THE INFLUENCE OF CLIMATIC AND SILVICULTURAL FACTORS ON STEM CIRCUMFERENCE GROWTH OF HOLM OAK (*Quercus ilex* L. ssp. *ballota*) IN THE SOUTHWEST OF SPAIN

Reyes Alejano, Daniel Martín, Javier Vázquez, Raul Tapias

University of Huelva (Spain)

OBJECTIVES

The aims of this study are: i) to describe the average pattern of stem circumference growth of holm oak in open woodland forests (dehesas) during for 4 years (2004-2007), ii) analyzing the influence of climatic conditions and silvicultural treatments (pruning) on it. To this end, we conducted an experimental study at a plot in the province of Huelva (Southwestern Spain) where trees were subjected to traditional (light, moderate or heavy) pruning (see Alejano et al., 2008).

MATERIAL AND METHODS

Experimental plots

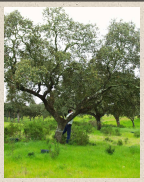
The province of Huelva

	SB plot
Area	2.7 ha
Density	36 trees/ha
Height	128 m
Weather	633 mm rainfall 18.6ºC mean annual temperature 2 months frost
Soils	Shale grauwacke 67 cm soil depth Regosols to luvisols
Understorey	Absence of bushes, herbaceous species (grazing and tillage of soil)
Main Uses	Fighting bulls

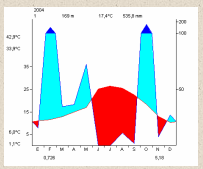
Main features of the plot

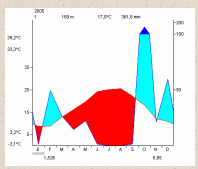
Tree Features	San Bartolomé plot (100 trees)		
	Min	Max	Average ± SD
Height (m)	4.5	9.5	6.54 ±1.08
Diameter (cm)	15.28	57.30	35.40 ± 7.23
Crown radius (m)	2.84	6.62	4.46 ± 1.07

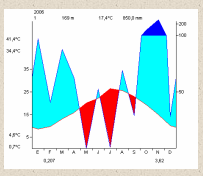
Main features of the trees

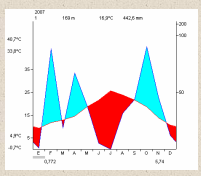


SB plot









Climodiagrams representing climatic data for every studied year (2004-2007) in San Bartolomé plot. The drier and colder year has been 2005, with a very strong summer drought and with scarse rainfall in spring. The rainier and warmer year has been 2006, with some rainfall even in summer.

Pruning treatments

Trees in the plot were subjected to traditional pruning at three different intensities (*viz.* light, moderate or heavy); some, however, were left unpruned and used as controls. Pruning was done in February 2003 in San Bartolomé in order to more accurately compare the effect of this practice aside the influence of the particular climatic conditions of the pruning year. All trees had been pruned before such a time; in the plot trees were also pruned in 1996 (seven years before 2003). The number of trees under each treatment was 25 in San Bartolomé (25 trees* 4 treatments = 100 trees per plot). Treatments were randomly assigned to trees.

Stem circumference growth measurement

Band dendrometers have been placed in the plot for radial growth measurement. 32 band dendrometers have been installed in SB plot, what means 8 trees with dendrometers per pruning treatment. The trees have been randomly selected between the 25 trees per treatment. Monthly measurements have been taken from Jun 2003 to December 2007 . Growth is always measured in mm.

RESULTS

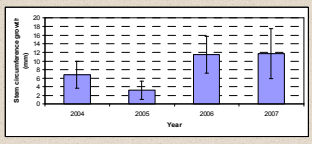


Fig. 1 Average radial growth per year in SB plot

Differences in growth depending on the year

Differences in the average annual growth per tree between years, can be appreciated in the figure 1. Using ANOVA analysis, significant differences (p=0.00) in average monthly radial growth between years have been found. The smaller growth has been measured in 2005, a year very dry (precipitation was 53–56% of the mean value for the period 1960-2005) and with heavy frosts in the first quarter, that could have led to bud freezing and to a considerably decreased xylem hydraulic conductivity (water potential in mid summer reached -3.70 MPa) (Alejano et al., 2008).

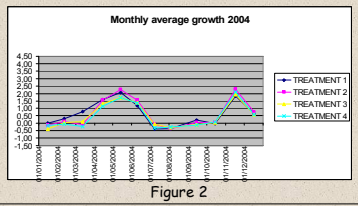


Figure 2

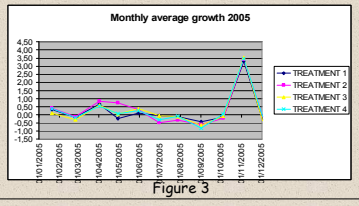


Figure 3

Growth and pruning treatment

We haven´t foun significant differences in monthly stem circumference growth depending on the pruning treatment applied (p= 0.575), although we can appreciate in figures 2 to 5 that the growths are lower for trees with heavy pruning and for non-pruned trees.

Growth peaks are showed is spring and autumn, except for 2005 when spring peak doesn't exist due to the coldness and dryness of that year. We want to stress the negative growths that have been found specially in the summer months in all the studied years, due to the typical summer drought of mediterranean climates.

Growth and climate

Average monthly radial growth evolution along the studied years (2003-2007) is shown in the figure 6 where it is compared with monthly rainfall. The figure shows us that the rainfall peaks meet with growing peaks, and there is a positive correlation (Pearson coefficient = 0.637) between theses two variables. We haven't found significant correlations between growth and temperature

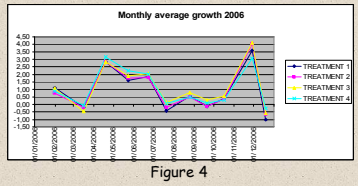


Figure 4

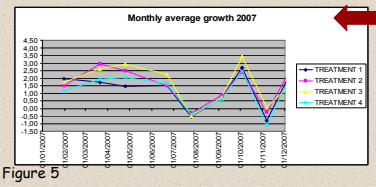


Figure 5

treatment 1, no- pruning; teart. 2, light pruning; treat. 3, moderate pruning; treat. 4, heavy pruning

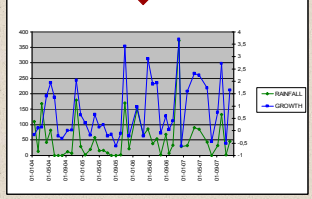


Figure 6. Average monthly radial growth per treatment for the studied period (2003-2007)

REFERENCES

Alejano R, Tapias R, Fernández M, Torres E, Alaejos J, Domingo J. Influence of pruning and the climatic conditions on acorn production in holm oak (*Quercus ilex* L.) dehesas in SW Spain. Annals of Forest Science 65 (2008) 209

ACKNOWLEDGEMENTS

This study was conducted within the framework of research projects CO1218, CO3192 AND po7rnm02688, funded by the Agriculture Council and Innovation, Science and Enterprise Council, of the Andalusian Regional Government, and Project AGL2002-02757, supported by MCyT. The authors wish to thank José Luis García Palacios for allowing them to lay out the San Bartolomé plot on his farm. Also, they are deeply indebted to the students of the University of Huelva who collaborated in the study.