Project brief

Thünen Institute of Farm Economics 2025/02a

Economic and Ecologic Effects of Peat Reduction in Horticultural Production Systems

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- **Peat-rich substrates are major emission hotspots across all production systems.**
- **Reducing peat use results in higher production costs, lower gross margins, and reduced net profits with existing technological capabilities.**
- **CO_2 avoidance costs vary significantly between crops and production systems due to differing sensitivities to peat reduction**
- **Achieving economically and ecologically viable peat reduction requires technical innovations and adjustments in production systems.**

By 2030, the German government aims to significantly reduce the use of peat in commercial horticulture. The impacts of this transition at the level of individual horticultural farms were analyzed in the collaborative project ToPGa (Development and evaluation of peat-reduced horticultural production systems).

Background and aims

In Germany, peat is extensively used in horticultural farms due to its reliability and versatile applications. However, peat extraction releases significant amounts of CO_2 stored in peatland over thousands of years, which has led to increasing political pressure to reduce its use. Achieving successful reduction requires a comprehensive analysis of current and peat-reduced and peat-free production systems to identify key influencing factors and their interactions. For a practical and sustainable transition, peat substitution must be both ecologically beneficial and economically viable.
Sub-Projects 7 and 8 of the ToPGa collaborative project, conducted by the Thünen Institute of Farm Economics and GreenSurvey, aimed to document selected production systems in their current state and under conditions of reduced peat use. These systems were evaluated from both economic and ecologic perspectives. The results contribute to a comprehensive understanding of the impacts of peat reduction or substitution. This knowledge provides a solid foundation for decision-makers to design well-informed measures that promote sustainable peat reduction.

Methodology

The economic impacts of reducing peat use in horticultural productions were analyzed and evaluated using example crops - petunia (Petunia x hybrida), poinsettia (Euphorbia pulcherrima), St. John's wort (Hypericum 'Hidcote'), arborvitae (Thuja occidentalis), basil (Ocimum basilicum), strawberry (Fragaria x ananassa), and blueberry (Vaccinium corymbosum). For the analysis, the approach of typical production systems was chosen. This approach comprises three phases:
(1) Identification: Literature reviews and expert consultations were conducted to capture existing knowledge on typical production systems and representative farms.
(2) Interviews: Selected farms were interviewed, either in person or online, and the collected data were analyzed to develop preliminary models of typical production systems.
(3) Focus Group: The preliminary models were discussed, adjusted, and validated with experts in a focus group. The impacts of peat reduction on current systems were also examined to form the basis for modeling peat-reduced and peat-free production systems.
Based on this, peat-reduced and peat-free production systems were modeled. Subsequently, the production systems were analyzed from both economic and ecological perspectives. Key metrics included Gross Margin II (GM II), which reflects revenue after deducting variable and direct fixed costs, and the CO_2 footprint, which was calculated for the status quo, peat-reduced, and peat-free scenarios. Risks associated with peat reduction were also assessed. By integrating economic and ecologic results, CO_2 avoidance costs were determined, quantifying the cost of avoiding one ton of CO_2 emissions in crop production.

Results

The analysis results indicate that reducing peat use in horticultural farms is economically feasible but currently leads to higher production costs with existing substrate technologies.
Gross margins decline for all example crops when reducing peat content in substrates, with some crops being more sensitive to peat reduction than others. The ornamental plant

sector demonstrates the highest tolerance to reduced peat content, whereas the nursery sector is the most sensitive, experiencing significant declines in GM II - 75% for arborvitae and 99% for St. John's wort. These declines are primarily due to longer cultivation periods and higher failure rates in some crops, which increase variable costs while reducing revenues. Peat reduction generally lowers the CO_2 footprint for all analyzed crops. However, exceptions were observed with blueberries grown in containers and basil cultivated in winter. For these crops, shorter utilization periods and increased energy requirements lead to higher emissions, offsetting the ecologic benefits of peat reduction.

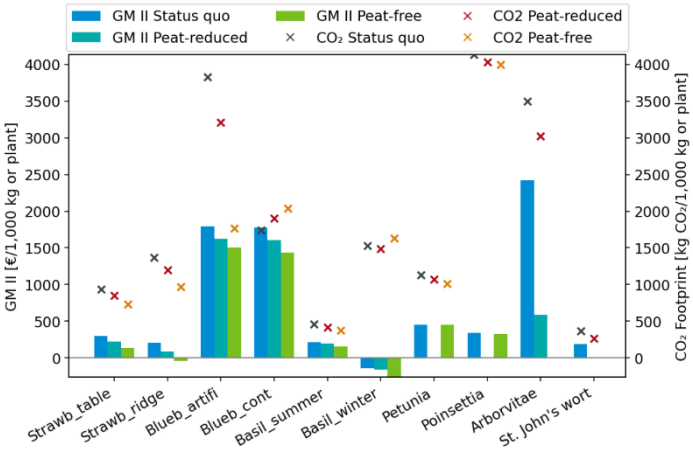
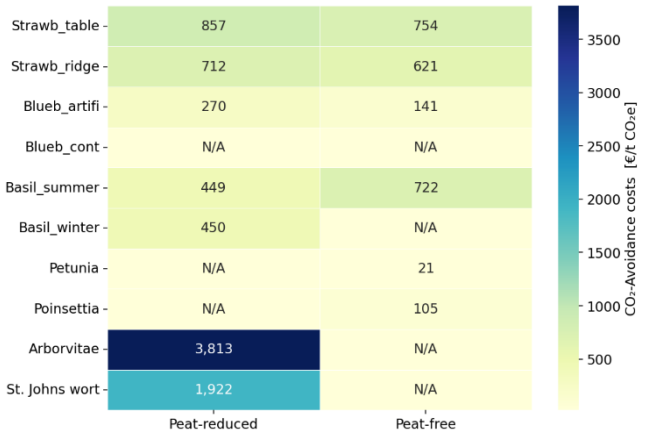


Figure: Gross Margin II (GM II) and CO_2 footprint of investigated example crops in the growing media with different peat content (Source: Thünen Institute/own representation)

CO_2 avoidance costs vary significantly across crops. Ornamental plants have the lowest CO_2 avoidance costs, while nursery plants incur the highest. Notably, for blueberries grown in containers and basil cultivated during winter, peat reduction leads to no CO_2 savings, as emissions actually increase with peat reduction.
In the berry sector, the CO_2 avoidance costs for peat-free blueberry production at artificial soil are approximately five times lower than those for strawberry production. While the economic impact of peat-free blueberry production is comparable to that of strawberry production, the CO_2 savings from blueberry production are five to ten times greater.

Table: CO_2 avoidance costs per ton of CO_2e in the investigated example crops (Source: Thünen Institute/own representation)



Conclusion

Peat-rich substrates represent emission hotspots in all production systems, and peat reduction or substitution generally reduces the CO_2 footprint. However, with current technological capabilities, peat reduction often results in higher production costs, lower gross margins, and reduced profits due to increased failure rates, lower product quality, or longer cultivation periods.
In cases where cultivation periods significantly increase and failure rates rise, complete peat substitution may not always be economically or ecologically viable. CO_2 avoidance costs also vary widely across crops and production systems due to differing sensitivities to peat reduction, making a one-size-fits-all solution impractical.
To ensure economically and ecologically successful peat reduction, technical advancements (e.g., optimizing substrate properties) and adjustments in production systems (e.g., site-specific, sensor-based irrigation and fertilization management) are essential.

Further Information

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Yoon et al. (2024) Financial effects of reducing the use of peat in blueberry production systems. German Society for Horticultural Science (DGG), German Society for Horticultural Science (DGG), 10 p, 10.5288/DGG-PR-12-02-JY-2024

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