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in

Oliveira M.M. (ed.), Cordeiro V. (ed.).
XIII GREMPA Meeting on Almonds and Pistachios

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 63

2005

pages 71-74

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=5600012>

To cite this article / Pour citer cet article

Arquero O., Lovera M., Salguero A., Morales J., Navarro A. **Tree growth descriptors of main late-flowering almond varieties in the Mediterranean basin.** In : Oliveira M.M. (ed.), Cordeiro V. (ed.). *XIII GREMPA Meeting on Almonds and Pistachios*. Zaragoza : CIHEAM, 2005. p. 71-74 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 63)



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Tree growth descriptors of main late-flowering almond varieties in the Mediterranean basin

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SUMMARY – This work studies vegetative habits at the end of the first growing year of almond trees that were not pruned. The following 12 late-flowering varieties were studied: 6 Spanish ('Antoñeta', 'Cambra', 'Glorieta', 'Guara', 'Marta' and 'Masbovera'), 3 Italian ('Cristomorto', 'Supernova' and 'Tuono') and 3 French ('Ferraduel', 'Ferragnès' and 'Lauranne'). The parameters analysed were growth habit, trunk diameter, height and width of the canopy and the ratio between canopy height and width. Most of the varieties showed a spreading growth habit. Only 'Antoñeta' was classified as weeping. Differences on vigour among the studied varieties were not relevant, only 'Marta' presents great vigour compared to the other varieties.

Key words: Almond, *Prunus dulcis*, late-flowering almond varieties, growth habit, tree vigour.

RESUME – "Descripteurs de croissance de l'arbre chez les principales variétés d'amandiers à floraison tardive dans le bassin méditerranéen". Ce travail examine les modes végétatifs des amandiers, à la fin de la première année de croissance, sans aucune taille. Les 12 variétés suivantes à floraison tardive ont été étudiées : 6 espagnoles ('Antoñeta', 'Cambra', 'Glorieta', 'Guara', 'Marta' and 'Masbovera') 3 italiennes ('Cristomorto', 'Supernova' and 'Tuono'), et 3 françaises ('Ferraduel', 'Ferragnès' and 'Lauranne'). Les paramètres analysés étaient les tendances de croissance, le diamètre du tronc, la hauteur et la largeur de la canopée et le ratio entre hauteur et largeur de la canopée. La plupart des variétés montraient des tendances à une croissance éparse. Uniquement 'Antoñeta' était classifiée comme arbre pleureur. On n'a pas trouvé de différences importantes concernant la vigueur parmi les variétés étudiées, sauf que 'Marta' a présenté une grande vigueur par rapport aux autres variétés.

Mots-clés : Amandier, *Prunus dulcis*, variétés d'amandiers à floraison tardive, tendances de croissance, vigueur de l'arbre.

Introduction

Nowadays, there is a dominant trend to implant late-flowering and self-compatible almond varieties. These varieties suffer less harvest losses from frosts and their pollination is not so much determined by the presence of pollination varieties or bees.

Growth patterns of a variety are of paramount importance because of their determinant influence on cultural techniques (mainly tree spacing, training and pruning systems) that will determine production level as well as crop productions costs.

There are several researches on the different varieties growth habit but all of them were carried out on adult trees that were previously pruned. However, this work was carried out on one-year-old trees that were not previously pruned, therefore, allowing each variety to have its own natural growth habit.

Materials and methods

The work was carried out in a almond varieties orchard at CIFA "Alameda del Obispo" in Córdoba (Spain), at tree spacing of 7x2 m, under drip irrigation, in deep soil and very suitable climatic

conditions. This trial was made with one-year-old plants, planted on January 2002 and selecting 3 main branches of the tree on May 2002, to obtain a vase-shaped tree. All the trunk buds appeared during the vegetative period were removed. These primary scaffolds were not pruned at all. Data collection was made on December 2002, after vegetative growth was finished.

The following 12 late-flowering varieties were studied: 6 Spanish ('Antoñeta', 'Cambra', 'Glorieta', 'Guara', 'Marta' and 'Masbovera'); 3 Italian ('Cristomorto', 'Supernova' and 'Tuono'); and 3 French ('Ferraduel', 'Ferragnès' and 'Lauranne'). All the cultivars were grafted on peach x almond hybrid rootstock, GF-677.

The trial was made on 6 trees or repetitions by variety. The following parameters were analysed:

(i) Tree growth habit. It was assessed by visual evaluation, establishing five types: extremely upright, upright, spreading, drooping and weeping (Fig. 1).

(ii) Tree vigour. It was quantified by the trunk diameter measure, at 30 cm high from the ground. Height and width of the canopy and relation between them were also measured.

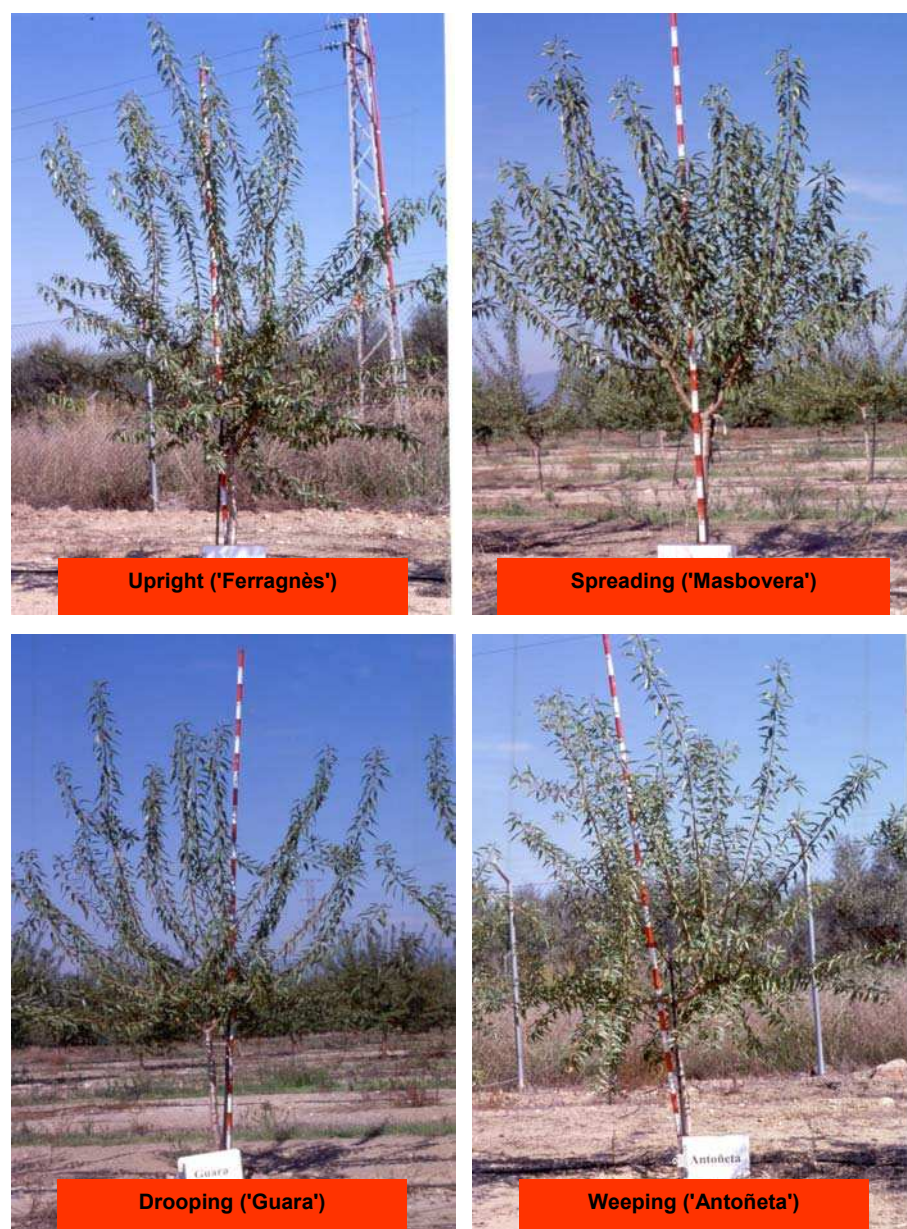


Fig. 1. Growth habits types.

Results

Tree growth habit

As Table 1 reflects, most varieties showed a spreading growth habit. 'Ferraduel', 'Ferragnès' and 'Marta' were classified as upright; 'Cambra', 'Guara' and 'Lauranne' as drooping; and 'Antoñeta' was the only one variety showing weeping (Fig. 1).

Table 1. Varieties classification attending to their growth habit

Upright	Spreading	Drooping	Weeping
'Ferraduel'	'Cristomorto'	'Cambra'	'Antoñeta'
'Ferragnès'	'Glorieta'	'Guara'	
'Marta'	'Masbovera'	'Lauranne'	
	'Supernova'		
	'Tuono'		

Tree vigour

'Marta', 'Ferraduel', 'Tuono' and 'Ferragnès' varieties showed the longest trunk diameters whereas 'Lauranne' got the lowest value. Attending to the height/width ratio 'Ferragnès', 'Ferraduel', 'Marta' and 'Tuono' had the highest value and 'Lauranne' got the lowest value again (Table 2).

Table 2. Trunk diameters and canopy dimensions

Cultivar	Trunk diameter (cm)	Canopy		
		Height (m)	Width (m)	Height / width
'Antoñeta'	3.5 ± 0.06	1.7 ± 0.06	2.0 ± 0.06	0.88 ± 0.02
'Cambra'	3.6 ± 0.16	1.6 ± 0.05	1.8 ± 0.04	0.89 ± 0.04
'Cristomorto'	3.7 ± 0.05	1.6 ± 0.06	1.8 ± 0.08	0.88 ± 0.02
'Ferraduel'	4.3 ± 0.07	1.9 ± 0.06	1.6 ± 0.04	1.19 ± 0.05
'Ferragnès'	4.1 ± 0.01	2.2 ± 0.05	1.7 ± 0.02	1.25 ± 0.05
'Glorieta'	4.0 ± 0.23	1.4 ± 0.15	1.6 ± 0.11	0.87 ± 0.04
'Guara'	3.9 ± 0.11	1.5 ± 0.06	1.7 ± 0.08	0.86 ± 0.02
'Lauranne'	3.0 ± 0.14	1.2 ± 0.07	1.6 ± 0.05	0.75 ± 0.03
'Marta'	4.6 ± 0.16	1.6 ± 0.04	1.4 ± 0.04	1.12 ± 0.02
'Masbovera'	3.7 ± 0.08	1.3 ± 0.07	1.5 ± 0.02	0.89 ± 0.05
'Supernova'	4.0 ± 0.09	1.6 ± 0.06	1.5 ± 0.07	1.06 ± 0.05
'Tuono'	4.2 ± 0.13	1.7 ± 0.06	1.8 ± 0.10	0.94 ± 0.03

Mean values ± standard error.

Comparing the results obtained for the height/width ratio (Table 2) with the growth habits results (Table 1), it can be deduced that the varieties of most upright growth habits also showed a higher value of the height/width ratio.

Conclusions

Most Spanish almonds varieties have spreading growth habit. Varieties of more upright growth habit ('Ferraduel', 'Ferragnès' and 'Marta') usually have longer trunk diameter as well as higher height/width ratio of the canopy.

Acknowledgements

This work has been financed by the Dirección General de Investigación Agraria (Junta de Andalucía, Spain), with the cooperation of Almendra del Sur, Crisol, Mañán and Almeriplant.