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Note

Possible criteria for selection of *Quercus suber* plus trees

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Summary — The field work for selecting superior trees of cork oak is described. Requirements for selection are different from those employed for timber tree breeding, because the product to be improved is not wood, but bark. The field work is being developed in a natural forest of 16 000 ha, 8 000 of which are pure cork oak. As the trees are debarked once every 9 years, each year an area of 800–900 ha is selected. The characters assessed were tree size and form, resistance to pests and diseases, bulk production of cork, and cork quality. At the time of debarking, every 9 years, 64 superior trees are selected for progeny testing.

selection / breeding / *Quercus suber*

Résumé — Critères de sélection d'arbres plus du chêne liège (*Quercus suber* L). *Cet article décrit les méthodes de sélection d'arbres plus de chêne liège en forêt. Les critères de sélection sont différents de ceux utilisés chez les espèces où la production de bois est l'objectif principal. Chez le chêne liège, l'objectif est la production de liège. Une méthode de sélection a été développée dans une forêt naturelle de 16 000 ha, dont 8 000 ha forment un peuplement pur de chêne liège. Comme le liège est prélevé tous les 9 ans, une surface variant de 800 à 900 ha est choisie chaque année. Les arbres sont notés pour leur taille, leur forme, la résistance aux maladies, la production en quantité et en qualité de liège. À chaque prélèvement de liège, tous les 9 ans, 64 arbres plus sont sélectionnés en vue de mettre en place des tests de descendances.*

***sélection / amélioration génétique /* Quercus suber**

INTRODUCTION

Quercus suber L covers an area of about 500 000 ha in Spain. Spain and Portugal produce 75% of the world's cork, 25% of which comes from Spain.

Many authors, *eg*, Natividade (1954) and Correia (1981) have stressed the necessity for genetic improvement of cork-oak, but the first plan for genetic improvement only began in 1987. As in every similar plan, the selection of superior trees in of foremost importance (Zobel and Talbert, 1983).

In a previous article (García-Valdecantos, 1989), the difficulty of choo-

Table I. Means (± standard deviations) of the scores obtained in 1987 and 1988 for the groups of characters A, B and C (see *Materials and Methods*).

Year	*No of trees measured*	*No of trees selected*	*Means of all trees measured*				*Means of trees selected*			
			Group A	*Group B*	*Group C*	*Total*	*Group A*	*Group B*	*Group C*	*Total*
1987	96	5	20.9 ± 3.2	11.1 ± 4.1	7.1 ± 6.0	39.5 ± 8.0	22.0 ± 1.9	15.0 ± 4.1	10.1 ± 4.1	47.1 ± 5.1
1988	92	10	21.3 ± 3.6	9.7 ± 2.0	10.2 ± 7.3	41.2 ± 8.1	23.8 ± 6.2	9.8 ± 2.5	18.0 ± 4.6	51.6 ± 5.2

sing appropriate criteria for selecting superior cork oak trees was emphasized. In fact, there is no prior experience for selection of improved bark. The few papers published on oak selection describe techniques for improvement of wood quality and production (Coggeshall, 1987; Harmer, 1989; Kanowski *et al*, 1991).

MATERIALS AND METHODS

The field work is being carried out in the La Almoraima estate, in the south of Spain. The average rainfall is 900 mm/year, and altitude ranges from 200 to 500 m. Within the 16 000 ha forest is the largest pure forest of cork oak in Europe: 8 000 ha. As trees are debarked once every 9 years, each year an area of 800–900 ha is investigated.

The first preselection is done by looking at phenotypic characters: height, bole straightness and health.

Three groups of characters are measured and assigned scores.

Group A: total height of the tree in m: $h/2$ (0–10 points); surface coefficient of the bole: $K_s = h \times c/200$, h being the height to the first branch in m, and c the circumference in cm (0–10); roughness of the bark (0–3); bark cracks (0–4); form coefficient of the tree: $K_c = 0.4\ (V \times R)$, V being the verticality (from 5 points for 90° to 0 points for 75° or less) and R the straightness (from 5 points for straight bole to 0 points for badly curved). This character has usually been measured in a subjective way by other workers, *eg*, Squillace *et al* (1975), Ledig and Whitmore (1981) and Williams and Lambeth (1989), but we measured it with a device which allows objective measurements (García-Valdecantos and Catalán, unpublished); damage and injuries (0–2); and acorn yield (0–10).

Group B: weight of the cork produced (0–10); roughness of the bark after debarking (0–3); and health (0–8).

Group C: quality of the cork produced, measured in a subjective way (0–30).

After the first cycle is completed (in 1996), the data obtained will be analyzed statistically, in order to select the most significant characters. Then, the 64 trees with the best scores will be selected for progeny testing.

RESULTS

At present, it is impossible to provide definitive results. However, analysis of the data obtained in 1987 and 1988 sheds some light on the suitability of the method. The data were collected in 2 of the poorer parts of La Almoraima (table I).

It is interesting to compare these data with the single character of greatest importance: the weight of the cork produced (in kg/tree) (table II).

DISCUSSION

Even if the group A characters are given too much weight (maximum possible is 49 points), their importance suggests that a slight reduction may be desirable. The relative weights of groups B and C seem to be fairly realistic. The lack of information about future development of the market for different qualities could make it necessary to increase the points given to B and C in proportion to the reduction of group A.

Table II. Average weight (kg/tree ± SD) of cork for all measured, and selected trees.

Year	*Average wt of cork for*	
	Trees measured	*Trees selected*
1987	104.4 ± 55.8	164.2 ± 47.5
1988	67.8 ± 38.4	84.3 ± 30.2

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