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Abstract. Almond growing is increasingly extending to areas where the species is not truly suited to, despite favourable climate. The most common problems in many Mediterranean countries include replanting, limestone chlorosis, and soilborne pests and diseases such as *Meloidogyne* root-knot nematodes and *Armillaria mellea* root-knot. Several almond x peach hybrids have shown good performance as rootstocks for different stone fruit species, including almond. The first commercially known hybrid was 'GF- and it is still used worldwide and demanded at present for almond growing. Eight almond x peach hybrids from the CITA breeding programme were evaluated in a rootstock trial located at CITA. They were grafted with the almond selection 'B-2- in 1994 and planted in 1995 at a distance of 5 ×, using 'GF- and 'Nemared' as controls. The trunk cross sectional area (TCSA) and productivity were evaluated. The results showed a differential performance for production and vigour between the 'GF- and 'Nemared' as compared to the GxN series. Some differences were also observed for vigour among the three already commercially propagated 'Garnem' 'Felinem' and 'Monegro'.

Keywords. Agronomic behaviour – Breeding – *Prunus amygdalus* – Vigour – Production.

Essai de huit porte-greffe interespecific hybrides GxN en amandier

Résumé. *Le culture de l'amandier est de plus en plus étendue aux zones où il n'est pas vraiment adapté, malgré leur climat favorable. Les problèmes les plus communs dans de nombreux pays méditerranéens comprennent replantation, chlorose ferrique, et les ravageurs et les maladies du sol telles que* Meloidogyne, *nématodes à galles et* Armillaria mellea *root-knot. Plusieurs hybrides amandier x pêcher ont montré une bonne performance en tant que porte-greffe pour les différentes espèces de fruits à noyau, y compris l'amandier. Le premier hybride commercialisé était 'GF-677' et il est encore utilisé dans le monde entier pour le culture de l´amandier. Huit hybrides amandier x pêcher du programme d'amélioration génétique du CITA ont été évaluées dans un essai de porte-greffe situé au CITA, Saragosse, Espagne. Ils ont été greffés avec la sélection d'amandier 'B-2-5 'en 1994 et plantés en 1995 à une distance de 5 x, en utilisant 'GF- et 'Nemared' en tant que témoins. La superficie de coupe transversale du tronc et la productivité ont été évalués. Les résultats ont montré une performance différentielle pour la production et la vigueur entre le 'GF- et 'Nemared' par rapport à la série GxN. Quelques différences ont également été observées pour la vigueur parmi les porte-greffes GxN les plus utilisés, 'Garnem' 'Felinem' et 'Monegro'.*

Mots-clés. *Comportement agronomique – Amélioration génétique* – Prunus amygdalus – *Vigueur – Production.*

I – Introduction

Almond [*Prunus amygdalus* Batsch; syn. *P. dulcis* (Mill.) D.A. Webb] is the most important tree nut crop in terms of production in the Mediterranean countries (FAOSTAT, 2015). This crop, although well adapted to the Mediterranean climate, is sometimes limited by many soil-related problems: replanting, limestone chlorosis, and soilborne pests and diseases such as *Meloidogyne* root-knot nematodes and *Armillaria mellea* root rot, which are common in this region. For these reasons, traditional rootstocks should be replaced by new ones in order to provide a good adaptation to each soil condition, thus ensuring a commercial production. Peach x almond hybrid rootstocks have been

widely utilized in during the last decades. Among the interspecific hybrids, the mostly used is 'GF– due to its good adaptation to calcareous soils. However, this hybrid is sensitive to root knot nematodes (RKN). Other interspecific hybrids from the CITA breeding program are already commercially propagated, such as Felinem', 'Garnem' and 'Monegro', from the 'Garfi' x 'Nemared' cross, aimed to introduce RKN resistance from 'Nemared'. These interspecific hybrids were characterized by a good adaptability to poor soils and easy propagation by hardwood cuttings and in vitro (Felipe, 2009*).* These three hybrids are red-leafed and have shown a better performance in peach replanting conditions than 'GF- (Gomez-Aparisi *et al.*, 2000). Thus, in order to evaluate the agronomic performance of other genotypes of the GxN hybrids with almond, we studied eight different rootstocks grafted with an almond selection in a trial at CITA, during ten years.

II – Materials and methods

The experiment was carried out in a plot located at CITA. Six almond x peach hybrids ('GN1', 'GN2', 'GN14', 'Garnem', 'Felinem' and 'Monegro' from the CITA breeding program) were grafted with the almond selection 'B-5- in 1994 and planted in 1995 at a planting distance of 5x5m, and evaluated from 1998 to 2006. 'GF- and 'Nemared' rootstocks were used as controls.

The experimental design was a randomized complete block with 9 to 7 single tree replications for each rootstock.

The data collected yearly per tree were trunk diameter growth measured above the graft union (cm) and production per tree (kg/tree). Trunk cross sectional area, TSCA (cm^2), was also calculated.

The data were subjected to a one-way analysis of variance (ANOVA) with SPSS software. The means were separated using 's post-hoc test ($p \leq 0.05$).

III – Results and discussion

The vegetative growth expressed as TSCA showed that the GxN hybrids had a significantly higher vigour than 'GF- and 'Nemared' (Fig. 1). All of them induced a positive lineal growth along the years (Fig. 1). Comparing the TCSA values among the GxN series, there were no differences until 2005, when 'GN- showed the highest area, followed by 'GN-, 'Garnem' and 'Monegro'. In 2006, 'GN- maintained the highest vigour in comparison to the others, followed by 'Garnem'.

During 2000, 2002 and 2005, significant differences were observed in production among all rootstocks. In 2003, production was low due to spring temperatures and in 2004 all genotypes were chilling injured (Fig. 2). When the production of 'GF- and 'Nemared' were compared to the GxN hybrids, no significant differences were observed, except for 'GN- which showed the highest production in 2005, however, this hybrid showed the lowest production, despite its vigorous vegetative growth during that year (Fig. 1). 'Garnem', 'Felimen' and 'Monegro' showed similar values among them, but higher than 'Nemared' along the years (Fig. 2). The general trend followed by the GxN clones from 2002 to 2006 demonstrates these three hybrids are a good choice for re-planting instead 'GF-677' due to their high vigour and root knot nematodes resistance for Mediterranean conditions as well as the high productive efficiency of these genotypes.

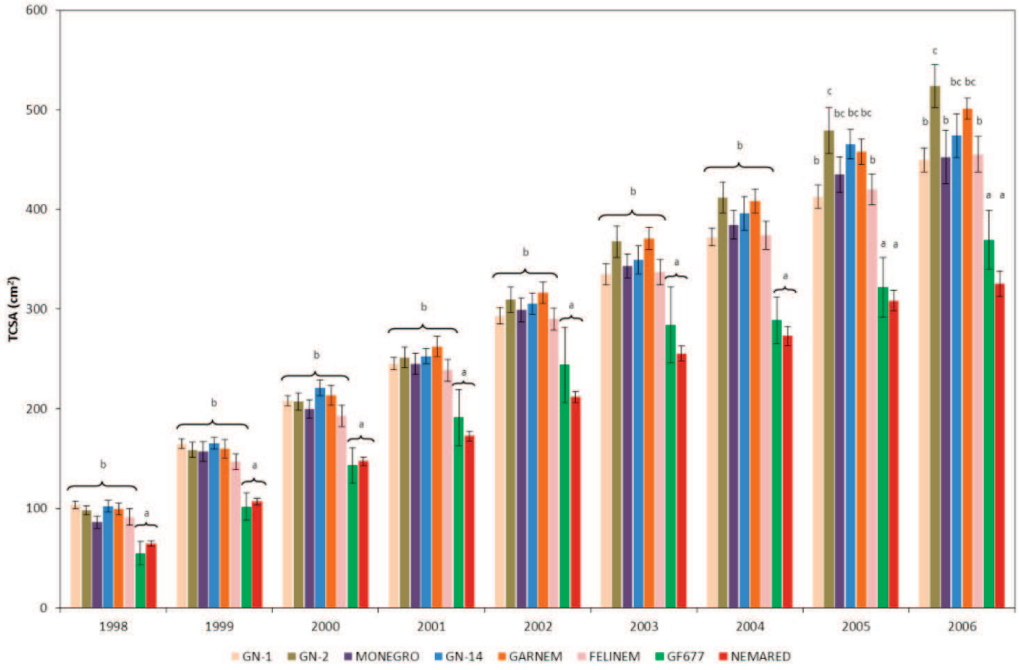

Fig. 1. Trunk cross-sectional area (TCSA) of almond selection 'B-5-2' grafted onto eight rootstocks along the years. Same letter values indicate a no significant difference ($p \leq 0.05$) following Duncan's post hoc test. Error bars means the standard error from the mean.

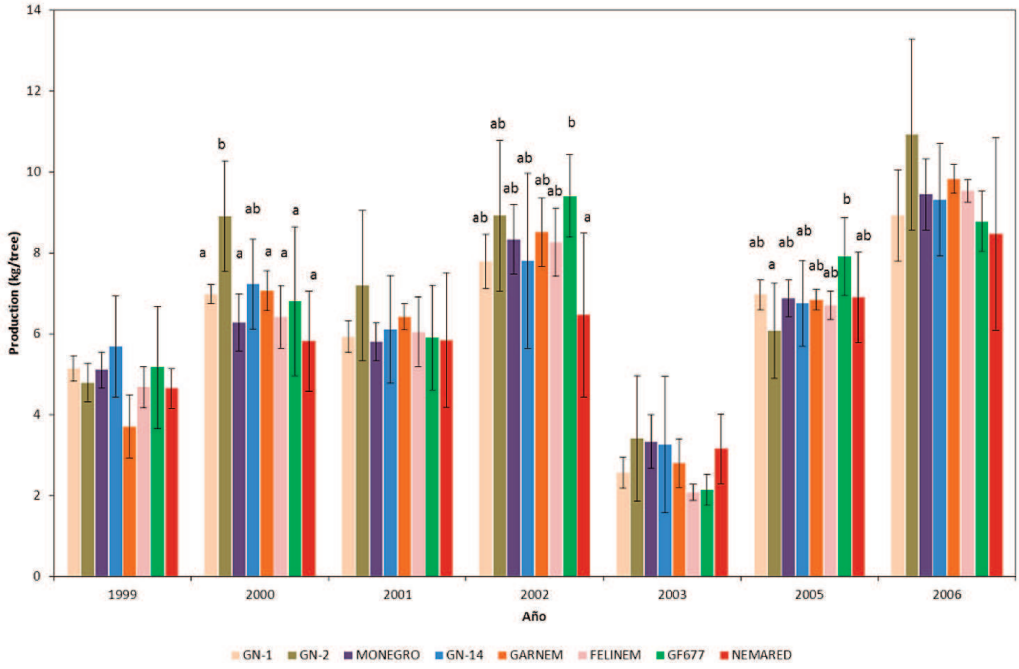

Fig. 2. Production per tree (kg/tree) of almond selection 'B-5-2' grafted onto eight rootstocks along the years. Same letter values and years without letter indicate a no significant difference ($p \leq 0.05$) following Duncan's post hoc test. Error bars means the standard error from the mean.

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