grey steppe cattle or Podolian is one of the three primitive indigenous cattle breeds in Serbia which is suitable for organic production. Podolian cattle originated directly from European wild cattle (Bos primigenius Bojanus). The hair is grey and slightly shadowed on the neck, belly and outer parts of limbs. It has extremely big ilyra-shaped horns which can be 1m long and whose span can be 1.5 m. This breed is characterized by firm hooves, regularly positioned legs, dry joints, strong tendons and long pace. These cattle have a life expectancy of 25-30 years. The Podolian cow is characterized by rather slow growth and low production of milk and meat. Milk production is sufficient for calves (800-1000 liters). The organic farms differed in many aspects from the conventional systems. Milk production in accordance with the principles of organic production demands that the livestock production system adapt to specific technology-in first line origin of feed, reproduction, health, welfare and behavior of animals (Rosati and Aumaitre 2004). Organic milk production can be more beneficial to both animals and the environment than conventional production (Nicholas *et al.* 2004). Organic agriculture has achieved a positive contribution to the preservation of the environment, reduction of arable land and residual pesticides and thus has a direct effect on the improvement of human health (Bloksma *et al.* 2008). For many people this is an important consideration for buying organic milk. However, for others the main reason for buying organic is the idea that organic food is more healthy. New research (Bloksma *et al.* 2008; Collomb *et al.* 2008; Fall and Emanuelson 2011; Butler *et al*. 2011; Schwendel *et al.* 2015) has also revealed that these healthful fatty acids are found in higher quantities in organic milk versus conventional, principally attributed to the high intake of pasture in the diets of organic livestock. So, oganic raw milk compared with milk from conventional production has a better fatty acid composition i.e. contains more polyunsaturated fatty acids with a higher proportion of omega-3 fatty acids and conjugated linoleic acid (Ellis *et al.* 2006; Prandini *et al.* 2009). The mentioned group of fatty acids

1 Vethem Ltd. Veterinary station, Velika Plana, Serbia, eMail:vethemvs@gmail.com

2 John Naisbitt University Belgrade, Faculty of Biofarming, Bačka Topola,Serbia

3 Szent István University, Faculty of Agricultural and Environmental Sciences, Godollo Hungary

4 Patent Co., Mišićevo, Serbia

(especially omega-3) has positive effects on human health. Their activity is associated with improvement of neurological function (Contreras and Rapoport 2002), decreases the risk of diabetes, prevents the occurrence of cardiovascular diseases, improves function of the immune system (Wahle *et al.* 2004). Milk from organic production contains more α-tocopherol and vitamin A (Pentelescu 2009). To date there are no studies to determine the milk quality of Podolian cattle in Serbia. Therefore, the present study was carried in order to determine some parameters of milk quality this primitive indigenous breed. Also, this was a good opportunity to get know these genetically very old animals, which have remained virtually unchanged throughout evolution.References are not necessary but can be done in following way (Lastname *et al.* 2003; Lastname and Lastname 2004).

Material and methods

One organic dairy farm and 14 Podolian adult cows aged from 5 to 8 years were used in the study. The animals were kept mostly in stables with temporary access to pastures. The feeding of the cows in organic farming was based on home-grown fodder and grass-clover products and hay (including home-grown grains). Animal get received fresh water ad libitum. At the time of samples collection, all cows were clinically healthy without any clinically visible signs. In june 2015 three milk samples were taken from farm at a one week interval. All samples were delivered for analysis to the laboratory for testing food products at Faculty of Technology Novi Sad. The laboratory is accredited in accordance with the international standard (ISO 17025). Preservation of milk samples was carried out in compliance with the regulations ISO 13366-2:2006 and IDF 148-2:2006. Gas chromatography was used for the analysis of milk quality (fat, protein, dry matter and fatty acid). The obtained results were analysed by the STATISTICA statistical software(Ver.13 StatSoft Company).

Results

There are no much data on the specific parameters of the milk quality of this critically endangered indigenous cattle breed in Serbia. The results of analyses of raw cows' milk samples coming from organic farming are summarised in Table 1. The fat content was 4.31±0.77 %, proteins content was 4.14±1.24 %, dry matter was 13.28±0.78 % of which non-fat dry matter 8.96 %.The saturated fatty acids present in milk accounts for approximately 46.86 % by weight. The most important fatty acid from a quantitative viewpoint is palmitic acid (16:0), which accounts for approximately 24.25 % by weight of the total fatty acids. Myristic acid (14:0) and stearic acid (18:0) make up 5.09 and 11.54 % by weight, respectively. Of the saturated fatty acids, 4.32% are short-chain fatty acids (C4:0-C10:0). Approximately 47.73 % of the fatty acids in milk are mono-unsaturated with oleic acid (18:1) accounting for 42.89 % by weight of the total fatty acids in Podolian dairy milk. Poly-unsaturated fatty acids constitute about 3.26 % by weight of the total fatty acids and the main poly-unsaturated fatty acid is linoleic acid (18:2) accounting for 2.94 % by weight of the total fatty acids.

Discussion

Milk contains about 3.4% fat and is said to have more than 400 individual fatty acids, making it one of the most complex fatty compositions of all edible fats (International Dairy Foods Association 2000). Milk contains saturated, monounsaturated, and polyunsaturated fats; the goal is to reduce saturated fats in the milk and increase polyunsaturated fats (like omega-6 and omega-3), and further, to increase omega-3 in the diets of both cows and humans (Simopoulos 2003; Schwendel et al. 2015). A low ratio of n-6 to n-3 FA, for example, is beneficial for human health. Too high the amount of n-6 FA may have and negative consequences (e.g. cardiovascular disease, cancer, and inflammatory and autoimmune diseases) (Simopoulos 2003). Current recommendations regarding the dietary ratio of omega-6:omega-3 fatty acids target 1:1 or 2:1, but even a 4:1 ratio was found to have a positive effect on asthma patients (Simopoulos 2003) and decreased mortality in patients with a previous myocardial infarction (Simopoulos 2010).Two common approaches are to influence milk fatty acids composition through dietary changes or to genetically select cows with a more preferable milk fatty acids profile (Bilal et al. 2012) such as the primitive indigenous cattle breeds. Milk fat content of podolian cows in our results was 4.31 %. In studies of many authors (Bloksma et al. 2008; Popović-Vranješ et al. 2011; Fall and Emanuelson 2011; Butler et al. 2011; Palupi et al. 2012; Schwendel et al. 2015) recorded that milk produced in organic dairy farming had a lower concentrations of saturated but more unsaturated fatty acids, which is the case with our results. This ratio of fatty acids in organic milk is preferred in terms of positive impact on human health. As consumers become more concerned about their health and where their food comes from, interest in purchasing milk products high in beneficial fatty acids like omega-3 and conjugated linoleic acid will undoubtedly continue to increase. The use of indigenous breeds and maximizing grazing and managing pastures and stored feeds for quality will help certified organic dairy operations increase and/or maintain these beneficial fatty acid in livestock feed, and therefore, the animals’ milk fat, providing health benefits to cattle and humans alike.

Table 1: Quality milk of Podolian cows

Milk components	Weighted Mean	SD	Lowest value	Highest value	CV, %
Fat, %	4.31	0.77	3.80	6.80	17.96
Protein, %	4.14	1.24	3.22	8.20	30.14
Dry matter, %	13.28	0.78	12.50	15.16	5.87
Non-fat dry matter,%	8.96	0.34	8.36	9.77	3.80
Butyric acid (C4:0)	1.75	0.14	1.61	1.89	7.98
Caproic acid (C6:0)	1.02	0.09	0.92	1.08	8.91
Caprylic acid (C8:0)	0.51	0.03	0.48	0.54	6.24
Capric acid (C10:0)	1.04	0.04	1.00	1.08	3.81
Lauric acid (C12:0)	1.13	0.02	1.11	1.16	2.08
Myristic acid (14:0)	5.09	0.05	5.05	5.16	1.11
Myristoleic acid (C14:1ω5)	0.31	0.02	0.31	0.32	0.62
Pentadecylic acid (C15:0)	0.56	0.09	0.55	0.57	1.66
Palmitic acid (C16:0)	24.25	0.44	23.96	24.05	1.81
Palmitoleic acid (C16:1ω7)	0.12	0.00	0.12	0.13	2.89
Sapienic acid (C16:1ω10)	2.08	0.05	2.03	2.11	2.49
Margaric acid (C17:0)	0.85	0.03	0.83	0.89	3.71
Heptadecenoic acid (C17:1)	0.61	0.03	0.58	0.64	5.26
Stearic acid (C18:0)	11.54	0.26	11.24	11.71	2.28
Vaccenic acid (C18:1ω7)	1.72	0.14	1.55	1.81	8.57
Oleic acid (C18:1ω9)	42.89	0.22	42.67	43.12	0.52
Linoleic acid (C18:2ω6)	2.94	0.05	2.89	3.01	1.96
Conjugated linoleic acids	0.32	0.02	0.29	0.33	8.52
Arachidic acid (C20:0)	0.14	0.01	0.13	0.16	6.62
Saturated fatty acids	46.86	1.20	46.88	48.29	2.56
Mono-unsaturated fatty acids	47.73	0.46	47.26	48.13	0.96
Poly-unsaturated fatty acids	3.26	0.07	3.18	3.34	2.14

References

Bilal G, Cue RI, Mustafa AF, Hayes JF (2012) Short communication: Estimates of heritabilities and genetic correlations among milk fatty acid unsaturation indices in Canadian Holsteins. J Dairy Sci 95:7367–7371.

Bloksma J, Adriannsen-Tennekes R, Huber M, van de Vijver LP, Baars T, de Wit J (2008) Comparison of organic and conventional raw milk quality in the Netherlands. Biol Agric Hortic 26: 69-83.

Butler G, Stergiadis S, Seal C, Eyre M, Leifert C (2011) Fat composition of organic and conventional retail milk in northeast England. J Dairy Sci 94: 24-36.

Collomb M, Bisig W, Bütikofer U, Sieber R, Bregy M, Etter L (2008) Fatty acid composition of mountain milk from Switzerland: Comparison of organic and integrated farming systems. Inter Dairy J 18: 976-982.

Contreras MA, Rapoport SI (2002) Recent studies on interactions between n-3 and n-6 polyunsaturated fatty acids in brain and other tissues. Cur Opin Lipidol 13: 267-272.

Fall N, Emanuelson U (2011) Fatty acid content, vitamins and selenium in bulk tank milk from organic and conventional Swedish dairy herds during the indoor season. J Dairy Rese 78: 287-292.

International Dairy Foods Association. 2000. Milk facts. IDFA, Washington, DC.

Nicholas PK, Padel S, Cuttle SP, Fowler SM, Hovi M, Lampkin NH, Weller RF (2004): Organic dairy production: a review. Biol Agric Hortic 22: 217–249.

Palupi E, Jayanegara A, Ploeger A, Kahl J (2012) Comparison of nutritional quality between conventional and organic dairy products: a meta-analysis. J Sci Food Agric 92: 2774-2781.

Pentelescu NO (2009) Fatty acid, retinol and carotene content of organic milk. Inter J Bioflux Society 1: 21-26.

Popović-Vranješ A, Savić M, Pejanović R, Jovanović S, Krajinović G (2011): The effect of organic milk production on certain milk quality parameters. Acta Vet 61: 415–421.

Prandini A, Sigolo S, Piva G (2009) Conjugated linoleic acid (CLA) and fatty acid composition of milk, curd and Grana Padano cheese in conventional and organic farming systems. J Dairy Rese 76: 278–282.

Rosati A, Aumaitre A (2004): Organic dairy farming in Europe. Live Produc Sci 90: 41–51.

Schwendel BH, Wester TJ, Morel PCH, Tavendale MH, Deadman C, Shadbolt NM, Otter DE (2015): Invited review: Organic and conventionally produced milk-An evaluation of factors influencing milk composition. J Dairy Sci 98: 721-746.

Simopoulos AP (2003) Importance of the ratio of ω-6 /ω-3 essential fatty acids: Evolutionary aspects. World Rev Nutrit Diet 92:1–22.

Simopoulos AP (2010) The ω-6 /ω-3 fatty acid ratio: Health im- plications. Oilseeds and fats, Corps and Lipides 17:267–275.

Wahle KWJ, Heys SD, Rotondo D (2004) Conjugated linoleic acids: are they beneficial or detrimental to health? Progress in Lipid Rese 43: 553-587.

Animals - Global

Title	**Author/s**	**Country**
The mineral question in ruminants: Improving animal production and in-place soil fertility	Regina Lis Haller	Argentina
Cattle husbandry without slaughtering as a link between the animal rights and the organic agriculture movement	Patrick Meyer-Glitza	Germany
Enhancing sustainability in India's organic states: The case of animal husbandry in Sikkim	Mahesh Chander	India
Rangeland forage biomass production and composition under different grazing regimes on a Namibian organic livestock farm	Lea Ludwig, Judith Isele, Gerold Rahmann, Anita Idel, Christian Hülsebusch	Namibia
Field evaluation of Beaveria bassiana as biological control of ticks Rhipicephalus microplus in Colombia	Jaime Fabián Cruz , Tatiana Durán, Valeria Navarro, Jorge Fierro, Dolly Pardo	Colombia
An investigation on an innovative solution for boosting organic sheep and goat production by nomad pastoralists	Hamid Reza Ansari-Renani, Mohammadreza Rezapanah	Iran
Indigenous herbal treatment of diarrhoea in Nigerian smallholder sheep and goat production systems	Fasae Oladapo Ayokunle and Adenuga Adebayo Jimoh	Nigeria

The mineral question in ruminants Improving animal production and in-place soil fertility

Regina Lis Haller[1]

Key words: Ruminants, Individual mineral supply, soil fertility, subtropical regions

Abstract

In the north of Argentina, trials were carried out offering 10 single minerals to bovines and sheep, instead of mineral mixtures. The consumption of the whole herd, intake behaviour of single animals and clinical observations seem to confirm that this species have a clear instinct for their needs. Using this ability would not only lead to a better production at lower costs, but also improve over time the in-place fertility of the soil, exactly with the minerals that are at a low level in the specific farm.

Acknowledgements

I would like to acknowledge the organic farmer Ricardo Friedenberger, who had the idea and the courage to carry out by himself the first trials. Furthermore, I'm very grateful to all the small farmers who took part in this experience, and are still using this method.

Introduction

Extra mineral supply for ruminants is both in conventional and organic animal husbandry a current part of management, also in subtropical regions of South America. It is normally done by injection (different mineral solutions) or by offering a salt mixture. These products can only be an approach to the specific needs of every animal in the herd during the whole year. In addition, minerals in mixtures have the disadvantage of inhibiting each other's entrance from the intestine into the lymphatic stream. As a result, the total mineral intake is much higher than actually needed, and the mineral composition in the animal manure does not reflect the specific lack of minerals of the farms' soil. This investigation tries to demonstrate that ruminants "know" what is missing in their food. This ability can be used to improve animal productivity, and through the herd's manure, make an organic and individually balanced mineral import to every farm.

Material and methods

Taking up an idea of Ricardo Friedenberger, a local organic farmer, 10 minerals, each mixed with table salt, were offered separately to cow and sheep herds during several months in the province of Misiones, Argentina.

The first step consisted in consulting bibliography regarding mineral needs in bovines and sheep and the toxic levels for each mineral in both species. Furthermore, existing papers about mineral levels in pastures of the region (Province of Misiones) were consulted. With this information, the different minerals to be offered and its composition were defined, as well as the concentration of each in common table salt. The aim was to allow the animals to cover their needs, without risking intoxication.

As a second step, the farms where to carry out the trials had to be chosen. Three farms with sheep (between 15 and 65 animals) and 1 bovine dairy farm (only cows in lactation, on average 59

[1]M.Sc. med. vet. Regina Lis Haller, Argentina, reginahaller1@yahoo.com.ar

animals) took part, distributed in the province. The farmers were in charge of collecting and registering the resulting information. They were given register sheets and technical support to do it. Care was taken of the design and placing of the salt dispenser, to ensure free daily intake for every animal.

The trial's duration was between 3 months and more than 1 year. Register was taken of the herd consumption. Observations of individual intake behaviour, clinical changes in the herd and observations about productivity, made by the farmers, were taken into consideration.

Results

Dairy Cattle

The following table 1 shows above the minerals and percentage of each, mixed with common table salt (NaCl), that were chosen for the single salt supplementation in bovines.

This minerals were offered to a Frisian dairy herd in the province of Misiones, Argentina, with subtropical climate, 1500 mm rain per year, whole year pasture, tropical and subtropical grass, supplementation with 1 – 3 kg of cereals per day, on average 59 cows in lactation. The animals had twice a day the possibility of free choice mineral intake after milking. Before starting the trial, the herd had free supplementation of a bonemeal-NaCl mixture, in a proportion of 1:3. The trial was carried out between Nov. 97 and May 98 (summer and autumn).

The herd consumption during the first month of trial, and average consumption during 7 months was the following, described in table 1:

Table 1: offered Minerals, percent of each in common table salt (NaCl), first month intake in gr. per day and cow, and average intake in gr. per day and cow over 7 months, for every mixture.

Offered Mineral	Cu SO_4	Co SO_4	Zn SO_4	Fe SO_4	IKO_3	Mn SO_4	MgO	Ca-Carb.	Bone meal	NaCl	Total
Percent in NaCl	4%	0.5%	4%	3%	0.5%	1%	7%	25%	50%	100%	
1. month intake	4.27	4.90	4.90	2.42	7.94	5.05	3.40	10.42	2.05	5.05	50,04
Prom. Intake 7 months	4.58	4.55	3.62	3.28	4.06	3.62	2.27	3.38	2.41	3.05	32.55

Additional clinical observations

The herd obtained a good milk production for the region, the hot season and food quality (average of 11, 2 l per day in a standard lactation (210 d)). In the supplementation period, retention of placenta was only seen in two premature cases. Before, retention was stated in 21 % of all births. The cases of claw problems went down to zero. Before, a lot of problems had been reported. No problems with grass tetanus were reported.

Observed intake behaviour

Every single animal had some time in front of the mineral–"buffet" to choose its individual intake after milking. The cows chose only 1-3 different minerals at once, and not all 10 mono-salts offered. At the beginning of the trial, the total intake was significantly higher than the average of the whole period. This happened mainly with the minerals Calcium and Iodine, but also with Zinc and Manganese; all of them at low level in the region. The preferences were changing during the year, with the availability of pasture, temperature and weather. For instance, the Mg-consumption was near zero during hot periods with old grass, but went up during rainy periods with new grass.

Sheep

The same minerals where also offered to 3 sheep herds, distributed in the Province of Misiones, Argentina; with less cooper concentration (to avoid intoxication) and more iron. Climate and rainfall was about the same as for the place of the Frisian herd. The sheep were on natural pasture in yerba mate plantations, and at night in stables. They where supplied with 100 g of corn per day and sheep, during winter time. The number of animals of each herd is stated in the below tables.

Table 2: Offered minerals and percentage of each, mixed with common table salt (NaCl), for sheep

Offered Mineral	Cu SO_4	Co SO_4	Zn SO_4	Fe SO_4	IKO_3	Mn SO_4	MgO	Ca-Carb.	Bone meal	NaCl
Percent in NaCl	0,5%	0.5%	4%	5%	0.5%	1%	7%	25%	50%	100 %

a) **Farm Carlos Klein, Garuhapé, Misiones, Argentina**
48 adults and 15 lambs, trial period 26.02.97 - 30.06.98, 489 days.

Table 3: Average consumption of each mixture in gr. per animal and day, Klein

Offered Mineral	Cu SO_4	Co SO_4	Zn SO_4	Fe SO_4	IKO_3	Mn SO_4	MgO	Ca-Carb.	Bone-Meal	NaCl	Total
Prom. intake	1.67	1,50	0.95	1,14	1,25	1,06	1,12	1,08	1,00	1,30	12,07

b) **Farm Ervino Georgens, San Vicente, Misiones, Argentina**
15 animals incl. lambs, trial period 05.09.97 - 20.04.98, 190 days.

Table 4: Average consumption of each mixture in gr. per animal and day, Georgens

Offered Mineral	Cu SO_4	Co SO_4	Zn SO_4	Fe SO_4	IKO_3	Mn SO_4	MgO	Ca-Carb.	Bone-Meal	NaCl	Total
Prom. intake	1.58	1,56	0,35	1,67	1,32	1,49	1,14	1,05	0,52	1,84	12,63

c) **Farm Daniel Pinelli, San Pedro, Misiones, Argentina**
36 young animals (6-8 months), trial period 05.09.97 - 30.01.98, 129 days.

Table 5: Average consumption of each mineral in gr. per animal and day, Pinelli

Offered Mineral	Cu SO_4	Co SO_4	Zn SO_4	Fe SO_4	IKO_3	Mn SO_4	MgO	Ca-Carb.	Bone-Meal	NaCl	Total
Prom. intake	0,52	0,69	0,35	0,69	0,54	0,69	0,54	0,35	0,35	0,54	6,26

Additional observations

Control of parasitosis during the trials showed a relationship of the degree of vermicosis and Fe-intake. The sheep of Pinelli had an average of EPG 650, the ones of Klein EPG 10'000 and sheep of Georgens showed a EPG 30'000.

The sheep chose only one or two different minerals at once. Higher intake was observed at the beginning of the experiments. Mostly Iodine, Cooper, Zinc and Iron where chosen. Two sheep with claw problems chose only Zinc and Cooper during a whole week and recovered without additional treatment. A consumer's observation was the "nicer" taste of the meet from these animals. Copper supplement is known to be critical in sheep, but no intoxication symptoms were found during two years of free choice with (accidental!) 5 % Cu. But in the same herd, after 1 week of feeding 5 % copper in a *mineral mixture*, 50 of 200 sheep were dead, the rest showed clear symptoms of cooper intoxication!

Discussion

These trials are only punctual and need repetition and wider application. They were part of a bigger study (Haller, 2006). But single observations and this few results seem to open interesting possibilities. For instance, the total intake was in general very low. This is in context with other experiences (McDowell, 2003), but much less than most literature suggests for mixtures. It can be explained with the different supplementation system. Steiner also states that in minerals, the quality is crucial and minimal quantities can be enough (Steiner, 1924). Productive and clinical observations from the farmers have to be the basis for practical consideration. In organic and biodynamic agriculture, the aim should be to consider every farm as an auto-sufficient organism, and to minimize the inputs. Ruminants could help to "analyse" in a cheap and practical way the mineral balance of pasture and soil in every specific farm, and add over time just the lacking ones through the preferential intake.

Suggestions to tackle with the future challenges of organic animal husbandry

Every organic/biodynamic farm has to have its animal husbandry! Maintaining and increasing soil fertility and soil life is not possible without the help of animals through manure and their active presence and services (DOC study of Fibl, Steiner 1924). This should be the clear message. In general, the farmers have to be empowered to creatively integrate their husbandry in the whole farm. This can be supported by giving information and access to basic investment, to make husbandry more profitable. This paper shows only a very small part of the possibilities to do this. Women and elder children are often very interested in animals and have good observation abilities. They should be given priority in such programs.

References

Baker, D. (1995): Zinc bioavailability, in Bioavailability of nutrients for animals: amino acids, minerals and vitamins. Edited by Ammerman, C.B., Academic Press, 367-398.

Baker, D. (1995): Copper bioavailability, in Bioavailability of nutrients for animals: amino acids, minerals and vitamins. Edited by Ammerman, C.B., Academic Press, 127-156.

Capaul, E. (1997): Oligoelementos o Microelementos. In Nutrición Animal, Nº 18, 44-45.

Capaul, E. (1998): Magnesio en el Bovino: Aproximación a su fisiopatología. In Nutrición Animal, Nº 24, 30-32.

Kumach, H. et al. (1996): A study on the mineral status of beef and dairy cattle and buffalo in central Thailand.Asian-australian Journal of animal Sciences, 5, 525-531.

Haller R. 2006): Manejo de Yerbales con ovejas – Diseño de alternativas Agroecológicas con y para productores familiares yerbateros en la provincia de Misiones, Argentina. Master tesis, Universidad Internacional de Andalucía, España

Henry, P. R. (1995): Magnesium bioavailability, Iron bioavailability, Cobalt bioavailability, Manganese bioavailability, Selenium bioavailability, Sulfur bioavailability in: Bioavailability of nutrients for animals: amino acids, minerals and vitamins. Edited by Ammerman, C.B., Academic Press, 119-126, 169-199, 201-237, 239-256, 303-336, and 349-366. http://www.fibl.org/index.php?id=2018

McDowell, L.R. (2003): Grazing Ruminants Require Free-Choice Minerals. in Feedstuffs Magazine, Issue 47, Volume 75.

Perego, J.L. (1996): La Suplementación Mineral del Ganado Vacuno en la Provincia de Misiones. INTA Cerro Azul, Misiones, Miscelánea Nº 35.

Primavesi, A. (1982): Fertilización Pastoril, en Manejo Ecológico del Suelo, El Ateneo, Buenos Aires, 447- 453.
Steiner, R. (1924): Über das Wesen der Fütterung. In Geiseswissenschaftliche Grundlagen zum Gedeihen der Landwirtschaft, Rudolf Steiner Verlag, 227-252.

Cattle husbandry without slaughtering asa link between the animal rights and the organic agriculture movements

Patrick Meyer-Glitza[1]

Key words: vegetarianism, veganism, animal rights, care-ethics, long lactation

Abstract

Animal rights (Regan 2004) and veganism usually abolish all animal agriculture, but some animal rights advocates give the possibility of reduced animal husbandry (Donaldson and Kymlicka 2011). By a cattle husbandry without slaughtering, as avegetarian cattle husbandry, the possibility to reconcile the right of life, of bodily integrity and of freedom for cattle with their use are given. Drawing on qualitative interviews and Grounded Theory (Corbin and Strauss 2008) for 5 case studies (farms) their ethics, the care- and the agri-systems are analyzed.

The concept of animal integrity is extended within the five care rules of the non-slaughtering cattle husbandry that are: universal, unconditional, lifetime of care, familising and prevention. The exemplary contribution margin of milked cows, which includes the oxen and the pension of the cows, is 2.826 €. The milked cows reach an average age of 11,4 years and lactations are extended to an average of 3,1 years with 3.000 kg per year.

Acknowledgments

I would like to thank Prof. Franz.-T. Gottwald, Prof. Wolfgang Bokelmann, Prof. Ton Baars and Prof. Detlef Fölsch for their support in working on this topic.

Introduction

In western countries vegetarianism and veganism are growing social trends with vegetarianism resembling old traditions in Asia, especially India. In Germany there are at least 2 % vegetarians (Max Rubner-Institut 2014). Vegetarians often don't know that their consumption of milk and milk products entails the slaughtering of the non-productive milk cows and the fattening up of bull calves. As half of the vegans disregard all animal husbandry and thus also the benefits cattle can give especially to organic farming by manure, milk, traction and working the landscape, about 41% of vegans do not disregard all kind of animal husbandry (Janssen et al. 2015). Drawing on Indian tradition and experiences, cattle husbandry without slaughtering initially came to western countries through the Hare Krishna movement. While there is a small but rapidly growing number of sanctuaries in Germany that keep farm animals, there are less farms that milk the cows and do not slaughter them. How do these milking farms manage to keep cattle and benefit to some degree of their products? How to combine animal rights and a reduced use of the animals?

Material and methods

Interviews within 5 case studies – four in Europe and one in India – were conducted using narrative and semi-structured interview techniques. The cases were selected by theoretical sampling (Strauss and Corbin, 1996: 148-165) during the ongoing research, while looking for minimal and maximal internal contrasts. Additionally, text-segments were selected according to their content, change of speaker, description, narrative, or unintelligibility and analysed by sequential micro analysis (Rosenthal, 2005).

[1] Humboldt Universität zu Berlin, Facultuy of Life Sciences, Division of Ressource Economics. Am Dorfplatz 7, 23689 Rohlsdorf, Germany, patmg@web.de.

The Data of the 5 Case Studies (two milking farms and three 3 sanctuaries) were coded and categorized (Charmaz, 2006) separately, using the coding system of Grounded Theory and the software of Atlas.ti. Supported by Memos this led to the emerging of categories and subcategories with their respective properties and dimensions. After analysing the single cases, the anonymized cases were compared along the ethics of action and the management of an agri-care system that works (cf. Meyer-Glitza and Baars, 2012). All the farms of the case studies work basically organic, but not all farms are certified. A contribution margin for the milked cows is calculated.

The agri-care system

The care-system and animal integrity

The care-system within this cattle husbandry consists of five core rules: 1. universal (including all ages, sexes and health statues); 2. unconditional (no animal products needed for a right to life); 3. lifetime of care (care for the whole life); 4. familiing (caring for healthy, ill, aging, handicapped and dying animals alike as for humans and family members); and 5. prevention (the farm as a model and as a means of public relations). These core rules are motivated by animal rights (Regan 2004) and to a great extend by ethics of care (Donovan and Adams 2007) and also contrast with the IFOAM principles.

The integrity of cattle as their ability to express species-specific behaviour and to integrate influences of the environment (Schmidt 2008) is cut off by slaughtering. Slaughtering means the destruction of the bodily integrity. The killing of unproductive cattle resembles an ecocentric approach to integrity (integrity of living systems) and a capitalistic principle rather than looking at the individual animal and implementing fairness. Alifetime integrity is suggested, giving the animals the possibility to have a full life and adding a dimension of ontogenesis and individual psychological development to animal integrity.

The three farm stiles

Within the system of non-slaughtering there emerged the following three farm stiles:

1. Pure sanctuary: The animals are kept for their own good, no products like milk are produced or sold, also no products are grown with cow dung.

2. Farming sanctuary: A sanctuary that is selling dung-products, or products grown with dung and that also may use oxen for traction/draft.

3. Vegetarian cattle husbandry: A farm that is breeding and selling milk-products, selling agricultural products which are fertilised with cow dung and that is partially working the oxen. These farms may or may not take in animals like sanctuaries.

Exemplary contribution margin of milk cows

Cows of the case study which is taken as the basis for the contribution margin on average get 12,1 years old, compared to 4,8 years for milk inspected conventional dairies in Germany and about 6 years for organic dairies - all figures include calve mortalities. The oxen in the case study get 9,9 years old. The lactations from 1993-2011 of the case study average 2,8 years, but take an estimated 3 years when the following years of the ongoing lactations are taken into account. There is a high variation for the length of lactation, which is up to 10 years. The replacement rate is about 10,5 %. The average milk production of one lactation is 9.055 kg with 3.018 kg milk a year. An extended lactation is characteristic for the two case studies milking, and spontaneous lactations take place on one farm.

In organic farming extended lactations are more common with milk goats than with dairy cows. Extended lactations up to 16 month (Lehmann 2016) or for two years (Meyer-Glitza and Leisen 2017) are recommended for high yield cows and herds with seasonal calving. Thus less fodder

(Lehmann 2016) and expenses for rearing calves (Meyer-Glitza and Leisen 2017) are needed, as alsothe risk times of bearing a calf and the first weeks of lactation are intermitted – although extended lactations may not be specie-specific and come along with a higher risk of accidents because of cows being more often in heat.

There are non-slaughtering farms in Italy and Canada and a horticulture in Germany that keep cattle mainly for the manure.

The calculation of the contribution margin of the milked cows (Table 1) is based on the following (a) assumptions and (b) study-results:

- Each cow has two calves/lactations in her lifetime to replace herself and an oxen (a).
- Calves have free access to the mother-cow and suckle 10 month until natural weaning takes place and 3.111 kg milk are suckled. The daily intake by the calves for the first 4 month is 12 kg and for the following 6 month is 9 kg milk (a).
- Every cow retires for 3,8 years (b). Thus for every year of the 6 years (2 lactations x 3 years) of milking the cow also carries the costs for 0,63 years of retirement.
- The same amount of male and female animals is born. Each milked cow carries the upkeep of 1,2 oxen (12,1 years life expectancy of cows : 9,9 year life expectancy of oxen) (a). The work of the oxen is not included.
- The producer price is 3,00 €/kg milk. The producer price of the case study is 3,26 €, but as the producer price of other examples is less (for Ahimsa Milk it is about 2,69 €), 3,00 € are taken.
- The body of the dead animals (carcass) is not used in any way (b).

Table 1: contribution margin cow and kg milk of a vegetarian cattle husbandry

benefits		€
Milk sold	3,00 €/kgx 1981 kg	5943
Dung	Stable and pasture	649
Variable costs		
Upbringing	1475 € : 6 a milking years	246
Cows in "rent"	0,63 years "rent"/year milking x 622 € "rent"/a	392
Oxen	8,9 years : 6 years milking x 1475 €/ox	2188
Sundry variable costs[1]	including 2 ql concentrate x 42 €	683
Veterinary costs and medication		182
Sum variable costs		3691
Staple food		640
Contribution margin		2261
Contribution margin per kg milk		0,92

[1]Hygiene, fees, electricity, water, disease fund, litter, rendering plant, variable machine costs, claw trimming

For a herd of 40 cattle (male and female) the total contribution margin for milked cows would be 24193 € (10,7 milked cows x 2261 €). Due to the extensive non-slaughtering husbandry system there is only a limited need for concentrate feed. But to produce the same amount of milk it is necessary to care for about 4,1 times the amount of cattle than is done in organic farming. There is also more time needed caring for the individual animals as they get sick, old, are dying (or some of the oxen are worked). If in an rough estimate the working hours milking and looking after all the cattle are counted as is done for the milked cows (54 h/a), this would make 12,21 EUR per working hour (24193 € : 1982 h).

Discussion

Combining the agri- and care-system the cattle husbandry without slaughtering ads substantial features to organic farming and the IFOAM principles (cf. Meyer-Glitza and Baars 2012). All cattle, male and female, have the possibility to grow old.

Putting emphasize on the individual animal, basically adapting to grassland areas and crop rotation, this way of farming is an alternative for ethical vegetarians and some vegans. There will be less animal products, but the benefits of cattle as part of the farm nutrient cycles are maintained. Manure and the expensive milk are valued as by-products of maintaining the life of the cattle.

Prolonged lactations can increase the ethical soundness of organic farming as less male calves will be fattend up on conventional farms and slaughtered.

The vegetarian and the vegan movement are strong among young people and woman in western countries, while vegetarianism has a long tradition in India. Vegetarian cattle husbandry is a way of building a bridge between the animal rights movement and organic cattle husbandry.

References

Charmaz K (2006) Constructing Grounded Theory. A Practical Guide through Qualitative Analysis. Sage Publication, Thousand Oaks CA

Donaldson S, W Kymlicka (2011) Zoopolis. A Political Theory of Animal Rights. Oxford University Press, Oxford UK

Donovan J, Adams CJ (2007) Introduction. In: Donovan J, Adams CJ (ed) The Feminist Care Tradition in Animal Ethics. Columbia University Press, New York, pp 1-15

Janssen M, Busch C, Rödiger M, Hamm U (2015) Einstellungen von Veganern zu landwirtschaftlicher Tierhaltung. In: ”Tierhaltung im Spannungsfeld von Tierwohl, Ökonomie und Gesellschaft”. Tierwohl-Tagung in Göttingen 07.-08. Oktober 2015, pp 10-13. https://www.uni-goettingen.de/de/tagungsband/524868.html. Accessed 20. January 2016

Lehmann JO (2016) Extended Lactation in Danish Dairy Production. Dissertation, Aarhus University

Max Rubner-Institut (2014) Anzahl der Vegetarier verdoppelt. Press release by 13.3.2016. https://www.mri.bund.de/de/presse/pressemitteilungen/presse-einzelansicht/?tx_news_pi1%5Bnews%5D=64&cHash=9b3616076988dae68008be952cecc0d0. Accessed 30. April 2016

Meyer-Glitza P, Baars T (2012) Non-killing Cattle Husbandry. In: Rahmann G & Godinho D (ed) Tackling the Future Challenges of Organic Animal Husbandry: 2nd Organic Animal Husbandry Conference, Hamburg, Trenthorst, 12 - 14 September, 2012. vTI Landbauforschung, Braunschweig, Sonderheft 362, pp 184-187

Meyer-Glitza P, Leisen E (2017) Zweijährige Laktationen durch einmal ausgesetzte Kalbung - eine Fallstudie. In: Wolfrum S, Heuwinkel H, Reents HJ, Wiesinger K, Hülsbergen KJ (ed) Beiträge zur 14. Wissenschaftstagung Ökologischer Landbau. Ökologischen Landbau weiterdenken - Verantwortung übernehmen - Vertrauen stärken. Dr. Köster, Berlin, pp 464-467

Regan T (2004) The Case for Animal Rights. University of California Press, Berkeley and Los Angeles

Rosenthal G (2005) Interpretative Sozialforschung. Eine Einführung. Juventa Verlag, Weinheim and Munich

Schmidt K (2008) Würde oder Integrität – Verlangt die gentechnische Veränderung von Tieren neue tierethische Konzepte? ALTEX 25, 4:313-320

Strauss A, Corbin J (1996) Grounded Theory: Grundlagen Qualitativer Sozialforschung. Beltz, Psychologie Verlags Union, Weinheim

Enhancing sustainability in India's organic states: The case of animal husbandry in Sikkim

Mahesh Chander[1]

Key words: Sikkim, organic state, sustainability, livestock

Abstract

There is significant interest in promoting organic agriculture in rainfed, drylands and mountainous areas in developing countries like India. Considering the natural benefits in switching to organic farming in these areas, the government find it justified to declare such regions as organic zones or fully organic states. The state of Sikkim in North-eastern part of India is one such state declared as fully organic state. The political decisions and policies need preparedness for implementing such decisions to prove the move justified. Moreover, the sustainability requires efforts across different dimensions of the practices. The stakeholders are expected to make required changes especially by making it more science based. This paper describes the preparedness of the department of Animal Husbandry especially efforts put in by scientists and officials in drawing a roadmap for organic animal husbandry development in Sikkim.

Introduction

On 18th January, 2016, the Prime Minister of India announced Sikkim[2] as India's first fully organic agriculture state. It was a huge announcement having wide ranging implications for the agricultural sector of the state. Sikkim has been gearing itself for switching to organic agriculture since 2010 when Sikkim Organic Mission[3] (SOM) was officially launched on 15th August 2010 to organize activities more systematically under a formal structure. Even much before this, in 2003,the historic declaration was made in Sikkim State Legislative Assembly, wherein, resolution was passed for policy interventions towards realizing the vision of transforming Sikkim into a 'Total Organic State'. These intent of state to convert to organic status led to series of activities and initiatives by various departments of government to iniatiate pro organic activities in the state. The state department of agriculture & rural development department were particularly more active to bring about necessary changes in the system. The state department of animal husbandry too took initiative to follow up the activities compliant to organic animal husbandry. This paper describes the initiatives undertaken towards developing a roadmap of Organic animal Husbandry development in Sikkim state.

Material and methods

For streamlining organic animal husbandry developmental activities in the state, the Department of AH, LF & VS organized the first Organic animal husbandry workshop for the Veterinary Officers of the state on 27 & 28th September 2014, which initiated some thinking on the lines of Organic Animal Husbandry. To take forward organic animal husbandry development activities in the state a little further, a daylong workshop was convened on 31st October, 2015 by the SOM.

This workshop was conducted under the expert guidance of the author, wherein, 42 veterinarians took part in the deliberations.

[1] Principal Scientist & Head, Division of Extension Education, ICAR- Indian Veterinary Research Institute, Izatnagar-243 122 (UP) India. www.ivri.nic.in, Email: mchanderivri@gmail.com

[2] https://en.wikipedia.org/wiki/Sikkim

[3] http://www.sikkimorganicmission.gov.in/

The development officials of the state including veterinarians from the state animal husbandry and dairy development and rural development departments have been attending various training programmes, exposure visits outside the state, workshops, orientation programmes, certification procedures etc over last 3-4 years while marching towards becoming truly an organic state in India.

Results

The key objective of this workshop was to develop a Road Map for organic animal husbandry development in the state of Sikkim. The workshop and series of discussions with the stakeholders in livestock sector of Sikkim state resulted in a document, *Organic animal husbandry development in Sikkim: The roadmap* (Chander & Sharma, 2015). The document so developed, thus, showed the way forward for organic animal husbandry developmental activities in the state. Further to this, three senior level veterinary officers of Livestock & Dairy Development Departments attended a Model Training Course on Organic Animal Husbandry at ICAR-Indian Veterinary Research Institute, Izatnagar during 16-23 November, 2015 coordinated by the author. Later on, two scientists from ICAR- National Organic Farming Research Institute based in Sikkim underwent a short course on Organic animal Husbandry coordinated by the author at ICAR- Indian Veterinary Research Institute to enhance their capacities in this emerging area. The SOM, the Department of AH, LF & VS and the newly established National Organic Farming Research Institute are working towards making organic animal husbandry alongside crops a sustainable practice in Sikkim leading to an increasing number of visitors to the state to learn and promote organic farming. In India's North Eastern region in particular, Sikkim is being seen as a role model state to be followed upon in other states in the region in matters of organic agriculture.

Discussion

This document is a humble effort towards development of organic animal husbandry in state of Sikkim, which has taken an ambitious, path breaking and a bold & pioneering decision to be the first fully organic state in India in all respect. This is appreciable but challenging decision at the same time, since many nuts and bolts would have to be fixed to give a practical shape to it to be acceptable under organic production systems. The farming practices including animal husbandry practiced in Sikkim being very close to practices recommended under organic production systems; the State is naturally blessed for organic farming. Yet, we need creative interventions in the areas of animal breeding, feeding, housing, management, disease control, value addition, product marketing etc. to make it truly organic state. It is a challenging task considering the feed and fodder scarcity, nagging diseases especially coccidiosis in poultry, uncontrolled movement of livestock along borders of the state. This document has recommended several needed interventions for guiding the stakeholders at different levels towards orienting & developing organic animal husbandry in Sikkim as the sustainable practice.

References

Chander, Mahesh and Ghana Shyam Sharma. 2015. Organic Animal Husbandry Development: The Roadmap. Sikkim Organic Mission, Government of Sikkim, Department of AH, LF & VS, Tadong, Sikkim.https://drive.google.com/file/d/0B0TX5SvS4lMRQmhTWDFkdVNZc3c/view

Rangeland forage biomass production and composition under different grazing regimes on a Namibian organic livestock farm

Lea Ludwig[1], Judith Isele[2], Gerold Rahmann[1,3], Anita Idel[4], Christian Hülsebusch[1,5]

Key words: ranching, cattle, sheep, Holistic Management™, stocking density, stocking rate

Abstract

The extent and the mechanisms of rangeland vegetation responses to variations of stocking rate, stocking density, grazing intensity, grazing itineraries, and durations of grazing and rest events are insufficiently understood to provide practical decision support for livestock farmers grazing management. Different rangeland management and grazing strategies, among them Holistic Management TM are propagated, but lack scientific endorsement and have stimulated a vivid scientific debate. This paper reports preliminary results of a study on the impact of variations in stocking rate and stocking density on range forage biomass production and composition on the organic cattle and sheep farm Springbockvley in Namibia. Results indicate a tendency that grazing at both, higher stocking density (approx. factor 4) and increased stocking rate (between factor 1.2 and 2) resulted in lower yield depression following reduced rainfall. High density grazing appears to lead to lower accumulation of standing dead plant material and litter. The experiment is ongoing and data analysis is preliminary.

Introduction

Rangelands and/or grasslands cover 30-45 % of the global terrestrial surface (e.g. WRI 2000, MEA 2005, FAO 2016), with low and heterogeneous net primary production, which is the main fodder resource for low external input livestock husbandry. Across Sub-Sahara Africa, rangelands sustain 70 % of the livestock population, provide livelihoods for over 50 million inhabitants and contribute considerably to meat supply and national GDPs (Rass 2006).

Conservation areas and agriculture increasingly expand onto Africas grazing lands, accompanied by a controversy concerning productivity and environmental damage of current livestock based range management (cf. Homewood and Rodgers 1987). Since the 1990s, alternative rangeland management and grazing strategies (including Holistic Planned Grazing, Savory and Butterfield 1999) emerged. Essentially based on varying grazing and rest periods, stocking density and grazing intensity, they have shown convincing success in practical rangeland restoration, hence are also propagated in communal grazing areas, although they lack both, scientific endorsement (e.g. Briske et al. 2014), and practical decision support tools that might facilitate a wider adoption. In order to identify factors that could be incorporated in grazing decision support tools we studied range forage biomass production under different stocking rate and stocking density on a Namibian livestock farm.

[1] University of Kassel, Germany, eMail: lea.ludwig@student.uni-kassel.de
[2] Farm Springbockvley, Namibia, eMail: iselkuel@iway.na
[3] Thuenen-Institute of Organic Farming, Germany, eMail: gerold.rahmann@vti.bund.de
[4] Anita Idel Project Management, Germany, eMail: anita.idel@t-online.de
[5] German Institute for Tropical and Subtropical Agriculture, Germany, eMail: huelse@ditsl.org

Material and methods

The study was carried out on the 9,500 ha cattle and sheep farm Springbockvley about 180 km Southeast of Windhoek. The climate is semiarid with on average 260 mm annual rainfall in a mono-modal distribution (cf. figure 1). Soils are sandy and partly limestone dominated. Main forage grasses are *Stipagrostis uniplumis*, *Schmidtia kalahariensis* and *Aristida stipitata*. Grass growth terminates in May and restarts with the onset of the rains in November.

Springbockvley is under Holistic Management since 1990 and certified organic (Namibia Organic Association NOA) since 2013. The farm is divided into 60 paddocks and was stocked with on average 890 Nguni cattle and 3,700 Damara sheep between June 2013 and May 2016 (approx. 387,600 kg livestock biomass resp. 861 livestock units LU at 450 kg LW; average stocking rate was 41 kg livestock biomass per ha). The farm is currently grazed in a full farm rotation with three herds: cows (133,000 kg livestock biomass, 296 LU), oxen (106,000 kg livestock biomass, 236 LU) and sheep plus young fattening bulls (148,000 kg livestock biomass, 329 LU). Every herd grazes every paddock on the farm about once in a year according to a grazing plan for a number of days determined each year in May after a visual biomass assessment, from which the number of allowable grazing days per paddock is derived. Grazing duration per paddock is shorter during the growing period and longer during the dry period. Paddocks are always grazed in the same sequence by all herds. This regime allows for average resting periods between 80 and 100 days between grazing events.

In addition to the current grazing regime (Control), two variations (DoubleSR, HigherSD) where applied to grazing paddocks in four replications (House, Achab, Sand, Pan) each. DoubleSR was grazing at increased stocking rate, i.e. the paddock was grazed for twice the duration foreseen in the plan. HigherSD was grazing at an increased stocking density, i.e. the paddock was subdivided with a mobile electric fence into a number of parcels equivalent to the number of grazing days foreseen in the plan. Every day a new parcel was opened for the herd to graze.

Destructive biomass assessment was done in May (end of growing period) of 2014, 2015 and 2016. A one square metre metal frame was placed every 20 m along a 200 m transect in ten replications for each of the 12 paddocks (three treatments, four replications). Aboveground plant biomass within the frame was harvested quantitatively separated by species, weighed fresh, stored in paper bags, dried at ambient temperature under shade, and weighed dry. A more detailed description of the experimental site, the grazing history, the grazing management, and the research design is provided by Rahmann et al. (2015).

Results

Rainfall and biomass data are shown in figures 1 and 2 respectively. Available biomass (i.e. annual and perennial grasses, legumes and non-legume dicotyledons) declined from 2014 through 2016 in all three treatments, corresponding to cumulative rainfall during 12 months prior to sampling. Standing dead biomass increased in the first year particularly under normal and higher density grazing but under both treatments it declined from 2015 to 2016 while it again increased under double stocking treatment. The amount of litter was constant. Perennial grasses had the largest share in available biomass (58.2-97.3% across years and treatments) followed by annual grasses, legumes and non-legume dicots. Perennials increased while all other decreased over the years irrespective of the treatment.

Figure 1: Rainfall on Farm Springbockvley June 2012 to May 2016

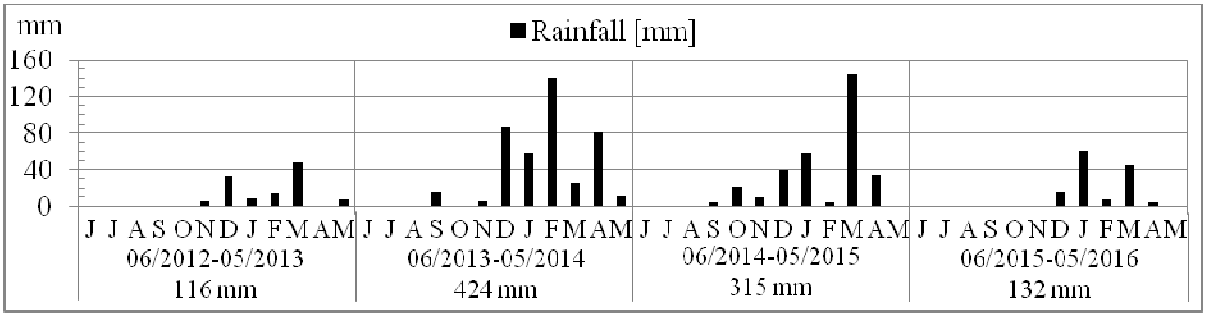


Figure 2: Available plant biomass, standing dead and litter yield [t DM/ha] under different grazing regimes on Farm Springbockvley (2014-2016)

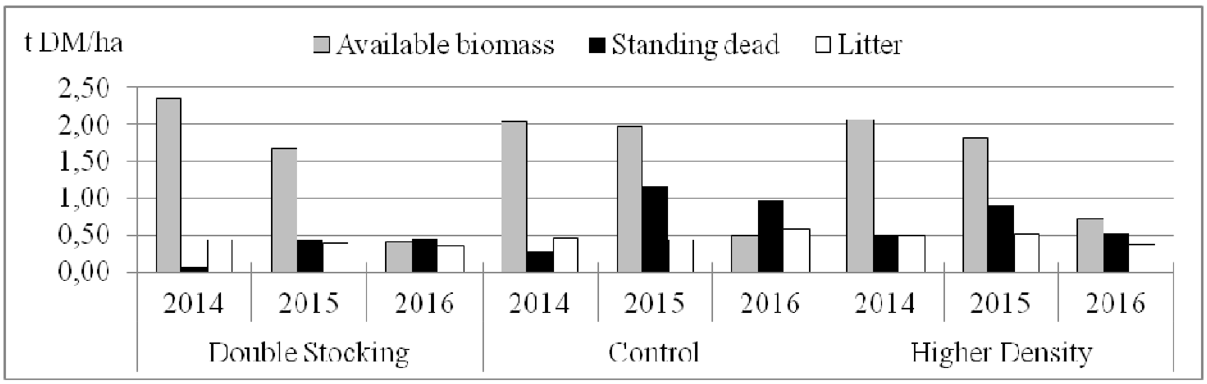


Table 1 shows aboveground forage biomass by treatment for three replications with associated cumulated stocking rate and average stocking density calculated for three grazing events prior to the respective biomass sampling.

Table 1: Aboveground plant biomass yield [t DM/ha] under three different grazing regimes at three different replications 2014-2016

		Sand DM (CSR/ASD)	Achab DM (CSR/ASD)	Pan DM (CSR/ASD)
Double SR	2014	3.39 (22/993)	1.99 (51/1236)	2.18 (37/742)
	2015	1.93 (83/1778)	2.02 (81/ 835)	1.39 (57/697)
	2016	0.55 (104/1052)	0.32 (105/974)	0.52 (57/903)
Control	2014	3.08 (38/937)	1.45 (65/1130)	1.84 (51/921)
	2015	1.93 (57/1229)	2.34 (38/780)	1.80 (30/685)
	2016	0.37 (66/951)	0.66 (56/897)	0.41 (47/843)
Higher SD	2014	3.22 (42/3814)	1.56 (63/4127)	1.36 (49/3917)
	2015	2.80 (60/4993)	1.89 (36/2813)	1.09 (33/3009)

	2016	0.74 (63/3808)	1.11 (60/3252)	0.59 (43/3604)

DM [t/ha]: dry matter aboveground plant biomass; CSR [kg LW/ha/a] = cumulated stocking rate over the period, ASD [kg LW/ha] = average stocking density

Replication House was omitted due to missing data for 2013/14 in table 1 and 2.

Table 2 presents the relative biomass production as biomass measured plus biomass hypothetically consumed at the given stocking rate multiplied by 0.03 (assuming maximum forage intake of 3% per kgLW), index figure 2013/14 = 100. Relative litter/standing dead as measured (cf. figure 2), index figure 2013/14 = 100.

Table 2: Relative biomass production and biomass reduction (2013/14 = 100) under three different grazing regimes 2014-2016

	Relative biomass production			Relative litter/standing dead		
years	DoubleSR	Control	HigherSD	DoubleSR	Control	HigherSD
2013/14	100	100	100	100	100	100
2014/15	90	96	91	238	226	155
2015/16	49	43	58	234	230	98

Discussion

As shown in table 2 results suggest that both, an increased stocking rate and density, may be beneficial for an improved production of available biomass. Higher stocking density may in addition lead to reduced accumulation of standing dead plant material and litter. The observed years vary in rainfall, which is likely the cause of reduced biomass growth over the years. Longer experiment periods are necessary to identify factors determining biomass growth and establish possible quantitative relations. Such factors could then be incorporated in grazing management decision support tools.

References

Briske D, Ash A, Derner J, Huntsinger L (2014) Commentary: A critical assessment of the policy endorsement for holistic management. Agricultural Systems 125: 50-53.

FAO (2016) FAO Statistics,http://faostat3.fao.org/browse/E/EL/E. Accessed 26 September 2016.

Homewood K, Rodgers WA (1987) Pastoralism, conservation and the overgrazing controversy. In: Anderson D, Grove R (eds.) Conservation in Africa: peoples, policies and practices. Cambridge University Press,pp111-28

MEA (Millennium Ecosystem Assessment) (2005) Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Rahmann G, Hülsebusch C, Isele J, Idel, A (2015) Organic Livestock Production Sustainable increase of meat production on natural grasslands in Namibia - research methodology and preliminary results -. In: Achieving Social and Economic Development Through Ecological and Organic Agricultural Alternatives, Proceedings of the Scientific Track, 3rd African Organic Conference, 5 - 9 October 2015, Lagos, Nigeria, S. 145-154.

Rass, N (2006) Policies and strategies to address the vulnerability of pastoralists in sub-Saharan Africa. PPLPI Working Paper No. 37. Pro-Poor Livestock Policy Initiative, FAO, Rome

Savory A, Butterfield J (1999) Holistic Management - A New Framework for Decision Making. Island Press, Washington DC, USA,p 616

WRI (World Resources Institute) (2000). A Guide to World Resources 2000–2001:People and Ecosystems: The Fraying Web of Life. World Resources Institute, Washington DC

Field evaluation of *Beaveria bassiana* as biological control of ticks *Rhipicephalus microplus* in Colombia

Jaime Fabián Cruz[1], Tatiana Durán[2], Valeria Navarro[2], Jorge Fierro[2], Dolly Pardo[3]

Key words: entomopathogen, exoparasites, acaricides resistence

Abstract

The different test of evaluation to use Beaveria bassiana for the biological control of ticks in dairy cattle of tropical areas of Colombia shows it as an appropriate alternative, when evaluated by applying it on prairies and on animals, conduce to the reduction of telogins Rhipicephalus microplus population over strategic areas of cattles. In experiment with application on animals, the reduction of population was 75.16%, after two weeks, meanwhile after spread on prairies kept the reduction on 69.79% at 90 days post-application. Both experiments shows the effective develop of fungus hyphae penetrating the cuticule of telogins ticks.

Acknowledgments

The researchers are grateful to farmers in the municipalities of Pasca and Une (Colombia) for their collaboration in the development of these projects.

Introduction

The infestations by ticks cause important pathologies in cattle. For the farmers can cause significant monetary losses, due to the cost of chemicals, the resistance and damage to animals and the environment. For the reduction of the environmental impact caused by chemical products, it is necessary the researches in alternatives for the control of ectoparasites of low cost and low environmental impact. Biological controllers as *Beauveria bassiana* may be effective for the control of ticks such as *Rhipicephalus microplus* (Bittencourt *et al.*, 1997). Their effectiveness evaluation for the control of ticks in cattles is important and implementable in extensive farms (Abdigoudarzi *et al*., 2009). *Beauveria bassiana* is a fungus that produces a lethal pathogenesis in ectoparasites, penetrating the cuticle of the tick, and conquering their body cavity. Their hyphae develop and invade the whole organism until they reach the coelom and cause the death of the parasite (Pucheta *et al*., 2006).

Material and methods

This research was experimental and exploratory and has 2 test. Experiment 1 was applying *Beaveria bassiana* to animals and experiment 2 was applying to prairies. The first was done in 3 dairy farms located in the municipality of Pasca (Colombia), with cattle of the Norman race. In each

[1] Professor Universidad Antonio Nariño (Colombia). Veterinary Faculty. www.uan.edu.co. E-mail: jaime.cruz@uan.edu.co
[2] Veterinary students. Universidad Antonio Nariño (Colombia)
[3] Professor Universidad Antonio Nariño (Colombia). Veterinary Faculty. www.uan.edu.co

farm were taken 10 cattle (males and females) with ages between 6 months and 3 years. A random assignment of the treatments (one per farm) was made, two of which involved the use of entomopathogenic fungi (*Metarhizium anisopliae* and *Beauveria bassiana*) at doses of 1 g per liter applied to animals and another to a conventional product (ivermectin) in doses of 10 mg per animal. The variable to be measured was the number of telogins of *Riphicephalus microplus* per animal in strategic areas of cattle: face, ear, chin, axilla, udder and perineum, recording the information and counting pre application and post application on days 1, 14, 20 and 33. The data were analyzed using ANOVA and SNK test.

The second experiment was developed on a dairy farm in Une (Colombia) with problems due to infestation with ticks. *Beauveria bassiana* (20 grams diluted in 20 liters of water) was applied to the prairies. After the application of the fungus, the animals were introduced into the paddock. Tick counts were used for data evaluation in 7 randomly selected adult animals, reviewing head, behind the ears, neck table, rib, plank, fold and pit of ijar, axilla, bragadas, udder and perineal region, Extracting adult telogins manually. The procedure was performed every eight days during 3 months.

A laboratory test was performed where ticks were incubated to observe the reaction of the fungus on them. The data were tabulated and analyzed using an ANOVA in a completely randomized experimental design. The data were submitted to the Shapiro-Wilk normality test.

Results

Experiment 1. Table 1 shows the results found in telogin counts of live ticks pre and post treatment according to the methodology, in the farms chosen as experimental.

Table 1. Counts of ticks (teloginanimal^{-1}) for different treatments

Días	*Beauveria bassiana*	*Metarhizium anisopliae*	Ivermectina	Average	n
1	46,7±9,2	62,7±18,3	136,4±19,8	81,9^{d}	30
14	11,6±4,4	27,2±11,2	18,7±6,8	19,1^{e}	30
20	23,1±4,7	41,4±12,0	136,3±19,8	66,9^{f}	30
33	50±7,7	65,8±14,9	63,5±8,4	59,7^{g}	30
Average	32,8^{a*}	49,2^{b}	88,7^{c}	56,9	30
N	40	40	40	40	120

* Different letter: Significant (p<0,05) Test SNK

As observed, tick counts were different in the three farms sampled. It should be noted that teleogines with a dead cottony layer but still attached on the body surface of the bovine animals evaluated and treated with *Beauveria bassiana* were observed, while some dead-looking, dead-on-the-skin teleogines were observed on the skin of the animals in Cattle treated with *Metarhizium anisopliae*.

Experiment 2. Figure 1 shows the population behavior of ticks in animals where the fungus has not been applied and its results 90 days after application. At the moment of the counting in the pastures with presence of the fungus a significant population diminution of ticks is observed.

The data were submitted to the Shapiro-Wilk normality test and their normal distribution was verified (P = 0.051). The results were submitted to ANOVA obtaining a highly significant difference (P = 0.000) between the days post-application. The results demonstrate the effectiveness of the fungus *Beauveria bassiana* to be spread in the pastures as a strategy to control the ticks. Its effectiveness was evidenced after the second application 90 days after the first one, which allowed its establishment in the paddocks where the fungus had spread.

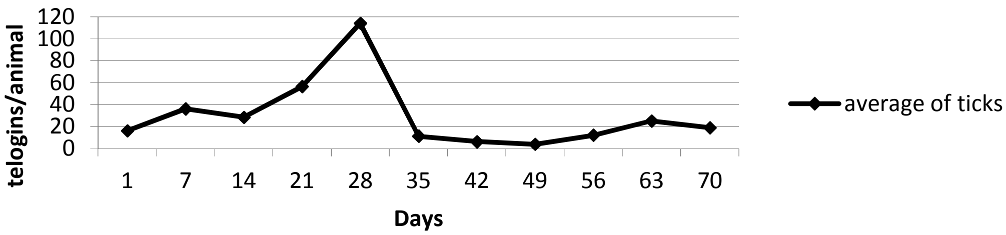


Figure 2. Population of ticks during the experiment

Experiments are suggested to evaluate the frequency of application, the dose, the costs and the method of application. It is recommended to evaluate the fungus for a time not less than 6 months, and to evaluate its effects on other populations of arthropods

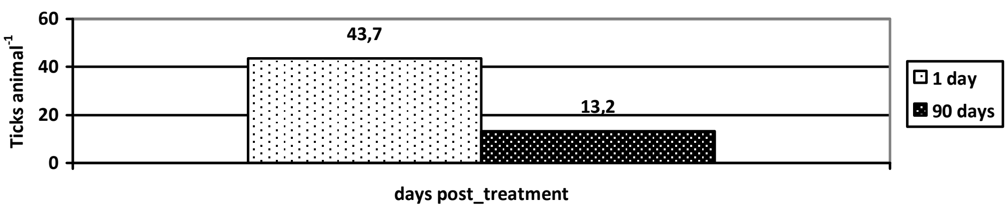


Figure 2. Average of ticks during experiment

A challenge for livestock producers is to look for alternatives that help to solve the infestations of exoparasites, especially of ticks and endoparasites in the tropics. The evaluation of alternatives that implement biological control, plant extracts and homeopathy is important for the organic animal husbandry.

Discussion

The results found in the first experiment allowed mortality rates of 76% to be reported in the first two weeks, confirming the findings reported in the literature (Kaaya et al.,1995; Fernández, 2006; Bendeck, 2012). The present study resulted in 57% mortalities in the tick population at day 14 post entomopathogenic fungus application, mortality lower than that reported by Souza (1999); As shown in table 1, an increase in the number of ticks was observed in the last count (30 days post-application), reaching a value similar to that found in the first count.

For the second experiment, the results are in agreement with Bonilla (2014) and López et al (2009), whom observe the effectiveness of *Metarhizium anisopliae* and *Beauveria bassiana* in reduction of infestation between 75% to 90%. As shown in Figure 2, the tick population present in animals decreased markedly when application of the fungus was repeated 90 days later on grazing pastures.

References

Abdigoudarzi M, Esmaeilnia K, Shariat N (2009). Laboratory Study on Biological Control of Ticks (Acari:Ixodidae) by Entomopathogenic Indigenous Fungi (*Beauveria bassiana*). Iranian J Arthropod-Borne Dis. 3(2): 36-43

Bendeck N (2012). Evaluación de *Beauveria bassiana* y *Metarhizium anisopliae* para el control de *Boophilus microplus* en vacas del hato lechero de Zamorano. Proyecto especial presentado como requisito parcial para optar al título de Ingeniera Agrónoma en el Grado Académico de Licenciatura. Escuela Agrícola Panamericana Zamorano. Departamento de Ciencia y Producción Agropecuaria. Honduras. pág. 3-10

Bittencourt V, Souza E, Peralva S, Mascarenias A, Alves S (1997). Avaliação da eficacia in vitro de do isisolados do fungo entomopatogênico *Beauveria bassisana* (Bals.) Vuill. Emfêmeas ingurgitadas de *Boophilus microplus* (Canestrini, 1887) (Acari: Ixodidae). Revista Brasileira de Parasitologia Veterinaria 6 (1): 49-52

Bonilla M P (2014). Efecto del corte de pelo y el uso de hongos entomopatógenos (*Beauveria bassiana* y *Metarhizium anisopliae*) en el control de garrapata (*Bophilus microplus*) en ganado bovino. Departamento de ciencia y producción agropecuaria, Zamorano/Honduras

Fernández J (2006). Evaluación de la eficiencia del control de garrapatas (*Boophilus microplus*) con tres frecuencias de aplicación de *Beauveria bassiana.* Zamorano: Escuela Agrícola Panamericana, ed. Zamorano: Escuela Agrícola Panamericana, Honduras, Trabajo como requisito de grado, pág. 11- 22

Kaaya G, Esther P, Mwangi N and Elizabeth A (1995) Prospects for biological control of livestock ticks, *Rhipicephalus appendiculatus* and *Amblyomma variegatum*, using the entomogenous fungi *Beauveria bassiana* and *Metarhizium anisopliae.* The International Centre Of Insect Physiology and Ecology (Icipe), Nairobi, Kenya Received. Vol 34. Pág. 23

Sun M, Ren Q, Guan G, Liu Z, Ma M, Gou H, Chen Z, Li Y, Liu A, Niu Q, Yang J, Yin H, Luo J (2011). Virulence of *Beauveria bassiana, Metarhizium anisopliaePaecilomy ceslilacinusto* the engorged female *Hyalomma anatolicum* Anatolicum tick (Acari: Ixodidae).Veterinary Parasitology ELSEVIER

Pucheta Díaz M, Flores Macías A, Rodríguez Navarro S, De La Torre M (2006) Mecanismo de acción de los hongos entomopatógenos. Interciencia. Vol. 31, núm. 12, pp. 856-860

Souza A, Reis R, Bittencourt V (1999). "Efeito do contato dos fungos *Beauveria bassiana* e *Metarhizium anisopliae* na ecdise ninfal de *Amblyomma cajennense*". Rev. Bras. Cien. Vet., No.2, Vol. 6, p. 84-87

An investigation on an innovative solution for boosting organic sheep and goat production by nomad pastoralists

Hamid Reza Ansari-Renani[1,2], Mohammadreza Rezapanah[1,3]

Key words:nomad, rangeland, goats, sheep, organic products,

Abstract

An initiative comparison study among production systems (Organic based on EU regulation 834/2007, conventional and nomadic) shows a potential for boosting organic system via sheep and goat production by nomad pastoralists. The nomadic traditional feeding management practice there were no minerals, vitamins, pro-vitamins and GMOs for animal feed. Nomad sheep and goat breeds were considered to be robust, adapted to the environment and disease tolerant livestock. In nomadic system no animal cruelty practices such as tail ducking, dehorning and tethering were allowed.Nomadic livestock products i.e. meat, milk, wool can be innovatively considered as organic or beyond for ethical aspects after building up further regional and/or international studies, surveillance, adopted regulation and suitable certification system such as participatory guaranty system (PGS).

Acknowledgments

We are thankful to the Animal Science Research Institute of Iran, Center of Excellence of Organic Agriculture and Agriculture and Natural Resources Center of Kerman Province for supporting this project. We also thank the nomad herders who shared and contributed their knowledge and information with the authors.

Introduction

From a global perspective, certified organic is still a niche. Organic sheep and goat production based on grazing (Rahmann 2002 and 2014) could be a valid alternative for animals kept in intensive or industrial systems fed with standard ration of concentrates. Existing similarities between organic agricultural products and extensive farming systems in many developing countries (Ben Kheder 2001) enables many traditional farmers including nomads to convert to organic system.

Approximately 25% of the world's land surface supports about 20 million pastoral households or about 180-200 million people. These lands usually fall under the categories of deserts, mountains and steppes of the world which include the Sahara, Sahel and Horn of Africa, the Middle East, Pakistan and India to Tibet and Mongolia in Asia and the mountains of Peru, Bolivia, Northern Chile and Argentina in South America. The geographical and ecological conditions of Iran are well suited to small ruminant production. The relatively low cost of the sheep and goat farming (local breeds-well adapted to their environment plus extensive free communal grazing areas) and the increasing demand for expensive organic products in domestic and regional export markets encourages nomads to shift to organic production.

[1] Center of Excellence of Organic Agriculture, Velenjak, Tehran, Iran, eMail: rezapana@yahoo.com
[2]Animal Science Research Institute, Agricultural Research Education and Extension Organization (AREEO), Karadj, Iran
[3]Iranian Research Institute of Plant Protection (IRIPP), Agricultural Research Education and Extension Organization (AREEO), Velenjak, Tehran, Iran, WWW.IRIPP.IR, eMail: rezapanah@iripp.ir and m.rezapanah@areeo.ac.ir

Nomads play an important role in sheep and goats production mainly because they keep 58.5% of the sheep and 39.7% of the goat population of Iran. Sheep and goat populations of Iran are 53.8 and 25 million heads which ranks 6th and 5th in the world (Anonymous 2014). Attempts were made in this study to address constraints and shortcomings of a sustainable nomadic system to boost organic livestock production, regarding ethical aspects of organic agricultural movements (Rezapanah 2011 and 2015) that have been considered by nomad pastoralists in semi PGS approach practically. Such national coherent systems (Ebrahimi and Rezapanah 2011) for organic agriculture will boost food and feed risk analysis toward sufficient food safety system regionally and globally (Rezapanah 2015).

Material and methods

A comparison study among production systems such as organic based on EU regulation 834/2007, conventional and a nomadic system based on studies on 30 nomad settlements chosen at random within ± 20 km of Baft city in Kerman province (Ansari-Renani 2015, Ansari-Renani *et al.* 2013 and 2012) were made. A structured questionnaire was completed for each individual nomad family of settlement heads including family composition and labour allocation structure; herd structure and management, housing, stocking rate, nutrition, feeding, watering, health, veterinary treatment, breeding, transportation, management practices, slaughtering, processing and reproduction. The responses to those questions were tallied and the percentages of the various responses were calculated. Final information was gathered primarily through in-depth interviews with nomadic men and women livestock producers and also with specialist and field observations. Also, the percentage of nomad farms using chemicals fertilizers and pesticides and source of feed and type of grazing land were evaluated and compared with the norms.

Results

Compared with conventional and organic systems (Table 1), nomadic sheep and goat production was highlighted by natural breeding of locally adapted native breeds, extensive use of rangeland as a source of livestock feed, no use of prophylaxis, minimal allopathical treatments, the protection of the environment, improved animal welfare and sustainable animal husbandry practices. In nomadic system of sheep and goat production, one objective was to achieve animals' well being through animal welfare oriented husbandry and appropriate use. Curtailing freedom of movement, sensory deprivation, and unsocial ways of husbandry, not allowing any contact with animals of the same species, or forcing too close a contact were not permitted in nomadic farming.

In organic farming a feeding system which leads to anemic conditions in sheep and goats is prohibited and considered as animal cruelty. To avoid such condition, as feeding management practice, 23% of nomad farms preferred tree-covered grazing areas which include wild oak trees, as the nutritive value of leaves that are rich in iron, sulphur and cupper consumed by animals complements the grass very well. 38 and 39% of farms used open grass land and bush/shrub and stone covered rangeland respectively.

In focus group discussions, nomad herders frequently emphasized that the diversity of plant species consumed was responsible for the superior taste and healthiness of sheep and goat milk and meat. Most of these plants have medicinal value. Nomadic farming system with well diversified livestock population in terms of species and breeds is ideal for organic livestock production. The nomadic sheep and goat production being largely extensive, animal welfare is not much compromised compared to intensive or conventional type of animal production. Nomadic livestock products can be innovatively considered as organic or beyond for ethical aspects after building up further regional and/or international studies, surveillance, adopted regulation and suitable certification system.

Table 1. Characteristics of conventional, organic and nomadic animal husbandry

	Conventional*	**Organic (834/2007)***	**Nomadic**
Breeds, origin	Highly performing, special breeds and cross-breeds according to product aimed for	Only animals reared on organic farms, diversity of breeds, sometimes rare breeds, natural breeding	Native breed, locally adapted, natural breeding
Keeping (buildings and free runs)	Animal protection laws (requirements for keeping of animal according to species)	Special requirements for keeping animals oriented toward animal welfare (stock density, space, grazing, tiding, etc.)	Animal are kept in rangeland oriented toward animal welfare
Feeding	According to current food stuffs legislation (permitted food additives such as enzymes, synthetic amino acids, etc.)	Food stuffs produced as much as possible on site, feeding rations according to animal welfare (e. g., minimum use/parts of roughage) only specifically permitted additives, no synthetic amino acids, no genetically modified organisms	Rangeland is considered the main source of livestock nutrition, no synthetics, no GMOs, no pesticides and chemical fertilizers, livestock are not fed in stables or in restricted areas but they move and graze freely in extensive open grazing areas.
Management and treatment	Managed breeding, if necessary stable-wide prophylaxis, legally required waiting periods according to drug prescription law	No prophylaxis (exception: legally required vaccination), only three allopathical treatments per year for long live animals (>1 year) respectively 1 treatment for livestock, which is not used more than one year; double the waiting period after use of drugs, minimum 48 hours. Restricted interfering with the animal's integrity (no polling, beak trimming, tail clipping, etc.)	No prophylaxis (exception: legally required vaccination), minimal allopathical treatments per year, no tethering, polling and tail clipping.

Transport	Animal transport regulation	Animal transport regulation with short transport ways	Animals are displaced by migration mainly, some transportation by trucks

*Adapted from Rahmann 2002 and 2014

Discussion

Growing demand for organic sheep and goat products will continue to be the main driver of nomadic livestock systems for domestic and export markets. The ideology behind principles and standards of organic animal husbandry is not new to the nomadic farming system of Iran, whose community insist upon the animal welfare and animal natural rearing systems since ancient times. A country rich in indigenous animal genetic resources like Iran is very much suitable for adopting this innovative farming system (Babajani *et al.* 2015 and Ebrahimi and Rezapanah 2011 and Rezapanah 2015). Moreover, nomadic farming system with well diversified livestock population in terms of species and breeds is ideal for organic livestock production. Nomad breeds being less susceptible to diseases and stress, need less allopathic medicines/antibiotics (Ghalyanchi Langeroudi *et al.* 2015). Besides, limited external input use including for animal production and maximum on farm reliance brings it further closer to organic systems.

The nomadic sheep and goat production being largely extensive, animal welfare is not much compromised compared to intensive or conventional type of animal production. Also, nomadic livestock products can be innovatively considered as organic or beyond for ethical aspects after building up further regional and/or international studies, surveillance, adopted regulation and suitable certification system especially via PGS that will enable nomads to convert to organic system.

References

Anonymous (2014) FAOSTAT. www.faostat.fao.org

Ansari-Renani HR (2015) Cahmere production, harvesting, marketing and processing by nomads of Iran – A review. Pastoralism: research, policy and practice. 5: 18.

Ansari-Renani HR, Mueller JP, Rischkowsky B, Seyed-Momen SM, Moradi S (2013) Nomadic pastoralism in southern Iran. Pastoralism: research, policy and practice 3: 11.

Ansari-Renani HR, Mueller JP, Rischkowsky B, Seyed-Momen SM, Alipour O, Ehsani M, Moradi S (2012) Cashmere quality of Raeini goats kept by nomads in Iran. Small Ruminant Research. 104: 10-16.

Babajani A, Shabanali-Fami H, Asadi A and Rezapanah M (2015) Explain driving policy instruments of organic farming development in Iran. Iranian Journal of Agricultural Economics and development Research 46 (2): 267-276.

Ghalyanchi Langeroudi A, Rezapanah M and Yusefzade kalkhoran A (2015) A quick overview of herbal medicines (phytobiotics) in the commercial poultry. Proceeding of national conference of organic animal, poultry and aquatics products, Rasht, Iran, Sept 2-3, 2015. 10 pages. DOI: 10.13140/RG.2.1.3319.8805

Ebrahimi A and Rezapanah M (2011) The strategic program of organic agriculture in Iran. Agricultural Research,Education and Extension Organization (AREEO), Tehran. 490 p. (In Persian)

Ben Kheder M (2001) Mediterranean organic agriculture course, organic vegetable production, Mediterranean Agronomic Institute of Bari, Bari.

Rahmann G (2014) Organic sheep and goat farming. 2nd international conference on trade and market development of organic producers. Tehran, Iran.

Rahmann G (2002) The standards, regulations and legislation required for organic ruminant keeping in the European Union. EAAP publication 106, 15-26.

Rezapanah M (2015) Establishing national coherent systems for organic agriculture and food and feed risk analysis toward sufficient food safety system. Proceeding of national conference of organic animal, poultry and aquatics products, Rasht, Iran, Sept 2-3, 2015.15 pages. DOI: 10.13140/RG.2.1.1878.0887

Rezapanah M (2011) Bioethics traces in organic production. Proceeding of 2nd International Congress on Bioethics, Feb. 5-7, 2011, Iranian Research Institute of Genetic Engineering and biotechnology, Tehran, Iran, pp: 144 (and 95).

Indigenous herbal treatment of diarrhoea in Nigerian smallholder sheep and goat production systems

Fasae Oladapo Ayokunle[1] and Adenuga Adebayo Jimoh[1]

Key words: Sheep, goats, diarrhoea, indigenous herbs, phytochemical, Nigeria

Abstract

The indigenous herbs of antidiarrheal importance in smallholder sheep and goat production systems were investigated in southwest Nigeria. The study identified 11 plant species used to treat diarrhoea and the recipe varied across plant species while the route of administration was orally. Phytochemical components were analyzed for tannin, saponin, flavonoid and alkaloid which were observed in different plant parts showing their potential as antidiarrheal agents. The usage of these herbs could therefore be an indispensable component of traditional medicine practice which can serve as safe alternative and complementary medicines to various allopathic drugs that could lead to safeguard health issues and obtain optimum production from animals.

Introduction

Sheep and goats are the predominant domestic ruminants, widely distributed in the rural and peri-urban areas of south western region Nigeria. This region is characterized by high rainfall, humidity and heat that provide ideal conditions for disease-causing organisms and vectors, thereby impeding the productivity of sheep and goats by various health constraints among which diarrhoea have been found to have higher prevalence with common clinical signs of gastrointestinal disorders caused by both infectious and non-infectious agents. Back to antiquity, this constraint has been managed by the rural farmers using natural herbs primitively as remedies (Nwude and Ibrahim, 1986). Herbs are relatively simpler to prepare and administer and have been known to provide low cost animal health care alternatives in rural communities, due to their important antimicrobial principles and phyto-constituents and wider therapeutic potentials. This study investigates into the natural means of treating of diarrhoea using indigenous herbs in south west Nigeria as an indispensable component of traditional medicine practice in enhancing sheep and goats productivity.

Material and methods

The study was carried out in farm settlements located in three senatorial districts of Ogun State, south west Nigeria namely Ado-Odo, Ikenne, and Ibiade farm settlements, were the rearing of sheep and goats is common among the settlers.

Structured questionnaires, enquiries and personal interview were used to collect data from 50 farmers from each of the farm settlements, making altogether 150 farmers. The questionnaires were administered through person-to-person contact in order to identify the plants and to ask major questions such as parts of plant used, preparation method and mode of administration for the treatment of diarrhoea. The phytochemical screening of the herbs for alkaloids, saponins, flavonoids and tannins was carried out according to the procedures described by Trease and Evans (1989). Pictures of medicinal plants used were presented and descriptive analysis was used to analyze the data.

[1] Fasae Oladapo Ayokunle, Department of Animal Production and Health, Federal University of Agriculture, P.M.B.2240, Abeokuta, Nigeria. Email- animalexp@yahoo.co.uk

Results

The preference for small ruminant type across the study areas indicates that goat was more preferred to sheep (Figure 1) and diarrhoea was observed to be a major disease problem in sheep and goats with goats generally more affected than sheep (Figure 2).

The level of usage of herbs in the treatment of diarrhea in sheep and goats across the study areas are shown in Table 1. More than 92% of the farmers admitted using antidiarrhoeal herbs to treat their animals, with more than 80% agreed to their effectiveness in the treatment of diarrhoea. The role of friends and neighbours played a major role in the dissemination of knowledge in the usage of these herbs.

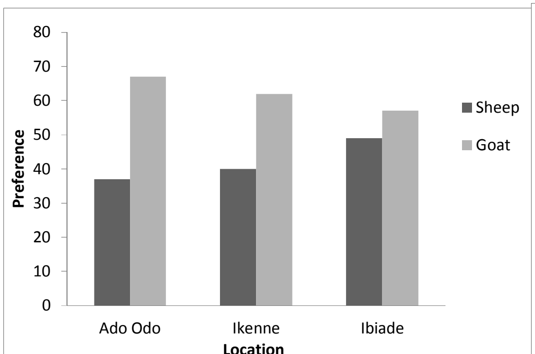


Figure 1: Preference of small ruminant type in the selected locations

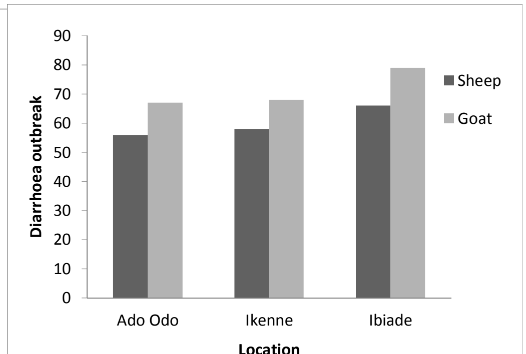


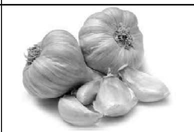
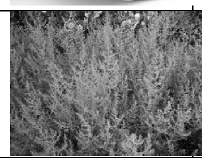
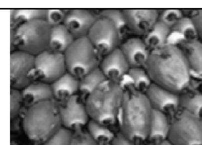
Figure 2: Level of diarrhoea outbreak in sheep and goats in selected locations

Table 1: Level of usage of indigenous herbs for the treatment of diarrhoea in sheep and goats

Parameters	Farm settlements					
	Ado odo		Ikenne		Ibiade	
	Frequency	%	Frequency	%	Frequency	%
Frequency of usage	47	94	48	96	46	92
Herbs effectiveness	40	80	42	84	45	90
<u>Knowledge source</u>						
Religion Leader	5	10	4	8	5	10
Friend/Neighbour	19	38	18	36	22	44
Oral conversation	17	34	21	42	19	38
Generational History	9	18	7	14	4	8

The list of eleven (11) identified plants, their botanical, common and local names and the plant parts used for the treatment of diarrhoea in sheep and goats in the study areas are presented in Table 2. Seeds, fruits, stem, bark, leaves, roots, rhizomes and bulbs were the common plant parts used for diarrhoea treatment. The phytochemical screening of these plant parts showed the presence of active pharmacological components such as tannins, saponins, flavonoids and alkaloids. The recipe for the treatment of diarrhoea varied across plant species while the route of administration was orally.

Table 2: Indigenous herbs and phytochemical properties (PP) used for treatment of diarrhoea in sheep and goats

Names and plant part used	Picture	P P				Recipe	Route of administration
		A	S	F	T		
Botanical : *Allium sativa* Common: Garlic Indigenous: Ayuu Part used: Bulb		+	+	+	+	Decoction	Oral
Botanical : *Azadirachta indica* Common: Neem tree Indigenous: Dongoyaro Part used: Stem bark and leaf		+	+	+	+	Soak fresh or dried pounded bark in boiled water	Oral
Botanical : *Carica papaya* Common: Pawpaw Indigenous: Ibepe Part used: Fruit		+	+	+	+	Prepare a concoction by boiling grated papaya in water	Oral
Botanical:*Chenopodium ambrosiodes* Common: Worm wood Indigenous: Arunpale Part used: Root and leaf		+	+	+	+	Decoction of dried leaves	Oral
Botanical : *Citrus aurantifolia* Common: Lime Indigenous: Osan wewe Part used: Fruit and leaf		+	+	+	+	Fruit juice is mixed with sugar to make paste	Oral
Botanical : *Elaeis guineensis* Common: Oil palm Indigenous: Ope Part used: Fruit extract		+	+	+	+	Mix oil extract with little salt	Oral
Botanical *: Ocimum gratissimum* Common: African basil Indigenous: Efinrin Part used: Leaf		+	+	+	+	Squeezed leaves with *Nicotiana tabacum* and administer juice	Oral
Botanical : *Lagenaria breviflorus* Common: Wild colocynth Indigenous: Tagiri Part used: Fruit		+	+	+	+	Decoction of fruits	Oral
Botanical : *Mangifera indica* Common: Mango Indigenous: Mangoro Part used: Stem bark		+	+	+	+	Bark is soaked for 24 hours and the water extract is used	Oral
Botanical : *Zea mays* Common: Maize Indigenous: Agbado/Ooka Part used: Seeds		+	-	+	-	Seeds roasted	Oral
Botanical : *Zingiber officinale* Common: Ginger Indigenous: Ataale Part used: Rhizome		+	+	+	-	Rhizome with sugar are grinded to make fine powder	Oral

PP = Phytochemical properties, A = Alkaloid, S = Saponin, F = Flavonoid, T = Tannin, + = Present, - = Absent

Discussion

Goats preference to sheep across the study areas confirms earlier reports that the numerical ratio between sheep and goats in Nigeria is 1 to 3 (Oni, 2002) and the high prevalence of diarrhoea in goats compared to sheep is at variance with reports of Unigwe et al.,(2016), which could be attributed to the management of animals as well as the environment. .

The components of the pharmacological components namely tannin, saponin, flavonoid and alkaloid observed in different parts of the identified herbs in this study are known to be biologically active and have been shown to possess antidiarrheal properties (Longanga et al., 2000), which justified the use of these herbs in traditional medicine as a natural remedy for treating diarrhoea in sheep and goats. This affirms findings of earlier researchers that many plants leaves, bark, pods and roots have been found to possess astringent properties and are used medicinally for a wide variety of ailments including diarrhoea (Orwa et al., 2009).

Suggestions to tackle with the future challenges of organic animal husbandry

Based on the results obtained in this study, the identified plants parts have been found to exhibit antidiarrhoeal activity which can be used as natural agents for the treatment of diarrhoea in sheep and goats. The usage of these herbs could therefore be an indispensable component of traditional medicine practice in the treatment of diarrhoea in sheep and goats which can serve as safe alternative and complementary medicines to various allopathic drugs that could lead not only to safeguard health issues and obtain optimum production from animals but also ensure food safety concerns.

References

Unigwe, CR., Ogbu, UM., Balogun, FA., Orakwue, OK, Nwufoh, OC, Nwachukwu, BC (2016) Prevalence of Small Ruminant Diseases/Disorders at Mokola Veterinary Hospital, Ibadan, Nigeria Journal of Biology, Agriculture and Healthcare 6, (1):22

Nwude N, Ibrahim MA (1986) Plants used in traditional veterinary medical practice in Nigeria. Journal of Veterinary Pharmacology and therapeutics, 3:261–273.

Oni OO (2002). Breeds and genetic improvement of small ruminants (sheep and goats) National Animal production research Institute. Ahmadu Bello University Shika, Sheref Salam Press, pp. 3-4.

Orwa, C, Mutua, A, Kindt, R, Jamnadass, R., Anthony S (2009). Agroforestree Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya

Trease GE, Evans WC (1989). Pharmacognosy. 13th Edition. Bailliere Tindall Ltd., London, pp. 350-389.

Longanga OA, Vercruysse A, Foriers A (2000). Contribution to the ethnobotanical, phytochemical and pharmacological studies of traditionally used medicinal plant in the treatment of dysentery and diarrhoea in Lomela area, Democratic Republic of Congo, J. Ethnopharmacol. 71(3):411-423.

Food

Title	Author/s	Country
Quality and nutritional value of tomato as influenced by organic practices	Mohammad Khurshid Alam, Md. Habibur Rahman and Md. Abdur Rahim	Bangladesh
Diversifood, a multi-actor and transdisciplinary European research to boost cultivated diversity for quality and resilience	Véronique Chable, Edwin Nuijten, Ambrogio Costanzo, Isabelle Goldringer, Riccardo Bocci, Bernadette Oehen, Frédéric Rey	EU
Sustainable diets: An approach to bridge the prevalent intention-behaviour-gap via citizen involvement	Leonie Fink, Angelika Ploeger, Carola Strassner	Germany
Self assessment of health status and lifestyle of french Organic and conventional food consumers	Kamila Okulska, Ewa Rembiałkowska	Poland
Research into nutritive value and anticancer properties of berries from biodynamic, organic and conventional production	Dominika Średnicka-Tober, Renata Kazimierczak, Ewelina Hallmann, Nadzieja Drela, Ewa Kozłowska, Ewa Rembiałkowska	Poland
Quality of organic food and its impact on health: the review	Marcin Baranski, Leonidas Rempelos, Carlo Leifert	UK
A methodology to go from stakeholders' expectations to research questions: implementation on organic food processing	Marc Tchamitchian, Servane Penvern, Céline Cresson, Laetitia Fourrie, Bruno Taupier-Létage, Rodolphe Vidal, Joël Abécassis	France
Review: The content of bioactive compounds in different berry fruits from organic and conventional production	Ewelina Hallmann, Dominika Średnicka-Tober, Renata Kazimierczak, Ewa Rembiałkowska	Poland

Quality and nutritional value of tomato as influenced by organic practices

Mohammad Khurshid Alam[1], Md. Habibur Rahman[2] and Md. Abdur Rahim[3]

Key words: Trichocompost, Vermicompost, Neem oil, Neem seed kernel extracts

Abstract

The experiment was conducted in combination of four different types of organic amendments namely trichocompost, vermicompost, kitchen waste compost and cow dung dried digestate with three different types of botanicals along with chemicals and absolute control. The results indicated that application of Vermicompost along with Neem oil gave the highest dry matter content of fruit (8.2%), shelf life (18.67 days), firm fruit (12.1 kg-f/cm^2 at 7 DAS) while the maximum yield (39.1 t/ha, among the organics), pericarp thickness (5.4 mm), ascorbic acid content (19.6 mg/100 g) and β-carotene (46.2 μg/100 g) were recorded from the treatment combination of Trichocompost and Neem oil. Overall results suggested that Vermicompost @ 10 t/ha with neem oil @ 5 ml/l and treatment combination of Trichocompost @ 10 t/ha with 5ml/l Neem oil were found better in respect of quality and nutritional value during organic tomato production.

Acknowledgements

Funds provided as PhD Research Grants from 'Strengthening Research Project of Bangladesh Agricultural Research Institute' Gazipur, Bangladesh.

Introduction

Organic agriculture is becoming popular across the country - Bangladesh and many NGO's, private entrepreneurs have come forward to use locally available different types of organic amendments instead of harmful chemicals and also using various types of botanicals to reduce the pest attack. These materials not only have the potential to produce a considerable yield but also to increase the nutritional value and quality of tomato and accordingly this experiment has undertaken to estimate the variation among different production practices.

Material and methods

This experiment was conducted in the field at the Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh during the winter season (October to March) in 2013-14. This location is characterized by relatively scanty rainfall, low humidity, low temperature, short day and long clear sunshine period during this season. The soil type is Madhupur Tract (AEZ 28) and Chhiata soil series, with a clay loam texture. Soil samples collected from the experimental plot before the experiment were analysed for key properties (Table 1).

Four different types of organic amendments namely Trichocompost, vermicompost, kitchen waste compost and cow dung digestate (dried) were collected from different NGO's involved with composting in Bangladesh and were also analysed (Table 2).

[1] Bangladesh Agricultural Research Institute, Gazipur, Bangladesh. E-mail: khurshidal@hotmail.com
[2]& 3: Professor, Dept. of Horticulture, Bangladesh Agricultural University.

Table 1: Results of the chemical analysis of soil sample before planting tomato

Soil properties	P^H	OM (%)	Ca	Mg	K	Total N (%)	P	S	B	Fe	Zn
			(meq/100g)				µg/g				
Result	6.3	1.56	5.8	1.9	0.12	0.07	16	19.5	0.35	112	2.1
Critical label	-	-	2.0	0.8	0.20	-	14	14	0.20	10	2.0

Table 2: Result of the chemical analysis of different types of organic soil amendments

Type of compost	Nutrient content					
	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Sulfur (%)	Calcium (%)	Zinc (ppm)
Trichocompost	1.71	1.07	1.31	0.44	1.43	139.0
Vermicompost	1.63	1.18	1.46	0.52	1.73	186.0
Kitchen waste compost	1.38	1.09	1.12	0.41	0.89	136.0
Cow dung digestate	1.42	0.93	1.25	0.33	0.92	126.0

Three different types of botanicals namely neem oil ((*Azadirachta indica*) @ 5ml/l, Neem seed kernel extract @ 50g/l and Biskatali (*Hydropiper polygonum*) leaf extract @1:10 was collected following standard method. The experiment was laid out in a randomized complete block design with fourteen treatments replicated three times including chemical treatment and absolute control. The organic amendments were applied @ 10t/ha in the planting field one week before transplanting the tomato seedlings. Twenty eight days old tomato seedlings were transplanted on 24th November, 2013 with a spacing of 60 cm from row to row and 50 cm from plant to plant. The percentage of dry matter (DM) content of fruit was calculated by the following formula:

$$DM(\%) = 100 - \frac{Fresh\ weight - Dry\ weight}{Fresh\ weight} \times 100$$

Twenty representative fruits from each treatment were used for measuring the pericarp thickness by cutting the fruit along the equatorial part and measured by slide calipers and the average was recorded in mm. The ascorbic acid content of tomato pulp was estimated by 2, 6 Dicholorophenol indophenols visual titration method as described by Ranganna (1994). **β** - Carotene was estimated using by column chromatography method (A. O. A. C. 1990). The shelf life of the tomato fruits was calculated as per Mondal (2000). Firmness was performed by using a Digital firmness tester (DFT 14, Agro Technologie, France) at 7 days after storage (DAS) and results were expressed in kg force cm^{-2} (kgf cm^{-2}). The recorded quantitative data were analyzed following the analysis of variance for the Randomized Complete Block Design by using computer package program MSTAT-C and MS Excel.

Results

Combination of organic fertilizers with botanicals caused a significant difference in respect of quality and nutritional parameters, although chemical treatment gave the highest yield (54.06 t/ha) while trichocompost and vermicompost individually with neem oil gave the better yield (39.1 and 38.76 t/ha, respectively) among the organics (Table 3). The highest dry matter (8.2%) of fruit was observed from the treatment combination of vermicompost with neem oil while conventional practices (chemical) gave significantly poor dry matter (6.3%) of fruit. There was significant difference in pericarp thickness which varied from 4.3 mm to 5.4 mm, the maximum being obtained from the treatment combination of trichocompost with neem oil. On the contrary, chemically treated plot gave the lowest pericarp thickness (4.3 mm) which was significantly similar with absolute control. Production practices viz. organic and conventional practices exerted a significant influence on ascorbic acid content. The combination of trichocompost with neem oil gave the higher amount of ascorbic acid (19.6 mg/g) while poor performance was found from the control plot which was followed by conventional practices. Similar trend was found in case of β-carotene. The combination of vermicompost with neem oil caused a significant increase (18.67 days) of keeping quality while the shortest shelf life (10.67 days) was observed in case of chemical treatment which was significantly differed from others but followed by untreated plot. At 7 DAS, the highest firmness value (12.1 kg-f/cm^2) was recorded in treatment combination of vermicompost with neem oil. In contrast, significantly poor performance i.e softer fruit was observed in chemically treated plot which was followed by treatment combination of cowdung digestate with botanicals but statistically different in most cases.

Table 3:Quality and Nutritional value of tomato as influenced by organic practices

Treatment	Yield (t/ha)	% Dry matter of fruit	Pericarp thickness (mm)	Ascorbic acid (mg/100 g)	Beta carotene µg/100g)	Shelf life (Days)	Firmness (kgf/cm2) of fruit at 7 DAS
T_1 = T + N	39.1±1.9	7.5±0.57	5.4±0.40	19.6±1.5	46.2±4.2	16.3±1.2	9.70±1.70
T_2 = T + NK	37.4±1.2	7.2±0.50	5.2±0.32	19.3±1.7	45.5±3.3	15.7±0.33	9.20±0.80
T_3 = T + B	36.38±2.3	7.3±0.35	5.3±0.32	18.2±0.9	44.4±5.4	15.3±0.88	9.40±0.75
T_4 = V + N	38.76±3.0	8.2±0.45	5.3±0.32	19.1±1.4	45.7±2.4	18.7±0.88	12.1±0.80
T_5 = V + NK	36.7±2.0	8.0±0.70	5.2±0.31	18.4±1.4	44.8±4.8	16.7±0.67	10.9±0.78
T_6 = V + B	35.7±0.7	8.1±0.46	5.1±0.26	17.6±2.3	42.7±4.0	17.3±0.88	11.5±0.57
T_7 = K + N	36.04±1.5	6.8±0.15	4.6±0.40	16.8±2.4	39.8±3.8	14.3±0.88	8.80±0.86
T_8 = K + NK	35.7±2.3	6.5±0.12	4.8±0.23	16.5±1.5	38.4±3.1	13.7±1.20	8.10±0.62
T_9 = K + B	35.02±2.3	6.6±0.17	4.8±0.23	14.9±0.9	38.9±1.0	14.0±0.58	8.70±0.96
T_{10} = C + N	37.4±1.8	7.2±0.46	5.2±0.26	15.2±0.5	42.1±1.9	15.0±0.58	8.00±0.78
T_{11} = C + NK	35.36±0.9	7.0±0.26	5.3±0.20	14.7±1.3	40.3±2.4	14.7±0.33	7.10±0.51
T_{12} = C + B	34.68±1.9	7.1±0.35	5.0±0.47	15.1±1.2	41.7±4.5	14.3±0.88	7.50±0.56
T_{13}=Chemical	54.06±3.4	6.3±0.15	4.3±0.31	14.1±0.8	38.2±1.4	10.7±0.33	6.60±0.66
T_{14}=Control	22.1±1.8	7.1±0.31	4.5±0.40	11.2±0.6	32.6±2.8	13.3±0.33	9.10±0.61
CV (%)	9.4	5.3	6.11	8.31	8.08	7.43	8.93
LSD value (0.05)	3.82	0.47	0.51	1.601	5.63	1.36	0.93
LSD value (0.01)	-	0.64	-	2.298	-	1.87	1.36
Level of significance	*	**	*	**	*	**	**

*Significant at 5% level; ** significant at 1% level;
T = Trichocompost @ 10 t/ha N = Neem oil @ 5 ml/l
V = Vermicompost @ 10 t/ha NK = Neem seed kernel extracts @ 50 g/l
K = Kitchen waste compost @ 10 t/ha B = Biskatali extracts @ 1:10
C = Cowdung dried digestate @ 10 t/ha
Chemical includes recommended dose of chemical fertilizer and pesticides while control plots had not received any form of fertilizers, compost or botanicals.

Discussion

Significantly highest yield was found from chemically treated plot and is closely in line with the findings of many investigations (Lee 2010; and Heeb et al. 2006). The combination of vermicompost with different botanicals gave distinctly higher dry matter of fruit while chemical practice gave the lowest dry matter of fruit. Chemical fertilizer reduces the dry matter content of tomatoes which was supported by many investigators (Marzouk and Kassem 2011; and Alvarez et al. 1988). Organic practices gave significantly higher amount of ascorbic acid over conventional practice which confirms the findings of Chatterjee et al. (2013). Chemical practice gave the least vitamin C and it could be due to presence of higher nitrogen content which was supported by Montagu and Goh (1990). Nutritional parameter β-carotene was comparatively higher in organically produced tomato than that of conventional practice. This result accords with the findings of Caris et al. (2004). Shelf-life was higher in organic practices than untreated and chemical treatment. In contrast, chemically produced tomato had the lowest shelf-life and it could be due to presence of higher nitrogen rate which enhanced deterioration of fruit and resulted in reduced shelf life. This result was in conformity with the findings of Upendra et al. (2003). The combination of vermicompost and trichocompost with botanicals gave the firmer fruit which might be due to presence of apparently higher amount of calcium (Sinha et al. 2009). This result is also in line with the finding of Chatterjee et al. (2013). Organic practices produce products with higher nutritional value as well as superior quality than that of conventional practices.

Reference

Alvarez CE, Garcia C, Carracedo AE (1988) Soil fertility and mineral nutrition of organic banana plantation in Tenerife. Biological Agriculture and Horticulture 5:313–323. doi.org/10.1080/01448765.1988.9755153

A.O.A.C. (1990) Official Methods of Analysis. Association of Official Analytical Chemists, Washington, DC, USA.

Caris VC, Amiot MJ, Tyssandier V, Grasselly D, Buret M, Mikolajczak M, Guilland JC, Bouteloup-Demange C, Borel P (2004) Influence of organic versus conventional agricultural practice on the antioxidant microconstituent content of tomatoes and derived purees; consequences on antioxidant plasma status in humans. J Agric Food Chem52(21): 6503-9. DOI: 10.1021/jf0346861

Chatterjee R, Jana JC, Paul PK (2013): Vermicompost substitution influences shelf life and fruit quality of tomato (*Lycopersicon esculentum* Mill.). Amer J Agrl Sci Tech 1**:** 69-76.

Heeb A, Lundegaardh B, Savage GP, Ericsson T (2006) Impact of organic and inorganic fertilizers on yield, taste and nutritional qualities of tomatoes. J Plant Nutr Soil Sci 169: 535-541. DOI: 10.1002/jpln.200520558

Lee J (2010) Effect of application methods of organic fertilizer on growth, soil chemical properties and microbial densities in organic bulb onion production. Scientia Horticulturae 124(3): 299–305.

Marzouk HA, Kassem HA (2011) Improving fruit quality, nutritional value and yield of Zaghloul dates by the application of organic and/or mineral fertilizers. Scientia Horticulturae127(3): 249–254.

Montagu KD, Goh KM (1990) Effects of forms and rates of inorganic nitrogen fertilizers on the yield and some quality indices of tomato. New Zealand J Crop Horti Sci 18(1): 31-37. http://dx.doi.org/10.1080/01140671.1990.10428067

Mondal, M. F. (2000) Production Storage of Fruits (in Bangla). Published by Mrs. Afia Mondal, BAU Campus, Mymensingh – 2202. 312p.

Ranganna S (1994) Manual of Analysis of Fruit and vegetable Products. Tata McGraw – Hill Publishing Company Limited, New Delhi, 1112 p.

Sinha RK, Sunil Herat, Gokul Bharambe, Swapnil Patil, Bapat PD, Kunal Chauhan, Dalsukh Valani, (2009) Vermiculture Biotechnology: The emerging cost-effective and sustainable technology of the 21st century for multiple uses from waste and land management to safe and sustained food production, Environment Res. J., NOVA Science Publishers, NY, USA, Invited Paper: 3 (2/3).

Upendra MS, Ramdane D, Bharat S (2003) Mineral nutrition in tomato. Food, Agriculture & Environment 1(2): 176-183

Diversifood, a multi-actor and transdisciplinary European research to boost cultivated diversity for quality and resilience

Véronique Chable[1], Edwin Nuijten[2], Ambrogio Costanzo[3], Isabelle Goldringer[4],Riccardo Bocci[5],Bernadette Oehen[6], Frédéric Rey[7]

Key words: diversity, populations, food chain, quality, seed systems, participatory research

Abstract

The organic sector needs diversity at crop level to increase the sustainability of the agricultural systems from an ecological point of view, and at intra and inter varietal levels to favour adaptation, co-evolution and health of crops. DIVERSIFOOD, a European H2020 project bringing together 12 countries (2015-2019) explores how underutilised and forgotten plant species can be more broadly used, in order to contribute to sustainable food systems in the light of environmental and social challenges. DIVERSIFOOD is addressing local organic development by several means: (1) redesigning research organisation, (2) rethinking hypotheses and methods of plant breeding for diversity, (3) increasing the number of cultivated crops, (4) managing community seed banks and farmers' networks to increase organic seed availability and (5) bringing together local multi-actor groups and, optimise marketing strategies and various tools for valorisation of biodiversity based on successful case studies.

Acknowledgments

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 633571

Introduction

DIVERSIFOOD (2015-2019) explores how underutilised and forgotten plant species can be more broadly used, aims to 1) create more diverse cultivated plant populations, 2) increase the quality of crops and their products, and 3) contribute to sustainable food systems in the light of environmental and social challenges. Modern industrial agriculture has led to a substantial reduction of cultivated diversity, both at the genetic and at the species level. The organic sector needs diversity at species level to increase the sustainability of the agricultural systems from an ecological point of view, and at intra and inter varietal levels to favour adaptation, co-evolution and health of crops. By stimulating cooperation between farmers, researchers, processors and consumers within the food chain, with 21 partners representing 12 counties, DIVERSIFOOD promotes a transdisciplinary and multi-actor research to increase relevance of scientific activities mainly addressed to organic and low input sectors.

Context and overall objectives

[1] INRA, Institut National de la Recherche Agronomique, France, Veronique.chable@inra.fr
[2] LBI, Louis Bolk Institute, The Netherlands, e.nuijten@louisbolk.nl
[3] ORC, Organic Resarch Center, United Kingdom, ambrogio.c@organicresearchcentre.com
[4] INRA, France, isabelle.goldringer@inra.fr
[5] RSR, ReteSemi Rurali, Italy, riccardo.bocci@semirurali.net
[6] FiBL, Forschungsinstitut für biologischen Landbau, Switzerland, bernadette.oehen@fibl.ch
[7] ITAB, Institut Technique de l'Agriculture Biologique, France, frederic.rey@itab.asso.fr

One of the scientific goals is first to connect biological and social sciences in order to establish a 'proven' concept for a multi-actor approach suited for participatory breeding and the maintenance of genetic diversity at various levels (genetic diversity in crops, farming systems and food chains). The challenge is (re)introducing and improving underutilised crop species and varieties, such as landraces or abandoned or neglected open-pollinated varieties for a wide range of different crop species (broccoli, tomato, wheat, maize, barley, faba bean, buckwheat, chestnut, carrot, lupin…), through simple or more complex crossing or mixing schemes.

To further create and adapt new diverse populations to local conditions (e.g. to farmers' practices, specifically within organic farming systems, and to local, regional or specific markets), a panoply of breeding strategies is adapted to each crop species within decentralized selection organisation involving several actors (farmers, breeders, processors, consumers...).

DIVERSIFOOD is sustaining a paradigm shift from pure conservation to the idea of dynamic management of cultivated diversity and genetic resources. For this purpose, the project investigates how communities organise themselves to foster autonomy for seed and identifies critical tools and bottlenecks in seed production. The main objectives are: (1) to improve the seed quality in Community Seed Systems; (2) to increase the communities or networks capacity to manage genetic resources; (3) to release a set of technical and policy recommendations; (4) to increase the awareness of policy makers on the potential of dynamic management of agricultural biodiversity.

Key success factors and bottlenecks in the marketing of food diversity (product development, sales channels and price) as well as the most supporting types of policy and networks, are analysed through case studies. Systems to communicate the added value of the biodiverse products from participatory breeding (e.g. field visits, networks, labels, trademarks, apps, Participatory Guarantee Systems) are evaluated in depth for their effectiveness in informing and involving consumers. The approach covers the whole supply chain and includes also needs and expectations of breeders, farmers and processors and their networks, including retailers and end users.

The development of innovation is throughout the whole project integrated with dissemination activities emphasizing face-to-face communication through social events, workshops and training sessions. The project aims for an active involvement of a diversity of stakeholders and for concrete and sensible connections to food challenges on the grounds. This helps to demonstrate how society at large can encourage sustainable agriculture, so contributing to the broader societal sustainability.

The specific approach of DIVERSIFOOD can be of significant interest for the organic sector: the decentralised organisation of the research and the renewal and diversification of crops will increase organic seed availability.

Multi-actor organisation of the research

Multi-actor research needs time and space to allow the emergence of a common culture which favours true exchanges building progressively. Transdisciplinarity allows integrating scientific knowledge with relevant craftsmanship know-how to really fit to the needs of the grounds (figure 1). Crucial to building the multi-actor approach is an iterative process in order to formulate a common objective and research approach embedded in the reality of the food chain. Competences from researchers and professionals are complementary and evolve concomitantly.

Common culture begins with the same definitions of words and concepts such as diversified food system, food quality, sustainable food systems, food democracy, community management of agro-biodiversity, collaborative/participative and action-research, transdisciplinarity and paradigmatic shift and co-evolutionary processes. The concept "resilience" can be considered the result of all the previous ones and the overall objective of DIVERSIFOOD actions: the resilience of the food system calls for adaptive capacities of the food chain at the agro-ecological and socio-economic level to provide sufficient high quality food and to maintain its cohesion over time.

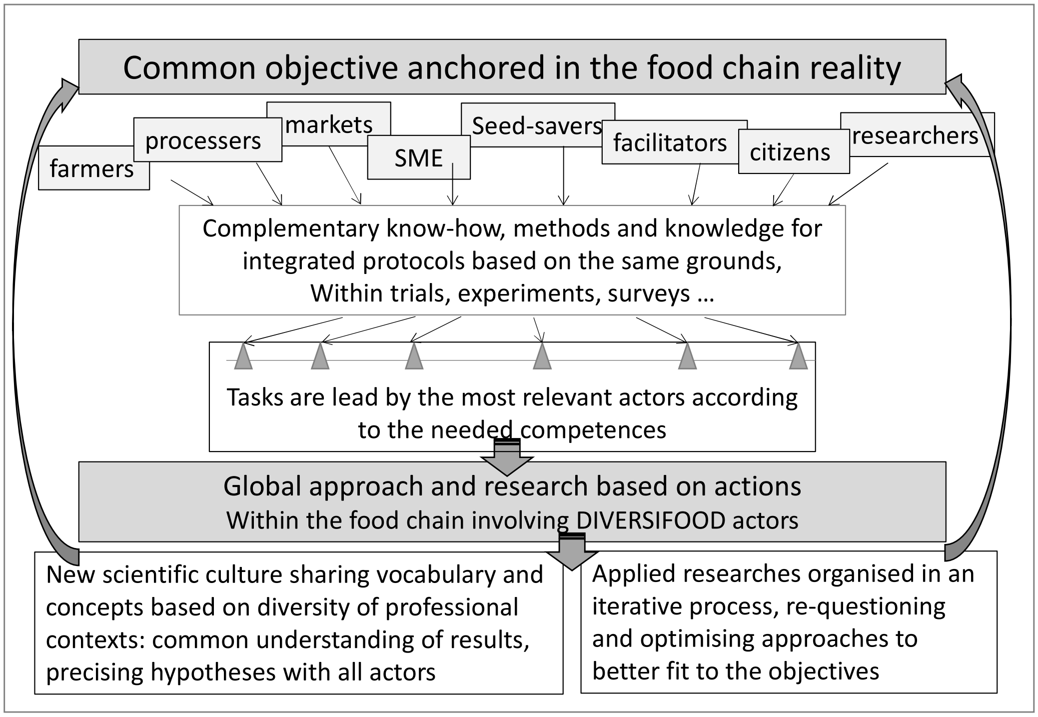


Figure 1. Multi-actor process within DIVERSIFOOD, a European project for increasing cultivated diversity within food chain and resilience of farming system

Creating new diversity

An important activity is to identify and collect genetic resources (GR) and related knowledge of underutilised/ neglected/forgotten crops; they could be either (1) novel, 'outsider' species, e.g. quinoa, (2) old, neglected species, e.g. rivet wheat and buckwheat (3) neglected germplasms of common species, e.g. old cultivars (mainly open pollinated varieties) for maize and tomato, and (4) common species in marginal areas, e.g. chickpeas in the UK. The development of an overall framework is on-going for an efficient, decentralised network of crop and cultivar evaluation for cultivation and use and for breeding, and then, the diffusion of knowledge to drive further testing and breeding, as well as to promote the rediscovery, cultivation and use of underutilised crops in a broader audience.

At the basis of new plant breeding activities, previously identified GR are combined to generate a large number of diverse populations to boost intra-crop diversity. Some of these populations developed in previous projects are evaluated and compared in order to assess both the usefulness of the methods for population development and the interest of the populations in breeding (for broccoli, bread wheat, tomato, durum wheat, carrot).To support the development of participatory research, methods for statistical analyses and data mining relevant for decentralized on farm evaluation and breeding have been adapted or developed by the partners (e.g. Bayesian models, spatial analyses, multivariate and clustering approaches, non-parametric methods for classification and decision trees) such as evaluation protocols with farmers' selection indexes and score sheets have been developed

Community seed system

CSBs (Community Seed Banks) were founded since the early 1980s in Europe. Many are based on seed savers´ and farmers´ networks. They play an important role overcoming deficiencies in EU or state policies regarding conservation and sustainable use of plant genetic resources. Moreover, Community seed systems in Europe play an important role as providers of seeds, know-how and network hubs for local and sustainable food systems, local adaptation and diversity management.

The community manages the seed bank following common objectives based on shared values, developing a specific culture and identity that reinforces organic principles. Objectives may address local interest and ecological issues (e.g. developing diversity for adaptation, recovering local crops, reviving traditional knowledge) and may enhance efficiency of actors organised within networks (e.g. exchange of seeds, information and know how, enhancing autonomy and fairness).

Therefore, DIVERSIFOOD, by connecting and comparing existing networks aims to learn from good practice and will search for answers to the questions: (1) What approaches, components and modalities characterise CSB models in "the West" in comparison to "the South", and what can we learn from each other? (2) What policies and practices are required to promote the role of CSB in Europe as safeguards and promotors of agricultural diversity? (3) What roles could CSB play in future to improve resilience of the food chain?

Discussion

DIVERSIFOOD is addressing local organic development by several means: (1) redesigning research approaches, (2) rethinking hypothesis and methods of plant breeding for resilience, (3) increasing the number of cultivated crops and data required to support more diverse varieties, crops, rotations and the overall food systems (4) managing community seed banks and farmers' networks to increase organic seed availability and (5) bringing together local multi-actor groups and optimising marketing strategies, methods and specific tools for valorisation of biodiversity based on successful case studies. The practical outcomes will be several plant populations, improved breeding methods for diversity and a set of recommended practices to organise community seed banks and promote participatory research as well as policy recommendations to boost cultivation and consumption of food diversity by consumers and producers in Europe. In sum, DIVERSIFOOD is strengthening the organic vision that promotes an agriculture that is embedded in territories, producing healthy and high quality products, biologically and culturally diverse, empowering food system actors from the farmer to the consumer. Moreover, the project is supporting innovative concepts and tools for achieving true sustainability and scaling-up organic practices.

Sustainable diets: An approach to bridge the prevalent intention-behaviour gap via citizen involvement

Leonie Fink[1], Angelika Ploeger[2], Carola Strassner[3]

Key words: bottom-up approach, citizen science, intention-behaviour gap, sustainable diets

Abstract

Our currently practiced food systems are far away from being considered as sustainable. To achieve the overall needed sustainable development we need to make our food systems more sustainable. This includes also our diets. But when it comes to sustainable diets we often have to deal with the issue of the prevalent intention-behaviour gap. Most of us strugglewith bridging this gap for a successful adoption of sustainable dietary-related habits. Here we see a need for a support through tools like diet adoption concepts. To get access to citizen’s needs and what could help them it stands to reason that they get directly involved in the development processes for such tools. Therefore, an appropriate approach needs to be developed.

Introduction

Modern and westernised food habits are causing problems in many ways. Characterised by a high intake of meat and highly processed convenience food and a low intake of fresh vegetables and fruits (Popkin 2006) peoples diet is neither health promoting nor sustainable in respect of our natural environment. It affects the increase of greenhouse gas production which relies mainly on deforestation, livestock production, the chemical treatment of the soil and furthermore on the industrial production of synthetic fertilizers which itself relies on an enormous use of fossil energy (FAO 2016). This brief outline shows us that today’s widely practiced food systems and diets are not sustainable. To address this challenge and bring about a crucial change, a development towards more sustainability is needed. Many issues have to change to achieve the different goals not least including addressing the missing link between agricultural production and foodstuff consumption, to support people’s awareness of and action on the above mentioned issues. What we need to establish and practice are sustainable food systems. For the existence of a sustainable food system we also need a high adoption rate of sustainable diets. Sustainable food systems and thereto linked diets have the potential to ensure worldwide food security and health of people, animals and nature (FAO 2012). One challenge of a successful adoption of diet concepts lies in the prevalent gap between intention and behaviour – especially when it comes to healthy and sustainable diets (Schwarzer 2008, Verplanken and Wood 2006). Because of this issue, concepts are needed which support the process of adopting a sustainable diet and continuing practice. To meet that challenge, it can be key to involve stakeholders like citizens in the development process. Based on the reported success of stakeholder involvement in the product development (for instance increased usability of products, potentially higher rate of customer satisfaction) via open innovation approaches (Chesbrough 2003, Chesbrough et al 2006), we identified an unused potential in our research field of adopting sustainable diets. Accounted for by the possible success of such an innovative approach we strive for developing our own approach to bridge the prevalent intention-behaviour gap via

[1] University of Kassel, Germany, www.uni-kassel.de&FH Münster University of Applied Sciences, Germany, eMail: l.fink@fh-muenster.de

[2] University of Kassel, Germany, www.uni-kassel.de, eMail: a.ploeger@uni-kassel.de

[3] FH Münster University of Applied Sciences, Germany, www.fh-muenster.de, eMail: strassner@fh-muenster.de

citizen involvement. To do so, we see the need of examining possible participation approaches which, if so, are also applied in similar actions and try to combine the findings within our approach.

Material and methods

For the issue of this paper we took literature from different research disciplines into account. Focusing on our research topic to bridge the gap between intention and behaviour in regard to sustainable diets, we choose to start with the comprehensive issue of food consumption. Therefore, we looked for existing studies on participation processes like open innovation, citizen science and projects like innovation labs who are addressing this issue. A systematic literature research in the field of stakeholder involvement and innovation (labs) regarding to sustainable diets, nutrition, food, food security and agriculture was conducted via online search engines. We then took our findings as a basis for the development of our approach to bridge the gap between intentions and behaviour when it comes to adopting sustainable diets. Because it was not sufficient enough we examined further literature of participation processes like open innovation approaches used in modern product development, to catch up on the essential research findings in regard to possible benefits and applied methods. Thereby we focused especially on user involvement within the innovation processes. Based on our findings wethen developed a theoretically possible approach to address our research question.

Results

Addressing established approaches to involve citizens in development processes regarding to food consumption and especially sustainable diets we found more or less suitable work which has been reported. The following two approaches matched our research topic mostly.

The first approach that we found is part of the LiveWell for Life project of WWF UK. In 2013 WWF and Friends of Europe hosted the second LiveWell for LIFE stakeholder workshop. About 50 key stakeholders from food, environment and health sections were participating. The participants identified opportunities and barriers when it comes to adopting sustainable diets (WWF 2013). Unfortunately, we could not find out how exactly the workshop was designed. Yet we found it interesting that the research topic matches mostly with ours and that the approach was a multi-stakeholder workshop. What we are missing here is the involvement of citizens.

Another approach that we found are the "Food Change Labs" established by Hivos and IIED in cooperation with local partners in Indonesia, Zambia and Uganda (Hivos et al 2016). These change labs are based on a social innovation approach which involves citizens in the solutions finding process (Hivos 2016). Some video examples on the website of the food change labs (www.foodchangelab.org) let us get first impression of their exactly work. What we take from this approach is the success of involving citizens and put them into the position of innovators or solution finders.

Yet we couldn't find any identic research, which leads us to design our own approach. Doing so, we examined, as mentioned before, literature on participation processes which leads us to the open innovation process commonly used in modern product development (Chesbrough 2003). Based on our comprehensive research in the field of open innovation we could emphasize, that our envisaged involvement of citizens can first take place in special arranged workshops for idea generation. To bring this approach into action we plan to perform several idea-workshops (in different cities in Germany) in which we apply a structured application of different creativity techniques in combination with several work tasks. The creativity techniques shall enable citizens to get access to different point of views linking to the workshop's research question "How can we close the gap between intention and behaviour respectively sustainable diets?". The tasks therefore are deposited with issues like nutrition settings, the five dimensions of sustainability (IFOAM best practice guideline for agriculture and value chains) and intercultural aspects regarding nutrition. During the workshop it is foreseen that the citizens generate ideas which are addressing the mentioned research question. The workshop approach can be a trial for further application in other countries. Results of the workshop can be used to be applied in a following experiment and can then be examined for success or failure.Because we see a huge potential in this developed approach, it is foreseen to perform this kind of idea-workshops in the near future.

Discussion

Sustainable development in all of its facets is a challenging social process. For this reason, it is necessary to involve and engage as many people as possible in these processes of change (Bass et al 1995). Most recently the need for community involvement in diverse regards to identify important issues is coming up strongly (Fraser et al 2006). Therefore, bottom-up approaches seems to be suitable and needed. In the past many non-participatory approaches failed (Bass et al 1995). The most important benefit of engaging citizens in participation is to ensure that the generated ideas and mentioned issues are relevant for them and further at the local level (Fraser et al 2006). This kind of a bottom-up approach seems to be auspicious and innovative in regard of the mentioned need of change. But we also need to involve the challenge of how innovative ideas can then have an impact on a larger scale (Olsson et al 2014).It is clear that many stakeholders along the food chain – especially citizens – have to get involved to introduce the needed change and support bridging the intention-behaviour gap when it comes to sustainable diets and an overall standing sustainable food system. This highlights how interwoven our food system really is. Moreover, our research approach to involve citizens in idea generation processes is strongly contributing to organic 3.0. Especially to one of the main features called a culture of innovation. Our theoretical construct and future applied approach involves citizens and drives thereby societal development. Besides our considered research method of workshops for idea generation has an innovative character because we couldn't find identic research approaches that address our topic of sustainable diet adoption. Through our approach citizens can develop basic idea approaches and concrete project ideas. These ideas will be defined and developed further to possibly realise them as projects within the framework of the organic food system programme (www.organicfoodsystem.net). This solves the mentioned question how the ideas can have an impact on a larger scale. It can be said that they can have the potential to drive organic more into mainstream and out of its niche.

References

Bass, S, Dalal-Clayton, B & Pretty J (1995) Participation in Strategies for Sustainable Development. Environmental Planning Issues (EPG) No. 7

Chesbrough, HW (2003) Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School Press, Boston, Massachusetts

Chesbrough, HW, Vanhaverbeke, W & West, J (2006). Open Innovation: Researching a New Paradigm. Oxford University Press, Oxford

FAO (2012) Sustainable Diets and Biodiversity. Directions and Solutions for Policy, Research and Action. http://www.fao.org/docrep/016/i3004e/i3004e.pdf. Accessed 15 November 2016

Fraser, EDG, Dougill, AJ, Mabee, WE, Reed M & McAlpine P (2005) Bottom up and top down: Analysis of participatory processes for sustainability indicator identification as a pathway to community empowerment and sustainable environmental management. J Environ Manage 78(2):114–127

Hivos (2016) Our change labs. https://hivos.org/role/knowledge-innovation?snid=15029. Accessed 15 November 2016

Hivos, IIED & KRC (2016) Uganda Food Change Lab: Planning for the future food system of Kabarole district. http://www.foodchangelab.org/assets/2016/09/food-lab-pub.pdf. Accessed 16 November 2016

Olsson, P, Galaz, V & Boonstra, W J (2014) Sustainability transformations: a resilience perspective. Ecol Soc 19(4):1-13. doi:10.1016/j.jenvman.2005.04.009

Popkin, BM (2006) Global nutrition dynamics: The world is shifting rapidly toward a diet linked with noncommunicable diseases. Am J Clin Nutr 84(2):289-98

Schwarzer, R (2008) Modeling Health Behavior Change: How to Predict and Modify the Adoption and Maintenance of Health Behaviors. Appl Psychol 57(1):1-29. doi:10.1111/j.1464-0597.2007.00325.x

Verplanken, B and Wood, W (2006) Interventions to Break and Create Consumer Habits. Journal of Public Policy & Marketing 25(1):90-103

WWF (2013) Adopting healthy, sustainable diets: key opportunities and barriers. LiveWell for LIFE Report. http://livewellforlife.eu/wp-content/uploads/2013/05/Adopting-healthy-sustainable-diets-report.pdf. Accessed 15 November 2016

Self-assessment of health status and lifestyle of French organic and conventional food consumers

Kamila Okulska[1], Ewa Rembiałkowska[1]

Key words: organic food, consumer, lifestyle, health status, contact with nature

Abstract

The aim of study was to compare self-assessment of health status and elements of lifestyle of French women eating conventional and organic food. The research was conducted by survey – 591 women with an average age of 35.9 years were interviewed. The conventional food group consisted of 122 women and the organic food group was divided into two groups: 249 light consumers (organic food accounted for at least 50% of their consumption) and 220 heavy consumers (at least 75% of organic food in their diet). The results show that the conventional food consumers assess their health status significantly lower than heavy organic food consumers, regardless of similar education level and lifestyle. On the other hand, a statistical difference for both organic food groups in comparison to the conventional food group was observed for the contact with nature indicator. As regards the living environment indicator, no difference between the groups was observed.

Acknowledgements:

The authors thank cordially Sigolène VERNERET from ISARA Lyon, Christophe PICHON from Lyon Freecycle and several other colleagues for their help and all study participants for their valuable contribution.

Introduction

According to Council Regulation No 834/2007 organic production is an overall system of farm management and food production that combines best environmental practices and production of high quality foodstuffs. The latest studies show that organically produced food is characterized by better nutritional composition (Barański et al. 2014, Średnicka-Tober et al. 2016 a, Średnicka-Tober et al. 2016 b). Meanwhile, very few studies objectively assess the real impact of organically produced foods on human health. It is commonly known that French consumers attach a high importance to food consumption and the quality of food products. Therefore it was interesting to investigate the nutritional habits, health self-assessment and the elements of lifestyle of French organic and conventional food consumers.

Material and methods

The research was conducted in France by surveying 591 women with an average age of 35.9 years, who filled in a questionnaire. 122 of the respondents were conventional food consumers (who consume less than 50% of organic food), and 469 were organic food consumers (who have been consuming organic food for at least 6 months). In order to better differentiate, the organic food group was divided into two sub-groups: light consumers (who declare eating a diet consisting of at least 50% organic products) – 249 women and heavy consumers (who declare at least 75% of organic foods in their diet) – 220 women. Period of time when organic food was eaten in the group with light and heavy organic food consumption is given in a table 1.

[1]Warsaw University of Life Sciences, Poland, www.sggw.pl

Table 1.**Period of time when organic food was eaten in the group with light and heavy organic food consumption.**

Time period	light organic food consumption	heavy organic food consumption
	% of consumers	% of consumers
Half a year	1.6 %	2.7 %
One year	3.6 %	0.9 %
1 – 2 years	7.2 %	4.6 %
2 – 4 years	20.9 %	11.8 %
More than 4 years	66.7 %	80.0 %

The respondents were asked to complete a four part questionnaire concerning the following: self-assessment of health status, nutritional habits, living environment and contact with nature. Examples are given in a table 2. Answers to questions from parts 1, 3 and 4 were quantified (an appropriate number of points was assigned to each answer – more points if the answer represented better health status or living environment). The quantification method is described in detail in a paper of Rembiałkowska et al. (2008). As a result three indicators were calculated: health status, living environment and contact with nature. All data was tested against normality to be sure that ANOVA is a suitable statistical procedure. Next all data was analysed by one-way analysis of variance (ANOVA) with significance defined as p-value = 0.05. To define which group differs from which the post-hoc Tukey HSD test was used. In the ANOVA system it is possible to compare the groups with different object numbers, because the system is balancing this issue itself.

Results

According to the analysis, French heavy organic food consumers assess their health condition as significantly better than do consumers of conventional food. The group with light consumption of organic food does not differ significantly from either the group of heavy organic food consumers or from the organic consumers group (table 3).

Table 2. **Examples of issues brought up in the survey**

Part of the survey	Issues
Health status	How often do they have infectious diseases, suffer from chronic disease, do they have problems with digestive tract, dental diseases, skin diseases, allergies, how often do they have doctor’s appointments, stays in hospital, headaches, insomnia, how often are they exposed to stress and how do they manage it, attitude towards life, use of stimulants, sport practices
Nutrition	Number of meals, composition of meals, do they eat breakfast, do they eat regularly, opinion about the quality of their meals, snacks between meals, special diet, attention paid to additives in food products, use of fast food restaurants
Living environment quality	Detached house/ flat, distance from highway, distance between house and areas of vegetation, level of noise

Contact with nature	Do they have gardens/allotments, pets and flowers in house, place of spending weekends/holidays

Regular sport activity is declared by most of the respondents, regardless of the type of food consumption. Similarly, the self-assessment of health status was assessed as good in most cases.

Table 3. **Health status indicators**

	Conventional group (122 women)	Light consumers group (249 women)	Heavy consumers group (220 women)
Maximum*		29 points	
Mean ± SD**	21.64 ^{b} ± 2.92***	22.04 ^{ab} ± 2.68	22.44 ^{a} ± 2.62
SE****	0.27	0.17	0.18
Significance		p = 0. 029	

** the highest possible number of points to be collected by every respondent*
*** SD – standard deviatio*
****the same small letters (a, a) mean that there is no statistical difference between the average results; different small letters (a, b)mean that there is a statistical difference between the average results.*
***** SE - standard error*

Table 4. **Living environment quality indicators**

	Conventional group (122 women)	Light consumers group (249 women)	Heavy consumers group (220 women)
Maximum		12 points	
Mean ± SD	7.89 ^{a} ± 2.63	8.25 ^{a} ± 2.53	8.4 ^{a} ± 2,61
SE	0.25	0.17	0.18
Significance		p = 0. 247	

Explanations the same as under Table 3.

Table 5. **Contact with nature indicators**

	Conventional group (122 women)	Light consumers group (249 women)	Heavy consumers group (220 women)
Maximum		18 points	
Mean ± SD	8.9 ^{b} ± 2,68	9.7 ^{a} ± 2.88	9.85 ^{a} ± 2.75
SE	0.24	0.18	0.19
Significance		p = 0.008	

Explanations the same as under Table 3

Organic consumers adhere much better to dietary guidelines than the conventional ones. Nevertheless, the majority of all the respondents declare normal body weight and BMI. The analysis of living environment quality does not show any significant differences between the groups (table 4). However, organic consumers significantly more often than conventional spend their weekends, holidays and free time outdoors, close to nature (table 5).

Discussion

In a big French study (Kesse-Guyot et al. 2013) the consumption of organic foods was associated with a higher education level and higher level of physical activity, but not with a higher income compared to the non-organic consumers. Other studies (Hassan et al. 2009, Oates et al. 2012) also showed that organic consumers did not report a greater income but had a higher level of education than the conventional ones. It is in accordance with the own results. In a Dutch study (van de Vijver and van Vliet 2012) the organic consumers compared to the conventional ones have reported better health what is similar to our results. Several studies have proved that organic consumers present much better nutritional profile than the conventional ones (Rembiałkowska et al. 2008, van de Vijver and van Vliet 2012, Kesse-Guyot et al. 2013, Baudry et al. 2016). It is in accordance with the presented study. The interesting result of our study is that the conventional food consumers, although exhibited similar lifestyle, were characterized by lower health status than organic heavy consumers.

Conclusions

Heavy organic consumers declared significantly better self-assessment of health than conventional consumers. Both heavy and light consumers of organic food declared significantly closer contact with nature than conventional food consumers. Organic food consumers adhered better to dietary guidelines in comparison to the conventional consumers. The consumption of organic food should be considered as integral part of a healthy lifestyle.

References

Barański M, Średnicka-Tober D, Volakakis N, Seal Ch, Sanderson R, Stewart G.B, Benbrook Ch, Biavati B, Markellou E, Giotis Ch, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Tahvonen R, Janovska D, Niggli U, Nicot Ph & Leifert C (2014): Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: a systematic literature review and meta-analyses. British Journal of Nutrition 112, 794-811.

Baudry J, Allès B, Péneau S, Touvier M, Méjean C, Hercberg S, Galan P, Lairon D & Kesse-Guyot E. (2016): Dietary intakes and diet quality according to levels of organic food consumption by French adults: cross-sectional findings from the NutriNet-SantéCohortStudy.Public Health Nutrition: 20(4), 638–648

Hassan D, Monier-Dilhan S, Nichele V & Simioni M. (2009): Organic Food Consumption Patterns in France. Journal of Agricultural & Food Industrial Organization, 7: 1–23.

Kesse-Guyot E, Péneau S, Méjean C, de Edelenyi F.S, Galan P, Hercberg S & Lairon D. (2013): Profiles of organic food consumers in a large sample of French adults: results from the Nutrinet-Sante cohort study. PLoS One 8, p. e76998.

Oates L, Cohen M, & Braun L (2012): Characteristics and consumption patterns of Australian organic consumers. Journal of the Science of Food and Agriculture 92, 2782-2787.

Rembiałkowska E, Kazimierczak R, Średnicka D, Bieńko K & Bielska M. (2008): Different aspects of organic and conventional food consumers' lifestyle. New Medicine 12, 16-19

Średnicka -Tober D, Barański M, Seal CJ, Sanderson R, Benbrook C, Steinshamn H, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Eyre M, Cozzi G, Larsen N K, Jordon T, Niggli U, Sakowski T, Calder P, C, Graham C G C, Sotiraki S, Stefanakis A, Yolcu H, Stergiadis S, Chatzidimitriou E, Butler G, Stewart G & Leifert C. (2016 a): Composition differences between organic and conventional meat: a systematic literature review and meta-analysis. British Journal of Nutrition, 115, 994 -1011.

Średnicka-Tober D, Barański M, Seal CJ, Sanderson R, Benbrook C, Steinshamn H, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Eyre M, Cozzi G, Larsen N K, Jordon T, Niggli U, Sakowski T, Calder P, C, Graham C G C, Sotiraki S, Stefanakis A, Yolcu H, Stergiadis S, Yolcu H, Chatzidimitriou E, Butler G, Stewart G & Leifert C. (2016 b): Higher PUFA and n-3 PUFA, conjugated linoleic acid, α-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: a systematic literature review and meta- and redundancy analyses. British Journal of Nutrition, 1-18

van de Vijver LP & van Vliet ME (2012): Health effects of an organic diet consumer experiences in the Netherlands. Journal of the Science of Food and Agriculture 92: 2923–292

Research into nutritive value and anticancer properties of berries from biodynamic, organic and conventional production: Project funded by Ekhagastiftelsen

Dominika Średnicka-Tober[1], Renata Kazimierczak[1], Ewelina Hallmann[1], Nadzieja Drela[2], Ewa Kozłowska[2], Ewa Rembiałkowska[1]

Key words: organic farming, biodynamic farming, blueberry, raspberry, anticancer, in vitro.

Abstract

We would like to introduce our research study funded by Ekhaga Foundation in the 2015 call (project No. 2015-76), with the aim to examine whether agricultural production methods determine nutritional quality and anticancer activity of fruit. The two-year project started in April 2016, with raspberry and blueberry fruits from biodynamic, organic and conventional agricultural system used as study objects. The chemical analyses of fruit composition include i.e. wide range of bioactive compounds (vitamin C, phenolic acids, flavonoids, proanthocyanidins, carotenoids) and total antioxidant activity. In addition, direct and indirect anticancer properties of berries are planned to be tested in vitro using Caco-2 Human Colon Carcinoma Cells and THP-1 human macrophage cell line. As growing demand for organic and biodynamic foods is driven by consumers' perception that they are more nutritious and health-beneficial, the presented research topic can undoubtedly count on high societal interest.

Introduction

Demand for organic and biodynamic foods is driven by consumers' perception that they are more nutritious and health-beneficial (Średnicka et al. 2016). At the same time available research results on health impacts of organic foods are limited (Bradbury et al. 2014), and there are hardly any studies undertaking the topic of the health-related quality of biodynamic products (Maciel et al. 2011). It is expected that organic and especially biodynamic fruit produced to high quality standards, with the use of natural agricultural methods, are characterized by beneficial composition and higher anticancer potential compared to fruit from agricultural systems relying on artificial fertilizers and chemical pesticides. Colorectal cancer used as a model in our study is the fourth most common cause of cancer related mortality globally and has been proven to be strongly associated with diet (van Duijnhoven et al 2009). As many of strong natural antioxidants, such as phenolic compounds abundant in berries, are not efficiently absorbed in the small intestine, we can expect not only systemic effect of these compounds, but also their direct action in the colon (Brown et al. 2012).

Material and methods

A general scheme of the experiment has been presented in Figure 1.

Analysis of chemical composition of fruit

Fruit (raspberry and blueberry) samples are planned to be collected in two consecutive years (2016 and 2017) from 3 biodynamic, 3 organic and 3 conventional farms matched for location in July-September, at ripeness. Freeze-dried samples are subject to the following chemical analyses in the laboratory of the Chair of Organic Food WULS-SGGW using validated published protocols and methods: concentration of total and reducing sugars, vitamin C, phenolic acids, flavonoids (anthocyanins, flavanols, flavonols), proanthocyanidins, carotenoids, chlorophylls, antioxidant

[1] Warsaw University of Life Sciences, Poland, www.sggw.pl, eMail: dominika_srednicka_tober@sggw.pl

[2] University of Warsaw, Poland, www.uw.edu.pl, eMail: ndrela@biol.uw.edu.pl

activity, dry matter content, acidity. In addition, all fruit samples will be analyzed for pesticide residues in the Institute of Plant Protection (National Research Institute), Department of Pesticide Residue Research in Poznań, Poland.

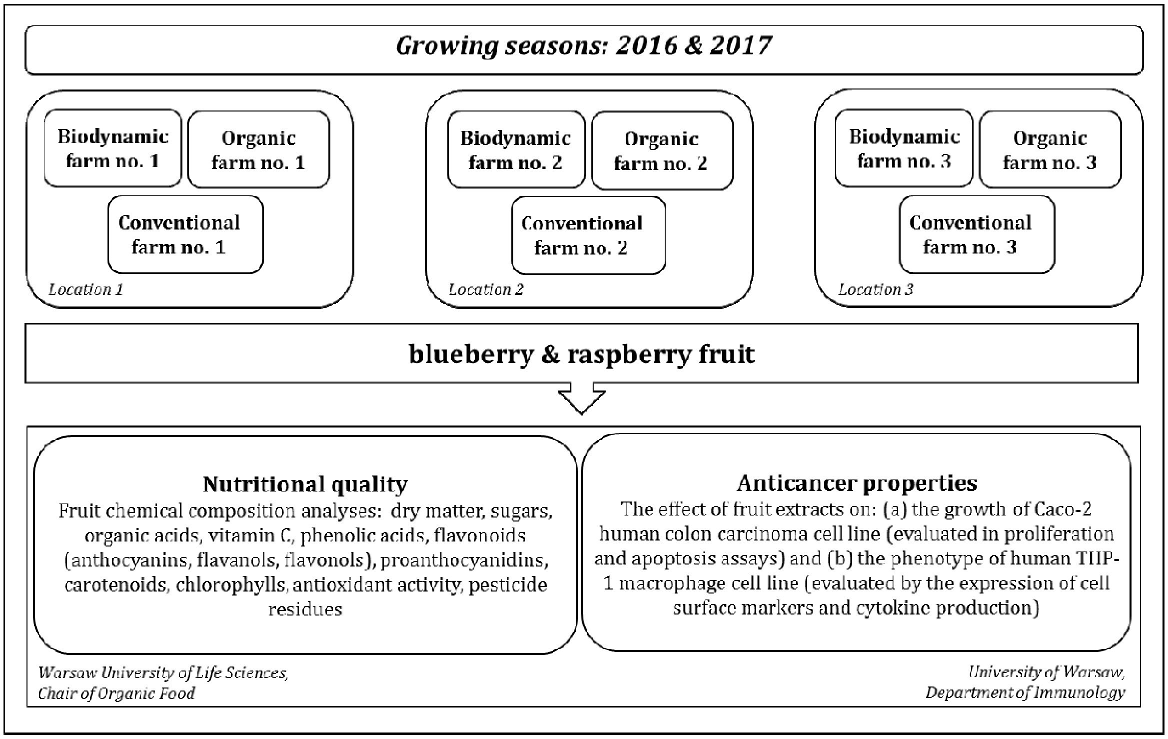


Figure 1. Research into nutritive value and anticancer properties of blueberry and raspberry fruit from biodynamic, organic and conventional production: experimental design.

Analysis of fruit anticancer properties

Freeze-dried fruit powder is planned to be used to prepare extracts for in vitro experiments. Both direct and indirect anticancer properties of selected berries will be tested. Direct activity of fruit extracts will be estimated based on proliferation and apoptosis vs. necrosis level of Caco-2 Human Colon Carcinoma Cells exposed to extracts applied alone or with anticancer drugs. To assess the level of cell apoptosis and necrosis flow cytometry technique will be used. Annexin V conjugated with fluorescein and propidium iodide cell staining will be used to examine the percentage of apoptotic and necrotic cells in cell cultures (Vermes et al. 1995). To examine the level of cell proliferation the CFSE technique will be used according to the method described by Lyons (2000). The percentage of proliferating cells will be analyzed using flow cytometry. Indirect (systemic) anticancer activity will be tested based on the effect of extracts on the modulation of phenotype of human macrophage cell line (THP-1 Human Monoblastic Leukemia Cell Line). We will examine the expression of macrophage surface markers involved in the activation of T helper and cytotoxic T lymphocytes (MHC I, MHC II, CD80, CD86) as well as production of cytokines known to create local, tumour surrounding microenvironment: (IL-10, IL-12, TNF-alpha, IL-1, IL-6). The expression of mentioned surface markers on THP-1 Human Monoblastic Leukemia cells treated with fruit extracts alone or with anticancer drugs will be estimated using flow cytometry technique. Cells will be stained with monoclonal antibodies labelled with different fluorochromes. Concentrations of cytokines released by THP-1 cells will be assessed in CBA test using flow cytometry technique. Each extract will be tested in 2 replicates, and two independent experiments will be conducted.

Expected results and their importance

It could be expected that organic and especially biodynamic fruits are characterized by higher in vitro anticancer potential compared to the fruit from conventional agricultural systems, due to their beneficial composition. As previously mentioned, demand for organic and biodynamic foods is driven by consumers' perception that they are more nutritious and health-beneficial (Średnicka-Tober et al. 2016). At the same time number of research carried out so far to examine health impacts of organic foods is very limited (Bradbury et al. 2014). The presented topic is therefore undoubtedly important and can count on high societal interest. Verification of the hypothesis on the superiority of organic and biodynamic fruits (especially with respect to their anticancer effects) could have a strong impact on consumers' choices and in the effect would bring an important contribution towards the further development of organic and biodynamic sector of fruit production.

It has been shown that growers' interest in production of blueberries and raspberries, as well as the consumption level of these fruit in European countries, has significantly increased in recent years (Nilsson and Svensson 2011). Therefore this horticultural sector seems to be a good target for organic and biodynamic production, both for the newcomers to the sector, and the current producers seeking for new solutions to address the consumers' needs for safe, high quality produce. Additionally, confirmation of the hypothesis on the superior quality and stronger anticancer effects of biodynamic over organic fruit may motivate organic farmers to move towards biodynamic production methods.

It is worth underlying that colorectal cancer targeted in our study is the fourth most common cause of cancer related mortality globally (van Duijnhoven). Epidemiological data suggests that colon cancer, as well as other cancers of the digestive tract, are very susceptible to dietary modification, possibly due to being in direct contact with bioactive food constituents (Brown et al. 2012). Confirmation of the anticancer effect of the studied fruit, including the ability to potentiate the effects of anticancer drugs, but also identification of a link between agricultural production methods and anticancer activity of fruit, may significantly contribute to the current strategies of prevention and treatment of cancer.

The results of the first year of the described Ekhaga research study will be presented during the 5th ISOFAR Scientific Conference "Innovative Research for Organic 3.0" at the 19th Organic World Congress, New Dehli, India, November 9-11, 2017.

Acknowledgment

The authors gratefully acknowledge financial support from Ekhaga Foundation for the described research project: Research into nutritive value and anticancer properties of blueberry and raspberry fruit from biodynamic, organic and conventional production (project number: 2015-76).

References

Średnicka D, Kazimierczak R, Hallmann E (2016):European organic food consumers: motives, actions and implications. Problemy Zarządzania 14, 100-108.

Bradbury KE, Balkwill A, Spencer EA, Roddam AW, Reeves GK, Green J, Key TJ, Beral 1, Pirie K (2014): Organic food consumption and the incidence of cancer in a large prospective study of women in the United Kingdom.British Journal of Cancer 110(9), 2321-2326.

Maciel LF, Oliveira C, Bispo E, Spinola M (2011): Antioxidant activity, total phenolic compounds and flavonoids of mangoes coming from biodynamic, organic and conventional cultivations in three maturation stages. British Food Journal 113(9), 1103-1113.

Brown EM, Gill CI, McDougall GJ, Steward D (2012): Mechanisms underlying the anti-proliferative effects of berry components in in vitro models of colon cancer. Current Pharmaceutical Biotechnology 13(1), 200-209.

van Duijnhoven F.J., Bueno-De-Mesquita H.B., Ferrari P., Jenab M, Boshuizen HC, et al. (2009): Fruit, vegetables, and colorectal cancer risk: the European Prospective Investigation into Cancer and Nutrition. American Journal of Clinical Nutrition 89 (5), 1441-1452.

Lyons AB (2000): Analysing cell division in vivo and in vitro using flow cytometric measurement of CFSE dye dilution. Journal of Immunological Methods 243(1-2), 147-154.

Vermes I, Haanen C, Steffens-Nakken H, Reutelingsperger C (1995): A novel assay for apoptosis. Flow cytometric detection of phosphatidylserine expression on early apoptotic cells using fluorescein labelled Annexin V. Journal of Immunological Methods 184(1), 39-51.

Nilsson T, Svensson B (2011): Raspberries and new soft fruits. The Expansion Horticulture project report of the Swedish University of Agricultural Sciences.

Quality of organic food and its impact on health: the review

Marcin Baranski, Leonidas Rempelos, Carlo Leifert

Key words: organic food, quality, nutritional composition, animal health, human health

Abstract

Recent systematic literature reviews and meta-analyses have identified significant and nutritionally-relevant composition differences between organic and conventional crops, meat and dairy products. Results suggest that a switch to organic food consumption would result in an increase intakes of antioxidants with crops and omega-3 fatty acids with meat and milk, but reduce intakes of the toxic cadmium and pesticide residues with crops and omega-6 fatty acids, iodine and selenium with milk and meat.

The evidence from several animal dietary intervention studies suggest that switching from conventional to organic feeds results in changes to growth and hormonal balances, and increased immune system responsiveness. Human cohort studies have reported associations between organic crop and dairy consumption, and reduced risk of certain diseases and obesity. Overall the published evidence suggests that a switch from conventional to organic food consumption may have significant impacts on human health.

Acknowledgments

The authors are grateful for funding from the European Community financial participation under the Sixth Framework Programme for Research, Technological Development and Demonstration Activities for the Integrated Project QUALITYLOWINPUTFOOD, FP6-FOOD-CT-2003- 506358.

We also gratefully acknowledge financial and technical support from the Sheepdrove Trust for ‘the Meta-Analyses of Data on composition of Organic and Conventional foods’.

Introduction

The demand for organic food has increased rapidly over the last 25 years in many developed countries in Europe, North America, and Asia/Oceania (Willer and Kilcher 2011). It is mainly driven by consumer perceptions that organic farming is more sustainable, and delivers environmental, biodiversity, animal welfare and food quality and safety benefits compared to intensive conventional farming (O’Doherty Jensen *et al.* 2011; Uzunboylu and Ozguven 2012; Pomsanam *et al.* 2014).

The core principles and objectives of the organic farming focus on minimising environmental impacts of agriculture while maintaining or improving soil fertility, crop health, animal welfare, food quality and the long-term sustainability of food production systems (Lampkin 2002). To achieve these objectives organic farming standards prohibit or restrict the use of many external inputs that are widely used in conventional farming, primarily because they are considered non-renewable or scarce resources (e.g. mineral fertilisers, energy) or potentially deleterious to human health (e.g. synthetic chemical pesticides, fungicides and herbicides, antibiotics, hormones, food additives, GM-crops and animals). To ensure the organic farming standards they are defined by government laws and regulations, and controlled and certified in most countries (European Commission 2016; USDA 2016).

While there is increasing scientific consensus about many biodiversity, environmental, sustainability-related benefits of organic farming, there is still considerable scientific controversy about whether or not, and to what extent organic production methods result in food quality and safety, and health benefits for the consumers. This review will summarise (i) the evidence from systematic reviews/meta-analyses of published data on nutritionally relevant composition differences between organic and conventional foods, and (ii) the results from animal dietary intervention and human cohort studies in which associations between organic feed consumption and health related physiological parameters were investigated.

The review highlights the benefits associated with organic food consumption, and thereby contributes towards objective 1 of the Organic 3.0 strategy.

Effect of organic farming standards on food composition

Over the years the composition differences between conventional and organic crops and processed foods has been studied extensively, in (i) farm surveys in which samples were collected from conventional and organic farms located in the same region or country, (ii) controlled field experiments in which crops were cultivated according conventional or organic standards, and (iii) basket studies in which samples were obtained from the market. Results from those studies were often difficult to summarise, because authors used different experimental protocols and/or different number of samples. In recent years the use of systematic literature search protocols followed by statistical meta-analyses methods adopted from medical science allowed the comprehensive summary of such data (Brandt *et al.* 2013).

A series of recent systematic reviews and meta-analyses conducted by the NEFG have shown that there are substantial differences in the concentrations of nutritionally relevant compounds between organically and conventionally foods (Barański *et al.* 2014; Średnicka-Tober *et al.* 2016a, b;). Most important finding showed that:

- organic crops were estimated to have 17% higher antioxidant activity and between 18% and 69% higher concentrations of a range of individual antioxidants, while conventional crops were estimated to have 15%, 10%, 30%, and 87% higher concentrations of protein, nitrogen, nitrate, nitrite, respectively, and 48% higher levels of the toxic metal cadmium, and were 4-times more likely to contain detectable pesticide residues (Barański *et al.* 2014);
- organic meat, milk and dairy products were shown to have approximately 50% higher concentrations of omega-3 fatty acids (Średnicka-Tober *et al.* 2016a, b);
- organic meat was shown to also have slightly lower concentrations of myristic- and palmitic acid (Średnicka-Tober *et al.* 2016a);
- organic milk was reported to contain 40% higher levels of total conjugated linoleic acid (CLA), higher iron (20%) and α-tocopherol (13%) concentrations, while conventional milk was estimated to have 71% and 21% higher concentrations of iodine and selenium, respectively (Średnicka-Tober *et al.* 2016b).

Meta-analyses carried out prior to 2014 produced broadly similar results where the same parameters were analysed. Brandt *et al.* (2011) reported higher levels of antioxidants in organic crops. Smith-Spangler *et al.* (2012) reported higher concentrations of phenolic compounds (the main group of antioxidants found in crop plants) and lower contamination with pesticides in organic crops, higher concentrations of omega-3 fatty acids in organic milk, and that the majority of published studies found higher cadmium concentrations in conventional crops. Palupi *et al.* (2012) only reviewed studies on milk composition published between March 2008 and April 2011 and reported significantly higher concentrations of omega-3 fatty acids, CLA and tocopherol in organic milk. Dangour *et al.* (2009a) in his report for the UK Food Standards Agency shown a trend towards higher concentrations of omega-3 PUFA in organic animal products (pooled data for milk, meat and eggs), but did not included these results in the published paper (Dangour *et al.* 2009b).

The most recent studies (Barański *et al.* 2014; Średnicka-Tober *et al.* 2016a, b) were based on a much larger evidence base (343, 67, and 196 studies for crops, meat and milk/dairy products respectively) than previous systematic reviews by Dangour *et al.* (2009a) who analyses 46 studies on crops and 9 studies on milk, meat and eggs, Brandt *et al.* (2011) who synthesises evidence from 65 studies on phytochemical in crops only, Palupi *et al.* (2012) who analyses 13 paper on milk composition published after 2008 only, and Smith-Spangler *et al.* (2012) who analyses 154, 35 and 37 studies on crops, meat and milk respectively. Moreover, the more recent systematic reviews (Palupi *et al.* 2012; Smith-Spangler *et al.* 2012; Barański *et al.* 2014; Średnicka-Tober *et al.* 2016a, b) used state-of the art meta-analysis protocols based on standardised mean differences, which allowed to weight the contribution of each finding in overall estimate on the basis of the sample size included in each primary study. Also the most recent meta-analyses (Barański *et al.* 2014; Średnicka-Tober *et al.* 2016a, b) included also the GRADE (Grading of Recommendations, Assessments, Development and Evaluation) based strength-of-evidence assessments in line with currents recommendations for systematic reviews/meta-analyses (Guyatt *et al.* 2008). The reviews by Dangour *et al.* (2009a) and Brandt *et al.* (2011) were based on unweighted meta-analyses, which are considered less reliable and accurate (Philibert *et al.* 2012).

At the same time it is important to highlight that there are still significant gaps of knowledge with respect to composition differences between organically and conventionally produced foods. Most importantly, there is:

- a need to systematically review and meta-analyse reports on mycotoxin levels in crops and/or composition differences in eggs from organic and conventional farms;
- insufficient data to accurately estimate the magnitude of differences for individual crops and meat products from different livestock species, as a result it is currently not possibly to accurately estimate differences in dietary intakes of most desirable and undesirable compounds resulting from organic and conventional food based diets;
- not enough published information to compare concentrations of a wide range of nutritionally relevant nutrients (e.g. water soluble vitamins, and many minerals in milk and meat) and undesirable compounds (e.g. pesticides, antibiotics, hormones, synthetic food additives in milk and meat) in a meta-analysis.

Impacts of organic food consumption on health

Although the systematic reviews/meta-analyses (Barański *et al.* 2014; Średnicka-Tober *et al.* 2016a; Średnicka-Tober *et al.* 2016b) has demonstrated that there are significant and nutritionally relevant composition differences between organic and conventional foods, there is still a controversy on whether this has a substantial effect on the physiology and health of animals and humans. The insufficient number of published animal dietary intervention and human cohort studies does not allow to conduct systematic review and meta-analysis which could compare impacts of organic versus conventional food consumption on health-related physiological parameters. However, an increasing number of these studies, including experiments conducted by the NEFG (Skwarlo-Sonta *et al.* 2011; Srednicka-Tober *et al.* 2013), have identified associations between organic feed/food consumption and specific health, and health related physiological parameters (Finamore *et al.* 2004; Lauridsen *et al.* 2008; Huber *et al.* 2010; Skwarlo-Sonta *et al.* 2011; Jensen *et al.* 2013; Srednicka-Tober *et al.* 2013).

A few published animal dietary intervention studies identified significant effects of feeds produced from organic crops, comparing to feeds from conventional crops, on animal growth and various physiological parameters (body composition, plasma antioxidant, hormone and immunoglobulin levels, and immune system responsiveness). However, they used different animal species and/or experimental designs, which make it difficult to identify consistent trends across studies (Finamore *et al.* 2004; Lauridsen *et al.* 2008; Huber *et al.* 2010; Skwarlo-Sonta *et al.* 2011; Jensen *et al.* 2013; Srednicka-Tober *et al.* 2013). One relatively consistent trend was found for immune system responsiveness. Six out of 8 studies (1 with rabbits, 2 with chicken, 2 with rats and 1 with mice) reported greater responsiveness with organic feeds (Staiger 1988; Plochberger 1989; Finamore *et al.* 2004; Lauridsen *et al.* 2008; Huber *et al.* 2010; Roselli *et al.* 2012), while 2 studies (1 with pigs and 1 with rats) reported no significant difference (Millet *et al.* 2005; Jensen *et al.* 2013). None of the studies reported greater responsiveness with conventional feeds.

Most human cohort studies in which associations between organic vs. conventional food consumption and health parameters were investigated were mother and child dyad cohorts. Recent cohort studies in Norway, Denmark and The Netherlands showed that organic vegetable and/or dairy consumption was linked to a reduced risks of (i) pre-eclampsia in mothers (Torjusen et al. 2014), (ii) hypospadias in baby boys (Christensen *et al.* 2013; Brantsæter *et al.* 2016) and/or (iii) eczema in infants (Kummeling *et al.* 2008).

A sub-study (of about 54,000 adults) of the French-Belgium Nutrienet-Sainté cohort reported that regular consumers of organic food had a substantially lower risk of being overweight (28% for woman and 28% for men) or obese (41% for women and 57% for men) (Kesse-Guyot *et al.* 2013). This association was found even after data were adjusted for age, physical activity, education, smoking status, energy intake, restrictive diet, and adherence to public nutritional guidelines.

A subgroup of a large UK cohort study focused on cancer incidence in middle-aged showed that there is a weak association between organic food consumption and a reduced incidence of non-Hodgkin's lymphoma, although the study was based on an observation period of only 7 years (Bradbury *et al.* 2014).

Conclusions

Despite growing evidence supporting that switching from conventional to organic food consumption has significant effect on animal and human health, there is still a need to perform well-designed human dietary intervention studies to address knowledge gaps and provide more accurate estimates. Furthermore, dietary intervention studies with humans should be supplemented with more controlled experiments with animal models to provide a more mechanistic understanding the impact of organic vs. conventional foods on human health. Also, there is a requirement for more and better designed field experimental, and farm and retail survey-based studies that compare the composition of organic and conventional crops, meat types and eggs in a wide range of different pedo-climatic and agronomic backgrounds. This would allow the intakes of nutritionally relevant compounds with organic and conventional foods to be compared in different dietary scenarios and thereby help to improve the design of human dietary intervention studies.

References

Barański M, Średnicka-Tober D, Volakakis N, Seal C, Sanderson R, Stewart GB, Benbrook C, Biavati B, Markellou E, Giotis C, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Tahvonen R, Janovská D, Niggli U, Nicot P, Leifert C (2014) Higher antioxidant and lower cadmium concentrations and lower incidence of pesticide residues in organically grown crops: A systematic literature review and meta-analyses. Br J Nutr 112, 794-811.

Bradbury KE, Balkwill A, Spencer EA, Roddam AW, Reeves GK, Green J, Key TJ, Beral V, Pirie K, The Million Women Study C (2014) Organic food consumption and the incidence of cancer in a large prospective study of women in the united kingdom. Br J Cancer 110, 2321-2326.

Brandt K, Leifert C, Sanderson R, Seal CJ (2011) Agroecosystem management and nutritional quality of plant foods: The case of organic fruits and vegetables. Crit Rev Plant Sci 30, 177-197.

Brandt K, Srednicka-Tober D, Baranski M, Sanderson R, Leifert C, Seal CJ (2013) Methods for comparing data across differently designed agronomic studies: Examples of different meta-analysis methods used to compare relative composition of plant foods grown using organic or conventional production methods, and a protocol for a systematic review. J Agric Food Chem 61, 7173-7180.

Brantsæter AL, Torjusen H, Meltzer HM, Papadopoulou E, Hoppin JA, Alexander J, Lieblein G, Roos G, Holten JM, Swartz J, Haugen M (2016) Organic food consumption during pregnancy and hypospadias and cryptorchidism at birth: The norwegian mother and child cohort study (moba). Environ Health Perspect 124, 357-364.

Christensen JS, Asklund C, Skakkebæk NE, Jørgensen N, Andersen HR, Jørgensen TM, Olsen LH, Høyer AP, Moesgaard J, Thorup J, Jensen TK (2013) Association between organic dietary choice during pregnancy and hypospadias in offspring: A study of mothers of 306 boys operated on for hypospadias. J Urol 189, 1077-1082.

Dangour AD, Aikenhead A, Hayter A, Allen E, Lock K, Uauy R (2009a): Comparison of putative health effects of organically and conventionally produced foodstuffs: A systematic review. Report for the food standards agency. London.

Dangour AD, Dodhia SK, Hayter A, Allen E, Lock K, Uauy R (2009b) Nutritional quality of organic foods: A systematic review. American Journal of Clinical Nutrition 90, 680-685.

European Commission (2016) Organic farming. Available at: http://ec.europa.eu/agriculture/organic/ (Accessed: 3 August 2016).

Finamore A, Britti MS, Roselli M, Bellovino D, Gaetani S, Mengheri E (2004) Novel approach for food safety evaluation. Results of a pilot experiment to evaluate organic and conventional foods. J Agric Food Chem 52, 7425-7431.

Guyatt GH, Oxman AD, Vist GE, Kunz R, Falck-Ytter Y, Alonso-Coello P, Schünemann HJ (2008) Grade: An emerging consensus on rating quality of evidence and strength of recommendations. BMJ 336, 924-926.

Huber M, van de Vijver LPL, Parmentier H, Savelkoul H, Coulier L, Wopereis S, Verheij E, van der Greef J, Nierop D, Hoogenboom RAP (2010) Effects of organically and conventionally produced feed on biomarkers of health in a chicken model. Br J Nutr 103, 663-676.

Jensen MM, Halekoh U, Stokes CR, Lauridsen C (2013) Effect of maternal intake of organically or conventionally produced feed on oral tolerance development in offspring rats. J Agric Food Chem 61, 4831-4838.

Kesse-Guyot E, Péneau S, Méjean C, Szabo de Edelenyi F, Galan P, Hercberg S, Lairon D (2013) Profiles of organic food consumers in a large sample of french adults: Results from the nutrinet-santé cohort study. PLoS ONE 8, e76998.

Kummeling I, Thijs C, Huber M, van de Vijver LPL, Snijders BEP, Penders J, Stelma F, van Ree R, van den Brandt PA, Dagnelie PC (2008) Consumption of organic foods and risk of atopic disease during the first 2 years of life in the netherlands. Br J Nutr 99, 598-605.

Lampkin NH (2002): Organic farming. 2nd edn. Ipswich: Old Pond Publishing.

Lauridsen C, Yong C, Halekoh U, Bugel SH, Brandt K, Christensen LP, Jorgensen H (2008) Rats show differences in some biomarkers of health when eating diets based on ingredients produced with three different cultivation strategies. J Sci Food Agric 88, 720-732.

Millet S, Cox E, Buyse J, Goddeeris BM, Janssens GPJ (2005) Immunocompetence of fattening pigs fed organic versus conventional diets in organic versus conventional housing. Vet J 169, 293-299.

O'Doherty Jensen K, Denver S, Zanoli R (2011) Actual and potential development of consumer demand on the organic food market in europe. NJAS 58, 79-84.

Palupi E, Jayanegara A, Ploeger A, Kahl J (2012) Comparison of nutritional quality between conventional and organic dairy products: A meta-analysis. J Sci Food Agric 92, 2774-2781.

Philibert A, Loyce C, Makowski D (2012) Assessment of the quality of meta-analysis in agronomy. Agric Ecosyst Environ 148, 72-82.

Plochberger K (1989) Feeding experiments. A criterion for quality estimation of biologically and conventionally produced foods. Agric Ecosyst Environ 27, 419-428.

Pomsanam P, Napompech K, Suwanmaneepong S (2014) Factors driving thai consumers' intention to purchase organic foods. Asian J Sci Res 7, 434-446.

Roselli M, Finamore A, Brasili E, Capuani G, Kristensen HL, Micheloni C, Mengheri E (2012) Impact of organic and conventional carrots on intestinal and peripheral immunity. J Sci Food Agric 92, 2913-2922.

Skwarlo-Sonta K, Rembialkowska E, Gromadzka-Ostrowska J, Srednicka-Tober D, Baranski M, Krolikowski T, Wisniewska K, Rusaczonek A, Hallmann E, Lueck L, Leifert C (2011) Response of animal physiology to organic versus conventional food production methods. NJAS 58, 89-96.

Smith-Spangler C, Brandeau ML, Hunter GE, Bavinger JC, Pearson M, Eschbach PJ, Sundaram V, Liu H, Schirmer P, Stave C, Olkin I, Bravata DM (2012) Are organic foods safer or healthier than conventional alternatives?: A systematic review. Ann Intern Med 157, 348-66.

Srednicka-Tober D, Baranski M, Gromadzka-Ostrowska J, Skwarlo-Sonta K, Rembialkowska E, Hajslova J, Schulzova V, Cakmak I, Ozturk L, Krolikowski T, Wisniewska K, Hallmann E, Baca E, Eyre M, Steinshamn H, Jordon T, Leifert C (2013) Effect of crop protection and fertilization regimes used in organic and conventional production systems on feed composition and physiological parameters in rats. J Agric Food Chem 61, 1017-29.

Średnicka-Tober D, Barański M, Seal C, Sanderson R, Benbrook C, Steinshamn H, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Eyre M, Cozzi G, Krogh Larsen M, Jordon T, Niggli U, Sakowski T, Calder PC, Burdge GC, Sotiraki S, Stefanakis A, Yolcu H, Stergiadis S, Chatzidimitriou E, Butler G, Stewart G, Leifert C (2016a) Composition differences between organic and conventional meat: A systematic literature review and meta-analysis. Br J Nutr 115, 994-1011.

Średnicka-Tober D, Barański M, Seal CJ, Sanderson R, Benbrook C, Steinshamn H, Gromadzka-Ostrowska J, Rembiałkowska E, Skwarło-Sońta K, Eyre M, Cozzi G, Larsen MK, Jordon T, Niggli U, Sakowski T, Calder PC, Burdge GC, Sotiraki S, Stefanakis A, Stergiadis S, Yolcu H, Chatzidimitriou E, Butler G, Stewart G, Leifert C (2016b) Higher pufa and n-3 pufa, conjugated linoleic acid, α-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: A systematic literature review and meta- and redundancy analyses. Br J Nutr 115, 1043-1060.

Staiger D (1988) The nutritional value of foods from conventional and biodynamic agriculture - feeding trial to ascertain the effects on the fertility of rabbits. IFOAM Bull 4, 9-12.

Torjusen H, Brantsæter AL, Haugen M, Alexander J, Bakketeig LS, Lieblein G, Stigum H, Næs T, Swartz J, Holmboe-Ottesen G, Roos G, Meltzer HM (2014) Reduced risk of pre-eclampsia with organic vegetable consumption: Results from the prospective norwegian mother and child cohort study. BMJ Open 4, e006143.

USDA (2016) Organic standards. Available at: https://www.ams.usda.gov/grades-standards/organic-standards (Accessed: 3 August 2016).

Uzunboylu H, Ozguven N (2012) World conference on business, economics and management (bem-2012), may 4–6 2012, antalya, turkeyorganic foods motivations factors for consumers. P Soc Behav Sci 62, 661-665.

Willer H, Kilcher L (2011) The world of organic agriculture. Statistics and emerging trends 2011. Fibl-ifoam report. IFOAM, Bonn and FiBL, Frick.

A methodology to go from stakeholder's expectations to research questions: implementation on organic food processing

Marc Tchamitchian[1], Servane Penvern[1], Céline Cresson[2], Laetitia Fourrie[2], Bruno Taupier-Létage[2], Rodolphe Vidal[2], Joël Abécassis[3]

Key words: Town-hall meeting, participative method, research agenda

Abstract

To develop research projects on organic food processing, the French Research Institute of Organic Farming and the French National Institute for Agricultural Research co-organised a participatory meeting to define shared research questions and involve stakeholders (researchers, private companies, representatives of funding agencies and consumers). Based on the Town Hall Meeting method, it enabled attendees to express and discuss their points of view on proposals they made together. This led to twenty-two research questions about bio-compatibility, conservation, sustainability, adaptation to the food system and flexibility, socio-economic or health. It also led to mid-term strategic agenda. Some of these questions are currently used to build multidisciplinary projects in the framework of a French organic processing network.

Introduction

Organic food processing has a great responsibility: handing to consumers food that still conveys the principles of organics. It raises many questions, on raw materials, on processing, but also on the end-product and the way it is presented and packed. How to deal with raw materials heterogeneity? Which processes can be used, with which ingredients? And many other questions. The European platform TP Organics (Moeskops and Cuoco 2014), Kahl et al. (2013) and others highlight the need for more research in this area, to go further than just define concept framework, but do not venture into a prioritization of these questions: the priority is related to the local economies and situations, to stakeholders' and private companies' strategies. It is also related to the nature of the questions: some are mainly technical (process design, adaptation of recipes), some relates to regulations, while others cover many domains ranging from ethics to analytics (e. g. what defines an organic processed product, how to assess its properties). Priority setting must also conjugate research temporality and stakeholders' engagement.

In France, the research dedicated to organic food processing is scarce, despite the recent initiative to coordinate the different R&D actors in this domain, the RMT TransfoBio (a technological network dedicated to organic food processing, associating development organisations and processing company representatives). The diagnostic of this RMT on this scarcity is that it is probably not due to a lack in funding, but rather to the difficulty for research to find specific questions in organic food processing. It is therefore most interesting to design consensus-based methods allowing stakeholders to express their concerns and questions that research could solve and consortium creation to stimulate project design. We describe the implementation of such a method to design a research agenda dedicated to organic food processing.

Material and methods

[1] ECODEVELOPPEMENT, INRA, 84000, Avignon, France. marc.tchamitchian@inra.fr, servane.penvern@inra.fr

[2] ITAB, 75013, Paris, France. celine.cresson@itab.asso.fr, laetitia.fourrie@itab.asso.fr, bruno.taupier-letage@itab.asso.fr, rodolphe.vidal@itab.asso.fr

[3] UMR IATE, INRA, 34000, Montpellier, France. joel.abecassis@inra.fr

To achieve the goals of eliciting a diversity of research questions fulfilling the expectations of the stakeholders and reaching a consensus on these questions, the method must take into account the following constraints. It must involve a large panel of stakeholders. It must allow free expression and avoids domination. It must yield a limited number of final formulations, built from all the diversity of proposals while preserving its richness. It must allow to validate the final formulations and finally it must show public and private funding bodies that these questions are of true interest and legitimate.These constraints clearly point towards participatory methods, which implies a strong and rigorous organisation.

Actors and roles

Three types of actors are involved in the process: an organizing committee, stakeholders and funding agency representatives. The role of the organizing committee is manifold. It is responsible for the design of the participative event, for the facilitation during the interactions between stakeholders, but also for the use of the results of the event to foster research actions addressing the questions raised during the process. The committee must have facilitation skills but does not need to be deeply aware of the addressed domain, because this is delegated to the panel of stakeholders that are gathered. The stakeholders, either directly involved in the economic sector, or simply concerned because it uses its production for example, must be in a large enough number and balanced in terms of role that they play. Finally, funding body representatives are called to raise their awareness of bottlenecks and immediate questions that will require attention from research.

Organisational steps

The general organization of the participatory event leading to the identification of a series of research questions and a hierarchy of these questions follows three progressive steps. The first step is the elicitation of consensus-based questions addressed to research. The second step aims at obtaining from the participants two different information, a ranking of the questions according to their knowledge and needs and a list of participants interested in being involved in building a research action. The final step gathers representatives of public or private funding bodies who are asked to react to the hierarchized list of research questions and how it could enter their own agenda.

Step 1 elicitation of research questions. Among the several participatory methods presented in Elliott et al. (2005), the 21st century town meeting (also known as Town Hall Meeting) satisfies most of the above-mentioned constraints. Its drawback is that it requires a heavy organization and is somewhat complex to implement. The general idea is to work on questions in a funnel like process, however allowing for returns. Ideas are expressed by small groups (tables in Figure 1) in response to a question and are gathered. They are then grouped by similarities by a panel of experts, which allows for a reformulation taking into account the different shades. These reformulations are displayed and the participants can react, either by reinforcing or proposing new formulations. On complex questions, this process must be iterated, guiding the participants from the simpler to the more complex.

In our case, the first question asked to the participant was "According to you, what is a quality organic food?" The goal is twofold, acquainting the participants with the method, and setting the basis of the progression towards the final goal. The second question was "Therefore, what does it imply for organic food processing?" The last question finally deals explicitly with the research agenda: "What questions on processing for the production of a quality organic food do you address to research?"

Step 2 ranking. The twenty resulting research questions have been displayed on boards, allowing the participants to review them. Each participants was given five stickers, which they had to put on the research questions they thought were most urgent. According to the stakeholder category (researchers, economic operators, producer or consumer, advisors and development agent), the stickers were from different colors. Each could choose to put several stickers on one same question to express a high level of priority. At the same time, they could add their name on the questions they were interested in to contribute to future work on this topic. These two actions could be independent.

Step 3 raising awareness of funding bodies. The organizing committee also invited representatives of funding agencies (Ministry of agriculture, research agencies) to attend this participatory meeting, and invited them to a final round table, with a double goal. First, the invitation to express their position in a round table was thought to be a good incentive to ensure their participation, second, participation also should increase their level of implication in the process, and their level of readiness to adopt (part of) the resulting research agenda.

Results

The main results of the implementation of this participatory method to organic food processing is a list of 20 research questions (2 of them have been reformulated and split afterward by the organising committee for precision sake leading to a 22 question list). The main questions, according to stickers vote, are listed in Table 1. The second result is the ranking of these questions (step 2) by participant category. For example, the most important question according to researchers, consumers and producers is the impact of production systems on food quality, while the processing companies favoured the questions on packaging and new processes. The question on the definition of an organic food ranked 4th, because it raised a relative interest of all the participant categories. It has been the most widely shared question, conversely to questions 1 to 3 who ranked better because of a massive vote of fewer categories.

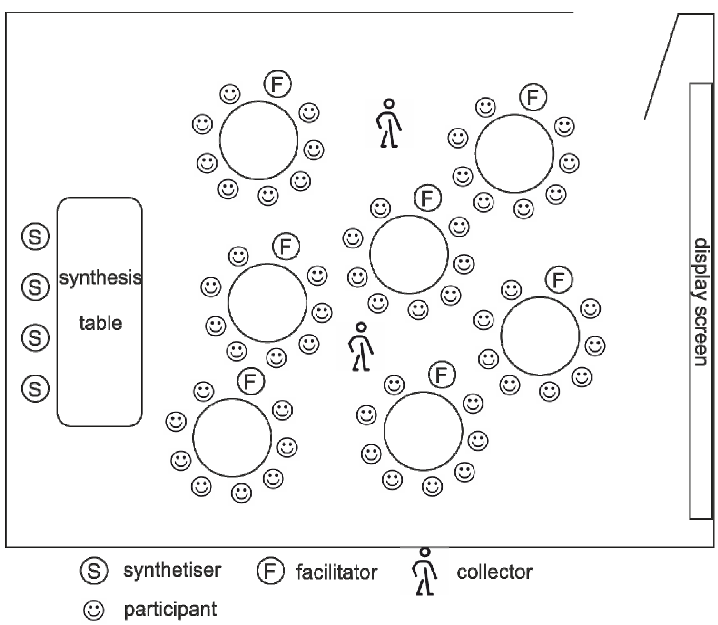


Figure 1. Room organization during the 21st century meeting phase (step 1)

Discussion

On the method

Today, research agendas are more and more commonly established and published, and used by funding bodies to decide on their priorities (e.g. Moeskops and Cuoco 2014). The construction process can be based on surveys (Lamichhane et al. 2016) or on experts meetings (Kahl et al. 2012); which allows for different types of interactions during the process. Surveys generally allow for directed information transfers, and the consulted panel has little possibilities to interact with the proposed results (research agenda in this case). Experts meetings offer two-ways exchanges when time allows for the organization of several workshops. The process that we have adopted here falls within the scope of the second types of methods, the consulted panel having the possibilities to interact during the construction of the research agenda. However, the Town Hall Meeting method is designed to allow these exchanges to take place at once, during the building of the research agenda. Indeed, the consulted panel is immediately aware of the questions the results from their inputs.

The second step that has been implemented in the presented case aimed at prioritizing the resulting agenda. In survey-based methods, this is generally achieved by a statistical analysis of the collected answers. In our case the consulted panel directly built the prioritization by voting.

Table 1: Top 5 research questions resulting from the participatory meeting

1	Impact of production systems, of cropping/herding techniques and processing on organic food quality
2	Developing a global quality indicator, taking into account formulation, processing, nutrition, taste, origin, environment, and demonstrating its credibility
3	Develop new processes to preserve or enhance the quality and limit risks (contaminants, allergens)
4	Defining, characterizing and measuring the vitality, naturality and authenticity of OF products
5	Finding alternatives to additives, optimizing formulations with organic ingredients

Hence the proposed design described in this paper combines the advantages of the survey-based and of the expert meetings methods. However, the quality of the results we obtained is dependent on the representativeness of the consulted panel. A large panel is therefore needed. By contrast to surveys, the proposed methods allows to control the composition of the panel.

On the results

Interesting questions were expressed through this methodology, and the participants generally indicated a high degree of satisfaction, both because they could see their concerns translated into questions addressed to research and because they are now better acquainted with each other. However, a little part of the material, gathered from the ideas expressed, could not find their way into the final question list. It was the case of ideas that have been expressed only once, were rather different from the others, and had been evaluated as probably of small general interest. On the contrary, orphan ideas that seemed to be promising have been selected at the synthesis step, and displayed.

As indicated above, some questions raised a shared interest, but most of the high ranking questions had varied appreciation from the different participant categories. The highest ranking questions for research only yields 3rd among processing companies, and 6th among advisors and development agents. These discrepancies confirm the diagnostic on the scarcity of research on this topic in France: the questions of highest interest for the economic agents are not those favored by research, and conversely.

A major output of this method is that some questions were identified with convergent priority, although they did not rank highest. Since the meeting (December 2015), the organizing committee, jointly with the organic network (RMT), supports the building of collaborative research projects around these questions. They are interesting because they allow gathering different actors of the

R&D system together. It is expected that starting collaboration around shared questions will build a common culture and will ease to create convergent interests on the less shared questions of higher priority.

The main difficulties that were encountered in keeping the wake after the participatory meeting itself, are the adjustment between funding calls, that are not yet in phase with the produced research agenda, and the nature of the questions raised. As it can be seen in Table 1, many of these questions are multidisciplinary, and cross boundaries that were rather closed up to now, a result of the diversity of the participants, and of the funnel process that led to the expression of these questions. This adds another dimension to the efforts that have to be made not to let such a meeting without concrete output addressing the needs and concerns of the participants and of the society they represent.

Suggestions to tackle with the future challenges of organic food process

Our work can mainly contribute to position organic systems as part of the multiple solutions needed to solve the tremendous challenges faced by our planet, especially in food processing and packaging for a sustainable consumption. All stakeholders were empowered so they become real partners in the system. The upcoming work will help to identify innovations potential and show how organic sector actors are working towards best practices through continuous improvement. Some of the research questions will lead to a diversity of appropriate methods for ensuring transparent integrity and give an overview of best available food technologies for sustainability.

References

Elliott J, Heesterbeek S, Lukensmeyer CJ, Slocum N (2005). Participatory Methods Toolkit: A practitioners manual. King Baudouin Foundation Flemish Institute for Science and Technology Assessment, Flemish Institute for Science and Technology Assessment.

Kahl J, Baars T, Bügel S, Busscher N, Huber M, Kusche D, Rembiałkowska E, Schmid O, Seidel, K, Taupier-Letage B, Velimirov A, Załecka, A (2012). Organic food quality: a framework for concept, definition and evaluation from the European perspective. J. Sci. Food Agric. doi:10.1002/jsfa.5640

Lamichhane, JR et al. (2017). Identifying obstacles and ranking common biological control research priorities for Europe to manage most economically important pests in arable, vegetable and perennial crops. Pest Manag. Sci. doi.org/10.1002/ps.4423.

Moeskops B, Cuoco E (eds.) (2014). Strategic research and innovation agenda for organic food and farming. TP Organics, Brussels.

Review: The content of bioactive compounds in different berry fruits from organic and conventional production

Ewelina Hallmann, Dominika Średnicka-Tober, Renata Kazimierczak, Ewa Rembiałkowska

Key words: organic, conventional, strawberry, raspberry, blueberry, polyphenols

Abstract

The berry fruits are one of the best sources of bioactive compounds. Polyphenols abundant in berries belong to different chemical groups: phenolic acids and flavonoids. They play a significant role as antioxidants and anticancer agents. Organic farm management affect significantly the level of polyphenols in berries. Because of their healthy properties berry fruits (strawberry, raspberry and blueberry) from organic production could be recommended as a perfect component of well-balanced diet.

Acknowledgments

The authors thank the Foundation Ekhaga, project no. 2015-76 for research funding. The present work is a review of the literature. Analytical results will be presented at the Congress.

Introduction

Botanical classification of berry fruits

The group of berry fruits are a very wide and divided for few sub-groups: authentic berry fruits (berries). To this group belong to: blackcurrant, gooseberry, cranberry, bilberry, black chokeberry; authentic berry fruits (collective stone fruits). To this group belong fruits contained multi- fruits berries: raspberry, blackberry; ostensible berry fruits, which have edible overgrown blossom bottom as well as the botanical type of fruits is the small nut (strawberry and wild strawberry) (Kazimierczak *et al.* 2006). The most important berry species in Poland are: strawberry (*Fragaria×ananassa* Duchesne), raspberry (*Rubus idaeus* L.) as well as blueberry (*Vaccinium corymbosum* L.). Berry fruits play an important role in human nutrition, because they contained a lot of bioactive compounds from different chemical groups, better known as antioxidants. Those compounds belong to polyphenols two large chemical group (flavonoids and phenolic acids). One of the most important appearance attribute of berry fruits is colour. It is being caused by the accumulation of anthocyanins in flesh and skin of fruits (Silva *et al.* 2007). Phenolics are the only putative defensive molecules ubiquitous in higher plants. They have played a central role in theories of plant-herbivore interactions (Young *et. al,* 2009). They function and working in plants are an very huge and not to the end well known (Gross *et al.* 1998; Ghasemzadeh and Ghasemzadeh 2011). For human health polyphenols are mostly used as antioxidant agents and protect body cells against oxidation. They are a powerful antioxidants as well take part in many metabolic process (Manach *et al.* 2004; García-Lafuente *et al.* 2009).

Classification of phenolics compounds

Polyphenols. Polyphenols compound are identified in higher plant tissue and more than several hundreds were found in edible plants. Phenolic acids. Among this chemical molecules we single out two classes of phenolic acids: derivative of benzoic and cinnamic acids. In higher plant the content of hydroxybenzoic acids are on rather low level with exception of red fruits (strawberry, raspberry, blueberry). Furthermore hydroxybenzoic acids are compounds of complex structures such as hydrolyzable tannins (ellagitannins) in berry fruit (strawberries, raspberries as well as blueberries). On the other hand hydroxycinnamic acids are much common in edible plants than hydroxybenzoic acids. To this group belong to such compound as: caffeic, ferulic and p-coumaric acids. One of the most well-known hydroxycynaminic acid is chlorogenic and it is a very common in berry fruits (50-200 mg/100 g FW).

Flavonoids. One of the most important group of polyphenols are flavonoids. Flavonoids it are more than thousand chemical molecules and to more precisely they have to be divided for few sub-groups (flavonols, flavones, flavanones, isoflavones, flavanols (called as well flavon-3-ols) and anthocyanins. This last sub-group have to be divided for two smaller: catechins and proanthocyanidins. The main problem with classification of flavonoids is that they could associated with a many various carbohydrates as well as organic acids and give completely different compounds and structures. From the huge group of flavonoids, flavonols are the most common in parts of edible plants. They mostly representative by kaempferol anf quercetin as well as they derivates (glucosides, rutinosides, arabinosides). In fruits flavonoids present in low concentration, but is not mean they have a low biological potential. Characteristic action of flavonols is synthesis in outer part of tissues, mostly exposed on sun light. It leads to explanation, that higher concentration of favonols in skin part of fruit is defensive reaction of plants against UV radiation. Proanthocyanidins are the most diversified chemical, bioactive compounds belong to flavonoids group. They are most common in berry fruits and they are a substrates for colour dye synthesis such anthocyanins. The berry fruits are one of the best sources of different polyphenols, especially anthocyanins and flavonoids (Fernandes *et. al,* 2012).

Table 1: The effect of organic plant management on quality of berries at the base of literature review

crop	compound	organic/ with effective microorganism (EM)**	conventional/ integrated*/without effective microorganism (EM)**	p-value	references
strawberry	total polyphenols (mg/g FW)	1.37	1.24	0.0003	Reganold *et. al* (2010)
	vitamin C (mg/g FW)	0.621	0.566	0.009	
	total anthocyanins (µg/g FW)	205	192	NS[1]	
strawberry	DPPH (µM TE/g FW)	17.22	11.82*	p<0.05	Fernandes *et al.* (2012)
	FRAP (µM TE/g FW)	24.13	15.29*		
strawberry	kaempferol (mg/100 g FW)	0.62	0.53	p<0.05	Häkkinen and Tőrrőnen (2000)
	quercetin (mg/100 g FW)	0.36	0.40		
	ellagic acid (mg/100 g FW)	52.73	50.20		
	p-coumaric acid (mg/100 g FW)	2.63	2.46		
	total polyphenols (mg/100 g FW)	56.23	53.60		
strawberry	total polyphenols (mg/100 g FW)	62.9**	67.2**	NS	Hallmann *et al.* (2016)
	total phenolic acids (mg/100 g FW)	10.03**	10.72**	NS	
	total flavonoids (mg/100 g FW)	6.73**	4.26**	p<0.0001	
	vitamin C (mg/100 g FW)	57.8**	63.6**	NS	
strawberry	vitamin C (mg/100 g FW)	64.00	62.23	NS	Khalid *et al.* (2013)
strawberry	vitamin C (mg/100 g FW)	40.5	37.2	p<0.05	Conti *et al.* (2013)
strawberry	total polyphenols (mg/100 g FW)	226.4	192.4	p<0.05	Wojdyło *et al.* (2010)
	ABTS (µM TE/ 100g FW)	69.06	54.26	p<0.05	
raspberry	total phenolic acids (mg/100 g FW)	18.34	15.89	0.0026	Kazimierczak *et al.* (2015)
	total flavonoids (mg/100 g FW)	19.11	14.57	0.0011	

	total anthocyanins (mg/100 g FW)	174.7	109.6	0.0034	
	vitamin C (mg/100 g FW)	41.2	41.7	NS	
raspberry	total polyphenols (mg/100 g FW)	517.6	578.5	p<0.05	Wojdyło *et al.* (2011)
	vitamin C (mg/100 g FW)	23.6	20.8	p<0.05	
	ABTS (μM TE/ 100g FW)	44.0	43.0	NS	
blueberry	total polyphenols (mg/100 g FW)	290.0	260.0	p<0.05	Ochmian *et al.* (2015)
	total anthocyanins (mg/100 g FW)	208.0	183.0	p<0.05	
	total flavonoids (mg/100 g FW)	17.7	15.9	p<0.05	
blueberry	total polyphenols (mg/100 g FW)	338.0	330.0	p<0.05	You *et al.* (2010)
	total anthocyanins (mg/100 g FW)	152.0	140.0	p<0.05	
blueberry	total polyphenols (mg/100 g FW)	319.3	190.3	p<0.05	Wang et al. (2008)
	total anthocyanins (mg/100 g FW)	131.0	82.4	p<0.05	

[1] NS not significant statistically, p>0.05

Conclusion

In many reported experiments we can observe the positive effect of organic farm management on quality of berry fruits. The level of total polyphenols as well as groups of phenolic compounds was mostly higher in organic fruits compared to the conventional ones. Therefore strawberry, raspberry and blueberry fruits from organic production could be recommended as a perfect component of well-balanced diet.

References

Conti S., Villari G., Faugno S., Melchionna G., Somma S., Carusoa G. (2014) Effects of organic vs. conventional farming system on yield and quality of strawberry grown as an annual or biennial crop in southern Italy. Scientia Horticulturae 180, 63-71;

Diamanti, J., Capocasa, F., Balducci, F., Battino, M., Hancock, J., & Mezzetti, B. (2012). Increasing strawberry fruit sensorial and nutritional quality using wild and cultivated germplasm. PLoS ONE, 7(10), 464-470;

Fernandes, V. C., Domingues, V. F., de Freitas, V., Delerue-Matos, C., & Mateus, N. (2012). Strawberries from integrated pest management and organic farming: Phenolic composition and antioxidant properties. Food Chemistry, 134, 1926–1931;

García-Lafuente A, Guillamón E, Villares A, Rostagno MA, Martínez JA. (2009) Flavonoids as antiinflammatory agents: implications in cancer and cardiovascular disease. Inflammatory Research 58, 537–552;

Ghasemzadeh A., Ghasemzadeh N. (2011) Flavonoids and phenolic acids: Role and biochemical activity in plants and human. ournal of Medicinal Plants Research 5, 31, 6697-6703;

Gross G.G., Hemingway R.W., Yoshida T., Branham S.J. (1998) Plant polyphenols 2. Chemistry, biology, pharmacology, ecology. Proceedings of the 3th Tannin Conference 14-19 of July 1998, ISBN 0-306-46218-4, Publishers Kluwer Academic Plenum, New York.

Hallmann E., Piotrowska A., Świąder K. (2016) The effect of organic practices on the bioactive compounds content in strawberry fruits. Journal of Research and Applications in Agricultural Engineering 61, 3, 176-179;

Häkkinen S.H., Tőrrőnen A.R. (2000) Content of favonols and selected phenolic acids in strawberries and Vaccinium species: inifence of cultivar, cultivation site and technique. Food Research International 33, 517-524;

Kazimierczak, R., Świetlikowska, K., Wasiak-Zys, G. (2006) Fruits, Domestic fruits in: The raw plant materials, published by SGGW, Warsaw, Poland, 234-240;

Kazimierczak R., Hallmann E., Kowalska K., Rembiałkowska E. (2015) Biocompounds content in organic and conventional raspberry fruits. Acta fytotechnica. zootechnica, 18, 40-42;

Khalid S., Qureshi K.M., Hafiz I.A., Khan K. S., Qureshi U.S. (2013) Effect of organic amendments on vegetative growth, fruit and yield quality of strawberry Pakistan Journal of Agriculture Research 26 , 2, 104-112;

Manach C, Scalbert A, Morand C, Rémésy C, Jimenez L. (2004) Polyphenols: food sources and bioavailability. American Journal of Clinical Nutrrition. 79,727–747;

Ochmian I., Kozos K., Chełpiński P., Szczepanek M. (2015) Comparison of berry quality in highbush blueberry cultivars grown according to conventional and organic methods. Turkish Journal of Agriculture and Forestry, 39, 174-181;

Reganold J.P. , Andrews P.K., Reeve J.R., Carpenter-Boggs L., Schadt Ch. W., Alldredge J.R., Ross C.F., Davies N.M., Zhou J. (2010) Fruit and soil quality of organic and conventional strawberry agroecosystems. PLOS One 5, 9, 1-14;

Silva, L. F., Escribano-Bailón, M. T., Pérez, J. J., Rivas-Gonzalo, J. C., Santos-Buelga, C. (2007) Anthocyanin pigments in strawberry. LWT – Food Science and Technology, 40, 374–832;

Wang S.Y., Chen C-T., Sciarappa W., Wang C.Y., Camp M.J. (2008) Fruit quality, antioxidant capacity, and flavonoid content of organically and conventionally grown blueberries. Food Chemistry 56, 14,5788-5794;

Wojdyło A., Oszmiański J., Teleszko M., Rozpara E., Król K., Bielicki P., Milczarek M., Ochmian I., Cebulak T., Srudel M., Bielicki P., Wójcik-Seliga, Głowacka A., Golis T. (2010) Porównanie składu chemicznego ze szczególnym uwzględnieniem zawartości związków fenolowych, aktywności przeciwutleniającej i przeciwnowotworowej owoców jagodowych i ich przetworów z uprawy ekologicznej oraz konwencjonalnej. Wyniki badań z zakresu rolnictwa ekologicznego w 2009 roku, Falenty 2010, 167-178;

Wojdyło A., Oszmiański J., Teleszko M., Rozpara E., Król K., Bielicki P., Głowacka A., Golis T. (2011). Skład chemiczny i wartość biologiczna owoców ziarnkowych, pestkowych i jagodowych z uprawy ekologicznej. Wyniki badań z zakresu rolnictwa ekologicznego w 2010 roku, Falenty 2011, 167-178;

You, Q., Wang, B., Chen, F., Huang, Z., Wang, X., Luo, P.G. (2010) Comparison of anthocyanins and phenolics in organically and conventionally grown blueberries in selected cultivars. Food Chemistry, 125, 201–208;

Young, J.E., Zhao, X., Carey, E.E., Welti, R., Yang, S.S., Wang, W. (2005) Phytochemical phenolics in organically grown vegetables. Molecular Nutrition & Food Research. 49, 1136-1142;

Socio-economics - Europe

Title	Author/s	Country
The open-source licence: A legal approach to securing seed commons in Europe	Johannes Kotschi, Max Rehberg and Bernd Horneburg	EU
The EU organic sector in 2030: a scenario analysis	Raffaele Zanoli, Yulia Barabanova, Eduardo Cuoco, Daniela Vairo	EU
OK-Net Arable online knowledge platform	Ilse A. Rasmussen, Allan Leck Jensen, Margit Styrbæk Jørgensen, Helene Kristensen, Malgorzata Conder, Cristina Micheloni, Bram Moeskops	Europe
Organic farming and local development	Philippe Fleury, Céline Cresson, Audrey Vincent	France
A national platform to foster research cooperation. 100 research topics.	Vianney Le Pichon, Stéphane Bellon Marion Desquilbet, Eve Fouilleux, Denis Lairon, Marc Tchamitchian	France
Do organic food companies respond adequately to customer requests on their Corporate Social Responsibility-performance?	Denise Gider, Thomas Krikser, Ulrich Hamm	Germany
Buying organic foods – Are there favourable dietary consequences?	Carola Strassner, Rainer Roehl	Germany
Sustainability performance assessment by means of four parameters of organic products in Austria	Richard Petrasek, Thomas Drapela, Thomas Lindenthal, Isabella Gusenbauer, Stefan Hörtenhuber, Ruth Bartel-Kratochvil, Michaela C. Theurl	Austria
What will affect the future development of the organic sector? A structured review of scenario analysis	Daniela Vairo, Danilo Gambelli, Raffaele Zanoli	EU
National and regional Organic Action Plans to develop organic farming and supply chain – experiences and recommendations	Otto Schmid , Nic Lampkin, Susanne Padel, Stephen Meredith	EU
Participatory Ecobreeding : a needed way for Agroecology plant improvement- the case of agroforestry.	Dominique Desclaux	France

Analysis of the real purchase behaviour of organic wine consumers	Isabel Schäufele, Ulrich Hamm	Germany
Estimating missing organic data by multiple imputation: the case of organic fruit yields in Italy	Francesco Solfanelli, Danilo Gambelli, Daniela Vairo, Raffaele Zanoli	Italy
"Organic +" – How advertisement campaigns construct a shattered image of organic farming	Valentin Fiala, Bernhard Freyer	Austria
Using Q Methodology to facilitate the establishment of the 2030 vision for the EU organic sector	Raffaele Zanoli, Eduardo Cuoco, Serena Mandolesi, Simona Naspetti	EU
The added values of Core Organic II research projects	Stéphane Michel Bellon, Ulla Sonne Bertelsen	France
Motivations and Doubts when Converting to Organic Dairy Farming in an Era of Conventionalisation	Maëlys Bouttes, Guillaume Martin	France
Implications of subsidiary cropping and tillage system on economics and production risk	Benjamin Blumenstein, Maria R. Finckh, Jan Henrik Schmidt, Sally Westaway, Lars Olav Brandsæter, Detlev Möller	Germany
Improving inspection procedures in organic farming using feasible practices	Danilo Gambelli, Francesco Solfanelli, Raffaele Zanoli	Italy
Information Sharing and Acceptance of novel production strategies along the organic dairy supply-chain: an empirical analysis.	Simona Naspetti, Serena Mandolesi, Raffaele Zanoli, Terhi Latvala, Phillipa Nicholas, Susanne Padel, Ellen J. Van Loo	EU
Collective management of cultivated biodiversity : initiatives supporting an agro-ecological transition toward organic 3.0	Frederic Rey, Laurent Hazard	France
Assessing the production impacts of a large-scale conversion to organic farming in England and Wales	Laurence Smith, Philip Jones, Adrian Williams, Guy Kirk	UK

The open-source licence: A legal approach to securing seed commons in Europe

Johannes Kotschi[1], Max Rehberg[2] and Bernd Horneburg[3]

Key words: open-source, seeds, plant breeding, seed-commons, variety, seed licence

Abstract

Open source offers a solution to the increasing privatisation of common goods, or "commons". Since 2012, plant breeders, agricultural scientists, lawyers and commons experts have sought methods and strategies to apply the open-source principle to crop seeds. A working group has created an open-source seed licence that allows the use of seeds unrestricted by plant variety protection or patents on seeds. A newly registered tomato variety has been licensed using this open-source licence.

Acknowledgments

We are grateful to all colleagues involved in the Seeds as Commons Project and in the Organic Outdoor Tomato Project for successful cooperation and to the Mercator Foundation and the Software AG Foundation for their generous support.

Introduction

For thousands of years, crop seeds have been a common good. All over the world, crops have been cultivated, enhanced and bred by farmers, a practice which resulted in a rich diversity of crops and varieties. But since the emergence of scientific plant breeding at the end of the 19th century, plant breeding and plant production have become increasingly separated. Scientific plant breeding has contributed greatly to agricultural development: the yield increases of crops and the intensification of agriculture would have been impossible without a high-performance plant-breeding sector. At the same time, plant genetic resources in agriculture have been increasingly privatised and the market has become concentrated in a few hands with the characteristics of monopolies. But seed monopolies tend to reduce inter- and intraspecific plant genetic diversity. Uniform cropping systems with only a few crops and varieties, spread over large areas are the opposite of what is required (IAASTD 2009). In addition, farmers and society as a whole are becoming dependent on just a few companies. This is a threat to agricultural production and to food security; alternatives are needed.

Material and methods

An interdisciplinary group of agricultural scientists, plant breeders, and lawyers has developed an open-source seed (OSS) Licence for plant genotypes (new varieties, breeding lines and populations). The group was inspired by open-source concepts and related licences developed in computer science. First, the group analysed existing seed laws and searched for possible conflicts with open source. Second, the group compared different strategies towards open source, namely the ethical approach using a pledge or commitment and the legal approach using a licence

[1] AGRECOL, Association for AgriCulture and Ecology, Germany, www.agrecol.de, kotschi@agrecol.de
[2] CULINARIS – Healthy Seeds for Wholesome Food, Germany, www.culinaris-saatgut.de, m.rehberg@culinaris-saatgut.de
[3] Georg-August-Universität Göttingen, Division of Plant Breeding, Section of Genetic Resources and Organic Plant Breeding, www.uni-goettingen.de/en/48392.html, bernd.horneburg@uni-goettingen.de

(Kloppenburg 2014). A decision was taken in favour of the licence, because most European countries offer a favourable legal framework for enforcing licences. Based on this, a seed licence was developed and the steps needed for its implementation were defined (Kotschi and Rapf 2016). Finally, a newly released and registered tomato variety was licensed using the OSS Licence.

Results

The task

Instead of uniformity in the seed sector, a rich diversity of crops and their varieties is needed. Only then can the world's innumerable agro-ecological sites and corresponding farming systems be used in an optimal way. Varieties are needed that not only satisfy the needs of high-potential areas but also permit cropping on poorer soils and in difficult climatic conditions. Only then will it be possible to respond adequately to climate change and to achieve food security. Varieties are also needed that produce healthy food with few or no agrochemicals and make use of local agro-ecological potentials, even if they cannot be propagated on a large scale. Last but not least, varieties are needed that are suited to the specific requirements of organic agriculture, which in turn is necessary to maintain landscapes and their ecosystem services.

All this cannot be sufficiently supplied by the private seed sector. Its economic logic, namely economies of scale and decreasing innovation by monopolies, is in conflict with the tasks ahead. Therefore the non-private seed sector has to be strengthened and made a second pillar alongside private plant breeding.

The target group

While public-sector plant breeding has undergone a steady decline in Europe, a new group of stakeholders has evolved: civil society has come in. Within the past 30 years in Germany and Switzerland alone, around 50 breeding initiatives have been established that aim to develop suitable varieties for organic agriculture and horticulture. A second group addresses the conservation of neglected crops and old varieties. Both groups are organised as associations, foundations or informal networks and operate as non-profit organisations. While registering and releasing new varieties, many renounce plant variety protection and make varieties available unconditionally and to everybody. This freedom allows users to privatise further developments. In other words: commons are created but not protected as such.

The strategy

With the OSS Licence, AGRECOL offers plant breeders an opportunity to protect their new developments against privatisation and to maintain them as a commons. Seeds can be made available without any plant variety protection or patents. Therefore, "open-source" differs entirely from "open access", which is entirely free and unlimited.

The licence

The OSS Licence grants the licensee to use the seeds for his or her purposes, to multiply it, to pass it on and to enhance it. In addition, it allows the dissemination of multiplied and enhanced seeds. At the same time, it obliges the licensee to grant the same rights he or she has enjoyed to future owners of the seeds and any enhancements that have been made to them. This obligation is "viral" and is sometimes called "copyleft". Not only the licensed seed itself, but all enhancements to it are included. With the first licensing, a chain of contracts is started, which in principle is endless. Licensees become licensors, who pass on the seed with the same licence. In doing so, the licence protects a commons that can no longer be transferred into the private domain.

The OSS Licence of AGRECOL is a "sui generis contract" and falls under the General Business Terms and Conditions of German Civil Law (§ 305 I BGB), a pre-written contract for general, multiple and unilateral use by one single party, and not individually negotiated. Any user (licensee/contractee), receives a simple use right on the condition of fulfilling the duty to make available for public use, on the same conditions, any development on or enhancements to the seed/crop that they may have made.

The OSS Licence is, therefore, a material-transfer agreement. It confers use rights together with the material object, in the form of seeds or vegetative parts of plants. When the material is transferred, a contract is entered into that ensures the mutual, reciprocal rights and duties associated with the material in question, as well as all future developments to that material, in perpetuity. As such, the OSS licence – and its contractual nature – implicitly also pertains to the genetic information contained within the given material. The material-transfer agreement can be used to protect the seed of various genotypes: newly developed varieties, breeding lines and populations.

Disclosure of the licence.

The OSS licence is a private contract. If you want to sell, give away or exchange seeds under the OSS licence, you must – *unambiguously* – disclose the licence conditions of the transfer. This means that any transfer is valid only if the licensee is fully aware of the terms and conditions of the licence. A so-called "shrink-wrap licence", in which the licence conditions are accepted by tearing the wrapping would probably violate the legal conditions and cannot be recommended. For professional traders, who for instance sell seeds in small quantities in supermarkets or garden centres, it means that an abridged version of the OSS licence must be printed on the wrapping of the seeds with reference to the online, full-text version. For individuals (farmers etc.), the licensors must ensure that a copy of the licence accompanies the materials being transferred; they must explicitly inform the recipient (the licensee) of the materials about the terms and conditions of the OSS licence.

Enforcing the licence.

The Nagoya Protocol (CBD 2016), a supplementary agreement to the Convention of Biological Diversity, allows the sovereign-rights holder of a genetic resource to determine the conditions of their use – by prior informed consent and on the basis of mutually agreed terms. Mandatory documentation, when using plant genetic resources, ensures compliance with these terms and conditions. In most EU countries, the sovereign-rights holder is usually the one who is in possession of the resource. At the end of the breeding process that is the breeder.

In Europe, the Nagoya Protocol is a strong lever to enforce the OSS licence. Article 4 of the EU Regulation is crucial: it indicates that the user of a plant genetic resource (seed) must document the time and place of access to that resource, and, where appropriate, also prove "the presence or absence of rights and obligations relating to access and benefit-sharing" (European Union 2014).

Financing OSS-licensed varieties

It is often argued that it would be impossible to finance plant breeding with an open-source licence and without royalties from plant variety protection or patents on seeds. Historically, however, agricultural seeds were primarily developed without a compulsory levy. In many developing countries, plant breeding mostly does not follow a business model based on royalties, and even in developed countries there are private breeding companies that do not rely financially on exclusive intellectual property rights. Another aspect may be more important. If services for society as a whole have a large share in plant breeding, then not only farmers and direct users should be engaged in covering the costs. Processers, traders and consumers, finally the whole value chain, and beyond the government should contribute. If plant breeding aims to create commons it represents a non-profit rather than an economic activity. However, the production and provision of seeds is entirely of an economic nature.

Many organic cereal and vegetable breeders in Europe finance their breeding work partly through "variety development contributions" that are negotiated between breeders, seed producers and farmers. Some have, in cooperation with the food trade, developed a levy on food items and most of them raise funds from government programmes and foundations for their breeding activities (Kotschi and Wirz 2015). The funds for commons based plant breeding are still small but increasing continuously.

The first OSS licensed variety

In April 2017 the cocktail tomato *Sunviva* was released from the Organic Outdoor Tomato Project. The project started in 2003 at the University of Göttingen, Germany, as participatory organic plant breeding programme that involves the entire value chain (Horneburg 2010). It is based on the free exchange of knowledge and tomato genotypes and enhances organic plant breeding (Horneburg and Becker 2011).

Discussion

The laws on securing intellectual property rights on seeds have been strongly developed, whereas seeds as commons receive almost no legal protection. With the OSS Licence a way has been found to redress this imbalance. The idea to license a newly released variety as open-source and with a copyleft clause is new and unfamiliar. Its potential impact is complex and difficult to anticipate. The release of the first OSS-licensed varieties will stimulate discussion. It will also generate valuable experience on the feasibility, acceptance and impact of open-source licences among plant breeders, seed producers and growers and in society as a whole.

References

CBD, Convention on Biological Diversity (2016) The Nagoya Protocol on Access and Benefit- Sharing. https://www.cbd.int/abs/text/articles. Accessed 15 November 2016.

European Union (2014) Regulation (EU) No 511/2014 of the European Parliament and of the Council of 16 April 2014 on compliance measures for users from the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization in the Union Text with EEA relevance. Official Journal of the European Union.

Horneburg B (2010) Participation, utilization and development of genetic resources in the Organic Outdoor Tomato Project. In: Goldringer I, J Dawson, F Rey, A Vettoretti (eds) Breeding for resilience: a strategy for organic and low-input farming systems? EUCARPIA 2nd Conference of the "Organic and Low-Input Agriculture" Section. pp139-142

Horneburg B and Becker HC (2011) Selection for *Phytophthora* field resistance in the F_2 generation of organic outdoor tomatoes. Euphytica 180:357-367

IAASTD (2009) Agriculture at a crossroads. International Assessment of Agricultural Knowledge, Science and Technology for Development. Synthesis Report. Washington DC.

Kloppenburg J (2014) Re-purposing the master's tools. The open source seed initiative and the struggle for seed sovereignty. Journal of Peasant Studies. 41:6, 1225-1246

Kotschi J and Rapf K (2016) Liberating seeds with an open source seed licence. Working paper. AGRECOL. Guggenhausen. www.agrecol.de/files/OSS_Licence_AGRECOL_eng.pdf

Kotschi J and Wirz J (2015) Who pays for seeds? Working paper. AGRECOL and Section for Agriculture Goetheanum. Göttingen and Dornach.

The EU organic sector in 2030: a scenario analysis

Raffaele Zanoli[1], Yulia Barabanova[2], Eduardo Cuoco[2], Daniela Vairo[1]

Key words: scenario analysis, organic food and farming, vision, strategic analysis, uncertainties

Abstract

What might the future look like for the organic sector in 2030? Using participatory scenario analysis based on qualified expert assessments, we have investigated various future options. While predetermined trends are reflected in all scenarios in the same predictable way, uncertainties play out differently and shape the scenarios. The main uncertainties has been used as the basis to develop scenarios for the future of organic food & farming, option planning and benchmarking the visions.

Acknowledgments

The authors wish to acknowledge IFOAM EU for developing the project "An organic Vision for Europe in 2030" and all and workshop participants for sharing their ideas for the future during the workshop.

Introduction

Organic food and farming in Europe has achieved a great success. The clear success of Organic 2.0 has opened the way for Organic 3.0. Where does the organic sector aim to be in 2030? IFOAM EU launched the Vision 2030 process with the aim of providing direction and orientation to the organic sector. Relevant future trends and uncertainties have been selected. The same set of trends and uncertainties, ranked by their potential impact on the organic sector, and combined with the expert knowledge of a group of stakeholders, form the basis of four scenarios that represent plausible futures that set the context in which the organic sector can exist. In what follows, an overview of scenario analysis will be given, and the methodology followed in this study will be described. Results of the scenario analysis in terms of narratives will be presented, followed by the discussion which try to answer to the question: How does your research contribute to Organic 3.0?.

Materials and methods

A scenario describes (textually or graphically) a set of hypothetical sequences of events that might reasonably take place (Kahn and Wiener 1968). Scenarios can be considered as hypothetical images of the future that describe the functioning of a system under different conditions with a certain degree of uncertainty (for review, see Bunn and Salo 1993; Zanoli *et al.* 2012 and Amer *et al.* 2013).

The qualitative approach (intuitive logic) has been the most used in scenario analysis, while more formalised methods (trend impact analysis, cross impact analysis) have been less popular, in particular in the early years (Tapinos 2013). This was mainly due to a lack of affordable computing tools (for a review of these methodological approach, see Zanoli *et al.* 2000).

[1] Università Politecnica delle MARCHE, D3A, Via Brecce Bianche, 60131 Ancona Italy, E-Mail zanoli@agrecon.univpm.it, daniela@agrecon.univpm.it

[2] IFOAM EU Group, 124 Rue de commerce, 1000 Brussels Belgium. E-Mail yulia.barabanova@ifoam-eu.org

As noted by Athey (1987), scenario models depend on intuitive judgment rather than on rigorous models, since ''no hard data about the future exists''. This derives from the use of qualitative information that is usually provided by expert assessments, which is used for envisioning rather than just extrapolating (Bunn and Salo 1993).

The literature on scenarios focuses on the use of scenarios as tools for learning (Kahn and Wiener 1968; Bradfield 2008); in other words, scenarios force individuals to examine their perceptions and to develop a shared view of uncertainty.

In the present analysis a deductive-qualitative scenario (van der Heijden 1996) through a participatory approach has been used.

In an intensive two-day workshop in Rome in November 2014, participants with expert knowledge identified the two general areas, among the list of relevant megatrends circulated before the workshop[3], believed to have the highest impact on the organic food and farming sector in 2030 and the highest level of outcome uncertainty, that formed the central themes of the developing scenarios (rows and column in table 1).

These two uncertainties play out differently in different scenarios, reflecting potential directions in which future might develop:

Table 1: Main scenarios fo the organic food and farming sector

Uncertainties	Political stability	Political instability
Incompatible technologies	i-Food	Phoenix
Compatible technologies	When all goes well	Organic vs Eco-Tech

Results

Once the four scenarios had been identified, the workshop participants were asked to develop consistent narratives, by considering consumer behaviour and the state of ecosystems as important grouping of predetermined trends that could have a significant impact on the overall context. These were then revised in an interactive process to produce extensive narrative that are summarised in the following.

Scenario 1: i-food

This is almost a business as usual scenario, since it is not too different from what is already happening.

By 2030 technological breakthroughs and the creation of a single digital market helped the EU to rebalance economy and take the global lead in digital technologies. As a result, the EU also managed to overcome the political crisis and euro scepticism. More consumers are interested in health attributes of food and are able to afford products that meet these requirements. Several Free Trade Agreements are signed and new members enter the EU.

Thanks to the use of nanotechnology in food production and processing, production systems focus more on the quality of final product as opposed to the sustainability of the production process, making process-based approaches, which include organic, less relevant.

Scenario 2: Phoenix

[3] Megatrends are large-scale and long lasting societal, economic, political, technological or environmental changes that occur gradually over an extended period of time and affect to various degrees the lives of individuals, companies, sectors and states. They are the underlying forces that define the future world and therefore are important factors for developing vision and strategy.

This is the gloomiest scenario. Political instability culminate in some countries leaving the EU and also leads to a less well-functioning internal market. The EU single market is severely fragmented, enforcement of EU Regulations weakens, CAP payments are phased out.

As a result of intensive exploration and use of fossil fuels, climate change speeds up leading to dramatic and unpredictable changes and shocks in some regions, disrupting harvests and causing price spikes for some commodities.

A two-stream market emerges in which values-driven consumption (fair trade, organic, etc.) goes side by side with a cost-driven consumption offering low cost, low quality products. The organic sector survives going back to its grassroots while urban agriculture and CSA (Community Supported Agriculture) prosper.

Scenario 3: Organic vs Eco-tech

In this tricky scenario, political instability culminate in a weaker EU, which does not break up but leads to strengthened national sovereignty and a fragmented EU single market: tariffs, duties, border controls are partially restored.

A variety of eco-products with health benefit claims is available on the market. Consumers are confused because of proliferation of eco-labels and reputation economy influences consumer choices.

Green energy is widely available in the EU and many farmers start producing biogas, further decreasing their energy costs. As consequence, organic farming struggles to keep its separate identity in the face of more sustainable "conventional" agricultural practices.

Scenario 4: When all goes well

Apparently this scenario depicts an 'organic paradise' but….the devil is in the details! By 2030 technological breakthroughs and the creation of a single digital market helped the EU to rebalance economy and take the global lead in digital technologies.

Strong civil society resistance to GMOs, biofuels, and fracking helped introduce the bans on these types of energy and gave extra support measures to green renewable energy.

As a result, we observe the growth of organic and other value driven production systems, which are not that different from "more ecological" conventional products, which are obtained by means of precision farming, nanopesticides and similar innovations. The variety of organic and other similar "green" labels as a result of increased imports is confusing for some EU consumers. As a result, they favour long-established brands.

Discussion and Conclusions

These four sketched scenarios are part of the framework conditions for the organic sector in 2030 and will serve the purpose of a test-bed for future strategies and plans of the sector. Scenario analysis is therefore a fundamental element of any strategic process aiming at robust decision-making.

These scenarios can help the sector to be prepared to tackle the challenges of the future in Europe, even the gloomiest one, by focussing on the main drivers defined in our scenario: political and technological, with economic and market consideration somewhat depending from these two. In 2015 the main issue is: will the EU survive the enlargement and the changes implied by the Maastricht treaty and the stability pact? A collapse of the Euorpean Union is still a remote possibility and the increasing pressure over the Euorpean Commision of Free Trade agreements is putting any market regulation at risk. Soecifically, it may help shaping the Organic 3.0 concet relying loess on EU regulations and governemnental support, and more on developing the core values of the organic sector in relation to what consumers and society are also willing to accept and give value to.

References

Amer M, Daim TU, Jetter A(2013): A review of scenario planning. Futures 46, 23-40.

Athey TR (1987): The dynamics of volunteer participation in futures research. Futures 19 (2), 168–183.

Bradfield RM (2008): Cognitive barriers in the scenario development process. Advances in developing human resources 10, 197–215.

Bunn DW, Salo AA (1993): Forecasting with scenarios. European Journal of operational research 68 (3), 291-303.

Kahn H, Wiener AJ (1968): The year 2000: a framework for speculation on the next thirty-three years, Macmillan, New York.

Schnaars SP (1987): How to develop and use scenarios. Long Range Planning, vol. 20 no. 1, 105-114.

Tapinos E (2013): Scenario planning at business unit level. Futures 47, 17–27. doi:10.1016/j.futures.2012.11.009

van der Heijden K (1996): Scenarios: The Art of Strategic Conversation. John Wiley, Chichester.

Zanoli R, Gambelli D, Vairo D (2000): Organic farming in Europe by 2010: scenarios for the future. In: Organic Farming in Europe: Economics and Policy, vol. 8. University of Hohenheim, Hohenheim. 87 p.

Zanoli R, Gambelli D, Vairo D (2012): Scenarios of the organic food market in Europe. Food Policy 37, 41-57.

OK-Net Arable online knowledge platform

Ilse A. Rasmussen[1], Allan Leck Jensen[2], Margit Styrbæk Jørgensen[3], Helene Kristensen[4], Malgorzata Conder[5], Cristina Micheloni[6], Bram Moeskops[7]

Key words: arable, yield, tools, knowledge, discussion, communication

Abstract

The complexity of organic farming requires farmers to have a very high level of knowledge and skills, but exchange on organic farming techniques remains limited. In order to increase productivity and quality in organic arable cropping in Europe, the thematic network OK-Net Arable under Horizon 2020 has the aim to improve the exchange of innovative and traditional knowledge among farmers, farm advisers and scientists. An online platform for knowledge exchange has been created, offering innovative education and end-user material as well as communication between stakeholders. A number of specific tools – providing information about how to put existing knowledge from research and practise into use – have been chosen. They are presented on the platform with the possibility to find solutions, evaluate them, comment and discuss them or ask questions about them and to suggest new tools to be shown on the platform.

Acknowledgments

This paper is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 652654.

Introduction

The complexity of organic farming requires farmers to have a very high level of knowledge and skills, but exchange on organic farming techniques remains limited (EU SCAR, 2013). Closing the yield gap is one of the most important challenges in organic arable farming in Europe (EIP-AGRI Focus Group Organic Farming 2013). The thematic network OK-Net Arable under Horizon 2020 has the aim to improve the exchange of innovative and traditional knowledge among farmers, farm advisers and scientists to increase productivity and quality in organic arable cropping in Europe. This contributes to Organic 3.0 by helping farmers and advisors become more innovative and improving towards best practices. Overcoming the yield gap in organic arable farming will also make organic agriculture more sustainable. In order to increase productivity and quality in organic arable cropping in Europeby exchange of knowledge among the stakeholders, the online knowledge platfrom farmknowledge.org has been created.

Material and methods

Based on the final report by the EIP-AGRI Focus Group on Organic Farming (2013)as well as on work in the project (Niggli et al., 2016), the most prominent factors contributing to overcoming the yield gap between organic and conventional arable farming were chosen for themes on the online

[1] ICROFS, Denmark, icrofs.org, ilsea.rasmussen@icrofs.org
[2] Aarhus University, Denmark, au.dk, alj@eng.au.dk
[3] Aarhus Unviersity, Denmark, au.dk, margits.jorgensen@agro.au.dk
[4] ICROFS, Denmark, icrofs.org, helene.kristensen@icrofs.org
[5] FiBL, Switzerland, fibl.org, malgorzata.conder@fibl.org
[6] AIAB, Italy, aiab.it, c.micheloni@aiab.it
[7] IFOAM EU, Belgium, ifoam-eu.org, bram.moeskops@ifoam-eu.org

platform created by OK-Net Arable. These are the five themes: Soil quality and fertility, Nutrient management, Pest and disease control, Weed management and Crop specific solutions.

A list of more than 200 different resources providing knowledge, decision support, education or update on relevant issues for these themes was collected by scouting websites and contacting research and advisory organisations within the field. The term "tool" was defined as "formatted information used as a mean for circulation of knowledge among farmers and advisors" (Micheloni, pers.comm.), and tools for knowledge exchange were grouped into 1) tools providing knowledge, 2) tools for decision support and 3) tools for education/updating. The tools were in many different formats: web platforms & websites, videos, educational resources such as webinars & e-learning, leaflets & guidelines/fact sheets, calculation tools & decision support systems, books & reports and audio/podcasts (see fig. 1). A subset of the 200 tools was chosen for the first version of the platform.

Figure 1. Icons for the different types of tools.

In a re-iterative process, the platform and its contents were designed, commented by project partners, re-designed, tested by farmers and advisers, improved etc. Farmers' needs were taken into account at every stage of developmentamong others by involving Farmer Innovation Groups (Cullen et al., 2016) in the participating countries in order to make it easy for them to use.

Results - The knowledge platform

The OK-Net Arable project under Horizon 2020 created a platform (http://farmknowledge.org/) aimed at filling the gap in the exchange of information about organic arable farming between farmers and advisers across Europe. The platform can be translated into the ten languages of the project partners, in addition to English: Bulgarian, Danish, Dutch, Estonian, French, German, Hungarian, Italian and Latvian). Originally, this was planned to be carried out by Google Translate (https://translate.google.com/), however, as translation was varying from acceptable over confusing to wrong, all texts on the platform itself have been translated by the project partners.

The platform contains a "toolbox" of tools, described with metadata. The metadata includes information about the problem, the tool addresses, the solution(s) it offers, a description of the tool, the theme(s) it addresses, the language(s) it can be found in, the year it has been release, the country of origin and information about the issuing organisation. The tools themselves as well as the metadata about the tools are translated by Google translate, and thus use of their recommendations in other than the original language is not advisable. The users can rate the tools with one to five stars, and the mean rating and number of rates a tool has received is shown, helping others to see whether previous users have found a certain tool relevant.

The metadata of the tools, and if possible, the tools themselves are stored in Organic eprints (orgprints.org), the world's largest archive with publications about research and development in Organic Agriculture. In order to accommodate this, Organic Eprints had to be adapted to be ready to include this metadata. This was carried out by ICROFS, the administrator of Organic Eprints.

In order to accommodate discussion about the themes and tool, a module from DISQUS (disqus.com) has been integrated on each theme and tool page. Users have to login to give comments, they can login with existing accounts for Facebook, Twitter or Google Plus or create an account in DISQUS, and users can share the theme and tool pages on their own social media streams. The discussion is monitored continuously by IFOAM EU, and it is made sure that all questions are replied by relevant experts.

Users can search for tools on a specific topic using either the themes, the specific keywords chosen to be relevant for organic arable farming or free-text search. As the specific keywords have been translated to the 10 languages, a user searching for "ukrudt" in Danish will also find tools in French with the keyword "adventices". The users can also search for specific tool types, e.g. videos, tools in certain languages, and tools from a certain country of origin.

Discussion

Organic farmers and advisers know that a lot of knowledge exists about organic arable farming, but it can be difficult to find and in many cases it is difficult for them to use e.g. research results directly in their daily work. The online platform farmknowledge.org offers tools in the sense that the resources shown there present scientific and practical knowledge "digested" for use by practitioners. In addition, it offers the possibility for users to comment, discuss and ask questions about important themes and specific tools. In this way, the online platform contributes to Organic 3.0 by helping farmers and advisors become more innovative and improving towards best practices. Overcoming the yield gap in organic arable farming will also make organic agriculture more sustainable.

References

Cullen B, Amos D, Padel S, Jamart A, Delanote L, Pelican B, Apostolov S, Ponzio C, Vetemaa A, Mikk M, Fontaine L, Cadillon A, Oudshoorn F, Dezsény Z, Fischinger S, Moeskops B 2016. OK-Net Arable: Description of farmer innovation groups. http://orgprints.org/30748/.Accessed on 20th April, 2017

EIP-AGRI Focus Group Organic Farming (2013): Optimising Arable Yields Recommendations and Outputs. EIP-AGRI Agriculture & Innovation. https://ec.europa.eu/eip/agriculture/en/content/focus-group-organic-farming-optimising-arable-yields-recommendations-and-outputs.Accessed on 1st Dec., 2016

EU SCAR (2013), Agricultural knowledge and innovation systems towards 2020 – an orientation paperon linking innovation and research, Brussels. 204 pp.

Niggli U, Schmidt J, Watson C, Kriipsalu M, Shanskiy M, Bàrberi P, Kowalska J, Schmitt A, Daniel C, Wenthe U, Conder M, Wohlfahrt J, Schild M, Dierauer H, Krauss M, Moeskops B, Padel S, Micheloni C, Constanzo A, Thonar C & Wilbois KP 2016. Organic Knowledge Network Arable: State-of-the-art research results and best practices. http://orgprints.org/30506/. Accessed on 20th April, 2017

Organic farming and local development

Philippe Fleury[1], Céline Cresson[2], Audrey Vincent[3]

Key words: local initiatives, social equity, empowerment, objectives for OF, public policies

Abstract

Organic farming (OF) is more and more regarded as a response to local collective issues: environmental, economic and social ones. In this paper, we are showing how, in the history of OF development, local initiatives and dynamics are becoming increasingly important. Then, based on a detailed analysis of six local actions, we analyse the diversity and the complexity of these dynamics in terms of objectives, involved stakeholders and forms of governance. The discussion handle, in an operational perspective, the difficulties, the success factors and the challenges for Organic 3.0 of such projects.

Acknowledgments

The authors gratefully acknowledge financial support from the French Agriculture Ministry (2013 call for innovation and partnership projects of CASDAR (rural and farm development special account)), from the French Foundation, from the Daniel and Nina Carasso Foundation and also from the network for rural development in France.

Introduction

From a local development perspective organic farming is more and more seen as an effective tool to address collective issues, such as environmental, economic and social ones. Stakeholders working for the development of OF are very frequently called upon by local communities and other local actors to solve various issues through OF development: environmental problems namely water pollution or biodiversity losses, organic food supply for school catering, food education, etc.

We are going to see how, in the history of OF development, the issue of local development and dynamics is becoming increasingly relevant and, in an operational perspective, which are the difficulties and the key success factors of such experiences. Even more, local initiatives appear increasingly as a central issue for organic 3.0.

Material and methods

To progress in the understanding of place-based initiatives towards OF development, we implemented a research and development project based on the analysis of six local initiatives, located throughout France. For each project, we analysed the documents relating to them and we interviewed 10 to 12 stakeholders: farmers, citizens, local elected officials, policy makers, agricultural advisors and local facilitators. We documented: objectives, key moments in the dynamics, stakeholder strategies, difficulties, initiated actions, place and role of OF, results in terms of OF growth and local development. The analysis crosses sociological and geographical concepts: stakeholder analysis, local development and collaborative resource management. We have also

[1] ISARA-Lyon, Social Sciences Department, Laboratoire d'Etudes Rurales, Agrapole, 23, rue Jean Baldassini, F 69364 Lyon Cedex 07. e-mail : fleury@isara.fr

[2] ITAB, 149 rue de Bercy – F 75595 PARIS cedex 12. e-mail : celine.cresson@itab.asso.fr

[3] ISARA-Lyon, Social Sciences Department, Laboratoire d'Etudes Rurales, Agrapole, 23, rue Jean Baldassini, F 69364 Lyon Cedex 07. e-mail : vincent@isara.fr

analysed the international scientific literature concerning the relationships between OF and local development.

Results

Organic farming and local development

The analysis of the international scientific literature concerning OF development highlights that research is mainly focused on 2 topics: farmers' motivation to change for OF (Lamine & Bellon, 2009) and institutional dynamics of the OF sector. Regarding this second point Michelsen and al. (2001) proposed, from a comparative analysis in different European countries, a six steps model to characterize the development path of organic movements. The first steps refer to the setting of the OF sector: organic movement birth, political recognition and then economic support from public policies. The next three steps which lead to the institutionalization of OF cover the capacity of OF organizations to be recognized and to win three fields: conventional agricultural organizations, food market and institutions. Today the institutionalization of OF debate is focused on its "conventionalisation" (Darnhofer *et al.,* 2009).

Scientific publications dealing with OF local development dynamics are less numerous. However, several studies show that OF does not increase homogenously in all areas. Some spatial aggregations phenomena of OF conversions at regional or local scale are mentioned by several authors (Allaire *et al*., 2013; Bichler *et al*., 2005; Gabriel *et al*., 2009; Ilbery *et al*., 1999). At the local level, some recent papers analyse OF development dynamics. This research emphasises the analysis of actors' networks and the governance models of these dynamics (Duffaud-Prevost, 2015 ; Lamine *et al*., 2011 ; Cardona, 2012 ; Vincent et Fleury, 2014).

A major transformation is taking place now in OF development driving forces. The territorial dimension is becoming increasingly important. It implies a rethinking of OF development strategies by focusing more on collective actions and by involving new stakeholders (economic partners of supply chains, local and regional authorities, etc.). The challenge is to establish new relationships between them, and finally to connect OF development and local development. From a research perspective, this leads to revisit the theoretical models of OF development and to enrich them with a local or territorial dimension.

Diversity of local initiatives

The analysis of six OF local dynamics provides a detailed overview of the diversity of OF local development initiatives (Table 1). This analysis is based on four themes:

- Objectives addressed to OF;
- Projects initiators and leaders;
- Supportive public policies;
- Technical and organisational innovations.

The objectives of these projects are rarely limited to OF itself with a view focusing on conversion or growth in organic production. OF, its products, its practices but alsoits values are seen in a wider perspective including environment preservation, job creation, development of exchanges and mutual learning between organic and conventional farmers, food education, food sovereignty, social equity and health of socially disadvantaged groups, disabled workers inclusion, etc. These are both OF local development projects and local developments projects in which OF plays a major role.

Table 1: OF local development projects diversity

	Objectives	Project leaders	Supportive public policies	Technical and organisational innovations
1	Local and organic vegetables supply. Landscape and patrimonial enhancement of a green space within the city	Metropolis and local authorities, Chamber of agriculture. Farmers are not aware about OF	Urban development. Land planning. Flood prevention. Preservation of agricultural land	Association of global issues at metropolis level and action at municipal level
2	Access to organic food for low-income families Social equity and food education	Organic farmers group and local authorities	Urban and social policies (local level). Environment and health policies (region)	Conviviality: cooking, diet and farming learning. Links between social and agricultural services
3	Organic wine to solve economic crisis. Organic values promoted: environment and energy saving, food quality	Mayor of the commune. President of the wine cooperative	From local to European levels: CAP, Agenda 21, environment, land planning, education	Winemaking, horse-drawn works. Local marketing, Participatory governance,
4	Development of a supply chain of organic herbs and medicinal plants Limitation of land abandonment	Agricultural secondary school. Chamber of agriculture, enterprises and then farmers.	Agricultural education, agriculture Ministry, local authorities	Production and processing methods. Marketing. Network from farmers to consumers
5	Developing OF. Enabling exchanges between farmers (OF and non-OF). Water quality and soil fertility	Organic farmers group and conventional farmers, agro-forestry association and local cooperatives	Agriculture and environment : local authorities, water agency, FEADER	Soil tillage and plant cover. Organisational: forums, farm-type descriptions, discussion group
6	Providing catering with local organic products. Job creation for disabled workers. Reducing fossil energy use	Organic farmers group. NGO of rehabilitation for disabled workers.	Local level: agricultural, social and school food policies	Vegetable processing platform. Links between food supply, education and social inclusion

Discussion

These local dynamics reflect a new generation of projects: increasingly complex, leading new issues and innovations. Indeed, the partners are increasing (farmers, consumers, NGO’s, food chains operators, training, health and social public institutions …) and the projects have multiple objectives. Even more, the very local levelscales-up and if the projectsstart at a very local level, a certain number of them are growing to concern a larger area. Those enlargements take different forms: (i) the local « spillover » spread, where the project leader try to reach the upper land level (from local to regional). (ii) The replication with several similar actions in one or several regions. (iii) And finally scaling-up of supply chains to increase the diversity and the quantity of sold products and the targeted markets. In all these cases, the projects deal with some difficulties, uncertainties and, if these extension strategies are quite new, they are real.

OF local development projects address challenges of Organic 3.0 by positioning organic farming as a modern and innovative alternative in local societies and communities. They contribute to put in reality key features: holistic empowerment from the farmers to the consumers, inclusion of wider sustainability objectives relevant both for agriculture and local development, promotion of education and values, etc. There is both a need to strengthen such dynamics by relevant public policies and to develop participative research to progress in their efficient implementation.

References

Allaire, G., Cahuzac E., Poméon T., Simioni M., 2014. Approche spatiale de la conversion à l'agriculture biologique: les dynamiques régionales en France. Economie rurale 339-340, 9-31.

Bichler, B., Häring A.-M., Dabbert S., Lippert ., 2005. Determinants of spatial distribution of organic farming in Germany. In Researching sustainable systems. Adelaide: ISOFAR, P. 304-307.

Cardona, A. 2012. L’agriculture à l’épreuve de l’écologisation. Eléments pour une sociologie des transitions. Thèse de doctorat en Sociologie, EHESS, Paris, 429p.

Darnhofer, I., Lindenthal T., Bartel-Kratochvil R., Zollitsch W., 2010. Conventionalisation of organic farming practices : from structural criteria towards an assessment based on organic principles. A review. Agronomy for Sustainable Development 30(1), 67-81.

Duffaud-Prevost, M-L. 2015. L'ancrage territorial par une géographie multilocale. Le cas des entreprises de la filière plantes à parfum, aromatiques et médicinales dans la vallée de la Drôme. Thèse, Pradel: Université Paul Valery, Montpellier III, 448p.

Gabriel D., Carver S. J., Durham H., Kunin W. E., Palmer R. C. Sait S. M., Stagl S., Benton T. G., 2009. The spatial aggregation of organic farming in England and its underlying environmental correlates. Journal of Applied Ecology 46(2), 323-33.

Ilbery, B., Holloway L., Arber R.,. 1999. The geography of organic farming in England and Wales in the 1990s. Tijdschrift voor economische en sociale geografie 90(3), 285-95.

Lamine, C., Bellon S., 2009. Conversion to organic farming: a multidimensional research object at the crossroads of agricultural and social sciences. A review. Agronomy for Sustainable Development 29(1), 97-112.

Michelsen, J., Lynggaard K., Padel S., Foster C., 2001. Organic Farming Development and Agricultural Institutions in Europe: A Study of Six Countries."Organic Farming in Europe: Economics and Policy 9, 1-179.

Vincent, A., Fleury, P. 2014. Development of organic farming for the protection of water quality: local projects in France and their policy implications. Land Use Policy 43, 197–206.

A national platform to foster research cooperation. 100 research topics.

Vianney Le Pichon[1], Stéphane Bellon[2]Marion Desquilbet[2], Eve Fouilleux[3], Denis Lairon[4], Marc Tchamitchian[2]

Key words: organic, research, food system, France

Abstract

In order to mobilize the French research potential to develop organic farming, a multidisciplinary team of 15 researchers and stakeholders was established. Their collaborative work consisted of identifying and bringing together the needs of the organic sector and translating them into research topics for key areas. They thus drafted the first French framework program for research and innovation in organic farming. The first part of this paper presents the conceptual framework of the organic food system and the importance of improving methods for evaluating its multiple performances. It then presents 100 research topics structured into 6 themes that cover the entire organic food system.

This work confirms the relevance of such team arrangements to be in line with sector challenges and opportunities. After this first benchmark, the role of FROG, this French organic platform, is to mobilize stakeholders to define the organic food system to be designed in the future, and ultimately to increase the number of research projects dedicated to its achievement.

Introduction

Despite a significant potential in both farming and research, France has not yet been sufficiently involved in answering calls for research projects dedicated to the development of organic food and farming (Gall *et al.* 2009). This can be attributed to a lack of collective mobilization and to the small size or dispersion of research teams involved in the organic field. This paper presents the French approach that sought to compensate for this shortcoming, drawing on the example of European technology platforms.

Two facilitators from ITAB1 and INRA2 brought together a team of volunteers made up of researchers and stakeholders. For a year and a half they have worked collaboratively to meet the needs, that have already been identified but partially and scattered. They completed them with consultations and translated them into research topics. They then drafted a strategic research agenda. This document aims at suggesting topics to funders who draw up calls for projects both in France and at the European level as well as to inspire the teams of researchers likely to contribute to build projects.

Material and methods: gathering people and translating needs in research topics

[1] Institut Technique de l'Agriculture Biologique, ITAB, France, www.itab.asso.fr, vianney.lepichon@itab.asso.fr

[2] Institut National de la Recherche Agronomique, INRA, France, www.inra.fr, stephane.bellon@inra.fr, marion.desquilbet@toulouse.inra.fr, marc.tchamitchian@inra.fr

[3] Centre de coopération internationale en recherche agronomique pour le développement CIRAD-CNRS, France, eve.fouilleux@cirad.fr

[4] Institut national de la santé et de la recherche médicale, INSERM, denis.lairon@orange.fr

The first stage consisted of bringing together 15 researchers and stakeholders with various fields of knowledge and skills, from different institutions and disciplines. They were able to convert existing needs into research topics in the many dimensions of the organic farming and food system.

Then, the few national priorities already proposed by the CSAB, the national organic scientific committee (Meynard and Cresson 2011), or in Ambition Bio 2017, a national action plan (MAAF 2013) and the European research topics presented by the Technological Platform for organic food and farming (TPOrganics 2014) were used as knowledge synthesis and guidelines.

The work of gathering and synthesizing the needs thus far identified in various institutions was started in 2015. It was updated in light of knowledge of individual experts and on the state of the art litterature in various scientific fields. If the needs are known by the actors, they are usually not explicitly written down and rarely translated into research topics. Their very detailed accuracy also needed to be incorporated. It was thus completed by territorial or thematic consultations. They were done on purpose or during existing events like scientific conferences.

Those two tasks showed the scope of the work to be carried out and the interest that the platform could bring to those actors in return. Indexes have been designed to enable them to retrieve the research topics relevant with the detailed needs provided.

Main outcomes: A national platform and 100 research topics

All the needs translated into research topics were organized and presented in the first national strategic agenda for organic research in France (Le Pichon *et al.* 2017).

FROG: a French technological platform to foster organic research projects

The methodology and the first two drafts of the strategic agenda were discussed three times with the CSAB scientists. The final draft and the process was agreed by the research committee of Ambition bio in 2016.

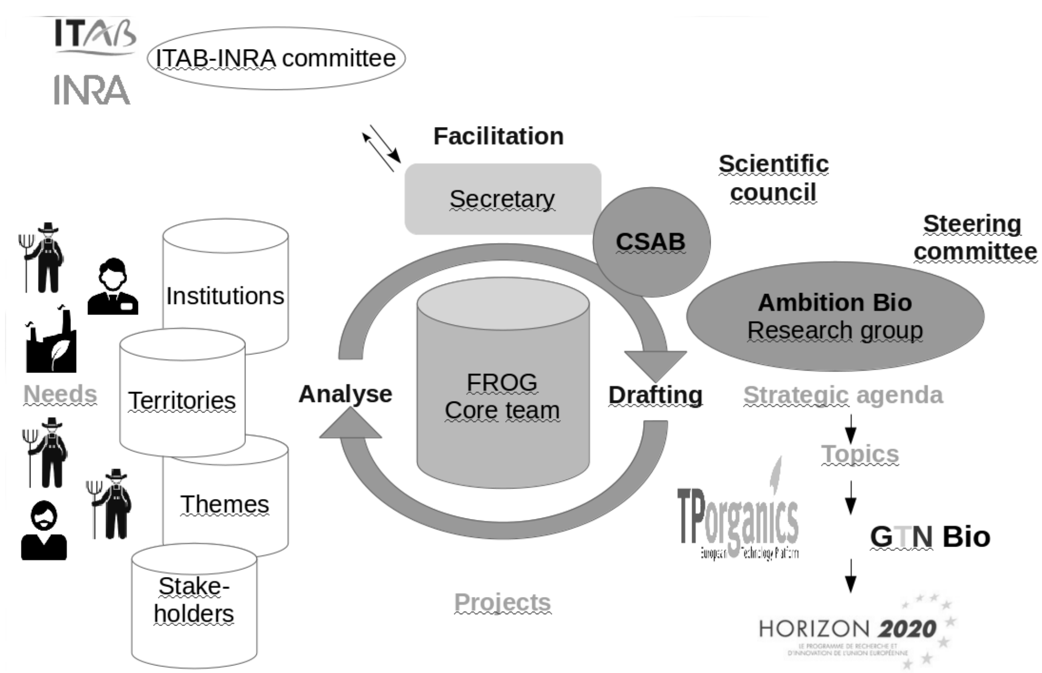


Figure 1. Frog process and governance

This strategic agenda is intended to be operational for two main targets. The first is made up of French and European funders to provide them with topics relevant for their research projects calls. The second target is to encourage researchers to build and propose projects. Regular updating of this program should also facilitate dialogue between all stakeholders involved in organic food and farming development to highlight sector needs and research topics.

Due to the already high number of French research institutions, it has been decided not to formalize this platform as a legal structure. It is open to all good willing and no membership is required. The core team (the 15 original researchers and stakeholders) has given the name FROG (standing for French Research Organic Group), to this technological platform.

Strategic agenda : 1st part - a conceptual framework for research

The first part of the strategic agenda presents a conceptual framework on which research for organic food and farming should be based.

- The organic food system (OFS), prototype of a sustainable food system

In keeping with the transformative ambition of its founding project, organic farming is considered here as a food system (IPES Food 2015). This concept covers several dimensions: production, food and health, environment, socio-economy, politics. These multiple dimensions are embedded in various public policies, foremost in the European regulation.

- Rethinking performance, a methodological challenge

The articulation of those dimensions, their implementation and the evaluation of their cross-impacts are complex. Indeed, the evaluation modes of multiple performances are often inadequate and focused on immediate needs to the detriment of a longer-term vision favouring a re-design of systems or trade-offs in transition trajectories.

- Define systems targeted over the long term

The systemic approach is one of the strengths that make OFS a particularly interesting research object as a prototype of a sustainable food system (Bellon and Penvern 2014). It is therefore essential to guide the research, that the stakeholders define the systems they target for the future, either with prospective scenarios (Le Pichon 2015) or in the definition of a vision (Organic 3.0).

Strategic agenda : 2nd part - 100 research topics

The second part of the strategic agenda brings together 100 research topics relating to the multi-performances of the food system according to six major themes (A to F).

- (A) Multi-performance analysis: new metrics are needed for the assessment of the food system, from processes of living being in agroecosystems to food processing and finished product, with their consequences in terms of cross-assessment between performances;
- (F) The impacts of regulations, policies and public actions: it encompasses both the ones explicitly dedicated to organic farming and those indirectly affecting its development;
- (B) Productive performances :analyzing and improving existing farming and agri-food systems, and re-designing them at different levels;
- (C) Nutritional and health performances: addressing the relationship between food quality and agricultural systems, and the impacts of the food system on the health of farmers and citizens;
- (D) Environmental performances: for different compartments (soil, water ...) or stakes (energy and waste, ecosystem services, indicators of environmental quality accounting for interactions between compartments); and
- (E) Economic, social and territorial performances: from the farmers quality of life to the consumption patterns.

Each theme is divided into research topics (a hundred in total). Each elementary topic is presented in three sections (specific challenge, scope, expected impacts).

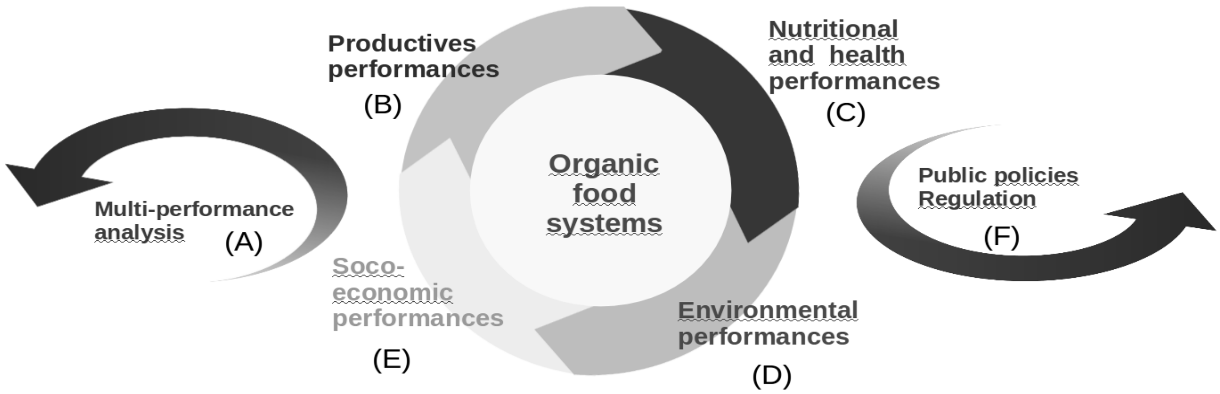


Figure 2. The multi-performances of Organic Food System and the leverages of its evolution

Discussion

Identifying and describing 100 research topics was necessary to cover all the needs identified for developing the entire organic food system. This should encourage a large number of researchers in a variety of disciplines. But it is also necessary to select priorities in particular to propose shorter lists to funders. The FROG platform is now confronted with four new challenges:

1. How and with whom to prioritize topics;
2. How to keep topics up-to-date and mobilize all stakeholders;
3. How to encourage researchers to respond to calls for projects when the topics are selected;
4. How to ensure that the system approach is privileged after dividing everything into 100 topics.

Several options are being considered including exchanges with other technological platforms in Europe, on-line stakeholder consultations and partnerships to mobilize researchers in each institution.

References

Gall E, Millot G, Neubauer C (2009) Faiblesse de l'effort français pour la recherche dans le domaine de l'Agriculture Biologique : approche scientométrique. Innovations Agronomiques 4:363-375.

Le Pichon V (2015) Quelle bio dans 30 ans ? Des scénarios de prospective. Biofil 100:16-17.

Meynard J-M, Cresson C (2011) Le Conseil Scientifique de l'Agriculture Biologique identifie 8 priorités de recherche-développement. NESE 35:27-40.

Bellon, S, Penvern S (eds) (2014) Organic farming, prototype for sustainable agricultures. Springer.

Le Pichon V, Tchamitchian M, coord. (2017) Programme cadre français pour la recherche et l'innovation en Agriculture Biologique. FOG, ITAB. http://www.itab.asso.fr/downloads/frog_web.pdf. Accessed 24 April 2017

[IPES Food] International Panel of experts on sustainable food systems (2015). The new science of sustainable food systems: overcoming barriers to food systems reform. First Report. http://www.ipes-food.org/images/Reports/IPES_report01_1505_web_br_pages.pdf. Accessed 24 April 2017

ITAB (2010) Besoins de recherche identifiés par les Commissions Techniques de l'ITAB.

MAAF (2013) Programme Ambition Bio 2017. Projet Agro-Ecologique pour la France. http://agriculture.gouv.fr/sites/minagri/files/documents/publications/pdf/140214-ProgrammeBio-BD_version_cle0b7bd2.pdf. Accessed 24 April 2017

TP Organics (2014). Strategic Research and Innovation Agenda for Organic Food and Farming. Brussels. http://tporganics.eu/wp-content/uploads/2016/01/tporganiceu-strategic-research-and-innovation-agenda-2014-brochure-20150129.pdf. Accessed 24 April 2017

Do organic food companies respond adequately to customer requests on their Corporate Social Responsibility-performance?

Denise Gider[1], Thomas Krikser[1], Ulrich Hamm[1]

Key words: CSR-communication, CSR-performance, Sustainability Marketing, Customer request handling

Abstract

Corporate Social Responsibility (CSR) is becoming more important for food companies since it increases customer loyalty. So far, no studies investigated how companies respond to customer requests addressing their CSR-performance and whether organic companies (OC) respond differently compared to conventional companies (CC). 200 requests were sent to OC and CC inquiring information on different CSR-activities. The responses were analysed by evaluative qualitative content analysis.

Overall 66% of the OC (67% of the CC) responded. Slight differences occurred in the professionality and indication of comprehensible information between OC and CC. 21% of OC communicated only a low implementation level of CSR or no activities at all. OC communicated a higher implementation level for environmental concerns and waste management than CC. In order to legitimate the price premium for organic products, OC have to implement and communicate more activities in all CSR-dimensions (e.g. procurement).

Introduction

The implementation of CSR is gaining in importance for food companies (Luhmann and Theuvsen 2016). CSR improves customer loyalty, consumer trust in credence goods (e.g. organic products) and provides options for product differentiation (Karstens and Belz 2006, Perrini *et al.* 2010, Luhmann and Theuvsen 2016, Zander *et al.* 2013). To the best knowledge of the authors, research investigating of how OC implement and communicate their CSR-performance does not exist. Besides, it is not known whether OC exceed CC in their CSR-communication since CC invest more and more in extensive CSR-campaigns. It may be expected that OC have expertise in trust-building communication with consumers, since some organic consumers express a lack of trust in organic labelling (Hemmerling *et al.* 2015) and pose critical questions to OC. The aim of this exploratory study is to fill this research gap and to derive managerial implications and recommendations for an improved implementation and communication of CSR.

Material and methods

In order to capture the CSR-communication of food companies, overall 100 companies (50 OC and 50 CC) in Germany were addressed with two customer requests via email that contained in each case four specific questions.The requests were sent to the 25 largest OC and the 25 largest CC of food retailing as well as to the 25 largest OC and the 25 largest CC of the food processing industry.CC were included in order to serve as a reference point to assess the performance of OC. The requests contained questions regarding employee concerns (salary, training), procurement (local and fair sources of supply, selection criteria for suppliers), waste management (avoidance of food waste, recyclability of packaging) and environmental concerns (electricity from renewable

[1] University of Kassel, Agricultural and Food Marketing, Faculty of Organic Agricultural Sciences, Germany, www.uni-kassel.de/go/alm, eMail: d.gider@uni-kassel.de, hamm@uni-kassel.de.

energy sources, energy-saving measures). The company responses were analysed by an evaluative qualitative content analysis (Kuckartz 2014). The quantitative data analysis compiled descriptive statistics and nonparametric tests were performed (Chi-Square and Mann-Whitney-U-Test) since the assessed measurements were not normally distributed.

Table 1: Categories "Professionality" and "Indication of comprehensible information"

Evaluation criteria (in %)	All companies (n=133)	OC (n=66)	CC (n=67)
Professionality			
Expression of thanks for request	85.7	80,3	91.0
Timely response (within four days)	51.9	54.5	49.3
Indication of position	85.7	77.3	94.0
Indication of contact information	88.7	83.3	94.0
Further communication offer	41.4	50.0	32.8
Reference to future customer relations	36.8	28.8	44.8
Indication of comprehensible information			
Information about market	36.8	42.4	29.2
Information about company	60.9	57.6	64.2
Information about products	69.9	78.8	67.2
CSR-certificate	27.8	24.2	31.3
CSR-award	11.3	10.6	11.9
Hyperlink for further CSR-information	44.4	34.8	53.7
Email-attachment containing further CSR-information	7.5	12.1	3.0
Printed version of a CSR-report mentioned	3.0	4.5	1.5
Examples for CSR-activities	81.2	83.3	79.1
Numbers on CSR-activities	48.1	47.0	49.3
CSR-partners or membership in CSR-associations	57.9	66.7	46.3
CSR-motives mentioned	74.4	69.7	79.1

Significant at P≤0.05 Significant at P≤0.01 OC: Organic companies, CC: Conventional companies

The coding system was derived from theoretical findings on effective request handling and effective CSR-communication to consumers. It consisted of three main categories evaluating the quality of the response: "Professionality", "Indication of comprehensible information" and "Communication on the implementation of CSR-activities". The last-named category classified the responses using an ordinal scale ranging from 0 to 3 to measure the implementation level of CSR-activities (0=no information, 1=lack of specification, 2=limited implementation, 3=implementation). This classification was based on indicators of different CSR-guidelines,e.g. guidelines of the Global Reporting Initiative (GRI 2015), Eco-Management and Audit Scheme (EMAS 2010), German Sustainability Code (German Council for Sustainable Development 2016) and ISO 26000 (ISO 2010). The categories "Professionality" and "Indication of comprehensible information" were coded using a binary scale (0=absent, 1=present). The composition of the categories "Professionality" and "Indication of comprehensible information" are presented in Table 1. Afterwards, the indicators of the categories were in each individual case aggregated to an overall index by summing up the value of variables.

Results

Overall, 133 of the 200 requests received responses: 66 by OC and 67 by CC. There were only slight differences in the categories "Professionality" and "Indication of comprehensible information" between OC and CC. CC significantly more frequently indicated the position of the responding person, whereas OC significantly more often expressed a further communication offer (Table 1). Hence, no significant differences in the overall index "Professionality" were found between OC and CC.Within the quality dimension "Indication of comprehensible information", CC significantly more frequently related to further CSR-information via a hyperlink. OC on the other hand significantly more often mentioned CSR-partners or memberships in CSR-associations (Table 1). With regard to the overall index "Indication of comprehensible information", there were no significant differences.

The majority of OC and CC responded inadequately to the four questions posed in the consumer requests regarding their respective CSR-activities. Many responses neglected to address the questions asked or only stated imprecise information. Overall, OC communicated a significant higher implementation level with regard to environmental concerns and waste management, but not regarding employee concerns and procurement.In the overall index "Communication on the implementation of CSR-activities", OC communicated a significant higher implementation level than CC companies (Table 2).

Table 2: Index "Communication on the implementation of CSR-activities"

Communication on the implementation of CSR-activities (in %)	All companies (n=133)	OC (n=66)	CC (n=67)
Low level of implementation	30.8	21.2	40.3
Medium level of implementation	38.3	40.9	35.8
High level of implementation	30.8	37.9	23.9

Significant at P≤0.05 OC: Organic companies, CC: Conventional companies

Discussion

OC should improve theirCSR-communication. They need to respond to all customer requests as well as answer questions in a detailed manner. It has become apparent that OC only communicated a higher implementation level of CSR regarding environmental concerns and waste management. Both are resource conservation measures and as such fundamental to organic agriculture. Focussing on these topics only is problematic, because consumers perceive organic products as more fair compared to conventional products (cf. Hemmerling *et al.* 2015). OC have to better integrate social concerns into their business operations, especially considering that problems such as unfair pricing also occur in OC (Hendersen 2014). Particularly, since CC emphasise their CSR in huge PR campaigns, OC have to assume and communicate more responsibility in all CSR dimensions to justify the premium price of organic products and to fulfil its pioneering role as a leading sustainable food system (cf. Arbenz *et al.* 2015).

References

Arbenz M, Gould D, Stopes C (2015): Organic 3.0. For truly sustainable farming and consumption. http://www.ifoam.bio/en/organic-policy-guarantee/organic-30-next-phase-organic-development. Accessed24 April 2017

EMAS (2010) The new core indicators of EMAS III. http://www.emas.de/fileadmin/user_upload/06_service/PDF-Dateien/UGA_Infosheet_Indicators.pdf. Accessed 24 April 2017

German Council for Sustainable Development (2016) The Sustainability Code. Benchmarking sustainable economy. http://www.nachhaltigkeitsrat.de/fileadmin/user_upload/dokumente/publikationen/broschueren/RNE_The_Sustainability_Code_Text_no_52_June_2016.pdf . Accessed 24 April 2017

GRI (2015) G4 sustainability reporting guidelines. Implementation manual. https://www.globalreporting.org/resourcelibrary/GRIG4-Part2-Implementation-Manual.pdf. Accessed 24 April 2017

Hemmerling S, Hamm U, Spiller A (2015) Consumption behaviour regarding organic food from a marketing perspective. A literature review. Org. Agric. 5:277-313. doi: 10.1007/s13165-015-0109-3

Hendersen E (2014) Realizing the principle of fairness: Standards to bring it to life throughout the organic supply chain. Presentation at the IFOAM Organic World Congress 2014, Istanbul, Turkey, 13-15 October 2014. http://orgprints.org/23664/.Accessed24 April 2017

ISO (2010) ISO 26000:2010. Guidance on social responsibility. https://www.iso.org/obp/ui/#iso:std:iso:26000:ed-1:v1:en. Accessed 24 April 2017

Karstens B, Belz F-M (2006) Information asymmetries, labels and trust in the German food sector. A critical analysis based on the economics of information. Int J Advert 25:189-211. doi: 10.1080/02650487.2006.11072962

Kuckartz U (2014) Qualitative text analysis. A guide to methods, practice and using software. SAGE Publications, London

Luhmann H, Theuvsen L (2016) Corporate Social Responsibility in agribusiness. Literature review and future research directions. J Agr Environ Ethic 29:673-696. doi: 10.1007/s10806-016-9620-0

Perrini F, Castaldo S, Misani N, Tencati A (2010) The impact of Corporate Social Responsibility associations on trust in organic products marketed by mainstream retailers. A study of Italian consumers. Bus StrategEnviron 19:512-526. doi: 10.1002/bse.660

Zander K, Stolz H, Hamm U (2013) Promising ethical arguments for product differentiation in the organic food sector. A mixed methods research approach. Appetite 62:133-142. doi: 10.1016/j.appet.2012.11.015

Buying organic foods - Are there favourable dietary consequences?

CarolaStrassner[1], Rainer Roehl[2]

Key words: foodservice, menu change, meat, seasonal, convenience, frugal

Abstract

Recent research in Europe suggests that consumers regularly buying organic foodstuffs follow diets that are closer to healthy and sustainable dietary recommendations. Field observations from foodservice consultancy suggest a similar pattern for so-called large-scale consumers. Here, too, buying and using organic foodstuffs seems to be associated with better diet and better knowledge of foods. This phenomenon was explored by means of interviews with organic foodservice professionals in Germany. On the balance the results show evidence of changes particularly concerning the issuesmeat/plant-based, seasonal/local, semi-finished products, sustainably sourced fish and Fair Trade. The preliminary study suggests that both behaviour and knowledge of foodservice operators are impacted.

Acknowledgments

We thank the following students of the M.Sc.-degree programme "Sustainability in service management and food industries" and the course "Sustainability in hotels, restaurants and catering services"at FH Münster University of Applied Sciences who were involved in the identification of respondents and data collection: Till Karlheinz Beckemeyer, Lisa Borghoff, Stefanie Brathe, Karina Buß, Anica Chudzian, Olesa Deis, Fara Flügge, Laura Hoffmann, Mia Jaensch, Jonas Laum, Vanessa Lüder, Daniela Müssig, Nathalie Pflaum, Alexandra Schute, Janine Simanek, Kim Nora Skapczyk, Christina Spickermann, Fabian Theveßen, Sina Kim Wiewel.

Introduction

Recent research in France and Germany using independent national consumption study data suggests that consumers regularly buying organic foodstuffs follow diets that are closer to healthy and sustainable dietary recommendations (Eisinger-Watzl *et al.* 2015, Kesse-Gyuot *et al.* 2013), thus indicating that following organic consumption patterns may contribute to enhancing health and sustainability (Baudry *et al*. 2015a, b).

Field observations from over 20 years of foodservice consultancy suggest a similar pattern for so-called large-scale consumers, i.e. professional foodservice operations (Roehl, personal communication). Here, too, buying and using organic foodstuffs seems to be associated with better diet and better knowledge of foods. This phenomenon seems to be independent of foodservice operation types. To our knowledge it has not been investigated, prompting us to explore whether the introduction of organic food in foodservice operations changes the food offered and if so, in what way.

Material and methods

[1] FH Münster University of Applied Sciences, Germany, Department of Food – Nutrition – Facilities, www.fh-muenster.de/strassner, Strassner@fh-muenster.de

[2] a'verdis Sustainable Foodservice Solutions, Germany, www.a-verdis.com, rainer.roehl@a-verdis.com

For this explorative study qualitative methodology was used, specifically interviews with a minimum of 20 foodservice operators. Respondents were selected from a pool of supplier-caterer tandems identified within a larger project. Selection criteria included foodservice operation in Germany, use of organic food for a minimum of one year prior to interview, a certified organic foodservice operation. The foodservice sector was not included among the selection criteria and thus not limited, but, instead open to catering operations in education, care, business as well as hotels and restaurants.

Interviews were carried out face-to-face or by telephone according to a set procedure. The protocol included 12 questions in total, covering three areas: procurement and use of organic foods (6 questions), development of the menu (4 questions), knowledge of food quality and food origin (2 questions). Responses were recorded as audio files and subsequently analysed.

Students of the M.Sc.-degree programme "Sustainability in service management and food industries" at FH Münster University of Applied Sciences were involved in the study as interviewers, which took place in the timeframe from October 2016 to February 2017.

Results

The complete sample size consisted of 38 foodservice operations covering the South (8), East (2), West (19) and the North (9) of Germany. The main types were restaurants and cafés (11, including 2 with Michelin stars) and catering companies (11: 2 event, 2 institutional and 7 school caterers). The catering companies ranged in size from about 350 meals per day up to 7.000 meals per day. Other foodservice types were hotels (4, including 2 Bio-Hotels), student unions (3), schools and kindergartens (3), a clinic (1) and other (5). Within the sample 28 were certified organic according to German provisions, 8 were not certified (of which 2 had given up certification) and 2 gave no data.

A very large part of the sample had a high organic proportion. According to self-reported estimates, 28 foodservice operators have 60 % organic or more; 18 are fully organic. Two operators estimated their organic use at 30-40 %; for the remaining 8 we have no data. The interviewees of the 100 % organic operations were highly motivated to use organic. Twelve of them stated that they were fully organic from the moment they started their operation. Only two reported starting with a small amount of organic produce and progressing to more; one of these stated the lack of appropriate supply as the reason.

Interviewees were asked whether the arrangement of menus, recipes or meals had changed through organic use, and, if so, in what way. Though 12 were able to respond clearly about the impact of a change (yes: 7; no: 3) for others the answer was mixed and for many a direct answer was less easy than describing the development itself, from which the impact could then be read. The following issues were mentioned by at least 5 respondents in their descriptions.

Meat (or the converse: vegetarian or vegan fare): Many foodservice operators laid the focus on vegetarian fare, though their reasons varied from their general philosophy favouring a plant-based diet (2) to simply having more vegetarian food offers without changing their meat offers through organic use (2). Changes mentioned on account of organic use included an increase in the nose-to-tail principle (3), less meat/more vegetarian (2), less use of expensive meat cuts (1) and smaller meat portions (1).

Seasonal / local: 8 respondents stated that their menu arrangement and food offer decisions around organic produce are influenced by seasonal and local availability. Almost all allocated high importance to this factor and it was more readily identifiable as having an influence on their fare than organic. In this connection mention was made of the economic advantage of seasonal / local organic procurement and the current importance of local foods to customers.

Semi-finished products: Interviewees stated that cooking from fresh ingredients was important to their philosophy (2) or that they used more fresh ingredients as a consequence of organic use. Others stated that they used less pre-processed products or a lower degree of convenience on account of organic integration (2), one citing price/availability as the reason. This in turn increased the workload for the staff and brought more self-manufacture (2) but was apparently not reason enough to avoid organic use.

Fish: Interviewees mentioned their fish use in the context of organic. Two operators stated that organic fish was too expensive to include in their recipes; six operators stated that they chose MSC-fish for their menus.

On being asked whether their organic use had impacted other food qualities used, 5 interviewees mentioned Fair Trade products and one mentioned using old traditional cereals.

Exploration of a possible impact through organic use was extended to questions about a general increase in interest or knowledge about food quality and origins. Ten respondents gave a clear "yes" in answer while the four respondents that said "no" linked this to their long-standing personal interest and conviction regarding organic food. Details varied widely amongst the positive respondents and included not just a change in interest, knowledge or attitude but also behaviour. Respondents stated that their knowledge had increased, they took greater issue with sustainability overall, they were more critical (discriminating) and had increased the quality standards they accepted for food products. Furthermore, respondents mentioned reading more organic press, visited more trade fairs, considered their development under life-long learning and enjoyed learning new things. Two respondents mentioned now reading scientific articles and two made sure their staff was further educated in these matters. Foodservice operators also declared that they now visited their suppliers, that they worked together with these cooperatively to find solutions and that they had more respect for farmers' work in producing foodstuffs.

Discussion

Based on the outcome of the exploratory study together with the field observations we find a number of points that merit further research along the lines of hypothesis generation and evaluation. Even though the data is somewhat skewed towards too many fully organic respondents and thus presents more difficulties for an analysis of impacts following organic use, nonetheless respondents described changes in a number of fields typically linked with guidelines for more sustainable diets (Auestad and Fulgoni 2015; FAO 2012), healthy diets (Lucock *et al.* 2014) and also frugal diets (Martinéz-Gonzalez *et al.* 2015). We see potential for a more rigorous study design, clearly differentiating between fully organic operators and those starting with an organic share well under 50 %, as well as the use of closed-ended questions targeting specific changes as identified here. Moreover, we see potential to frame organic introduction and use in the professional kitchen context as an instrument for change, linking with the science and practice of change management, as well as with the field of sustainability transformation science.

References

Auestad N and Fulgoni VL (2015) What Current Literature Tells Us about Sustainable Diets: Emerging Research Linking Dietary Patterns, Environmental Sustainability, and Economics. Adv Nutr 6:19–36.

Baudry J, Méjean C, Péneau S, Galan P, Hercberg S, Lairon D and Kesse-Guyot E (2015a) Health and dietary traits of organic food consumers: results from the NutriNet-Sante study. Br J Nutr 1-10.

Baudry J, Méjean C, Allès B, Péneau S, Touvier M, Hercberg S, Lairon D, Galan P and Kesse-Guyot E (2015b) Contribution of Organic Food to the Diet in a Large Sample of French Adults (the NutriNet-Sante Cohort Study). Nutrients 7(10): 8615-8632.

Eisinger-Watzl M, Wittig F, Heuer T, Hoffmann I (2015) Customers Purchasing Organic Food - Do They Live Healthier? Results of the German National Nutrition Survey II. Eur J Nutr Food Saf 5(1): 59-71, Article no.EJNFS.2015.003.

FAO (2012) Sustainable diets and biodiversity: directions and solutions for policy, research and action. Barbara Burlingame and Sandro Dernini (eds) FAO Nutrition and consumer protection division, Roma, 307 p, FAO.

Kesse-Guyot E, Péneau S, Méjean C, Szabo de Edelenyi F, Galan P, Hercberg S, Lairon D (2013) Profiles of Organic Food Consumers in a Large Sample of French Adults: Results from the Nutrinet-Santé Cohort Study. PLoS ONE 8(10): e76998. https://doi.org/10.1371/journal.pone.0076998

Lucock MD, Martin CE, Yates ZR, Veysey M (2014) Diet and our genetic legacy in the recent anthropocene: a Darwinian perspective to nutritional health. J Evid Based Complementary Altern Med 19(1):68-83. doi: 10.1177/2156587213503345. Epub 2013 Sep 12.

Martínez-González MA, Salas-Salvadó J, Estruch R, Corella D, Fitó M, Ros E for the PREDIMED investigators (2015) Benefits of the Mediterranean Diet: Insights from the PREDIMED Study. Progress in Cardiovascular Diseases 50–60 http://dx.doi.org/10.1016/j.pcad.2015.04.003

Sustainability performance assessment by means of four parameters of organic products in Austria

Richard Petrasek[1], Thomas Drapela[1], Thomas Lindenthal[1], Isabella Gusenbauer[1], Stefan Hörtenhuber[1], Ruth Bartel-Kratochvil[1], Michaela C. Theurl[1,2]

Key words: Sustainability assessment, carbon footprint, water footprint, biodiversity assessment, regional benefit, organic products

Abstract

This contribution presents the assessment of four aspects of sustainability, product carbon footprint (PCF), water footprint (WF), biodiversity potential (BDP), and regional benefit (RB) along the value chain of 79 food products for an Austrian organic brand. Only PCF and WF were highly correlated (r=0.92, p<0.001) and showed much more variation than BDP and RB. A principal component analysis (PCA) was conducted to examine similarities and differences of five aggregated food product groups – 1. cereals & legumes, 2. fruits, 3. vegetables, 4. dairy products 5. meat & eggs. The products and product groups mainly differentiated along the first component that was largely determined by PCF and WF. Our analyses show that products can perform very differently in the analysed sustainability aspects. We conclude that the isolated assessment of single sustainability aspects is not sufficient and a comprehensive method covering all important aspects of sustainability would be required.

Acknowledgments

The project was funded by Hofer KG.

Introduction

Sustainable food production is an important issue in the scientific and public debate. Consumers' awarenessof sustainable food production is increasing andfarmers, processors and retailers step up their effortsto communicate their sustainability performance.

In the sustainability assessment of food products, we focused on four aspects of major importance: greenhouse gas emissions (GHGE), water use, biodiversity potential and regional benefit. Considering a set of different aspects of sustainability is preferable compared to single aspect approaches (e.g. only GHGE) because products might perform differently in different aspects. Livestock products, for example, might show high regional benefits and may be positive for biodiversity but cause high GHGE. These patterns can vary considerably for different products.

For this paper, we assessedthe above-mentioned sustainability aspects for five product groups: i) cereals and legumes, e.g. oat, soya; ii) fruits, e.g. raspberry, apple; iii) vegetables, e.g. potatoes, pumpkins; iv) dairy products, e.g. milk, cheese and v) meat and eggs, e.g. beef, minced meat.

Material and methods

The assessment methods for the four considered aspects of sustainability have been developed for organic products in Austria between 2008 and 2015.

[1] Research Institute of Organic Agriculture (FiBL). http://www.fibl.org/de/oesterreich/standort-at.html, richard.petrasek@fibl.org

[2] Institute of Social Ecology, http://www.uni-klu.ac.at/socec/eng/inhalt/1.htm

The PCF includes all relevant greenhouse gases (Carbon Dioxide, CO_2; Methane, CH_4; Nitrous Oxide, N_2O) in CO_2-equivalents (CO_2eq), according to IPCC (2006) and IPCC (2007) guidelines, and is closely based upon the eco-balance guidelines ISO 14040, ISO 14044 and PAS 2050 standard. The system boundaries range from agricultural production to retailers, including the upstream supply chain (e.g., production of fertilizer, pesticides or seeds) as well as processing, packaging, storage and all transports up to and including retail. Unlike most PCF found in the literature, two further items, namely, land use change (LUC; GHGE-source) and changes in humus (GHGE – source or -sink) were included in the analysis based on Hörtenhuber et al. (2010), with minor modifications according to Küstermann et al. (2008). Secondary data from GEMIS Austria, ecoinvent and relevant national and international publications and statistics were consulted (e.g. Fritsche et al., 2007; Nemecek and Kägi, 2007).

The WF results are based on the method presented by Hörtenhuber et al. (2014), which refers to the concept of Hoekstra et al. (2010). The WF includes a use of (a) surface- and groundwater (so-called „blue" water), (b) „green" evapotranspiration water from precipitation and (c) virtual „grey" water. The latter is the amount of water which is potentially needed to dilute emissions (e.g. nitrate) into freshwater below limits for drinking water quality. The results are calculated in regard to life cycle assessment (LCA) principles and include all stages along the supply chain from cradle to retailer. Results are accounted for based on an inventory level, i.e. they were not weighted to generate for instance estimates on critical demands for scarce water resources (see Hörtenhuber et al., 2014).

The BDP estimates how "biodiversity friendly or – promoting" an agricultural farm is managed and covers the entire farm (Schader et al., 2014). The core of the assessment method consists of 99 parameters concerning agricultural practices and semi-natural habitats and their impacts on the diversity of eleven indicator species groups. For each farm a biodiversity performance score, the so-called biodiversity potential, is calculated ranging from 0% to 100%, where 100% would be reached with the highest possible scores for all parameters.

The RB indicates the socio-economic advantages a region gains by regionally produced food, with the background of resilience and sustainable development. By addressing a food product, the model comprises its whole supply chain covering agricultural production, processing and retailing. A set of 28 indicators, derived from literature and clustered to the four themes "regional value-added", "regional resilience", "corporate resilience" and "product properties" forms the core element of the model. Input data values are matched with their corresponding weights and impacts, and are multiplied by the so called "Regional Correlation Factor" (for details see Markut et al., 2015) which results in an interim score for each input data value. These interim scores are summed up and result in the regional benefit induced by the regionally labelled product for the respective region.

For this paper, we compiled 79 products results and categorized them into the five product groups. Pairwise Pearson correlations between the results of the four sustainability aspects were calculated. We conducted a PCAto analyse the relations between the 79 products and the five product groups regarding all four assessed sustainability aspects. All statistical analyses were performed with PAST 3.12 (Hammer et al., 2001).

Results

The results of the four aspects of sustainability for the 79 assessed products, aggregated in five groups, are shown in Figure 1. The PCF and the WF, which are strongly correlated ($r = 0.92$, $p < 0.001$), have the absolute highest values for animal products (mean PCF = 4123 g CO_2eq / kg product) in contrast to vegetable products (mean PCF = 160 g CO_2eq / kg product). Since PCF and WF are calculated per kg product, differences in absolute yields have a substantial effect on the results. The BDP scores show less variation between groups, although variation within groups was considerablyhigh in some groups, especially vegetables. The farms themselves, the on farm practice and the ecological measures (e.g. no pesticide use), were crucial for the achieved results. The RB results indicate slightly higher values for animal products as well as for fruits and their value chains.

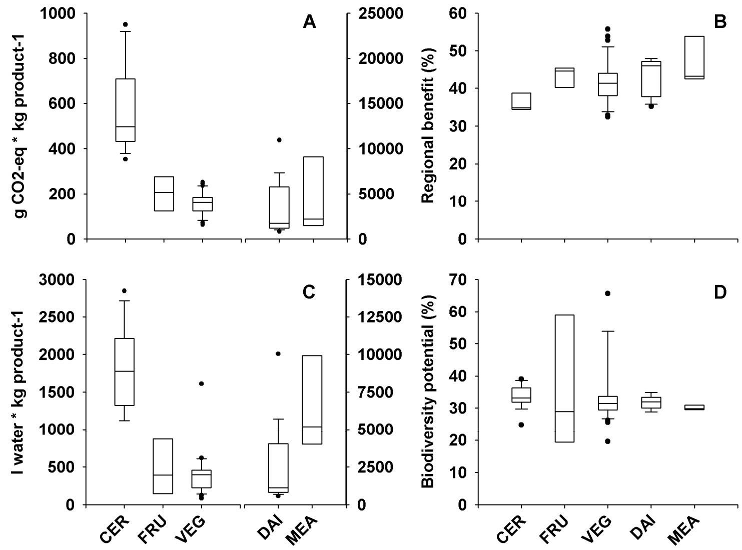


Figure 1. Results for the four sustainability aspects – product carbon footprint (A), regional benefit (B), water footprint (C) and biodiversity potential (D) – of the product groups CER (cereals & legumes, n = 18; for RB n = 8), FRU (fruits, n = 4), VEG (vegetables, n = 34); DAI (dairy products, n = 17) and MEA (meat & chicken eggs, n = 6). Please note the different ranges on the Y-axis in A and C for CER, FRU and VEG and for DAI and MEA, respectively.

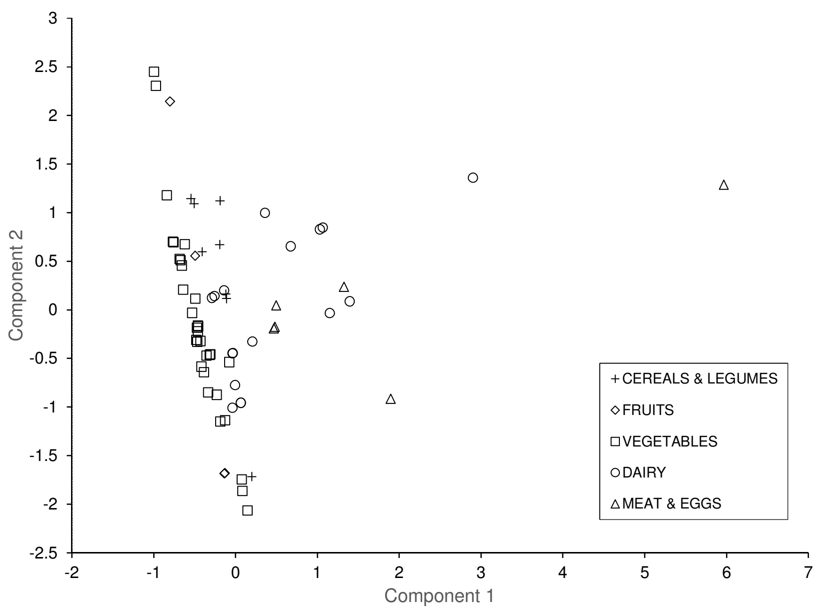


Figure 2. PCA-Scatterplot (correlation matrix, eigenvalue scale). Component 1 (51.0% explained variance) is mainly correlated with product Carbon Footprint and water footprint with loadings of 0.66 each. Component 2 (26.5% explained variance) is correlated with regional benefit (loading -0.59) and biodiversity potential (loading 0.73). Note: Axis not centered on zero.

In the PCA,the products and product groups mainly differentiated along the first component (51.0% explained variance, Fig.2) that was mainly determined by PCF and WF (both loadings of 0.66). The second component represents mainly BDP (0.73) and RB (-0.59). Visual inspection of the scatter plot reveals two groups of products, which are separated from the others: i) products with high values of RB combined with average values of PCF and WF for vegetable products; ii) high values of BDP with average values of PCF and WF for animal products (in particular for dairy products).

Discussion

This work gives a first detailed overview of four sustainability performance indicators of different organic agricultural food products – over the whole value chain (PCF, WF, RB) and at the farm level (BDP). The consideration of PCF, WF, RB and BDP covers the main local and global issues of the present and the future of sustainable agricultural production and its provision of public (e.g. biodiversity) and private (e.g. food, fibres) goods. To understand such systems and to optimize them, detailed examinations combined with a comprehensive assessment of sustainability issues are needed. Some animal products, for example, contribute to relatively high regional benefits and to conservation and generation of biodiversity on farmland, but consume high amounts of resources with respective impacts on PCF and WF. Single parameters (even when including different aspects in one model like RB) are only aspects of sustainability and do not cover the whole picture. However, the detailed examination with such methods will help to tackle present and future challenges (e.g. consumption and availability of means of production or rather resources) of our food system.

References

Fritsche, U.R., Schmidt, K., Öko-Institut e, V.I. für angewandte Ö, 2007. GEMIS, Handbuch zu Gemis 4.4.

Hammer, Ø., Harper, D.A.T., and P. D. Ryan, 2001. PAST: Paleontological Statistics Software Packagefor Education and Data Analysis. Palaeontologia Electronica 4(1): 9pp

Hoekstra, A.Y., Chapagain, A.K., Aldaya, M.M, Mekonnen, M.M., 2011. The water footprint assessment manual: Setting the global standard, Earthscan, London, UK. 203 pp. ISBN 978-1-84971-279-8.

Hörtenhuber, S., Lindenthal, T., Amon, B., Markut, T., Kirner, L., Zollitsch, W., 2010. Greenhouse gas emissions from selected Austrian dairy production systems—model calculations considering the effects of land use change. Renew. Agric. Food Syst. 25, 316–329. doi:10.1017/S1742170510000025

Hörtenhuber, S, Weisshaidinger, R, Lindenthal, T, Zollitsch, W (2014), Water-use and impact-weighted water footprints – methodological approach and case study for two Austrian milk production systems. In: LCA Food (Eds.), Proceedings of 9th International Conference LCA of Food. 9th International Conference LCA of Food, San Francisco, OCT 8-10, 2014. 10 pp. http://www.lcafood2014.org/papers/129.pdf

Küstermann, B., Kainz, M., Hülsbergen, K.-J., 2008. Modeling carbon cycles and estimation of greenhouse gas emissions from organic and conventional farming systems. Renewable Agriculture and Food Systems 23, 38–52. doi:10.1017/S1742170507002062

Markut, T., Gusenbauer, I., Bartel-Kratochvil, R., Hörtenhuber, S., Lindenthal, T., 2015. Regionale Bio-Lebensmittel – Bewertung der sozio-ökonomischen Vorteile für die Region aus Sicht der Nachhaltigkeit am Beispiel Frischmilch in Österreich., in: Häring, A.M., Hörning, B., Hoffmann-Bahnsen, R., Luley, H., Luthardt, V., Pape, J., Trei, G. (Eds.), . Presented at the Beiträge zur 13. Wissenschaftstagung Ökologischer Landbau, 17.-20. März 2015, Eberswalde, Dr. Köster, Berlin, pp. 633–636.

Nemecek, T., Kägi, T., 2007. Life Cycle Inventories of Swiss and European Agricultural Production Systems. Final report ecoinvent V2.0 No. 15a. Agroscope Reckenholz-Taenikon Research Station ART, Swiss Centre for Life Cycle Inventories, Zurich and Dübendorf, CH.

Schader, C., Drapela, T., Markut, T., Meier, M.S., Lindenthal, T., Hörtenhuber, S., Pfiffner, L., 2014. Farm- and product-level biodiversity assessment of conventional and organic dairy production in Austria. International Journal of Biodiversity Science, Ecosystem Services & Management 10, 20–39. doi:10.1080/21513732.2013.878752

What will affect the future development of the organic sector? A structured review of scenario analysis

Daniela Vairo[1], Danilo Gambelli[1], Raffaele Zanoli[1]

Key words: scenario analysis, organic food and farming, driving forces, uncertainties

Abstract

What are the main drivers/uncertainties that affect the future development of the organic food and farming sector? In what follows we present a structured review on the available scientific publication concerning scenario analysis on the future development of the organic food and farming sector in Europe. The aim of this review is to summarise the present knowledge and evaluation of the main drivers, and to consider how they could represent a contribution for facing the future challenges of Organic 3.0.

Introduction

In 2013 43.1 million ha were under organic agricultural management worldwide: Oceania represents 40% of this land, while Europe more than 25% (the organic food market was valued at 24.3 billion euros) (Willer and Lernoud 2015). Despite these figures, the reality is that organic farming (OF) has not even reached 1% of global agricultural land or of food consumption. Now, the aim of Organic 3.0 is to become the benchmark for sustainability worldwide and widespread adoption of OF: so what could impact upon the future of the organic food and farming sector worldwide? The use of scenario analysis in OF field of research try to answer this question. In what follows, a structured review on the available scientific publications using scenario analysis to investigate the possible pathways of evolution of the OF sector in Europe, is presented. The aim is to provide an orientation and a common direction to the organic sector, in order to face the challenges of Organic 3.0.

Material and methods

A scenario describes (textually or graphically) a set of events that might reasonably take place (Kahn and Wiener 1968). Scenarios can be considered as hypothetical images of the future, which describe the functioning of a system under different conditions with a certain degree of uncertainty. The basic aim of scenario analysis (SA) is not forecasting the future, or fully characterising its uncertainty, but rather bounding this uncertainty. It is not a single, well defined approach used in SA, but a variety of techniques that range from the qualitative 'intuitive logics' approach, through to more formalised methods (trend impact analysis, cross impact analysis). In addition, different classification of scenario exist. The wide range of different approaches and classifications to scenario analysis demonstrates that there is no consensus yet about the best method(s) to use. Scenario analysis can be seen as a process of understanding, analysing and describing the behaviours of complex systems in a consistent, and as far as possible, complete way. In this context, to define the framework for the evolution of the investigated system (time-frame and spatial framework), SA usually identifies the driving forces and their trends and/or expected evolutions. Here we present the results of a systematic review of the scientific literature concerning SA in organic farming. In particular we focus on the set of driving forces considered in each study, and provide a classification based on qualitative coding process (Gibbs 2007). Two online databases

[1] Università Politecnica delle MARCHE, D3A, Via Brecce Bianche, 60131 Ancona Italy, www.univpm.it, eMail daniela@agrecon.univpm.it, danilo@agrecon.univpm.it, zanoli@agrecon.univpm.it

(Scopus and Science direct) have been used to identify relevant scientific publications between years 2005 and 2016. The following combination of keywords have been used in searching databases: "scenario" and "scenario analysis" with "organic food", "organic farming", "organic market", "organic product", "organic production" and "organic crop". Grey literature has not been taken into consideration. Publications concerning farms scenarios and scenarios on land use (with organic farming considered a marginal aspect of the study) have not been selected. Publications which aim is to assess the sustainability of organic farming or/and the impact on other economic and environmental indicators, have not been chosen, since our structured review relates only on macro aspects of organic farming.

Results

Only few SA concerning agricultural themes refers to organic farming. Here we have selected seven scientific publications, two of which concern organic breeding scenarios and have been mentioned only for completeness of analysis. All scenarios are referring to the European context, with two SA focussing on specific European countries. The exclusion of grey literature in our review, could have affected this result. No paper considers a broad worldwide context.

Delmotte et al. (2017) develop participatory and qualitative scenarios related to the evolution of agriculture in the Camargue region of southern France, where rice is the main crop. The time horizon was set to 15 years from 2014. In this paper, four narrative scenarios have been developed and used as a method to explicitly link local and global changes, and the integrated assessment of scenarios as a way to foresee their consequences at the farm and regional levels. The final list of driving forces have been ranked by their potential impacts and the level of uncertainty.

Zanoli et al. (2015) presented a scenario analysis regarding the future development of the organic sector in Europe by year 2030. The authors developed a participatory approach, using qualitative information given by expert assessments. A deductive-qualitative approach has been used in order to identify two main uncertainties with the most impact for the sector, which play out differently in 4 diverse scenarios.

In Rozman et al. (2013) a system dynamics (SD) model for the development of organic agriculture in Slovenia has been presented, in order to identify key variables that determine conversion dynamics. The SD model enables simulation of different policies scenario in order to achieve strategic goal. Nine different simulation scenarios for the time of 120 months beyond the year 2010 up to 2020 have been performed.

Zanoli et al. (2012), Gambelli et al. (2010) presented a scenario regarding the future development of the market of organic food products in Europe by year 2015. The scenario follows a participatory approach, exploiting potential interactions among the relevant driving forces, as selected by experts. Driving forces have been ranked by impact and uncertainty in order to determine the key areas that formed the themes of the 4 developing scenarios. Network analysis is used to identify the roles of driving forces in the different scenarios.

Zanoli et al. (2000) presented five major possible forms that the European market for organic products might have assumed by 2010. Scenario analysis considers the interactions among a set of variables that are supposed to be able to depict the relevant aspects of the system where the possible evolution has been analysed. In this study, an inductive bottom-up and interactive approach was used, and a selection of the most important key variables (internal and external) that influenced the organic products market in the EU was performed. Instead of a probabilistic evaluation of the event combinations, these authors preferred to adopt an approach that was based on fuzzy logic.

Finally, Oudshoorn et al. (2009) explored the sustainability of scenarios for organic dairy farming in Denmark; by using a participative process with stakeholders and expert knowledge, three scenarios were defined. Nauta et al. (2001) presented six possible breeding scenarios for organic dairy farming in Netherlands. A participative approach have been used.

Based on the analysis of the selected papers, we clustered the driving forces that shared a common higher-level concept into 7 main themes, labelled accordingly to the driving forces they encompass. Theme 1 is "General economic conditions", and includes "reputation economy", "public subsidies", "food prices", "general level of consumer income", "barrier to trade", "food demand and supply", "population size", "oil prices". Theme 2 is "Policy and social instability" and includes "EU Collapse", "EU policy", "CAP reform", "specific organic farming support". Theme 3 is "State of ecosystems" and includes "climate change", "resource - land and water - availability". Theme 4 is "Technological change" which inglobe "GMO-free neighbouring environment", "green technology", "bio-fuels", "fracking". Theme 5 is "Consumers' attitude" and includes "consumer behavior", "consumer confidence", "awareness and consumer recognition of organic products", "safety and quality perception of organic food with respect to conventional food", "food scares". Theme 6 is "Endogenous advances for OF" and includes "marketing", "market development", "education", "self-organization", "diversification through farm pluriactivity".

Table 1: Main themes affecting the future of the organic sector

Authors/ Themes	Delmotte et al. (2016)	Zanoli et al. (2015)	Rozman et al. (2013)	Zanoli et al. (2012)	Zanoli et al. (2000)
General economic conditions	✓	✓	✓	✓	✓
Policy and social instability		✓	✓	✓	✓
State of ecosystems	✓			✓	
Technological change		✓			✓
Consumers' attitude towards OF		✓		✓	✓
Endogenous advances for OF	✓		✓		

Discussion

Results from the review of SA literature provide an insight on the potential evolutions of the organic sector. Despite the range of methodological approaches and scope, the studies provide a common view on the issues which may influence the organic sector in the future. The general political uncertainty and the scattered recovering from the economic crisis, place new clouds on the worldwide organic market. Disruptive events like the "Brexit", the new protectionist US approach and conservative measures undertaken by some governments are likely to affect organic market growth, with particular effects for the European market. The development of the organic sector will be conditioned upon the capability to find renewed and integrated approach relating the role of consumers, producers, technology and environment for an enlarged sustainable approach. In this context profitability of organic producers will be conditioned by the choice between a passive, price-taker approach, or a more active, price-making attitude. The main drivers that could condition the future of the organic sector seem to be already defined in the available literature, though the direction they will take in the future is not. Following the Organic 3.0 vision, to go mainstream, the sector needs to grow both on the demand and the supply side. The new organic farmers and processors may be quite different from pioneers and even the current "newcomers", while consumer demand is likely to be more driven by (lower) process. This may put pressure on producer prices and, consequently, on organic quality. How the sector will be able to guarantee a "principled change" is all to be seen.

References

Delmotte S, Couderc V, Mouret JC, Lopez-Ridaura S, Barbier JM, Hossard L (2017) From stakeholders narratives to modelling plausible future agricultural systems. Integrated assessment scenarios for Camargue, Southern France. European Journal of Agronomy 82, part B: 292-307. doi: 10.1016/j.eja.2016.09.009

Gambelli D, Vairo D, Zanoli R (2010) Exploiting qualitative information for decision support. Journal of decision systems 19 (4): 407–422

Gibbs GR (2007): Analyzing Qualitative Data. Sage, London

Kahn H, Wiener AJ (1968) The year 2000: a framework for speculation on the next thirty-three years. Macmillan, New York

Nauta WJ, Groen AF, Veerkamp RF, Roep D, Baars T (2005) Animal breeding in organic dairy farming: an inventory of farmers' views and difficulties to overcome. Netherlands Journal of Animal Science (NJAS) 53-1: 19-34

Oudshoorn FW, Sørensen CG, de Boer IJM (2009) Environmental evaluation of three alternative futures for organic dairy in Denmark. Agronomy Research 7: 691–705

Rozman Č, Pažek K, Kljajić M, Bavec M, Turk J, Bavec F, Kofjač D, Škraba A (2013) The dynamic simulation of organic farming development scenarios – A case study in Slovenia. Computers and Electronics in Agriculture 96: 163-172

Zanoli R, Barabanova Y, Vairo D (2015) What scenarios for the further development of organics in 2030? A participatory approach for scenario analysis. IFOAM Agribiomediterraneo International conference "Agroecology for Organic Agriculture in the Mediterranean", 10-13 September 2015, Vignola Castle (Modena) and SANA Bologna, Italy

Zanoli R, Gambelli D, Vairo D (2000) Organic farming in Europe by 2010: scenarios for the future. In: Organic Farming in Europe: Economics and Policy, vol. 8. University of Hohenheim, Hohenheim.

Zanoli R, Gambelli D, Vairo D (2012) Scenarios of the organic food market in Europe. Food Policy 37: 41-57

Willer H, Lernoud J (eds) (2015) The World of Organic Agriculture. Statistics and Emerging Trends 2015. FiBL-IFOAM Report. Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM – Organics International, Bonn.

National and regional Organic Action Plans to develop organic farming and supply chain – experiences and recommendations

Otto Schmid[1], Nic Lampkin[2], Susanne Padel[3],Stephen Meredith[4]

Key words: organic action plans, organic agriculture, policies, governance

Abstract

We report on experiences with national and regional Action Plans for organic agriculture in Europe. Action Plans provide a mechanism to integrate policies to develop and support organic farming and supply chains through a multiple-actor approach, recognising the market, environmental and other public good goals and challenges involved.

Acknowledgments

The study has been financed by IFOAM EU Group. The authors thank the national IFOAM EU representatives and national experts for their contribution and advice.

Introduction

Over the last decade the development of Organic Action Plans (OAPs) has gained momentum as a mechanism for achieving a more integrated and balanced approach to organic policy-making in different European countries and at EU level. However the uptake, effectiveness and continuity of OAPs can vary significantly from country to country. For instance, differing government priorities, the lack of ring-fenced public funding and the expectation that the organic sector should take the lead rather than government can impede the development of OAPs.

In a study and guide commissioned by IFOAM-EU Group (Schmid, Padel, Lampkin, Meredith 2016) an analysis was made on the current status of OAPs in EU and EFTA countries with a special focus on plans at national and regional level and an in-depth analysis of six OAPs in the Czech Republic, Denmark, France, Germany, Andalusia (Spain) and Scotland (UK). It also takes into account the OAPs developed at EU level by the European Commission. The guide builds on the EU-funded ORGAP project which undertook a comprehensive comparative review of several national and regional OAPs and produced a manual to support the development of OAPs and a toolbox for evaluation (www.orgap.org).

Material and methods

The guide is based on an investigation in all EU-countries with a standardized questionnaire through the IFOAM Group representatives on the status quo of Organic Action plans in 2015. Recommendations take the experiences into account from the ORGAP-Project and the on-going EU LEADER—Project "SME-Organics" (www.interregeurope.eu/smeorganics) with a focus on regional OAPs and Small and Medium Companies (SMEs).

[1] Research Institute of Organic Agriculture (FiBL), Switzerland. www.fibl.org, otto.schmid@fibl.org

[2] Organic Research Centre (ORC), England, www.orc.uk, nic.l@organicresearchcentre.com

[3] Organic Research Centre (ORC), England, susanne.p@organicresearchcentre.com

[4] IFOAM-EU Group, Belgium, www.ifoam-eu.org, stephen.meredith@ifoam-eu.org

Results

From 31 countries observed in Europe (European Union (EU) and European Free Trade Association (EFTA) countries), 12 countries were found to have an integrated support programme for organic agriculture as a national Organic Action Plan or a similar initiative under a different name (Tab. 1).

Table 1: National Organic Action plans (or similar support programme) in 2015 in Europe

Country	Running period of OAP	Period previous OAP	Implemen-tation year first OAP	Quantitative targets of current OAP
Austria	2015-20	2008-13	2001	20 % org. land by 2016
Croatia	2011-16	-	2011	8% org. farm land by 2016
Czech Republic	2011-15	2004-10	2004	15 % org. farm land by 2015, 3 % org. food consumption
Denmark	2012-20	1999-03	1995	(15 % org. land)
Estonia	2012-20	2007-13	2007	50 % increase of org land 2014-20
Finland	2015-18	-	2013	20 % org. farm land by 2020
France	2014-20	2008-12	2008	200 % org. farm land 2013-20
Germany	2013-20	2012-15	2001	20 % org. farm land - but no year
Italy	2014-20	2005-09	2005	none
Lithuania	2013-15	2007-10	2007	none
Luxembourg	2015-	2009-13	2009	none
Poland	2009-15	2011-14	2007	none
Slovenia	2005-15		2005	15 % org. land by 2015

Source: Schmid, Padel, Lampkin, Meredith 2016

19 countries were found to have no (or no more) a national OAP: Belgium, Bulgaria, Cyprus, Germany, Greece, Iceland, Italy, Latvia, Lithuania, Malta, Netherlands, Norway, Portugal, Romania, Slovakia, Spain, Sweden, Switzerland, United Kingdom.

In countries where the responsibility for agricultural and rural development policy lies with the regional or provincial governments, the initiative to develop an OAP is also taken at regional level. In this case OAPs exist in some but not all of the regions or provinces of 5 countries (Belgium, Germany, Spain, Switzerland and the United Kingdom). Regional OAPs in some parts were in: Belgium (Wallonia and Flanders); Germany (Bavaria, Baden-Wurttemberg, Hesse, Lower Saxony, Mecklenburg Western Pomerania, North Rhine-Westphalia, Saxony, Saxony-Anhalt, Thuringia) Spain (Andalusia, Valencia, Castilla y León, Pais Vasco and the Canary Islands); Switzerland (Fribourg, Jura); United Kingdom (Scotland).

A comparative assessment of the existing national and regional OAPs, from an organic sector perspective, found the Danish OAP to be most well developed and implemented, with other plans well received by organic stakeholders in Estonia, Finland, Slovakia and both regions of Belgium. OAPs have also been developed at EU level in the last 10-15 years. The first EU Organic Action Plan was published by the European Commission in 2004, and a second OAP was adopted by the European Commission in 2014.

Action Plan development process and administration

The survey of existing national and regional OAPs and case studies show that often but not always the first initiative to develop an OAP comes from government. A preparatory team or expert and advisory group with some representation from the organic sector is put in place, making the OAPs either a top-down or mixed initiative (combination of top-down and bottom-up).

The case studies in particular show that policymakers and administrators have an important role in the three critical stages of OAP elaboration. This includes:

Development: In most cases the OAP preparation phase lasts 12-18 months before any actions are implemented. Stakeholder involvement is often stronger at the beginning of the OAP development process, however follow-up activities with stakeholders to ensure the continuity of a plan does not always happen in practice. In most case studies OAP elaboration involved a status quo analysis. Judging by the stated objectives of the OAPs both production and market orientated supply chain development are considered in all cases with the aim of achieving a balanced development between supply and demand. OAP goal setting was strongly influenced by the policy environment.

Implementation: This stage can last from one year up to eight years. Implementation does not always coincide with relevant EU policy processes e.g. taking advantage of EU Rural Development Programmes (RDPs) measures under the CAP in order to adequately resource OAPs. This is particularly relevant as implementation is strongly influenced by available resources.

Evaluation: Monitoring and evaluation has received less attention at present. Very few of the OAP case studies foresaw either a formative evaluation (to learn lessons and improve plans following a learning cycle, supported with monitoring) or a summative evaluation (final performance evaluation). However, there are some examples e.g. Czech Republic where an evaluation was completed and lessons learned from a previous OAP used to shape the development of the next one.

Target setting: Nine countries (all four national case studies) and three regions (none of the regional case studies) have set quantitative targets under their OAPs. This is often related to the proportion of agricultural land that should be managed organically within a certain period. A few OAPs have set an annual target for the proportion of the food market to be supplied organically. However, in the majority of OAPs there is very little real progress in developing quantitative targets and for political reasons many governments plan no longer to set such targets.

Budget allocation: With the exception of Denmark and partly France, most OAPs have no specific budgets for their OAP development process (including support for stakeholder consultations and communication) as well as for specific measures to implement plans (with the exception of producer support covered by CAP). Some plans aim to include private funding for specific actions.

Communication: A good and continuous communication from the launch and the achievements of the actions in the OAP is a key factor for success. There are quite some differences between the case studies as to how this communication is done.

Focus areas of actions and support measures

Most national and regional OAPs focus areas and support measures cover a number of themes. These include:

Information: In the past the information measures were mainly addressed to consumers to make the EU and/or national organic logos better known at national level. Today, however more targeted promotion and information campaigns have been developed e.g. to build awareness at municipal level in schools.

Training and education: Many new plans emphasize the training and education of farmers whilst highlighting the need for integrating organic farming training into college and university curricula.

Research, innovation and development: The important role of research and development is explicitly mentioned in many plans. However the financial resources of the governments often do not correspond to the sector needs.

Producer support: To strengthen the supply base, most countries, even without OAPs, use the CAP to support organic producers in conversion or maintaining farmland organically. OAPs can help to target this support at specific sectors and build capacities in areas such as advisory services and infrastructural investments. Some OAPs therefore propose to use Rural Development funds for investment support or other structural measures to facilitate increased innovation.

Market development: Historically organic policy support has focused on production oriented land area payments. However under current and future OAPs, promotion and market development (including support for short supply chains) are considered a priority. Particular attention is given to public procurement and export opportunities in the many OAPs. Special educational seminars for supply chain actors have also been designed.

Measures related to inspection, certification and regulations: In some OAPs, emphasis is also given to inspection and certification e.g. an extension and/or improvement of organic standards on national level for special product groups or improvements in the efficiency and transparency of inspection.

Recommendations

OAPs seek to respond to the needs of the organic sector in a specific country and region whilst contributing to wider policy objectives. The development and implementation of OAPs should be seen as a partnership between policymakers and the organic sector. Below recommendations for more effective OAPs are set out, targeted at both policymakers and the organic sector.

General recommendations for all stakeholders:

- OAPs objectives should identify and address the specific needs of the organic sector in the country or region, focussing on future development potentials.
- Allocate a specific budget to the OAP to ensure sufficient financial and human resources are dedicated to implementation.
- Regular monitoring and evaluation should be well-integrated into the OAP.
- An effective OAP need a broad set of instruments that can tackle the organic sector supply and demand needs.

Specific recommendations for policy makers at national, regional and EU level:

- Facilitate participatory stakeholder involvement during the OAP development and implementation.
- Tailor some actions towards building capacities and a more resilient organic sector.

Specific recommendations for the organic sector:

- An OAP is not an end point in itself, but a strategic instrument for developing the organic sector goals in the context of wider policy goals.
- Aim to develop a broad stakeholder alliance that can support the OAP's long-term development and implementation.

References

Schmid O, Padel S, Lampkin N, Meredith S (2015) Organic Action Plans: A Guide for Stakeholders. IFOAM EU, Brussels

Schmid O, S. Dabbert S, Eichert C, Gonzalvez V, Lampkin N, Michelsen J, Slabe A, Stokkers R, Stolze M, Stopes C, Wollmuthová P, Vairo D and Zanoli R (2008) Organic Action Plans. Development, implementation and evaluation. A resource manual for the organic food and farming sector. Frick (CH), Research Institute of Organic Farming FiBL and Brussels, IFOAM EU Group. http://orgprints.org/13481

Participatory Ecobreeding for Agroecology

Dominique Desclaux[1]

Key words: Agroforestry, Participatory Plant Breeding (PPB), GxE interactions, Organic farming

Abstract

Agroforestry, as a topic to address the intersection of agronomy, ecology, genetics, and social sciences, obliges to rethink plant improvement. We propose to use the new term oïkosbreeding or Ecobreeding to emphasize the need of considering the whole ecosystem. The term refers to both place and action. Adapted to plant breeding, it implies to reconsider both the target and the way to achieve it. Concerning the target, by contrast with "formal" breeding, not only 'response' traits must be taken into account, but also 'effect' traits i.e. how plants influence ecosystem function. Concerning the way of breeding, as a great diversity of cropping systems are usually ranged under the banner of AgroEcology (agroforestry, organic, sustainable, integrated, ecofarm, etc…) leading to a diversity of outlets and markets, participatory approaches are essentials, and allow catching the diversity of requirements and the interactions between genotype and agronomical, ecological and social environment.

Acknowledgments

This study was implemented in the frame of the European project "Agroforestry that will advance rural development" (AGFORWARD). AGFORWARD has received funding from the European Union's Seventh Framework Program for Research, technological development and demonstration under grant agreement n° 613520.

Introduction

A great diversity of cropping systems can be ranged under the banner of Agroforestry (AF); we propose here to focus on design including field crops and trees, and to decidedly consider organic agroforestry as a component of agroecology cropping systems. While Agroforestry is largely studied with more than 22000 articles (period 1970-2015), referenced in the Web of Science, that contained the two keywords "agroforestry" and "crop" (Desclaux et al., 2016), in terms of genetics, very few studies are implemented on agroforestry. Indeed, when adding the keyword "breeding", the number of articles falls to less than 1700 (figure 1) and the majority concerns the breeding of the trees. Very few concern field crops and if any, the main aim is the evaluation of some varieties in AF systems (Singh et al., 2015; Sirohi et al., 2012; Tiwari et al., 2012), and not real plant improvement.

Farmers deplore that the crop varieties they grow are not adapted to their AF systems because no selection is made under these conditions. Therefore there is an urgent need to breed for AF.

When zooming on the ecosystem services offered mutually by the trees and the associated crops (MEA, 2005), Supporting (nutrient cycling, soil formation, primary production) and Regulating (climate regulation, flood regulation, disease regulation, water purification) services have to be considered. The facilitation and competition effects on shoots and roots between tree and crop lead to elaborate an efficient breeding strategy by choosing the relevant breeding criteria and by rethinking the way of breeding.

Breeding criteria for field crops associated to trees

[1] DiaScope unit- Inra- 34130 Mauguio, France, email : dominique.desclaux@inra.fr

Shade tolerance/ Maximisation of solar radiation use : A great number of studies report that the tree shade, by reducing the photosynthetically active radiation (PAR) intercepted by crops, leads to a decrease in yield. The reduction of PAR increases with the time (22% lower during wheat flowering, 56 % at maturity) (Li et al., 2008) and the yield of cereal can decreased by more than 50% (Dufour et al., 2013). The varieties proposed to farmers being all bred under full sun are not the best adapted to shade conditions. Integrate this criteria into a breeding program means to determine if it exists a genetic variability in the targeted crop for the following traits: (i) plant and leaf shape able to capture more light, (ii) photoperiodic need, (iii) radiation use efficiency (RUE) (Molero et al., 2015), (vi) phenology.

Soil Nutrient contribution: AF, by promoting a permanent input of litter, increases the organic matter content of the soil and of the microbial community (Araujo et al., 2012). Root-induced changes to the chemical environment of the rhizosphere are crucial to the nutrient acquisition of many plant species and include modifications to pH, reduction/oxidation conditions, complexation of metals and enzyme activity (Hinsinger et al., 2003). Molecules contained in tree root exudates influence the development of Arbuscular mycorrhizal fungi (AMF). AMF constitute a key functional group favoring short-lived crops growth by improving plant nutrition and protecting plants from stresses (Shukla et al., 2012). Breeding strategies should take into account functional traits like the ability of some crop varieties to increase their own AMF colonization when associated with trees, by analyzing the potential genetic variability for root exudates that favor mycorrhization. These traits have never or very few been studied in formal breeding, compared to nitrogen use efficiency (NUE) that is currently one of the main aim in formal plant breeding program.

Soil Water contribution: A fundamental hypothesis of AF is that diverse plant forms such as trees and crops occupy different soil strata with their root systems when grown in association. It leads to a degree of complementarity in their use of soil resources and especially of water. Rooting depth and the vertical distribution of root systems are of particular interest for AF. Response to root management must be regarded as a clear breeding aim. The annual crops develop their root system when those of the trees are already established. Parameters of root competitiveness, such as root length density, mycorrhization and flexibility in response to water and nutrient patches in the soil, have to be considered for predicting the outcome of interspecific root interactions (Schroth, 1999). These traits must be combined with the usual WUE (Water use efficiency) trait in AF plant breeding programs. Several authors have emphasized the critical role of arbuscular mycorrhizal fungi (AMF) in improving the ionic content and water parameters in hosts plants including sorghum (Augé et al., 2015), and barley (Tao et al., 2014).

Microclimate adaptation/ contribution: Planted in alignment or in hedges, trees play on two essential elements: radiation and air flow. They contribute to decrease daily amplitude of air (2.5 to 8°C) (Lott et al., 2009) and of soil temperature (5°C) (Van Noordwijk et al., 2014) and to play a role of windbreak. Wind may stimulate photosynthesis and increase yields in crop plants, while in different circumstances it retards growths or occasions physical damage (Grace, 1977). It seems therefore relevant to screen the crop genetic diversity under different situations of wind and temperature.

Pests and Diseases resistance: Some studies provide examples of reduction in pests with the use of AF (Girma, Rao, & Sithanantham 2000). This can be explain by lower populations of specialist herbivores in AF systems that contained both host and non-host plants, and by an increased abundance of predators, crop auxiliaries and parasitoids (Schroth et al., 2000). However, there are also instances where agroforestry has led to an increase in pest abundance. High nutrient availability in AF could lower carbon-nutrient ratios and also reduce the plant defense systems. The effect of agroforestry on pests and diseases does not only depend on crop type, but also on factors such as pest identity, microclimate, and the microclimatic preferences of the pest (Schroth et al., 2000; Pumarino et al., 2015). Therefore these traits must be evaluated in several situations.

Weed competition: Allelopathic effects of litter extracts and rhizospheric soil of agroforestry trees on the root growth of crops and other tree species have often been detected under controlled conditions (Ramamoorthy and Paliwal, 1993). But in the field it is still rather obscure as it is notoriously difficult to distinguish from other, soil-root and root-root interactions. In some studies, higher weed diversity has been shown to be associated with a higher proportion of insect-pollinated species thereby extending food potential for other groups of organisms and creating a source of complexity for the agro-ecosystem (Kuussaari et al., 2011). Breeding for this trait means to firstly screen the germplasm/varieties of field crops for both allelopathic potential and allelopathic response and to valorize it.

How to breed for Agroforestry?

Formal breeding methods were not always suitable to address the very large diversity of both environmental conditions and end-users needs. This large diversity is frequently encountered in AF Systems. Participatory plant breeding (PPB) methods represent alternatives aimed to improve local adaptation breeding, to promote genetic diversity, to empower farmers and rural communities. The term PPB refers to a set of breeding methods usually distinguished by the objectives (functional or process approach), institutional context (farmer-led or formal-led), forms of interaction between farmers and breeders (consultative, collaborative or collegial), location of breeding (centralized or decentralized), and stage of farmer's participation in the breeding scheme (participatory varietal selection or participatory plant breeding). Few PPB programs for AF are running at this time, but they are powerful to catch the diversity of the AF systems and to share knowledges between all the participants (Desclaux and Nolot, 2014).

Conclusion

Most often, breeding for Agroforestry is only seen as breeding for shade. But this reduced way of thinking ignores the numerous benefits of the trees. Because interactions are much greater in AF systems than in mono-cropping systems, a systemic approach is much more relevant than an analytic one. As a main difference with respect to conventional field crop breeding, breeding for AF obliges to consider traits influencing agroecological structure and function as important as- or more important than- the classical targeted traits such as yield or quality. Among these traits, shoots traits (growth form, leaf shape, photosynthetic rate, displaced phenology, etc..) and roots traits (shape, type of exudates, mycorrhization,etc..) must be highlighted. Some of them have even been counter bred in formal breeding. AF contributes to change perception of plant improvement towards an ecologic manner. Taking into account key concepts from community ecology –namely niche differentiation, facilitation, competition - and translating these into a breeding framework is necessary. Therefore, referring to the etymology, the term oikos-or eco-breeding should be used for AF breeding, in order to emphasize that it's necessary to take into account habitat of plants and the whole ecosystem. What must be considered is not only 'response' traits i.e. how plant responses to environmental stimuli, but also 'effect' traits i.e. how plants influence ecosystem function (Lavorel and Garnier, 2002). Moreover, the way of breeding must change to integrate the great diversity of AF practices and outlets. Including farmers, collectors, processors, consumers in a Participatory plant breeding program will lead to higher adapted varieties to AF.

References

Araujo, A.S.F, Leite L.F.C, Iwata B.F., Lira Jr M.A., Xavier G.R, Figueiredo M.V.B. (2012). Microbiological process in agroforestry systems. A review. Agronomy for Sustainable Development, 32(1), 215-226.

Augé, R.M., Toler, H.D., Saxton, A.M. (2015). Arbuscular mycorrhizal symbiosis alters stomatal conductance of host plants more under drought than under amply watered conditions: a meta-analysis. Mycorrhiza, 25:13–24

Desclaux , D. Nolot JM. (2014). Chapter : 20. Does the Seed Sector Offer Meet the Needs of Organic Cropping Diversity?. In Organic Farming, prototype for sustainable agricultures. S.Bellon, S.Penvern. Ed. Springer

Dufour, L., Metay, A., Talbot, G., & Dupraz, C. (2013). Assessing light competition for cereal production in temperate agroforestry systems using experimentation and crop modelling. Journal of agronomy and crop science, 199(3)

Girma, H; Rao, MR; Sithanantham, S. (2000). Insect pests and beneficial arthropods population under different hedgerow intercropping systems in semiarid Kenya. Agroforestry systems, 50 (3): 279-292

Hinsinger, P., Plassard, C., Tang, C., Jaillard, B. (2003). Origins of root-mediated pH changes in the rhizosphere and their responses to environmental constraints: a review. Plant Soil, 248, 43-59.

Kuussaari, M., Hyvönen, T., Härmä, O. (2011). Pollinator insects benefit from rotational fallows. Agriculture, ecosystems & environment, 143, 28–36.

Lavorel, S; Garnier, E. (2002). Predicting changes in community composition and ecosystem functioning from plant traits: revisiting the Holy Grail. Functional ecology, 16 (5) : 545-556

Li, F., Meng, P., Fu, D., & Wang, B. (2008). Light distribution, photosynthetic rate and yield in a Paulownia-wheat intercropping system in China. Agroforestry Systems, 74(2), 163-172.

Lott, J. E., Ong, C. K., & Black, C. R. (2009). Understorey microclimate and crop performance in a Grevillea robusta-based agroforestry system in semi-arid Kenya. Agric&Fo. Met., 149(6), 1140-1151.

MEA, Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Synthesis. Island Press, Washington, DC.

Meddich A., Oihabi,A., Jaiti F, Bourzik W. and Hafidi M.(2015). Rôle des champignons mycorhiziens arbusculaires dans la tolérance du palmier dattier à la fusariose vasculaire et au déficit hydrique. Botany 93: 369–377.

Molero, G., Rivera-Amado, A. C (2014) Dissection of Yield Potential Related Traits: What Shall We Focus On? in Reynolds, M. P. et al, 2015. Proceedings of the international TRIGO (Wheat) yield potential. CENEB, CIMMYT, Cd. Obregon, Sonora, Mexico 24-26 March 2015.

Pumarino L., Weldesemayat Sileshib G., Gripenbergc S., Kaartinena R., Barriosb E.,Nyawira Muchaned M. (2015). Effects of agroforestry on pest, disease and weed control: A meta-analysis. Basic and Applied Ecology, 16 573–582

Ramamoorthy, M; Paliwal, K. (1993). Allelopathic compounds in leaves of gliricidia-sepium (jacq) kunth ex walp and its effect on sorghum-vulgare l . journal of chemical ecology 19 (8): 1691-1701

Schroth G. (1999). A review of belowground interactions in agroforestry, focussing on mechanisms and management options Agroforestry Systems, 43: 5–34,

Shukla A., Kumar A., Jha A., Dhyani S.K., Vyas D. (2012). Cumulative effects of tree-based intercropping on arbuscular mycorrhizal fungi. Biology and Fertility of Soils, 48:899–909

Singh, N. R. ; Mishra, H. S. ; Tewari, S. K. ; Sumit Chaturvedi. (2015). Suitability of soybean varieties under second year Populus deltoides plantation in tarai region of Uttarakhand. Indian For. 141 (9) : 981-984

Sirohi, C. ; Rao, O. P. ; Rana, B. S. (2012). Varietal comparison of wheat and paddy under Populus deltoides based agri-silvicultural system in sodic soil.Indian Journal of Forestry, 35 (3) 291-294

Tao, L., Lin, G., Zhang, X., Yongliang, C., Shubin, Z., Chen, B. (2014). Relative importance of an arbuscular mycorrhizal fungus and root hairs in plant drought tolerance. Mycorrhiza 24(8), 595-602.

Tiwari, T. P., Virk, D. S., & Sinclair, F. L. (2009). Rapid gains in yield and adoption of new maize varieties for complex hillside environments through farmer participation.Field crops research, 111(1), 137-143.

van Noordwijk, M., Bayala, J., Hairiah, K., Lusiana, B., Muthuri, C., Khasanah, N., & Mulia, R. (2014). Agroforestry solutions for buffering climate variability and adapting to change. CAB-International, Wallingford, UK, 216-232.

Analysis of the real purchase behaviour of organic wine consumers

Isabel Schäufele[1], Ulrich Hamm[1]

Key words: organic wine, local wine, sustainability, consumer panel

Abstract

Surveys across different countries elicited that consumers had positive perceptions regarding organic wine production. However, other studies reported that positive attitudes towards organic food would not hold for organic wine. But how do consumers behave in real purchase situations? Data obtained from a panel of 30,000 households was used to analyse German organic wine consumers´ buying behaviour. Household attitudes regarding sustainable consumption were used for segmentation. Four clusters could be identified: "Disinterested in sustainable food", „Interested in local food", „Interested in organic food" and „Interested in organic and local food". The most promising consumer segment for organic wine from Germany is the cluster of consumers "Interested in organic and local food". Traditional wine producers like France, Italy and Spain should focus on consumers "Interested in organic food" in general.

Acknowledgments

This work was supported by the Federal Ministry of Food and Agriculture in the framework of the Federal Program on Organic Farming [grant number 2814OE014].

Introduction

Consumer studies in different countries revealed that consumers preferred organic over conventional wine (Janssen et al. 2012) and elicited a higher willingness to pay for organic wine (Brugarolas et al. 2010; Pagliarini et al. 2013; Wiedmann et al. 2014). However, Mann et al. (2012) showed that consumers preferred conventional over organic wine. Reasons could be the great importance consumers place on country of origin when it comes to wine purchasing decisions and the bad quality image associated with organic wine (Mann et al., 2012) particularly with regard to taste (Stolz and Schmid 2008). However, none of the articles examined real purchase situations. Do consumers prefer organic over conventionally produced wine when it comes to wine purchase decisions and on which attitudes are the buying choices grounded? The aim was to group consumers based on different attitudes towards sustainable consumption and to assess each group´s market potential for organic wine.

Material and methods

The study is based on a household panel dataset collected by the GfK Group (Nuremberg, Germany), one of the largest marketing research companies in the world. The GfK panel covers grocery purchases of 30,000 households in Germany, which is quite unique in size. We focused on households who bought organic wine at least once in the period between 12/2014 and 11/2015. One particular fact of the dataset is, that the purchase information is linked to socio-demographic data and statements on attitudes of each household leader. The analysis focused on statements on sustainable food consumption and environmental protection. On basis of factor analysis (principle components analysis) the variables were reduced to a lower number of unobserved variables (factors). Afterwards, k-means clustering was conducted on the factors to identify homogeneous

[1] Department of Agricultural and Food Marketing, University Kassel, Germany, www.uni-kassel.de/agrar/alm, i.schaeufele@uni-kassel.de

consumer groups; the number of clusters was determined by the ward method. Because the cluster analysis is sensitive to outliers, outliers were eliminated via hierarchical cluster analysis (method: single linkage) beforehand. In order to describe the clusters, they were tested for significant differences in various variables (socio-demographics, wine consumption behaviour) using single factor variance analyses (ANOVA) and chi square test.

Results

Factor analysis yielded in three factors which explained 63.3 % of the total variance. The factor “organic products” summarizes positive statements regarding organic production, e.g. organic products are healthier/taste better. The second factor “no individual responsibility for environmental protection” combines statements which express that environmental protection is not that important. The third factor “domestic products” unites positive statements on local and national production, e.g. high trust in local products and high quality of domestic food products. Based on the factor scores of 2,196 households four clusters were identified (see Table 1).

Table 1: Expenditure share and willingness to pay

	Cluster 1 Disinterested in sustainable food (21.7 %)	**Cluster 2** Interested in local food (21.5 %)	**Cluster 3** Interested in organic food (34.4 %)	**Cluster 4** Interested in organic and local food (22.3 %)
Expenditure share in %				
Organic wine	26^{ac}	21^{a}	34^{b}	29^{c}
Domestic wine	36^{a}	45^{b}	34^{a}	45^{bc}
Willingness to pay in €/L				
Conventional wine	3.39^{a}	3.44^{a}	3.95^{b}	3.58^{b}
Organic wine	4.12^{a}	4.26^{ad}	4.43^{bd}	4.57^{cb}

Shares and mean values with different letters differ significantly (p<0.05).

Attitudes towards the consumption of organic and local food were in line with wine purchase behaviour. For example, the cluster “Interested in organic food” had the highest expenditure share for organic wine. However, the cluster “Interested in organic and local food” showed the highest willingness to pay for organic wine. Focusing on consumer groups´ purchase behaviour we revealed divergences regarding organic and local wine: The cluster “Interested in local food” (“Interested in organic food“) showed highest (lowest) preference for domestic wine and lowest (highest) preference for organic wine. However, the cluster “Interested in organic and local food” (“Disinterested in sustainable food”) revealed high (low) preference for organic and domestic wine. The cluster of “Disinterested in sustainable food” was characterized by a relative low preference for domestic and organic wine. Organic red wine originated more frequently from other European countries than Germany. However, German organic rosé wine was bought comparatively often (see Table 2). Cluster 1 preferred to purchase organic wine at discount supermarkets and had the lowest willingness to pay for conventional wine. Consumers of the cluster “Disinterested in sustainable food” were younger and had a relatively low monthly net income. The cluster “Interested in local food” showed a relatively high preference for organic white wine from Germany; direct wine purchases (producer/cooperative/cellar) were relatively frequent. Compared to the other clusters, consumers of the cluster “Interested in local food” were often older or middle-aged and had a lower formal education level and lower incomes. The cluster “Interested in organic food” had an above average preference for organic red wine from Germany and white wine from the rest of Europe. Organic wine was bought relatively often in supermarkets. Consumers of this cluster were more likely to be younger and middle-aged with higher formal education levels and higher incomes. When purchasing food products sustainability labels and fair trade was comparatively important. The cluster "Interested in organic and local food" had the highest willingness to pay for organic wine and together with the cluster "Interested in local food" the highest expenditure share for domestic wine. Organic wine purchases were preferably conducted at wine specialty shops. The consumers of the cluster "Interested in organic and local food" were more likely to be older than 70 years and in the middle income class.

Table 2: Share of organic wine purchases by origin and wine colour (N=6,577)

		Cluster 1 Disinterested in sustainable food (21.7 %)	**Cluster 2** Interested in local food (21.5 %)	**Cluster 3** Interested in organic food (34.4 %)	**Cluster 4** Interested in organic and local food (22.3 %)
Red	Germany	9.2 %[a]	18.0 %[b]	22.4 %[c]	18.7 %[b]
	Rest of Europe	90.8 %[a]	82.0 %[b]	77.6 %[c]	81.3 %[b]
White	Germany	28.4 %[a]	43.7 %[b]	28.9 %[a]	33.1 %[a]
	Rest of Europe	71.6 %[a]	56.3 %[b]	71.1 %[a]	66.9 %[a]
Rosé	Germany	60.9 %[a]	20.8 %[b]	20.4 %[b]	40.0 %[c]
	Rest of Europe	39.1 %[a]	79.2 %[b]	79.6 %[b]	60.0 %[c]

a,b,c,d shares of clusters with different letters differ significantly (p<0.05). Wine origins outside Europe account for less than 1% of organic wine expenditures and were therefore excluded of the analysis.

Discussion

There seems to be a close relationship between actual purchase behaviour and attitudes; the so called "attitude-behaviour gap" appears to be rather low for consumers of organic wine. Consumers who preferred organic wine the most (Cluster 3) had strong pro-environmental attitudes and a preference for fair-traded food. Therefore a comprehensive communication on sustainability issues is recommended. However, Cluster 3 had the lowest interest in local production.

Like Long and Murray (2013), we detected two different groups of local consumers. Those, who are at the same time strongly committed to organic production (Cluster 4) and those who are exclusively supporting local production (Cluster 2). We assume that consumers of Cluster 4 purchase local, organic wine for the perceived higher quality in terms of taste and health. Opposing this, we conclude that the consumer group only interested in local food (Cluster 2) is less quality oriented.

References

Brugarolas M, Martinez-Carrasco L, Bernabeu R, Martinez-Poveda A (2010) A contingent valuation analysis to determine profitability of establishing local organic wine markets in Spain. Renewable Agriculture and Food Systems 25:35–44

Delmas MA, Grant LE (2008) Eco-labeling strategies: The eco-premium puzzle in the wine industry. American Association of Wine Economists, Working Papers No. 13

Janssen M, Zander K, Hamm U (2012) Präferenzen und Zahlungsbereitschaft deutscher Verbraucher bei Öko-Wein. Abschlussbericht zum gleichnamigen Forschungsprojekt im Rahmen des BÖLN. Universität Kassel. URL: http://orgprints.org/20975/1/20975-10OE087-uni-kassel-hamm-2012-zahlungsbereitschaft-fuer-oekowein.pdf. Accessed June 30, 2016

Long MA, Murray DL (2013) Ethical Consumption, values convergence/divergence and community development. Journal of Agricultural and Environmental Ethics 26: 351–375

Mann S, Ferjani A, Reissig L (2012) What matters to consumers of organic wine? British Food Journal 114: 272–284

Pagliarini E, Laureati M, Gaeta D (2013) Sensory descriptors, hedonic perception and consumer’s attitudes to Sangiovese red wine deriving from organically and conventionally grown grapes. Frontiers in Psychology 4: 1–7

Stolz H, Schmid O (2008) Consumer attitudes and expectations of organic wine. http://orgprints.org/13974/. Accessed August 24, 2016

Wiedmann K-P, Hennigs N, Behrens SH, Klarmann C (2014) Tasting green: An experimental design for investigating consumer perception of organic wine. British Food Journal 116: 197–211

Estimating missing organic data by multiple imputation: the case of organic fruit yields in Italy

Francesco Solfanelli[1], Danilo Gambelli[1], Daniela Vairo[1], Raffaele Zanoli[1]

Key words: organic yields, missing data, multiple imputation

Abstract

Data on organic yields are still quite sparsely reported by official statistical sources for most of the European countries, including Italy. However, yield data is essential both at the micro and macro level to understand the economic sustainability for organic farmers, to verify the relative profitability conditions that could lead to widespread conversion of farmers and to assess the potential of organic farming for feeding the world. The aim of our study is to provide a review of available yield data and a feasible method to estimate missing data on organic yields from available sources. We apply Multiple Imputation (MI) exploiting the available data, expert assessment and structural information to recover missing data on organic fruit crop yields for the Central regions in Italy. This approach provides encouraging results, and interesting opportunities for further analysis.

Acknowledgments

This publication was generated as part of the ORGANICDATANETWORK Project, agreement no. 289376 (http://www.organicdatanetwork.net), with financial support from the European Community under the 7th Framework Programme. The publication reflects the views of the author(s) and not those of the European Community, who is not to be held liable for any use that may be made of the information contained.

Introduction

Detailed and reliable data on organic yields is essential both at the micro and macro level. From a micro perspective, this information can be used to estimate the volume of crop production. Data on volumes are essential for producers, processors and traders that can easily identify areas of surpluses or deficits in the organic market. Crop specific yield data are also a crucial information that could support the decision of conversion to organic for different farm types and regions. From a macro perspective, access to reliable data on organic crop yields is crucial to assess the potential of organic farming in terms of food security. Data on yields are also necessary for policymakers, administrators, and scientists concerned with planning and evaluation of the organic sector (Stolze and Lampkin 2009). Despite their relevance, available data regarding organic crop yields is not nearly as detailed and reliable as overall (conventional and organic) agricultural statistics.

The aim of the present study is to apply a statistical procedure to recover missing data on organic yields. We refer to data on organic production in Italy, one of the leading organic-producing countries in the EU. In Italy, only very basic data on organic production, such as certified organic holding, land areas and livestock numbers is available and reported. Detailed yield data is only available from ISTAT for the aggregated agricultural sector (i.e. conventional and organic farms), while few specific organic yield data are available from FADN samples and grey literature. In particular, here we demonstrate the use of Multiple Imputation (MI) (Rubin 1987; Schafer 1997) to fiil-in the gaps in the data on organic fruit yields for the Central regions in Italy.

[1] Università Politecnica delle Marche, Ancona, Italy, Via Brecce Bianche Ancona (AN) Italy - 60131,
E-Mail solfanelli@agrecon.univpm.it

Material and methods

While few reports provide estimates of production volumes and value, basically no studies have proposed estimates of the specific organic crop yields at country/regional level, and with a reasonable degree of precision (Gerrard et al. 2012). Only few and quite early studies concerning organic yield estimates can be found in scientific literature. Most of them are based on literature review and expert assessments (see among others Offermann and Nieberg 2000), and in some cases they only provide organic yields in relative terms with respect to conventional yields (De Ponti et al. 2012; Ponisio et al. 2015).

Data on crop yield considered in this study refer to five regions in central Italy and were estimated by cross-checking information from different sources: ISTAT, FADN, expert assessment and literature review. ISTAT's (Italian National Institute of Statistics) dataset provides data on total crop yields for the year 2010. INEA (National Institute of Agricultural Economics) provides data regarding both total and organic yields obtained by a FADN sample in the years from 2010 to 2013. Expert opinion was elicited in the five selected regions, which provided additional data on organic fruit crop yields. The expert survey was conducted in winter 2014 through contact and feedback with the ISMEA (Institute for study, research and information on agricultural and agro-food market) regional experts. Finally, a literature review concerning appropriate recent scientific publications and studies was also used to supplement experts' opinions. To verify the consistency of organic yield estimates collected from experts and literature, we have used official conventional data as a benchmark: in particular, we have deleted organic crop yield data from expert assessment exceeding the official conventional yield data. A common database was produced, merging data from each of the four sources. The average values of both organic and total crop yields were computed. The database includes a panel of 40 observations referring to eight different fruit crops for the five regions considered in the analysis. The missing values for the variable organic crop yield are 25. Among the various procedures suggested in the literature to deal with these missing data, Multiple Imputation (MI) – firstly proposed by Rubin (1976) - has emerged as one of the more common modern options. We apply MI based on Markov Chain Monte Carlo (MCMC) simulation, to the estimate missing value with an iterative process. As a result, we obtain an estimation of the missing yield data combined with the respective confidence intervals.

Model specification and results

The specification of the imputation model is the first step in MI. According to Rubin (1987), a linear regression imputation method can be used to fill in missing values of continuous variables, such as organic crop yield. MI has proven to be more robust and reliable than alternative methods for missing data imputation like list wise deletion and regression models (Schafer 1997). Let $Y_{i\,j}$ = ($Y_{i\,j;\,obs}$,$Y_{i\,j;\,mis}$) be the desired value of the partially observed average organic crop yields in our sample of size 40; where $Y_{i\,j;\,obs}$is the observed value and $Y_{i\,j;\,mis}$is the missing value. Let $X_{i\,j}$ denote the average total crop yield, which in our data set are fully observed, and β the relative coefficient. Let α_j be the regional dummy and $\delta_j$the relative coefficient. Let $\varepsilon_{i\,j}$ the residual. The imputation model can be written as follow:

$$Y_{i\,j} = \alpha_j\,\delta_j + \beta\,X_{i\,j} + \varepsilon_{i\,j} \qquad (1)$$

where i=1,…,8 refers to the 8 crops; j = 1,…,5 refers to the 5 region.

Once the model is specified, the first step in the MI procedure consists in the computation of the mean vector and covariance matrix (starting value) of the data that do not have a missing value ($Y_{i\,j;\,obs}$). Based on this available prior distribution a first complete dataset is created filling the missing values with random numbers. The second step takes the now completed dataset (observed plus the estimated missing values) and generates other estimates for both the mean vector and covariance matrix, which are then used for the imputation of other missing values. Following

Graham et al. (2007) this procedure can be iterated for several steps. Due to the high proportions of missing values, we run 100 iterations. According to Rubin's rules, the final estimate is the average of the estimates produced in each iteration (Rubin 1987). Table 1 shows, for reason of space, the results for yield data for five main fruit crops only, with the respective confidence intervals; official total yield data from ISTAT are also reported as a benchmark.

Table 1: Completed Yield data (t ha-1) of the main fruit crop by region

Crop	Region	Organic Yield Estimates (t ha^{-1})	Confidence interval (α=0.05)		Total Yield – ISTAT (t ha^{-1})
Apples	**Abruzzo**	**16.65**	**16.40**	**16.89**	**24.05**
	Lazio	**14.66**	**14.35**	**14.97**	**19.20**
	Marche	**13.56**	**13.28**	**13.85**	**20.65**
	Tuscany	15.00			19.01
	Umbria	**15.90**	**15.57**	**16.23**	**19.37**
Apricots	Abruzzo	6.50			9.28
	Lazio	**6.06**	**5.77**	**6.35**	**8.73**
	Marche	8.20			12.81
	Tuscany	11.11			11.11
	Umbria	**3.76**	**3.50**	**4.03**	**5.00**
Kiwi	**Abruzzo**	**16.18**	**15.91**	**16.44**	**18.28**
	Lazio	16.25			19.20
	Marche	**10.02**	**9.82**	**10.22**	**13.44**
	Tuscany	**11.71**	**11.49**	**11.93**	**12.67**
	Umbria	12.20			16.00
Peaches	**Abruzzo**	**12.49**	**12.24**	**12.73**	**15.55**
	Lazio	**8.85**	**8.60**	**9.11**	**13.97**
	Marche	9.40			16.74
	Tuscany	16.86			16.86
	Umbria	**12.43**	**12.14**	**12.73**	**15.10**
Pears	**Abruzzo**	**16.49**	**16.26**	**16.71**	**18.94**
	Lazio	**11.05**	**10.81**	**11.30**	**14.50**
	Marche	12.80			15.83
	Tuscany	15.00			15.77
	Umbria	**11.83**	**11.53**	**12.13**	**15.31**

In bold the imputed values.

According to our results, organic yields are on average about 80% of total yields, with substantial differences between crops and regions (see Table 1). Results seemgenerallyreasonable, and the confidence interval of the organic yield estimates are quite narrow. On one hand, for some crops and in some regions (e.g. peaches for Marche and Lazio) the organic-conventional differential is much higher. On the other hand, in other combinations of crop and region (i.e. apricots and peaches for Tuscany) the yield gap is null.

Discussion

Information about yields of organic productions is among the key aspects that affect the decision of farmers to convert to organic, and is at the basis of the general debate concerning the capability of organic farming of providing food in sufficient amount for the increasing world population. Nevertheless, the availability of accurate and complete data about organic crop yields in Europe is still scarce. Our study shows that MI is an effective method for improving the availability of organic yield data when statistical information is scattered and incomplete. However, MI may benefit from additional data concerning site-specific production conditions and the relevance of the crops in the various regions. Longer time series for yield data would improve the performance of MI procedure and allow for more accurate consistency checks. Information gathered from data can also be integrated by experts' knowledge who can contribute to validate MI results.

References

De Ponti T, Rijk B, Van Ittersum M K (2012) The crop yield gap between organic and conventional agriculture. Agric Sys 108:1-9. doi:10.1016/j.agsy.2011.12.004.

Gerrard CL, Vieweger A, Padel S (2012) D2.1 Report on data collectors: Inventory of data collecting and publishing institutions, OrganicDataNetwork deliverable 2.1, Report to the EU Commission, The Organic Research Centre, UK. http://orgprints.org/23009/1/OrganicDataNetwork_D2%201_Report%20on%20data%20collectors_Inventory%20of%20data%20collecting%20and%20publishing%20institutions.pdf. Accessed 28 April 2017.

Graham JW, Olchowski AE, Gilreath TD (2007) How many imputations are really needed? Some practical clarifications of multiple imputation theory. Prev Sci 8: 206–213. doi: 10.1007/s11121-007-0070-9.

Offermann F, Nieberg H (2000) Economic Performance of Organic Farms in Europe. Organic Farming in Europe: Economics and Policy - Vol. 5. University of Hohenheim, Stuttgart.

Ponisio LC, M'Gonigle LK, Mace KC, Palomino J, de Valpine P and Kremen C (2015) Diversification practices reduce organic to conventional yield gap. Proceeding of the Royal Society B: Biological Sciences. doi: 10.1098/rspb.2014.1396.

Rubin DB (1976) Inference and missing data. Biometrika 63: 581-592. doi:10.1093/biomet/63.3.581.

Rubin DB (1987) Multiple Imputation for Nonresponse in Surveys. John Wiley & Sons, New York.

Schafer JL (1997) Analysis of Incomplete Multivariate Data. Chapman and Hall, New York.

Stolze M, Lampkin N (2009) Policy for organic farming: Rationale and concepts. Food Policy 34(3): 237-244. doi: 10.1016/j.foodpol.2009.03.005.

"Organic +" – How advertisement campaigns construct a shattered image of organic farming

Valentin Fiala[1], Bernhard Freyer[1]

Key words: Advertisement campaigns, organic 3.0, organic values, media frames, multimodal analysis, organic quality

Abstract

In societies where only a small fraction of people have direct experience with agriculture, media representations of organic farming are an important source of information. We conducted a multimodal analysis of TV clips from two Austrian advertising campaigns for organic brands to find out how both companies present their products and construct an image of organic farming. The results show that both campaigns frame organic not as a unified but as a diversified field and position their brands as products of a higher level of quality. This positioning as "organic+" includes qualities that exceed the requirements of organic regulations—e.g., regional production—and also ties traditional values to their brands. This research reassures the importance of the current discussion about "Organic 3.0" in illustrating if organic wants to become a role model for sustainable farming it must embrace new aspects that exceed regulations.

Acknowledgments

1000 thanks to Milena Klimek for proofreading this article. She is cool.

Introduction

Since its pioneer days organic farming has developed out of several grass root initiatives and into an institutionalized and regulated part of the current agro-food system (Vogt, 2007). During this development organic farming has been defined through official standards. These standards provide a legal foundation for organic production,yet cannot entirely encompass the richness and diversity of the organic movement. Parallel to this development a socio-technical change in agriculture sectors made it possible that today only a small fraction of people work or have close contact to the farming sector. For many people direct experience with agriculture is decreasing and knowledge about farming is predominantly achieved through second-hand media. Studies in Europe and the US show that many people without a farming background have little agricultural literacy and hold specific and often clichéd images about farming that are connected to stereotypical representations in mass media (Aubrun, *et al.* 2005a, 2005b; Duncan and Broyles, 2006; Matscher and Schermer, 2010).

The few direct agricultural experiencespeople have and the abstract legal definition of organic does not provide enough of a foundation to complete the image people in modern food systems have about organic farming. Representations transported by mass media play an important role and are a very powerful way to evoke these images (see Hall, 1997). Therefore we investigated how organic farming is presented in different Austrian TV advertisement campaigns. We focused on the visual and textual information that was used to represent organic farming in the clips, what themes were addressed, and how organic farming was framed. This analysis is helpful for the ongoing Organic 3.0 debate (i.e., the attempt to establish organic as the global role model for sustainable farming(Arbenz, Gould, & Stopes, 2015) and move it beyond the current certification regime). Our

[1] University of Natural Resources and Life Science, Vienna (BOKU), IFÖL, http://www.nas.boku.ac.at/ifoel/ , valentin.fiala@boku.ac.at

analysis delivers insight into how this 'moving beyond the legal definition'is already thematised in media representations.

Material and Methods

To understand how organic was constructed in the two advertisement campaigns we used frame analysis. Framing describes the process of constructing reality by selecting certain aspects and making them more salient (Entman, 1993). In the context of mass media, so-called media frames can be defined as the *"central organizing idea or story line that provides meaning to an unfolding strip of events"* (Gamson and Modigliani, 1989, p. 143). An 'organic' frame is therefore a specific way to present organic to the audience. We studied two different advertisement campaigns launched in Austria by two large European retailers advertising their own organic brands: JaNatürlich! (JaN) and Zurück zum Ursprung (ZZU). The analysed material consisted of 33 television ads. Originally the clips have been aired on Austrian television. Later they have been made public on the online platform Youtube from where we collected them. Table 1 provides an overview of the analysed material.

Table 1: Analysed material of advertisement campaigns

Campaign	# of clips	Average run time	Total # of shots	Upload on Youtube
JaN	18	33.2 seconds	295	7.12.2009 -10.10.2016
ZZU	15	24.5 seconds	257	24.09.2009 - 5.10.2016

Often frame analysis focuses on a broad analysis of a large number of articles and/or pictures. Detailed analysis about the specific use of text and visual elements within the single articles or pictures are often not conducted. In contrast to that, we have a much smaller scope of analysis, but place more emphasis on what visual and textual elements are used in the clips. TV clips use different modes to create meaning. Hence our analysis is multimodal and we take not only written, but also visual information into account (Kress and Van Leeuwen, 2001).

First, we conducted a qualitative content analysis of the single shots—i.e., the film sequence between cuts—and analysed relevant language and visual content. Second, based on the content analysis, we identified the addressed themes and implied values in a semiotic analysis (for an overview on both analytical approaches see Rose, 2011). Third, we used this information in a frame analysis and asked what the 'central organizing idea' was that constructs an image of organic. Finally, we compared the different campaigns.

Results

Table 2 shows with what textual information the audience of the clips is confronted. Due to space limitation we cannot provide concrete text examples, but only indicate in column two, which plots have been used in the clips—e.g., text was used to tell a story about a romantic relationship. Furthermore table 2 shows the visual information provided in the clips—i.e., visual elements used in the shots and the showed performances of actors. Finally, it names the overall themes that have been addressed in the single advertisements. The numbers in brackets indicate in how many clips a plot, visual, theme etc. appeared.

Generally, the two campaigns use different advertising strategies. In the JaN campaign the plots of each clip evolves around the life of a middle-aged, single, organic farmer who lives together with his talking pig. Many clips are about the romantic relationship between the farmer and the main female actor of the clips, who is a young teacher in a nearby village. The clips aim to be humorous and punch lines are delivered at the end of them. In the campaign of ZZU the audience follows

Werner Lampert (the founder of ZZU and a pioneer of the Austrian organic scene) on his journey as he visits different places in Austria to show where and how organic products of ZZU are produced and processed. Through this storyline he often takes on the role of an explorer, or the role of an old lecturer, who teaches the audience about sustainability.

Table 2: Textual and Visual Information and Addressed Themes of TV Clips

Campaign	Text information (plots)	Visual setting and performance	Addressed themes
JaN	Romance (8); recreation (5), family/ children (3), competition (2), funny characteristics of animals (2), differences of farmers and business (1);	Idyllic (often alpine (10)) landscape; traditional clothes, old farm machinery, infrastructure, tools and practices; high degree of manual work; folkloric decoration; traditional rural communities; stereotypical gender roles (all clips)	Regional production(4); very strict species orientated husbandry (4); nature protection (4); stricter organic quality (4); product diversity (4); superior product quality (3), stricter controls (1)
ZZU	The founder of ZZU visits places important for ZZU (agricultural production or food manufacturing) and explains what is happening (all clips)	Idyllic alpine landscape (9); other idyllic landscape (2), cows (6); bakery (4), traditional village (2); in general lower tech farm machinery, farmers often in traditional, sometimes in working clothes, bakeries look modern, and use up to date technology	Regional production (8); sustainability/nature protection (7), stricter/ superior organic quality (5), traditional handcraft (4), small scale farming (2), transparency (1), fairness (1), regional economics (1), species orientated husbandry (1)

The visual elements of "JaNatürlich" show a stereotypical and romanticized image of organic farming. This exaggerated picture fits well with the plots of the clips, which do not aim to represent the real world (this is obvious since one of the main characters is a talking pig). Additionally, the actors perform stereotypical gender roles. The main male character, the farmer, performs physical labour. The main female character, a primary school teacher, educates children. Between the two characters a classic romantic relationship develops. The visuals of ZZU illustrate an idyllic Austrian landscape and often focus on natural landscape elements and free-range animals. Aside from actors often seen in traditional dress and a strong focus on traditional handcraft, there is however, a clear attempt to show other aspects such as actual production processes.

Therefore both campaigns highlight traditional values such as: origin, customary family life, handcraft, manual labour, intact natural environments, and untouched and beautiful alpine landscapes.[2] The clips of the campaigns address different themes. All of the themes address certain qualities of their products and many of which exceed organic standards. The most prominent themes are regionality and sustainability. Finally both campaigns use slogans to summarize their key message. Throughout their campaign ZZU uses mostly the slogan *"So weit muss bio gehen – zurück zum Ursprung"* (That's how far organic has to go – back to the roots). JaN uses varieties of the phrase *"Am besten ist Bio wenn…"*. (Organic is best, if...). The phrase is completed with the main message of the clip, for example "Organic is best, if animals have a lot of space to run free".

[2] These are all values often connected with a traditional image of Austria.

Discussion

Our analysis identified how the image of organic farming is constructed and framed in two Austrian advertisement campaigns. In both campaigns the brands are presented as organic products that exceed 'average' organic quality. Therefore organic is presented as a diversified sector with the possibility to distinguish different types and qualities of organic according to additional qualities—exceeding organic standards. Therefore we call this frame "organic+". The more detailed analysis also revealed subtle values, which are used to fill this frame and therefore create an identity of organic farming. Here, regionality, anidyllic Austrian landscape, traditional handcraft, customary gender roles and a bygone way of farming are important. Although this is true for both campaigns, the JaN campaign paints a more stereotypical picture.

Contributions to Organic 3.0

These results support IFOAM's (International Federation of Organic Agricultural Movements) idea that Organic 3.0 should keep organic regulations as a solid baseline, yet aim for continuous improvement and be open for other aspects of sustainable farming, because that is how organic brands are already marketed. Here regionality plays an important role The results also show the prevalence of stereotypical and unrealistic organic farming images and their connections to very traditional values. Organic 3.0 must react to these problematic aspects. Its proposed outreached to a broader audience and its positioning as the future for sustainable farming must also include a dialog about farmers' reality and must contest such a nostalgic view of organic.

References

Arbenz, M., Gould, D., & Stopes, C. (2015). Organic 3.0 or truly sustainable farming and consumption. Bonn: IFOAM - Organics International.

Aubrun, A., Brown, A., & Grady, J. (2005a). Harmfull and Productive Pattersn in Newspaper Presentations of Food Systems. In A. Webb & R. Hestermann (Eds.), Perceptions of the U.S. Food System: What and How Americans Think about their Food (pp. 57-87). East Battle Creek, MI Kellogg Foundation.

Aubrun, A., Brown, A., & Grady, J. (2005b). Not While I'm Eating. In A. Webb & R. Hestermann (Eds.), Perceptions of the U.S. Food System: What and How Americans Think about their Food (pp. 31-57). East Battle Creek, MI Kellogg Foundation.

Duncan, D. W., & Broyles, T. W. (2006). comparison of student knowledge and perceptions toward agriculture before and after attending a Governor's School for Agriculture. NACTA journal(March), 16-21.

Entman, R. M. (1993). Framing: Toward clarification of a fractured paradigm. Journal of communication, 43(4), 51-58.

Gamson, W. A., & Modigliani, A. (1989). Media discourse and public opinion on nuclear power: A constructionist approach. American journal of sociology, 1-37.

Hall, S. (1997). Representation: Cultural representations and signifying practices. London: Sage.

Kress, G. R., & Van Leeuwen, T. (2001). Multimodal discourse: The modes and media of contemporary communication. London: Bloomsburry.

Matscher, A., & Schermer, M. (2010). Zusatznutzen Berg? Argumente für den Konsum von Bergprodukten. Agrarwirtschaft, 58(2), 125-134.

Rose, G. (2011). Visual methodologies: An introduction to researching with visual materials. London: Sage.

Vogt, G. (2007). The origins of organic farming. In W. Lockeretz (Ed.), Organic farming: An international history (pp. 9-29). Wallingford: CABI.

Using Q Methodology to facilitate the establishment of the 2030 vision for the EU organic sector

Raffaele Zanoli[1], Eduardo Cuoco[1], Serena Mandolesi[2], Simona Naspetti[2]

Key words: organic sector, Q methodology, vision

Abstract

The aim of this study is to understand perspectives on a desired future for the organic sector in Europe in order to develop a shared vision. This purpose was obtained applying the quali-quantitative analysis of Q methodology (Brown, 1980). A selected group of experts from different nationalities, recruited during the BioFach Congress 2015 were asked to provide their viewpoints on what should be the vision for the organic sector in Europe in 2030, sorting 48 statements containing possible future visions about the organic sector. Results indicated two distinct and common positions about the future of EU organic sector.

Introduction

What is the future for organic sector in Europe? In the last decade, the greater interest in a healthier diet and a more ecological society increased the importance of the organic food and agricultural business (Zanoli *et al.,* 2012; Zanoli, 2004; Jensen *et al.,* 2011, Willer and Kilcher, 2011). According to Jensen et al. (2011) the number of consumers for the organic market is going to increase in Europe. In particular about food, consumers are willing to pay more identifying a strong link with health and quality of life. Organic food and farming are considered more sustainable compared to conventional sector in particular because farming systems do not use chemicals (Scott *et al.,* 2014). In addiction, the development of a more sustainable consumption and behavioural changes in favour of more "green" solutions are also increasing in China but not with the same growth in Western Europe and North America, where the organic sector is well established (Thøgersen *et al.,* 2016)

Despite positive trends for organic sector, it is important to understand how stakeholders perceive the role of the organic sector and how the value of organic food and farming could be enhanced and communicated.

The aim of this study is to take a picture of the current visions of the organic sector through the experts' viewpoint and to understand if there is the intention and possible ways for extending its niche.

In order to discover the existing perspectives for the organic sector a selected group of experts was engaged. Opinions from a group of experts were collected applying Q methodology (Brown, 1980) widely used to investigate the existing viewpoints about a specific topic. Q methodology traditionally applied in psychology and medical research (McKeown and Thomas, 2013), is now applied in several areas of interest and also a wide literature about its application in agricultural and rural science exists (Pereira et al., 2016; Mandolesi *et al.* 2015; Nicholas *et al.,* 2014; Hall, 2008; Eden *et al.,* 2008; Davies and Hodge, 2012).

[1] D3A, Università Politecnica delle Marche, Via Brecce Bianche, Ancona, Italy, eMail: zanoli@agrecon.univpm.it
[2] SIMAU, Università Politecnica delle Marche, Via Brecce Bianche, Ancona, Italy

Material and methods

Q methodology (Stephenson, 1935; Brown, 1980; McKeown and Thomas, 2013) is used for the systematic study of human subjectivity. In Q methodology, people with similar viewpoints are grouped into the same group by the application of factor analysis between individuals (not between variables). According to this methodology, each respondent produces a Q sort that is cross-correlated with the Q sorts collected from other respondents. Then, factor analysis is applied in order to define groups of people that have a shared or similar point of view. The emerging factors are than interpreted basing on the factor arrays and usually a name is given to each factor extracted.
A Q study consists of five steps (McKeown and Thomas, 2013): construction of the “concourse”, development of the Q sample, selection of the P set, Q sorting, and Q factor analysis. In Q methodology, the “concourse” refers to, “the flow of communicability surrounding any topic” (Brown, 1993) and it can include any existing materials (e.g. statements, pictures etc.) about the topic under investigation (Brown, 1980). For this study, the “concourse” included over 500 statements that were collected from workshops took place in Italy and Spain, congresses, research projects and surveys (World Organic Congress in Istanbul 2014, SA- Soil Association Strategy to 2020, 3.0 – Organic 3.0, SOAAN, TIPI – research vision of TIPI). The “concourse” was reduced to 48 statements, called Q sample, applying the Fisher experimental design principles, as suggested by Brown (1980). The list of the final Q sample is reported in Table 3 reported in appendix.

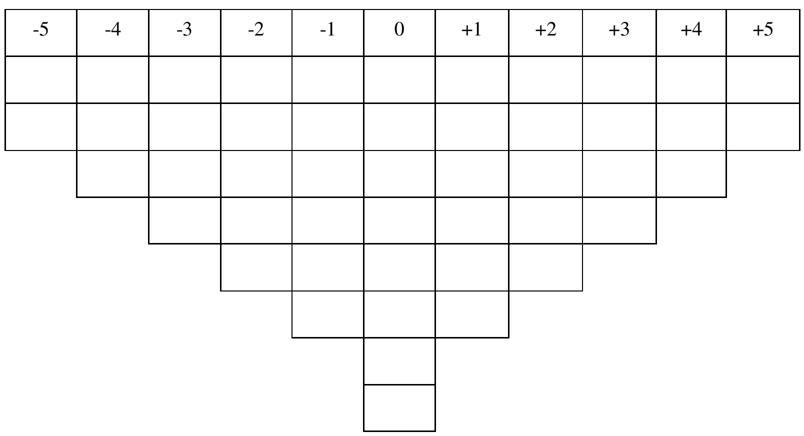


Figure 1. Q sorting distribution

To obtain this final Q sample, the 500 statements were classified in 16 main categories. Then, only few statements for each category, the best representing statements, were selected and included in the final Q sample. The 16 categories used to classify the statements were: “Value Chain Interactions”; “Employment, Income and Access to Land”, “Diets & Nutrition, Health”; “Mainstreaming VS Niche”; “Production Methods”; “Rural-Local”; “Organic & Conventional: food production in general”; “Certification”; “Procurement”; “Policy and Regulation”; “True-Cost”; ”Research”; “Education”; “Organic Principles”; “Agro-ecology” and “Miscellaneous”.

According to Brown (1980) a Q study requires only a limited number of respondents: “all that is required are enough subjects to establish the existence of a factor for purposes of comparing one factor with another”. Q sorts were collected during BioFach (the World's leading Trade Fair for Organic Food) in February 2015. The P sample, participants of the study, were 23 experts recruited during BioFach 2015 from different countries and were members of different organization or companies active in the organic sector. Each statement of the Q sample was printed and randomly numbered from 1 to 48. To generate the Q sort each respondents ranked the 48 statements into a quasi-normal distribution (Figure 1) from ‘Most like’ (+5) to ‘Most dislike’ (-5).Respondents ranked the statements provided according to their viewpoint following this condition of instruction:

"What should be the vision for the organic sector in Europe in 2030?". Once completed, the participants were asked to review their Q sorts and make any final adjustments and comments. Finally, Following Militello & Jansson's InQuiry procedure the sorting stakeholders were asked to come back the next day to discuss results and interpret the factor array in a participatory way. Only 16 showed up and were split according to "factor" membership.

Results

All 23 Q sorts were cross-correlated and factor analysed using the PQMethod software applying a centroid factor analysis with a varimax rotation (Watts and Stenner, 2012). To extract significant factors, the Brown's rule was applied (Brown, 1980). The number of factors was determined by selecting the factors with factor loadings – correlations between Q sorts – that were statistically significant at the 0.01 level; i.e., those exceeding ±0.37 (±2.58 × standard error [SE]; with SE = 1/√ (number of statements)). The rotated factor loadings, which explain the degree of correlation of each respondent with each Q sort, are shown in Table 1. Despite the presence of confounded loadings, represented by those individuals who loaded in both factors (see Q sort n° 2, 16 and 18), to attribute a specific Q sort to a specific factor, we based on the analysis of the singular Q sort and on the viewpoint expressed during the post-sort discussion. Finally, two factors were extracted. Factor 1 explained 22% of the study variance and 12 participants were significantly associated with this factor. Factor 2 explained 12% of the study variance and 7 participants were significantly associated with this factor. Four Q sorts were not associated significantly with either factor.

Table 1: Factor Loadings

Q sort number	Country	Factor 1	Factor 2
1	Czech Rep.	**0.4515X**	-0,1015
2	USA	**0.4615X**	0,3874
3	France	0,2435	**0.5511X**
4	Germany	**0.7962X**	0,2399
5	Netherlands	0.3216	-0,2662
6	Hungary	0,2298	**0.4793X**
7	Poland	0.3624	0,2769
8	Belgium	**0.7285X**	0,1873
9	Belgium	**0.5456X**	0,0585
10	UK	**0.4802X**	0,2674
11	Belgium	**0.5063X**	0,2878
12	UK	**0.4352X**	0,1706
13	Poland	-0,1569	**0.5677X**
14	Poland	0,0625	**0.4429X**
15	UK	**0.6564X**	-0,0979
16	France	0,3931	**0.6225X**
17	Latvia	0,2797	**0.4242X**
18	Finland	**0.4756X**	0,3843
19	Italy	0.3660	0,2573
20	Italy	0,0964	**0.4941X**
21	Italy	0,0005	0,1563
22	Germany	**0.7805X**	0,3551
23	Netherlands	**0.7165X**	0,1163

Description of Factors

Factor 1. Pioneers

The use of words or terms such as "pioneering role", "pioneer", "drive", "forward", "radically-alternative", "go a step further" characterizes and enriches the content of those statements ranked in the right side of the sorting distribution (**6**, +4; **9**, +4; **10**, +5). The vision of the organic sector that emerges from those statements recognizes the pioneering role of the organic sector, which is asked to promote new radical solutions for the whole agricultural sector. For this factor, the evolution of the organic sector or movement is strictly connected to social and environmental aspects. More specifically, concepts like "fair trade", "fairness", "ecology", "agro-ecology", "urban agriculture" emerged as important (**47**, +3; **11**, +3). The role of the organic farming for Factor 1 is fundamental for the success of the whole organic sector. Organic farming will be able to improve animal welfare (**32**, +3) and to reduce costs and increase the yields thanks to researches in seeds and breeds suitable for the organic sector (**40**, +4). This factor does not think that organic farming will be associated only to home-grown farming (**13**, -4), while, at the same time, claiming that global trade is not the main driver for the development of this sector (**17**, -4). This factor believes that a lot of work is necessary to expand the organic sector (**48**, -5).

Factor 2. Pragmatics

The second factor - "Pragmatics" – focuses more on aspects related to market dynamics (e.g. prices, norms, bureaucracy). Less bureaucracy (**24**, +5) and lower prices (**20**, +5) will influence the growth of the organic sector. This factor believes that the growth of the organic sector is linked to the promotion of more and better information about the organic products (**27**, +3) associated with the introduction of the "conventional" label for non-organic products (**25**, +3). Despite this group believes in a substantial growth of the organic sector (**7**, +4, **35**, +3).

Table 2: Distinguishing statements for Factor 1 and Factor 2

N	Statement	F 1	F2
10	The organic sector will continue to pioneer the transition to economically, ecologically and socially sound food systems in order to drive the whole agricultural sector forward	5*	0
6	The organic sector will keep its pioneering role in the context of agro-ecology	4*	0
40	Research on seeds and breeds suitable for organic farming will result in higher yields and lower cost of production for organic farmers	4*	-1
9	The organic sector will go mainstream while still proposing radically-alternative options to those consumers wishing to go a step further, and promoting those politically	4*	-2
32	Organic farming will improve animal welfare	3*	-1
47	The EU organic movement encompasses fair trade, agroecology, and urban agriculture	3*	-1
48	The EU organic movement doesn't exist anymore because all agriculture in Europe is organic	-5*	-3
13	Organic agriculture will be based on home-grown feed and food.	-4*	0
17	The global trade of organic products will be the most relevant driver of the development of the organic sector in Europe	-4*	-1
22	Organic products will benefit of reduced VAT	-3*	1
20	All EU consumers will be able to eat organic food at affordable prices	3	5*
24	There will be simpler norms and less bureaucracy for organic producers	0	5*
7	More than 50% of farming in the EU will be organic	2	4*
35	The consumption of organic food products will outperform the consumption of conventional foods.	-1	3*
25	Conventional products will have to be labeled 'conventional' and the chemical products used during their production will be mentioned on the label	-1	3*
27	Better information about organic production and markets will be more accessible	0	3*
23	Organic farmers will be paying fewer taxes for their contribution to the wellbeing and sustainability of the society	-2	2*

Both factors are positive towards the growth of the organic sector (**7**, +2, +4) that will not be reduced to a niche (**3**, -4, -3; **4**, -5, -5). They believe that the organic products will be more accessible and available to every EU consumer in both public and private sector (**21**, +5, +4; **42**, +2, +3). In next future, education regarding the organic movement will be encouraged in schools increasing the knowledge in the new generations (**41**, +2, +4). More in general, for both factors the future guidelines of organic sector need to be shared by whole stakeholders and spread to EU consumers. According to this, new policies and strategies are required to promote a radical change in people habits and a transformation in the food market in favor of organic products.

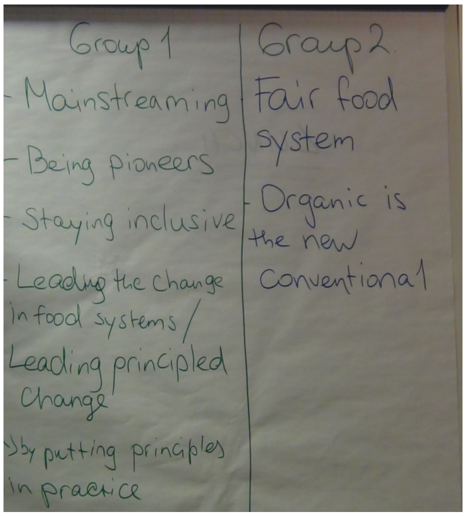


Figure 2. Participatory factor interpretation

Discussion

The participatory factor interpretation showed that the two groups (Group 1:"Pioneers", Group 2: "Pragmatics") were quite different in their vision of themselves (Figure 2). "Pioneers" see themselves as pioneers and change leaders and consider organic farming and food systems as inclusive and innovative, though strongly based on IFOAM organic principles. Pragmatics use less words in self-defining their own group (factor), and summarize organic food and farming as a "fair food system". Both groups/factors share the idea of "mainstreaming" i.e. becoming the "new conventional" agricultural system, as part of their vision. The IFOAM EU mission "Making Europe MORE organic", becomes, in the vision of participants, "Making Europe MAINLY organic". In the words of one of the participants: "All food will be organically produced and any food that is not will carry a health warning". Both competing visions are, therefore, in line with Organic 3.0 vision, which, in the words of IFOAM international, is "about bringing organic out of its current niche into the mainstream and positioning organic systems as part of the multiple solutions needed to solve the tremendous challenges faced by our planet and our species." (IFOAM, 2016).
While most participants associated to the first factor where coming from Northern and Western EU countries, and where long-standing members of IFOAM; the second factor was associated with new members mainly from Eastern and Mediterranean EU countries.

Conclusions

Our study has helped surface the two competing stakeholders' viewpoints (one more principle-based, the other more pragmatic and market-oriented) representing the core discourses illustrating the operant stories representing different weltanschauungs of IFOAM EU members. Understanding the underlying distinguishing viewpoints as well as consensus stances, actually helped us and IFOAM EU council in shaping the IFOAM EU 20130 vision that was finally approved by the

IFOAM EU Assembly in June 2015. Our participatory approach that was based on Q methodology allowed a scientific study of the subjectivity involved in such decision-making process, allowing to reach a good compromise of competing visions in the framework of Organic 3.0.

References

Brown, S.R., 1993. A primer on Q methodology. Operant Subj. 16, 91–138.

Brown, S.R., 1980. Political Subjectivity, Applications of Q Methodology in Political Science. New Haven, CT: Yale University Press.

Davies, B.B., Hodge, I.D., 2012. Shifting environmental perspectives in agriculture: repeated Q analysis and the stability of preference structures. Ecol. Econ., 83, pp. 51-57

Eden, S., Bear, C., Walker, G., 2008. The sceptical consumer? Exploring views about food assurance. Food Pol. 33, 624-630.

Hall, C., 2008. Identifying farmer attitudes towards genetically modified (GM) crops in Scotland: are they pro- or anti-GM?. Geoforum, 39, 204-212.

IFOAM (2016). Organic 3.0 (available at: http://www.ifoam.bio/en/organic-policy-guarantee/organic-30-next-phase-organic-development).

IFOAM EU (2015): Vision 2030 (avaiulable at: http://www.ifoam-eu.org/en/what-we-do/vision-2030)

Jensen, K.O.,Denver, S., Zanoli, R., (2011). Actual and potential development of consumer demand on the organic food market in Europe. NJAS - Wageningen Journal of Life Sciences 58,79-84.

McKeown, B., Thomas, D., 2013. Q Methodology. Newbury Park, CA: Sage Publications.

Mandolesi, S., Nicolas, P. K., Naspetti, S., and Zanoli, (2015). Identifying viewpoints on innovation in low-input and organic dairy supply chains: A Q-methodological study. Food Policy, Volume 54, Pages 25-34.

Nicholas, P.K., Mandolesi, S., Naspetti, S., Zanoli, R., 2014. Innovations in low input and organic dairy supply chains—what is acceptable in Europe. J. Dairy. Sci. 97,1157-1167.

Pereira, M.A., Fairweather, J.R., Woodford, K.B., Nuthall, P.L., 2016. Assessing the diversity of values and goals amongst Brazilian commercial-scale progressive beef farmers using Q-methodology. Agricultural Systems, Volume 144, Pages 1-8.

Mariana A. Pereira, John R. Fairweather, Keith B. Woodford, Peter L. Nuthall

Scott, S., Zhenzhong, S, Schumilas, T., Chen, A., 2014. Contradictions in state- and civil society-driven developments in China's ecological agriculture sector. Food Policy 45:158-166.

Stephenson, W., 1935. Correlating persons instead of tests. Charac. Personal. 4, 17-24.

Thøgersen, J., Zhoub, Y., Huangc, G., 2016. How stable is the value basis for organic food consumption in China? Journal of Cleaner Production 134:214-224.

Watts, S., Stenner, P., 2012. Doing Q Methodological Research: Theory, Method and Interpretation. London: Sage.

Willer, H., Kilcher, L., 2011. The World of Organic Agriculture. Statistics and Emerging Trends. FiBL-IFOAM Report. IFOAM, Bonn and FiBL, Frick pp. 286.

Zanoli, R., Gambelli, D., Vairo, D., 2012. Scenarios of the organic food market in Europe. Food Policy, 37:41-57.

Zanoli, R., 2004. The European consumer and organic food. Organic Marketing Initiatives and Rural Development series, vol.4. University of Wales, Aberystwyth pp.175.

Appendix

Table 3 The 48 Statements of the Q sample

N	Statement
1	Small producers that will sell directly on Internet, farmers market and other short chain systems will produce over 80 % of organic foods.
2	Organic farming will be synonymous of smallholder and family farming.
3	Organic agriculture will develop as a (bit larger) niche alongside with a more sustainable conventional agriculture.
4	The eco-functional intensification and green-tech solutions will reduce the organic sector to a small niche.
5	Organic farming will go beyond the niche by developing value chains of staple foods to respond to local and regional needs.
6	The organic sector will keep its pioneering role in the context of agro-ecology.
7	More than 50% of farming in the EU will be organic.
8	We will witness the first EU country to convert 100% of its farms to organic agriculture.
9	The organic sector will go mainstream while still proposing radically-alternative options to those consumers wishing to go a step further, and promoting those politically
10	The organic sector will continue to pioneer the transition to economically, ecologically and socially sound food systems in order to drive the whole agricultural sector forward.
11	The organic sector will fully comply with the four IFOAM principles of health, ecology, fairness and care, even if it will have an impact on its market share.
12	Organic farming will be the only approach to have fair and high revenue in agriculture.
13	Organic agriculture will be based on home-grown feed and food.
14	Reduction of oil supply and increases in energy prices will make local, labour-intensive organic farming the only way to produce food in Europe.
15	Fossil fuels and inputs will be banned in organic farming, which will only be allowed to use renewable energy resources such as fuel cells, microwave propulsion, etc.
16	The organic sector will fully comply with the cradle-to-cradle approach: only biodegradable/re-usable packaging, new products should be designed according to Life-Cycle Analysis (LCA), etc.
17	The global trade of organic products will be the most relevant driver of the development of the organic sector in Europe.
18	Organic-plus and biodynamic products will increase their market share, while the organic mainstream sector will be increasingly under scrutiny for its sustainability.
19	Production costs and prices of organic products will be lower, attracting more consumers.
20	All EU consumers will be able to eat organic food at affordable prices.
21	Good organic food is easily accessible and available to every EU consumer, including at work, in schools, hospitals and public institutions.
22	Organic products will benefit of reduced VAT.
23	Organic farmers will be paying fewer taxes for their contribution to the wellbeing and sustainability of the society.
24	There will be simpler norms and less bureaucracy for organic producers.
25	Conventional products will have to be labelled 'conventional' and the chemical products used during their production will be mentioned on the label.
26	The organic sector will strengthen its alliance with excellent, better-informed consumers who are buying top-grade or best-value products (prosumers).
27	Better information about organic production and markets will be more accessible.
28	The growth of local organic food production will reduce unemployment especially among the young people.

29	Social networks will make people be more conscious of the benefits of organic agriculture.
30	The organic sector will be recognised having improved people's health by the use of a more natural approach.
31	It is recognized that eating organic is good for your health and prevents diseases.
32	Organic farming will improve animal welfare.
33	The switch to organic diets led to the drop in number of food allergies in school children.
34	The production of organic alternative vegetable protein sources such as beans will increase allowing a reduction in the consumption of meat and fish.
35	The consumption of organic food products will outperform the consumption of conventional foods.
36	Organic agriculture will contribute to introducing more vegetables in diets in relation to meat or fish.
37	Organic fresh and whole foods are the ultimate trend, while careful processing technologies will produce foods with only minimal alterations to their intrinsic qualities.
38	The EU organic research and innovation program amounts to more than 50% of all agricultural research budget.
39	Research will have proven that organic food is healthier.
40	Research on seeds and breeds suitable for organic farming will result in higher yields and lower cost of production for organic farmers.
41	In all schools children are taught the principles of organic farming through classes, farm visits and direct contact with farmers.
42	Organic food is widespread and popular in canteens and restaurants.
43	All farmers will support biodiversity and address climate change.
44	IT and developments in robotics will increase yields by controlling pests, weeds and diseases without the need for chemicals.
45	Organic standards have progressively become stricter and stricter, step by step
46	The EU organic movement encompasses all who follow organic practices & principles whether certified or not.
47	The EU organic movement encompasses fair trade, agro-ecology, and urban agriculture.
48	The EU organic movement doesn't exist anymore because all agriculture in Europe is organic.

The added values of CORE Organic II research projects

Stéphane Michel Bellon[1], Ulla Sonne Bertelsen[2]

Key words: ERA-Net, organic food & farming, research, transnational, wordcloud, added value.

Abstract

An original and comprehensive approach was used in the ERA-Net CORE Organic (CO) to assess the added values of 14 transnational funded research projects. Such added values were identified by project leaders, and analysed with three complementary methods (frequency and comprehensive analyses, confrontation with call topics). The results show that these views from inside the projects enrich both classical scientific merits and impact assessment. They also serve capacity building in CO as a whole, and can improve cooperation in organic research and stakeholders communities.

Acknowledgments

The CORE Organic II ERA-Net was funded by the European Union's FP7programme, under the grant agreement number 249667.

Introduction

With the internationalization of organic food & farming (OF&F), cooperation among countries is increasingly necessary. At EU level, the European Commission (EC) provides a scheme for collaborative research. Since 2002 more than 100 ERA-NETs have been established to contribute to the strategy of a European Research Area (ERA). As other ERA-Nets, CORE Organic (CO) joins a number of European countries (n=11 to 21 between 2003 and 2016) in a collaboration supported by the EC. The main activity is to raise national funds and launch one or several calls, based on shared research and development priorities (Bellon et al., 2011). This paper addresses the benefits of the transnational collaboration, analysing the added values of transnational projects supported by CO. It contributes to the Organic 3.0 perspective in terms of R&D and creation of "a culture of innovation", namely in evaluating our achievements and assessing our impacts in terms of answering to the needs of the organic sector.

Material and methods

An excerpt of 14 project final reports from the latest FP7 COII (2010-2013; see http://www.coreorganic2.org/) was used to get feedbacks from project leaders and participants. It consisted in the answers to the following specific question: "describe the main advantages of the transnational research cooperation compared to a national research project approach in regard to the subject of the project …" (max 1 page). Due to the limited size of the corpus, a manual treatment was feasible, extracting key words and sentences, and organizing them. Frequency of answers was also considered (using the "wordcloud" application, while standardizing terms such as Europe and EU), although emphasis was laid upon new ideas or suggestions, with a view to identify a wide set of added values. Research seminars organized in 2011, 2013 and 2016 enabled us to complete or discuss these added values. In addition, a literature survey enabled identifying how the issue is being addressed by the EC and in specific journals, based on an initial query [TS: "international collaboration" AND (assessment OR evaluation OR impact OR added value) AND Europe].

[1] INRA, Ecodevelopment Unit, 228 route de l'Aérodrome, CS 40509, Domaine Saint Paul - Site Agroparc, 84914 AVIGNON Cedex 9, France. Email : stephane.bellon@inra.fr
[1] ICROFS, Blichers Allé 20, Postboks 50, DK-8830 Tjele, Denmark

Results

When considering all the content of the texts from the 14 project reports, the **word frequency of occurrence** can be distributed in three main categories, as follows:

Table 1: Major terms used in COII project final reports

Very high (>20)	High (10-20)	Medium (6-10)	
project(s) country(ies) researcher(s)	different data knowledge partners across new	transnational(ly) cooperation experiments analysis results value	production possible among added established common

Whereas the first column (3 most used terms) is contextual and descriptive, the second and third ones are more informative about added value in knowledge generation. This is enabled by differences among national situations and partners associated in the various projects. Importance is given to identifying common protocols, mostly based on experiments, and to cooperating in analyses. Additional words used with a lower frequency (62 words with 3-5 occurrences, data not shown) confirm this importance, with terms such as collaboration, interactions, shared, joint, network, etc. Other terms with the lowest frequency (78 words with less than 3 occurrences) are related with projects outcomes, using active verbs (e.g. gained, integrated, involved, obtain, perform) and nouns (e.g. relevant, synergies, together).

A comprehensive analysis based on full texts on "added values" complements the previous section. The answers given by coordinators in project reports vary. Their length ranges from a couple of sentences to a whole page. Their content can be organised in 3 main categories: (i) project approach and knowledge generation, (ii) methodological dimensions, (iii) outcomes and prospects. Excerpts of the answers included in the final reports were organized according to these categories and anonymised, using a code for each project (between brackets in this section).

(i) "The project enabled assembling scattered knowledge and disseminate synthesis through various channels", "A critical mass in various research disciplines was reached, in a transdisciplinary network", "The project enabled working at various levels of organisation" (TO); "The transnational cooperation is essential to this project, not only in respect of the input of case studies that constitute a unique basis for the analysis and insight but also by contribution with different analytical perspectives and contextual insight" (HG). As a whole, complementarities among teams and valuation of differences among countries are stressed in project reports. The network created within consortia enable a critical mass of expertise on a common topic. Differences among national situations are turned into complementarities for interdisciplinary and multi-level approaches. In the research process, both the contribution of stakeholders and the learning potential for students rarely appear as transnational added-values.

(ii) "Field experiments of the same type in the different countries have not always showed the same results. This can be explained by differences in soil and climate situations among regions. Therefore it was important to achieve experiments from more countries to be able to understand which basic mechanisms are involved in the interactions we try to manipulate" (SM)." A common laboratory protocol for sampling and analyses was established to ensure comparability of results between partners. The optimal sampling scheme was agreed" (SO). Special attention is usually given to elaborating knowledge synthesis and defining common methodologies during the initial phase of the projects. A wider range of variation can also be explored, due to the diversity of national trajectories and situations. This provides a more complete experimental setting or data base, and possibly more robust conclusions and a wider pallet of solutions to solve the issues addressed.

(iii)"The common discussions and the experiences shared are promoting the build-up of a common expertise about living mulch as potential tool to manage organic cropping systems will contribute to spread within the European organic stakeholder communities a consistent knowledge on targeted crops" (IV). "Strong synergies have been observed between partners, which is evident from several joint publications. In addition, the networks and collaborations established during the project period have been and will be continued and further expanded in new projects" (AF). Apart from intrinsic merit of scientific results, based on peer review (sometimes after the end of the project reporting period), this section of reports often consider the project trajectory i.e. how activities undertaken in the consortium can continue. Capacity building within consortia and extension potential at EU level were also mentioned.

In order to **identify possible specificities among the answers,** we differentiated them according to the initial topics of the call. We only considered the first call, to have enough data. It included three thematic research areas:

(1) Designing robust and productive cropping systems at various levels (6 projects)

(2) Robust and competitive production systems for monogastrics (3 projects)

(3) Ensuring quality and safety of organic food along the whole chain (2 projects).

In overall pictures provided by "wordcloud" for each topic, terms with higher frequency (Table 1) are present for all three topics. Since methods used differ among topics, "experiments" dominate in topic 1, whereas "data" are more important in topics 2 and 3. Specific terms related to the general orientation of each topic are not dominant (e.g. crops for topic 1; monogastrics for topic 2; food for topic 3). Interestingly, other key-words of the call topics do not appear explicitly in the texts. This may be due to the fact that project leaders consider that this dimension is addressed when presenting results in final reports, and not in the section related with added-values.

Discussion

In the reviewed scientific literature, the term "added-value" of research projects is scarce, except at national level (e.g. in Norway and Finland). Based on our query, terms such as research impact and outputs prevail in academic journals. One issue sometimes addressed is the balance between scientific outputs and broader societal impacts of the projects, and how this balance can be assessed (Holbrook and Frodeman, 2011). In this ERA-Net, we are trying to increase the added values by 1) including sector experts focussing on the needs of the transnational sector in the first step of evaluation of the proposals, 2) having explicit procedures to facilitate the selection of proposals within the consortium and 3) supporting dissemination of results also in countries not taking part in the CO project.

As a whole, financial evaluation remains a more critical assessment criterion for scientists. Funding and its rules differ among countries, and funding bodies have an important role in this accountability at all the steps of a project, from its selection to the evaluation of reports. Since many projects refer to previous and future projects, it would also be interesting to consider larger time spans (over 3 years projects) and identify pathways of projects (Gaunand *et al.,* 2015). Other authors also reviewed and proposed methodologies for evaluating the relative success of collaborative research projects. For instance, Bartlett (2016) suggests integrating two dimensions: achievements of the intended research activities, and evidence of the apparent impacts. Each dimension includes four criteria, involving the evaluators assessing project reports to assign scores to each criterion. Such proposals could be considered by funding bodies to evaluate project reports. However, economic and social or policy outcomes (2 of the impact criteria suggested by Bartlett,

2016) can't be assessed with the current reporting framework in CO, and possibly within the duration of a project.

Interestingly, a report from European Commission explicitly refers to "added-values" (Vullings *et al.,* 2014). The authors identify 5 criteria for added value: networking; facilitating European excellence and capacity building; coordinating a critical mass; fostering mutual learning and harmonisation; avoiding redundancies and improving efficiency. The first criterion is not easily accessible, because selection criteria in designing a consortium are rarely explicit. Whereas a minimum number of 3 participating countries was suggested in this call, one project involved 42 partners from 20 countries. The other 4 suggested criteria are globally fulfilled, based on the overall results presented in the previous section, although the relative weight given to each of them differs among projects. Our results will also be used in the newly started CO project (CO Cofund, 2016-2021), where attention will be given to project management at all steps, from the evaluation of submitted proposals to the enhancement of the innovation potential of selected proposals.

Suggestions for future challenges of transnational organic research

- Opening to other countries, within and outside Europe, would enhance our experience and stimulate exchanges with similar initiatives,
- Create a dynamic mapping of collaborations in projects, combining topicality (why and how a topic makes sense or not within a given country?) and scientometrics (which institutions collaborate? on which topics?),
- Amplify the role of social sciences in projects and their evaluation, as suggested during a CO Research Seminar held in October 2016.

Conclusions

Two main conclusions can be drawn from this experience. First, it stresses the importance of addressing added-values in the reporting, and making them integral part of impact assessment of selected research projects. Secondly, it shows a community and capacity building in the pathway and achievements of this ERA-Net, which can be considered as an opened learning system.

References

Bartlett AG, 2016. Evaluating relative success of donor-funded collaborative research projects. Research Evaluation, 1-16.

Bellon S, Alföldi T, Anil S, van der Meulen S, 2011. Identification of research priorities in transnational EU projects in Organic Food & Farming. Ifoam-Isofar Korean Organic World Congress [kowc], September 2011: 342-345.

Dax T, 2014. Shaping rural development research in Europe: acknowledging the interrelationships between agriculture, regional and ecological development. An enhanced research strategy supported by the ERA-NET RURAGRI. Studies in Agricultural Economics 116 : 59-66.

Gaunand A, Hocdéc,A, Lemariéa S, Matta M, TurckheimdE.de, 2015. How does public agricultural research impact society? A characterization of various patterns. Research Policy 44, 849–861.

Holbrook J.B., Frodeman R., 2011. Peer review and the ex-ante assessment of societal impacts. Research Evaluation 20 (3): 239-246.

Vullings W. et al., 2014. European Added Value of EU Science, Technology and Innovation actions and EU-Member State Partnership in international cooperation. EC, DG for R& I.

Farmer motivations and doubts when converting to organic dairy farming in an era of conventionalisation

Maëlys Bouttes[1], Guillaume Martin[1]

Key words: livestock farming, organic farming practices, France

Abstract

Organic farming is being criticized for following a trend of conventionalisation meaning that it progressively aligns with conventional agriculture. Our objective was to characterize farmer motivations and doubts when starting their conversion to organic farming in a context of conventionalisation. We conducted comprehensive surveys with 20 dairy farmers in Aveyron, France. We coded their discourse through a deductive content analysis highlighting their motivations and doubts according to a number of categories including knowledge and perception of reality, risk perceptions, belief in own capacities, experienced social pressure, trust in the farm social environment and aspirations. We show that farmers combine motivations and doubts at the crossroad between conventionalised and traditional organic farming. In a context of conventionalisation, these partly renewed motivations and doubts have to be considered to redesign the support system (advisory and financial) accordingly.

Acknowledgments

The authors would like to thank surveyed farmers for their time and candor and APABA and the chamber of agriculture of Aveyron for their support. This study was funded by the French ANR Agrobiosphère program as part of the TATABOX project (ANR-13-AGRO-0006) and by INRA and the Occitanie region as part of the ATA-RI project and MB's PhD project.

Introduction

Organic agriculture is developing worldwide. Several quantitative and qualitative studies have addressed farmers' motivations and doubts when converting to organic (Cranfield et al., 2010; Smit et al., 2009). However, all these studies relied on farmers' interviews conducted after their conversion to organic farming. Yet, memories are transformed over time and farmers' motivations and doubts might evolve along with their conversion. Moreover, as observed in the French dairy sector, the development of organic agriculture is seen by multiple actors as a conventionalisation process, meaning that "organic farming is becoming a slightly modified version of modern conventional agriculture" (Darnhofer et al., 2009). In such an era, farmer motivations and doubts when converting to organic farming might be renewed. We highlighted dairy farmer motivations and doubts when starting their conversion to organic farming in an era of conventionalisation.

Material and methods

Conversion to organic farming is a form of on-farm innovation. To analyze farmer motivations and doubts at the implementation stage, we applied the conceptual framework developed by Leeuwis (2004) that distinguishes farmers' areas of perception that reflect reasons for action, i.e. domains of motivations and doubts: actions, knowledge and perception of reality, risk perceptions, belief in own capacities, experienced social pressure, trust in the farm social environment, aspirations, and perceptions of own role and responsibility. We used a qualitative survey approach with semi-structured interviews to collect the perceptions of farmers regarding these areas of motivations and doubts when converting to organic agriculture.

[1] AGIR, Université de Toulouse, INPT, INP-Purpan, INRA, Université Toulouse, ENFA, 31320 Auzeville, France, https://www6.toulouse.inra.fr/agir, eMail : maelys.bouttes@inra.fr

In France, the conventional dairy sector faces a crisis since 2015 whereas the organic sector is developing. We surveyed farmers located in Aveyron where there are 170 dairy farms over a total of 1200 farms. In 2016, around 40 dairy farms started their conversion to organic and 70 additional farm conversions are expected by 2018. The local context is mainly driven by one dairy who contracted to produce organic milk powder for the Chinese market.

In keeping with the case-study research approach (Eisenhardt, 1989), we chose to interview diverse dairy farmers rather than a statistically-representative sample of dairy farmers from Aveyron. Our aim was to obtain a diversity of farmer situations (mainly in terms of soil-climate context and distance from organic practices) from which we expected diverse motivations and doubts to convert to organic. We chose 20 dairy farmers starting their conversion from spring 2016 with local farm consultants.

We coded farmer discourses during the interviews according to the above-suggested areas of perception that reflect farmers' motivations and doubts (Leeuwis, 2004) and we further created contextualized subcategories for each area of perception. We ended up with a synthetic map of farmer motivations and doubts. We also kept track of farmer quotes to highlight the convergences and divergences among them.

Results

Action: driven by conventional actors

Farmers' decision to convert to organic agriculture was made while they were looking for options to get out of the milk price crisis they faced. A key event that strengthened their decision was the participation to a collective training session organized by the Chamber of Agriculture. This structure is well-identified and well-considered by surveyed farmers who are not familiar with traditional organic networks. Organic consultants from the Chamber of Agriculture had positions on conventional agriculture in the past, and were recognized as "good" consultants which reassured farmers to go into organic. This context illustrates the importance of the involvement of mixed (active in both the organic and conventional sectors) chain actors (especially consultants) for the development of organic agriculture. This point has already been emphasized in the Dutch organic dairy sector (Smit et al., 2009).These changes are typical of a conventionalisation process and the concomitant evolution of actors in the chain.

Kowledge-Perception of reality: a "negative" image of organic farmers

Most surveyed farmers initially related organic farming to hippies and ungifted farmers who are not productive. Several visits of local organic dairy farms were organized by the Chamber of Agriculture. During these visits, surveyed farmers discovered organic farmers who seemed happy and peaceful and who managed to get satisfactory milk production levels with their cows. They also met established organic farmers with whom they shared values, and even agricultural practices before those farmers had started their conversion. Their perception of organic farmers changed a lot over a small period of time. In a context of conventionalisation, one could expect that this "negative" image of organic agriculture would have disappeared but it remained well-grounded in the case study territory. These results are original and indicate that many farmers still go into organic while their practices are distant from organic standards and their networks are different from traditional organic ones.

Risk perceptions: a secure local conventional actor, but will the conventional strategy be robust?

All surveyed farmers engaged with the local dairy well-identified in the conventional milk market. They regarded this dairy as a robust actor because (i) it processes the milk in a local factory (ii) it has signed contracts with Chinese companies to export organic milk powder, and these companies have invested money to equip their local factory (iii) it remains very active on the conventional market and this position secures farmers in case they would have to (for any reason) come back to conventional production. Farmers still had several fears, especially on the mid- to long-term stability of organic milk prices in a market oriented towards exportation. Farmers feared that the organic milk market will experiment a saturation or a possible drop of the Chinese market. Farmers also questioned the future modifications of the organic standards and of the future european common agricultural policy. They thought organic agriculture is going to become the standard production model and that this would mean less subsidies with equivalent production standards. They feared that organic specifications would become stricter. On the other hand, they recognized that more flexible rules would compromise consumers' confidence in their products. Farmers' decision to go for a mixed dairy also active in the conventional sector rather than a specialized organic dairy oriented towards the national market is illustrative of the conventionalisation context. And this context led farmers to express fears about the organic sector similar to the reasons that led them to step out of the conventional sector.

Belief in own capacities: the organic choice, just an other challenge

Rather confident in their own capacities, many farmers saw their job as a continuous challenge. They considered their conversion to organic agriculture as a new challenge. For some of them, going into organic was a sudden plunge into the unknown and would necessitate learning, but they appeared more stimulated than worried about that. For farmers, acquiring new skills has been identified by many studies as an important challenge during their conversion to organic agriculture (Cranfield et al., 2010). In our case, farmers were aware of this need but quite confident in their capacities to learn and progress. We may connect this result with the available knowledge base on local organic dairy farms, and to the work of local consultants who provided converting farmers with the required knowledge and information to set-up their conversion.

Experienced social pressure: being organic for being loved?

All farmers expressed a strong social pressure exerted by society for deciding to go into organic. They suffered from being seen as polluters whatever they did on their farms and seemed worn out to have to justify their agricultural practices. They also noticed an increasing number of TV programs presenting the negative impacts of pesticides and the benefits of organic agriculture. Becoming an organic farmer was for some of them a relief to live « quietly » in the society but they insisted on staying supportive with conventional farmers. This can be seen as a result of the conventionalisation and question how these farmers will live with their new image in their traditional networks and if they would at some time join the traditional organic networks.

Trust in social environment: organic agriculture, regression or progress?

When farmers' family were strongly involved in the farm, several situations highlighted the importance of farmers' parents and children perceptions for going into organic. Parents often saw organic agriculture as a step backward. On the contrary, in most cases where one of the children was interested to carry on the farm, he/she was a driving force to give this orientation to the farm. Indeed, in an era of conventionalisation, organic agriculture is given more space in agricultural education programs than in the past and is better regarded by the new generations.

Aspirations: being able to live from a job of passion

Aspirations expressed by farmers were quite convergent. They aimed to find a satisfactory balance between income and quality of life at work. Farmers wanted to have a sufficient milk price and reduced costs so as to live out of their work. They were willing to carry on the work of the past generations and often connected that with the wish to transfer a sustainable farm to the next generation. All farmers expressed their passion for their work even if it tended to erode with the problems they had faced as conventional farmers. They saw the organic project as a possibility to regain motivation to test new practices, have new challenges such as the one of being productive without synthetic inputs, and be stimulated by collective exchanges with other farmers. The choice of organic agriculture mostly echoed an awareness of biocide risks for them and for consumers, even if they considered that their rationale was already to limit their use. These results are in line with several studies highlighting multi-factorial motivations of farmers when going into organic (e.g. (Padel, 2001). Some studies showed changes of farmer motivations over time and emphasized specifically on the increasing importance of profitability between 1991 (Henning et al., 1991) and 2001 (Hall and Mogyorody, 2001). All surveyed farmers wished to have a more profitable farm but that was always combined with other aspirations. These results support the argument of other studies that « for most farmers, perceived economic viability may be a necessary condition […] but is not a sufficient one »(Darnhofer et al., 2005), even in a conventionalisation context.

Role and responsibility: do we have the choice?

Some farmers wondered if they should really take into account all the externalities of the farm to make their decisions. Their priority was to save their farms from the conventional milk crisis but they did not question much the sustainability of their project once considered in a global context.

Discussion

In the context of conventionalisation of organic agriculture, the support system (education, extension…) provided to farmers needs to be adapted especially during the conversion stage. This adaptation requires integrating farmer motivations and doubts for going into organic. We showed that farmers combine motivations and doubts at the crossroad between conventionalised and traditional organic farming. We highlighted that: (i) farmer field days in well-managed organic farms are essential by acting as proof of concept enhancing the credibility of organic farming; (ii) the presence of mixed actors (dairies, consultants) appears necessary to reduce farmer uncertainty and fears on professional networks once they start their conversion; (iii) policies to control the amounts of milk produced would contribute to reduce farmer doubts for going into organic. Farmers can be encouraged to get involved in the decision-making of their dairies and in the development of organic farming at large.

References

Cranfield, J., Henson, S., Holliday, J., 2010. The motives, benefits, and problems of conversion to organic production. Agric. Human Values 27, 291–306. doi:10.1007/s10460-009-9222-9

Darnhofer, I., Lindenthal, T., Bartel-Kratochvil, R., Zollitsch, W., 2009. Conventionalisation of organic farming practices: from structural criteria towards an assessment based on organic principles. A review. Agron. Sustain. Dev. 30, 67–81. doi:10.1051/agro/2009011

Darnhofer, I., Schneeberger, W., Freyer, B., 2005. Converting or not converting to organic farming in Austria: Farmer types and their rationale. Agric. Human Values 22, 39–52.

Eisenhardt, K., 1989. Building theories from case study research. Acad. Manag. Rev.

Hall, A., Mogyorody, V., 2001. Organic Farmers in Ontario: An Examination of the Conventionalization Argument. Sociol. Ruralis 41, 399–322. doi:10.1111/1467-9523.00191

Henning, J., Baker, L., Thomassin, P., 1991. Economics Issues in Organic Agriculture. Can. J. Agric. Econ. Can. d'agroeconomie 39, 877–889. doi:10.1111/j.1744-7976.1991.tb03649.x

Padel, S., 2001. Conversion to Organic Farming: A Typical Example of the Diffusion of an Innovation? Sociol. Ruralis 41, 40–61. doi:10.1111/1467-9523.00169

Smit, A. a H., Driessen, P.P.J., Glasbergen, P., 2009. Conversion to Organic Dairy Production in the Netherlands: Opportunities and Constraints. Rural Sociol. 74, 383–411. doi:10.1526/003601109789037286

Implications of subsidiary cropping and tillage system on economics and production risk

Benjamin Blumenstein[1], Maria R. Finckh[2], Jan Henrik Schmidt[2], Sally Westaway[3], Lars Olav Brandsæter[4], Detlev Möller[1]

Key words: conservation tillage, cover crops, mulch, stochastic simulation

Abstract

Subsidiary cropping and mulch systems as well as conservation tillage may induce multiple positive agro-ecological effects, increasing resilience and yield stability of cash cropping in organic farming systems. As this may also implicitly affect production economics and risk potential, the paper at hand evaluates two year crop-rotations from empiric field data, considering costs and revenues of production as well as yield effects based on stochastic risk simulation. Absolute profitability as well as risk potential substantially varies between cropping systems and locations and does not necessarily display a definite preference of conventional/reduced tillage or subsidiary cropping systems. However, a temporal expansion of the period under observation considering long-term effects of soil fertility enhancing management practices may illustrate their risk-reducing potential as well as the necessity to handle them as long-term investments with instant expenses and subsequent economic returns.

Introduction

Obviously, the use of fertilization and plant protection with instant effects on plant growth and health is severely restricted in organic farming systems. Therefore, with regard to the broadly discussed sustainable intensification of (organic) agriculture (Niggli et al. 2008, Royal Society 2009) other measures need to be taken into account that focus on the improved utilization of agro-ecological effects in order to ensure yield stabilizing or even increasing framework conditions. For organic cash cropping, these measures include e.g. intercropping such as cover crop or mulch systems (Hartwig and Ammon 2002) as well as reduced tillage systems (Pittelkow et al. 2015) with multiple ecological, but also economic effects. The economic evaluation of different tillage systems is dependent on field and empirical data from experimentally operating research groups. However, deterministically deduced statements from field trials, needed for farm consultancy, are extremely restricted by local and site-specific framework conditions as well as annual effects, leading to a wide range of results. Therefore, in the economic analysis at hand we integrated the variability of input parameters as stochastic effects applying Monte-Carlo-simulation. The results derived from risk simulation represent a much more realistic picture of integrated empiric and economic evaluation and allow for an improved basis of decision-making for practitioners.

Material and methods

The economic and risk assessment presented in this paper is based on empiric findings regarding the adaptation of inter/cover crop and mulch systems in conventional (*CT*) and reduced (*RT*) tillage

[1] University of Kassel, Faculty of Organic Agricultural Sciences, Department of Farm Management, Steinstr. 19, D-37213 Witzenhausen, Germany, blumenstein@uni-kassel.de
[2] University of Kassel, Faculty of Organic Agricultural Sciences, Group Ecological Plant Protection, Nordbahnhofstr. 1 a., D-37213 Witzenhausen, Germany
[3] The Organic Research Centre, Elm Farm, Hamstead Marshall, Berkshire. RG20 0HR, UK.
[4] Norwegian Institute of Bioeconomy Research (NIBIO) and Norwegian University of Life Sciences, Norway

systems in two-year crop rotations from the EU funded *OSCAR* project *Optimising Subsidiary Crop Applications in Rotations* (2012-2016). We focus on the organically managed trial locations of Kassel University (KU, Germany) (winter wheat-potato), Organic Research Centre (ORC, United Kingdom) (winter wheat-spring barley) and Norwegian Institute of Bioeconomy Research (NIBIO, Norway) (winter wheat-spring barley). Risk simulation of crop and tillage systems is based on the cost-benefit calculation methods according to Olson (2003) and KTBL (2016), the key economic figure being the *net return after charge for unpaid labour and management as well as an interest charge* (NR). Agricultural standard data to calculate labour and machinery costs (KTBL 2016) were used to complement the site-specific data. A yield dependent adjustment of machinery costs was considered.

For risk analysis, probability distribution functions (PDF) were estimated for yield parameters (main crop and grain straw) as well as sorting and storage losses (potato) based on the field data, using the Microsoft Excel based risk software @RISK (PALISADE 2010). The best fitting distributions were selected based on the χ^2 statistics. Depending on data availability and location between eight and 16 single data sets could be used to fit the distributions. The probability distributions were truncated at 0 kg yield per ha at the lower end as well as at the maximum yield values observed in the respective field trials of the different locations in order to avoid improbable yield assumptions. PDFs of grain yields were correlated with their respective straw yield data. Depending on the data structure, the fitted PDFs comprised of *Gamma*, *Weibull*, *BetaGeneral*, *Pearson*, *LogLogistic*, *InvGauss*, *Triangular* and *Uniform* distributions, entering a Monte Carlo simulation in order to display probability distributions of the net return expressed in € ha^{-1} a^{-1}.

Results and discussion

The impact of soil cultivation and subsidiary cropping on yields and economics appear to be quite dependent on cropping system as well as annual effects of each trial location (Table 1). Comparing the tillage systems *CT* and *RT* (with the mean net return (NR) displaying the static profitability, and the standard deviation (SD) showing the variability of results from stochastic risk simulation), *CT* systems are mostly more profitable than *RT* systems in all locations (based on higher main crop yields). However, for KU, RT brassica/oat and vetch systems display a lower SD and therefore lower risk potential, and for ORC, the gap between *CT* and *RT* systems is rather small for both NR and SD. For the NIBIO location, except for the control N50 system (fertilized with dried chicken manure, equivalent of 50 kg N ha^{-1}), all *RT* systems show a similar or lower risk potential (SD) than *CT* systems. Comparing the subsidiary cropping systems, adverse effects depending on the location can also be noticed. At KU, subsidiary cropping systems are predominantly more profitable than the control system in both *CT* and *RT* systems, however, often with a higher risk potential. At ORC, in *CT* systems the control system displays highest *NR*, in *RT* systems the leguminous subsidiary crop systems dominate the brassica and control system. At NIBIO location, in both low and high N fertilization groups the white clover system is most profitable but medium or most risky compared to the other cropping systems or control.

An important factor which has not been considered in the evaluation above are long-term nutrient and carbon effects induced by subsidiary crops, contributing to soil fertility and yield potentials, especially in N limited organic farming systems. Nitrogen provided either by storage in plant biomass or N_2 fixation is often not available immediately but throughout an entire crop rotation. Therefore, yield effects of subsidiary crop nitrogen is most likely only marginally represented in the two-year OSCAR crop rotations. A monetary evaluation of the nitrogen provided by the respective subsidiary crops (price per kg N results from the production costs of the respective subsidiary crops divided by the amount of N provided by the subsidiary crop) may increase the additional value of subsidiary crops for the entire crop rotation by up to 160 (ORC) and 280 € ha^{-1} a^{-1} (NIBIO), respectively. The N input by dead mulch may even account for 875 € ha^{-1} a^{-1}, together with the N value of the cover crop resulting in additional N fertilizer value of 1130 € ha^{-1} a^{-1} for KU location.

Table 1: Net return (NR) (€ ha^{-1} a^{-1}) and Standard deviation (SD) of inter/cover crop and mulch systems in conventional and reduced tillage systems for three European locations (Germany, UK, Norway)

Kassel University (Germany) (winter wheat – potato)

SC[a]		White clover	Subt. clover	Brassica/oat	Vetch	-	-
CT[b]	Mean NR[d]	9.401	9.300	10.322	10.832		
	SD[e] (σ)	1.740	1.989	2.063	2.497		
RT[c]	Mean NR	7.626	9.829	8.691	9.392		
	SD (σ)	1.916	2.042	1.225	1.709		

Organic Research Centre (UK) (winter wheat – spring barley)

SC		Control	Brassica	Black Medick	Brassica/ Black Medick	-	-
CT	Mean NR	4.176	3.944	3.884	3.836		
	SD (σ)	470	472	546	388		
RT	Mean NR	3.226	2.734	3.307	3.257		
	SD (σ)	557	708	518	534		

NIBIO[f] (Norway) (winter wheat – spring barley)

SC		Control N50[g]	Vetch N50	White clover N50	Control N100	Vetch N100	White clover N100
CT	Mean NR	1.142	584	1.291	796	767	1.181
	SD (σ)	145	183	244	372	241	261
RT	Mean NR	557	417	821	575	653	889
	SD (σ)	215	191	197	146	154	199

[a]Subsidiary crop; [b]Conventional tillage; [c]Reduced tillage; [d]Net return (€ ha^{-1} a^{-1});[e]Standard deviation; [f]Yield values from spring barley restricted to mean values from second trial repetition due to crop failure in first trial repetition; [g]kg Nitrogen ha^{-1} from dried chicken manure

Conclusions

The presented results do not easily allow for general conclusions on economic advantages concerning profitability and risk for certain tillage or cropping systems mainly due to different trial conditions at the several locations as well as annual effects. Nevertheless, certain tendencies can be derived from the economic evaluation. *RT* systems usually imply lower management costs, which, however, could mostly not be exploited in favour of a better profitability due to often lower yields in the *RT* systems, which, however, may stabilize over time. Risk analysis indicates that reduced tillage may help to decrease production risks in some locations (e.g. partly at NIBIO and KU), but may also increase variability of results for other locations (ORC).The consideration of long term effects of integrated subsidiary crops, such as nutrient availability (nitrogen) or soil fertility (carbon) could substantially improve the economic feasibility of reduced tillage as well as subsidiary cropping systems. The increase of physical and economic productivity while at the same time generating eco-system services (e.g. carbon storage) would perfectly fit into the concept of *eco-functional intensification*. In order to be able to truly determine the advantages or disadvantages of different tillage or cropping systems future analyses should incorporate long-term trials that will show the long-term effects of nutrient availability and soil fertility. The adaptation of soil properties from *CT* to *RT* systems is usually a multi-annual process, and, despite the challenges with weed control and spring nitrogen mineralization (especially in organic *RT* systems), yields potentials may not necessarily be lower than in *CT* systems (Mäder and Berner 2011), which, however, could not always be displayed in the short-term trials at hand.

Incorporating long-term beneficial effects into the evaluation will essentially also be reflected in the economic sustainability of reduced tillage and subsidiary cropping systems. Consequently, the adaptation of reduced tillage systems or subsidiary crops to improve soil fertility and stabilize or even increase long-term productivity, from an economic point of view, must be seen as a regular investment, where expenses incur instantly and economic returns often only pay off after several years.

References

Hartwig NL & Ammon HU (2002) Cover crops and living mulches. Weed Science 50 (6), 688-699

KTBL (2016) www.ktbl.de. Online-tool of the German Kuratoriums für Technik und Bauwesen in der Landwirtschaft e.V. Darmstadt.

Mäder P & Berner A (2011) Development of reduced tillage systems in organic farming in Europe. Renewable Agriculture and Food Systems 27(1), 7–11

Niggli U, Slabe A, Schmid O, Halberg A, Schlüter M (2008) Vision for an Organic Food and Farming Research Agenda 2025. Organic Knowledge for the Future. TP Organics, Brussels and Bonn, 44p

Olson K (2003) Farm Management: Principles and Strategies. Wiley-Blackwell

PALISADE (2010) User manual for @RISK 5.7, risk and simulation add-in for Excel. Palisade Corporation. Ithaca, NY, USA.

Pittelkow CM, Liang X, Linquist BA, van Groenigen KJ, Lee J, Lundy ME, van Gestel N, Six J, Venterea RT, van Kessel C (2015) Productivity limits and potentials of the principles of conservation agriculture. Nature 517, 365–368

Royal society (2009) Reaping the benefits: Science and the sustainable intensification of global agriculture, London, 72p

Improving inspection procedures in organic farming using feasible practices*

Danilo Gambelli[1], Francesco Solfanelli[1], Raffaele Zanoli[1]

Key words: Organic certification, risk-based controls, inspections planning

Abstract

The aim of this paper is to consider feasible approaches that could improve the effectiveness of the inspection procedures of organic control bodies. This could reduce the burden of certification for operators and improve the competitiveness of the organic sector. We develop a risk-based model for inspections based on structural information on organic farmers, and including aspects concerning the scheduling and type of the visit, as well as those concerning inspectors. The results of our model indicate that there is scope for increasing the efficiency of inspections, which could result in a prioritisation of controls for farmers at higher risk of non-compliance, while reducing unnecessary burden for the remaining cases.

Acknowledgments

This study was funded as part of the CERTCOST Project, agreement no. 207727 (http://www.certcost.org), with financial support from the European Community under the 7th Framework Programme. This paper reflects the views of the author(s) and not those of the European Community, who is not to be held liable for any use that may be made of the information contained.

Introduction

Third party certification has been a core element of distinction for organic products and for a common definition of organic farming practices. There is scope for a revision of the certification standards, which could evolve focussing more on the provision of ecosystem and social services related to organic farming. Present standards should however be kept as a reference of minimal conditions to be met,focussing on the improvement of the efficiency of the certification system, which could result in lower costs for farmers and in a general increase in organic farming attractiveness and competitiveness. Here we develop a model for the improvement of the present procedure of inspections for farmers, based on data and information that are already available at the Control Body (CB) and consider feasible modifications of the inspections procedures. The analysis considers a bivariate probit model aiming at measuring the likelihood of detection of non-compliance (NC) and is based on a dataset from an Italian CB, containing information on the inspections and structural characteristics of organic farmers in Italy.

Material and methods

The data are obtained from the archives of the largest CB in Italy. The dataset considers the outcomes of 37,930 inspections on 10,249 farms from 2007 to 2009. Farmers are normally inspected at least once a year, but further inspections might be planned by the CB. We use available data about the type of sanctions issued by the CB as a proxy for the corresponding NC. Sanctions are issued when NC are detected during inspections, and there is a univocal relation between the severity of a sanction and the corresponding type of NC. Following Council Regulation No 834/2007, NC are classified as irregularities and infringements. Here we refer to irregularities as

[1] Università Politecnica delle Marche, via Brecce Bianche Ancona - 60131 Italy. Email: d.gambelli@univpm.it

"Slight NC" (i.e. NC mainly referring to formal/bureaucratic flaws), andto infringements as "Severe NC" (i.e. NC mainly involving incorrect product identification and labelling, use of non-permitted substances, and/or cultivation of 'parallel' organic and conventional crops, etc.). The aim of our analysis is twofold. First we want to measure the likelihood of detection of the two types of NC based on a set of explanatory variables concerning a) inspections' characteristics (annual/follow-up/unannounced inspection, sampling, timing of the inspection), b) structural farm data (risk class attributed to each farmer by the CB, localization, other certification schemes), c) inspectors experience. See Table 1 for the list of explanatory variables (note that "Region: Centre" and "Medium-Risk class" are omitted to avoid collinearity). Secondly we discuss how the efficiency of inspections could be improved making a more accurate use of information available to the control bodies. In particular, for the timing of inspection we have developed a specific 'timeliness index' that, according to the kind of farm crop and livestock productions, indicates the period of the year when we expect the highest risk of noncompliance. For each farm i, we consider the number of crops CR_{it} and the number of livestock types LV_{it} that at the time of the visit t can be considered "at risk of noncompliance": they can be equal zero if respectively no crop or no livestock production is available at the farm. We also consider the total number of crops and livestock types for each farm: $CRtot_i$, $LVtot_i$. The timeliness index T_{it} for each inspection is then computed as: $T_{it} = \frac{CR_{it} + LV_{it}}{CR\,tot_i + LV\,tot_i}$,where t=time of inspection; i=1…f (f=total nr of farm). T_{it} ranges between T_{it} = 0 (when at the time of the inspection no one of the crops/livestock types in the farm are considered at risk of noncompliance) and T_{it}= 1 (when at the time of the inspection all crops and/or livestock types are considered at risk of noncompliance). T_{it}=1 only for 14% of inspections, while T_{it}= 0 for 30% of inspections, and the average value of T_{it} for inspections is 0.28, (see Table 3). Hence, we have a distribution of inspections far below the theoretically optimal situation where all inspections are done with the optimal timing for each farm.

Empirical evidence shows the correlation of the two different types of NC (Gambelli et al., 2014a, 2014b; Zanoli et al., 2014a, 2014b), e.g. due to a fraud attitude of the farmer, to specific market conditions or to the specific farm structure etc. Therefore, we specify a bivariate probit model to estimate the likelihood of detection for the two types of NC, i.e. a probit model with two equations with correlated disturbances (Greene, 2008). We define $\mathbf{y}_{i1}$,$\mathbf{y}_{i2}$ as binary variables, respectively for "Slight NC" and "Severe NC", taking values 1 if at leastone NC is detected in the i-th inspection, and 0 otherwise. We also define$\mathbf{x}'_{i1}$ and $\mathbf{x}'_{i2}$as the row vectors of k_1 and $k_2$explanatory variables respectively for "Slight NC" and "Severe NC"; i = 1,…,N where N is the total number of inspections in the 2007-2009 period (N = 36,153 inspections). In matrix form the model becomes:

1) $\mathbf{y}_1 = \mathbf{X}_1\boldsymbol{\beta}_1 + \mathbf{e}_1$; $\mathbf{y}_2 = \mathbf{X}_1\boldsymbol{\beta}_2 + \mathbf{e}_2$

where $\mathbf{e}_1$ and $\mathbf{e}_2$ are the vectors of the error terms and are assumed to be correlated. More specifically the correlation coefficient ρ between $\mathbf{e}_1$ and $\mathbf{e}_2$ approximates the tetrachoric correlation between the two binary variables $\mathbf{y}_1$ and $\mathbf{y}_2$.

Results

Table 1 shows the results of the biprobit model. The LR test shows a significant correlation between the two equations, confirming the hypothesis of a co-dependence between "Slight NC" and "Severe NC". For what concerns the "Slight NC" equation, "Unannounced inspection" has a positive coefficient showing that this type of inspections may increase the likelihood of their detection. On the other side, "Follow-up inspections" show a negative coefficient, which might indicate that "Slight NC" could be fixed in the time period scheduled for the follow-up inspection. As expected, the "Inspection timeliness" and "High/Low Risk class" do not show relevant effects on the likelihood of detection of "Slight NC". This result is consistent with the type of NC involved: bureaucratic flaws are likely to happen independently with respect to time and it is reasonable to expect no particular relationship between "Slight NC" and the risk ranking. Concerning the regional localisation, "Slight NC" are proportionally more concentrated in the central regions of Italy. Finally, "Inspector's experience" shows a negative coefficient, while we expected that more experienced inspectors could be more effective in the detection of NC.

For what concerns the "Severe NC" equation, both "Sample" and "Inspection timeliness" have a relevant impact and results indicate that "Severe NC" are more likely to be detected when the inspection is made in the critical time periods of the livestock or crop productions and when samples are taken during the inspection. Consistently with the results for "Slight NC" equation, the "High-risk class" has now a significant and positive coefficient, while the "Low-risk class" maintains a non-significant coefficient. This result confirms that "Severe NC" are more likely to be encountered when high-risk operators are concerned. "Follow-up inspection" has a negative coefficient (thought significant at 8%),which similarly to the "Slight NC" case might indicate how the follow-up procedures can be considered as an effective tool for solving NC in a limited time period. Finally, the regional dummies indicate a lower likelihood of NC detection in the southern regions of Italy.

Table 1: Results of the biprobit model for "Slight NC" and "Severe NC"

	"Slight NC"		"Severe NC"	
Explanatory Variables	**est. coeff.**	**prob. > |z|**	**est. coeff.**	**prob. > |z|**
Inspector's experience	-.01177	0.000*	-.00620	0.209
Follow-up inspection	-.23011	0.001*	-.18080	0.079**
Unannounced inspection	.22643*	0.000*	-.05094	0.468
Sample	-		.45350	0.000*
Inspection timeliness	-.01294	0.674	.12136	0.007*
Other certification schemes	.00881	0.704	-.00145	0.967
Low-Risk class	.01204	0.660	-.03467	0.402
High-Risk class	.05989	0.179	.23108	0.000*
Region: Centre	.57395	0.000*	.00635	0.885
Region: South	-.03325	0.320	-.26954	0.000*
Constant	-1.75982	0.000*	-2.10845*	0.000*
Log likelihood	-10,383.41			
Wald (prob.>chi2)	0.0000			
Lr Test (prob. >chi2)	0.0105			

* significant at P<0,01; ** significant at P < 0,1; [a] "Severe NC" only

Discussion

The results of our model show that there is scope for improving the effectiveness of inspections. Detection of "Slight NC" can be improved with "Unannounced inspections"; controversial results arise for "Inspectors experience": the likelihood of detection of "Slight NC" is higher for 'less "experienced' inspectors. Results are particularly interesting for the detection of "Severe NC". The "Inspection timeliness" and the "Samples" taken during inspections emerge as relevant factors that could increase the likelihood of uncovering "Severe NC". CBs could exploit crops and livestock specific information at the farm level such as those related to the phenological stages. Actually, the analysis of the distribution of "Inspection timeliness" indicates that only a limited share of inspections is carried out with the appropriate timing, showing therefore scope for substantial improvements of the effectiveness of inspections. Increasing the number of samples and rescheduling inspections in the appropriate periods are two feasible options that could provide a substantial increase in the rate of NC detection. However, scheduling inspections in the appropriate time periods and increasing sampling could lead to managerial difficulties for the CBs, due to potential shortage of resources in the critical periods. Sampling is a costly operation, and concentrating inspections in shorter time periods could easily lead to difficulties in the management of inspectors' workload. Presently the activity of the CBs is largely conditioned by the compulsory annual visit for each organic operator. In this study, we have focussed on the potential of inspection procedure from a CB perspective and based on data normally available to CBs operating in countries with established organic standard procedures. From the farmers' perspective, improved compliance might be gained thanks to proper training and extension programs. Available evidence show that more experienced farmers are less prone to "Severe NC" (Zanoli et al. 2014a). The results in our model concerning the reduced likelihood of finding NC during follow up inspections, could be considered as an indication that organic certification might operate also as a technical support, helping to solve both bureaucratic and managerial NC. In line with the Organic 3.0 vision, third-party certification – if properly revised – may contribute to the further development of the organic sector and still represents the essential tool for assuring the maintenance of minimum standards in enlarged organic markets. However, third-party certification could evolve promoting proper risk-based inspections that might provide a twofold benefit. First, it would focus on riskier (typically larger) farms, while lowering the reporting requirements and costs for low risk-small scale family. Alternative certification procedures, such as self-claims or participatory guarantee systems, could be considered for small organic farms. Secondly, certification services could also include guidance and technical assistance to farmers. Under such conditions certification will no more represent a deterrent for small operators to stay or convert into organic, rather might contribute to lower barriers to entrance of new organic farmers.The pre-condition for an effective risk-based approach to certification requires the availability of sufficient information to be processed. This should be taken into consideration in countries presently developing organic standards, which should consider a certification system that can provide inspection records plus structural data at farm level.

Conclusions

A redistribution of inspections, inspired by a more extensive exploitation of the risk-based approach to compulsory controls can be taken into consideration for small, low-risk operators. Simplified controls e.g. based on group certification, and a more intensive use of paper-less and automated, remote-control procedures (e.g. drones) could be a solution for the future. CBcouldre-allocate resources for (more expensive) inspections involving more samples and planned in critical time periods, that could be reserved for the (less numerous) high-risk operators. Increased efficiency in the certification process might benefit particularly small scale farm that might take advantage of reduced burden of a renewed certification system, which will nevertheless remain as a key condition for the assurance of the organic standards.

References

Gambelli, D., Solfanelli, F., Zanoli, R., Zorn, A., Lippert, C., & Dabbert, S. (2014a). Non-Compliance in Organic Farming: A Cross-Country Comparison of Italy and Germany. Food Policy, 49: 449-458. DOI: 10.1016/j.foodpol.2014.05.012.

Gambelli, D., Solfanelli, F., & Zanoli, R. (2014b). Feasibility of risk-based inspections in organic farming: results from a probabilistic model. Agricultural Economics, Vol. 45(3): 267-277.DOI: 10.1111/agec.12063.

Greene, W. H. (2008), Econometric Analysis (6th ed). Upper Saddle River, NJ, Prentice Hall.

Zanoli, R. Gambelli, D., & Solfanelli, F. (2014a). Assessing Risk Factors in the Organic Control System: Evidence from Inspection Data in Italy, Risk Analysis, 34(12): 2174-2187. DOI: 10.1111/risa.12244.

Zanoli, R. Gambelli, D., Solfanelli, F., & Padel S. (2014b). Assessing the risk of non-compliance in UK organic agriculture: An econometric analysis, British Food Journal, 104 (8): 1369-1382. DOI: 10.1108/BFJ-10-2012-0262.

Information Sharing and Acceptance of novel production strategies along the organic dairy supply-chain: an empirical analysis.

Simona Naspetti[1], Serena Mandolesi[2], Raffaele Zanoli[3], Terhi Latvala[4], Phillipa Nicholas[5], Susanne Padel[6], Ellen J. Van Loo[7]

Key words: innovation, organic, production strategy, dairy, acceptability, supply-chain

Abstract

In this paper we have applied an extended version of the technology acceptance model (TAM) to testing the following hypothesis: the higher the information sharing within the supply chain the lower the effect of subjective norm on supply chain acceptance of a novel production strategy.

Three novel production strategies were presented to dairy supply chain members (farmers, processor and compound feed producers and dealers) by means of an online questionnaire in six EU countries (AT, BE, DK, FI, IT, UK) in order to assess the acceptance of innovative production systems and to identify collaborative behaviours.

We found that the perceived usefulness of these strategies is higher for organic farmers, while collaborative patterns reduce the impact of subjective norm on usefulness and overall acceptance. Our findings also have relevant practical implications for dairy farmers, compound feed producers and retailers, dairy processors, researchers, and advisers.

Introduction

The decision to adopt a new technology or a novel production strategy is related to the amount of knowledge one has regarding how to use that technology appropriately (Rogers, 2003). Sharing relevant information is an important form of cooperation, and has strong implication on acceptance and adoption of innovative technologies and production strategies. Indeed, information sharing is an essential element of inter organizational relationships among the members of a supply chain. Organic farming systems are 'information intensive' and the availability of information is particularly relevant for 'knowledge-based' innovative production strategies (Padel 2001). When information is not available, people tend to rely on other people opinions and experience, which are broadly referred to as subjective norms. In this study, the acceptance of three novel production strategies was measured for the organic and low-input dairy sector. In the following sections, methodology and results derived from the analysis of dairy supply-chain members' answers (farmers, retailers and processors) on the adoption of innovations proposed are presented. The study presented is part of a wider study in which consumers' acceptability was also measured (for further information see Zanoli *et al.,* 2014 & 2015).

Material and methods

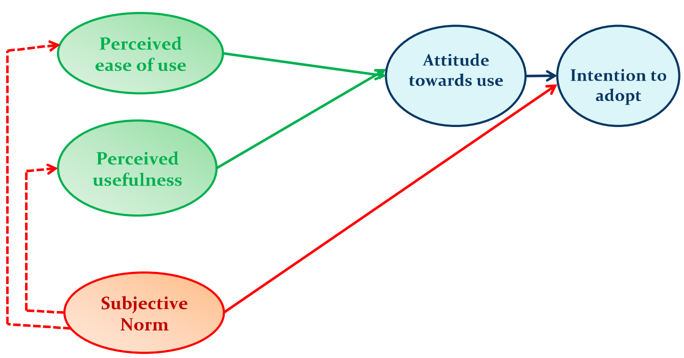
[1] SIMAU, Università Politecnica delle Marche, Via Brecce Bianche, Ancona, Italy, simona@agrecon.univpm.it
[2] SIMAU, Università Politecnica delle Marche, Via Brecce Bianche, Ancona, Italy
[3] D3A, Università Politecnica delle Marche, Via Brecce Bianche, Ancona, Italy
[4] LUKE, Natural Resources Institute, Tuusula Area, Finland
[5] Institute of Rural Sciences, University of Wales Aberystwyth, United Kingdom
[6] ORC, Hamstead Marshall, Newbury, United Kingdom
[7] Department of Agricultural economics, Ghent University, Belgium

The innovation strategies considered for this study were: "Agroforestry" (integration of animals and trees on the same plot of land), "Alternative Protein Source" (using of home-grown protein crops, such as lupins, beans and peas, as animal feed) and "Prolonged Maternal Feeding" (the calves and lambs can suckle directly from their mothers - or a foster mother - for the first 3-5 months after they are born).

A four-section questionnaire was developed to collect data. The main section of the survey included the list of novel production strategies, their definitions and section based on an extended and modified Technology Acceptance Model (TAM) developed by Davis (1989). The other three sections of the questionnaire dealt with information on the supply chain level, socio-demographic information on respondents and their company, and with the level of collaboration (information sharing) along the supply chain. Survey was distributed on-line by email, farmers' newsletter, distribution list and personal interviews. Data were analysed using statistical software packages to produce tables and test the theoretical model (Figure 1). Measurement reliability and validity was evaluated by confirmatory factor analysis (CFA) and Cronbach's alpha. Strong evidence of measurement reliability and convergent validity was found, together with multiple-group measurement invariance (organic vs. conventional).

Table 4: Description of the sample

Country	AT	BE	DK	FI	IT	UK	T
				6	53	57	223
				5	28	39	161



Results

Over 50% of each supply-chain level ranked first the "Alternative Protein Source" production strategy. Results do not show many differences among the different supply chain members, therefore we report only the results related to farmers. Estimation of the structural equation model across all responses yielded a much more simplified structure than the one originally hypothesized (Figure 1 & 2). Significant paths are going from Subjective Norm to Perceived Usefulness to Intention to Adopt (standard errors in parenthesis). Both Perceived Ease of Use and the Attitude towards Use variables were dropped from the model after initial testing. The final results indicate a close fit between the model and the data ($\chi 2 = 50.64$, degrees of freedom [df]=25; RMSEA = 0.042; CFI = 0.99; SRMSR = 0.02). The model provides good insights on the adoption of novel production strategies by dairy farmers.

The cognitive aspect prevails, confirming the importance of Perceived Usefulness as a predictive variable of intention. This finding indicates that dairy farmers, when they intend to adopt a new production strategy, do so primarily because they consider it useful and believe that will provide substantial benefits.

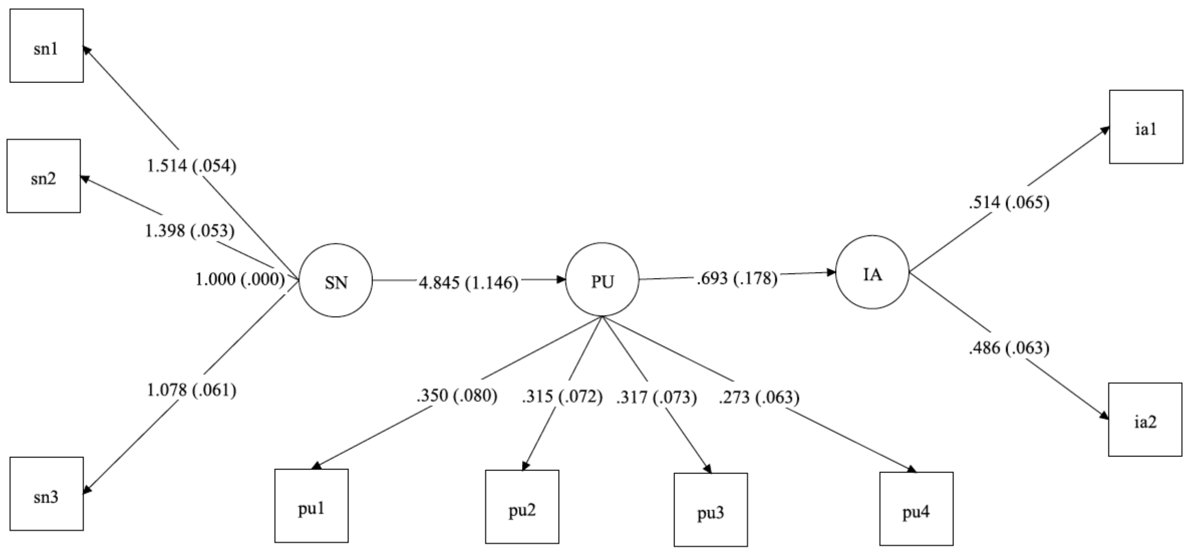


Figure 2: The final empirical model on farmers

At the same time, dairy farmers tend to consider useful what other relevant people or institutions (leading companies, other farmers, advisers, etc.) consider useful too. This finding confirms the role of Subjective Norm in influencing intentions but qualifies the role of perceived usefulness as mediator of this influence.

We conducted a post-hoc analysis, which allows to conclude that the model is not farmers' group or strategy specific. Full metric invariance could be established for the organic and conventional groups, but – quite expectedly – not for the three strategies. These results suggest that while organic and conventional farmers form their intention in identical manners (that is Perceived Usefulness is influenced by Subjective Norms to the same extent, and intentions are equally influenced by Perceived Usefulness), the way constructs are measured and the strength of the path differs in relation to each production strategy. Tests of latent means differences, showed that organic farmers – on average – perceive all the three strategies as more useful and have a higher intention to adopt any of them in comparison with conventional farmers. Organic farmers – on average - exhibit a higher Subjective Norm in relation to the three strategies, too. This means that their social environment is more favorable to these strategies than the conventional farmers' environments is.

Significant interaction effects were found between information sharing and subjective norm: as collaborative efforts on information sharing increase along the supply chain, the impact of subjective norm on perceived usefulness is decreased. Farmers who share more knowledge and information on innovation certification and product quality feel less subject to the opinions of other people in forming their opinions on the usefulness of an innovation strategy.

Discussion

Farmers' perceptions of what other relevant people want them to do, strongly influences what farmers' perceive as useful to adopt, particularly if they are uncertain about the impact of certain innovations on their farms.

The fact that the most preferred strategy - across all countries and roles in the dairy supply chain - was soy substitution by "Alternative Protein Source" (home-grown feed), may derive from the large influence of others opinions on each individual (subjective norms). Many farmers affirm that they have already adopted this strategy, indicating that this innovation is potentially already better embedded in the sector. Others feel more confident in being followers of a tested strategy. In other words, individual farmers consider it more useful and are more likely to adopt those innovations, those novel production strategies that receive broader consensus among their peers, their advisers and the society in general.

Finally, the finding that those farmers who are better in sharing information along the supply chain are those whose opinions are less impacted by the opinions of others may help understanding the role of increased collaboration within the supply chain to speed up the adoption of novel technologies and strategies, especially those which appear less 'mainstream' in the eyes of the prospect adopters. Sustainable production strategies, especially those applied in organic farming, need strong collaboration throughout the whole supply chain: input producers need to recognize the (novel) needs of their farming customers, while processors, distributors and finally consumers need to perceive the higher value produced by means of these more sustainable practices.

Conclusion

Organic farming was probably the most notable innovation in agriculture in the 20th century. Our results confirm that organic dairy farmers are more prone to innovate than conventional or low-input farmers and that their social environment is more favourable to innovation. However, information on novel production strategies, in order to be shared within a supply chain, need to be freely accessible by all interested parties. Since providing information and knowledge is costly, increased public efforts in the direction of increased free access to information resources as well as increased provision of information, advisory and extension services are paramount to the adoption of sustainable production strategies in the dairy supply chain.

References

Davis, F. D., Bagozzi, R. P., and Warshaw, P. R., (1989): User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, Management Science 35(8): 982-1002.

Padel, S. (2001): Conversion to Organic Farming: A Typical Example of the Diffusion of an Innovation?, Sociologia Ruralis 41(1): 40-61.

Rogers, E.M. (2003). Diffusion of innovations (5th ed.). New York: Free Press

Zanoli, R., Mandolesi, S., Naspetti, S., Latvala, T., Nicholas, P.K., Padel, S., Van Loo, E. J. (2014), Supply Chain Survey Results, Deliverable D5.2, SOLID, unpublished report.

Zanoli, R., Mandolesi, S., Naspetti, S., Latvala, T., Nicholas, P.K., Padel, S., Van Loo, E. J. (2015), Consumer Survey Results, Deliverable D5.3, SOLID, unpublished report

Collective management of cultivated biodiversity initiatives supporting an agro-ecological transition toward organic 3.0

Frederic Rey[1], Laurent Hazard[2]

Key words: cultivated biodiversity, community management, participatory plant breeding, Seed House, seeds

Abstract

Seed control is a food sovereignty issue. Following the almost complete transfer of seed management to the private sector in France, in the last fifty years, farmers' communities have been developing new methods for the management of agrobiodiversity. The ProABiodiv project (2012-2015) focused on the use of these new methods for maize and forage crops. Results show that from a technical and organizational point of view, community practices depend on the local context. The communities adapt what they learn from the experience of other groups and from the researchers working with them. Therefore, no single model of collective management of agrobiodiversity can be promoted for all conditions. However, the actors of these groups develop a form of collective intelligence which, together with the genetic diversity of the populations they manage, ensures a great adaptation capacity to ongoing global changes. These are valuable initiatives in support of an agro-ecological transition towards organic 3.0.

Acknowledgments

The authors thank all the partners of the ProABiodiv project: AGB24, AVEM, Belar Hazia, CBD, RSP. The ProABiodiv Project "Managing Cultivated Biodiversity - Study of local initiatives on maize and fodder", Casdar project n° 1148, received financial support from the French Ministry of Agriculture (Casdar-DGER, 2012-2015) and was co-piloted by INRA and ITAB.

Introduction

To face the shortage of seeds in the organic sector, some French farmers are collectively organizing the management of their own plant genetic resources. Under the name "Maison de la Semence" (Seed House), these farmer communities innovate by mobilizing and selecting genetic resources adapted to their local conditions, but also by producing knowledge on both the management of seeds and of the people involved in the collective action. For these communities, the main challenges are to i) develop plants adapted to the practices and to the objectives of the farmers and ii) reappropriate knowledge associated with seed management. We led a research-intervention project with four of these Seed Houses managing allogamous crops. The ProABiodiv project (2012-2015) was supported by the French Ministry of Agriculture, and its aim was to analyse the functioning and to accompany the development of these Seed Houses (Ouvrage collectif, 2015).

Material and methods

Our strategy consisted in developing a research-intervention approach (David, 2001). For three and a half years, we participated in the collective management of seeds, experienced both technical and organizational innovations. We exchanged and analysed these activities along with the actors. They took place in four Seed Houses: AgroBioPérigord (Dordogne), CBD (Poitou-Charentes), AVEM

[1] Institut Technique de l'Agriculture Biologique, France, www.itab.asso.fr, Frederic.Rey@itab.asso.fr

[2] Institut National de Recherche Agronomique France, www.toulouse.inra.fr, laurent.hazard@inra.fr

(Aveyron) and GIS ID64 (Pyrénées Atlantiques) which managed different annual crops including maize and forage (sainfoin, lucerne, orchard grass, clovers). Ten interviews were conducted with farmers and with the facilitators of the AVEM, AGP24, CBD, GIS-ID64 Seed Houses to characterise their modes of organisation. The interviews also focused on the governance and the history of the different initiatives. The interviews were transcribed and analysed (coded with N'Vivo software). Each collective developed their own patterns of selection and of the functioning of their group and provided reference materials to enable us to trace its history, governance and/or mode of operation. The different functions ensured by these Seed Houses were identified through an iterative process combining reflection workshops and fieldwork.

Three participatory workshops dedicated to the seed quality issue were conducted with the AGP24, CBD and AVEM Seed Houses, respectively. By bringing together producers, facilitators/technicians and researchers, these workshops allowed us to understand and describe how the actors are coping with the seed quality issue.

Results and discussion

Several French initiatives involved in cultivated biodiversity management gave themselves the name "Maison de la Semence" (Seed House). The name was inspired by the Brazilian "Casas de Sementes Crioulas" (Vasconcelos & Mata, 2011). These initiatives bring together farmers, and are often run by a facilitator/technician to manage seeds. The aim of the Seed Houses is to develop cultivated biodiversity and related knowledge; they often take the form of a network anchored in a territory.

Use of genetic resources

Mobilising genetic resources begins by defining the objectives of the group and the desired characteristics of the plants. Seeds can be sourced locally though seed exchanges or when travelling abroad. The stakeholders we interviewed stressed the need to encourage meetings with other users to collect knowledge and know-how associated with seeds. Seeds can also be sourced from seed banks and genetic resource centres. However, it is difficult to identify potentially suitable populations among those available, because their description in seed banks is often too succinct and not sufficiently informative. Another problem is that seeds conserved in cold conditions often result in fragile plants, which have to be acclimatised. In addition, the small number of seeds provided can lead to consanguinity problems in the following generations.

Assessment of genetic resources

Seed Houses often assess their genetic resources on an experimental platform. These tests make it possible i) to objectify differences between new populations, ii) to choose the most promising populations, and/or iii) to evaluate the effect of the selection made. These experimental platforms are also places of cross learning, which allow the actors to exchange knowledge and to create a common culture. The platforms can also be used to show the work that has been achieved. In all cases, creating and maintaining such platforms has a high cost for the initiatives.

Improvement of genetic resources

One of the main objectives of a Seed House is to select plants suited to local growing conditions that do not necessarily comply with the standards of intensive agriculture: no irrigation, associated crops, low-input and organic farming (OF), continuous grazing, long crop rotations, etc.

The plant breeding programmes developed in the Seed Houses are based both on natural selection in the farmer’s field and on conscious selection made by the farmers themselves. Farmers told us it takes two or three generations to adapt a population to their environment.

The most common plant breeding mode is mass selection. Each Seed House has its own protocols. For example, AGP24 selects the ears of maize on plants that best match their expectations to use as seed in the following year: 600 ears produce the necessary seed for about 1.5 ha. Selection criteria often concern plant vigour, susceptibility to diseases, stem hold, early maturity, the appearance of the ear, etc. More complex protocols also exist, for example, including detasseling (Bio of Aquitaine, 2013).

Limiting the risk of genetic contamination and consanguinity is a permanent concern in cross-pollinated species. To avoid the risk of GMO intrusion into offspring, AGP24 carries out annual GMO testing on selected seeds. Risks of consanguinity are limited by the large number of plants selected. For example, AGP24 recommends a pool of at least 600 plants.

Seed quality and heath management

Seed Houses rediscover, adapt, create and disseminate knowledge associated with seed management. Our study revealed that this knowledge and know-how are very diverse: knowledge covers subjects ranging from the biology of reproduction of species to theories of learning with related know-how: from hand detasseling to the conditions required for the emergence of collective intelligence. Networking is therefore fundamental for their reappropriation. This is one of the most important points in the collective dimension of the action. It allows learning through the exchange of knowledge and observation of practices. The activity of a Seed House presupposes a continuous process of production of knowledge, in addition to the reappropriation of existing knowledge. The latter is reviewed to think about practices which correspond to the local current context. This approach may also be based on knowledge gained abroad. AGP24 trips to Latin America, for example, allowed some farmers to learn specific plant breeding techniques. Another source of learning is exchanges with researchers in participatory breeding programmes. Transmission is based on peer exchange, organised, for example, as a day of training.

Conclusion

Seed Houses are based on interactions between people, plants and their environment. They depend on tools, rules and norms. To make sense and to be sustainable, in each initiative, these have to be redefined according to the local context. There is therefore no single model that could be promoted for the collective management of agrobiodiversity under all conditions.

All the actors of these initiatives develop a form of collective intelligence. Together with the genetic diversity of the populations they manage, it provides a great capacity of adaptation to organic agriculture to face local constraints and ongoing global climate changes.

By their action, they connect seeds with their associated knowledge, and without which the seed is unusable. Seeds are thus a vector of knowledge; they enable farmers to network, to discuss their practices, and even to question the coherence of their farming system. In this way, these initiatives are a relevant vector for the development of innovation and of sustainable OF systems.

However, such initiatives are fragile. Developing a trial and error approach to find appropriate solutions and suitable modes of operation is a long-term process. In an era when progress aims at the immediate satisfaction of needs, this can lead to frustration. In addition, it is also a time-consuming commitment. Producing seeds is an additional activity on a farm. Despite these difficulties, many farmers expressed their satisfaction in reclaiming sovereignty over their seeds.

During the course of our project, we observed the importance of facilitators/advisors in the success of these participatory approaches. Being a kind of "innovation brokers", they develop a novel and wide range of skills. There is a need to acknowledge their competencies and to analyse and formalize their skills to build a professional training dedicated to the training of Seed House advisors.

Finally, there are still a few barriers to be broken down: the seed regulatory framework is one of them; project funding methods are another one. As a matter of fact, these funding methods should recognize the relevance of flexible project management and participatory approaches. Participatory approaches enable adaptation to a complex and uncertain agricultural context. They have demonstrated their effectiveness in the creation of innovation and in finding solutions to real problems. Although they may seem "strange" to the academic world, they are nevertheless forging a path in a society which demands that research generate innovations.

Within these Seed Houses and using multi-actor and transdisciplinary approaches, a true culture of co-innovation between farmers, farm advisors and scientists is being developed. The actors are involved in a process of continuous improvement toward best practices. What is more, such initiatives empower farmers, who recover seed sovereignty. These are cost-effective initiatives, which contribute to the development of mutualisation, to real partnerships, and to the valorisation of food products on a territorial basis. They are able to support agriculture in disadvantaged areas and have been shown to improve quality of life of the actors involved (Ouvrage collectif, 2015). In these ways, these initiatives support an agro-ecological transition and a shift toward organic 3.0 (Arbenz et al., 2016).

References

Arbenz Markus, Gould David and Stopes Christopher, (2016) Organic 3.0 – for truly sustainable farming and consumption, IFOAM Organics International, Bonn and SOAAN, Bonn.

Bio d’Aquitaine, (2013) L’Aquitaine cultive la biodiversité 2001-2011, 10 ans d’expérience et d’expérimentation sur les variétés paysannes de maïs et tournesol : Bilan, Résultats, Perspectives.

David A (2001) Intervention Research as a General Frame-work for Management Research. In: A. David, A. Hatchuel and R. Laufer (eds), The New Foundations of Management Science, (English translation). Vuibert/FNEGE, Paris.

Ouvrage collectif, (2015) Collectively managing agricultural biodiversity: study of local initiatives. Gérer collectivement la biodiversité cultivée: étude d'initiatives locales. Editions Educagri.

Vasconcelos JMG & Mata MF (2011): 10619-Casas de sementes comunitárias: Estratégias de Sustentabilidade alimentar e preservação da biodiversidade no semi-árido cearense. Cadernos de Agroecologia, 6 (2).

Assessing the production impacts of a large-scale conversion to organic farming in England and Wales

Laurence Smith[1,2], Philip Jones[3], Adrian Williams[2], Guy Kirk[2]

Key words: scaling of organic farming, optimisation, modelling

Abstract

This paper explores the implications for food production and land use of a 100% conversion to organic farming in England and Wales. The analysis uses a large-scale Linear Programming model of England and Wales agriculture, incorporating estimates of yield differentiated by soil and rainfall class, plus nitrogen supply/offtake and livestock feed demands. Results revealed a major reduction in arable crop outputs, milk and monogastric livestock under all organic scenarios. The results suggest that innovative approaches to nitrogen management on organic farms and changes in farm structure could help to improve the performance of organic agriculture at a national level, although this would require a major shift in current practices.

Acknowledgments

The material presented was produced within a PhD supported by the Organic Research Centre and the Engineering and Physical Sciences Research Council (EPSRC).

Introduction

With growing concerns over the capacity of modern farming to maintain current levels of production, in the face of environmental damage and increasingly costly inputs, there has been increasing interest in alternative low-input systems such as organic farming. Although such systems have the potential to produce food in an environmentally benign manner the broader impacts of a widespread conversion to organic practices are still unclear. This study aimed to provide a robust estimate of these impacts, e.g. on food production and land use, of a 100% organic conversion in England and Wales (E&W).

Material and methods

To answer the research question "how much food would be produced under a 100% organic agriculture in England and Wales?" a Linear Programming model was developed in the GAMS[i]programming language. The objective function of the model, which was maximised, was aggregate food output (Z) as metabolisable energy, i.e.:

$$\text{Maximise: Z} = \sum_{ij=0}^{n} C_{ij} \text{ x } X_{ij}$$

$$\text{subject to: } Ax_{(ij)} \leq b; \quad x_{(ij)} \geq 0$$

1 The Organic Research Centre, UK, www.organicresearchcentre.com, email: laurence.s@organicresearchcentre.com

2 School of Energy, Environment and AgriFood, Cranfield University, UK, www.cranfield.ac.uk, email: adrian.williams@cranfield.ac.uk

3 School of Agriculture, Policy and Development, University of Reading, UK, www.reading.ac.uk, email: p.j.jones@reading.ac.uk

Where C is the energy output of organic agricultural products (i) on each soil/rain class (j) and X is the activity scalar (crop areas or livestock numbers). A represents the input and resource requirements associated with diverse agricultural activities (x) and b is the resource endowment and input availability vector (e.g. manure-N, land by site class).

Data on typical organic crop yields and crop rotations were obtained from published sources providing technical information to the sector, structured interviews with farmers, recent meta-analyses (e.g. Seufert et al., 2012) and the Defra Farm Business Survey (FBS). Crop yields were adjusted for 16 soil/rainfall classes and 3 nitrogen-fixation rates through an application of the NDICEA model (Nitrogen Dynamics In Crop Rotations in Ecological Agriculture, Van der Burgt et al. 2006). Technical data on typical organic livestock systems were obtained from industry sources, the FBS and recent studies (e.g. Leinonen et al. 2012). A range of scenarios were assessed by adjusting key model parameters. Data from each scenario were compared to a 2010 baseline (Defra, 2011) and to results from the most recent study in this area (Jones and Crane, 2009). Upper limits on the production of individual crops and livestock products were set at 150% of production volumes in the non-organic baseline, under an assumption that further increases could not be absorbed by the market.

Results

The crop production volumes and livestock numbers under each organic scenario are presented in Figures 1 and 2 below, as a percentage of the non-organic baseline.

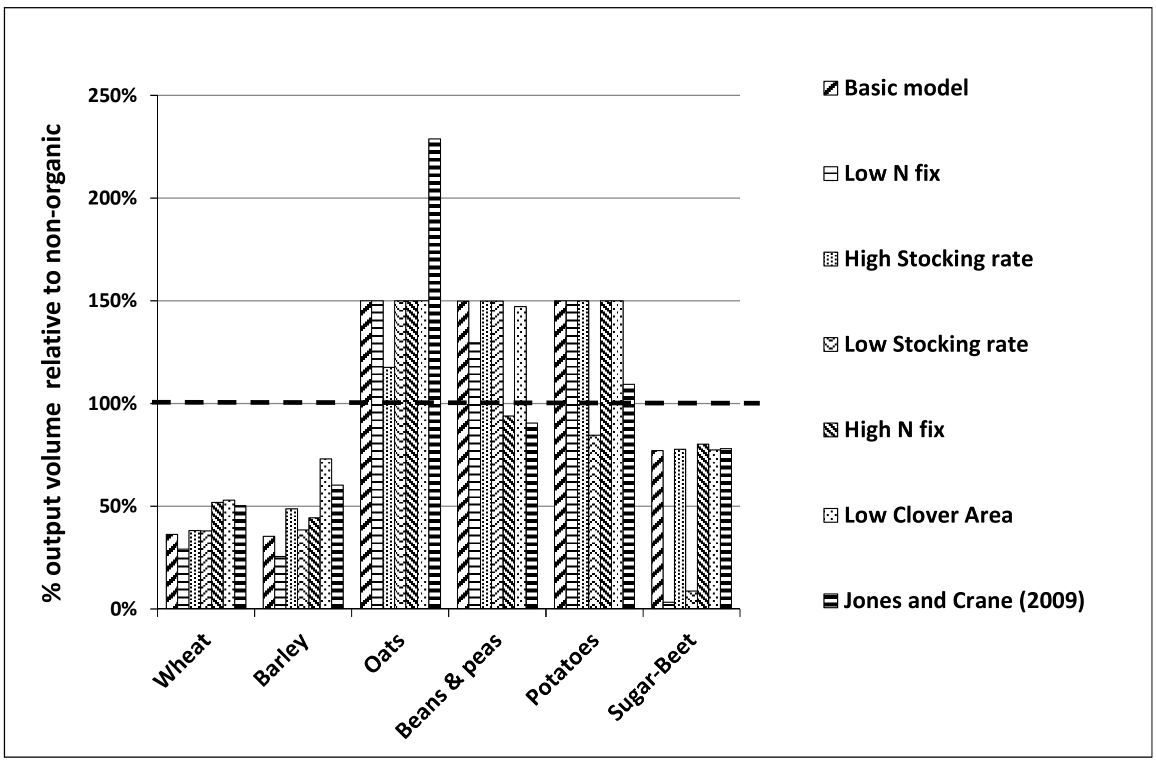


Figure 1. Production of arable crops in England and Wales under organic management scenarios as a percentage of a 2010 non-organic baseline

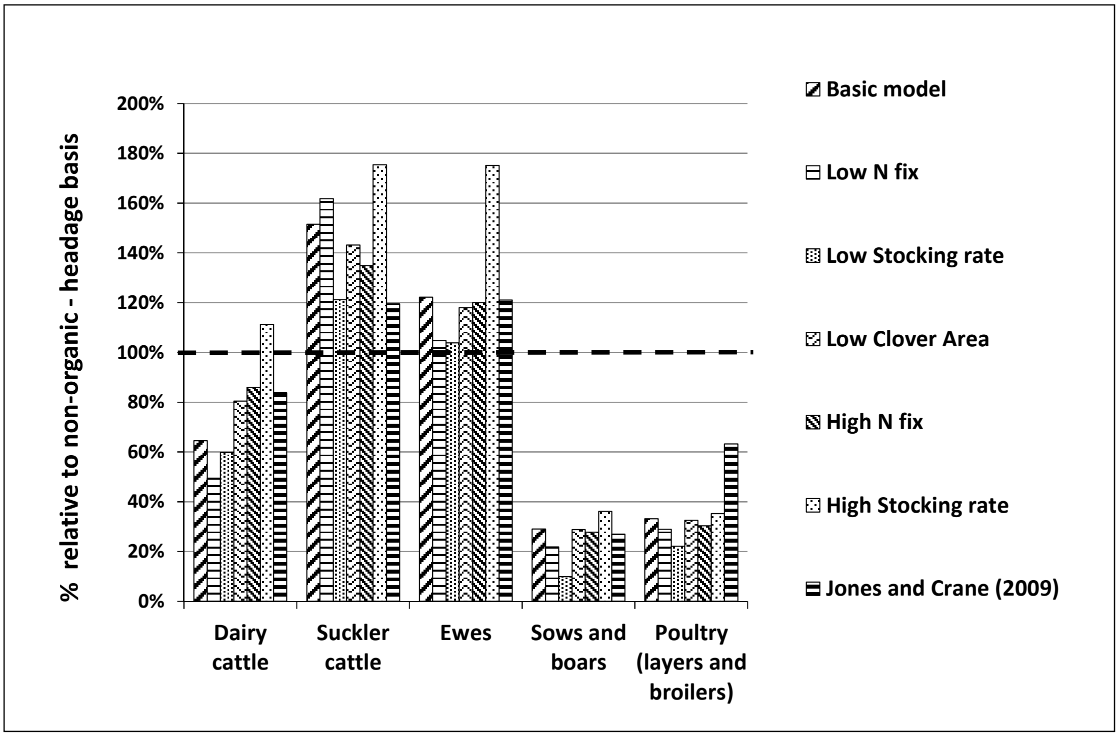


Figure 2. Livestock numbers in England and Wales under organic management scenarios as a percentage of a 2010 non-organic baseline

Despite increases for some crops such as oats and beans, total crop production was considerably lower than the non-organic baseline under all organic scenarios, in particular as a result of lower outputs of wheat, sugar-beet and barley. For livestock, beef and sheep numbers usually increased whereas monogastric livestock fell sharply. Dairy cattle numbers and milk production volumes were approximately three-quarters and two-thirds of the conventional baseline, with the greatest reductions seen in western areas of E & W. The greatest variation across scenarios was seen for the low and high nitrogen fixation rates. Reducing the area of fertility-building ley increased the outputs for cereals and reduced the production of high-N offtake crops (e.g. sugar-beet).

Discussion

The major decrease in crop production volumes under the organic scenarios highlights the importance of optimising the fertility building phase within organic arable systems in order to maintain yields. A switch from long-term leys of >12 months to targeted short-term green manures would help to increase outputs, through increasing land availability, although ensuring adequate nitrogen supply at times of peak-demand is likely to remain a challenge. Models such as NDICEA can help to improve nitrogen use efficiency in organic rotations through highlighting surpluses and deficits of N at key points. Increased use of imported composts (e.g. from household waste) and varietal (instead of species) diversity in rotations could also help to increase outputs.

For most scenarios, the total cereal production volumes were considerably lower than the estimates by Jones and Crane (2009). This illustrates the lower yield obtainable on wetter soils in western parts of the UK, something that could be improved through better cultivation practices and rotation design (e.g. reduced tillage and avoiding ploughing leys in the autumn to reduce leaching). The much lower production of wheat also highlights the importance of focusing organic breeding efforts on this staple crop.

In common with Jones and Crane (2009) an increase in ruminant livestock was found under organic management, with big increases occurring in arable-dominated eastern areas. Although beef and sheep livestock numbers increased the meat output was comparatively close to the non-organic baseline as a result of longer finishing periods. A sharp decline in the production of pigs and poultry was observed due to limits on feed availability, lower stocking rate limits and poorer feed conversion ratios. Developing suitable breeds for organic monogastric systems continues to present a challenge and more research on the efficient use of slower-growing breeds in organic systems would be valuable. Replacing some of the traditional small beef suckler herds on organic arable farms with poultry or pigs would also help to increase outputs for these livestock types, but would increase feed-crop needs.

Overall food-energy outputs fell to between 38% and 66% of the 2010 non-organic baseline, depending on scenario. Even if food waste were to be reduced the switch to organic methods would therefore result in a substantial decrease in domestic food production, requiring an increase in imports. Whether overseas land would be available for such an increase is questionable and a fundamental change in diets and/or farming systems could be required to avoid significant supply shortfalls.

Suggestions to tackle the future challenges of Organic 3.0

Similar rates of production for ruminant livestock highlight the potential benefits from a wider application of organic practices (e.g. clover in grassland to reduce dependence on manufactured N fertiliser) on organic and non-organic farms producing milk, beef or lamb.The much lower outputs for monogastric livestock also highlight a potential need to revisit organic standards in these areas to improve production efficiencies. Improved approaches to nitrogen management could also be explored to assist the development of the sector, with particular regard to rotation design.

References

Defra (2011) Agriculture in the United Kingdom 2010. http://tinyurl.com/AUK2010.

Jones P & Crane, R (2009) England and Wales under organic agriculture: how much food could be produced? Centre for Agricultural Strategy, University of Reading. http://tinyurl.com/E-W-Organic.

Leinonen, I, Williams, AG, Wiseman, J, Guy, J, Kyriazaki, I (2012) Predicting the Environmental impacts of chicken systems in the United Kingdom through a life cycle assessment. Broiler production systems. *Poultry Science* 91, 8-25.doi: 10.3382/ps.2011-01634.

Seufert, V, Ramankutty, N & Foley, JA (2012) Comparing the yields of organic and conventional agriculture. *Nature* 485, 229-232. doi: 10.1038/nature11069.

Van der Burgt, G, Oomen, G, Habets, A, Rossing, W (2006) The NDICEA model, a tool to improve nitrogen use efficiency in cropping systems. *Nutrient Cycling in Agroecosystems* 74, 275-294. doi:10.1007/s10705-006-9004-3.

[i] General Algebriac Modelling System (GAMS). GAMS Development Corporation. http://www.gams.com

Socio-economics - Global

Title	Author/s	Country
Why is Africa struggling with organic farming? A methodological contribution from sociology	Gian Linard Nicolay	Africa
What marketing condition makes organic products more accessible? A case study in Brazil (view paper)	Elaine Caliman Sposito, Lucimar Santiago de Abreu	Brazil
Going organic - A Critical Analysis of the Potential for Organic Farming in Ethiopia	Bernhard Freyer, Yoseph Delelegn, Zerihun Nigussie, Richard Onwonga, Jim Bingen	Ethiopia
Improving statistical information on the agro-environmental indicator "organic area" at the global level	Helga Willer and Julia Lernoud	Global
Higher Education on the Rocky Road to Organic 3.0 in Thailand: A Synthesis of Themes and Results from Four Research Projects, 2014-2016	Wayne Nelles, Supawan Visetnoi	Thailand
Organic and Conventional Wheat Yields Analysis of US Agricultural Census Data	Carolyn Dimitri	USA
Women in organic cocoa farming systems in Ghana: Empowered?	Irene Susana Egyir, Joseph Bandanaa, Joseph Clottey, G.K. Ofosu-Budu, Irene Kadzere, Christian Schader, Willem-Albert Toose, Bo Van Elzekker, Emelia Monney and Esther Agyekum	Ghana
ODS from PGS-certified organic smallholders' vision: achievement and challenges within public policies and territorial diversities.	Eva Torremocha	Global
Entrepreneurial culture and capability of Organic farmers' organisations in the Phillipines	Maria Rowena A. Buena, Cory William Whitney	Phillipines

Six myths of Research in Organic Farming	Bernhard Freyer, Jim Bingen, Valentin Fiala	Austria
Emerging Trends in China’s Organic Farming: Five Case Studies	Huichen Gao, Suguru Masaki, Dong-Cheol Shin, Lei Jia, Hong Park	China
Participatory guarantee systems: Organic certification to empower farmers and strengthen communities	Robert Hom, Hervé Bouagnimbeck, Roberto Ugas, Markus Arbenz, Matthias Stolze	Peru
Competences for responsible action through interdisciplinary teamwork in agroecology: Norway and India.	Anna Marie Nicolaysen, Charles Francis, Barbara Smith, Geir Hofgaard Lieblein, Parthiba Basu, Tor Arvid Breland, Anshuman Das	Norway, India
Organic agriculture and rural livelihoods: Enhancing social capital among organic small landholders in the Peruvian Andes	Silvana Vargas, Roberto Ugás	Peru
Spreading agricultural good practices: multidimensional benefits observed in Kampong Thom, Cambodia	Félicien Meunier, Camille Heylen, Amaury Peeters, Sreykhouch Ek, Malyne Neang, Saray Hean, Sinal Peanh	Cambodia
A sustainable organic production model for ‘Food Security’ in the United Arab Emirates and Sicily	Khalid Butti Al Shamsi, Antonio Compagnoni, Giuseppe Timpanaro, Paolo Guarnaccia, Paolo Caruso, Simone Rocchi	United Arab Emirates
Changes in Organic Participatory Guarantee Systems (PGS) in Northern Vietnam	Nhung Tu Tuyet, Cory William Whitney	Vietnam

Why is Africa struggling today with organic farming? A contribution from sociology and systems thinking

Gian Linard Nicolay[1]

Key words: organic farming, sociology, development tool, pro-poor growth, Africa, food and agriculture systems

Abstract

This narrative presents the social and sociological context of the current African food and agriculture system from the perspective of organic agriculture. A method is presented that allows to observe and understand sustainable forms of agriculture, particularly organic farming in Africa, and its key features like organic markets (both domestic and export), soil organic matter enhancement, biodiversity, socio-economic benefits for smallholders and societies, local economies and economic growth in a new way. The method includes economic, political and cultural codes, is based on process and development sociology, social system theory, transversality and action-research based on innovation platforms and is mainly focussed on the sub-national level. The paper presents preliminary results of its applications in various African countries, explaining the interconnectedness of the various socio-economic aspects and factors linked to farming, resistances against organic and potentials towards the various forms of organic and sustainable agriculture. I conclude that organic agriculture is highly relevant for all family farms and for development, as well as for politics promoting a pro-poor agenda and business tapping into the rapidly growing organic markets.Recommendations are made for aligning the recently discussed concepts of Ecological Organic Agriculture (EOA) and Organic 3.0 in the African context.

Acknowledgments

This research paper became possible thanks to four different projects run since 2010 in Africa. The funding of EuropeAid (Syprobio), Swiss National Science Foundation and Swiss Agency for Development and Cooperation (ORM4Soil and Yamsys) and finally to the Austrian Government (ConneSSA/ERAfrica) is gratefully acknowledged. My personal thanks forBrian Baker and Adrian Müller for their critical reading of the manuscript.

Introduction

Why are people still starving? Why is the debate on the appropriate forms of producing food still driven mainly by ideologies? What can people expect from organic farming, broadly defined by Organic 3.0, as a practical way to end hunger in Africa, feed all people and restoring depleted landscapes? How do these questions relate to society and why should a new method for analyses based mainly on sociology make any difference? Food and agriculture understood as a socio-ecological process is not only complex and multifaceted, but also situational to both time and place, hence dynamic. African social ecology is particularly complex, struggling since colonial times with nation building, independence and economic development (Balandier 1970, Stoop and Hart 2005). Smallholder farming is still the dominant livelihood in Africa and agriculture continues to play a great role in development and transformation of economy and society (IFAD 2016). FiBL has worked to promote organic farming in Africa for about 10 years, taking a pragmatic approach, seeking to change the sector towards sustainability and climate change resilience and not just describe it for academic purposes. In this paper, I try to explain why and how sociology (together

[1]FiBL (Research Institute of Organic Agriculture), Switzerland, www.fibl.org,
eMail: gian.nicolay@fibl.org.

with economics and anthropology) as a science (and approach) is used and what results we can present so far to improve the status of organic farming as a "state of the art" form of practice within the overall sector of agriculture and rural development in Africa. Consistent with Organic 3.0 (Niggli 2015, Arbenz 2016), organic agriculture includes all forms of farming that care for healthy soil as the foundation, use cyclical and regenerative practices to produce food, enhance biodiversity, and treat fairly all people involved in the food system. Agroecology, permaculture, biodynamic agriculture, regenerative agriculture and eco-farming in principle are part of organic. This interpretation of organic is also in line with the concept of Ecological Organic Agriculture (EOA) as defined and promoted by the African Union since 2011. The narrow, legalistic, market-oriented version of organic is referred to as Organic 2.0 in this text.

The food and agriculture sector is divided in various distinct constituencies, most of them claiming to be alternatives to the mainstream industrial – here defined as both large scale and exploitative (Kesavan and Swaminathan 2008)- and conventional agriculture, considered to be ecologically and socially unsustainable (Pimentel 2005, Weis 2010) even on small-scale level. This is particularly true in Africa, the continent with the largest reserves of land for farming and therefore a battlefield of economy and ideology. If we want to understand the conditions for converting industrial, conventional and unsustainable forms of farming to organic, then we need social sciences based methods as these processes happen within societies. The method must as well be specific enough, and answer questions at local level, but be open enough to capture phenomena beyond the primary production and dealing with the topics of current world society or humanity and world citizenship (Elias 1978). It would so cover the topics of Sustainable Development Goals (SDG) including the requirements of pro-poor economic growth (Rockström, Williams et al. 2017). The method should fit to both rural and urban farming, as latter will gain fast in importance (Biel 2014). We hypothesize that with most current methods applied the weakest point is the blindness of most involved individual observers-actors and research programs against society in it's integrity-i.e. the human, social, economic, political, cultural and historic dimensions- and its role in shaping the sector. The exclusion of social sciences, respectively the separation of economics and sociology (including anthropology), reduces the chances to grasp relevant phenomena, which involve in the field of farming and agriculture always both individual ("egoistic") non-social actions (Weber 1922) as well as dominantly social actions (Elias 1978). Only if we take the key social and economic factors jointly into account, resistances against and opportunities for organic farming can be understood and changed.

I have tried to argue the key role of agriculture in addressing various targets of the SDG like poverty, hunger, land use and climate change security (Nicolay 2016). Societies embed food systems, as it is a prime function of societies to assure food provision for its members. Over the last two centuries, nation-societies with growing fractions of urban population have replaced the often ethnic-based patrimonial or feudal societies, englobing large numbers of people, governing over extended territories and increasing the complexity. In Africa, colonialism over-shadowed this process, covering the years from the 1880s to the 1960s. Contrary to Asia and Latin America, which were better able to emancipate from the former colonial powers, African societies remained even after independence in conflictual relations with its political emancipation by non-integrating the masses of the poor. One consequence is the difficult relation between the African peasantry with its urbanized elite- often connected with landlords and local chiefs, and the vulnerability of Africa towards increased global demand for productive land. From the practical side, the huge landmass of Africa- larger than China, India, USA and Europe together- organized in over a quarter of all nations worldwide (54), has an impressive and unmatched diversity related to culture, language, socio-politics and ecology. The social and human diversity and richness of African societies and economies require sound knowledge when dealing with change, technology, business or politics. These areas are all relevant for organic agriculture and food systems, as food production performance is a combination of natural-ecological and socio-economic factors.

Africa has moved from the third-from-last position in 2011 to become the second-most attractive investment destination in the world (EY 2014). Kenya, Ghana, Mozambique, Uganda, Tanzania and Zambia are becoming more prominent. The importance of the agricultural sector has increased sharply, ranking only marginally behind mining and metals concerning growth potential (EY 2014).The barriers separating farmers from the markets are however still impressive (WB 2012). Additionally, the vulnerability to natural and societal shocks increases uncertainty, which in turn raises the cost of doing business in Africa and hampers productivity and growth. For addressing these sources of vulnerability and building resilience both natural and social factors are critical to maintain solid growth rates by the inclusion of potentially viable small-scale and family farms operating sustainably. The World Bank advises to make structural transformations in the societies and economies to capitalize on the significant growth opportunities. From Boserup (1965) and Botoni (2009) we know that population growth has the potential to induce agrarian change- hence structural transformation- and increase labour- and land-productivity. The potential however is only realized when habits and skills of the farmers match the technological requirements. Societal or institutional conditions must be in place therefore. Africa's population, the fastest growing and youngest in the world, is now concentrated in urban areas. This new class of consumers has a smaller family, is better educated and higher earning, and is digitally perceptive (McKinsey 2012). The fast rising urban consumer with a household income above UDS 20'000 is considering quality products and so organic food is expected to soon be on his or her request.

Our interest with this article is to clarify on the methodological questions on how this highly complex process, mainly within the specific nation-societies of SSA, could be understood scientifically, and hence influenced. At stake are food and agriculture systems, economies, social order, productivity gains of small-scale farms and comparative options of investments from both public and private (domestic and foreign). We understand more and more that the impacts of failures are felt at global level in form of increasing migration flows, desertification, famines, social unrest and terrorism due to economic breakdowns and unemployment of the youth and climate change due to – among others- ongoing decarbonisation of the depleted soils. The research done so far shows the need to apply an integrated approach covering all the four social dimensions of the relevant system, i.e. the nation-society: economy and markets, politics, organization/interactions and culture. Secondly, the difference between organic and industrial and conventional agriculture must be considered to make use of the growing markets of organic products (food, cosmetics and fibre). The main challenge remains in the interpretation of structural dynamics. What is the role of the peasant class as an estate and its relation with the respective national elite, both within government and within the economy? How can the given nation-state enhance and stimulate land and labour productivity with economic-based policy measures (incentives prices, input supply, education and infrastructure)? Who will address the alarming situation of the still declining soil fertility leading to unacceptable productivity levels in the farming sector? How can the universities address these challenges with appropriate curricula for the students and how the social sciences including history and sociology rise their profile with academia?

In the context of sustainability, we should foster the imaginary of organic farming as a unique opportunity to address multiple challenges and so get out of the current niche and ideological confusion. The challenges to face are food insecurity, poverty respectively economic growth, family organization, natural and particularly soil and land restauration, biodiversity and the coping with climate change. The method we aim to promote aims to systematically identify the mental factors (Godelier 1986) (complementary to the material ones) of organic agriculture and sustainable development and is targeted towards district level, i.e. below the (highly complex) national level and beyond the village or neighbourhood level, focused around value chains efficiency and farm productivity. In such a way, it becomes possible to observe and better understand and empirically test the (i) imaginary and mental construct component of agriculture and food systems and (ii) status and eventual resistances against organic agriculture and (iii) ways to overcome them in the given context.

Material and methods

The point of departure for this paper is the neglect of social sciencesto solve problems in the food and agriculture sector in Africa, particularly the underestimation of organic agriculture as a mainstream solution. These problem statement come from development and real-life experiences in various countries over more than 25 years. Only during the last seven years, I realized that the lack of social scientists involved in many research teams could be one of the core problems. Coming as a trained agronomist more from the engineering and as a post-graduate student in social sciences from the development side, I refreshed then the sociological skills to apply them in research contexts of agricultural development, where sociology is rather unknown. Cross-disciplinary relations- mainly with soil sciences, agronomy, economics and communication sciences- a state of mind of proceeding towards actually solving rather than just describing the phenomenon (or problem) facilitated the synthetic process of inquiry, complementing the analytical part of the science (sociology) applied. Various research for development projects, all of them related with understanding and solving soil fertility and food insecurity problems- and not necessarily aiming to promote the "classical" (i.e. certified) organic farming- provide the empirical base for my research. I used activities within various ongoing projects with FiBL-involvement in Africa, particularly Mali, Ivory Coast, Burkina Faso, Ghana, Kenya, Zambia and Morocco to develop the concept, collect and codify data and refine useful theories. We (as a project team) were—and still are—mostly working at sub-national level. This assures to keep the contact with the farms, with the extension services, with involved researchers and eventually policy makers and stakeholders from the involved market-driven value chains.

Important to note that FiBL, the Swiss-based Research Institute of Organic Agriculture, is a non-academic private foundation with strong development and extension with advisory components. Organic farming in the strict sense (i.e. certified to provide organic products for the world market and protect the producers and compensate the added quality with a premium price) never defined the boundary of the work in Africa but rather "sustainable farming". Therefore, in most areas farmers involved in the research for development set-ups are so called traditional or conventional farmers. In that sense, we applied the Organic 3.0 concept from the beginning, without aiming the conversion towards certified organic. The core interest for us was to understand the farmers as well as the role society and its institutions and economies play in shaping not only the behaviour of the farms and households, but as well the other economic players- and then to be proactive in transforming socio-ecological systems(Guattari 2015) towards resilience. In this paper, social systems theory and social science in general was applied (Luhmann 1995) as a first step. We identified a matrix of 18 parameters and 99 variables (Tab.1), which we consider as universal variables or codes to describe key elements (get the data) and then predict the behaviour of society and its members in its inner dynamics and so assess the probability for eventual investments into agriculture, from both farmers and the public and private investor's side. This first tool has been refined over the last three years (Nicolay 2016). Ithen used the concept of figuration and the theory of (civilization) process (Elias 1994) to align the elements (variables) towards an integrated model of societal dynamics, including intra- and international-society parameters. Refined predictions on the future behaviour of both individual farms and local and national figurations are the expected outcome, organized around innovation platforms and linked with policies and programs including both private and public actors. I made analyses of clusters of interdependencies constituted by farmers, government, investors, input providers, research and extension organizations, consumers and donors as part of the emerging toolbox summarized here with Tab.1. These clusters (or figurations if becoming complex) often need more empirical data to be described in detail and tested, than can be collected by singular research processes within projects (with limited human resources, time and budgets for social science). We hypothesize that these figurations fulfil the function of the given national society to assure adequate food provision for its members and that a failure would lead to serious social breakdown of the given social order, leading to a potentially new figuration (Elias 1969 (1939)).

Table 1. The matrix to assess a local food and agriculture system based on 99 variables

	Parameter	variables							n var
1	**demography**	pop density	demo. structure						2
2	**infrastructure**	health infr	roads infra	schools infr	water infra	markets infra	credit infra	processing inf.	7
3	**farming system**	land and soil quality	other assets farm	labour farms	farm income	markets farm	investments farm	Ag structure	7
4	**human capital**	age	health	knowledge	dignity	food security	labor availab.	well-being hum.	7
5	**economic capital**	legal property	agr. markets	investments	farm type	assets eco.	poverty		6
6	**financial capital**	% HH with cred. Access	incomes (HH, oth)						2
7	**social capital**	customs/habits	trust	education (status)	networks	urban centers	movements		6
8	**cultural capital**	languages	values	norms, rules	innovations	myths	ritual	collect. memory	7
9	**symbolic capital**	influence	rigths	territoriality	governance				4
10	**Creativity (organic flow as opposed to the mechanical)**	fantasy (as opposed to stiffness)	laughing (reques-ting the correction of s.t. uncomplete)	comedy	theatre (as institution and culture)	attentiveness (free acting)	contempory art (the way to show how things are)	degree of obedience (as attitude)	7
11	**social interaction**	wordsOfmouth com.	family (s.i.)	local communities	clans and tribes	age groups (s.i.)	gender (s.i.)	migration	7
12	**organizations**	associations (org)	religious org	enterprises	CBO	NGO	public (org)		6
13	**Economy**[f]	Ag sector	Industry (incl. Food)	Services (Eco)	land market	production (Eco)	consumption	land (Eco)	7
14	**Education**[f]	learning society	basic literacy	socio-cultural edu.	formal education				4
15	**Politics**[f]	coherent ag pol	coh. rural dev pol.	security	leadership (Pol)	governance events			5
16	**Law**[f]	property rights	land tenure	human rights	labor rights	customary law	policy framework		5
17	**Mass media**[f]	radio access	TV access	mob. phones applic.	internet/ soc.m	print m. access			5
18	**Research/Science**[f]	ag and social sciences	ag research	innovations (Res)	higher edu. (Res)	farmer research			5
	; society type								**99**

This method allows integrating economic, social, cultural and political factors simultaneously and organized around innovation platforms (Nicolay 2016 b), without abstracting from key societal factors like demography, farming systems and infrastructure. It takes into consideration the evolutionary nature of figurations, understood as chains of interweaving of interdependencies of people as well as the economy of the farms. The most complex social forms in our days are nation-states and allies of them regrouped around ideologies and common values (like G20, NATO, European Union, Russia-China Alliance, UN). These highly complex figurations are self-reproducing structures with only limited direct influence of individual actors (Elias 1978). Under the theory of social systems, the concept of World society (Luhmann 1998) has the same meaning as "Humanity" in figuration sociology. It constitutes the highest form of integration of all human associations, evolving since 1945 with relevant institutions in the food sector like FAO and various programs aiming global food security within the UN framework but as well the networks created by the transnational companies. These figurations influence the habits and economic conditions of the farms and its related markets and prices and so shaping the pattern for the required economic and agricultural growth within nation-societies.

I applied the method (together with various research teams) in 15 districts, mainly within the 7 mentioned countries, beginning in 2012 in Mali (in 2016 only in Morocco) with a group of sociologists, economists and agricultural scientists and with the support of innovation platforms, constituted by representatives from the local society including farmers (both organic and conventional) and policy makers. To capture the national layers of the figurations, additional data was used from available publications, interviews and related scientific disciplines (like institutional economics, social anthropology, political sciences, agricultural history). Comparative studies among various nation-societies, regions and value chains improved the understanding of the country-specific structures and power balances and the conditions for up taking or refusing of pro-organic measures and programs.

Results

We found that this holistic or integrated method (in relation to the mental/social aspect) is not only fascinating, but also required to cope with the complex nature of the African food and agriculture systems and to better understand the dynamics of organic within the sector. Food and agriculture systems are part of national figurations dealing with food provision, economic development, ideologies, power balance and nation building. As over 50% of the population makes its living out of farming, and farmers/peasants constituting most of the electorate, this huge social estate or class plays a potential major role in both economics and politics. The very low productivity of the land and the farms is a result of sub-optimal policies, contradictions in the economic patterns of the resource-poor farms (mainly mismatch between product prices and input costs), open or latent class struggles (peasantry vs urban elite), difficult ecological conditions (poor soils, lack of water, deforestation, climate change) and geopolitics. It serves for the critics of organic agriculture as a main argument against the usefulness of organic agriculture, as the non-acceptance of synthetic fertilizer would contradict the requirements of the impoverished African soils.

One difficulty was the application of the sociological concepts to the non-sociologists, as this knowledge is often limited. We found that the matrix (Tab.1) can be simplified into five core factors determining the social dynamic and building a figuration out of the following factors: collective memory, governance, social learning, organization, markets and investments by the farms. These interrelated factors can be attributed to the domains of culture, politics, societal/psychic and economics and markets (Tab.2).

Table 2: Key factors determining the collective action of farmers

Core factors	Core function	Dominant parameters (see Tab.1)	Dominant variables
Culture	Orientation; Collective memory	Cultural capital; Creativity	custom; value; fantasy/imagination; myths; degree of obedience
Politics	Governance through power monopoly	Symbolic capital; Politics; Laws	territoriality; influence; rights; security; governance
Societal 1 and Psychic	Social learning and needs satisfaction	Social capital; Research; Education Creativity; Human capital	movements; trust; networks; urban centers; science, innovation and technology (SIT); well-being and dignity
Societal 2	Organization	Organizations; Demography; Human capital; Social interaction [this parameters acts however as well on the other factors]	population density; dignity; human well-being; local communities; enterprise; gender; migration
Economic (incl. farming	Production and house-hold needs satisfaction through Economy and markets	Farming system; Economy, Economic capital; Financial capital; Infrastructure	farm income; agriculture structure; land markets; industry; investment; (processing) infrastructure
Mass media; acts simultaneously on collective memory, governance, social learning and organization		Mass media	radio; word-of-mouth; social media

These factors clusteredinto dynamic figurations, systemically connected and interrelated and which are in each case specific and unique, become the main object of observation. We used this simplified model to allow non-sociologists to apply it as a tool,to better understand the dynamics and imagining societal reality as a totality, integrate it into economic models and rules, and discuss with the stakeholders of the innovation platform on the consequences for their concrete case of development or solution path.By applying this formal approach and not only identifying key features of the content of each variable, but the nature of connectedness, we get descriptions and patterns of local societies dynamics as they have evolved over longer time (> 20 years) and mostly without being planned by any actor. We can deduct economic bottlenecks out of these largely diagnosed patterns, providing scenarios for realistic and possible alternative developments for sustainable agriculture. This process of deduction is however not easy to describe in theoretical terms and cannot be treated here.

Global markets, national policies, technology and credit availability, land tenure security, appropriate prices, farmer skills, organizational capacity, culture and a highly diverse ecology all require consideration to understand the complex interconnections required to induce a voluntary change of the food and agriculture system. Organic farming producing for the world market schemes only work when solid (often international) organizations (in most cases NGO) become active and prepare and manage the value chains including the labour and cost intensive certification process. Farmers producing for specific organic commodities like cotton, other crops were produced in most cases the conventional way (using synthetic fertilizers for maize due to lack of alternatives), as conditions were not fulfilled to do otherwise. Lack of compost, machinery, labour, organic markets and no or only minimal public incentives reduce the attractiveness for farmers to invest into the organic pattern of production. In general, organic cotton farms (Organic 2.0) are in most cases small-scale holders with above average of women-headed farms taking opportunities to get free training, reduce debt risks and access to project-based credits and profitable markets with premium prices.

Analysing the factors and figuration from the local perspective (i.e. sub-national), the high dependency of farmers (both conventional and organic) on national institutions becomes clear. This dependency is a "new" phenomenon, emerging with colonization and continuing with the independency of the new national states (Imfeld 2007, Casanova-Pérez, Martínez-Dávila et al. 2016). It takes in most cases the form of a barrier, separating from a sociological perspective the local figuration, i.e. the traditional peasant-based society, from the central state in form of the government and the involved urban elite. In other words, the national society, imposed by colonial powers since the late 19th century, has not yet fully reached the traditional society (or vice versa). Incomplete connections and interweaving create so barriers or a vacuum and with that many misunderstandings between farmer (and indigenous) and "formal expert" knowledge. This may explain why the traditional and indigenous forms of farming, developed without state actors, are systematically underestimated and considered as outdated. The dominating ideologies today (mainly capitalism and communism), nurtured by non-African actors, play a stronger role at national level, whereby their eventual success stories at local level provide the arguments of their actors to pursue their paths and concepts. Ideologies may superimpose the pragmatic and practical knowledge of the peasantry and with that the rich experiences developed over thousands of years in the various eco zones (to be tested at each case). The very weak institutions at nation-society level supposed to improve the communication between modern and traditional institutions, particularly extension services, research and parliament representation and media (mainly TV and national radio) are not capable to fill the gaps between local realities and national politics; often due to lack of interest, of resources and other priorities.

The high economic dependencies from the states towards foreign investors, capital markets and donors further contribute to reduce the communication of the government with locals and particularly the peasant-farmers and their local promoters. The power balance is hence more influenced by foreign forces than the own (farming) communities and latter only before the national elections addressed with promises rarely kept afterwards. A further constant of the national figurations is the ambivalence left to key institutions like land tenure (IFAD 2010, IFAD 2016). Land tenure is always simultaneously controlled by traditional village authorities and the central state, leading to insecurity for most of the farmers, as most of them are internal migrants or women and youth without land titles. The dependency of the politicians towards the traditional chiefs often blocks reforms aiminga more equal and secure land tenure and hence farmer investments. This explains one of the most tragic developments, which is the declining soil fertility over large landscapes and therefore the lowest agriculture productivity in the world. This is particularly relevant in areas with low and declining population density and under political regimes with unattractive incentives to stimulate productivity (Boserup 1965). The disconnection between "modern" forms of agricultural development based on the rather resource rich farms and the prevailing "traditional" form of subsistence-based farming including the potential "Organic 2.0 and 3.0" farms bears not only risks of social tensions, as these two forms of agriculture are competing for the scarce land and socio-political resources. Such a constellation would most probably reduce the chances to deal with ecological sustainability within the market driven and profit-oriented figuration. Additionally, the out-migration (both from rural areas as well from the country) weakens the economic conditions for productivity gains and growth. Under such constellations we predict that the national society through its government only acts for the "easy-going" commercial and industrial farmer community or in emergent conditions of extreme drought or other forms of heavy food shortages through recurring to international aid mainly. Organic farming is considered by most actors within the government organizations, including policy makers and researchers, as a form of traditional agriculture with no future. The lack of domestic consumers and organic promoters within the business community and the technical difficulties in applying organic farming on larger areas including more than one main cash crop, and production systems in the context of poor soils without the possibility to use synthetic fertilizers, may explain partially this "hostility". The lack of technology like machinery and appropriate tools further aggravates the situation. The African Union with its initiative launched in 2011 to promote Ecological Organic Agriculture (EOA) has not succeeded so far to change the behaviour of its member states. The main limitations of its application are within the working habits, the self-confidence of the farmers, the availability of inputs and markets as well as the performance of its promoters.

We can predict the following four specific factors as required elements for an*organic figuration embedded in the national and regional food and agriculture system*: committed people, appropriate technologies, good policies and organizations to transform ideas into action and institutionalize them. The organic figuration with its specific requirements on the absence of synthetic chemicals, more need on educational and organizational capital of the farmers, more work and labour input (leading to increased productivity) is more ambitious and requires more external support and initial investment than the conventional one. More labour input is required at farm level to provide the needed organic compost and manure, and improve and manage the complex relations between crops, trees and livestock. Hence from the investment side, this approach competes with the classical conventional farming based on reduced numbers of crops and simplified procedures related to pest management, crop rotation and soil fertility management. This change of figuration requires changes on all identified societal factors, i.e. politics, economics, culture and organization (see Tab.2). As different interests are involved in each figuration, change will not happen without some fight between the respective promoters. A key role will come towards the organized farmers, and more and more towards the African consumers of the fast growing middle-class in urban centres. Media, journalists as well intellectuals, artists and writers (Laye 1978, Kouyaté 2014) could become more influential in unveiling underlying interests, providing success stories, strengthening civil society, comparing approaches and linking consumers and producers both traditional and modern. The many non-African organizations already active in this process, mainly NGO, foundations, but as well state actors, UN agencies and programs will continue to support the African partners and contributing so towards the building of the world level figuration.

The international program of stimulating sustainable development goals (SDG) might provide some answers and guidelines in addressing the challenges. Improved dialogue among the stakeholders, as diverse and conflictual as outlined above, are without doubt a required must. The difficulties should not be underestimated. When FAO (2011) states the four reasons or factors explaining the increased food imports to Africa- i.e. demography, low productivity, policy distortions, week institutions and poor infrastructures- then we know from our research (sociology), that the analyses must be much more precise and detailed. More specific analyses and dialogue might reach the required understanding to take rational and democratic decisions at the relevant level. Programs and projects and the involved organizations should make more of such analyses whenever they plan, execute and evaluate. Ideologies, as powerful and convenient they might be at certain stages of human evolution, must be demystified to allow new perceptions, open dialogues and new outlines for specific solutions based on scientific soundness and facts. The peasant and farmer class is still marginalized, and so are the masses of consumers and poor people in Africa. "Agri-culture" is still underestimated as a key factor for social stability and sustainable development at both national and global level, as the various interweaving and connections linked to the nature of farming, land use and food consumption are not analyzed synchronically and in inter- and transdisciplinary manner. It still makes sense to talk about the Third Estate within Third Country societies. Their exclusion from the benefits of science, technology and state services reproduces huge masses of refugees, precariat fleeing toward urban centers and increasing social unrest and stress for the balances of power both nationally and internationally. Hence the importance and urgency to solve the structural problem of agriculture and food systems to unleash the potential of the tens of millions of currently unserved farmers for the economies and societies of Africa.The due inclusion of peasants and poor farmers including their long-standing knowledge on organic agriculture in the economies and societies will revolutionize the food sector and could end the hunger for good.

Many of the technical or agronomic aspects and solutions were in most cases invented and developed by the peasantry at local level over many thousands of years without major assistance from outside, as it depended since ever on creativity and innovation by the peasant-farmers themselves for survival. These forms of practice are not very different from the organic and agroecological principles. The fact that organic agriculture is struggling today in Africa is therefore a symptom of structural tensions in contemporary African societies. The markets would be there (at global level at least); the farmers would be interested to re-apply technologies, which are less harmful to health, improve the soil fertility, and which can be as economically rewarding as conventional products and approaches. It is now up-to the nation-states, the researchers and the sceptics of the peasantry to tap into the opportunities of organic agriculture and work closer with the interested farmers and the organic movement.

Discussion and recommendations

The results provide evidence that both agriculture as well as the place of organic farming within the sector are social issues, and that social sciences have the potential to contribute significantly to solutions of its problems. The integrated sociological and systems thinking method presented here in a very condensed form is still in the development stage. More empirical data fromeach of the various case studies are required totest these theories. The results so far show that the method can provide meaningful insights with can all be tested (and so rejected or improved). Our current data in the mentioned countries further suggest that the collective memory, social learning processes and organizations as well markets would be "ready" to foster organic farming, but state governance and national research institutions are not yet keen and often rather hostile for this "alternative" form of observing farming, as it proves to be complex and difficult to steer and control. The main bottlenecks are therefore situated in many cases at the policy and state level dealing with agricultural development. Local societies and their individuals (often low social class peasants) are often too weak in prestige, social status and economic power to challenge a shift in policy making and influencing its central government towards its collective interests. National research organizations depend financially and intellectually from central government (budgets) and external "clients" paying for their research. In a next step within the FiBL research-for-development program in Africa, the completion of the district-centred action-research and the presentation of case studies are envisaged. These studies will also show which forms of farming are most attractive for the giving social figurations. First conclusive results are expected latest by 2019. This task is still underestimated and hence neglected, as science still lacks to understand the complex dynamics between ecologies, farm behaviour, markets, institutions, ideologies, culture and policies. The organic community can definitely get out of its niche, by endorsing appropriate methods in understanding this social or mental dimension of food and agriculture systems and walk along with the "to-become" self-confident African peasant-farmers, with business people, emerging citizen and middle-class consumers on the development path to unleash the potential of organic farming within the agricultural sector.

The following recommendations, based on our findings and deducted from this sociological research process, can be made to promote organic agriculture in Africa:

1. Institutions that serve organic agriculture in Africa—AfroNet and their national NOAMs (National Organic Agriculture Movements)—need to better promote organic farming as a way to produce for local consumption as well as for global markets. A farm should not only receive the support for its export products and value chains, but for all farming activities, including soil fertility management and products including livestock production for domestic markets and household consumption. This move towards a more open and contextual interpretation of organic would build a broader societal and economic constituency and reduce the three weaknesses of the current organic practice: low attractiveness for many farmers, isolation of the organic movement and unhealthily specialization (Arbenz 2016).
2. Ecological Organic Agriculture (EOA) as promoted by AU and IFOAM should be considered "Organic" as much as certified organic market-oriented systems. There is a difference between a commodity or product labeled as organic and sold on the market that meets a legal standard protecting both producers and consumers and an organic farm as a production unit managed according to the principles of organic agriculture. This difference must be better communicated from the farm level to top policymakers. It can so be largely promoted in SSA. The distinction needs to make organic more attractive for African farmers.
3. Innovation and technology development and transfer in the organic sector should be treated at least on a parity with investments in conventional approaches, with priority given to technology, farmer innovation, joint ventures and cooperative enterprises. For example, subsidies for mineral fertilizers match capacity building to produce compost and other organic soil amendments. Similar investments in biological control insectaries, biopesticides tailored for local pests, and post-harvest handling facilities designed to effectively exclude pests and diseases offer organic-compatible solutions accessible by all farmers.
4. Organic farming should not be promoted too early in areas with depleted soils and food deficiency, except a concrete cash crop with reliable export markets is available. It is recommended to first re-establish the ecosystems—particularly soil fertility, quality, and health. This rule would improve the credibility for the organic approach and its promoters. We assume that it can take at least 10 years before the conditions for sustainable organic farming becomes imaginable in such depleted agro-zones.
5. The appropriate approaches to organic farming in Africa should engage African farmers, practitioners, intellectuals and consumer representatives. Scientists and researchers from bio-physical disciplines will need to work with social scientists and the humanities to replace ideological and mystical thinking with an evidence based approach.
6. Reforms of the agriculture sector should be based on growth chains rather than value chains (of commodities) and isolated growth islands. The organic sub-sector can be communicated and applied as such form of a "growth chain complex" that addresses livelihood, food and nutrition security, domestic

markets and ecosystem services and other benefits for humans, the public sector and the economy. Integrated into the overall agriculture sector, the organic method will improve the impact of the sectorial promotion as an engine for economic growth and for addressing the needs of the poor rural households.

7. Practical solutions require more cooperation with farmers and the peasant community, incorporating their knowledge and experience in locally-appropriate development paths. State institutions, the private sector and farmer organizations need to play more prominent roles, and international NGOs should slowly reduce their roles to be replaced by local actors that are on the ground and programs developed and implemented by African institutions.

References

Arbenz, M. e. a. (2016). Organic 3.0 – for truly sustainable farming and consumption. A guiding concept paper. Bonn, IFOAM Orgniac s International and SOAAN.

Balandier, G. (1970). The Sociology of Black Africa. Social Dynamics in Central Africa, Andre Deutsch.

Biel, R. (2014). "Visioning a Sustainable Energy Future: The Case of Urban Food-Growing." Theory, Culture & Society 31(5): 183-202.

Boserup, E., Ed. (1965). The Conditions of Agricultural Growth. The Economics of Agrarian Change und Population Pressure., Allen and Unwin (ecopy by Earthscan).

Botoni, E. and C. Reij (2009). La transformation silencieuse de l'environnement et des systèmes de production au Sahel : Impacts des investissements publics et privés dans la gestion des ressources naturelles.

Casanova-Pérez, L., J. P. Martínez-Dávila, S. López-Ortiz, C. Landeros-Sánchez and G. López-Romero (2016). "Sociocultural dimension in agriculture adaptation to climate change." Agroecology and Sustainable Food Systems 40(8): 848-862.

Elias, N. (1969 (1939)). The court society (Die höfische Gesellschaft). Oxford, Basil Blackwell (english translation).

Elias, N. (1978). What Is Sociology, Columbia University Press.

Elias, N. (1994). The Civilizing Process, Blackwell.

EY (2014). EY's attractiveness survey. Africa 2014. Executing growth.

FAO (2011). WHY HAS AFRICA BECOME A NET FOOD IMPORTER? Explaining Africa agricultural and food trade deficits. T. a. m. division, FAO.

Godelier, M. (1986). The Mental and the Material: Thought Economy and Society. London, Verso.

Guattari, F. (2015). "Transdisciplinarity Must Become Transversality." Theory, Culture & Society 32(5-6): 131-137.

IFAD, Ed. (2010). Rural Poverty Report 2011.

IFAD (2016). Rural Development Report 2016. Fostering inclusive rural transformation. Rome.

Imfeld, A. (2007). Decolonizing African Agricultural History. www.alimfeld.ch.

Kesavan, P. C. and M. S. Swaminathan (2008). "Strategies and models for agricultural sustainability in developing Asian countries." Philosophical Transactions of the Royal Society B: Biological Sciences 363(1492): 877-891.

Kouyaté, M. (2014). "L'expression politique dans une version de Camara Laye de l'épopée mandingue." Etudes mongoles et sibériennes, centasique et tibétaines 45(10).

Laye, C. (1978). Le Maître de la Parole. Kouma Lafôlô Kouma, Librairie Plon.

Luhmann, N. (1995). Social systems, Stanford University Press.

Luhmann, N., Ed. (1998). Die Gesellschaft der Gesellschaft (The English translation: Theory of Society), Suhrkamp.

McKinsey (2012). The Rise of the African Consumer. A report from the McKinsey's Africa Consumer Insight Center.

Nicolay, G. (2016). Integrated Organic Agriculture Research- African Experiences from the European Perspective. Third African Conference on Organic Agriculture, Lagos.

Nicolay, G. (2016 b). Theory-based Innovation Platform management. A contribution of sociology to agriculture research and development. 12th European IFSA Symposium, 2016. Theme 2: Methodology and frameworks of farming systems transformation, Harper Adams University.

Niggli, U. (2015). "Incorporating Agroecology Into Organic Research –An Ongoing Challenge." Sustainable Agriculture Research 4(3): 149-157.

Pimentel, D., Paul Hepperly, James Hanson, Rita Seidel and David Douds (2005). Organic and Conventional Farming Systems: Environmental and Economic Issues.

Rockström, J., J. Williams, G. Daily, A. Noble, N. Matthews, L. Gordon, H. Wetterstrand, F. DeClerck, M. Shah, P. Steduto, C. de Fraiture, N. Hatibu, O. Unver, J. Bird, L. Sibanda and J. Smith (2017). "Sustainable intensification of agriculture for human prosperity and global sustainability." Ambio 46(1): 4-17.

Stoop, W. A. and T. Hart (2005). "Research and Development Towards Sustainable Agriculture by Resource-Poor Farmers in Sub-Saharan Africa: Some Strategic and Organisational Considerations in Linking Farmer Practical Needs with Policies and Scientific Theories." International Journal of Agricultural Sustainability 3(3): 206-216.

WB (2012). Africa Can Help Feed Africa. Removing barriers to regional trade in food staples. P. R. a. E. M. A. Region, Worldbank.

Weber, M., Ed. (1922). Wirtschaft und Gesellschaft. Grundlagen der verstehenden Soziologie.

Weis, T. (2010). "The Accelerating Biophysical Contradictions of Industrial Capitalist Agriculture." Journal of Agrarian Change 10(3): 315-341.

Which marketing condition makes organic products more accessible? A case study in Brazil

Elaine Caliman Sposito[1], Lucimar Santiago de Abreu[2]

Key words: family farming, organic farmers market, organic market

Abstract

Concern over health and environmental and social problems generated by the production ofconventional agricultural products, promotes expansion of the organic market. At the same time, it is necessary to understand how and under which conditions the market valorises local production, strengthening organic family farming. This study analyses the commercialisation of organic food production in Vitoria (Brazil), evaluating the diversity and prices of these products in different marketing channels, such as supermarkets, grocery stores and organic farmers markets. It also compares the price of organic products with conventional products in these establishments. The results demonstrated that organic farmers markets had the greatest product diversity, in addition tobetter prices. It concluded that this channel valorises organic family production, helping to empower producers and promoting access to healthy food for local consumers, meeting the goals of Organic 3.0.

Acknowledgments

The authors wish to thank the Coordination for the Improvement of Higher Education Personnel(CAPES - Brazil).

Introduction

The problems generated by the production and consumption of conventional agricultural products require alternative actions in the production, distribution and marketing of food and fibre, and must simultaneously consider all the dimensions involved - environmental, social and economic. In Brazil, organic agriculture is regulated by Law 10,831 of December 2003. Although organic conformity assessment systems already involve third-party certification, Participatory Guarantee Systems (PGS) and social control (Flores, 2015), it is still necessary to evaluate how marketing conditions valorise organic family farming and provide diverse, accessible and quality organic products, approximating organic production to the concept of food sovereignty (Wittman, 2011). Because experience and local strategies can serve as incentives to further action, the aim of this study was to evaluate the marketing conditions of organic products in Vitoria, in the State of Espirito Santo, Brazil.

Material and methods

The State of Espirito Santo in Brazil (ES) has a history of ecological agriculture, begun in the 80s and motivated mainly by health problems caused by exposure to agrotoxins. Currently, smallholder organic farms are caracterised by a varied family production that is sold in eight organic farmers markets, mainly in the capital, Vitoria. These are street markets, organised by organic family producers from different rural regions, and that take place at different points of the city on various days of the week. This paper evaluated the marketing of organic products –diversity and price – in

[1] Federal University of Viçosa (UFV), Brazil, www.ufv.br, eMail: elainecalimans@yahoo.com.br

[2] Brazilian Agricultural Research Corporation (Embrapa), Brazil, www.embrapa.br, lucimar.abreu@embrapa.br

organic farmers markets, and compared their production to other markets of organic and non-organic products in the metropolitan region of the capital, Vitoria (ES). The data were collected every two months throughout 2014. The diversity of organic products was evaluated by the number of distinct products found in each of the following four categories of establishment analysed: supermarkets, grocery stores, organic farmers markets and agricultural fairs. Information on the prices of organic and non-organic products was collected directly from the following establishments: four supermarkets, one grocery store, three organic farmers markets and three nonorganic outdoor markets. The price of the organic and equivalent non-organic products was collected on the same day and in the same place for the supermarkets and grocery store. At the outdoor markets, the information corresponds to the closest dates and places, since organic and non-organic markets do not necessarily take place on the same day. With the supermarkets and organic farmers markets, the mean value of the cost per kilogram for each product at each establishment was calculated. A comparison of the price of organic products between these two categories of establishment was made using the percentage difference from the average price, similar to Santos (2014). In addition, the same described methodology compared the price of organic and nonorganic products within each of these establishments. Since organic farmers markets only sell organic products, their prices were compared to non-organic products from other outdoor markets.

Results

a- The diversity of organic products

The number of different organic products found in supermarkets, grocery stores and agricultural fairs was similiar, but lower when compared to organic farmers markets, as can be seen in Figure 1. The greatest diversity of organic products was found at the organic farmers markets, that had over five times more products than the supermarkets. In addition, this wide variety of products reflects the diversification of the cropping systems on those organic family farms, increasing the resilience of the agroecosystems (Gliessmanc and Rosemeyer, 2009). This was evaluated by means of the certificates presented by the producers, where the products from each property were listed. In these documents, the number of different certified items from any single property ranged from 42 to 85.

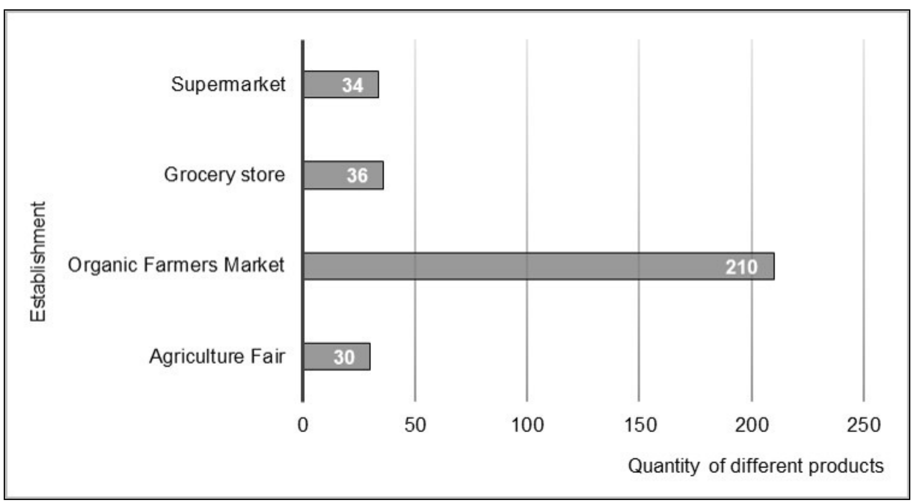


Figure 1. Diversity of organic products per establishment

b- The price of organic products

The study also analysed the price of twenty-three organic products in supermarkets and organic farmers markets.

All the organic products evaluated had higher prices in the supermarkets and grocery stores when compared to organic farmers markets. Comparing those establisments, the percentage difference between the prices for each product was calculated and the result shown in Figure 2. The highest and the lowest variations found were 325.4% (tomato) and 77.09% (chayote) respectively.

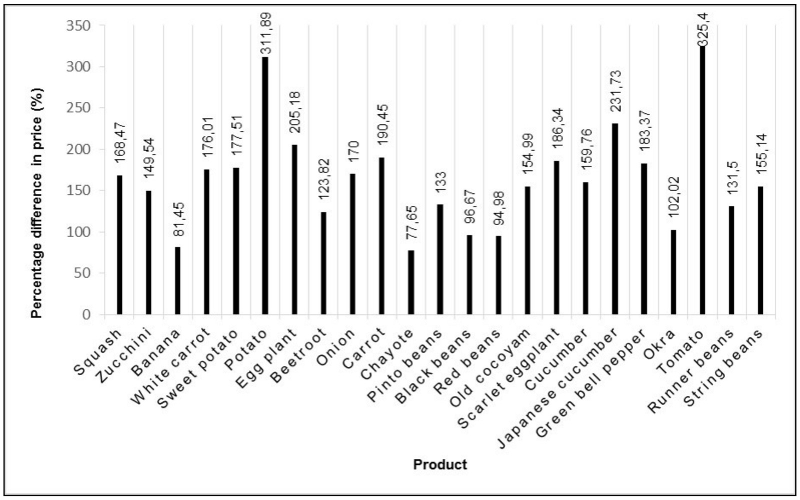


Figure 2. Percentage difference between price of organic products from supermarkets and organic farmers markets in Vitoria, ES, Brazil.

c- The price of organic compared to non-organic products

The price of organic products was compared to the price of non-organic products in supermarkets and outdoor markets. Figure 3 shows the results of the percentage difference between prices found in supermarkets and grocery stores. Minimum and maximum values ranged from 3.37% (Okra) to1109.46% (Potato) respectively. The average difference ranged from 56.212% (Okra) and 780.89% (Potato).

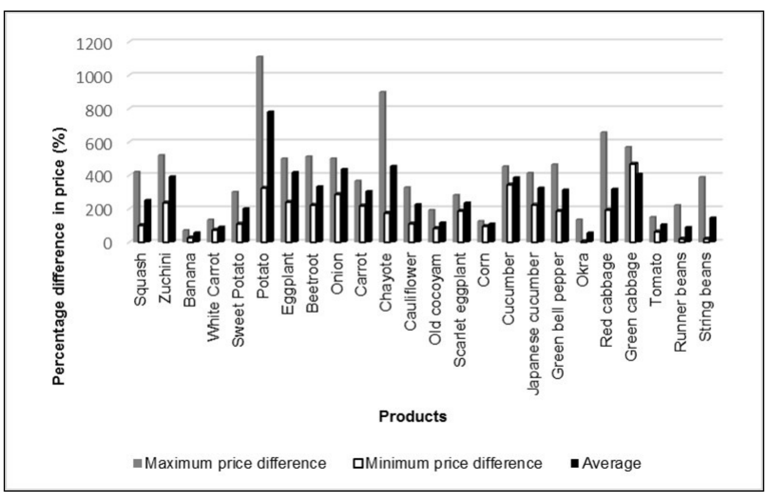


Figure 3. Percentage difference between the price of organic and non-organic products from supermarkets in Vitoria, ES, Brazil.

The price of organic products from farmers markets was compared to non-organic products from other outdoor markets. Both are street markets that take place once a week (on different days and indifferent places), however in the farmers markets, products are sold directly from the farmer to the consumer, whereas at the outdoor market there is usually a middleman. Figure 4 shows the percentage difference between prices from these two channels. The results show that organic products had higher (67.7%), lower (25.8%) or equal prices (6,5%) when compared to non-organic products. Also, even when organic products were more expensive than conventional products, the variation in percentage difference was substantially smaller than in supermarkets, ranging from 0 to 150%.

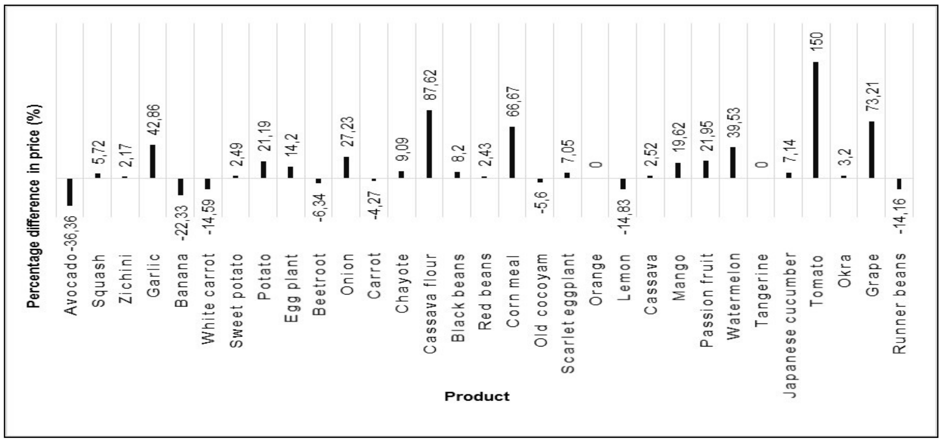


Figure 4. Percentage difference between the price of organic and non-organic products from organic farmers markets and other outdoors markets, in Vitoria, ES, Brazil.

Discussion

This study suggests that organic farmers markets enable consumers to have organic products that are more diverse and accessible, and occasionally cheaper than conventional products. This work reinforces the debate around the importance of diversified organic production in creating sustainable agri-food systems (Altieri, 2002). Moreover, short food-supply chains empower producers, as discussed by Lamine (2012), and contribute to food sovereignty as the right of local people to control their own food systems, including markets,ecological resources and modes of production. In order to increase consumers' access to diversified organic products, Organic 3.0 must strengthen organic family farming and the local initiatives of farmers markets.

References

Altieri MA(2002)Agroecology: the science of natural resource management for poor farmers in marginal environments. Agriculture, Ecosystems and Environment n. 93, p. 1–24.

Flores P (2015) Organic Agriculture in Latin America and the Caribbean In: FiBLI-FOAM Report. The World of Organic Agriculture. Statistics and Emerging Trends Research Institute of Organic Agriculture (FiBL), Frick, and IFOAM – Organics International, Bonn.

Gliessman S, Rosemeye M (Eds.) (2009) The conversion to sustainable agriculture: principles, processes, and practices. CRC Press.

Santos E P (2014) Produção orgânica: estratégia de marketing verde em supermercados. Dissertação (Programa de Pós-graduação em Engenharia Agrícola) – Universidade Estadual de Campinas, Faculdade de EngenhariaAgrícola. 140 p. – Campinas, SP.

Lamine et al (2012) Agri-food systems and territorial development: innovations, new dynamics and changing governance mechanisms. In Farming SystemsResearch into the 21st century: The new dynamic, p. 229-256. Springer, Netherlands.

Wittman H (2011) Food sovereignty: a new rights framework for food and nature? Environment and Society: Advances in Research, v. 2, n. 1, p. 87-105.

Going organic - A Critical Analysis of the Potential for Organic Farming in Ethiopia

Bernhard Freyer[1], Yoseph Delelegn[1], Zerihun Nigussie[2], Richard Onwonga[3], Jim Bingen[4]

Key words: Conversion, Ethiopia, model farms, organic matter, labour

Abstract

In this article we analyse and discuss how organic farming can be understood, in general, as a means to contribute to the sustainable development of smallholder farming systems. Drawing on our fieldwork in Ethiopia, we argue that organic farming systems is offering several systemic solutions to address some of the well-known agricultural challenges in tropical and subtropical regions, but also needs further development. Without question, organic smallholder farming requires many fundamental transformations in the agri-food system as a whole and in their institutions and organisations, the extension, research, the market and the policy system. Going organic could be an option, but it would require a fundamental change to include crop rotations, alley farming and biogas plants, pasture and animal husbandry management and other technologies in a collaborative i.e. community approach.

Introduction

Smallholder farmers in tropical and subtropical countries confront numerous inter-related internal and external challenges. These can be subdivided into three sectors.

Land: farm size is limited with approximately 0,5-2,0 ha per farm; there is pressure on communal land through growing population and land grabbing; and finally, farmers' land rights are limited.

Production: extensive soil erosion, soils pH often-below 5, low soil fertility. Farmyard manure is often burned; animal density is nearly 100% above the carrying capacity of the land; a decline of natural forests; lack of crop rotation, ploughing with oxen up to five times; low seed bed quality; no application of lime; harvest and post harvest losses are up to more than 50%; inadequate or non-existent storage facilities and processing equipment.

Markets: weak value chains and linkages to markets; high fees demanded by market brokers; export crops like vegetables or flowers, or organic coffee or honey, currently do not offer an opportunity to raise farmers income.

The above snapshot describes the living conditions of rural farm households and documents the situation of the agricultural sector in Ethiopia. Can a transformation of agriculture towards organic farming solve these problems? And what might be the framework for a bio3.0 in tropical and subtropical regions?

Material and methods

[1] University of Natural Resources and Life Science, Vienna (BOKU); https://www.nas.boku.ac.at/en/ifoel/; eMail: Bernhard.Freyer@boku.ac.at

[2] Bahar Dar University, Ethiopia

[3] University of Nairobi, Kenya

[4] Michigan State University, East Lansing, US

Our study took place in three areas around the Dangila (rain fed), the Merawi (Koga irrigation scheme) / Amhara Region and in the Awassa Region (semi-shadow coffee production). Our case studies illustrate many of the practices and challenges confronting smallholder farms in Ethiopia. From January to May 2016, we conducted a situation analyse (farm interviews, field walks, and field observations) on ten smallholder farms. The commonalities between farms allow us to classify them into three smallholder model farms-local, high input and organic-in terms of their applied materialities i.e. techniques (plants, animals, machines, tools). We sought to make visible the challenges smallholder farmers confront in establishing an environmental friendly i.e. organic and economically viable farming system. We conclude with some observations about the complexity of a system change from traditional / conventional to organic farming.

Results and Discussion

(a) Farming systems

- Local farm around Dangila

This widespread farming system in the Amhara region is approx. 1 ha in size with limited access to modern agricultural techniques. Inter-related subsystems and elements are: arable land mainly for cereals, potatoes and some vegetables; cows, goats, sheep, hinnies, chicken; forage basis; overused communal pasture land and straw; furthermore some fruit trees, eucalyptus and beehives (organic production). External inputs: small amounts of mineral fertilizer and feedstuffs (residues from local breweries or *niger* oil seed cake). Outputs are cereals, heifers, honey and some milk and meat, primarily for subsistence or for the market during the non-fasting season. In short, as a result of traditional crop production methods and a limited investment in agroforestry, the highly eroded soils have low levels of fertility with low humus content and low water holding capacity. In addition, insecure land tenure hinders investment in sustainable practices (Holden & Yohannes, 2002), such as liming or tree planting. The use of external inputs is low. Nutrient cycles are open and nutrients are lost via ongoing water and wind erosion that negatively affects crop yields as well as both milk and meat production. The materiality of the hand hoe, the oxen plough, or hinnies for transportation, conserve traditional practice formations, on the other hand there is no financial background for any investment to initiate a fundamental change.

- Intensified farm in Merawi / Koga irrigation scheme

This farm model with approximately 1,5 ha is relatively privileged due to its location in an irrigation scheme. Two cereal harvests per year, and even a third crop, and access to markets has led to increased incomes. But it is coupled with the inefficient use of fertilizers and pesticides. Because of the lack of organic matter, and liming to increase low pH, crop rotations with forage legumes, these practices lead to pest and diseases, soil degradation, compaction, acidification and ground water contamination through agricultural inputs. Neither the financial nor the human capital is available for taking a technologically or an environmentally positive step forward. There is also a lack of machinery to reduce the workload, while oxen plough and hand hoe is still the standard “mechanization”.

- Mixed organic coffee farm in the Awassa region

Our third model is a mixed organic coffee farm in Awassa region where certified organic coffee is cultivated under half shade with approximately 2 ha. It also includes several elements primarily of the first model (some crops, animals, fruit trees). Organic coffee production demonstrates a way forward toward biodiversity, healthy soils and plants. But due to the low quality of compost management and green manure practices, natural resource management needs to be improved. Similar to the other farm types there is a lack of investment in technology and in several techniques that could improve productivity. We conclude that farm income based on approximately 2 ha in mixed coffee farms is enough to maintain the household. But even the higher organic price for export coffee does not make a serious step forward in their economic situation.

(b) Potentials and challenges to go organic

Based on the above farm models and experiences from the literature, we explore the opportunities and investments required to convert to organic or to optimize the production system, while any the economic and market issues asks for another analysis.

- **Cropping and fertilizer systems**

There is evidence that intercropping (Akande et al., 2006, Dwivedi et al., 2015, Fujita & Budu, 1994, Mpairwe et al., 2002, Nedunchezhiyan et al., 2011, Nnadi & Haque, 1986), the use of farm yard manure (Ayoola & Makinde, 2008), and the use of forage legumes, e.g., alfalfa, clover or desmodium combined with alley cropping (Birech et al., 2014, Shibabaw et al., 2016) has the potential to compete with farming systems based on mineral fertilizer. Crop diversification with forage legumes (mandatory for organic farming) can also contribute to soil fertility and reduce weed pressure. Through the establishment of biogas, slurry can be sprayed to increase the cereal yields; the compost can be applied on potatoes and vegetables; and gas used in the kitchen can contribute to a more efficient energy system. Such a system could save labor for collecting fuel wood and money for charcoal as well as reduce the health risk of women while cooking. The challenges are the availability of forage legume seeds, the knowledge for the management of legumes and alley cropping, mechanical weed control and the collection and transportation and spraying of farmyard manure and slurry, and related additional labor. Still not put in practice is the manipulation of the pH through liming strategies, which would lead to a serious increase of plant nutrients availability and with that a relevant increase of yields (van Straaten, 2002).

- **Animal husbandry and feeding strategies**

To go organic, re-configuring the use of crop and pasture lands will be central in each model. Overgrazing has led to significant yield declines in forage crops that can be compensated by cultivating improved forages (such as alfalfa, clover, napier grass, etc.) and pasture management. Currently, forage legumes only cover 0.25 % of the animal nutritional need in Ethiopia (CSA, 2010b) and 0.18 % of animal feed needs in the Amhara Region (Firew & Getnet, 2010). Increased dairy productivity is tied to access to protein and starch rich green fodder and hay from leguminous plants and grass varieties (CSA, 2010a). Animal traction and threshing are one of the main reasons for keeping cattle on each of the farm models. However, the reduction of the number of animals is needed to avoid soil erosion and compaction on arable and pasture lands. Thus, there is a nexus between mechanization, the reduction of animals, workload and environmental damages.

- **Labor and mechanization – biogas and weed control**

Without exception, the farms are already extremely labor intensive. Consequently, the additional labor required in the move to organic integrating forage production, alley farming and compost / slurry spraying always raises critical questions. Compost management and sprayers to reduce labor are only affordable with external financial support and/or through a cooperative approach in which farmers share the investment and maintenance costs of modern technology. Cooperatives would have the potential to invest into machinery, but requires external start up capital from outside. Investment into zero grazing units combined with a half-day pasture system would allow the collection of farmyard manure for biogas production. Farmer or communal groups could invest in compost sprayers and improved techniques for cutting and transporting clover from the crop rotation; mechanized weeding with a horse-, an ox- or a tractor-drawn weeder would significantly reduce the farm workload. Affordable biogas systems on household level already exist (Puetz et al. 2011) and contribute to serious reduction of household workload.

Conversion specific challenges

There is no doubt that organic management methods (legume forage, alley farming, mulching, biogas production) require additional labor and need time to be successfully implemented on smallholder farms. The higher workload can be compensated through mechanisation of soil tillage. Forage legumes contribute to weed suppression and nitrogen fixation. Reduced expenses provide opportunities for investments into biogas plant and hand hoe labor / technology for weed control through the reduction of expenses for mineral fertilizers, herbicides and pesticides. Biogas slurry contributes to higher cereal yields and clover finally is the basis for higher productivity in the dairy sector, which is estimated with an increase from currently approximately less than 1 to 3t milk per cow and year.

Increased crop yields can be expected only after the second year from the following practices: direct pre-crop effects of legumes, the application of farmyard manure / slurry and the use of cuttings from alley trees. That is, this time gap between the investment in organic practices, and the economic return during the conversion period presents a key challenge for a system change. Several types of incentives would be needed to motivate farmers to move to organic, e.g. high support through advisory services, and technical support and investment into organic farming research.

Conclusion

We have shown that the organic approach offers a means to address decades of damage to the natural environment. It also opens a "repair shop" for soils, humus content, nutrient cycles, pH, biodiversity, crop rotation, alley and tree farming, forage quality, etc. – or in other words resetting the farming system.

The analysis further makes clear that there is need for an intensification of production. Several organic system technologies and practices can help solve some environmental challenges and in the meantime increase meat, milk and crop production over the long term. But this will be only possible with investments in technology (e.g. adapted soil tillage, mechanical weed control or biogas / composting techniques); and this investment should be done in a cooperative or a community.

Beyond the farm boundaries, it demands a transformative change in the local, national and international markets – current organic and fair trade systems alone cannot stabilize the farm economy -, including the broader rural and urban development policies, education, training and research investment into organic farming strategies.

Coming back to one of our questions at the very beginning – a "bio.3.0-framework" under tropical and sub-tropical ecological, societal and political conditions is a means of resetting the farming systems, includes both farm and household via the nexus of food / organic matter / energy and water and can be seen as an instrument to solve fundamental weaknesses of the agri-food system as a whole.

References

The references can be send by request through the first author.

Improving statistical information on the agro-environmental indicator "organic area" at the global level

Helga Willer[1] and Julia Lernoud[2]

Key words: Agro-environmental indicators, organic farming statistics, data collection

Abstract

Globally, organic farming continues to grow and has reached wide acceptance amongst farmers, consumers, market actors, and policymakers. According to the latest available data (per 31.12.2015), almost 51 million hectares are under organic agricultural management, and this constitutes one percent of the global agricultural land. Organic agricultural land area (and the organic share of the total agricultural land) is an agri-environmental indicator according to FAO, OECD, and Eurostat. However, the collection of these data is associated with several challenges, including data gaps and incomplete data, issues related to definitions, classifications, data quality, and data access. In order to enhance the use of this indicator by policy makers and society on the state and trends in agri-environmental conditions, better data are needed.

Acknowledgements

The authors gratefully acknowledge support for the data collection on organic agriculture worldwide from the Swiss State Secretariat for Economic Affairs (SECO), the International Trade Centre (ITC), NürnbergMesse, and the European Commission in the framework of the Organic Data Network project (2012-2014; grant agreement number 289376).

Introduction and background

Organic farming, which emerged in the first decades of the past century (Vogt 2000), continues to grow globally and has reached wide acceptance amongst farmers, consumers, market actors, policy makers and the public in many countries. Organic agriculture has garnered increasing official attention and support in the past years, in particular since 2000. Among other reasons, governments support organic farming because it responds to consumer demand for high-quality food and environmentally friendly farming practices. The benefits of organic agriculture are documented in many peer-review scientific papers, and organic agricultural land area (and organic share of the total agricultural land) is an agri-environmental indicator according to the Food and Agriculture Organisation (FAO) (2016), the Organisation for Economic Co-operation and Development (OECD) (2013), and Eurostat (2015).

According to FAO (2016), agri-environmental Indicators (AEI) are key tools to monitor the environmental performance of agriculture, track trends in environmental impacts, and provide information to assess the effects of the integration of agri-environmental concerns into policy measures. Indicators provide crucial information to monitor and analyse the effects of those policies on the environment. They can also contribute to the understanding and analysis of the environmental effects of future policy scenarios and agricultural projections (OECD 2013). The agri-environmental indicators have been developed by FAO in collaboration with OECD and Eurostat (FAO - Environment 2016). The FAO agri-environmental dataset available on the FAOSTAT homepage currently includes 24 indicators under eight domains: air & climate change, energy, fertilizers, consumption, land, livestock density, pesticide use, soil, and water use. The

[1] Research Institute of Organic Agriculture FiBL, Ackerstrasse 113, 5070 Frick, Switzerland, helga.willer@fibl.org

[2] Research Institute of Organic Agriculture FiBL, Ackerstrasse 113, 5070 Frick, Switzerland

domain "land" (with data on total agricultural land and land use) includes the data on the agri-environmental indicator "organic agriculture" (FAO - Environment 2016).

OECD explains that the agro-environmental indicator "organic area" "*reflects a move towards the elimination of the use of chemicals, some of which are of environmental concern. Organic farming practices also have important implications for biodiversity by altering habitat conditions ….*" And FAO (2016) writes that in organic agriculture "… *high emphasis is put on environmental and wildlife protection and animal welfare considerations*."

Material and methods: Data collection

The Research Institute of Organic Agriculture FiBL has been compiling and publishing data on organic agriculture based on national data sources and data from international certifiers annually since 2000. The data are published annually in a yearbook (Willer&Lernoud 2017a) and online (FiBL 2017). The data are widely used and quoted by governments drawing up action plans for organic agriculture, researchers, market actors, market research companies, and the media.

Whereas in the beginnings of FiBL's data collection activities, only data on the organic area and the number of producers were collected, data collection has been expanded in the past few years. Data collection is carried out in collaboration with many partners, using a standardized questionnaire (for metadata on the FiBL survey (see Willer & Lernoud 2017b). The network includes 200 data providers: private sector organisations, market research institutes, certification bodies as well as governments, many of which have established collection systems for data on the organic sector. These governmental data collection systems are often linked to the establishment of regulations/laws about organic agriculture, such as the European Union's regulation on organic agriculture, which describes precisely what data should be provided to Eurostat, the statistical office of the European Union (Council of the European Union 2007). Eurostat publishes data annually, covering a wide range of indicators such as area, livestock numbers, production, and operators; data are provided by the Member States of the European Union, its Candidate and Potential Candidate Countries, as well as the countries of the European Free Trade Association. Globally, FAOSTAT publishes global organic surface area/land use data online, based on the annual FAO land use survey, however, where countries do not supply these data, the FAO dataset is supplemented with data from FiBL (FAOSTAT 2016).

Results

According to the latest FiBL survey on certified organic agriculture worldwide (Willer&Lernoud 2017a) as of the end of 2015, data on organic agriculture was available from 179 countries (up from 172 in 2014). There were 50.9 million hectares of organic agricultural land, including in-conversion areas. The countries with the most organic agricultural land are Australia (22.7 million hectares), Argentina (3.1 million hectares), and the United States (2 million hectares). Currently, one percent of the global agricultural land is organic. Many attain higher shares: Liechtenstein (30.2%), Austria (21.3%), and Sweden (16.9%); in eleven countries, ten percent of more of the agricultural land is organic.

Discussion

From the experience of FiBL's long-standing data collection, there are a number of challenges related to organic data collection that needs to be tackled. These include lack of data and incomplete data, lack of common classifications, lack of common definitions, and inconsistent data. The Organic Data Network project, funded under the 7th Framework programme for research and technological development in the European Union, has developed recommendations for organic market data in Europe (Zanoli 2014). If applied to the global situation, with a specific focus on the organic area and land use data, the following recommendations emerge.

Recommendation 1: Strengthen existing collection efforts and set up national data collection where not yet in place

Even though "area" is the most commonly collected organic agriculture indicator, there is still a major lack of data on organic agriculture in many countries; in particular of land use and crop details (e.g. Australia, Brazil, India), furthermore the area data are not complete in all cases. Therefore, it would be beneficial if more governments set up data collection systems for organic data or expand the scope of existing data collection efforts by striving for more complete data, increasing the number of indicators collected, and including data collection cropping patterns. In many countries, particularly Africa and Asia, no governmental collection system is in place, and the data is collected either by the private sector or by FiBL that compiles the data from international certifiers, which is, however often incomplete and hard to obtain. It would be ideal if countries could follow the example of the European Union, which makes the collection of basic data mandatory in the organic regulation (European Commission 2014). Better data availability at a country level can then lead to better data availability at a global level.

Recommendation 2: Improve and harmonize methods to increase accuracy of data collection

Currently organic area data are collected with a wide range of methods, the most common being the collection of such data among organic certifiers (e.g. most countries in the European Union). Others collect the data in the framework of the farm structure survey (often based on samples; e.g. Australia) or in the framework of the Agri-environmental programmes (Austria, Switzerland). Due to the often difficult access to the data from certifiers, some countries collect the data among the organic operators (e.g. Kenya, Tanzania, Uganda; private collection systems). While the non-harmonised collection systems may seem a minor problem in the overall context, it has to be said that incomplete data and data gaps (e.g. on land use details) associated with some systems are not helpful when it comes to international comparisons and the assessment of the importance of organic agriculture.

Recommendation 3: Harmonise nomenclature and definitions

For organic agriculture many countries have a specific classification to organise their data, often not harmonized with the national or international agricultural statistics (e.g. some countries add the temporary grassland to the arable land, for others it is separately categorised as "grassland"). Another issue of constant concern is the treatment of areas for wild collection as agricultural land, resulting potentially in far too high organic shares of the total agricultural land.

Recommendation 4: Establish a system of routine quality checks

Data providers should establish a system of routine quality checks for organic data by applying plausibility checks. The comparison with the previous year(s), the comparison with the total farmland or the comparison of yields, can give important hints on potential inconsistencies and help to improve data quality.

Recommendation 5: Strengthen collaboration at the national, regional and global level and improve data access

At the national level, the collaboration of the authority in charge of the data collection with the organic sector could help to improve data quality and availability. International exchange, training and learning from role models is also needed. Better access to the data is one important prerequisite for this exchange. While the FAO and FiBL databases strive to give international access to data on area and some further indicators, on a country level data is often not shared or hard to find.

Outlook

The development of the organic sector, which has seen the continuous growth of the organic market and land under organic management, reflects the dynamic andinnovativenatureoforganicfoodandfarminginresponsetotheexpectationsofpolicymakersandthedemandsofconsumersforhigh-qualityfoodproduction.On a global level, availability of data on organic agriculture has improved considerably in the past years, in particular for data on organic agricultural land. However, with the collection of these data, there are challenges, including data gaps and incomplete data, issues related to definitions, classifications, data quality, and data access. In order to enhance the use of the indicator "organic land" by policy makers in order to assess the environmental performance of agriculture, better data are needed. Better support for data collection from governments and international institutions could help to improve the situation.

References

Council of the European Union (2007) Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91. Official Journal of the European Union L. 181/

Eurostat (2015) Agri-environmental indicators. Eurostat, Luxembourg. Accessed Sept 10, 2015.http://ec.europa.eu/eurostat/statistics-explained/index.php/Agri-environmental_indicators.

FAOSTAT (2016) Agri-Environmental Indicators: Land: The FAOSTAT website. FAO, Rome, Italy. http://www.fao.org/faostat/en/#data/EL. Accessed November 25, 2016

FAOSTAT (2016): Cropping patterns and organic agricultural area. The FAOSTAT3 website. Available http://faostat3.fao.org/mes/methodology_list/E. Accessed November 25, 2016

FAO – Environment (2016) Environment statistics. The FAO website. Available at http://www.fao.org/economic/ess/environment/en/. Accessed November 25, 2016

OECD (online) 2013 Edition of the OECD Environmental Database. OECD, Paris. Available at https://stats.oecd.org/Index.aspx?DataSetCode=TAD_ENVINDIC_2013.

OECD (2001): Environmental Indicators for Agriculture Methods and Results. Volume 3. OECD, Paris. Available at http://www.oecd.org/tad/sustainable-agriculture/40680869.pdf

Willer, H., Lernoud, J. (Eds.)(2017a) The World of Organic Agriculture. Statistics and Emerging Trends. FiBL and IFOAM – Organics International, Frick and Bonn.

Willer, H., Lernoud, J. (2017b) FiBL Survey on Organic Agriculture Worldwide – Metadata. In: Willer, H. and Lernoud, J. (Eds.) The World of Organic Agriculture - Statistics and Emerging Trends 2017**.** Research Institute of Organic Agriculture (FiBL) and IFOAM - Organics International, Frick and Bonn, pp. 296-306.

Zanoli, Raffaele (2014) Data Network for better European Organic Market Information - D7.1 Recommendations. Università Politecnica delle Marche, Ancona, Italy.

Higher Education on the Rocky Road to Organic 3.0 in Thailand: A Synthesis of Results from Four Research Projects, 2014-2016

Wayne Nelles[1], Supawan Visetnoi[2]

Key words: Organic Agriculture, Extension Research, Higher Education Policy, Mainstreaming

Abstract

To better understand the potential for Organic 3.0 in Thailand, and how organic agriculture (OA) can be mainstreamed and scaled-up, the role of Higher Education Institutions (HEIs) deserves closer study. This paper offers preliminary reflections on this challenge by reviewing a variety of documentation and stakeholder views synthesized from four policy dialogue and research projects conducted in Thailand from 2014 through 2016. It concludes that Thai HEIs are still poorly contributing to Organic 3.0 and that more research is needed to better identify and understand both inhibiting and enabling factors to OA mainstreaming in HEIs.

Acknowledgments

Numerous people, institutional partners, interviewees and donors collaborated in support of our four research projects and various consultation workshops. Space does not permit us to name every individual or organization. They should all be thanked. However, we especially acknowledge some donors providing various small grant funds to conduct field research or host national and regional consultations involving Thai experts. We are grateful particularly to: 1) CUSAR's Dean for travel funds to conduct interviews in Nan Province; 2) the **Swedish International Agricultural Network Initiative (SIANI) supporting a Thai Policy Brief and academic-government dialogue;** and **3)**Chula *UNISEARCH,* "ASEAN Cluster Fund," for a grant supporting a Thai extension case study as part of a Southeast Asian regional research project.

Introduction

Agriculture has been historically important to Thai culture, economy and society. The agri-food system is significant in Thailand's national economy (around 9 to 11 percent[3] of GDP) providing millions of jobs. Yet it is also a major contributor to environmental problems from pollution and biodiversity loss to climate change. And although numbers of organic producers have increased over the past decade alongside certified organic production and sales, the market is still barely one percent nationally. Research on how higher education in Thailand deters or advances sustainable agriculture (SA) is also limited (note, for example, Chinnasri and Chinnasri, 2011). HEI roles in supporting or inhibiting OA scaling-up or mainstreaming specifically deserve much more study in particular as this paper begins to do. Our study is also a response to the "Organic 3.0" challenge of "bringing organic out of a niche into the mainstream" called for by Organics International and many of its partners (Arbenz, Gould, and Stopes, 2015, p.1)

Methodology and Data

This paper utilizes and combines common methods and simple tools from the social sciences to gather data relevant to better assess Thai HEI roles in inhibiting and promoting or mainstreaming

[1] Canadian Visiting Scholar and Supawan Visetnoi, Chulalongkorn University School of Agricultural Resources (CUSAR), Bangkok, THAILAND. Email waynenelles@gmail.com
[2] Lecturer, CUSAR Email: supawan.v@chula.ac.th
[3] Based on 2014 World Development Indicators | World Bank (http://data.un.organd http://data.worldbank.org/)

and scaling-up OA. Data collected and reported over three years, summarizing and analyzing results of four projects come principally from: 1) field interviews and transcripts; 2) stakeholder consultation reports; 3) primary documents (such as MOUs, government policies, Power-Point presentations, Policy Briefs, learning resources); and 4) secondary literatures, some cited here.

Regarding Project #1, our primary evidence comes from transcripts of field interviews with 15 Thai Department of Agriculture Extension (DOAE) officials from Bangkok and Nan Province in 2014, as well as government policy documents and learning materials (Nelles and Visetnoi, 2016).

Regarding Project #2, during 2015 as part of a Swedish SIANI/Sida-funded Higher Education for Sustainable Agriculture (HESA) and Food Security project two Thai national consultations were held, a workshop and "write-shop," for experts to jointly draft outlines of a policy document. In addition CUSAR hosted an academic-government policy dialogue on HESA and Food Security in Thailand. Around 60 Thai participants contributed variously to these events. Primary data were stakeholder perceptions and recommendations documented in meeting reports and Power-Point presentations of officials reviewing government policies and programs (Visetnoi, et. al, 2016).

Regarding Project #3, in 2016, evidence comes from a small Thai workshop with eight scholars from different universities held in Bangkok to plan a regional research project on *Mapping and Assessing University-based Farmer Extension Services in ASEAN through an Agro-ecological/Organic Lens."* Main guiding questions were: 1) What universities, colleges or affiliated research institutes are now involved in doing extension education and/or research? and 2) What are their priorities about, capacities for, and impacts on agro-ecological (AE) farming or OA and food systems? Study outputs now include survey data and a case study of Thai institutions.

Project #4 was a desk-study which reviewed policies, curricula and extension services about education for sustainable agriculture (ESA) in the nine government-designated national research universities (NRUs). That research included analysis of how SA generally (with some reference to OA) was researched, taught and supported in farmer extension (Visetnoi and Nelles, In Press/2016).

In sum the present paper utilizes complementary social science methods synthesizing document analysis and stakeholder perceptions from at least 83 individual experts (mainly university professors and government officials) and several insitutional partners in four projects which include a systematic review of nine comprehensive elite research universities in Thailand.

Results

Evidence (quantitative and qualitative) from four studies over three years suggest the Thai higher education system does not view sustainable agriculture (SA) as a priority, much less OA teaching, research or extension. And (aside from Maejo University discussed below as a notable exception) it does not support the mainstreaming and scaling-up of OA. How is this so?

1. Our first field study in 2014 suggested Thailand's agri-food system is still based on agrochemical-dependent agriculture supported by public extension policies and programs with institutionalized connections to agriculture universities (and increasingly the private sector). This system inadequately assists farmers to do OA but more pro-actively and strategically promotes agrochemical use and product sales. For example, the renamed Thai Crop Protection Association (TCPA), formally "Thai Pesticide Association," has its national office on the Kasetsart University (KU) campus. The Department of Agricultural Extension (DOAE) also based on the KU campus has a memorandum of understanding (MOU) with the TCPA to support extension officer and farmer training with learning resources that promote agrochemical product use and (effectively) means and methods to maintain or increase their sales (Nelles and Visetnoi, 2016). Government enabled agrochemical-dependency, with support from a major university, is a serious socio-economic, social and political problem creating barriers to OA adoption, conversion or mainstreaming.

2. Our second project evolved out of new questions concerning the problematic role Thai and other Asian universities play in supporting policies and partnerships with agribusiness associations (such as the TCPA) that promote agrochemical-dependent agriculture while increasing corporate profits and undermining farmer efforts for OA. We began a small initiative in 2015 with partners to better understand Sustainable Agriculture (SA) teaching, research and services through a Swedish Sida HESA project engaging three pilot countries (Thailand, Philippines and Laos). Collaborators in that project produced *Policy Briefs* with recommendations about HESA in Thailand (http://www.siani.se/topic/hesa) and elsewhere in Southeast Asia. They included specific references to the weakness of OA in HEIs and farmer extension and ways to improve OA education (VisetnoI, et. al, 2016).

3. Our third project subsequently began mid-2016. It was funded by the UNISEARCH office of CU through an "ASEAN Cluster" grant to conduct a follow-up research project to the HESA-SIANI/Sida supported project. Findings from our recent OA/AE "*University-based Farmer Extension Services"* mapping research are preliminary, but already suggestive. A report from our first Thai workshop as well as presentations about the Thai case made during a regional workshop on 23 February 2017 in Bangkok point to a significant lack of university-based extension services supporting OA. Published proceedings include a Thai national case study (Visetnoi, et al, In Nelles, Ed., In Press/2017).

4. Our fourth project, a desk-study, reviewed the nine government-designated national research university (NRU) policies, curricula and extension services and their attention to SA education. It found, disappointingly, that SA was poorly taught, studied or practiced (with OA even less) in most universities. This was despite agriculture's major importance to the Thai economy and society and national policies ostensibly supporting sustainable development more generally. For example, KU established in 1943 under a mandate from the Ministry of Agriculture, was the first university in Thailand to offer a post-secondary educational program in agriculture. It now has over 67,000 students and claims that 1,678 out of its 7,475 courses somehow address environment and sustainability, yet it still has no curriculum or program on OA (Visetnoi and Nelles, In Press/2016).

Discussion

In sum our research synthesizing results from four projects over three years shows just how difficult it will be to mainstream OA in Thailand and that HEIs are still part of the problem in getting to Organic 3.0. Reasons and contributing factors are complex and varied, but some are due to historical and structural changes in the Thai public extension and higher education systems increasingly influenced by private sector interests that deter OA upscaling or mainstreaming. In addition HEIs also reflect the wider society and economy with two national agricultural development models that conflict. One is based on the OA-friendly "sufficiency economy" approach inspired by Thailand's late King which has long supported local communities and food security. The other is industrial-scale, agrochemical- dependent farming. The government and most universities consider OA largely as a niche alternative for high value exports and middle-class consumers rather than an approach or set of practices for broader environmental, socioeconomic, health and food security benefits. Moreover, the Thai DOAE does not utilize university OA expertise well. And there is little critical thinking about or integrated planning for OA policy or education across the Thai agri-food system. Thai universities still reinforce or encourage agrochemical-dependent approaches, even strategic partnerships with multi-national agribusiness corporations that deter OA learning and practice among faculty and students or with farmers.

Future Research

In sum more quantitative and qualitative research is needed to document and analyzeThai HEIsin inhibiting or enabling OA and its upscaling or mainstreaming. Butin sum our research suggests most Thai HEIs still poorly contribute to an Organic 3.0 vision or praxis. The exception is Maejo University (MJU) in Chiang Mai with an explicit aim and strategic “roadmap“ to become a leading university in organic agriculture in 2017 (Visetnoi, et. al., 2016, p. 4). Even so MJU faces many internal and external challenges to OA teaching, research and services deserving better analysis. MJU’s model should be studied for lessons learned and potential to be replicated, adapted or scaled-up nation-wide and regionally in Southeast Asia. If Thailand is serious about getting to Organic 3.0, more critical studies and reforms of the national university system are also needed, as well as more case study and comparative research of Southeast Asian HEIs to understand inhibiting and enabling factors to OA mainstreaming in policies, curricula, teaching and farmer extension.

References

Arbenz, Markus, David Gould and Christopher Stopes (2015). *ORGANIC 3.0for Truly Sustainable Farming & Consumption.* Discussion Paper/Booklet. Organics InternationalPresented to International Organic EXPO 2015, Goesan, Korea.

Chinnasri, Buncha, and Chinnasri, Oranutda (2011). Status of the Program on Sustainable Agriculture and Development at Higher Educational Institutions in Thailand. *Journal of Developments in Sustainable Agriculture*, 6, pp. 20-34.

Nelles, Wayne and Supawan Visetnoi (2016). “Thailand’s Department of Agricultural Extension (DOAE) andAgrochemical Dependency: Perspectives on ContributingFactors and Mitigation Strategies,” *Journal of Agricultural Education and Extension*. Vol. 22, No. 3, June 2016, pp. 225–240. DOI: 10.1080/1389224X.2015.1063519

Visetnoi, Supawan. Et. Al. (In Press/2017). “Higher Education and Agricultural Extension Services in Thailand: Current situation and future recommendations,” in Wayne Nelles, Ed. *Proceedings of Regional Symposium onMapping and Assessing University-based Farmer Extension Services in ASEANthrough an Agro-ecological/Organic Lens,* held 23 February 2017, Chulalongkorn University. Bangkok: Chulalongkorn University School of Agricultural Resources (CUSAR).

Visetnoi, Supawan and Wayne Nelles (In Press/2016) “Higher Education and Sustainability in Thailand: A Review of National Research University (NRU) Roles in Sustainable Agriculture Education,” *International Social Science Journal (ISSJ)*

Visetnoi, S., Yossuck, P., Sanuanpong, U., and Morakot, R. (2016). *TransformingThai higher education for sustainable agriculture: Addressing the need for food security*. Policy Brief. Stockholm: Swedish International Agricultural Network Initiative.

Organic and Conventional Wheat Yields - Analysis of US Agricultural Census Data

Carolyn Dimitri[1]

Key words: organic agriculture, yields, wheat, US, Organic 3.0

Abstract

Organic farming systems are reputed to have lower yields, when compared to conventional agriculture. In the United States, much of the research on yields has been taken place on research farms, which find that yields are roughly equivalent. More recent work on yield differentials on commercial farms finds that organic farms have significantly lower yields. This paper adds to the literature focusing on yields on commercial farms. Data from the US Census of Agriculture is used to estimate yield differences between organic and conventional wheat farms in the framework of a fixed-effects panel data model. The results indicate that yields on organic wheat farms are statistically significantly lower than those on conventional wheat farms. This work in progress will be extended to include variation in weather as an explanatory variable, and will address the relative resiliency of conventional and organic wheat farms in the face of variation in temperature and rainfall.

Introduction

One point of contention in discussions of the feasibility of widespread adoption of organic farming systems is the yield gap, where declines in yields are attributed to organic farming systems. As a result, the argument goes, organic farming systems are impractical in terms of meeting food security needs. Analysis of long term cropping system trials conducted in the United States finds that yields of the organic crops studied averaged about 95 percent of their conventional counterparts (Leibhardt, 2001). A recent meta-analysis finds that with good management practices and growing conditions, on a global scale, organic and conventional yields are similar for certain crops (Seufert, Ramunkutty and Foley, 2012). Yields on commercial farms, collected by USDA's Agriculture Resource and Management Survey, suggest that differences on working farms are larger than the farming systems trials predict (McBride and Greene, 2009). In comparison to conventional yields on commercial farms, organic soybean yields were 34 percent lower, organic corn yields were 27 percent lower, and organic wheat yields reduced by 32 percent (McBride et al., 2015).

Material and methods

Until recently, analysis of organic-conventional yields on US commercial farms has been precluded by lack of data on organic farming systems. Recently, however, the US Department of Agriculture expanded the Agricultural Census by focusing a periodic special collection of data from organic farms. The data collected by the US Department of Agriculture includes production, sales, acres, certification status, and select marketing data by crop, and is available online at the state level. This paper makes use of this relatively new data on organic farming, called The Organic Production Survey (reports data for 2008, 2011, and 2014), along with USDA's annual survey, to analyse differences in yields between organic and conventional crops on commercial farms (NASS, USDA 2016). The analysis relies on publicly available total wheat production, at the state level.

[1] New York University, United States, carolyn.dimitri@nyu.edu.

Table 1 shows the top five states, in terms of wheat production, for each of the three years, for conventional and organic wheat. With the exception of Montana (and Idaho in one year), the states that are the primary producers of conventional and organic wheat differ. Under both production systems, yields across states differ; for all states with wheat production, the average yield is 57 bushels per acre for conventional farms and 36 bushels for organic farms. Yield variations may result from differences in varieties (spring, winter, and duram), as well as weather, region, and farming practices.

Table 1: Top wheat producing states in the US: 2008, 2011 and 2014

Year	Rank	Conventional		Organic	
		State	*Yield*	*State*	*Yield*
2008	1	Kansas	40	Colorado	28
	2	North Dakota	36	Montana	20
	3	South Dakota	50	Wyoming	29
	4	Oklahoma	37	Utah	16
	5	Montana	30	Nebraska	29
2011	1	Kansas	35	Montana	27
	2	North Dakota	30	California	67
	3	Montana	35	Wyoming	31
	4	Washington	71	Idaho	52
	5	Idaho	83	Utah	21
2014	1	North Dakota	46	Montana	29
	2	Kansas	28	Wyoming	31
	3	Montana	37	Colorado	32
	4	Washington	48	Nebraska	33
	5	Idaho	78	Utah	16

Notes: Rank is in terms of bushels of wheat produced. Yield, calculated by the author, is bushels per harvested acre.

Data sources: Organic data from *USDA Organic Production Survey* and conventional data is from USDA Quikstats (https://www.nass.usda.gov/Quick_Stats/).

The dataset contains 197 observations, which includes state-level data for organic and conventional production for one, two, or three of the years. A panel data model was estimated, where the dependent variable is yield per acre. The panel is unbalanced, as there are 110 observations for conventional production and 87 for organic. Explanatory variables in the model include acres of harvested land and a dummy variable indicating whether the data represent organic or conventional wheat. The group variable is the state, as there is reason to believe (1) that growing conditions within each state are similar over time and (2) that soil quality, air temperature and other characteristics differ between states. By accounting for the influence of each state, the model can that better reflect yield differences that are due to the production system. Lastly, the year variable was insignificant and thus was dropped from the analysis.

Results

Both fixed-effects and random effects models were estimated. Post regression testing (via the Hausman test) indicated that the fixed effect model was the appropriate choice. The following table presents the results of the estimated fixed-effects model. The estimated coefficients on the number of acres and the organic dummy variable are both negative and statistically significant. Thus, as the number of acres dedicated to wheat within a specific state, grows larger, the yield (or bushels per acre) declines. Similarly, the estimated coefficient on the organic dummy variable suggests that, all else constant, an organic farm's yield is significantly lower per acre in comparison to that of a conventional farm.

Table 2: Estimated fixed-effects model, dependent variable yield per acre

Explanatory variable	Estimated coefficient	Standard error	t statistic
Acres	-2.36e-06	6.69e-07	-3.53
Organic	-21.80	1.85	-11.80
Constant	59.30	1.35	43.88
R-square (adjusted): 0.72		F(2,150) = 77.38, p value = 0.00	
Cov(u_i, Xb)=0.16			
sigma_u 12.30 sigma_e 9.72 rho 0.62 (fraction of variance due to u_i) test that all u_i = 0: F(44,150) = 5.94			

Note: N = 197; number of groups =45. Adjusted R-2 calculated using Stata's areg procedure; the fixed-effects model calculated using xtreg.

These preliminary results are promising, and through future work, we hope to improve these findings. The current models will be re-estimated using additional data, as 2015 data has recently been released. Other planned revisions include the separation of wheat by variety within each state, to account for yield differentials due to variety differences. Furthermore, future work will group yields by production region rather than state, since regions share growing conditions and often span several states.

Longer term analysis will focus on resiliency of organic farming systems. We are in the process of merging the production dataset with weather data, and plan to estimate a Just-Pope production function that explicitly links yields to land use, farming system method (organic or conventional) as well as to variation in temperature and precipitation. This extension is the longer term research question we hope to address: what is the relative resiliency of organic and conventional wheat farms in the face of climate (temperature and precipitation) variation. Finally, this work can be extended to other crops.

Discussion

It is widely accepted that three pressing global problems face modern society: climate change, biodiversity and food security. Numerous scholars and researchers have pointed to the potential positive effect that organic agriculture may have on biodiversity and climate change (Hole et al., 2005; Korenz and Lal, 2016). Yet one point of contention remains in relation to food security, where the declines in yields suggest that organic farming systems will be unable to meet food security needs of a burgeoning global population. Continued work on the research question of organic yields aims to add to the body of scientific literature on the organic-conventional yield gap, through analysis of publicly available data. Futhermore, the next phase of research in this project will address the resiliency of organic farming systems in the face of variability in rainfall and temperature. We hope to better understand how organic wheat yields (relative to conventional) respond to variations in climate. The results may have important implications for food security in the future, in the face of climate change, which is consistent with IFOAM's goals for Organic 3.0.

References

Hole, D. G., Perkins, A. J., Wilson, J. D., Alexander, I. H., Grice, P. V., & Evans, A. D. 2005. Does organic farming benefit biodiversity?. *Biological conservation*, *122*(1), 113-130.

Lorenz, K., & Lal, R. 2016. Environmental Impact of Organic Agriculture. *Advances in Agronomy*. 39, 99-152.

Liebhardt, B. 2001. "Get the facts straight: Organic agriculture yields are good." *Organic Farming Research Foundation Information Bulletin*. Summer. No. 10.

McBride, W. D., Greene, C., Foreman, L., & Ali, M. 2015. The Profit Potential of Certified Organic Field Crop Production. *US Department of Agriculture, Economic Research Service*.

McBride, W. D., & Greene, C. 2009. The profitability of organic soybean production. *Renewable agriculture and food systems*, *24*(04), 276-284

National Agricultural Statistics Service (NASS), US Department of Agriculture. 2016. *Organic Agriculture. Organic Production Survey data.* Available at https://www.nass.usda.gov/Surveys/Guide_to_NASS_Surveys/Organic_Production/index.php.

Seufert, V., N. Ramankutty, and J.A. Foley. 2012. "Comparing the yields of organic and conventional agriculture." *Nature*. 485, 229-232.

Women in organic cocoa farming systems in Ghana: Empowered?

Irene Susana Egyir,[1] Joseph Bandanaa[1], Joseph Clottey[1], G.K. Ofosu-Budu[1],
Irene Kadzere,[2] Christian Schader[2], Willem-Albert Toose[3],
Bo Van Elzekker[3], Emelia Monney[4] and Esther Agyekum[4]

Key words: Women empowerment, organic production, technology, policy, ProEcoAfrica project

Abstract

With limited markets and socio-cultural biases women in Ghana may not participate actively in decisions that lead to effective procurement of factors of production; technology transfer processes could enhance women's empowerment. In our study, we used sample survey from ProEcoAfrica project (www.proecoafrica.net) and focus group discussion data to analyze, descriptively, women's empowerment among organic cocoa farmers in forest areas of rural Ashanti Region. The descriptive analyses were guided by the Women's Empowerment in Agriculture Index (WEAI) (developed by the International Food Policy Research Institute) domains. The level of disempowerment in production, resources, income, leadership and time use is tested. All the WEAIs calculated except one, were below the 80% threshold; apart from the "control over income" domain, women were disempowered in all the domain areas. The local market in Ashanti region is not well developed to support women's access to organic resources and obtain premium price for produce. The findings reflected that women organic cocoa farmers were currently not adequately skilled to make independent decisions, screen and purchase inputs required for best practices and earn higher incomes from cocoa production. The study reflects some key policy areas: bringing input markets closer to communities to reduce dependence on social structures, availing community-based business advisory and resource centres to enhance regular consultation with experts, promoting suitable labour saving technologies for women in organic production, and fostering stronger organisation of farmers to ensure greater participation of women in leadership positions for more effective learning.

Acknowledgements

We are grateful to the Dutch Humanistic Institute for Cooperation (Hivos) and the Swiss Agency for Development Cooperation (SDC) for the financial support, and the Research Institute for Organic Agriculture (FiBL) for initiating the ProEcoAfrica project. We also thank the ProEcoAfrica National Advisory Committee members in Ghana and the Project Steering Committee, the project farmers, and field staff.

Introduction

[1] University of Ghana, Ghana, www.ug.edu.gh, eMail: iegyir@ug,edu,gh, ireneegyir@yahoo.com
University of Ghana, Ghana, www.ug.edu.gh, eMail: miparkerjnr@gmail.com
University of Ghana, Ghana, www.ug,edu,gh, eMail: josephclottey@gmail.com
University of Ghana, Ghana, www.ug,edu,gh, eMail: obuduster@gmail.com
[2] Research Institute for Organic Agriculture (FiBL), Switzerland, www.fibl.org, eMail: Irene.kadzere@fibl.org
Research Institute for Organic Agriculture (FiBL), Switzerland, www.fibl.org, eMail: Christian.shader@fibl.org
[3] Agro-Eco Louis Bolk, Ghana, www.agroeco.net, eMail: w.toose@agroeco.net
[4] Ministry of Food and Agriculture, Ghana, www.mofa.gov,gh, eMail: emonney@gmail.com
Ministry of Food and Agriculture, www.mofa.gov,gh, eMail:esther.agyekum@gmail.com

Ghana is a leading producer of cocoa in the world, but the efficiency of production has been questioned. Both economic and social reasons have been proffered. The social reasons bother on gender relations at household and community level, which make women less productive because of inability to fully participate in all economic decisions. Organic agriculture was introduced as a technology that could lead to sustainability since the negative impacts of conventional farming which dominates will reduce (Ayernor *et al.*, 2004). In the process women farmers who adopt the practices will be empowered both economically and socially through training and equipment. In 2011, the Agro-Eco Louis Bolk Institute formed the Tano-Biakoye Organic Cocoa Farmers Association in Atwima Mponua, a rural district in the forest zone of Ghana. The intention was to provide regular technical training and link farmers to markets that offer premium prices. The main purpose of this paper is to assess the extent to which women farmers have been (dis)empowered due to adoption of practices that lead to organic cocoa production. The five domain areas of the Women Empowerment in Agriculture Index (WEAI) developed by the International Food Policy Research Institute (IFPRI) were measured to determine 1) the extent of women's participation in household productive decisions, 2) the extent of women's access to and use of resources and 3) the extent to which women contribute to community action. The decision criterion for disempowerment using the WEAI is based on each gender group scoring less than 80 percent in the 10 sub-domains.

The data

The data employed was mainly from focus group discussions and a survey carried out by the ProEcoAfrica Ghana project in 2015. In the survey a total of 402 farmers were interviewed; 176 were female and 226 were male. Of the female, there were 91 organic farmers and 85 conventional farmers. The organic farmers were selected randomly from a data base provided by the Agro-Eco Louis Bolk Institute. Data on women's personal characteristics such as age, educational status and marital status were collected to determine agency. Data on technical farm characteristics such as size of farm fields, ownership of land and other assets, investment in diverse enterprises were collected to determine access to and use of resources (Annex 1). Other data to capture institutional factors included ease of access to credit, extension services, input markets and output markets. New data was collected to complement the ProEcoAfrica data with information to analyse women's participation in decision making at household, farm and community levels. Ten focus group discussions (FGD) were carried out in five communities with women (organic and conventional), men and opinion leaders. An adaptation of the WEAI process was used, hence the women and men interviewed were not necessarily from the same household.

Results

Participation in household productive decisions

The results of the WEAI is shown in figure 1. Considering perspectives of both women and men, women are disempowered in the sub-domains "input in productive decision making", "autonomy in production" and decision in access to credit. Use of household labour is slightly restricted for women; married women have to seek permission to borrow money for investment. However, women in organic production are completely empowered in the domain indicator, "control over use of income" (>80%). That rural women have control over use of income is contrary to traditional thinking and findings of most gender studies (Dos, 2011).

Access to and use of resources

Women's disempowerment in the resource domain is in terms of "ownership of assets, "decision on purchase, sale and transfer of assets" and "access to credit". The assets that most farmers own are the fields and residential facilities. From FGD, it was indicated that majority of farmers depended on family farms although from the ProEcoAfrica survey 60 out of 91 women organic farmers owned their fields. Of those who owned farm lands, the majority said they inherited it from their mothers and a few purchased the fields. The survey results also showed that only 26 percent of the women respondents borrowed money in the 2015 cropping year. Yet, in the district's capital town and other towns closer, there are many formal and semi-formal financial institutions – commercial bank branches, rural banks, savings and loans companies and microfinance schemes. The FGD revealed that women lack easy access to transport means to travel to city centres to buy inputs. Input dealers for organic farming mostly operate in the regional capital city (Kumasi, about 150 km away). Lack of full access to the wide range of the five telecommunication networks in Ghana means that information flow is difficult; the multiple sources of information that mobile telephony offer is not taken advantage of. Community-based business advisory and resource centres on organic production are not available, therefore women do not have regular consultation with extension officers.

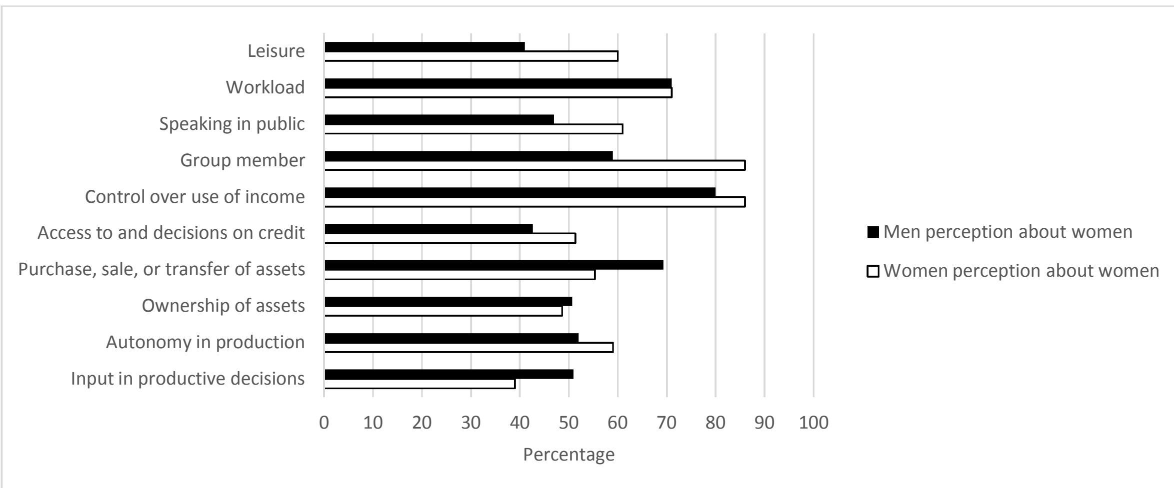


Figure1: Perception on domains of WEAI by men and women cocoa farmers

Contribution to community action

Our survey results indicate that women organic farmers spent most of their productive time on (in descending order) weeding (186 hrs/season), marketing (145hrs), harvesting (78hrs), land preparation (68hrs), pruning (63hrs), post-harvest operations (48hrs) and planting (45hrs). The high number of hours spent on weeding by organic farmers is due to restriction on herbicide application. Women have high work load but they make time for social gatherings such as attending church services, festivals, funerals and celebrating marriages and birth. Women's participation in social group is high but leading in mixed gender economic groups and speaking in public is still difficult for most women. Although there is a farmer organisation for organic farmers about 34 percent of the women did not declare their association with it in 2015.

Discussion

Organic farming requires good agricultural practices such as regular pruning and weeding to maintain farm hygiene. It is important that farm owners can have control over income and decisions on when, how much to spend and on what inputs. If women farmers can make decisions on what to spend money earned from crop sale on, they will find it easy to invest in best practice tools, equipment, seed, hired labour, and other inputs. That women are limited in contributing to decisions, which lead to choosing what to grow on family land, whether to expand fields or use family labour to support tasks on the farm, affects productivity. It is important that organic producers are not prevented from implementing options learnt from formal training.

That women are disempowered in decisions on purchase, sale and transfer of assets is explained by the restrictions they encounter when they want to act. Women cannot transfer family lands they farm on. This means that such land cannot be used as collateral for credit. Since credit is not readily available to the women, there is limited investment in quality inputs and equipment and the best organic production practices are not being adopted fully leading to lower incomes. Organic farming is new and advocacy as well as seeking external support and niche markets cannot be ignored. Learning in groups and negotiating positions are crucial skills for sustainability. However, interest in farmer organisation is low due to the inability of their membership to earn them easier access to credit, quality inputs, niche markets and continuous learning.

We propose local level stakeholders' partnership to ensure that input markets are placed closer to communities to reduce dependence on social structures. Community-based business advisory and resource centres should be established to enhance regular consultation with experts. Farmers' organisations should be strengthened to ensure greater participation of women in leadership positions for more effective learning. Promoting labour saving technologies would also enhance women farmers' effectiveness in organic farming.

References

Ayernor, G. K., Roling, N. G., Padi, B., Van Huis, A., D. Obeng-Ofori and P. B. Atengdem. (2004) Converging farmers' and scientists' perspectives on researchable constraints on organic cocoa production in Ghana: results of a diagnostic study. NJAS-Wageningen Journal of Life Sciences. 52:3-4), 261-284.

Doss, Cheryl (2011). The role of women in Agriculture. Paper prepared with SOFA Team. Working Paper Number 11-02. Food and Agriculture Organisation of the United Nations, Rome, Italy.

Annex 1: Characteristics of respondents

	Organic		Conventional	
Variable	Frequency	Percentage	Frequency	Percentage
Marital status in 2015:				
Married	53	58	62	73
Unmarried	38	42	23	17
Status in household in 2015:				
Head	53	58	37	43
Other	38	42	43	57
Educational level in 2015:				
Literate	60	66	53	38
Illiterate	31	34	32	62
Age in 2015:				
Minimum	19		27	
Mean	53		52	
Maximum	84		76	
Standard deviation	13.78		10.39	
Size of farm in 2015				
Minimum	0.04		0.07	
Mean	1.3		1.1	
Maximum	12		6.0	
Standard deviation	1.38		0.96	
Owned land in 2015?				
Yes	60	66	84	99
No	31	34	1	1
Borrowed money in 2015?				
Yes	24	26.4	22	25.9
No	67	73.6	63	74.1
Member of farmer organisation in 2015?				
Yes	57	62.6	31	36.5

No	34	37.4	54	63.5

ODS from PGS-certified organic smallholders' vision: achievement and challenges within public policies and territorial diversities.

Eva Torremocha[1]

Key words: Participatory Guarantee Systems (PGS), Sustainable Development Goals (SDG), Public policies, agroecology

Abstract

PGS are gaining recognition among stakeholders as suitable certification systems.. Their innovative approach based on their principles, as well as on their governance system converts them in useful tools for promoting actions for the Sustainable Development Goals fulfilment. Their support and promotion by government, through their recognition as official certification system would enhance, from the ground, public authorities efforts so to tackle the GDS.

Introduction

Participatory Guarantee Systems have been launched in Europe at the same time that the organic sector was getting conformed, during the 70's. They were the first certification scheme for the sector and they were the only process that was guaranteeing that products were compelling the organic rules set by each of the civil organization that run them. But PGS had a re-birth during the 90's, in Southern countries - mainly in South and Central America-. By that time, they were also implemented as certification processes but, in many experiences, they went forward, also acquiring a political and social look thanks to their stakeholders' engagement for local and sustainable development based upon collective governance locally driven from a territorial approach.

The objective of this research is to deeper on the several initiatives driven by local or national authorities aiming at recognising PGS as official certification systems. Two experiences are analysed, both conducted under government agroecology-friendly such as the Brazilian at a federal level, during the 2000 decade, and the Andalusian (Spain) one, at a regional level for the four years period 2004-2007. In Brazil PGS are recognised as official and there are two levels of recognition according to the markets to which farmers want to access, while in Andalusia, after 10 years of PGS growth and the commitment of the government that launched them at first, the local authority still not recognise them. Both processes are selected as study cases because of the difference in political, territorial and socioeconomical contexts.

Material and methods

The research analyses the difference between cultural approach from farmers to the political initiative, the methodology and strategies adopted by each government, the influence of the territorial scale during the process as well as the geopolitical framework and the public policies in which each of it evolved.

The author has been responsible for the internal process of launching and recognizing PGS within the Andalusian government (Spain) and worked hand to hand with Brazilian officers and stakeholders, thus the methodology is based on the results of direct observation. It is completed

[1] University Pablo de Olavide, Seville (Spain). www.historiaambiental.org evatorremocha@hotmail.com

with interviews to active actors of both processes in Brazil and Andalusia, as well as on bibliography analyses.

Results

Today, PGS are still proposing an alternative approach for certification, to the most usual, the conventional, lineal and reductionist one. They work gathering together farmers, processors, retailers, and consumers plus local social organizations or local authorities. from a bottom-up and multiactor approach, in fully accordance to the current recommendations for innovative solutions to tackle the big societal challenges such as SDG or climate change.

Thanks to their systemic definition based on the six principles aforementioned, PGS benefit from an organizational scheme featuring: soundness of principles but flexibility of rules, horizontality to ensure stakeholders' participation, and consideration for environmental and human diversity. Always conceived as an exchange of experiences and knowledge, they are in fact an innovative social building ongoing process.

They innovation is brought through i) the territorial approach they work with: they do include and work with and from diversity (bio, agro and social diversities), ii) the scheme they work with based on a collective and multiactor approach, as a basis for an integrative growth, iii) the horizontal approach that facilitates and enhances mutual learning on technical farming and nutrition/food security issues, but also a common enrichment as a group, and as individuals, regarding democratic and participative governance, iiii) the integration (whenever and wherever it's possible) of all the components of the agrifood chain, united at a territorial level.

In that sense PGS are promoting the achievement of the following SDG[2]:

1-End of poverty in all its forms everywhere: they work with smallholders in peasant communities as well as in more industrialized regions, and they overpass differences being able to find and work with similarities so to reinforce each group from and for its own identity and diversity, worldwide.

2- End hunger, achieve food security, and improve nutrition and promote sustainable agriculture: PGS foster organic agriculture that is recognised to be one of the sustainable farming systems today. They guarantee an improvement in food security at both level: access and diet diversification.

3-Ensure healthy lives and promote well-being for all at all ages: Organic farming has demonstrated to be healthier for farmers that are not exposed to chemical residues, but also for consumers. In industrialised regions, where farming is mainly done at an individual level, farmers do also recognise the positive impact of PGS as a means for not feeling alone anymore, but included and supported by a group of peers.

12- Ensure sustainable production and consumption patterns: Because they work on a mutual exchange basis and they approach certification as a tool for a never-ended improvement process, they have demonstrated to be effective for accompanying farmers, in peer-o-peer reviews, during their conversion into organic farming process.

13- Take urgent action to combat climate change and its impacts: as a tool that promotes the adoption of sustainable practices for production and consumption, PGS are already tackling the climate change challenge because they promote organic farming practices coupled to territorially

[2] https://sustainabledevelopment.un.org/?menu=1300

rooted initiatives for a local consumption that reduces dramatically foodmiles that are at the basis of one of the causes of GHG emissions from the agriculture sector.

15- Protect, restaure and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss: PGS define their organic norms under the umbrella of international regulations (Codex, Europe regulation -834/2007, national norms,…) but they do improve them according to their territorial conditions. They are thus especially useful and efficient for introducing more sustainable practices (against desertification, soil and terrestrial ecosystem degradation) but also to widespread them among smallholders. Acting as a multiplier of good practices for sustainability of agricultural practices.

16- Promote peaceful and inclusive societies for sustainable development. This point is tackled by the principles of participation, horizontality and trust that run PGS governance models, as well as with their multiactor approach. PGS stakeholders learn to work within and with diversity, they discover the need for being respectful to diversity and thus inclusive. Collective action and decision making processes are part of the global PGS experience and they have an impact in participants as a group, but also as individuals.

Moreover, and thanks to the fact that PGS work on the basis of farmers, (and whenever and wherever it's possible, consumers) involvement, to build collectively their own PGS, adapted to their own culture and biogeographical and socioeconomical conditions, they also favour an inclusive and sustainable growth coupled to better work conditions for smallholders (SDG 8) whom gain visibility and a better recognition (and price) for the efforts they provide to produce food in a sustainable way. At the same time, this constant work-together under cooperative and associative principles, compels a continuous improvement and learning for all participant (SDG 4), not only for farming matters, but also as a collective.

Discussion

Today, PGS have spread all over the world and many countries and regions do recognise them, officially, as certification systems able to guarantee the organic quality of food produced by small farmers. For the last 5 years, they exponential growth has put them in the political agenda at local, regional and national levels. Depending on the approach and where the PGS experiences are getting run, they are facing very different attitudes towards their recognition as another certification scheme. In some countries (manly in Asia and South and Central America) they are recognised at the same level that the third party certification scheme. Farmers have their product accepted within the labelized organic market. In other regions such as Europe or in many countries in Africa, farmers that are certifying their practices or products under a PGS scheme are not allowed to call their product "organic", nor to access to the associated benefits to be recognised as an organic farmer (for the CAP greening scheme, in Europe, ie). In general, there is no consensus on whether PGS have to keep a local dimension whether they can provide an access to international markets. This controversial point has demonstrated to become a bottleneck for many negotiations. Thanks to their multifocal approach and to their inclusion perspective PGS are able to tackle (directly or indirectly) half of the SDG. However, this difference in their official recognition as certification schemes fails at meeting the SDG 10: reduce inequality between and among countries.

References

On request by author.

Entrepreneurial Culture And Capability of Organic Farmers' Organizations in the Philippines

Maria Rowena A. Buena[1], Cory William Whitney[2]

Key words: Entrepreneurial capabilities, organizational culture, entrepreneurial culture

Abstract

The entrepreneurial culture of farmers' organizations of Magsasaka at Siyentipiko Para sa Pag-unlad ng Agrikultura (MASIPAG) in the Philippines is a contribution to Organic 3.0. The mechanisms necessary to reinforce an entrepreneurial culture for the Organic farmers' organizations of MASIPAG are described. Different PGS groups have similar entrepreneurial capabilities yet dissimilar competitive success and organizational cultural dimensions. Much work is needed to develop the entrepreneurial capabilities, we recommend that farmers actively participate in marketing activities within their localities, improve production, and take advantage of expanding markets; farmers' organizations leaders should encourage members to increase production and entice conventional farmers to transition to Organic production; MASIPAG should act as a support institution by helping farmers design appropriate programs to reinforce good business management.

Acknowledgments

We are grateful to Magsasaka at Siyentipiko Para sa Pag-unlad ng Agrikultura (MASIPAG) in the Philippines and to the many farmers who participated in the research.

Introduction

Organic 3.0 focuses on bringing Organic agriculture out of its current niche into the mainstream by positioning Organic systems among the many solutions needed to solve the extreme challenges of the modern day. To realize this potential the entrepreneurial culture of Organic farmers will need to be tapped. The capability and culture of Organic farmers' organizations as entrepreneurs is critical for their future yet few studies have evaluated these important aspects.

Organic production has been increasing in the Philippines since the passage of RA 10068 in 2010. Farmers' organizations have begun marketing and selling Organic products, yet they may not yet have entrepreneurial capability (EC), which usually applies to those with access to resources (Carland, et.al, 1984; Philippines, 2009). Entrepreneurial culture creates a motivating environment that transcends norms, values and relationships (Loveridge, et al. 2009). Capability is the resulting capacity to perform in pursuit of a mission (Zahra 2010). Strategic leadership and ECplays an essential role in honing organizations' entrepreneurial capabilities by creating the right organizational contexts. EC is important in achieving and sustaining an organizations competitive advantage (Nalevanko 2013).

Material and methods

The entrepreneurial capabilities of the MASIPAG farmer organizations were determined through collaborative methods (c.f. Whitney et al. 2014[ab])using a questionnaire with seven-point likert scale

[1] Magsasaka at Siyentipiko Para sa Pag-unlad ng Agrikultura (MASIPAG) Farmer-Scientist Partnership for Development, 2611 Cabern Village, Los Banos, Laguna 4030, Philippines. E-Mail: rbuena@masipag.org

[2] World Agroforestry Center (ICRAF), Nairobi / Center for Development Research (ZEF), University of Bonn, Walter-Flex-Straße 3, Bonn, Germany. E-Mail: cory.whitney@uni-bonn.de

adapted from the Entrepreneur Scan or E-Scan (Driessen and Zwart 2005) to objectively measure the entrepreneurial personality before and during the initial of business stages. This methodology was used to measure the entrepreneurial personality to facilitate assessment of entrepreneurs. The purpose of the scan is not so much to select 'successful' entrepreneurs, but more an instrument for further development of the personality of the entrepreneur (Driessen and Zwart 2005). E-Scan was complimented with focus-group discussions and key informant interviews to gather details of the organization, the history, factors that led to going into business and other important variables. Hofstede's (2011) six dimensions of organizational weremeasured. Similarities and differences of MASIPAG organizations in terms of marketing, finance, organizational management and production were analyzed and compared with Mann-Whitney U-Tests of frequency, counting, ranking and averaging

The answers of the farmers in all entrepreneurial capability categories were also added to obtain quantitative measures or scores. The sum of quantitative measures (scores) of the variables were computed to give each of the nine categories a general score. After which, the mean rank of the scores of the participants in each group were computed in each category. Each mean rank score was evaluated by comparing it with their respective median (Md) score, where:Md = (# of items * maximum score - # of items * minimum score / 2) + (# of items * minimum score). *Ifthe mean ≥ Md, the farmers' evaluation for the entrepreneurial capability category was deemed a positive evaluation, otherwise it was deemed a negative evaluation.*

Based on the assessment of the culture and marketing activities of each organization, key factors for competitive success were identified.

Results

The seven key factors for competitive success were:**1)** *Strong entrepreneurial environment:* Entrepreneurial culture among farmer organizations is important to sustain and maintain their business and consequently, their market and competitive position. **2)** *Innovative marketing strategies:* Organic rice marketing is continuously increasing in the Philippines; along with this growth is also the increase in competition as many business owners also sees opportunity in value of organic rice. **3)** Collaboration with both government and non-government organization offered a wider distribution network for both organizations. Organizations were able to offer their products to wider market by participating in trade fairs and exhibits often organized by the local government units. **4)** *Partnership and collaboration with other entities:* Strategic alliance with other organizations to strengthen the business is also crucial for the two groups of farmers. Organizations have strong ties with the local government unit which supported them with facilities and market promotion. Their membership with MASIPAG helped them gain knowledge in organic agriculture production and certification training and linkage with other farmer and non government organizations. MASIPAG also provides training on bookkeeping and organizational strengthening since the business is done by the group and therefore should be diagnosed and developed.**5)** Entrepreneurial capabilities explained that capabilities differ from characteristic in such a way that capabilities are learned and easy to change while characteristics are the fact, neither easy to learn or change in a short period of time. They further differentiate the two from competence as something a person is very good at, enabling a person to do his/her job well. It is the collection of knowledge, capabilities, characteristics and attitudes in relation with, or necessary for a good performance. Often, measurement of capability is done with organizations that wants or just starting their business to have an objective self-assessment. **6)** Entrepreneurs had an average entrepreneurial competence score of seven. Although the scores of BUSAFO and ILOFA are lower compared to the accepted average, it reveals which competencies and characters should be strengthened and to focus on. It also indicates what possible kind of training and other capacity building support should be provided to the organizations.**7)** Organizational culture scoresshow that organizations have almost the same characteristics based on the six dimensions, however, BUSAFO is more goal oriented in term of management focus. The group is focused on selling their organic rice to different organizations, in some cases, on the basis of trust thereby, putting the financial status of the group at risk.

Discussion

Results of the tests and analysis showed that the farmers' organizations are not entrepreneurial. This may be due to many factors, primarily that the organizations are made up of farmers from many different cultural background, ethnicity and geographic conditions. Some are traditional residents while other are migrants through the implementation of the homestead program of the Philippine government in the 1950's after the Second World War. Some migrated to search for food, survive, conquer frontiers, and colonize new territories, escape from war zones or political turmoil, and look for new and more rewarding and exciting opportunities (Liang 2006). However, economic opportunity is the major reason for migration (King 2008).

Realizing the important relationship of culture and entrepreneurial capabilities, further study needs to be done to better understand the factors, dimensions and other facets of entrepreneurship and how farmers can transcend from being producers to entrepreneurs. While factors such as personal characteristics and environment shape an individual's entrepreneurial competencies, providing conditions, including support services can assist farmers learn the needed capabilities to become entrepreneurs and later, develop the entrepreneurial culture of their respective organizations. The following are the recommendations for the organizational leaders based on the results of the analysis.

Results of the analyses showed that there is much to do to develop the entrepreneurial capabilities of the farmers. The opportunity of improving market awareness through networking with other groups and active participation in the marketing activities of their specific locality should be prioritized by the leaders as this is one key success factor identified.

Production should be improved to take advantage of the expanding market. Leaders should intensify internal promotion to encourage members increase production and entice chemical farmers to go organic. MASIPAG, as support institution, should also conduct study the entrepreneurial capabilities of other member organizations to draw results which will be appropriate for the whole network. The results of this study can aid in designing appropriate programs to reinforce the uniqueness and strengths of each organizations when it comes to handling business. The results of this study can also be used as baseline as well as basis for identifying priority areas in the designing or re-designing training and other capacity building support for farmer organizations. Specifically, the results of the statistical analysis should be cross-referenced first, including the results of the focused group discussion as the results came directly from the farmers' experience.

The local government units can help farmers' organization develop entrepreneurial capabilities and culture by supporting their marketing initiatives by providing accessible market, provide incentives or subsidy to both organic and in-conversion farmers to entice them to further produce organic products and at the same time attract conventional farmers to go into organic agriculture. More facilities specifically for organic production should also be provided to farmers group as well as activities to encourage them.

Other support institutions such as the local NGOS, academics, the church and consumers should also support this kind of initiative by the farmers by patronizing their products. NGOs providing loans and other financial support should also develop schemes where farmers will learn how to improve their financial status and at the same time be responsible in handling cash and financial records while academics can provide ideas, experience and support in terms of entrepreneurship and marketing.

References

Carland, James W., Frank Hoy, William R. Boulton, Jo Ann C. Carland (1984) Differentiating

Entrepreneurs from Small Business Owners: A Conceptualization, The Academy of Management Review, Vol. 9, No. 2, pp. 354-359

Driessen, Martyn P., Peter S. Zwart (2005). The role of the entrepreneur in small business success: the Entrepreneurship Scan.

Hofstede, Geert. (2011). Dimensionalizing Cultures: The Hofstede Model in Context. Online Readings in Psychology and Culture, 2(1). http://dx.doi.org/10.9707/2307-0919.1014.

King, Russell, Ronald Skeldon and Julie Vullnetari (2008). Internal and International Migration: Bridging the Theoretical Divide. Sussex Centre for Migration Research, University of Sussex

Liang, Zai (2006). The Sociology of Migration. pp. 487-495

Loveridge, Scott, Steven R. Miller, Timothy Komarek, Thasanee Satimanon (2009). Assessing

Regional Attitudes about Entrepreneurship. The Journal of Regional Analysis and Policy.

Nalevanko, Cynthia (2013). What is Entrepreneurial Capability? Journal of Leadership and Organizational Studies. Philippines, Empowering Smallholder Farmers in Market (2009), Philippines: Country Paper

Whitney CW, Den Braber K, Tu Tuyet N, Thorndal Jørgensen S (2014a) Measurable Impacts of the "Principles of Organic Agriculture" Survey of A Vietnamese Organic PGS, Rahmann G & Aksoy U (Eds.) Proceedings of the 4th ISOFAR Scientific Conference. 'Building Organic Bridges', at the Organic World Congress 2014, 13-15 Oct., Istanbul, Turkey

Whitney, C. W., den Braber, K., Từ Tuyết, N., and Thorndal Jørgensen, S., (2014b) Farm Management Schemes within Organic PGS; Survey and Analysis in Sóc Sơn, Hanoi, Vietnam, Building Organic Bridges. Proceedings of the 4th ISOFAR Scientific Conference at the Organic World Congress 2014 in Istanbul, Turkey, Thuenen Report 20, 1187-1190.

Zahra, Shaker A. (2011) Entrepreneurial Capability: Opportunity Pursuit and Game Changing. Copenhagen Business School, Denmark

Six myths of Research in Organic Farming

Bernhard Freyer[1], Jim Bingen, Valentin Fiala

Key words: Organic Farming Research; research methodology, organic 3.0

Abstract

Organic Farming Research (OFR) is well established and there is an ongoing discussion about the future research needs of organic farming. However, there is less discourse about the methodological features of OFR. During the editorial work on a comprehensive book about the state of the art in OFR, the authors received the impression that differences between ideals of OFR and actual research practices invited critical debate. In this article we label such discrepancies– somewhat provocatively – as myths about OFR. We identify six myths: (1) OFR follows a systemic research approach; (2) OFR is guided by the IFOAM Principles and organic regulations; (3) OFR produces results that are directly applicable in practice; (4) Research priorities are defined together with practitioners; (5) The methods applied in OFR differ fundamentally from those in research on conventional farming (6) Organic researchers are fully integrated the scientific community.

Acknowledgement

We thank the anonymous reviewer for their critical and helpful feedback.

Introduction

Today, organic farming research (OFR) is well established in many agricultural research institutions. Within the context of Organic 3.0, there is also an extensive debate about the necessary requirements, important research needs and the future development of organic farming. In contrast, the discourse about the specific methodological characteristics and ideals of OFR dates from the 1990s (see Lindenthal et al. 1996), and it has not been updated, except what Alrøe& Kristensen (2002) brought in on ethics and a systems perspective. During the editorial work of a comprehensive book about the state of the art in OFR, we realized that OFR lacks critical methodological discourse. Based on our observations regarding the discrepancies between the ideals, or myths, and the practices of organic farming research, we believe that it is important to launch a new discourse about the methodological characteristics of OFR. The myths represent an idealistic image of OFR that frequently create unnecessary difficulties for researchers. Similar to Roland Barthes (1972), we see myths as connotations that present phenomena as natural conditions, when in fact they are socially constructed. Moreover, the word, "myth" has polemic sharpness. It serves as a conceptual "lightening rod" that draws our attention to the need to questions many of our assumptions. In the following, we discuss six myths about OFR. For each myth, we first present how it is embodied in much OFR. Second, we offer a critique of this use.

Material and methods

The foundation for the identification and discussion of the six myths arises from insights gained in the process of preparing an edited volume on OFR (Freyer 2016). In this book, fifty-two authors contributed thirty-three chapters, discussed the state of the art, and the future challenges of different fields within OFR. After reviewing each of the chapters, and with additional literature review, we

[1] University of Natural Resources and Life Science, Vienna (BOKU); Bernhard.Freyer@boku.ac.at

identified the following preliminary list of myths. The list is not complete nor without flaws, and we invite readers to reflect on our suggestions and to help extend and refine it.

Results

Myth 1: OFR follows a systemic research approach

It is often stated that organic farming is a system-oriented form of agriculture. Organic farmers avoid certain external inputs, focus on the farm internal relations e.g. between crop rotation, biodiversity and climate change and local ecosystems. From that, authors deduct certain requirements for OFR (holistic description of problems, inter-, and transdisciplinarity) and propose the use of systems theory or a systemic approach as a solution (Lindenthal et al. 1996; Gibbon 2002; Fiala & Freyer 2016).

Systems theory has its place in OFR. For example "organic farming" is a prominent topic within the International Farming Systems Association (see Barbier et al. 2012). However, it is difficult to conduct systemic oriented inter-, and transdisciplinary research projects. This is often, because of a lack of time and financial resources, difficulties in publishing results and a lack of system oriented advanced education (see Fiala & Freyer 2016). As a result, disciplinary oriented research continues to dominate OFR and OFR follows current trends and research topic.

Myth 2: OFR is guided by the IFOAM Principles and organic regulations

Closely related to the first myth, it is commonly observed that organic farming practices are guided by the ethical framework of the IFOAM Principles (see Freyer & Bingen 2015), as well as by organic regulations. Consequently, it can be argued that the research in organic agriculture is also framed by ethical principles and should neither violate ethical principles nor rules (e.g. causing harm to animals), Furthermore OFR should also investigate the coherence between ethical principles and the practical consequences.

Although some research follows the organic principles, most of the research has no direct references to the ethical foundation of organic farming (and the IFOAM Principles are seldom the object of research). In part, the ethical framework of the IFOAM Principles are primarily intended for practice, but not for researchers and how they practice science or how their research aligns with the ethics (Freyer & Bingen 2015). Scientific research more often follows the organic regulations, not organic ethics or principles.

Myth 3: OFR produces results that are directly applicable in practice

The usefulness of results for practitioners is often ascribed to OFR (e.g., Lindenthal et al. 1996). This is strongly related with Myth 1 and 2. Indeed, basic research within the field of OFR is rare, and OFR has a long tradition of using an applied approach. This dominance of applied research may also be due to the demand for solutions that can be directly applied in the field. Practitioners of organic farming commonly ask for immediate answers and direct applicability of research results on their farms (Ekert et al., 2012).

However, it is important to understand that even results of applied research are often not directly transferable to practitioners. OFR scientists can only partly fulfil this demand because transforming and transferring results into practice is its own profession and needs a "transformer science", also known as "transfer research" (Fichten 2014)]. If a direct application is requested, this often requires additional resources that are not considered to be part of the normal research projects. Methodological approaches that explicitly consider the transfer of results are action research (e.g., Bloch et al. 2014 and Arman & Thomas 2004), or transdisciplinary research (e.g., Dressel et al. 2014, Freyer 2004, Freyer & Muhar 2006, Hoffmann et al. 2009 and Rieckmann 2015). But these approaches are not frequently found in OFR.

Myth 4: Research priorities have to be defined in collaboration with practitioners

In OFR, the connections to practitioners are emphasized strongly, and often research priorities in OFR are identified through a stakeholder driven process. Interviews with stakeholders, or mixed group discussions with farmers, advisors and researchers, represent such a participatory and integrative approach for identifying research needs. For example, in the case of the German Federal Ministry of Nutrition and Agriculture, research priorities were formulated by interviewing researchers, as well as other actors from the organic agrofood chain. However, in looking at the resulting research program, a coherent research strategy does not exist (Ekert et al. 2012). It is possible that the results of such preliminary work often only represent the knowledge and opinions of those choosing to participate. Thus, the results may be skewed toward those who are most attentive to, or interested in the proposed research.

Over the last two decades, many studies have identified and documented the research needs for OF. But most of these studies do not represent systematic, scientifically organized reviews. Without question, a comprehensive literature review should be the first step in identifying the scientifically based research needs in organic farming.

Myth 5: The methods applied in OFR differ fundamentally from those in research on conventional farming

Since it is often stated that OFR has certain requirements and follows a systemic approach, as well as ethical guidelines, it is sometimes assumed that OFR methods also differ from methods in research on conventional farming.

Does OFR apply methods that are different from conventional research? With some exceptions, (e.g., ethical reasons that influence breeding methods), there is no fundamental distinction between organic and conventional research methods. Nevertheless, it is important to note that while applied methods do not differ greatly, the results have a different meaning in OFR and CFR. Yield offers a good example. Wheat yields of 5t ha^{-1} for conventional farming are very small. But for organic production, yields have a different meaning because of the integrated perspective on yield that includes the energy need for mineral fertilizer, environmental impact, the quality of the wheat, the biodiversity in the field, etc.

Myth 6: Organic researchers are fully integrated into the wider scientific community

Different researchers practice OFR. To classify them has its limitations, but the following structure offers an orientation: (a) researchers who focus only on OFR; (b) researchers who deal with both conventional and organic systems; (c) researchers who do ORF by default; and, (d) researchers who exclude OFR, but write critically about it. Given this range of research, it appears that organic farming has become a topic of interest within the wider scientific community. Publications and scientific conferences on organic farming have been increasing in the last two decades (see www.orgprints.org). There are numerous options to present OFR in scientific peer reviewed journals, as well as conferences, including those for conventional agricultural.

On the other hand, Hülsbergen & Rahmann (2014) argue that the circle of organic researchers has grown very slowly over the years, as also documented by Ekert et al. (2012). DAFA (2015) similarly notes that the contribution of basic science researchers in the OFR is very limited. Both observations indicate that there exists an untapped research potential between the different researcher groups that could benefit from greater communication.

Conclusions

In this article we presented a preliminary list of myths about OFR. We know that there will not be a consensus around our interpretations. However - especially in the context of the further development of organic farming as “Organic 3.0” – it is important for the scientific community to engage with these myths and to reflect upon them. We have done so, and we invite other colleagues to do so as well. We believe that such reflection could launch an important creative process. Some of our initial conclusions include:

- There has been little critical debate over methodology since Lindenthal, Vogl and Hess (1996) critically discussed the methodology for OFR.
- The choice of methods includes, or excludes, insights on organic systems characteristics and qualities.
- In the context of Organic 3.0, in which the primary focus is on technological innovations, there is also a need for innovation in research methodologies.
- A research platform on organic farming methodologies, e.g., supported via a European COST-action, might offer a format to deepen the debate.

References

Alrøe, H. F., & Kristensen, E. S. (2002). Towards a systemic research methodology in agriculture: Rethinking the role of values in science. *Agriculture and Human Values*, *19*(1), 3-23.

Arbenz, M., Gould, D., & Stopes, C. (2014). ORGANIC 3.0—the vision of the global organic movement and the need for scientific support. Organic Agriculture, 1-9.

Arman, B., & Thomas, A. 2004. Der Beitrag der Sozialwissenschaften in interdisziplinären Umsetzungsprojekten am Beispiel des Teilprojekts konservierende Bodenbearbeitung im Unteren Jagsttal. *Schriften der Gesellschaft für Wirtschafts- und Sozialwissenschaften des Landbaus, 39*, 599-607.

Barbier, M., Bompart, M., Garandel-Batifol, V., & Mogoutov, A. 2012. Textual analysis and scientometric mapping of the dynamic knwoledge in and around the IFSA community. In Ika Darnhofer, David Gibbon & Benoit Dedieu (Eds.), *Farming Systems Research into the 21st Century: The New Dynamic* (pp. 73-95). Dordrecht, Heidelberg, New York, London: Springer

Barthes, R. (1972).

Bloch, R., Knierim, A., Häring, A.-M., & Bachinger, J. 2016. Increasing the adaptive capacity of organic farming systems in the face of climate change using action research methods. *Organic Agriculture, 6*(2), 139-151.

DAFA. 2015. (Hrsg.) Fachforum Ökologische Lebensmittelwirtschaft - Forschungsstrategieentwurf der Deutschen Agrarforschungsallianz, Braunschweig, Version 27.11.2015 http://www.dafa.de/fileadmin/dam_uploads/images/Fachforen/FF_Oekolandbau/dafa-ffoe-2015-11-27-strategieentwurf.pdf

Dressel, G., Berger, W., Heimerl, K., & Winiwarter, V. (Eds.). 2014. *Interdisziplinär und transdisziplinär forschen: Praktiken und Methoden*. Bielefeld: transcript Verlag

Ekert, S., Döring, T., Häring, A.M., Lampkin, N., Murphy-Bokern, D., Otto, K., . . . Vieweger, A. 2012. Evaluation des Bereichs Forschung und Entwicklung im Bundesprogramm Ökologischer Landbau.

Fiala, V., & Freyer, B. 2016. Systemtheoretische Grundlagen. In Bernhard Freyer (Ed.), *Ökologischer Landbau: Grundlagen, Wissensstand und Herausforderungen* (pp. 80). Stuttgart: UTB

Fichten, W. 2014. Spurensuche: Hat Praxisforschung systemische Wirkungen? *TriOS. 9. Jahrgang, Heft 1/2014*, 55.

Freyer, B. (2016). Ökologischer Landbau. Grundlagen, Wissensstand und Herausforderungen. UTB Stuttgart, 711 p.

Freyer, B. 2004. Inter-und transdisziplinäre Forschungspraxis-Beobachtungen und Empfehlungen. Wien: Institut für Ökologischen Landbau, Universität für Bodenkultur

Freyer, B., & Bingen, J. 2015. *Re-thinking organic food and farming in a changing world*: Springer

Freyer, B., & Muhar, A. 2006. *Transdisziplinäre Kooperation in der universitären Ausbildung: die Fallstudie" Leben 2014" in der Nationalparkregion Hohe Tauern, Oberpinzgau; ein Projekt im Rahmen des Programms Kulturlandschaftsforschung*: facultas. wuv/maudrichGibbon, D. (2002). *Systems thinking, interdisciplinarity and farmer participation: essential ingredients in working for more sustainable organic farming systems.* Paper presented at the Proceedings of the UK Organic Research 2002 Conference

Hoffmann et al. 2009

Hülsbergen, K.-J., & Rahmann, G. 2014. Die Zukunft des Systems Ökolandbau - Zusammenfassende Auswertung einer Umfrage vom Mai 2014. In DAFA (Ed.), *http://www.dafa.de/fileadmin/dam_uploads/images/Fachforen/FF_Oekolandbau/befragungsauswertung-ffoe-2014.pdf*

Lindenthal, T., Vogl, C. R., & Hess, J. (1996). Forschung im Ökologischen Landbau: Integrale Schwerpunktthemen und Methodikkriterien. Der Förderungsdienst; Bundesministerium für Land-u. Forstwirtschaft.

Rieckmann, M. 2015. Transdisziplinäre Forschung und Lehre als Brücke zwischen Zivilgesellschaft und Hochschulen. *ZEP: Zeitschrift für Internationale Bildungsforschung und Entwicklungspädagogik, 38*(3), 4.

Emerging trends in China's organic farming: Five case studies

Huichen Gao[1],SuguruMasaki[2],Dong-CheolShin[1], Lei Jia[3],Hong Park[1]

Key words: organic farming, China, various structures

Abstract

The theme of this study is the current situation of China's organic agriculture sector and its producers. Driven by export opportunities in a growing global market, China's organic farming has been dominated in the initial stage by export-oriented companies. However, with a continuously expanding domestic market and consumers' higher awareness about the environment and food safety, this sector has shown various structures in the past few decades. With a primary focus on the production chain, this research studies three different models of organic production in China's organic sector, including the company leading model, the farmers' cooperative model, and the non-certified organic practices. Our findings lead to recommendations for policymakers and other stakeholders to better understand the present trends in China's organic agriculture industry and to emphasize the role of organic agriculture in China (not only its commercial value but also its social values rooted in the core of the organic agriculture movements).

Introduction

China's organic farmingwas initially driven by export-oriented opportunities based on contract farming, and develop-and-import schemes promoted by large suppliers and retailers in the Global North. However, this pattern has changed over the past two decades. With the Chinese government gradually improving its certification system and the rise of consumer awareness on the environment and food safety, China's organic sector has been moving away from being dominated by export-oriented companies to becoming a more diverse sector. Specifically, export opportunities stimulated the growth of organic agriculture in China in the 1990s. With the internalization of existing management systems in developed countries, China needed only a decade to establish a sound third-party certification system with national regulations and standards. Thus, the improved management system facilitated massive capital injections in the organic sector and nurtured its prosperity in China's domestic market. With market maturity, China's unique characteristics have gradually spawned more players, such as independent farmers' organizations and an increasing number of consumer groups participating in the organic sector. A pattern of reverse development comparing with the Global North is revealed, which may lead this sector in China to having its special features. In this research, we study the emerging trends of China's organic sector from a producer's view.

Methodology

To gain a better understanding of the current situation of China's organic sector, we select five cases for in-depth case study analysis. Longsheng Company and Haobao Company are chosen to cover the company leading model. In addition, we use the FS Cooperative and the Dai Cooperative to study the model of farmers' cooperative. At last, the Little Donkey Farm is included in this study to unpack the non-certified organic practices, which are rapidly spreading in major cities across China in various forms. For each case, the main factors that contributed to the development of organic farming are investigated, and the author also addresses key investment issues, the adoption

[1] Hokkaido University, Japan, http://www.hokudai.ac.jp/, eMail: gaohuichen@yahoo.com

[2] Hirosaki University, Japan, http://www.hirosaki-u.ac.jp/

[3] Nihon University, Japan, http://www.nihon-u.ac.jp/

of organic standards and certifications, and the marketing and sales strategies. Considering China is a very large and diverse country, it is an undeniable fact that five cases are not enough to cover all the models of organic producers. The strategy is to carry out in-depth interviews and field surveys in each case and use them as an exploratory analysis of China's path to organic agriculture.

Summaries of each case

i. Export-oriented enterprise - Shandong Boxing Longsheng Food Co., Ltd.

Longsheng Company is selected as a typical export-oriented organic enterprise in China's organic sector. It was established in 2001 with a registered capital of 45.5 Chinese million yuan. Following a large investment in organic conversion and farmland expansion, the company's export business of frozen vegetables became profitable after 2005. By the year 2014, it had become a large-scale food enterprise with a total farmland up to 1,279.62 hectares and 400 regular employees.

Longsheng Company tried "contract farming" on one of its many farms in its early stages of development. This contractual partnership with local farmers is common in the eastern coastal area of China, where the economy is relatively developed, and local farmers are more willing to lease their farmland and take a job outside the village for a better income. However, because of the difficulty in overseeing every sub-contracted farmer, the company finally changed its strategy, adopting "direct farming" across all production bases. Meanwhile, it gradually shifted its marketing strategy after 2010 from taking only overseas orders to focusing mainly on the domestic market. One reason for this change is that it takes timeto fully convert developed farmland to organic cultivation. During this conversion period, the company's strategy is to grow grain crops, such as wheat and corn, for the domestic market and then begin vegetable rotation. A second reason is the increasing difficulty of maintaining organic certifications to meet the specifications of international orders. Specifically, the company had to maintain organic certifications of NOP, JAS, and EU, which necessitated hiring professionals and spending additional money and time. Also, the increasingly strict requirements of the Japanese import system, the so-called positive list system which includes normal monitoring inspections, strengthening monitoring inspections and inspection orders, increased the export risk, leading the company to abandon its Japanese business in 2009. Since China's domestic organic market has been growing quickly in the last decade, Longsheng Company is putting more focus on the domestic market.

ii. Domestic market enterprise - Haobao Organic Agricultural Co., Ltd.

As a typical organic enterprise in China's domestic market, Haobao Company adopted "direct farming" instead of signing contracts with local farmers in the early stages because its initial farmland, leased from the local village, had originally been a barren hillside devoid of farming activity for nearly 12 years. Originating from a city-level organic farm, this company spent its early years committed to producing organic products locally and promoting local-community development. In 2012, a non-agricultural capital injection led the company to adjust its strategy, resulting in the establishment of several sales branches across the country and a rapid expansion of production bases. These changes display obvious features of "conventionalization," which led the company to rely on energy-intensive sources of external inputs and caused energy consumption to skyrocket for its long-distance transport. Meanwhile, the social values central to the company's mission in its early stage were bypassed after 2012 and replaced by commercial interests.

This case illustrates that pursuing profit maximization through rapid expansion led the company to encounter several problems. As a result, the company had to abandon two production bases to save costs. Moreover, a great imbalance arose between the amount of certified organic products and the amount supplied to its members, which has raised concerns that the company is on suspicion of selling produces that are probably not sufficiently qualified as organic. Such occurrence is possibly a potential threat that may have an implication that affects the development of China's organic food industry. More importantly, growth in the organic sector following a large capital injection derives from conventional interests in niche commodities. In other words, the prevailing tendency for the conventionalization of organic farming is more likely to contribute to forging an unsustainable system, resulting in an erosion of local food systems and the core values of organic farming.

iii. FS Organic Specialized Farmers' Cooperative

In this case, we study the formation of organic rice production center of Wuchang City in Heilongjiang province. Afterward, we use the case of FS Cooperative to discuss the characteristics and roles of farmers' specialized cooperatives during this process. The success of this formation attributed to the introduction of basmati rice and promotion of cultivation techniques, most of which was led by the local government. On the other hand, private rice enterprises have taken responsibility on expanding rice sales channels since the privatization of rice business began in the 1990s. With high-quality seed and organic materials controlled by these companies, farmers were enclosed to work for them on rice production bases. However, as technical guidance on organic farming was provided, farmers' organizations developed on various levels.

As an exclusive marketing cooperative set up by an organic fertilizer company at first, FS Cooperative gradually got independent from this company with the help from local government. The technical department of township government had played a significant role in this process. Thus, its members' income had been well protected by their own cooperative with a contract price. Since the competition of rice business in Minle Township is very fierce, and the production base is in flux, it is hard for a company to control farmers for their interests only by controlling the production materials. Under these circumstances, independent farmer's cooperatives have developed their own organic businesses by taking over "contract farming" from large agribusinesses, which should not be regarded as a coincidence.

iv. Dai Village Organic Agricultural Specialized Farmers' Cooperative

In 2003, Dai Village was a poor and undeveloped. With support from the local agricultural technical institute and the establishment of the Dai Cooperative in 2006, the village has been continuously converting its land for organic farming. As a result, the collective raised the annual per capita income of Dai Village to 13,710 yuan in 2012, higher that the average income of the city where it belongs. Known as the "Dai Village Model," the cooperative' success reveals that small farmers, if well-organized, can carry out organic farming activities in China.

Characteristics of the cooperative can be summarized as follows. First, to organize small-scale farmers engaging in organic production activities, powerful leadership is necessary. In this case, the villagers' committee had played an important role inland transfer and in the promotion of organic technology. Secondly, there are a number of part-time farmers whose main income does not come from agriculture. In this case, the cooperative has maintained two types of organic farming: for rice cultivation, it sets up eight paddy field operating teams; for other products, it enters into contracts with members. This strategy, while ensuring the management of paddy fields, can also be effective in the development of other organic varieties. It should be noted that the introduction of high-quality Koshihikari rice helps the cooperative expand its sales channels. Finally, the cooperative has been working on a contract with another large company to produce organic glutinous rice in the future. When it comes to farmland expansion and seeking cooperation with other companies, questions of maintaining its independence and ensuring quality control are essential for the cooperative's future development.

v. The non-certified organic practices - Little Donkey Farm

The participatory guarantee systems (PGS) have been developed when smallholder producer groups in developing countries are increasingly unable to bear the human resource and financial costs of the management systems and documentation required for a third-party certification. It officially came to China when Little Donkey Farm was established in 2009. Since then, this model has sprung up in the major cities of China in just the past few years.

There are four main business models on the farm: “delivery share,” “labor share,” “parent–child community,” and “group buying.” Simply put, for “delivery share,” members submit a certain number of orders and prepayments to the farm; in exchange, the farm provides organic products weekly. In “labor share,” customers rent an individual area of farmland (e.g., 30 m^2) and enjoy cultivating and harvesting in this area. “Parent–child community” and “group buying” are designed to support “delivery share” and “labor share.” In 2011, a field school was established, and DIY carpentry workshops were held to organize educational activities in nature for children. Every month, several outdoor activities are arranged on the farm to allow children to get closer to nature and learn farming practices. Consumers are mobilized by the farm in a variety of ways. Here, short food supply chains connect local producers directly to consumers. Having consumers participate in the farm’s daily activities, third-party organic certification is no longer necessary. Meanwhile, the local community grows, as does trust in the local food network.

With rising consumer awareness about food safety, more and more consumer groups tend to develop their own marketing links. In this case, we can see that more social values have been added to organic farming. With growth in the domestic market and an increasing number of non-certified organic farms being establishedaround major cities, consumer groups’ participation has become a driving force that should not be ignored in China’s organic sector. Although very nascent and limited in scope, these non-certified organic practices are experiencing the complex process of adaptation in China.

Discussion

The development of China’s organic agriculture can be roughly divided into three phases: 1) the period before 1999 witnessed the launch of an export-oriented organic movement in China, with more than 95% of China’s organic product being exported to overseas markets (Qiao,2011). During this period, China’s national policy on sustainable agriculture was mainly focused on the Chinese Ecological Agriculture (CEA) and green food. 2) Between 2000 and 2010, the Chinese government set up and continually improved its regulations and standards of organic agriculture as well as the supervision mechanism of the third-party certification system. In this process, the export-oriented enterprises that developed during the first stage played a major role in the growth and development of China’s organic sector. Thus, China’s organic agriculture industry became recognized internationally and attracted more national attention. 3) After 2010, China’s domestic market for organic products has grown rapidly. Meanwhile, with the rise of farmers’ specialized cooperatives and consumer groups in the domestic market, China’s organic agriculture diversified away from export dominance to co-existing ownership structures.

This research investigates the various models of organic producers in China. Companies in the company leading model are more inclined to adopt direct farming for their productions, leaving contract farming being gradually internalized in farmers’ organizations and other groups. With support from the government, independent farmers’ cooperatives have developed fast and taken over the organic production used to be contracted by companies. Meanwhile, the practices of non-certified organic farming indicate that there is an emergence of value-based initiatives that pay attention to the broader values of organic production and highlight the importance of direct interactions between consumers and farmers. All these research findings lead to recommendations for policy-makers and other stakeholders to better understand and benefit from various structures in China’s organic agriculture, especially in the area of involving more small-scale farmers in this growing industry.

References

Qiao Y (2011) Organic agriculture development in China. In: Willer H. & Kilcher L. (ed) The world of organic agriculture: statistics and emerging trends 2011. IFOAM, Bonn & FiBL, Frick, pp. 132-136

Participatory guarantee systems: Organic certification to empower farmers and strengthen communities

Robert Home[1*], Hervé Bouagnimbeck[2], Roberto Ugas[2], Markus Arbenz[2], Matthias Stolze[1]

Key words: participatory guarantee systems, organic, organic certification, social processes, community development

Abstract

Third party certification can act as a barrier to market entry for smallholder producers because of high costs, paperwork and bureaucracy. Participatory guarantee systems (PGS) can assure consumers while avoiding the entry barriers of third party certification. This study aims to investigate farmers' motivations for, and outcomes from, participation in PGS. Interviews were conducted with 84 farmers from seven countries who were asked about their experiences in a PGS, with a particular focus on motivations for participation. The results suggest that PGS benefits include empowering farmers and building trust, which extend beyond the primary aim of PGS. Successful PGS base their activities on long lasting social processes and being well connected to consumers, markets, regulation bodies, governments, and their communities. Combining tradition collaboration within local level social structures contributes to ensuring the future of PGS as an alternative system to third party certification.

Acknowledgments

This extended abstract is derived in part from an article with the same title: published in Agroecology and Sustainable Food Systems on January 17, 2017.Available online http://dx.doi.org/10.1080/21683565.2017.1279702. The study on which this paper is based was commissioned by Universidad Nacional Agraria La Molina, Peru to IFOAM, under the AGROECO project (Ecological and socioeconomic intensification of smallholder agriculture in the Andes), funded by the Canadian International Food Security Research Fund. CIFSRF is a program of Canada's International Development Research Centre (IDRC) undertaken with the financial support of the Government of Canada provided through Foreign Affairs, Trade and Development Canada (DFATD).

Introduction

In the early days of the organic movement, certification was unnecessary because the organic industry was small and the integrity of produce was 'guaranteed' by trust: based on a direct relationship between the usually small-scale independent farmers and the consumer who met at the point of sale, such as at farmers' markets (Meirelles 2011). However, the worldwide demand for organic food is increasing, with a recorded growth rate of more than 10 percent in the most advanced markets for organic products, and has reached a worldwide total market value of US$ 72 billion (Willer and Lernoud 2015). As the scale of the organic food industry has expanded, consumers are increasingly able to purchase organic food through mainstream channels, such as supermarkets (Van Loo et al. 2012). The consumer now relies on cues that signal assurance of integrity (Martinez and Epelbaum 2011); foremost of which are externally issued certificates of organic compliance. Individual producers communicate compliance with standards.

[1] Research Institute of Organic Agriculture. Ackerstrasse, Frick, 5070 Switzerland

[2] IFOAM-Organics International, Charles-de-Gaulle Strasse 5, 53113 Bonn, Germany

Although third party certification systems play an important role in organic production and trade, they are not always suitable for small-scale operators and local market channels. Rather, third party certification can act as a barrier to entry for smallholder producers looking to access organic markets because of the high costs (Lundberg and Moberg 2009), and required paperwork and bureaucracy (IFAD 2003; Nelson et al. 2015). A further criticism of third-party certification is that it has a political dimension in which it is perceived to have been imposed on the developing world by the global North (Nelson et al. 2015). For the third-party certification of smallholder groups in the South, and typically for tropical products such as coffee and bananas, import markets started to allow a derogation of the rule that each individual farm had to be inspected annually by the certification body (CB). A range of stakeholders, including farmers, regulators, development organizations and consumer groups have therefore sought alternative certification systems that are better adapted to specific contexts.
Participatory guarantee systems are locally focused assurance systems that verify producers’ compliance to certain organic standards. PGS are based on active participation of stakeholders, and are built on a foundation of trust, social networks, knowledge building and exchange (IFOAM 2008). A typical PGS initiative involves producers, consumers and, often, other stakeholders such as staff from NGOs, universities and extension services, government representatives, and consultants (Nelson et al. 2010). The aim of this contribution is to investigate farmers' motivations for, and outcomes from, participation in PGS. In pursuing this aim, we will examine whether nutrition, farm performance, income, and marketing opportunities are perceived to have arisen through participation. Furthermore, we examine the factors that contribute to the foundation and survival of existing PGS and whether PGS can contribute to farmer empowerment.
It is beyond the scope of this exploratory and qualitative study to draw quantitative conclusions, such as whether there are intercultural or international differences, or to quantify any economic advantage or disadvantage to participation in a PGS. It remains the challenge of future research to address these questions in a quantitative and/or econometric study using appropriate instruments. The results of this study provide a starting point for such future research.

Material and methods

Case study PGS were selected for this study if they had been successfully operating for at least three years, were linked to markets, and were at least partially self-funded and had taken steps to move towards self-funding. Eight PGS initiatives in seven countries met these selection criteria and at least six farmers, who had participated in the PGS for at least three years, were interviewed (N=84) using a semi-structured questionnaire. Questions were formulated to ask why the participant joined the PGS; what changes with regard to nutrition, farm performance, income, and marketing opportunities had arisen through participation; and their opinion of their PGS including problems and solutions. The questionnaire was translated into the local language and administered in a face-to-face interview by a local researcher on the respondent’s farm. To minimize interviewer bias in the interviews that were, by necessity, conducted in several languages, two local researchers per case were chosen, coached and trained by IFOAM. The recorded responses were translated into English and transcribed before being analyzed centrally according to their content.

Results

PGS commonly start as a small group and seek to recruit farmers by convincing them of the benefits of participation. Prominent among the challenges for initiating a new PGS is the reluctance of farmers to join before it has a critical mass. Organizers must convince potential member farmers of future benefits, which may not yet be tangible, and the principal motivation for joining is to profit from some or all of the offered benefits. A range of beneficial social processes were identified, which are frequently observed in combination with PGS. Prominent among these is the organization of collective use of resources, sometimes known as self-help groups, which are important to the success of many PGS. Self-help groups are an example of the recursive and reflexive mechanisms suggested by Bodorkos and Pataki (2009) and have become an entry point into many PGS communities at a grassroots level. They provide a platform for various intervention activities, such as:

- Collective buying, which reduces costs;
- Joint marketing, which is essential to the expansion of market opportunities;
- Establishing seedbanks, which gives farmers access to varieties suited to local conditions;
- Supporting collective logistics in transportation for farmers who are often geographically isolated; and
- Enabling farming households to access affordable credit for agricultural and other purposes.

Participation in the collective actions of self-help groups, with their own social processes, reinforces the social inclusion, farmer empowerment and mutual support between producers and consumers that are inherent in PGS. Given that PGS are commonly composed of people living in close proximity and sharing the same ideals, support needs can be delivered in a way that is tailored to the individuals. For example, monitoring of credit usage and repayment is easier and the need for coercion is also reduced. Efficiently managed and well-funded self-help groups are therefore a recurring feature of successful PGS communities.

Like any collaborative grassroots venture, PGS encounter challenges. A major criticism of some PGS initiatives is that they are often started not because there is a market but because politically motivated donors believe PGS are more democratic and wish to challenge the "imposition" from the North and local competent authorities. That PGS are (may be) technically as effective as third-party often comes as a second consideration. Political issues are also essential for many of the donors that have funded PGS initiatives in the developing world. Costs of the system were not often a concern since there is an external donor and there is sometimes little evidence of a need for the initiative to become self-sufficient. In times of diminishing resources for projects, we are seeing that some PGS initiatives are dwindling or have disappeared. A further challenge that is fundamental to the sustainability of PGS is its formal recognition as a legitimate quality assurance system, which may require ongoing negotiation with local, regional and national governments as well as with organic regulation bodies. A number of countries – including Mexico and Brazil – have included PGS within their national organic regulatory frameworks, and countries interested in facilitating the use of PGS could look to these examples with respect to how PGS can be effectively included within legislation governing the organic sector. Recommendations and various scenarios for the role that governments can take in the support of PGS can be found in the IFOAM PGS Policy Brief: How governments can support Participatory Guarantee Systems (IFOAM 2015).

There is a growing demand for certified organic produce, with increasing numbers of producers involved: not all of who are able to access third party certification. Meanwhile, a wide range of organizations increasingly support PGS as an alternative system to third party certification for producers who market their produce locally (Nelson et al. 2010). The vision of combining tradition and participatory action is well placed to overcome the existing challenges to ensure the future of PGS. One participant states it clearly: "*We do not intend to stop and hope that our children will continue. It is important for us*".In addition to contributing to the stability and success of the PGS, the associated social processes also provide direct and indirect benefits to participating farmers.

Discussion

Participatory guarantee systems are more than just a means of organic certification with lower entry costs that Lundberg and Moberg (2009) suggest are necessary. They enable: collective buying, which reduces costs; joint marketing, which is essential to the expansion of market opportunities; the establishment of seedbanks, which give farmers access to varieties suited to local conditions; collective logistics in transportation for farmers who are often geographically isolated; and farming households to access affordable credit for agricultural and other purposes. PGS are typically driven by the energy of an individual, or a small group of people, who take the initiative to establish a system at the local level. From the results of this study, we recommend providing support to these people, who adopt the role of the change agent, which may encourage the spread of PGS and, in turn,will increase trust in the system and give more farmers access to the beneficial social processes.

References

Bodorkós B, Pataki G (2009) Local communities empowered to plan?: Applying PAR to establish democratic communicative spaces for sustainable rural development. Act Res 7(3):313-334.

IFAD (International Fund for Agricultural Development) (2003) The Adoption of Organic Agriculture Among Small Farmers in Latin America and the Caribbean. Thematic Evaluation. http://www.ifad.org/evaluation/public_html/eksyst/doc/agreement/pl/organic.htm#1. Accessed September 1 2016

IFOAM (International Federation of Organic Agriculture Movements) (2015) Policy Brief: How Governments Can support participatory guarantee systems (PGS), IFOAM, Bonn

IFOAM (International Federation of Organic Agriculture Movements) (2008) Participatory guarantee systems: Case studies from Brazil, India, New Zealand, USA, France. IFOAM, Bonn

Lundberg J, Moberg F (2009) Organic Farming in Brazil: Participatory certification and local markets for sustainable agricultural development. http://www.ifoam.org/sites/default/files/page/files/organic-farming-in-brazil_ssnc_2009.pdf. Accessed September 1 2016

Martinez M, Epelbaum F (2011) The role of traceability in restoring consumer trust in food chains. In: Hoofar J, Jordan K, Butler F, Prugger R (eds) Food Chain Integrity: A Holistic Approach to Food Traceability, Safety, Quality and Authenticity. pp 294-302. doi: 10.1016/B978-0-85709-068-3.50017-2

Meirelles L (2011) Certification of Organic Products. http://www.centroecologico.org.br/artigo_detalhe.php?id_artigo=26, Central Ecologico. Retrieved 1 September 2016

Nelson E,Gomez Tovar L, Schwentesius Rindermann R, Gómez Cruz M (2010) Participatory organic certification in Mexico: an alternative approach to maintaining the integrity of the organic label. Agr Hum Values 27(2): 227-237

Nelson E, Gomez Tovar L, Gueguen E, Humphries S, Landman K, Schwentesius Rindermann R (2015) Participatory guarantee systems and the reimagining of Mexico's organic sector. Agr Hum Values. doi 10.1007/s10460-015-9615-x

Van Loo E, Caputo V, Nayga R, Canavari M, Ricke S (2012) Organic Meat Marketing In Ricke S, Van Loo E, Johnson M, O'Brian C (eds) Organic Meat Production and Processing, Wiley Blackwell, Oxford, pp. 67-87

Willer H, Lernoud J (2015) The World of Organic Agriculture: Statistics and Emerging Trends, IFOAM (Bonn) and FiBL (Frick). ISBN 978-3-03736-306-5; 978-3-03736-307-2

Why is Africa struggling today with organic farming? A contribution from sociology and systems thinking

Gian Linard Nicolay[1]

Key words: organic farming, sociology, development tool, pro-poor growth, Africa, food and agriculture systems

Abstract

This narrative presents the social and sociological context of the current African food and agriculture system from the perspective of organic agriculture. A method is presented in short form that allows to observe and understand sustainable forms of agriculture, particularly organic farming in Africa, and its key features like organic markets (both domestic and export), soil organic matter enhancement, biodiversity, socio-economic benefits for smallholders and societies, local economies and economic growth in a new way. The paper presents preliminary results of its applications in various African countries, explaining the interconnectedness of the various socio-economic aspects and factors linked to farming, resistances against organic and potentials towards the various forms of organic and sustainable agriculture. I conclude that organic agriculture is highly relevant for all family farms and for development, as well as for politics promoting a pro-poor agenda and business tapping into the rapidly growing organic markets. Recommendations are made for aligning the recently discussed concepts of Ecological Organic Agriculture (EOA) and Organic 3.0 in the African context.

Acknowledgments

This research paper became possible thanks to different projects run since 2010 in Africa. My personal thanks forBrian Baker and Adrian Müller for their critical reading of the manuscript.

Introduction

Why are people still starving? Why is the debate on the appropriate forms of producing food still driven mainly by ideologies? What can people expect from organic farming, broadly defined by Organic 3.0, as a practical way to end hunger in Africa, feed all people and restoring depleted landscapes? Smallholder farming is still the dominant livelihood in Africa and agriculture continues to play a great role in development and transformation of economy and society (IFAD 2016). In this paper, I try to summarize why and how sociology (together with economics and anthropology) as a science (and approach) is used and what results we can present so far to improve the status of organic farming as a "state of the art" form of practice within the overall sector of agriculture and rural development in Africa. Consistent with Organic 3.0 (Niggli 2015, Arbenz 2016), organic agriculture includes all forms of farming that care for healthy soil as the foundation, use cyclical and regenerative practices to produce food, enhance biodiversity, and treat fairly all people involved in the food system. This interpretation of organic is also in line with the concept of Ecological Organic Agriculture (EOA) as defined and promoted by the African Union since 2011. If we want to understand the conditions for converting industrial, conventional and unsustainable forms of farming to organic, then we need social sciences based methods as these processes happen within societies. Societies embed food systems, as it is a prime function of societies to assure food provision for its members. The World Bank advises to make structural transformations in the societies and economies to capitalize on the significant growth opportunities. Africa's population,

[1] FiBL (Research Institute of Organic Agriculture), Switzerland, www.fibl.org,
eMail: gian.nicolay@fibl.org.

the fastest growing and youngest in the world, is now concentrated in urban areas. This new class of consumers has a smaller family, is better educated and higher earning, and is digitally perceptive (McKinsey 2012). The fast rising urban consumer with a household income above UDS 20'000 is considering quality products and so organic food is expected to soon be on his or her request. The research done so far shows the need to apply an integrated approach covering all the four social dimensions of the relevant system, i.e. the nation-society: economy and markets, politics, organization/interactions and culture. In the context of sustainability, we should foster the imaginary of organic farming as a unique opportunity to address multiple challenges and so get out of the current niche and ideological confusion.

Material and methods

The method we aim to promote aims to systematically identify the mental factors (Godelier 1986) of organic agriculture and sustainable development and is targeted towards district level. I used activities within various ongoing projects with FiBL-involvement in Africa, particularly Mali, Ivory Coast, Burkina Faso, Ghana, Kenya, Zambia and Morocco to develop the concept, collect and codify data and refine useful theories. We (as a project team) were—and still are—mostly working at sub-national level. Organic farming in the strict sense (i.e. certified to provide organic products for the world market and protect the producers and compensate the added quality with a premium price) never defined the boundary of the work in Africa but rather "sustainable farming". Therefore, in most areas farmers involved in the research for development set-ups are so called traditional or conventional farmers. In that sense, we applied the Organic 3.0 concept from the beginning, without aiming the conversion towards certified organic. In this paper, social systems theory and social science in general was applied (Luhmann 1995) as a first step. We identified a matrix of 18 parameters and 99 variables (Tab.1), which we consider as universal variables or codes to describe key elements (get the data) and then predict the behaviour of society and its members in its inner dynamics.

Table 1. The matrix to assess a local food and agriculture system based on 99 variables

	Parameter	variables							n var
1	**demography**	pop density	demo. structure						2
2	**infrastructure**	health infr	roads infra	schools infr	water infra	markets infra	credit infra	processing inf.	7
3	**farming system**	land and soil quality	other assets farm	labour farms	farm income	markets farm	investments farm	Ag structure	7
4	**human capital**	age	health	knowledge	dignity	food security	labor availab.	well-being hum.	7
5	**economic capital**	legal property	agr. markets	investments	farm type	assets eco.	poverty		6
6	**financial capital**	% HH with cred. Access	incomes (HH, oth)						2
7	**social capital**	customs/habits	trust	education (status)	networks	urban centers	movements		6
8	**cultural capital**	languages	values	norms, rules	innovations	myths	ritual	collect. memory	7
9	**symbolic capital**	influence	rigths	territoriality	governance				4
10	**Creativity (organic flow as opposed to the mechanical)**	fantasy (as opposed to stiffness)	laughing (reques-ting the correction of s.t. uncomplete)	comedy	theatre (as institution and culture)	attentiveness (free acting)	contempory art (the way to show how things are)	degree of obedience (as attitude)	7
11	**social interaction**	wordsOfmouth com.	family (s.i.)	local communities	clans and tribes	age groups (s.i.)	gender (s.i.)	migration	7
12	**organizations**	associations (org)	religious org	enterprises	CBO	NGO	public (org)		6
13	**Economy**[f]	Ag sector	Industry (incl. Food)	Services (Eco)	land market	production (Eco)	consumption	land (Eco)	7
14	**Education**[f]	learning society	basic literacy	socio-cultural edu.	formal education				4
15	**Politics**[f]	coherent ag pol	coh. rural dev pol.	security	leadership (Pol)	governance events			5
16	**Law**[f]	property rights	land tenure	human rights	labor rights	customary law	policy framework		5
17	**Mass media**[f]	radio access	TV access	mob. phones applic.	internet/ soc.m	print m. access			5
18	**Research/Science**[f]	ag and social sciences	ag research	innovations (Res)	higher edu. (Res)	farmer research			5
	: society type								**99**

This method allows integrating economic, social, cultural and political factors simultaneously and organized around innovation platforms (Nicolay 2016 b), without abstracting from key societal factors like demography, farming systems and infrastructure. I applied the method (together with various research teams) in 15 districts, mainly within the 7 mentioned countries, beginning in 2012 in Mali (in 2016 only in Morocco) with a group of sociologists, economists and agricultural scientists and with the support of innovation platforms, constituted by representatives from the local society including farmers (both organic and conventional) and policy makers.

Results

We found that this holistic or integrated method (in relation to the mental/social aspect) is not only fascinating, but also required to cope with the complex nature of the African food and agriculture systems and to better understand the dynamics of organic within the sector. Food and agriculture systems are part of national figurations (Elias 1978) dealing with food provision, economic development, ideologies, power balance and nation building. One difficulty was the application of the sociological concepts to the non-sociologists, as this knowledge is often limited. We found that the matrix (Tab.1) can be simplified into five core factors determining the social dynamic and building a figuration out of the following factors: collective memory, governance, social learning, organization, markets and investments by the farms. These interrelated factors can be attributed to the domains of culture, politics, societal/psychic and economics and markets (Tab.2).

Table 2: Key factors determining the collective action of farmers

Core factors	Core function	Dominant parameters (see Tab.1)	Dominant variables
Culture	Orientation; Collective memory	Cultural capital; Creativity	custom; value; fantasy/imagination; myths; degree of obedience
Politics	Governance through power monopoly	Symbolic capital; Politics; Laws	territoriality; influence; rights; security; governance
Societal 1 and Psychic	Social learning and needs satisfaction	Social capital; Research; Education Creativity; Human capital	movements; trust; networks; urban centers; science, innovation and technology (SIT); well-being and dignity
Societal 2	Organization	Organizations; Demography; Human capital; Social interaction [this parameters acts however as well on the other factors]	population density; dignity; human well-being; local communities; enterprise; gender; migration
Economic (incl. farming	Production and household needs satisfaction through Economy and markets	Farming system; Economy, Economic capital; Financial capital; Infrastructure	farm income; agriculture structure; land markets; industry; investment; (processing) infrastructure
Mass media; acts simultaneously on collective memory, governance, social learning and organization		Mass media	radio; word-of-mouth; social media

Global markets, national policies, technology and credit availability, land tenure security, appropriate prices, farmer skills, organizational capacity, culture and a highly diverse ecology all require consideration to understand the complex interconnections required to induce a voluntary change of the food and agriculture system. Organic farming producing for the world market schemes only work when solid (often international) organizations (in most cases NGO) become active and prepare and manage the value chains including the labour and cost intensive certification process. Farmers producing for specific organic commodities like cotton, other crops were produced in most cases the conventional way (using synthetic fertilizers for maize due to lack of alternatives), as conditions were not fulfilled to do otherwise. Lack of compost, machinery, labour, organic markets and no or only minimal public incentives reduce the attractiveness for farmers to invest into the organic pattern of production. In general, organic cotton farms (Organic 2.0) are in most cases small-scale holders with above average of women-headed farms taking opportunities to get free training, reduce debt risks and access to project-based credits and profitable markets with premium prices. Analysing the factors and figuration from the local perspective (i.e. sub-national), the high dependency of farmers (both conventional and organic) on national institutions becomes clear. The very weak institutions at nation-society level supposed to improve the communication between modern and traditional institutions, particularly extension services, research and parliament representation and media (mainly TV and national radio) are not capable to fill the gaps between local realities and national politics. The high economic dependencies from the states towards foreign investors, capital markets and donors further contribute to reduce the communication of the government with locals and particularly the peasant-farmers and their local promoters. Land tenure is always simultaneously controlled by traditional village authorities and the central state, leading to insecurity for most of the farmers, as most of them are internal migrants or women and youth without land titles. The dependency of the politicians towards the traditional chiefs often blocks reforms aiminga more equal and secure land tenure and hence farmer investments. This explains one of the most tragic developments, which is the declining soil fertility over large landscapes and therefore the lowest agriculture productivity in the world. Organic farming is considered by most actors within the government organizations, including policy makers and researchers, as a form of traditional agriculture with no future. The lack of domestic consumers and organic promoters within the business community and the technical difficulties in applying organic farming on larger areas including more than one main cash crop, and production systems in the context of poor soils without the possibility to use synthetic fertilizers, may explain partially this "hostility". The lack of technology like machinery and appropriate tools further aggravates the situation. The African Union with its initiative launched in 2011 to promote Ecological Organic Agriculture (EOA) has not succeeded so far to change the behaviour of its member states. The main limitations of its application are within the working habits, the self-confidence of the farmers, the availability of inputs and markets as well as the performance of its promoters. The fact that organic agriculture is struggling today in Africa is therefore a symptom of structural tensions in contemporary African societies.

Discussion and recommendations

The results provide evidence that both agriculture as well as the place of organic farming within the sector are social issues, and that social sciences have the potential to contribute significantly to solutions of its problems. The integrated sociological and systems thinking method presented here in a very condensed form is still in the development stage. More empirical data from each of the various case studies are required to test these theories. The following recommendations, based on our findings and deducted from this sociological research process, can be made to promote organic agriculture in Africa:

1. Institutions that serve organic agriculture in Africa—AfroNet and their national NOAMs (National Organic Agriculture Movements)—need to better promote organic farming as a way to produce for local consumption as well as for global markets. A farm should not only receive the support for its export products and value chains, but for all farming activities, including soil fertility management and products including livestock production for domestic markets and household consumption. This move towards a more open and contextual interpretation of organic would build a broader societal and economic constituency and reduce the three weaknesses of the current organic practice: low attractiveness for many farmers, isolation of the organic movement and unhealthily specialization (Arbenz 2016).
2. Ecological Organic Agriculture (EOA) as promoted by AU and IFOAM should be considered "Organic" as much as certified organic market-oriented systems. There is a difference between a commodity or product labeled as organic and sold on the market that meets a legal standard protecting both producers and consumers and an organic farm as a production unit managed according to the principles of organic agriculture. This difference must be better communicated from the farm level to top policymakers.
3. Innovation and technology development and transfer in the organic sector should be treated at least on a parity with investments in conventional approaches, with priority given to technology, farmer innovation, joint ventures and cooperative enterprises.

4. Organic farming should not be promoted too early in areas with depleted soils and food deficiency, except a concrete cash crop with reliable export markets is available. It is recommended to first re-establish the ecosystems—particularly soil fertility, quality, and health. This rule would improve the credibility for the organic approach and its promoters.
5. The appropriate approaches to organic farming in Africa should engage African farmers, practitioners, intellectuals and consumer representatives. Scientists and researchers from bio-physical disciplines will need to work with social scientists and the humanities to replace ideological and mystical thinking with an evidence based approach.
6. Reforms of the agriculture sector should be based on growth chains rather than value chains (of commodities) and isolated growth islands. The organic sub-sector can be communicated and applied as such form of a “growth chain complex” that addresses livelihood, food and nutrition security, domestic markets and ecosystem services and other benefits for humans, the public sector and the economy.
7. Practical solutions require more cooperation with farmers and the peasant community, incorporating their knowledge and experience in locally-appropriate development paths. State institutions, the private sector and farmer organizations need to play more prominent roles, and international NGOs should slowly reduce their roles to be replaced by local actors that are on the ground and programs developed and implemented by African institutions.

References

Arbenz, M. e. a. (2016). Organic 3.0 – for truly sustainable farming and consumption. A guiding concept paper. Bonn, IFOAM Orgniac s International and SOAAN.

Boserup, E., Ed. (1965). The Conditions of Agricultural Growth. The Economics of Agrarian Change und Population Pressure., Allen and Unwin (ecopy by Earthscan).

Elias, N. (1978). What Is Sociology, Columbia University Press.

Elias, N. (1994). The Civilizing Process, Blackwell.

EY (2014). EY's attractiveness survey. Africa 2014. Executing growth.

FAO (2011). WHY HAS AFRICA BECOME A NET FOOD IMPORTER? Explaining Africa agricultural and food trade deficits. T. a. m. division, FAO.

Godelier, M. (1986). The Mental and the Material: Thought Economy and Society. London, Verso.

IFAD (2016). Rural Development Report 2016. Fostering inclusive rural transformation. Rome.

Luhmann, N. (1995). Social systems, Stanford University Press.

McKinsey (2012). The Rise of the African Consumer. A report from the McKinsey's Africa Consumer Insight Center.

Nicolay, G. (2016). Integrated Organic Agriculture Research- African Experiences from the European Perspective. Third African Conference on Organic Agriculture, Lagos.

Nicolay, G. (2016 b). Theory-based Innovation Platform management. A contribution of sociology to agriculture research and development. 12th European IFSA Symposium, 2016. Theme 2: Methodology and frameworks of farming systems transformation, Harper Adams University.

Niggli, U. (2015). "Incorporating Agroecology Into Organic Research –An Ongoing Challenge." Sustainable Agriculture Research 4(3): 149-157.

Rockström, J., J. Williams, G. Daily, A. Noble, N. Matthews, L. Gordon, H. Wetterstrand, F. DeClerck, M. Shah, P. Steduto, C. de Fraiture, N. Hatibu, O. Unver, J. Bird, L. Sibanda and J. Smith (2017). "Sustainable intensification of agriculture for human prosperity and global sustainability." Ambio 46(1): 4-17.

WB (2012). Africa Can Help Feed Africa. Removing barriers to regional trade in food staples. P. R. a. E. M. A. Region, Worldbank.

Organic agriculture and rural livelihoods: Enhancing social capital among organic small landholders in the Peruvian Andes

Silvana Vargas,[1] Roberto Ugás[2]

Key words: social capital, livelihoods, food security, Andes

Abstract

This study identified the effects of organic agriculture in the rural livelihoods of Andean smallholders in Peru with emphasis on food security. Qualitative and quantitative research techniques were used. Key informant interviews and a field survey were conducted in rural communities. Communities in three Andean regions in Peru – Cajamarca, Cusco and Huanuco – were included. The total sample included 451 households. As per social capital-related indicators, research findings suggested that agroecological farmers are clearly more eager to get organized and participate in associations than conventional (e.g., 30.8% as compared to 18.3%, respectively). Along the same line, in terms of actual participation, results confirmed this trend (e.g., 84.6%% as compared to 27.4%, respectively). Additionally, organic farmers prioritize local agroecological associations and suggest that searching for new market opportunities is perceived as their main use.

Introduction

The sustainable livelihoods perspective emerges as an alternative to understanding the relationship between sustainable development, rurality and quality of life, particularly, among vulnerable groups. "Livelihoods", understood as the *capabilities, assets or material and social resources, and activities required to meet a lifestyle and are considered sustainable when they are resilient to adversity and remain, improve, or conserve without eroding the natural resource base* (Chambers & Conway, 1992) become relevant for organic research. Thus, livelihoods are an outcome of the interaction between the environmental conditions and actions that people performed to achieve their goals, including human, social, political, financial, physical and natural dimensions (DFID, 1999). However, to date, little is known about the relationship between organic agricultural-related practices and farmers' livelihoods. Results provide relevant inputs to improve rural development-driven interventions and the design of sound agricultural and social policy efforts.

Material and methods

Research population was composed by small landholding farmers. As part of an intentional sampling procedure, eligibility criteria were selected to identify two comparable groups – organic and conventional farmers. Contextual and biodiversity dimensions were controlled for in both groups. The final sample was composed by 451 cases. Out of these, 221 were organic farmers and 230 were conventional. Fieldwork took place between April and June 2014. The study was based on a mixed-method design that comprised both qualitative and quantitative validation exercises (Rossman and Wilson, 1984; Tashakkori and Teddlie, 1998). Nowadays, the potential of contrasting qualitative and quantitative techniques is recognized as the contrast often provides different inputs allowing for a better understanding of the problem at hand, in this case, the effects of organic practices in farmers' rural livelihoods. Data analysis was performed using the Statistical Package for the Social Sciences - SPSS (version 22.0). The analysis consisted of the use of descriptive and correlation statistical techniques to test for causal analysis.

[1] Pontificia Universidad Católica del Perú, www.pucp.edu.pe, eMail: svargasw@pucp.edu.pe

[2] Universidad Nacional Agraria La Molina, www.unalm.edu.pe, eMail: rugas@lamolina.edu.pe

Results

- *Social capital and agricultural innovation among organic farmers*

Overall results suggest that organic farmers differ from conventional in multiple social capital-related dimensions. On the one hand, there are differences associated to agricultural innovation favourable to the configuration of social capital. This is observable in variables such as self-identification, knowledge and adoption. **Table 1** suggests that, as compared to conventional, organic are more innovative in terms of knowledge sharing, crop adoption and seed management which might result in their involvement of different initiatives.

Table 1: Social capital and agricultural innovation by farmer group 2014

	Organic	**Conventional**
% farmers that consider themselves as organic (self-identification)	98.2*	12.2
% farmers who define themselves as extensionists (self-identification)	21**	3.8
% farmers who identify organic practices (knowledge)	99.1*	34.8
% farmers who produce the seeds used in the plot (knowledge)	82.4*	78.3
% farmers who have adopted new crops (adoption)	58.4*	25.7

* $p < 0.05$, ** $p < 0.01$

- *Social capital configuration among organic farmers*

Table 2: Social capital configuration by farmer group 2014

	Organic	**Conventional**
% farmers consider that associations are "highly important"	30.8*	18.3
% farmers willing to organize	48*	28.3
% farmers currently participating in an association	84.6*	27.4
% farmers participating in local associations	57*	8
% farmers who trust local association	64*	10

* $p < 0.05$

Moreover, organic farmers are clearly more eager to get organized and participate in associations than conventional. As suggested in **Table 2**, 30.8% of the latter consider that associating is "highly important" as compared to 18.3% of the conventional, presumably due to the perceived benefits this comprises. Along the same line, almost 85% of them do participate in some sort of organization as compared to 27.4% of the conventional. Additionally, in terms of trust, organic farmers prioritize local associations and indicate that identifying and searching for new market opportunities as their main use.

Discussion

Results are consistent with recent discussions about the need that sustainability issues be based on interlinking organic agriculture with socio-ecological perspectives where social capital remains as a core category (Kumaraswami, 2012). Moreover, the discussion on social capital leads to the importance of further exploring the different venues of resilient strategies developed by farmers (Barrett & Heady, 2014). As known, resilience – often understood as a dynamic category associated to the capacity individuals and communities have to satisfactorily adapt in the face of biophysical, economic or social risks – is based on a framework that integrates de the social, economic and ecological dimensions.

As Organic 3.0 brings into the discussion the need to activate research to actually bring organic out of its current niche into the mainstream and positioning organic systems, the role of local associations becomes considerably relevant. As such, the analysis of social-capital related dimensions is critical in order to identify multi-actor strategies aimed to design creative solutions to address the tremendous challenges faced by our planet, as they related to sustainable food systems.

References

Barret C & Headey D (2014): Measuring resilience in a risky world. Why, where, how and who? *2020 Conference Brief 1*. International Food Policy Research Institute.

Chambers R & Conway G (1992): Sustainable Rural Livelihoods: Practical Concepts for the 21st Century. IDS Discussion Paper 296. Institute of Development Studies.

DFID. 1999. DFID sustainable livelihoods guidance sheets. London: DFID.

Kumaraswamy S (2012): Sustainability issues in agro-ecology: Socio-ecological perspective. Agricultural Sciences 3 (2), 153-169.

Rossman G & Wilson B (1984): Numbers and Words: Combining Quantitative and Qualitative Methods in a Single Large-Scale Evaluation Study. Evaluation Review 9 (5), 627-643.

Tashakkori A & Teddlie C (1998): Mixed methodology: Combining Qualitative and Quantitative *Approaches*. California: Sage Publications.

Spreading agricultural good practices: multidimensional benefits observed in Kampong Thom, Cambodia

Félicien Meunier[1], Camille Heylen, Amaury Peeters[2], Sreykhouch Ek[3], Malyne Neang[3], Saray Hean[4], Sinal Peanh[4]

Key words: Cambodia, Agriculture, Sustainability, smallholder farmers

Abstract

Agriculture is the traditional mainstay of the Cambodian economy, accounting for almost 90% of GDP and employing around 85% of the work force. Agricultural practices remain mostly traditional even if intensification appears chaotically in some regions. In the central province of Kampong Thom, a non-governmental organization (Minority Organization for Development of Economy) spreads organic agricultural good practices to local vulnerable farmers encouraging them to develop environmentally friendly crop production systems and to diversify their incomes. A survey was conducted in the region to assess the benefits of such an approach five years after the beginning of the project. One hundred farmers equally distributed in two groups (target and control) were interviewed. This survey revealed significant differences between the two groups in terms of production systems, agricultural knowledge and risk mitigation activities.

Introduction

In Cambodia, about 85% of the households are involved in agricultural activities with an average agricultural land holding of 1.6 ha per family (NIS 2014). Most of these smallholder farmers are trying to meet first their consumption needs and are cultivating rice almost exclusively using traditional farming practices. This situation leads to low average yields and makes farmers extremely vulnerable economically. Their production is also highly dependent on the annual weather conditions and many of them already feel the consequences of climate change.

In this context, several local, regional, national or international stakeholders help smallholder farmers to increase their agricultural knowledge and to improve their farming practices. Minority Organization for Development of Economy (MODE) is working with vulnerable farmers in 8 communes of the central province of Kampong Thom providing seven day training on sustainable agriculture, field demonstrations and agricultural kits to diversify their production and to increase their incomes. The trainings and the kits focus on seven different topics related to food diversification and organic farming system: goods practices in chicken raising, system of rice sustainable intensification, method for developing an aquaculture production, methodology for composting and cultivating vegetables in the house garden, lessons for edible fruit tree planting and food processing. Trainings are then followed by regular follow-up by MODE field facilitation team during several months. Model farmers are also selected during the course of the project and help the diffusion of good organic practices.

Five years after the launch of the sustainable agriculture project (started in 2011) and after almost a thousand beneficiaries, it was time for the organization to assess the benefits of learning and applying sustainable agricultural practices for smallholder farmers in this Cambodian province.

[1] Earth and Life Institue, Université catholique de Louvain, Belgium, felicien.meunier@uclouvain.be
[2] Louvain Coopération au Développement, Louvain-la-Neuve, Belgium
[3] Ecoland Research Center, Royal University of Agriculture, Phnom Penh, Cambodia
[4] Minority Organisation for Development of Economy, Kampong Thom, Cambodia

Material and methods

The Sustainability Assessment of Food and Agriculture systems (SAFA) method developed by the Food and Agriculture Organization (FAO 2013) was used as the general framework defining sustainability in agriculture. 80 out of the 105 core indicators listed in this methodology were selected according to their relevance to the local context of the familial small-scale agriculture in Cambodia and on the basis of discussion with local partners. The selected themes and subthemes were distributed in the four dimensions of the agricultural sustainability, namely environmental integrity, social well-being, good governance and economic resilience.

From this indicators-based sustainability assessment tool, a questionnaire was developed to reveal the current farming practices of the interviewees, their economic status, the perception of the risks threatening their enterprise (as listed by local actors and the SAFA method) and their perspectives in a changing world. These answers aim at answering the following questions: what are the benefits of sustainable agricultural practices for small landholder farmers in Cambodia and among these benefits which dimensions stand out the most? The related hypothesis is that sustainable agriculture practices may have substantial and measurable benefits for human well-being and economic growth without harming the environment.

A panel of one hundred farmers was constituted. The interviewees were equally distributed in two groups: a target group (beneficiaries of the project) and a control group (vulnerable farmers non-beneficiary of the project). One of the main issues was to select non-beneficiary farmers at a level of vulnerability similar to the one of farmers selected for benefiting from the project. A preliminary survey allowed the interviewers selecting non-beneficiary farmers on the basis of their main job, income sources and land size.

2 to 3 hours long in-depth interviews then took place for the selected farmers in 10 villages of 5 representative communes. The villages were specifically chosen because they were the first to be project beneficiary and consequently the most susceptible to present significant differences in terms of farming practices. These interviews were conducted by the local staff of the MODE organization and students from the Royal University of Agriculture of Phnom Penh. Responses to the interviews were collected, translated in English and encoded in a common database. Analysis of variance was achieved using the groups as the explanatory variable. Statistical tests were performed in SPSS.

Results

Figure 1 shows the boxplot of the farm size in hectares as a function of the group: B stands for beneficiary and NB for non-beneficiary farmers. The central line shows the median, the bottom and the top of the box represent the first and third quartile, respectively and the ends of the whiskers show the minimal and maximal observed values of each group. No significant difference is observed between the two groups (p-value = 0.78). This result reinforced the idea that both groups are similar in terms of vulnerability. The farm size is indeed highly determinant in the Cambodian countryside for the standard of living. The two groups can thus be confidently compared. No significant differences could neither be observed in family structure or access to natural resources (such as water) or facilities (such as distance to main roads) between the two groups. All the results and statistical tests are summarized in Table 1.

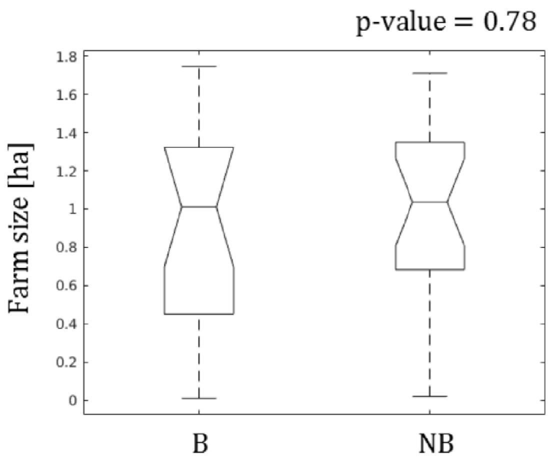


Figure 1. Boxplot of the farm size as distributed between the two groups. No significant difference could be observed.

However, several aspects were different between the two groups. First as shown in Figure 2, the total number of distinct products is significantly larger for the project beneficiaries. This suggests an increased diversity in production thanks to the adoption of the good agricultural practices lessons and the provision of agricultural kits (p-value = 0.008). This difference mainly comes from an increased number of produced vegetables and a more diverse animal husbandry. The p-values for the two latter tests reach 2.10^{-6} and 10^{-3}, respectively.

Table 1: summary of mean result values and statistical test results

	B			**NB**			p-value	significance
	Mean	Min	Max	Mean	Min	Max		
Farm size [ha]	1.05	0.05	1.75	1.1	0.09	1.7	0.78	
Family size	4.9	1	9	5	1	8	0.6	
Number of products	7.9	3	12	5.3	2	11	0.008	***
Number of detected risks	9.55	1	20	6.9	0	12	0.043	*
Number of produced vegetables	3.18	0	6	1.16	0	5	2.10^{-6}	***
Number of animal species	2.7	0	6	1.2	0	3	10^{-3}	***
Number of taken risk mitigation measures	5.1	0	11	2.6	0	6	0.006	***
Number of planned risk mitigation measures	2.5	0	5	0.4	0	2	10^{-4}	***

*significant at P<0.05 and *** significant at P<0.01
B = Beneficiaries, NB = Non-Beneficiaries

Similarly, the beneficiary group is much more aware of risks that may threaten their farm. On average, the beneficiary farmers recognized 9.55 risks identified by local partners against less than 7 for the NB group (p-value = 0.0429). Among these risks, the main differences concerned the problem of soil and water quality, the low availability of water resources, the climate changes and the lack of agricultural knowledge. Except for the latter, they are all included in the environmental pillar of the sustainability.

Finally, significant differences could also be found in the number of risk mitigation measures already taken (p-value = 0.006) or planned (p-value = 10^{-4}).

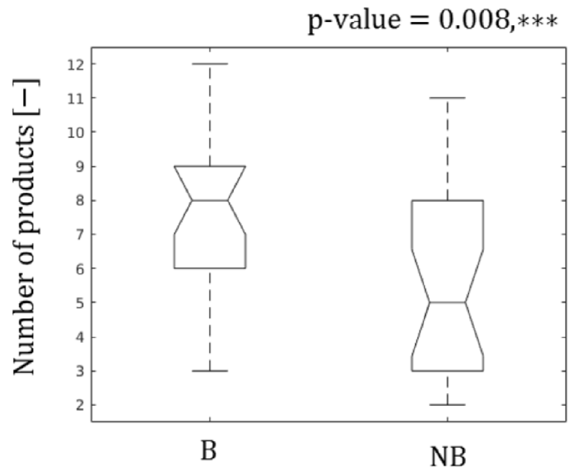


Figure 2. Boxplot of the farm size as distributed between the two groups. No significant difference could be observed.

Discussion

The conducted survey allowed us to observe and highlight significant differences between farmers applying good organic practices and other vulnerable farmers in terms of systems of production, threat perception and risk mitigation. The collected database can now and will be used in the near future (i) to determine the overall sustainability of the agriculture for the vulnerable farmers in Kampong Thom province, (ii) to calculate the percentage of farmers having adopted the practices learned during their training and using the material received several years before in their kit, (iii) to further assess the significant differences between the two groups in terms of general sustainability indices and (iv) to evaluate the most outstanding dimensions of the sustainability.

References

FAO, 2013, SAFA: Sustainability Assessment of Food and Agriculture Systems – Draft Guidelines.

National Institute of Statistics (NIS), 2014, Census of Agriculture in Cambodia 2013: Preliminary Report National. Phnom Penh: Ministry of Planning & Ministry of Agriculture, Forestry and Fisheries.

A sustainable organic production model for 'Food Security' in the United Arab Emirates and Sicily

Khalid Butti Al Shamsi[1], Antonio Compagnoni[2], Giuseppe Timpanaro[3], Paolo Guarnaccia[4], Paolo Caruso[5], Simone Rocchi[6]

Key words: Food security, Food Sovereignty, Organic agriculture, Local Market, SAFA (Sustainable Assessment of Food and Agriculture Systems), Short Food Supply Chains (SFSCs).

Abstract

The aim of this research is to contribute to food security by studying the development of integrated organic production models, related to biodiversity of food sources, soil fertility and water availability, both in the UAE and Sicily. Through the FAO SAFA tool multi-faced sustainability approach, interviews and visits in two organic farmers' communities in UAE and Sicily, first results are obtained: SAFA reporting for each farmer and each community, identification of some additional SAFA tool indicators for local market and migrant workers' relations. Overall, the two systems' commonality related to what is referred to in literature as Short Food Local Systems and as such, both contribute to territorial/local food support. Some best practices in organic production, direct marketing and migrant worker integration, have been identified and are shared with the farmers. The work has highlighted some operational issues that will be further explored in the future.

Introduction

Food sovereignty, the right of people to healthy, culturally appropriate and affordable food produced in a sustainable way, coupled with the related food policy for territorial farming, represent a challenge that involves both developing and developed areas. Climate change, economic crisis, migration flows, quality of life and various impacts on human health raise the issue of local consumption, as opposed to global market sourcing; such a presumed pathway towards sustainability presents peculiarities that are considered in this study. Local production and consumption models activate "Short Food Supply Chains (SFSCs)" that are considered by various stakeholders for defining economic development policies. UAE and Sicily include such models, while being linked by similar climate, demographic and migratory issues. The general objective of this work is to analyse the relationship between sustainability, food safety, food sovereignty and organic production practices in the study areas through empirical analysis.

Material and methods

The main methodology applied has been the study of the sustainability through a holistic approach lens, using the Sustainability Assessment of Food and Agriculture system (SAFA) framework and tools developed by FAO on a set of selected farms in the UAE and in Sicily. The goal was to validate the functionality of SAFA in the two territories and to identify additional customized indicators for the improvement of the system along the relevant focus areas, namely local supply

[1] University of Catania, United Arab Emirates, kbalshamsi@gmail.com.
[2] IFOAM AgriBioMediterraneo permanent secretariat, Italy, acompagnoni@database.it
[3] University of Catania, Italy, giuseppe.timpanaro@unict.it
[4] University of Catania, Italy, paolo.guarnaccia@unict.it
[5] University of Catania, Italy, paolo.caruso@unict.it
[6] FAO, Italy, 1simonerocchi@gmail.com

chains and migrant workers’ wellbeing. The SAFA framework comprises guidelines defining the codes of sustainability and a protocol for rating and weighting performance along various thematic areas, self-assessment questionnaires and default indicators for the assessment and the continuous monitoring of the business management situation.

Two groups of farmers have been selected in the two territories, 8 farmers per region, of which 7 certified along the EU organic regulation standards for plant production (open field and greenhouse vegetables (Sicily and UAE) and fruits, dates (UAE) citrus, fruits and ancient cereals (Sicily), livestock (mainly goats, sheep, chicken and honey) in both regions. All but 1 farm (in Sicily, integrated pest management and no herbicide or synthetic fertilizers, producing summer fruit and grapes for wine) have in common (in varying degrees) marketing directly their products in the local market. All farms have migrant workers. Some of the data collected was confirmed by organic and ethical certification records, some was verified by the researchers, other was (for the time being) relying on farmer’s declaration. Interviews with migrant workers were carried out together with an analysis of the legal and practical situation about migrant workers in the two regions. Organic 3.0 research approach relevance can be seen in the 360° sustainability approach and the special focus on food security/food sovereignty, local market and migrant workers’ integration. Last but not least is the fact that the research itself was observed to trigger organic farmers’ community development and sharing of best practices among them.

Results

1. General characteristics of the organic farms sample

Altogether, surveyed farmers managed organically farmed areas varying between 2 and 320 hectares, with an average surface area of approximately 55 hectares. Sicily is contributing to a larger average size of the farm. As stated, the whole sample is interested in primary production with local direct sales for variable rates between 50% and 80% of products, and has a tradition in organic production that in some cases (in Sicily) is of over twenty years. Non-family workers predominate in business management, ranging from a minimum of 1 to a maximum of 55 employed as "permanent workers" and between a minimum of 0 and a maximum of 30 as "temporary workers". In any case, the average size of human workforce is high and averages 12 and 10 units respectively for the two types.

2. Some best practices identified

Some organic fruit and vegetable growing (a), livestock breeding (b), marketing (c) and migrant workers’ integration (d) best practices have been identified by the research activities and were shared among the concerned farmers.

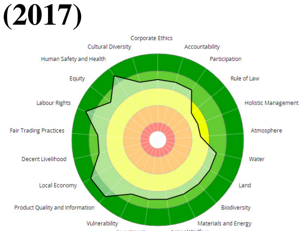
a. A great diversity in vegetable crop production, including some perennial fruit (citrus and almonds in Sicily, dates in the UAE) together with green manuring and use of compost are some of the best practices identified by the research, giving to the farm a more stable environment, both agronomically and economically.
b. Livestock breeding, sheep, goats and bovine in Sicily, sheep, goat, chicken and camels in UAE, integrated with vegetable production, either in the same farm or by collaboration with neighboring farms, has been identified as best practice, reducing off farm input buying and, when directly managed by the same farm, increasing products range (dairy products, meat and eggs) available for the local market.

c. Most of the farmers both in Sicily and UAE, are selling their products in local farmers' markets, some of the farmers are using social media and tools such as Facebook, Instagram and WhatsApp, as a best practice to better connect with consumers and update them on their products availability.
d. In Sicily, some of the farmers are participating in a regional program, Sicilia Integra, that can be seen as a best practice, where migrant and refugees are getting training on organic farming and sustainable development, including a period of internship in organic farms. The program is also active in promoting this approach in the market, valorizing the organic producers that are participating in the program.

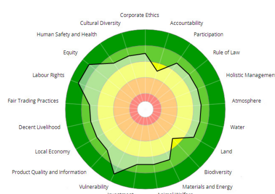
3. Preliminary results of the farmers' sustainability assessment process identified through FAO's SAFA tool

A first SAFA assessment reporting result for each farm was obtained, as well as one summarizing each farmers' community with their relative average scores (Figure 1). Additional indicators for the SAFA tool have been identified for local market, based on volumes, turnover and number of different products marketed directly by the farms.

Figure 1. SAFA polygons that identify the two farmer communities with their average scores (2017)



Farms in Sicily



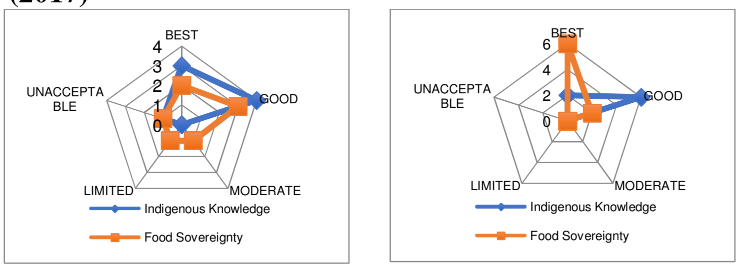
Farms in UAE

Overall, the macro-indicators considered show positive values for the two study areas, with greater evaluation for aspects such as "Human Safety and Health", "Labor Rights", "Local Economy", "Product Quality and Information" for Sicily and "Equity", "Labor Rights" and "Vulnerability" for UAE. All of these indicators show performance values ranging from 80 to 100 percent (intense green area) and high level accuracy data and / or information. These five indicators are referring to 2 sustainability dimensions: "Economic Resilience " and "Social Well-Being ", directly connected with the general objective of the research, demonstrating relations with sustainability and food security, food sovereignty and organic farming practices.

The FAO's SAFA tool "Food Sovereignty" indicator, is inserted in the "Social" dimension and in the "Cultural diversity" theme. From the macroeconomic policy level this theme is applied at the level of the single enterprise by means of indicators that detect its independence and its capacity of autonomy and control over its production and supply systems (availability of inputs and knowledge rooted in collective memory, such as species and varieties, availability of seeds, breeds of animals, etc., capability of penetration on the local market), as well as choices that reinforce this independence (freedom) from other operations. The "Cultural diversity" indicators are therefore two: "Indigenous Knowledge" and "Food sovereignty", and these have been specifically evaluated within the two Short Food Supply Chains considered in Sicily and the United Arab Emirates (Figure 2).

There are some background differences emerging from the comparison, that are related to the level of development of the local economic system and the level of awareness reached in the various stakeholders operating in the two areas. On the whole, however, it is necessary to emphasize that the creation of shorter supply chains for safe and high quality foods is a necessity felt in the two study areas. The existence of SFSCs represents, in fact, a new food supply chain system, based on a proximity model, also taking advantage of new technologies and tools such as web applications, community supported agriculture, local markets, farmers markets, integrated services (educational purpose, etc.).

Figure 2. Comparison between the levels of "Cultural diversity" found in Sicily and UAE (2017)



Sicily **United Arab Emirates**

Discussion

A relevant theme in this work is the importance of the ethical and economic sectors in terms of contribution to a fully sustainable agriculture; in fact, the assessed farms featured a close link between the preference for local market, the legality and fairness of worker conditions and high sustainability performances. Work will continue with the objective of: 1) to define a set of additional indicators for the definition of a "cultural" dimension of food sovereignty, so as to integrate SAFA tool and use it to support the decisions of different stakeholders; 2) from a technical point of view, indications for a lower consumption of natural resources (e.g. water) will be suggested for the production sectors interested by the survey; 3) for SFSCs considered to assess the ability of the latter to determine changes in eating habits and food education, greater attention to the safety and origin of the product, and the rediscovery of the territories and the value of the ancient local traditions.

References

FAO (2011). The State of Food Insecurity in the World, Food and Agriculture Organization of the United Nations, Rome, Italy.

Foodlinks (2013), Short food supply chains as drivers for sustainable development. Evidence document. Short Food Supply Chains - Community of Practice. Foodlinks Project. 105p.

Nyeleni (2002), Food Sovereignty: a Right for All. NGO /CSO Forum for Food Sovereignty. Rome.

OECD (2009). The Bioeconomy to 2030: Designing a Policy Agenda. OECD, Paris.

OECD (2013), LEED Program: Local Economic and Employment Development.

Schmid M., Padel S., Levidow L. (2012) The Bio-Economy Concept and Knowledge Base in a Public Goods and Farmer Perspective. Bio-based and Applied Economics 1(1): 47-63

Timpanaro, G., Scuderi, A., Foti, V. T., & Giudice, V. L. (2015), The Social Relationships' Effectiveness of" Agrisocial" Farms: A Model of Sustainable Local Development. RIVISTA DI STUDI SULLA SOSTENIBILITA'. n. 1. p.99-116.

Changes in Organic Participatory Guarantee Systems (PGS) in Northern Vietnam

Nhung Tu Tuyet[1], Cory William Whitney[2]

Key words: farm analysis, farm management, land-use planning

Abstract

Organic Participatory Guarantee Systems (PGS) may be on important contribution to Organic 3.0. The way that PGS systems are managed can be a major determinant of their success. In Northern Vietnam differing management of PGS systems can determine their level of social and ecological success, as well as the impressions of farmers and retailers. Nevertheless, more farmers' groups are turning to individual management and this may have negative consequences for the future of PGS in the region.

Acknowledgments

We are grateful to Danida for 8 years of financing the ADDA-VNFU Organic project, the Hữu Cơ PGS and the many farmers of Thanh Xuan and Luong Son communes who participated in the research.

Introduction

Rising demand for Organic around the Hanoi province of Vietnam poses a challenge for small-scale rural farmers who struggle to meet the cost and technical ability necessary for third party Organic certification. Organic PGS is a way for such farmers to access certification based on peer-review and social control. This system supports appropriate farming practices through social mechanisms (Fonseca et. al, 2008; Zanasi and Venturi 2008) and supports traditional livelihood systems based on high agrobiodiversity farming (Darlong 2008). PGS certification is context specific, allowing systems to adapt to local conditions and communities to collaborate on collective efforts for marketing. Potential for expansion to more Hanoi Organic markets and room for improvement in the management systems exists (Fresh Studio 2010). The level to which PGS farmers manage collective work and decision-making in land-use planning when sharing collective land varies and may be a determinant for the productivity and success of the PGS (Whitney et al. 2014[ab]). The current study seeks to describe the implications of shifting management practices on the future of PGS in the region.

Material and methods

Since 2008 farmers northern Vietnam have been operating within a PGS framework outlined by the Agriculture Development Denmark Asia (ADDA) and Vietnam Farmers Union (VNFU) Organic Project (ADDA-VNFU 2009). These farmers groups are operating under 'National Basic Standards for Organic Products in Vietnam' prepared by the Vietnamese Ministry of Agriculture and Rural Development (MARD 2006) and further clarified in the PGS Organic Standards published by the ADDA and VNFU Organic Project (ADDA-VNFU 2011). Under the framework, Organic farmers are organized into PGS groups to manage production and supply local markets on shared parcels of Organic certified land. Most farmers are responsible for a small plot of land within the certified area

[1] Hữu Cơ Organic PGS Vietnam, http://vietnamorganic.vn, eMail: nhungadda@gmail.com
[2] World Agroforestry Center (ICRAF), Nairobi / Center for Development Research (ZEF), University of Bonn, Walter-Flex-Straße 3, Bonn, Germany. E-Mail: cory.whitney@uni-bonn.de

while other farmer groups cooperate on the management of the entire land area (Whitney et al. 2014[ab]).

What follows is a report on the development of PGS since it was introduced to Vietnamese farmers in 2008. Differences between PGS systems in Thanh Xuan commune in the Red River Delta of the Hanoi province versus those of the Luong Son commune in the rugged mountainous areas in Hoa Binh province are considered with a focus on Organic vegetables data collected from PGS committee coordination annual reports and key informant interviews from 2008-2015.

Results

Data shows that the Organic production area has expanded from 2012-2013 and 2014-2015 PGS farmer members and production areas have expanded rapidly (from 68 members in 2012 to 101 members in 2015 and from 4.86 hectares in 2012 to 11.39 hectares in 2015 respectively). Consistent instruction and direction from the PGS Coordination Committee (PGSCC) is driving the shift.

Other drivers are the potential for greater income generation and increasing market demand. PGS Organic vegetable production is economically advantageous over rice production in the Hanoi province (the main production system in the region) and this also drives demand for PGS among farmers. A full-time farmer can earn 3 to 4 million Vietnamese dong (VND) (139 to 185 USD) per month, 30 million VND (1,389 USD) annually per *sào* (equivalent to 0.036 hectare) after costs. In contrast, a rice farmer gets about 20 million VND (926 USD) from one *sào* per year. Sales of PGS Organic vegetables in 2015 were three times higher than the sales in 2011 dues to growth of consumer demand for PGS Organic and the capacity of PGS farmers to meet demand.

With the less favorable geographical conditions, more fragmented land areas and relatively lower education of farmers, average production outputs and yield of PGS Luong Son was much lower than Thanh Xuan. From 2011-2015 average yield of Thanh Xuan and Luong Son was 28.49 tons per hectare and 8.78 tons per hectare, respectively. In 2015, average incomes for PGS Thanh Xuan increased three times compared to their 2011 earnings (362 million VND in 2015, up from 200 million VND in 2011). PGS Luong Son was not as successful in improving yields and income as PGS Thanh Xuan (80.5 to 114.5 million VND in 2011 and 2015 respectively). This discrepancy is likely due to: (i) Income sources other than PGS Organic vegetables, (ii) production quality that did not meet market requirements, (iii) unfavorable natural and social conditions. These factors will be further explored in a comprehensive survey in 2016.

Discussion

Results show that the ADDA-VNFU Organic PGS development and training on Organic production, integrated pest management (IPM) through extension and project staff and farmers has been largely successful (c.f. Fresh Studio 2010). PGS ensures high agrobiodiversity and traditional livelihoods by recognizing the merits of traditional practices and customs (Darlong 2008). Additionally positive trends in income also support Organic PGS production. Future research into PGS Organic vegetable production in the north of Vietnam should address the regional difference in production and work to support the expansion and quality of local Organic PGS. A follow up informant interview is planned and may be presented at the OWC.

References

ADDA-VNFU (Agriculture Development Denmark Asia and Vietnam Farmers Union) Organic Project (2009) PGS Participatory Guarantee System Of Organic Products Operational Manual For Producers 2009. Version 1.03

ADDA-VNFU (Agriculture Development Denmark Asia and Vietnam Farmers Union) Organic Project (2011) PGS Organic Standards. Version 1.3

Darlong, Vincent (2008) Harmonizing Jhum (Shifting Cultivation) with PGS Organic Standards in Northeast India: Key Features And Characteristics of Jhum for Process Harmonization. Cultivating the Future Based on Science: 2nd Conference of ISOFAR (International Society of Organic Agriculture Research), Modena, Italy

Fonseca, M F; Wilkinson, J; Egelyng, H; and Mascarenhas, G (2008) The institutionalization of Participatory Guarantee Systems (PGS) in Brazil: Organic And Fair Trade Initiatives. 2nd Conference of ISOFAR (International Society of Organic Agriculture Research), Modena, Italy

Fresh Studio Innovations Asia (2010) Market Access For Organic Vegetables – A Value Chain Approach. Agriculture Development Denmark Asia and Vietnam Farmers Union Organic Project (ADDA-VNFU), Hanoi, Vietnam

IFOAM (International Federation of Organic Agriculture Movements) (2012) The Principles of Organic Agriculture

MARD (Vietnam Ministry of Agriculture and Rural Development) (2006) 10TCN 602-2006; National Standard For Organic Production And Product Processing

Whitney CW, Den Braber K, Tu Tuyet N, Thorndal Jørgensen S (2014a) Measurable Impacts of the "Principles of Organic Agriculture" Survey of A Vietnamese Organic PGS, Rahmann G & Aksoy U (Eds.) Proceedings of the 4th ISOFAR Scientific Conference. 'Building Organic Bridges', at the Organic World Congress 2014, 13-15 Oct., Istanbul, Turkey

Whitney, C. W., den Braber, K., Từ Tuyết, N., and Thorndal Jørgensen, S., (2014b) Farm Management Schemes within Organic PGS; Survey and Analysis in Sóc Sơn, Hanoi, Vietnam, Building Organic Bridges. Proceedings of the 4th ISOFAR Scientific Conference at the Organic World Congress 2014 in Istanbul, Turkey, Thuenen Report 20, 1187-1190.

Zanasi, C; and Venturi, P (2008) Impact Of The Adoption Of Participatory Guarantee Systems (PGS) For Organic Certification For Small Farmers In Developing Countries: The Case Of Rede Ecovida In Brazil. Cultivating The Future Based On Science: 2nd Conference of ISOFAR (International Society of Organic Agriculture Research), Modena, Italy

Socio-economics - India

Impediments in adoption of organic farming - A few lessons from the farmers who reverted to conventional farming practices

Ganesh Birajdar, Tarak Kate

Note : This paper will also be presented at 'International Conference on Organic Agriculture in the Tropics 2017' during 20th to 24th August 2017 at Yogyakarta, Indonesia.

Keywords : Sustainable Agriculture, Organic, Perception, Ease of use, Economic buffer

Abstract

The stated goal of '*Organic 3.0* ' is to "*bring organic out of its current niche into the mainstream (Arbenz, Gould & Stopes, 2015).*" This means to understand how majority of the farmers would be convinced to adopt organic farming practices and will find them satisfactory enough to continue with. One of the effective ways to understand this is to ask the farmers themselves about the factors that discourage them from adoption of organic farming practices. We interviewed 67 farmers from *Vidarbha* region of central India, who started with organic farming and then abandoned it for different reasons. 65.68% of the interviewed farmers quit organic farming in first 3 years. The leading factors mentioned by farmers included perceived lack of profitability, availability of resources (mainly farmyard manure and labor), and external barriers (factors including lack of capital buffer, indebtedness, sickness/death/marriage in family, or drought/flood that forced them to quit organic farming or farming altogether).

Acknowledgment

The first author is thankful to 'Dr. Kusum Wankar Pratishthan' for availing the funds and to 'Dharamitra' for providing infrastructural support for this study. Authors also thank 'Chetana-Vikas' for helping to locate the farmers in its area of operation.

Introduction

Understanding the perceptions, motivations and the abilities of farmers is most crucial when it comes to pursue them for the adoption of organic farming system. There have been a number of studies in the past that have attempted to directly ask the farmers about their perception of organic farming: why they adopted sustainable farming practices, if they did, and why if they didn't? In different studies, most frequently mentioned barriers to organic farming include, perceived lack of usefulness/low yield, lack of required inputs, lack of technical knowledge (Darnhofer *et al.*, 2005; Panneerselvam *et al.*, 2012; Kimani *et al.*, 2013) and lack of external monetary incentives (Lapple & Kelley, 2010; Iliopoulou *et al.*, 2011). These studies included the farmers who have either been organic farmers or conventional farmers at the time of interview. Another very informative group to ask this question would be the farmers who started organic farming and then reverted to conventional farming after some period. Harris and others (2008) conducted one such study with the farmers who were associated with different organic certification bodies in United Kingdom. The leading reasons mentioned by these farmers to quit organic farming included, the practice not being viable (27%), certification fees being too high (16.4%), and the farm being sold or tenancy relinquished (9.7%). We undertook a similar study in the *Vidarbha* region of central India.

Material and Methods

The study was conducted in*Vidarbha* region of Central India during year 2014-16. It was conducted in two different rounds, for the reasons mentioned in the following paragraph. In the first round, we randomly selected 60 individuals, from a list of farmers who had been part of an organic farming initiative, and then shifted back to conventional farming for different reasons. This initiative was undertaken by 'Dharamitra', an NGO working for the promotion of sustainable agriculture (among other issues) during 2000-2010 in Yavatmal district in central India. 13 farmers of these 60 could not be interviewed for different reasons including, permanent migration to some other place, death of the farmer due to old age, not being in the village at the time of interview, etc.

The data was collected using the 'structured questionnaire survey'(Ajayi, 2007; Kimani *et al.*, 2013). The second round was followed by the first for two reasons:

1. Investigators believed that the paper-and-pencil nature of the survey instrument might have brought some biases in responses by farmers. There was a need of some way to check whether the magnitude of this bias is so large to make the study unreliable. Therefore, the same study was conducted with another set of sample, from another district in the same region. This time, the same questions were asked, but in a semi-structured interview format (Chambers, R. 2007; it was made sure that all the questions from the previous round were asked, but in more of organically developed conversation).The interviews were recorded on a voice recorder, instead of using a printed questionnaire.
2. In the first round, all the farmers belonged to a homogeneous group, as in they had been part of the same program conducted by the same organization. This limited the possibility to observe diversity of reasons for which farmers may say no to organic farming. Therefore, the farmers in second round were selected from another adjacent district, Wardha, located in the same region (N=20), using the 'snow-ball sampling' technique (Webler, Danielson & Tuler, 2009). Farmers in this sample started organic farming in three different conditions: a. as part of organic farming project by another NGO, 'Chetana-Vikas', b. motivation by govt. agricultural officers and c. on their own.

Farmers responses were categorized in 6 different categories: 'Negative opinion about usefulness/lack of profitability', 'external barriers', 'lack of required resources', 'individual preparedness, priorities and skills', 'practical choice of methodology', and 'ease of use'.

One important design we added in questionnaire was to ask the 'reasons for quitting organic farming' in two different ways. In one question, we asked farmers to simply state 2-3 reasons as they believed, why they could not continue with organic farming. In another question, we went on asking the same question but in terms of specific practices. For example, if a farmer responded that he used organic pesticides for pest control, why then he could not continue that particular practice. This allowed us to have deeper perspective on farmers' perception, reasoning and reasons to leave organic farming practices.

Results

We plotted the responses from both rounds of survey against each other. We found that the responses from both rounds (each representing a different district) followed a similar trend (Figure 1). Average age of the farmers was 50 years for both groups, total land (organic+chemical) was 6.83 and 8.23 acres, and number of years under organic system was 3.82 and 4.35, respectively for the farmers in Yavatmal and Wardha districts. As shown in figure 1, the most frequently cited reasons by farmers to revert to conventional farming were 'negative experience about usefulness/lack of profitability', 'external barriers' (factors including lack of capital buffer, indebtedness, sickness/death/marriage in family, or drought/flood) and 'lack of required resources'. 65.68% of interviewed farmers quit organic farming in first 3 years. These observations suggest that most of the farmers do not have an 'economic buffer' to survive through the 'period of transition' in which the yields are expected to decrease (Panneerselvam et al., 2012); and, therefore, most of them are forced to shift back to conventional farming in which there is at least minimum assurance, in immediate terms. Also, we noted that farmers mentioned the specific factors related to 'ease of use' when asked in terms of why they stopped each specific practice (e.g., mixed-cropping, composting) which do not come up when simply asked why they stopped organic farming. Overall, factors related to ease of use were noted 22% more frequently in latter case. Responding to what change was noticed after shifting back to conventional farming, 62.31% responses were that comparatively the productivity increased a little. Rest of the responses were: 27.54% - it negatively affected to shift back to conventional farming, in terms of increase in input-cost, soil health, and productivity; 7.24% - there was no difference; and 2.89% - they did not notice the difference. When asked if they would like to start organic farming in future, about 40% farmers said no for different reasons; however, more than 40% farmers showed their willingness to shift to organic farming again under certain conditions (Figure 2).

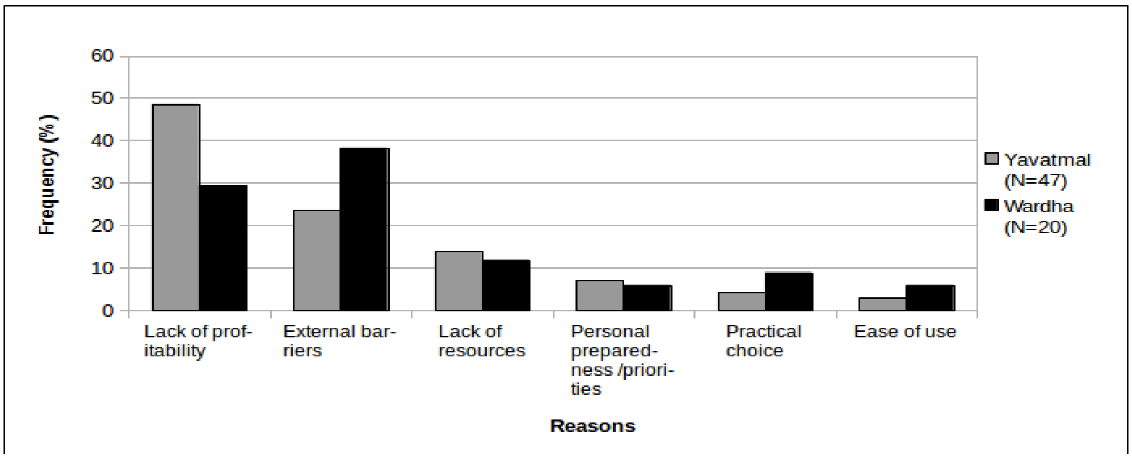


Figure 1: Reasons to quit organic farming, cited by farmers from Wardha and Yavatmal districts in central India

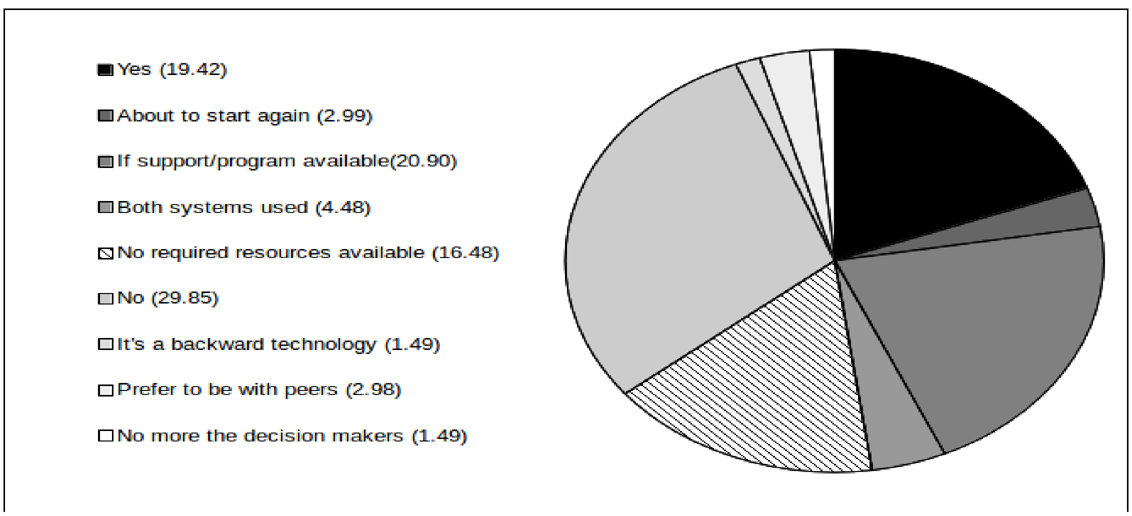


Figure 2:Responses - Willingness to shift back to Organic Farming

Discussion

Most studies so far have indicated that the key barrier to shift towards organic farming is the lack of the needed and expected returns from it, either because of the lack of any institutional support or because the lack of good yield/prices/market (Harris et al., 2008; Iliopoulou *et al.*, 2011 ; Panneerselvam *et al.*, 2012; Kimani *et al.*, 2013). We received similar responses in our study with a particular note of tendancy to revert to chemical farming in very initial years of transition. This suggest that creating an economic buffer for farmers in period of transition is one of the most crucial factors.
'Ease of use' of a practice very much affects the choice to adopt a practice (Ajayi, 2007). Importantly, we want to emphasize that 'ease of use' is not only, for example, about how to prepare an organic pest repellent. Apart from how 'demanding' a practice is, it is also about 'how easy is the access to required resources', 'how commonly it is used in surrounding community', and 'what is the amount of perceived certainty about the outcomes'. Taking together the issue of 'ease of use' and the farmers willingness to start organic farming again, we conclude that farmers *will* be able to shift to organic farming, if there is significant amount of institutional support. *The more challenging issue, we argue, is that of sustainability, not in terms of the productivity of soil, but rather in terms of individual farmers' ability to respond to changing needs.* The Green revolution, which was another 'significant shift' in farming practices, had been able to achieve its goal to increase the production of food-grains; but what it did not offer was the financial and knowledge empowerment of these farmers. According to a recent report by National Sample Survey Office of India (NSSO, 2014), average monthly income of an Indian farmer household is ₹6426, while the monthly consumption expenditure is ₹6223.This is the reason why most of the farmers today do recognize that yield in chemical farming system gradually decreases after initial peak, and the chemicals are degenerating the soil, but they are reluctant to do something about it on their own. Therefore, one of the key concerns in debate of '*Organic 3.0*'' should not only be about how to increase the area under organic farming, but also how to ensure that the farmers will be empowered enough in terms of capital and knowledge, so that they will be able to respond to the changing needs in future on their own.

References

Ajayi, O. C. (2007). User acceptability of sustainable soil fertility technologies: lessons from farmers' knowledge, attitude and practice in Southern Africa. *Journal of sustainable agriculture*, *30*(3), 21-40.

Arbenz M., Gould D. and Stopes C. (2015), *ORGANIC 3.0, for truly sustainable farming & consumption.* In: ISOFAR International Organic EXPO 2015, Goesan County. Available at : https://shop.ifoam.bio/en/organic-30-truly-sustainable-farming-consumption-full-length-version

Chambers, R. (2007). From PRA to PLA and pluralism: Practice and theory. *The SAGE Handbook of Action Research: Participative Inquiry and Practice*, 297.

Darnhofer, I., Schneeberger, W., & Freyer, B. (2005). Converting or not converting to organic farming in Austria: Farmer types and their rationale. Agriculture and human values, 22(1), 39-52.

Department of Economic Affairs (2014). Economic Survey 2014-15 (F.No. 1(93)/Ec.Dn./2014), New Delhi : Ministry of Finance, Govt. of India.

Harris, F., Robinson, G., & Griffiths, I. (2008). A study of the motivations and influences on farmers; decisions to leave the organic farming sector in the United Kingdom. Sustainable rural systems: Sustainable agriculture and rural communities, 99-112.

Iliopoulou, D., Douma, K., & Giourga, C. (2011). Motives and barriers to development of organic olive production. In Book of Abstract. International Conference on ORGANIC AGRICULTURE and AGRO-ECO TOURISM in the Mediterranean. DIO.

Kimani, N. J., Ngeru, M. K., Syano, N. M., & Joseph, L. M. (2013). BARRIERS TO ADOPTION AND CONSEQUENT CONVERSION TO AGRICULTURAL ECOLOGICAL LAND USE PRACTICES.

Läpple, D., & Kelley, H. (2010). Understanding farmers' uptake of organic farming.

National Sample Survey Office. (2014). Key Indicators of Situation of Agricultural Households in India (NSS KI 70/30). New Delhi : Ministry of Statistics and Programme Implementation, Govt. of India.

Panneerselvam, P., Halberg, N., Vaarst, M., & Hermansen, J. E. (2012). Indian farmers' experience with and perceptions of organic farming. Renewable Agriculture and Food Systems, 27(02), 157-169.

Webler, T., Danielson, S., & Tuler, S. (2009). Using Q method to reveal social perspectives in environmental research. Greenfield MA: Social and Environmental Research Institute. Downloaded from: www.seri- us.org/pubs/Qprimer.pdf

Organic in the eye of consumers in India

Sabyasachi Roy[1], Siddhartha Deb Mukhopadhyay[2]

Key words: organic food, consumer awareness, organic certification, Organic logo

Abstract

The objective of this study was to find out the extent of understanding of organic farming by urban consumers and the knowledge and trust in the organic certification logos in India. A web survey was undertaken with consumers across the major metros and state capitals from July to September 2016. The survey indicated that almost 92% respondents were aware of organic food, however, more than 70% of the respondents were not aware of the mandatory "India Organic" logo, which is required for all the third party certified organic products. Almost three-forth of the participants were not aware of the labeling systems or the indications that are to be mentioned on the label of organic products.

Introduction

In India, the government agriculture departments, NGOs, private companies, farmer organizations are involved in promoting organic to encourage demand for organic food. The National Programme for Organic Production (NPOP) provides for the standards for organic production, systems, criteria and procedure for accreditation of Certification Bodies, the national "India Organic" Logo and the regulations governing its use. The "India Organic" logo is mandatory for all third party certified organic products originating from the country (NPOP, 2014). There are also general requirements for labelling for clear and accurate information on the organic status of the product. The Government of India also introduced the "PGS-India Green" and the "PGS-India Organic" logos as a quality assurance initiative that is locally relevant, emphasize the participation of stakeholders, including producers and consumers and operate outside the frame of third party certification.

Consumer or the customer is the king is an age old mantra. The consumer decides what s/he should consume and buy. Growth of organic sector largely depends on the demand generated by the consumers for organic produce and products. Thus consumer knowledge and awareness about the benefits of organic food and other organic products is key factor for development of organic farming. Further, consumer need to be aware about the government rules & regulations, certifications, logo and labels that would help her/him to recognize an organic product among other products for making an informed decision for purchase. The presence of organic logo and other labels on the organic product as per the rules and regulations of a country also builds a sense of trust for the product in the market and in the mind of a consumer. Several researches across the world have reported that a state certification and labeling system creates confidence in organic labeling systems and consequently green consumerism (Sønderskov and Daugbjerg 2009, Sanders 2013).

There is hardly any research done in India regarding organic in the eyes of the consumers. Thus, the present study was taken up with the objective to find out how organic is perceived in the eyes of the urban consumers – the extent of understanding of organic farming as well as knowledge and trust in the organic certification logos in India.

[1]Institute of Agriculture, Visva-Bharati, Santiniketan, West Bengal, India. eMail: sabyaroy@gmail.com
[2] Associate Professor, Agricultural Extension, Institute of Agriculture, Visva-Bharati, Santiniketan, West Bengal, India.

Materials and methods

The study was undertaken with focus on urban consumers across India with emphasis on the four main metro cities and the major state capitals. A detailed review of the consumer related studies on organic across the world was done. A consumer web-survey was constituted using the Survey Monkey web platform. The survey was designed to find out the consumers’ knowledge and understanding about the concept of organic farming and organic products (Sanders 2013). The survey questionnaire comprised of questions related to perception on “India Organic” logo, third party organic certification body logos, organic labels and organic food and products. The questionnaire also comprised questions on organic food purchase behavior and perceived quality. Finally, the questionnaire contained questions on socio-demographic characteristics that included age, gender, education, household size, income, etc. Initially, a pilot of the survey questionnaire was done with a representative sample during June 2016. Based on the feedback, revisions were made in the questionnaire to improve the clarity and workability of the survey instrument (Oates et al. 2011). Finally, the web survey was formally conducted from July to September 2016. Social media platforms and emails were used for approaching general urban consumers for participating in the web-survey. The web questionnaire was developed in a way so that respondents were free to answer the questions they were comfortable and skip the rest. Further, four group discussion were held with the consumers to get a qualitative understanding on few topics. The data was compiled and tabulated using simple descriptive statistics like frequency and percentages.

Results

A total of 558 respondents shared their views on organic products from across India. As per regional spread, about 29% respondents were from Northern India, 20% from Southern India, 26% from Eastern & North Eastern India and 25% from Western and Central India. The age group of the respondents ranged from 18 to 74 years and 42% of the respondents were between the age group of 25-34 years, 32% between 35-44 years and about 10% 18-24 years. Overall, 30% of the respondents were women and 70% men. Around 71% of the respondents were married and about three-forth of the respondents were graduates and post graduates.

Consumer knowledge about the concept of organic farming

Table 1: Consumers awareness about organic food (n=548)

Statement	All respondents	Male respondents	Female respondents
Yes, aware of organic food	92%	91%	94%
No, never heard of organic	8%	9%	6%

Consumer knowledge and awareness about the benefits of organic farming is very important for decision making to purchase organic food and other products. The study revealed that almost 92% of the respondents were aware of organic food (Table 1). There was no big difference in awareness on organic food between male (91%) and female (94%) respondents.

Across India, more than 90% of the respondents indicated that organic food is produced by environment friendly methods and is to be grown without the use of chemicals and around 90% indicated that organic food should be organically certified (Table 2). The study also indicated that less than half of the respondents knew that organic has to be grown free from genetically modified seeds and more than four-fifth of the respondents also felt that organic food is processed without artificial additives.

Consumer awareness and knowledge about the mandatory "India Organic" logo

Organic products are characterized by particular principles and standards for the production and processing, which cannot be verified by consumers neither during the purchase process nor after consumption of the product (Janssen and Hamm 2011, Jahn et al. 2005). Thus a mandatory logo for organic food has been introduced in many countries to make the identification of organic products easier for consumers. In India, the "India Organic" logo is mandatory for all third party certified organic products originating from the country. Thus awareness about the existence of the "India Organic" logo and knowledge about the meaning of the logo is extremely important for increasing consumer confidence and transparency (Sanders 2013) and thereby to make recognition of organic products easier to them.

Table 2: Consumers giving correct answer regarding legal definition of organic food (n=474)

Statements	Respondents
Is produced by environment friendly methods	95%
Is grown without the use of chemicals	92%
Is organically certified	90%
Is processed without artificial additives	83%
Cannot be imported from overseas	73%
Is produced on small family farms	61%
May be grown from genetically modified seeds	57%
Is produced locally	54%

Table 3: Consumers awareness about the "India Organic" logo (n=558)

Response	Total Respondents	Male Respondents	Female Respondents
Yes	27%	28%	23%
No	73%	72%	77%

The web survey revealed that more than 70% of the respondents were not aware of the "India Organic" logo (Table 3). There was a small difference of 5% in the awareness levels between male and female respondents. Thereafter, the respondents who knew about the "India Organic" logo were asked about where they have seen the logo. About 60% of these respondents indicated that they had seen the logo on food items and 28% could not remember where they had seen the logo.

Table 4: Consumer views with regards to meaning of "India Organic" logo (n=142)

Statements	Respondents
Certified organic produce of India	27%
Certified organic produce	16%
Organic Produce	36%
Natural, Eco friendly, Chemical free, Good & Healthy	5%
Don't know, not sure	11%
Wrong answer	6%

The respondents, who were aware of the "India Organic" logo, were also asked about their understanding of the logo to find out if they really knew about the meaning of the logo. Open ended question was asked to the respondents and the answers were categorized and given in Table 4.

Around 27% of the respondents indicated the logo stands for certified organic products from India. However, much more respondents (36%) felt that the logo indicates organic food. Around 16% respondents also felt that the logo stands for certified organic produce and around 11% of respondents indicated that they do not know or were not sure about the logo.

In order to assess the degree of knowledge or confusion of the respondents about the different organic food logos, the respondents were shown eight logos that included "India Organic" logo, different PGS logos, food safety logo, non-organic logos and also fake logos. The results are presented in Table 5. About 50% of the respondents indicated that the "India Organic" logo as organic logo and 77% respondents indicated that Fairtrade logo as organic food logo. Less than one-fifth of the respondents knew about the three logos related to PGS certification. Almost one-third of the respondents wrongly observed that FSSAI logo is for organic food. The confusion in the mind of the respondents becomes clear when more than 10% indicated the fake logo as of organic food logo.

Further, almost three-forth of the respondents were not aware of the labeling systems or the indications that are to be mentioned on the label of organic products. More than half of the total respondents felt that stricter control rules are needed for increasing trust in organic products and control results from organic operators should be made public, i.e. published in the Internet. Also three-forth of the respondents indicated that organic inspections should be done by government institutions/authorities. Further, group discussion with selected urban consumers in Bangalore, Delhi, Kolkata and Mumbai revealed that the trust in the inspection system was not pronounced.

Table 5: Consumer awareness of organic logos (n=474)

Logos & symbols	**Respondents**
India Organic logo	47%
PGS Council logo	9%
PGS India Organic logo	21%
PGS India Green logo	13%
Export Inspection Council of India logo	7%
Fake organic logo	10%
FSSAI logo	34%
Fairtrade logo	77%
Don't know any of these logos or symbols	23%

Discussion and Conclusion

The respondents of the web-survey were mostly educated, young and urban population. The findings of the study indicate that a large majority of consumers in urban India were aware about the concept of organic farming and they had knowledge that organic food is to be grown without the use of chemicals and should be organically certified. At the same time, with regards to legal definition of organic food, more than half of the respondents seems to be confused as they indicated that organic is to be produced on small family farms, produced locally and cannot be imported from overseas, which are incorrect statements. Only about a quarter of the respondents were aware of the "India Organic" logo. Moreover, the consumers had little knowledge or awareness on organic standards, certification and labeling systems. Moreover, it was found in the web-survey and later in group discussion that there is a considerable lack of knowledge among the consumers about how to recognize organic food. Thus, it is recommended that empowering the consumers about benefits of organic farming and consumption of organic food is an urgent necessity for informed decision making by them. Moreover, it is very important to inform and educate the consumers about how to recognize organic food.

References

Sønderskov KM and Daugbjerg C (2009): Organic labeling systems and consumer confidence. **ICROFS news**, pp. 2-4: Downloaded from http://orgprints.org/16141

Sanders J (ed) (2013): Evaluation of the EU legislation on organic farming. Braunschweig: Thunen Institute of Farm Economics.

NPOP (2014): National Programme for Organic Production. New Delhi: Department of Commerce, Ministry of Commerce & Industry.

Oates L, Cohen M and Mann N (2011): Defining organic consumers. Downloaded from http://www.isofar.org/isofar/images/conferences/Proceedings/ISOFAR_Proceedings_2011_Namyangju_KOR_V2.pdf

Jahn G, Schramm M and Spiller A (2005): The reliability of certification: quality labels as a consumer policy tool. J Consumer Policy 28(1): 53–73.

Janssen M and Hamm U (2011): Consumer perception of different organic certification schemes in five European countries, Organic Agriculture 1, 31-43.

What socially motivates farmers to grow organic cotton in central India?

Amritbir Riar[1*], Lokendra S. Mandloi[2], Randhir S. Poswal[3], Monika Messmer[1], Gurbir S. Bhullar[1]

Key words: Cotton, yield variability, social motivations, biophysical motivations

Abstract

India is the largest producer of ‘organic cotton’, as it contributes about three quarters (74%) to the global organic cotton production. The Nimar valley of Madhya Pradesh in central India is important region for organic cotton production. In general, cotton yields are low and variable in the Nimar valley and often do not reach the attainable levels on several farms of the region. With a steeply increasing demand for organic fibre, it is important to safeguard and increase the production of organic cotton in a sustainable manner. The precise understanding of social and biophysical motivations of different farmers for following their respective farming practices is of high importance for sustainable future of organic cotton in central India. The study of the facts related to adoption of organic cotton production systems in the Nimar valley is particularly valuable for policy makers, smallholder farmers and sourcing organizations.

Acknowledgments

We gratefully acknowledge the financial support from Coop Sustainability Fund for this study. We extend our special appreciation and gratitude to the research team of bioRe association and the extension team of bioRe India Ltd. for conduct of the farmers’ interviews. The cotton farmers of the Nimar valley deserve a special appreciation for their continuous efforts to achieve sustainable production and for the excellent collaboration in participatory on-farm research.

Introduction

Organic agriculture is one of the most widely known alternative agricultural production systems advocated for its benefits. There have been strong calls for mainstreaming of organic agriculture in some of the developing countries as well and in some cases governments in different parts of the world have implemented pro-organic policies. This represents a remarkable opportunity, particularly for small and medium holding farmers in developing countries . Appropriate implementation of policy measures is necessary to fully utilize the potential of available scenario. Depending upon various socio-economic factors the adoption rates of organic farming practices vary among farmers in different regions. Understanding the motivation of farmers for adoption of their specific set of management practices is of crucial importance to design suitable policy measures. The objective of this study was to identity that whatsocially motivates farmers to grow organic cotton in the Nimar valley of central India.

Material and methods

During the cotton season of 2015 (May-December), a primary survey of organic and conventional cotton farms was conducted in the cotton growing region of west Nimar. Survey questions were standardised in focussed group discussions with farmers, extension workers, research staff and

[1] Research Institute of Organic Agriculture (FiBL), Ackerstrasse 113, Postfach 219,CH-5070 Frick, Switzerland.
[2] bioRe Association India, 5th km mile stone Mandleshwar road Kasrawad, Dist –Khargone, MP, India
[3] Head, TET, Central Soil Salinity Research Institute, Karnal-132001, Haryana, India
*Corresponding author: Amritbir Riar. E-mail: amritbir.riar@fibl.org

other stakeholders using the joint innovation platform of the Research Institute of Organic Agriculture (FiBL) and bioRe Association. For individual structured interviews, 60 organic and 60 conventional farms were randomly selected from five different cotton growing pockets/clusters of west Nimar. Each farm was treated as a single operational unit and the farmer responsible for decision-making was interviewed. Farmers were selected solely based upon their farming practices, irrespective of farm size, soil type, education, income or any other demographic factors. For data analysis, farmers were further grouped according to size of their land holdings, in order to broadly represent different socio-economic categories. They were grouped into small (<2ha), medium (2-4ha) and large (>4ha) holding farmers, with the small scale farmers recognized as being asset-poor (Singh et al., 2010; Coventry et al., 2015). Upon further subgrouping it was found that the number of respondents was too low in certain categories to arrive at statistically sound conclusions per group. However, the number of respondents are sufficiently large to be able to discern issues and emerging trends. The survey targeted whole farm information on cotton crop management practices (including variety selection, fertiliser management, weed and pest management, number of picking) as well as the information on farmer demography and attitudes. Each farmer was personally visited by one of the designated staff members of bioRe extension team. These staff members were appropriately trained in survey data compilation, to ensure standardized survey information input and coding. The data were compiled using an Excel spreadsheet and to derive inferences, Principal Component Analysis (PCA) was conducted on this data set.

Results

To identify the social motivations of different farmers for following their respective farming practices, PCA provided an overview on the relationship of organic or conventional farming practices on different sized farms to social motivational characters of the farmers. In the biplot figures below (Figure 1), the axis labels indicate the extent to which the mentioned factors account for the total variation in data. The proximity of a farming system group to a particular motivational character demonstrates the agreement of the farmers in that group to the influence from that character and the length of the vector shows the degree of influence compared to other characters. Analysis of survey data revealed that the motivational characters vary among farmers following specific farming practice and having different farm sizes. Besides the differences among different farm sizes, the points pertaining to organic and conventional farm groups spread into different coordinate quadrants (Figure 1) indicate the ideological differences among the followers of these two production systems. The first component of PCA accounting for 63.1% of the total variation, and first component + second component accounting for 85.1% of the total variation showed that these are the most common listed social motivational factors that impact on adoption of a specific management system for cotton production. Some of the social motivation factors such as perception of climate change, habitual reasons, long-term sustainability, interest to grow safer food and societal influence were more important on total variation than others as indicated by the long length of vectors in Figure 1.

Long-term sustainability of cotton was the major motivation for organic farmers with larger land holdings (> 4 ha). Whereas, growing safer food without pesticides and a wish to handover their land to the next generation in a better condition were expressed as main motivations by the organic farmers with medium sized holdings (2-4 ha). However, it is noteworthy that only 32.3% of the surveyed organic medium holding farmers wanted their children to become farmer one day. Motivation of small holding (<2 ha) organic farmers was to perform agricultural practices that are favorable for an intact nature and 33.3 % of them wanted their children to become farmers one day. In contrary to organic farmers, the motivation of conventional farmers was ambiguous. Large holding conventional farmers did not seem to derive their motivation from the mentioned social factors as indicated by the remote presence of point pertaining to this group in 2nd quadrate (Figure 1). The closest vector indicated that they were only concerned about their reputation in the community. Medium holding conventional farmers believed that the conventional practice was a better way of farming (personal belief). However, the small holding conventional farmers seemed to be aloof of the studied social factors and therefore, the social motivation of this farming group remains unclear. The closeness to vectors of 'personal belief' and 'appreciation from family' may suggest lack of awareness and limited risk bearing ability, preventing a shift from the existing farming practices.

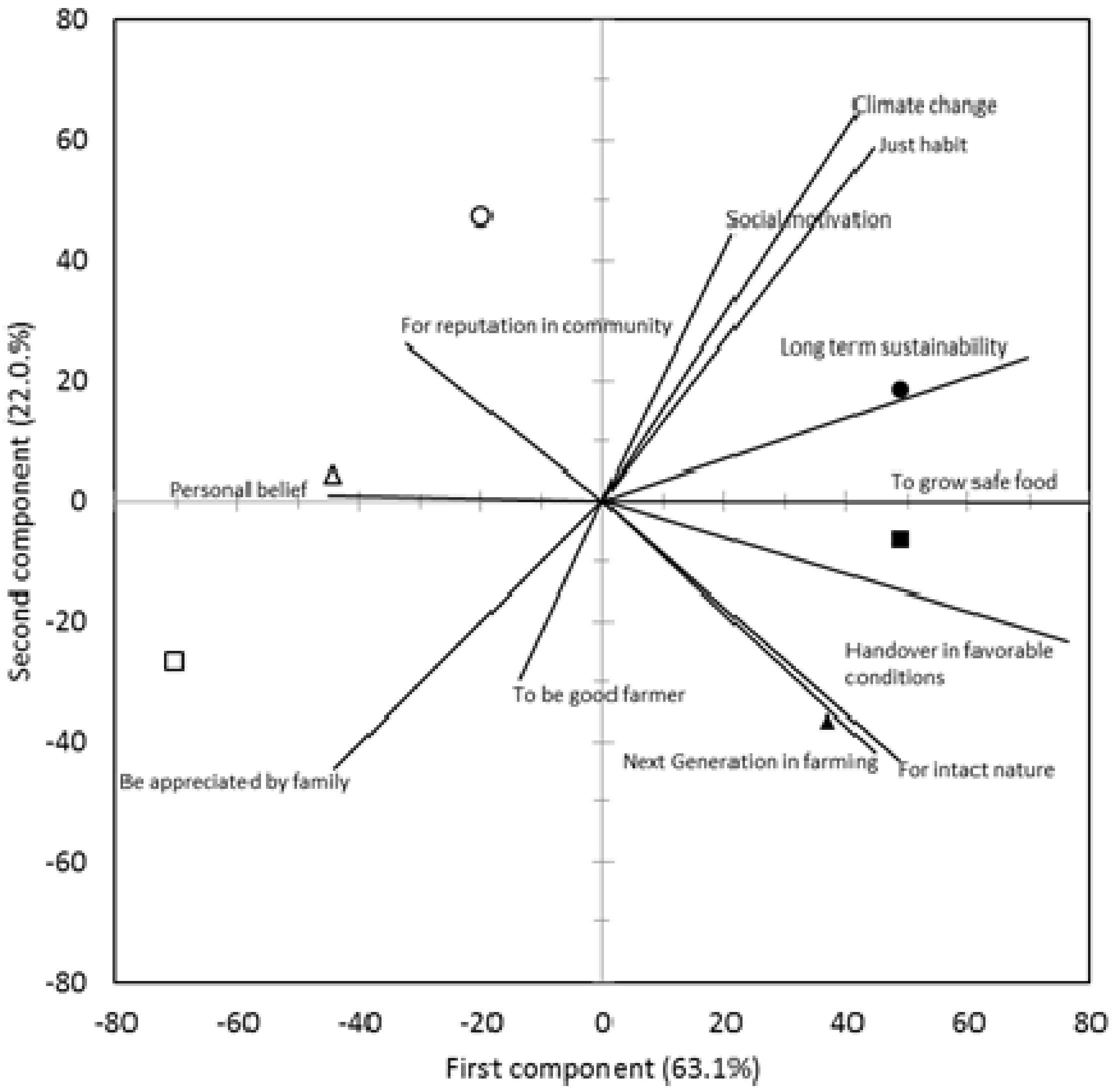


Figure 1. Biplot for the principal component analysis of the respective social motivational characters of (•) large, (▲) medium and (■) small holding organic farmers; as well as (o) large, (□) medium and (□) small holding conventional farmers. Closeness of a farming system symbol to a particular motivational character confers the dominance of that motivation, whereas length of the vector line signifies the effect of that motivational character.

Discussion

Long-term sustainability of cotton, growing safer food without pesticides, agricultural practices that are favorable for an intact nature and a wish to handover their land to the next generation in a better condition were expressed as main motivations by the organic farmers. In contrary to organic farmers, the motivation of conventional farmers was ambiguous.Studies conducted in Canada and United States have reported similar concerns as motivation of farmers for converting to organic e.g. concerns over environmental impact of farming and motivation for personal, family, or consumer health and safety (Cacek and Langner 1986; Lockeretz and Madden 1987; Molder et al., 1991; Hall and Mogyorody 2001; Cranfield et al., 2010). Understanding of social motivation behind the adoption of a farming system can help to make it ecologically sound, economically viable, Socially justifiable.

References

Singh S, Malik R, Dhankar S, Yadav A, Garg R, Kamboj B, Sheoran P, Lathwal O (2010) Nutreient use pattern in the irrigated rice-wheat cropping system in the indo-gangetic plains of Haryana, India. Exp. Agric. 46: 191-209.

Coventry D, Poswal R, Yadav A, Riar A, Zhou Y, Kumar A, Chand R, Chhokar R, Sharma R, Yadav V, Mehtae A, Cummins J (2015) A comparison of farming practices and performance for wheat production in Haryana, India. Agric. Syst. 137: 139-153.

Cacek T, and Langner L (1986) The economic implications of organic farming. Am. J. Alter. Agric. 1(1): 25–29.

Hall A, and Mogyorody V (2001) Organic farmers in Ontario: An examination of the conventionalization argument. Socio. Rural. 41(4): 399–422.

Cranfield J, Henson S, Holliday J, (2010) The motives, benefits, and problems of conversion to organic production. Agric. and Hum.Val. 27: 291-306.

Molder P, Negrave P, Schoney R (1991) Descriptive analysis of Saskatchewan organic producers. Can. J. of Agricultural Economics 39(4): 891–899.

Lockeretz, W., and P. Madden. 1987. Midwestern organic farming: A ten-year follow up. American Journal of Alternative Agriculture 2(2): 57–63.

Applying Modern and Ancient Management Principles to improve Sustainability and Profitability of Organic sector at Field level

Sakthi Sivakumar[1]

Key words: planning, management, field level, organic agriculture, resources, sustainability

Abstract

Agricultural sector throughout the world is faced with more challenges at field level with rapid depletion of available resources. But the current developments in utilisation of available resources are leading to unmanageable and irrecoverable state mostly in developing countries. Organic agriculture promises a better future at all levels of sustainability but its conversion and uptake rate is very low at global level due to the slow recovery time at field level and profitability at socio-economic level. Research at field level shows that applying modern management principles and planning to optimize the organic strategies at field level increases the sustainability and profitability at all levels.

Acknowledgments

The research study was carried out in the frame of the research project "Sustainable Technology Research". I would be thankful to Mr Mohana Maniganda Babu and Mr Vellaisamy for part of the fund support and Q BiT Technologies, Coimbatore, India for their technological support. I would gratefully acknowledge Mr Abhayadev and farmers who shared their knowledge and experience.

Introduction

Though technological developments in agriculture show better results but it seems to be a less attractive option for the present generation mostly in developing countries. This is primarily due to its lack of accountability and sustainability at providing quicker economic results and job security. Main reasons include geographic variations of parameters and practices of random and unclear management strategies at field level due to cultural variability. Mostly the gap among policy makers, scientific community and practitioners (farmers) seem to be filled with help of technologies on one side and loopholes are formed at field level in poor application and use of data.Farmers/Organic practitioners are totally collided and burdened by vast and varying information from all sides of scientific communities, technology, media and communication sectors because of information technology revolution. There is a state of confusion at field level in decision making whether to use time tested practices and/or micro level scientific principles with latest technologies. From the research studies it is stated that lack of application of good management principles in agriculture seems to the prime factor in projecting it as unviable and less attractive sector. Organic agricultural principles (Gomez et al., 2015) are clear to understand but should be carefully managed at field level. This study focuses on how to apply modern management principles and planning with organic principles to ease the practitioner and bring success not only at field level but also socio-economic levels.

Material and methods

The most important stakeholders at field level are farmers and when provided with poor knowledge and management of resources, it becomes the source of ever increasing causes of problems and unmanageable effects at all level. By adopting the management principles of both modern and

[1] Independent Researcher & Engineer, Anaimalai 642104, Coimbatore, India, eMail: sakthi_novare@yahoo.co.in

ancient strategies at all level which could increase in performance manyfolds from field level. To achieve field level success, proper planning(Martin et al., 2011) of the related attributes and management strategies of those are necessary as shown in Figure 1. Both the beginners and experienced stakeholders could use the planning strategiesto make organics uptake faster.

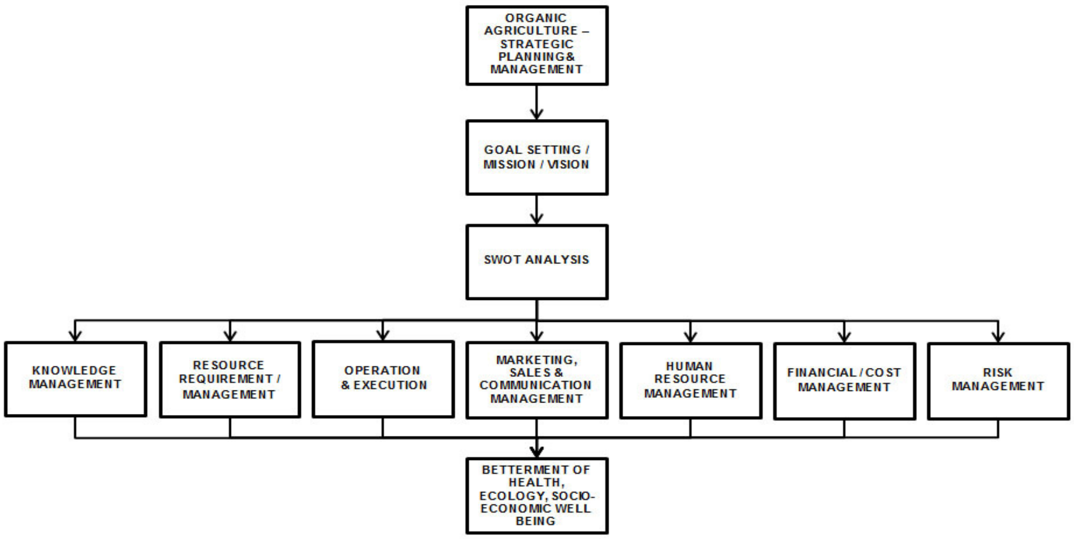


Figure 1. A model of Strategic Planning and Management in Organic Agriculture

Aim / Goal Setting: To utilize the available resources in a sensible manner keeping sustainability as goal in mind, bring good health to all, be beneficial to the society and live a life closer to nature.

Mission: Good future – healthy people and income – reducing money only motive and unnecessary wear and tear of over worked body and mind – thereby reducing our needs and desires directly harming the ecosystem and social system.

Key items to remember: Goal, Organic/Natural System, Knowledge base (Table 1), Project, Planning, Understanding, Discussions, Sharing, Clarifications, Openness, HR, Consulting, On-site visits, Record Keeping, Requirements, Operation &Execution, Monitoring & Tracking, Error Detection & Correction, Success & Failures, Opportunities, Marketing, Cost, Support, Leadership &Management, Collective/Teamwork.

Table 1: Organic Agricultural System: Knowledge Base

Organic / Natural System Process	Organic Converison Challenegs	Cropping & Production Methods	Soil Cultivation Methods	Soil Fertility / Nutrient Management	Seed Conservation & Plant Propgation
Mulching Methods	Water & Irrigation Systems	Weed Management	Integrated Pest & Disease Management	Animals Management	Modern Technology / Equipment Utilisation
Energy Conservation	Waste Management	Weather & Climatic Information	Organic Certification Process	Awareness Of Intensive / Chemical Farming	Records Keeping & Management

Special interest is shown to modern record keeping and management system (Table 2) with the use of digital scanners, cameras and storage devices and use of ancient management principles such as

(Williams 2016) in HR-Operations and Yoga, Meditation, Siddha & Ayurveda in Health (Table 3) reduced the failures and increased the performance manifold at all levels of the organic practices.

Table 2: Modern Records Keeping & Management

Daily/Weekly/Monthly/ Seasonal/Yearly/Longterm		Types Of Record		Types of Data		Mode of Capture & Storage	
To do list	Task done	External source	Own experience	Measurements Costs	Theory Image & Videos	Paper	Digital

Table 3: Application of Ancient Principles in areas of Organic Practices and Management

Goal Setting	Human Resource Management	Operations & Execution	Medical Treatments
Inspired by greater, selfless & extraordinary purpose	1. Focus on performers than results. 2. Self motivating than exercising control	1. Sustainibility from the inside out 2. Resilence – Recovery from failures	Use of Yoga, Siddha & Ayurveda Herbals for humans & animals

The research study mainly focuses in bringing out the planning for resource requirement (Table 4 and 5) and cost analyses (Table 4, 5 and 6) at organic field level operations due to lack of planning resources available for organic farmers/practitioners.

Table 4: Resource Requirement / Initial Fixed Cost – I

Land	Water	Electricity	Security & Operations	Transport
1.Land Purchase (Owned/ Leased) 2.Land Clearance 3.Leveling 4.Roads-Pathways 5.Labour 6.Fencing	1.Well(Already present) 2.Borewell 3.Initial Stage Motor-Pumps 4.Water Harvest Pond 5.Secondary Water Storage for Backup 6.Canals-Pippings -Fittings 7.Drip/Sprinkler Irrigation Materials 8.Emergency water outlets throughout the farm 9.Drums-Kits-Big Medium/Small 10.Hose	1.Electricity Connection-Farm-Stay 2.Automatic Starter-TT Switches-Fittings 3.Multimeter-Clamp Meter-Continuity Tester 4.Backup Wire-Blade-Knife-Tapes-Adhesive 5.Bulbs-Cutter Nose Player-Connectors 6.Safety Guards-Gloves-Sandals 7.Backup-Battery Solar-Biogas Alternatives	1.Fire Apparatus 2.Emergency Lights 3.Phone/PC/ Internet 4.Alarms-Safety Guards-Boots 5.Security Cameras-Monitors 6.Animals-Dogs 7.Agri Drones 8.Sticks-Weaopons-Baits-Organic Repellents 9.First Aid-Information-Kits-Live Herbal Medicinal Plants-Kits	1.Two Wheelers (Personal Travel) 2.Two Wheelers (Heavy Duty-Load Bearing) 3.Three/Four Wheelers-Hand Operated- Load Bearers 4.Small Load Bearing-Hand Pulled Container 5.Heavy Vehicle to Market(Optional) 6.Animals-Bulls-Carts 7.Clear Pathways

Table 5: Resource Requirement / Initial Fixed Cost – II

Machines & Equipments	Farm Animals Management	Organic Fertilizer Management
1. Tractor-Ploughing-Extra Attachments(Optional) 2. Power Tiller(Auto-Semi auto) 3. Brush/Weed Cutter. 4. Power/Battery Sprayer 5. Nife-Sickle-Blade-Axe-Chisel-Hammer 6. Digging Hoe-Spade-Rake 7. Traditional/Hand Plougher 8. Analog/Digital Weight Meter 9. Spanner Kits	1. Cattle/Goat/Chicken 2. Shed-Ropes-Lightings 3. Waste Collection System 4. Water Connection-Pipes-Outlets-Hose 5. Drums-Containers-Buckets 6. Foriage Plans 7. Feeding-Cleaning 8. Medical Kit-Information-(Both Herbal and Allopathy)	1. Waste Management Shed 2. Farmyard Manure Pits 3. Shadow Trees 4. Water Connection-Pipes Outlets-Hose 5. Drums-Containers-Buckets 6. Mechanical Tools-Trenching Hoe 7. Transport-Load Carriers 8. Filters-Ventury Systems 9. Safety Gaurds-Covers-Boots

Table 6: Running Cost

Primary	Secondary
1. Field or Land Preparation 2. Tilling-Ploughing-Digging 3. Bund Formation 4. Trenching 5. Machine Harvesting 6. Fuel 7. Labour	1. Field Trips-Communication 2. Bund Formation, Irrigation & Weeding 3. Organic Manuring-Preparation 4. Pest & Disease Control-Spray Preparation 5. Natural Pest Control Materials 6. Servicing of Materials & Equipments 7. Manual Harvesting-Transport-Farm-Markets 8. Packing-Unpacking-Materials-Bags-Threads 9. Value Addition-Materials-Labour-Stay-Work 10. Disaster-Accidents Recovery

Discussion

Our on-field study shows the usage of variety of modern machines and devices in Operation Management of soil cultivation, energy conservation, security and pest and disease management helped us to identify problems before hand and reduced the rework and time. Usage of Auto Power Tillers (Table 5) and digital devices such as Agri Drones (Table 2 and 4) for capturing plant canopy data, field pattern changes and security purposes eased the field operations. It is known that HR Management is the lifeline of whole process. Rigidity and unpredictability in decision making at management level arises because of poor use and understanding of human body, mind and emotional systems and their interaction with the environment. As we have a vast treasure regarding ancient wisdom principles from Yoga, Meditation (Guruji 2011), Naturopathy and Herbal medicines to solve future problems. More scientific research needs to be undertaken in future at bringing it to wide public use and inclusion in organic principles and strategies at all levels.

References

Gomez I, Thivant L, Scialabba N (2015) Training Manual for ORGANIC AGRICULTURE. TECA, IFOAM, FiBL, IIRR & FAO

Martin D, Fery M (2011) Growing Farms: Successful Whole Farm Management Planning Book Think It! Write It! EM 9043 44pp

Williams G (2016) Ancient Wisdom for Modern Workplaces, Academy of Culture Ambassadors

Guruji J (2011)Thavam. Navayugam Publications, Tamilnadu, India

Strategies for Sustainable Organic Agriculture in Diversified Ecosystems

M.Chandrasekaran[1], M.Anjugam[2], R.Balasubramanian[3]

Key words: Organic agriculture, economics, ecosystems, profitability, sustainability

Abstract

The present study analysed the economic feasibility of organic over conventional farming and the results revealed that in organic farming, under irrigated condition and in closer spacing crops (paddy, onion), yields were lower and under rainfed condition with wider spacing corps, the yield improved (coconut, mango). Cost of cultivation was higher under organic cultivation for banana and paddy. Cost of organic nutrients in the operational cost was also high. Net income was consistently lower in the case of paddy and banana; it was mixed in coconut and higher for mango. Hence, fodder production by farmers may be supported through the Milk Producers Co-operatives under 'cut and carry' fodder followed by development of pasture in waste lands, standardization of organic inputs and practices, organization of organic growers for collective making of organic inputs and selling organic produce and developing varieties that perform well under organic cultivation. Farmers can be advised to do processing and take up direct marketing which was found to be highly profitable.

Acknowledgments

The study was funded by State Planning Commission, Chennai, Tamil Nadu for the project entitled "Organic Farming in Tamil Nadu: Food Security and Land quality Implications" for the period from 2009 to 2012 with a total budget of Rs.4.0 lakhs.

Introduction

Area under organic cultivation in India was estimated to cross the two million ha by 2014 (IFOAM, 2015). India exported 135 products during 2013-14 with the total volume of 194088 MT including 16322 MT organic textiles and realized 403 million US $ registering a 7.73% growth over previous year (APEDA, 2014). Success stories are abound on profitable cultivation of many crops organically (The Hindu dated 17-07-2008). On the other hand, there are a number of apprehensions about food security implications of organic farming due to lower yield of crops and higher energy requirements (Murthy, 2008). Average yield reductions of organic systems relative to conventional agriculture was 10 to 15 % after three to four years of conversion; touching even 50% in some crops. However, in traditional rainfed agriculture, organic farming has the potential to increase the yield and production. In this context, the present study addressed i) to analyze the economic feasibility of organic farming vis-à-vis conventional farming and ii) to study the benefits and constraints in adoption of organic farming.

Material and methods

The study was conducted in five of the seven agro-climatic zones of Tamil Nadu viz., North Eastern Zone, North Western Zone, Southern Zone, Cauvery Delta Zone and Western Zone excluding the high rainfall zone and hilly zone. The list of certified organic farmers was obtained from Tamil Nadu Organic

[1] Director (Planning and Monitoring), Tamil Nadu Agricultural University, Coimbatore -641003, India, www.tnau.ac.in, eMail: mcsekaran@gmail.com

[2] Professor, Department of Agricultural Economics, Tamil Nadu Agricultural University, Coimbatore - 641003, India, www.tnau.ac.in, eMail : manjuecon70 @gmail.com

[3] Professor and Head, Dept. of Market Extension, Tamil Nadu Agricultural University, Coimbatore -641 003, India, www.tnau.ac.in, eMail:rubalu@gmail.com

Certification Department (TNOCD), Coimbatore. From the list, 30 organic farmers were selected in each zone. In addition to this, 30 non-organic farms (conventional farms) were randomly selected in the same location in order to have the comparison. Thus, the total sample of the study was 300 farms. Focus group discussion was also carried out with organic farmers to elicit more information. A Case study on organic paddy processing was also documented through this study. Percentage analysis was carried out along with paired 't' test for significance between organic and inorganic farming.

Results

Profile of organic farmers revealed that women participation in organic farming was considerable in Western zone (30 per cent) and Southern zone (30 per cent). In all the zones, higher rate of dependence of organic farmers on other sources of income was noticed that ranged from 23 to 87 per cent as against from 13 to 47 per cent in sample non-organic farms. Average farm size was high in North western zone (5.35 ha) and North eastern zone (2.63 ha) compared to non–organic farms. Predominantly, organic farming was pursued in irrigated conditions. Sample organic growers possessed relatively more number of livestock per farm (4.9 cattle and 3.24 goats) compared to non-organic growers.

All the sample organic growers were aware of certification but only 10 per cent got certified. Awareness creation is essential among the farmers to enjoy the benefits of certification. Majority of the sample farmers had knowledge on organic farming practices and most of them were adopting for the past 2 - 5 years with the exception of Western Zone where farmers knew and adopted organic practices for 10 years. Majority of the farmers reported that shifting to organic farming is mainly due to increasing cost of cultivation by external inputs, expectation of higher price and experimenting new ideas. All the organic growers were subscribing to one or more of publications for updating their knowledge on organic farming and members of commodity growers association.

Differences in Yield, Cost, Returns and input (nutrient) use

In paddy, yield difference varied between 4.41 and 33.68 per cent among different varieties, whereas, the overall average yield was lower by a substantial 26.96 and 19.45 per cent in North Eastern Zone and North Western Zone, respectively compared to conventional farming. In all the other crops (sugarcane, banana, tomato, turmeric), yield got reduced on the average between a little more than 19 per cent to little over 27 per cent and in onion in North Western Zone, the reduction was more than 46 per cent. In Western zone, the yield got reduced on the average between little more than 17 per cent to little over 33 per cent in the case of mango and banana, but it creased by 21 per cent in coconut under organic cultivation. In Cauvery Delta Zone, in paddy, the yield got reduced in ADT 36, ASD16 on the average by 16.18 per cent (but the yield of BPT 5204 was higher by 27 per cent). In coconut (14 per cent) and mango (22 per cent) increase in yield was observed. In Southern zone, the yield reduction in paddy - ADT 36 and ASD 16 variety was 323 kgs and 100 kgs, respectively and in both the varieties, the reduction in yield ranged from 1.86 to 5.47 per cent. The average yield of banana was 27100 kgs and 31309 kgs per hectare in organic and non-organic farming. The yield was lower by 4209 kgs per hectare (13.44 per cent) in organic farming compared to non-organic cultivation. In all the crops, the yield got reduced on the average between little more than 2.0 to 5.5 per cent in paddy and 13 per cent in banana. *Overall, the results thus, implied that under irrigated conditions yields were generally lower and under rainfed condition and in crops with wider spacing the yield improved.*

Cost of cultivation was generally higher under organic cultivation as a result of more labour requirement and higher cost of organic inputs with the exception of mango wherever cultivated, banana in Southern zone and paddy variety ADT36 in Southern zone. This is in contrast to the general response of the organic growers that the organic cultivation is less expensive as stated elsewhere. The cost of organic sources of nutrients under organic cultivation varied between 28.98 per cent and 84.85 per cent of the operational cost across different crops, whereas, under non-organic cultivation, the cost of nutrient sources predominantly constituted by inorganic sources ranged between 16.15 and 68.92 per cent. With the exception of rice and banana in Southern Zone, in other zones farmers did not take up any plant protection measures under organic cultivation.

Net incomes were consistently lower in the case of paddy and banana; it was mixed in coconut and consistently higher for mango under organic farming.

Benefits and Constraints

All the sample farmers (100 per cent) reported that soil quality has improved in terms of earthworm population increase in the soil and leaves looks to be green and fresh. It is also supported by the experiments conducted in Tamil Nadu Agricultural University (TNAU) shown that organic cultivation resulted in the improvement in physico - chemical and biological properties of the soil could help to improve the nutrient availability and status in the soil. However, results revealed that over a period of 3 years, the organic matter content in the organically cultivated soil increased only from around 0.60 - 0.63 % to 0.63 to 0.66% whereas in non-organic cultivation the organic matter content remained at 0.59 per cent. Experiments conducted in several parts of India also revealed similar pattern as regards increase in organic carbon content. In the long run however, the organic carbon content of the soil may increase relatively faster in organically cultivated areas. It is also found that pest population could be reduced by 52.88 per cent to 80.87 per cent in certain crops taken for experimentation. However, this also led to reduction in natural enemy population between 58.65 to 75 per cent. The scientists also indicated difficulties in plant protection through organic means alone. The organic practices however, helped to improve the microbial load in the soil. The population of bacteria, fungal and actinomycetes increased between 60.23 and 105.63 per cent. Overall, the results would show that the soil quality improved.

The sample farmers also reported that organic products happen to be very tasty and their shelf life is good (83 per cent). Mango traders preferred organic produce by seeing the quality of the fruit. Moreover, no or minimum incidence of pest and diseases was found (66.67 per cent). They produced organic products for their own consumption and for market as the organic produce happen to be safe for human consumption to stay healthy (50 per cent). In all the regions the sample farmers expressed, lack of technical information, shortage of labour, besides reporting that organic produce did not fetch premium price, organic inputs as expensive, organic operations time consuming and labour intensive, as the major constraints in adoption of organic farming.

Majority of the organic farmers expressed their views that equivalent of the amount spent on fertilizers and other inputs by non-organic farmers may be paid to them as compensation because of avoidance of chemical inputs for maintaining soil heath and for producing safe produce. All the farmers (100 per cent) expected higher price for the organic produce, subsidy for organic farming, market for organic produce, facilitating tie-up with the organized retailer for selling their produce and subsidized certification charges. Most of the farmers expressed their opinion that awareness programmes on organic farming may be arranged to benefit existing organic growers to impart knowledge on organic practices and to share experiences in organic farming to get convinced on their own, by way of "land to land" or "farmers to farmers" awareness programme**.**

Hence it is suggested that Fodder production by farmers may be supported through the Milk Producers Co-operatives for 'cut and carry' fodder, development of waste lands/ other fallows as pasture to promote organic farming. Scientists and other stakeholders should work in tandem to standardize the composition of the inputs and practices. Data base on organic growers at block level and they may be organized and given orientation in collectively making organic inputs to reduce cost and selling organic produce in farmers markets and other outlets owned by government. Samples may be randomly drawn from organic growers to ensure genuiness. Research should be intensified to develop varieties that perform well under organic cultivation and they can be advised to do processing and take up direct marketing. Public procurement of organic produce for use in public events and capacity building of organic farmers about various approaches, practices and strategies are suggested not only promote organic cultivation but also to improve the economic condition of the organic growers.

Focus Group Discussion

Organic farmers revealed that they are in need of local varieties / improved varieties to suit organic farming because hybrids especially in vegetables require more of chemical fertilizers and did not respond to organic inputs. Available organic input brands must be tested and certified by the Agricultural University for use by the organic farmers as these happen to be more expensive. Disbursal of interest free loan from cooperative banks to organic growers for cultivation of local varieties may be promoted.

Case study

In Southern Zone, farmers opined that though the yield of paddy (ASD 16 variety) got reduced by 24 per cent in the 4th year of adoption of organic practices, soil has loosened up much and has some fragrance and microbial population has increased. In Cauvery Delta zone, an organic paddy farmer (ADT 43 variety) realized a net income of Rs.71587 per hectare through processing of paddy and direct marketing of organic rice to the consumers with organic label compared to organic paddy (Rs.20107).

Discussion

Organic cultivation is crop and livestock interwoven as livestock serves as source of manure and constituents for on-farm preparation of many organic inputs. Therefore, maintaining livestock on farm becomes integral to organic farming which necessitates maintaining sources of fodder (either cultivation of fodder on-farm by the farmers or rejuvenation of pastures in common lands or vast stretches of wastelands or other fallows) besides providing drinking water sources for livestock. In the Indian conditions, with higher intensity input management already in place in irrigated areas and needing yields to grow to meet the additional requirement of the growing population, there are difficulties in dramatically increasing the area under organic cultivation as yield levels are said to reach a maximum of 90 per cent of the yield under non-organic conditions after four-five years into organic conversion. At all India level, only 0.42 per cent of the total cultivated area is under organic cultivation and there is faster growing market for organic produce in USA at 20 per cent. Therefore, even if the demand for organic produce in India is to grow at 20 per cent annually, the organic area will go up to little over two per cent of the total cultivated area in 10 years that too provided organic inputs are available and markets are organized.

References

APEDA (2014): www.apeda.com

FiBL, International Federation of Organic Agricultural Movement, 2015

Murthy, K.S.R.K (2008): Organic farming and food security, Business Line, 11.7.2008, online http://www.thehindubusinessline.com/2008/07/11/stories/2008071150200900.htm

The Hindu dated 11.4.2007, 3.7.2008; 17.7.2008.

Thünen Report

Bereits in dieser Reihe erschienene Hefte **–** *Volumes already published in this series*

1 - 32	siehe http://www.thuenen.de/de/infothek/publikationen/thuenen-report/
33	Anja-Kristina Techen, Elke Ries, Annett Steinführer **Evaluierung der Gewässerschutzberatung in Hessen im Kontext der EU-Wasserrahmenrichtlinie: Auswirkungen auf Wissen und Handeln von Landwirten**
34	Jan T. Benthien, Sabrina Heldner, Martin Ohlmeyer, Christian Bähnisch, Jörg Hasener, Clemens Seidl, Alfred Pfemeter, Christian Kathmann **Untersuchung der Faserqualität von TMP für die MDF-Produktion –** Abschlussbericht zum FNR-Vorhaben „Fiber-Impact" (FKZ: 22013211)
35	Andreas Tietz **Überregional aktive Kapitaleigentümer in ostdeutschen Agrarunternehmen: Bestandsaufnahme und Entwicklung**
36	Nicole Wellbrock, Erik Grüneberg, Daniel Ziche, Nadine Eickenscheidt, Marieanna Holzhausen, Juliane Höhle, Rainer Gemballa, Henning Andreae **Entwicklung einer Methodik zur stichprobengestützten Erfassung und Regionalisierung von Zustandseigenschaften der Waldstandorte**
37	Andrea Ackermann, Claudia Heidecke, Ulrike Hirt, Peter Kreins, Petra Kuhr, Ralf Kunkel, Judith Mahnkopf, Michael Schott, Björn Tetzlaff, Markus Venohr und Frank Wendland **Der Modellverbund AGRUM als Instrument zum landesweiten Nährstoffmanagement in Niedersachsen**
38	Hermann Achenbach und Sebastian Rüter **Ökobilanz-Daten für die Erstellung von Fertighäusern in Holzbauweise**
39	Hans-Dieter Haenel, Claus Rösemann, Ulrich Dämmgen, Annette Freibauer, Ulrike Döring, Sebastian Wulf, Brigitte Eurich-Menden, Helmut Döhler, Carsten Schreiner, Bernhard Osterburg **Calculations of gaseous and particulate emissions from German agriculture 1990 - 2014** **Berechnung von gas- und partikelförmigen Emissionen aus der deutschen Landwirtschaft 1990 – 2014**
40	Frank Offermann, Martin Banse, Claus Deblitz, Alexander Gocht, Aida Gonzalez-Mellado, Peter Kreins, Sandra Marquardt, Bernhard Osterburg, Janine Pelikan, Claus Rösemann, Petra Salamon, Jürn Sanders **Thünen-Baseline 2015 – 2025: Agrarökonomische Projektionen für Deutschland**
41	Stefan Kundolf, Patrick Küpper, Anne Margarian und Christian Wandinger **Koordination, Lernen und Innovation zur Entwicklung peripherer ländlicher Regionen** **Phase II der Begleitforschung zum Modellvorhaben *LandZukunft***
42	Sebastian Rüter, Frank Werner, Nicklas Forsell, Christopher Prins, Estelle Vial, Anne-Laure Levet **ClimWood2030 'Climate benefits of material substitution by forest biomass and harvested wood products: Perspective 2030' Final Report**
43	Nicole Wellbrock, Andreas Bolte, Heinz Flessa (eds) **Dynamik und räumliche Muster forstlicher Standorte in Deutschland – Ergebnisse der Bodenzustandserhebung im Wald 2006 bis 2008**

44	Walter Dirksmeyer, Michael Schulte und Ludwig Theuvsen (eds) **Aktuelle Forschung in der Gartenbauökonomie – Nachhaltigkeit und Regionalität – Chancen und Herausforderungen für den Gartenbau** – Tagungsband zum 2. Symposium für Ökonomie im Gartenbau
45	Mirko Liesebach (ed) **Forstgenetik und Naturschutz – 5. Tagung der Sektion Forstgenetik/Forstpflanzenzüchtung am 15./16. Juni 2016 in Chorin – Tagungsband**
46	Claus Rösemann, Hans-Dieter Haenel, Ulrich Dämmgen, Annette Freibauer, Ulrike Döring, Sebastian Wulf, Brigitte Eurich-Menden, Helmut Döhler, Carsten Schreiner, Bernhard Osterburg **Calculations of gaseous and particulate emissions from German agriculture 1990 - 2015** **Berechnung von gas- und partikelförmigen Emissionen aus der deutschen Landwirtschaft 1990 – 2015**
47	Niko Sähn, Stefan Reiser, Reinhold Hanel und Ulfert Focken **Verfügbarkeit umweltrelevanter Daten zur deutschen Süßwasseraquakultur**
48	Markus Ehrmann **Modellgestützte Analyse von Einkommens- und Umweltwirkungen auf Basis von Testbetriebsdaten**
49	Mirko Liesebach, Wolfgang Ahrenhövel, Alwin Janßen, Manuel Karopka, Hans-Martin Rau, Bernd Rose, Randolf Schirmer, Dagmar Schneck, Volker Schneck, Wilfried Steiner, Silvio Schüler, Heino Wolf **Planung, Anlage und Betreuung von Versuchsflächen der Forstpflanzenzüchtung** **Handbuch für die Versuchsanstellung**
50	Tobias Mettenberger **Jugendliche Zukunftsorientierungen in ländlichen Mittelstädten** Zur Rolle des alltäglichen (sozial-)räumlichen Kontexts beim Übergang von der Hauptschule in den weiteren Ausbildungsweg
51	Stefan Neumeier **Modellvorhaben chance.natur – Endbericht der Begleitforschung –**
52	Andreas Tietz **Überregional aktive Kapitaleigentümer in ostdeutschen Agrarunternehmen: Entwicklungen bis 2017**
53	Peter Mehl (ed) **Aufnahme und Integration von Geflüchteten in ländliche Räume:** **Spezifika und (Forschungs-)herausforderungen** Beiträge und Ergebnisse eines Workshops am 6. und 7. März 2017 in Braunschweig
54	G. Rahmann, C. Andres, A.K. Yadav, R. Ardakani, H.B. Babalad, N. Devakumar, S.L. Goel, V. Olowe, N. Ravisankar, J.P. Saini, G. Soto, H. Willer **Innovative Research for Organic 3.0 - Volume 1** Proceedings of the Scientific Track at the Organic World Congress 2017 November 9-11 in Delhi, India
54	G. Rahmann, C. Andres, A.K. Yadav, R. Ardakani, H.B. Babalad, N. Devakumar, S.L. Goel, V. Olowe, N. Ravisankar, J.P. Saini, G. Soto, H. Willer **Innovative Research for Organic 3.0 - Volume 2** Proceedings of the Scientific Track at the Organic World Congress 2017 November 9-11 in Delhi, India

THÜNEN

Thünen Report 54 - Volume 2

Herausgeber/Redaktionsanschrift

Johann Heinrich von Thünen-Institut
Bundesallee 50
38116 Braunschweig
Germany

www.thuenen.de

9 783865 761781