Short Note: Research Studies on Oak Cutting (Quercus robur L.): Premises for the Improvement based on Clonal Selection

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Summary

Within the framework of the general tendency of attaching greater importance and attention to the vegetative multiplication of forest trees, research studies were made on the "industrial" type of oak cutting. The aim of this research was to test those methods which by the beginning of the investigations have scored the best results so that relying on the results we should work out better strategies with clonal selection. Bifactorial tests were done where the A factor was the substratum and the B factor — the stimulating treatment of rhizogenesis. We made studies on young biological material. At the start of the experiment the assumption was that there was a certain physiological moment when in the donor-plant there is a certain hormone balance, favouring callogenesis and rhizogenesis. Our results confirmed the hypothesis.

Key words: oak (*Q. robur* L.) cutting, homone balance.

Zusammenfassung

Im Rahmen des allgemeinen Trends, der vegetativen Vermehrung von Waldbäumen mehr Gewicht und Aufmerksamkeit zu schenken, wurden Untersuchungen über die „industrielle" Stecklingsvermehrung der Eiche durchgeführt. Gegenstand der Forschung war die Prüfung jener Methoden, die bisher die besten Ergebnisse geliefert haben, auf Grund dessen bessere Züchtungsstrategien durch Selektion von Klonen ausgearbeitet werden können. Untersuchungen mit zwei Faktoren wurden durchgeführt: einer der Faktoren (A) war das Substrat und der andere (B) die Behandlung zur Wurzelbildung. Es wurde biologisch junges Material untersucht. Die Untersuchungen wurden unter der Voraussetzung begonnen, daß zu einem bestimmten physiologischen Zeitpunkt eine Balance der Hormone bei der Spender-Pflanze auftritt, die die Kallus- und Wurzelbildung begünstigt. Unsere Ergebnisse bestätigten diese Hypothese.

1. Introduction

As it is known the programmes for forest tree improvement based on sexual reproduction may bring out only part of the existing genetic variability.

Following the progress in the last few years, there is an unanemous acknowledgement that the vegetative is the best way to use the entire genetic, additive and non-additive variability and that it has numerous other advantages. In the case of the oak, vegetative multiplication might lead to new solutions on the problem of he rare and uncertain fruit growing of this species, as well as on the difficulty of preserving acorns for a longer period of time.

Oak cutting was the topic of several studies, some of which are quoted (Arbez, 1962; Cornu *et al.*, 1975a,b; Delaunnay, 1980; Garbaye, 1977 Garbaye and Le Tacon, 1978; Kleinschmit 1975; Martin, 1977; Nepveu, 1982; Nozeran and Rancillac, 1977; Spethmann, 1982a,b; Touzet, 1982; and others).

Results were encouraging, especially on the matter of the cutting used as a link of some improvement programmes based on clonal selection. The research and took into considering the most efficient methods. Moreover, at the basis of the research we laid the premise that there exists a certain physiological moment (sequence) when in the donor-plant a certain hormone balance favourable to callogenesis and rhizogenesis is achieved.

2. Material and Methods

Green cuttings, with 2—3 leaves cut at 1/3 of the height were used, and places round the terminal formed bud. The stems were already matured to a certain extent. 10—15 cm long cuttings were made out of the first growth the 1-year old seedlings in 1984, and of the 1st and 2nd growth from 2-year old seedlings in 1985.

Three cutting substrata were tested: (1) pearl gravel of silicon type; (2) 50% mixture of gravel and peat; (3) ground brown peat. Cutting beds with concrete prefab frameworks were used; the cutting substratum was 25—30 cm deep and was placed on a thick layer of big river gravel to provide a good drainage.

The experiment was bifactorial where the prime factor A was the substratum and the secondary factor B — the stimulation treatment. For the stimulation treatment of rhizogenesis we used: (1) indolyl butyric acid 0,5% and Benomyl 15%; (2) indolyl butyric acid 0,5% and (3) Seradix 1.

The cutting period was differentiated by reaching the moment which had been evaluated by organoleptic indexes as being optimal form the hormone balance point of view for rhizogenesis and obviously it varied according to the use of the first and second growth.

Cutting was made in the green house, provided with automatic means for artificial mist, ventilating systems and air conditioning. The relative air humidity was 85% at minimum ranging up to 100% and the maximum temperature 30° C. The results were statistically processed by variance analysis and the significances of difference between media were estimated by means of the Student test. The percentages were first turned into arc sin $\sqrt{\%}$.

3. Results and Discussions

Taking into account only the well developed and normal cuttings, results recorded for 1984 range within wide limits according to the cutting substratum (*Table 1*). Low percentages of callogenesis are added with more possibilities of rooting, which in the case of peat-in cutting, could raise the rooting percentage did not vary significantly dependent on the treatment which in fact in all cases had the indolyl butyric acid as a stimulator. After approximately 3 months since cutting, the roots were significantly longer in the cuttings grown on gravel + peat. The length of stems when the cuttings were taken out of the green house did not

Table 1. — Rooting of oak cuttings. 1984 Experiments.

Cutting substratum	Stimulation treatment of rooting	Percentage rooted cuttings	Percentage of callused cuttings
Gravel	IBA 5%+Benomyl 15%	55. 30	16. 4
	IBA 0. 5%	44. 00	9. 1
	Seradix 1	52. 35	10. 9
Gravel+Peat	IBA 0. 5%+Benomyl 15%	82. 16	2. 8
	IBA 0. 5%	64. 86	0. 6
	Seradix 1	63. 86	0. 0
Peat	IBA 0. 5%+Benomyl 15%	93. 50^{xxx}	4. 9
	IBA 0. 5%	94. 70^{xxx}	5. 3
	Seradix 1	95. 23^{xxx}	3. 1

xxx) significant at P = 0.1%.

differ significantly either in point of substratum or of stimulation treatment (*Table 3*).

Approximately 3 months after cutting and after a progressive daily reduction of air humidity in the green house by approximately 10%, the rooted seedlings were subcultured in the nursery on the stratum shadowed by grills and hose-watered daily. The loss percentage was practically non-significant. In 1985, the seedlings grew very well without losses and in autumn they were to be planted. As compared to data in literature (Garbaye and Le Tacon, 1978; Spethmann, 1982; and others), results obtained in 1984 test are much better, both as regards the rooting percentage and the maintenance one after subcultures in the nursery.

Good results, even better than those mentioned in the specialized literature were also obtained in the 1985 tests with elder material i. e. the first growth stage of the seedlings in their second vegetation season (*Table 2*). The rooting of cuttings obtained from the second growth of seedlings in their second vegetation season is significantly lower than that in the prior case, but figures are at the same level in other research studies.

The first growth cuttings scored the same rooting percentages on gravel and on peat. The cutting substratum did not influence the rhizogenesis of the second growth cuttings either. Instead, the rooting was significantly different on the same substratum-peat according to the stage of growth whence they were selected; 1st growth cuttings were rooted in a significantly higher percentage than those from the second growth.

We can conclude that the best results to be used on a large scale are obtained out of the first growth of seedlings in their first generation season. Results worthy to be mentioned at least for the improvement programmes are recorded in cuttings made out of the first growth of 2-year old seedlings; in all these cases peat was used as a ubstratum and indolyl butyric acid — as a stimulus for rhizogenesis, or the commercial product Seradix-1.

Table 2. — Rooting of oak cuttings. 1985 Experiments.

Cutting substratum	Stimulation treatment of rooting	Type of cutting	Percentage of rooted cuttings	Percentage of callused cuttings
Gravel	IBA 0. 5%	1st growth	80. 52	10. 5
Gravel+Peat	IBA 0. 5%	2nd growth	61. 46^{xxx}	19. 0
Peat	IBA 0. 5%	1st growth	84. 17^{xxx}	9. 8
		2nd growth	68. 20	7. 7

xxx) significant at P = 0.1%.

Table 3. — Some biometrical data of saplings obtained from cuttings. 1984 Experiments.

Cutting substratum	Length of the root (cm)	Number of roots formed from Callus	Length of the stem (cm.)	Growth achieved in the Green House (cm.)
Gravel+Peat	15. 34^{x}	5. 66	13. 86	3. 16^{x}
Peat	12. 03	5. 46	11. 82	1 36

x) significant differencies at P = 5%.

In the case of producing out of the first or second growth of 1 year respectively 2-year old seedlings, since the donor-plants resume their growth and by autumn they reach normal height under circumstances determined by lack or shortage of fructification, from the same quantity of acorn the seedlings prduction may also be doubled.

The major importance of results obtained with oak cuttings resides in that the latters prove to be the possibility of using an improvement process based on clonal selection which should reach great genetic and economic efficiency (gain) within a shorter lapse of time than we normally need when using the conventional methods. This assertion envisages the big periodicity of crop in oaks as well as numerous damaging factors which may cut down or even compromise the crop.

As an improvement strategy, within a first stage, conventional methods may be combined with clonal selection; within the improvement process a link may be represented by the "in vitro" vegetative microdiffusion for which an adequate technology has been perfected (Enescu *et al.*, 1985).

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