

Sustainable Management Models Applied to Chestnut Coppice in The North-East of Portugal

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Introduction

The sweet chestnut (*Castanea sativa* Mill.) is a valuable species in Portugal, namely in North-east region, both for fruit and timber production that is important to value because it plays an important economical role in this disadvantaged territory. So, a differentiation of management options is needed as an alternative to the traditional practices. The aim of this research is to study sustainable management models to produce timber with small, medium and large dimensions. These management models are compared with the situation "without intervention" which is the most frequent situation of the coppices in this region. At sixteen years old, we analyse the growth under different management models as well as the potentiality of the shoots to produce quality timber.

Materials and Methods

A trial with 4 permanent plots was established in a chestnut coppice in 1994, two years after the conversion of an old high forest stand, located in this region (41° 30' 41"N, 7° 37' 15" W). Three silvicultural management models were applied based on Bourgeois (1992) and adapted to our site conditions.

The treatments are: T1= Model 1: small dimensions; T2 = Model 2: medium dimensions; T3 = Control: coppice without intervention; T4 = Model 3: Large dimensions.

The shoots in the treatments are evaluated qualitatively using a graduation 1 to 5 in each parameter (1 corresponding to the worst and 5 to the best). The following parameters are considered:

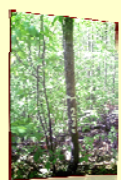
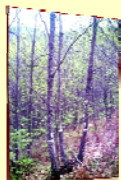
- St - Stratification of the canopy (Kraft Classification)
- V - Vigour
- F1 - Stem form (cilindricity)
- F2 - Stem form (curvature)
- F3 - Stem form (base curvature in the shoot)
- Br - Insertion height of medium and thick branches
- TQ1 - Timber quality of the first log (2.25 m)
- TQ2 - Timber quality of the second log of 2.25 long (up to 4.50 m).

A PCA and RDA multivariate analysis is performed using qualitative variables of shoots.

The growth in different treatments was analysed.

♦ Silvicultural models applied to the chestnut coppice

	Cultural Operations	Height of dominant shoot in stool (m)	Age (years)	Shoots per hectare before thinning	Shoots per hectare after thinning	Rotation age (years)
Model 1 Small dimensions	1 Thinning	6-9	5-9	9000-15000	3000-3500	25-30
	2 Thinning	10-12	10-14	3000	1500	
Model 2 Medium dimensions	1 Thinning	6-9	7-9	9000-13000	2000-2500	30-35
	2 Thinning	11-12	11-13	2000-2500	600-800	
Model 3 Large dimensions		Height (m)	Age (years)	Cultural Operations		40-50
		10-12	10-13	Selection of 150 to 250 future shoots ha ⁻¹		



T1 - Model 1

T2 - Model 2

T3 - Control

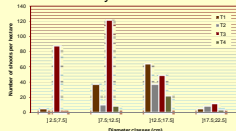
T4 - Model 3

References

Bourgeois, C. 1992. Le chataignier un arbre, un bois. I.D.F., Paris.

Results

♦ Number of shoots in the different treatments by diameter classes



The treatment T4 presents a small number of shoots but with better quality for timber.

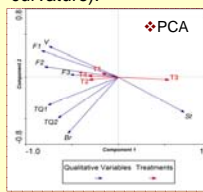


♦ Eigenvalues and loadings for the first three components

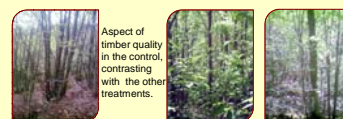
Components	C1	C2	C3
Eigenvalue	3.9630	1.2160	0.8554
Percent of explained variance	49.5	15.2	10.7
Cumulative Percent	49.5	64.7	75.4

Loadings	C1	C2	C3
St	-0.712	0.420	0.222
V	0.749	-0.359	-0.245
F1	0.830	-0.308	-0.083
F2	0.799	-0.124	0.156
F3	0.518	-0.031	0.803
TQ1	0.760	0.335	0.104
TQ2	0.651	0.488	-0.186
Br	0.546	0.671	-0.160

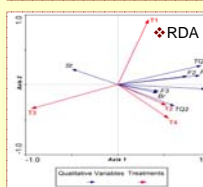
✓ The first three components explain more than 70% of total variance in the data. The first component (C1) is a general contrast between good and bad qualitative characteristics of the timber produced. Component 2 is mostly related to Br (insertion height of branches). Component 3 is mainly related to the variable F3 (base curvature).



✓ In plotting the first two PCA components in an ordination diagram it is clear that the treatment with a higher number of standing shoots, corresponding to the control (T3) contrasts with all the other treatments which are associated with better timber quality.



✓ A similar ordination pattern is observed when we force the axis to be linearly related with the treatments by using Redundancy Analysis (RDA).



Conclusions

✓ The results show that the best timber quality of the shoots is associated to the treatments T2 and T4. The control "without intervention" is associated to a stratified canopy due to high competition between shoots in this case. The quality of timber of the shoots is worse in the control (T3) in comparison to the others. These results demonstrate that the quality of timber is better and more valuable when the silvicultural management models are applied.

✓ This study proved that there are advantages for the landowners in applying these management models concerning timber quality and sustainability of the chestnut areas.

Acknowledgements

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