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Caboni E., Monastra F.

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New selections of almond, putative rootstocks for peach and almond

E. Caboni and F. Monastra
Istituto Sperimentale per la Frutticoltura,
Via di Fioranello 52, 00040 Rome, Italy

SUMMARY - Seven almond seedlings (M49, M50, M51, M52, M53, M54 and M55) are under evaluation as rootstocks for peach and almond in the Fruit Tree Institute (ISF) of Rome. 3 (M50, M51 and M55) of the 7 genotypes were used for grafting the peach cultivar Emilia, the nectarine cultivar Nectaross and the following almond cultivars: Supernova, Ferragnes, Tuono and Lauranne. The 3 genotypes showed a good grafting compatibility with both peach and nectarine cultivars. From the results on tree vigour, evaluated measuring the trunk cross-section, it was evident that M50 induced the most vigourous plants, while M51 and M55 induced less vigourous plants. From the rooting results, obtained *in vitro*, it was evident that M51 has the higher rooting capacity and in this clone it was possible to obtain 90% of rooted explants, without callus formation, using IAA; the most suitable auxin for all the other genotypes was IBA and it was possible to obtain satisfactory results for all the genotypes. M50 rooted less than all the others, in fact, 22% was the maximum rooting percentage obtained. More agronomical evaluations are now in progress in the field, using *in vitro* cloned material, to reach a complete characterization of all the genotypes.

Key words: Grafting compatibility, *in vitro* rooting, plant vigour, rootstock.

RESUME - *"Nouvelles sélections d'amandier comme porte-greffes pour pêcher et amandier". Nous avons mis à l'étude des semis d'amandier (M49, M50, M51, M52, M53, M54, M55) comme porte-greffes du pêcher et de l'amandier. Trois (M50, M51 et M55) de ces sept différents génotypes ont été utilisés comme porte-greffes des variétés de pêcher Emilia, de nectarine Nectaross et d'amandier Ferragnes, Lauranne, Supernova et Tuono. Nous avons observé pour les trois génotypes une bonne compatibilité de greffe avec le pêcher et la nectarine. Les arbres greffés sur M50 sont plus vigoureux que les arbres greffés sur M51 et M55. Nous avons aussi observé que le clone M51 a une très bonne capacité de prodution de racines* in vitro *avec IAA et on a constaté qu'il est possible d'obtenir jusqu'à 90% de plants enracinés ; l'auxine la plus adéquate pour les autres genotypes est IBA. M50 est le génotype qui donne la plus petite quantité d'enracinement, seulement 22%. Nous menons, en outre, dans différents vergers, l'étude de ces porte-greffes, obtenus* in vitro*, pour compléter les observations agronomiques.*

Mots-clés : *Affinité, comportement agronomique, porte-greffes, propagation* in vitro.

Introduction

Almond seedlings are suitable rootstocks for almond and peach cultivars; the choice of this rootstock for almond allows satisfactory yield in various soil conditions, but it is particularly required where some pedoclimatic problems are present, such as high calcareous chlorosis inducing soil and unirrigated area. Grafting peach on almond, more resistant to physical and biotic difficulties, is also feasible when the environmental conditions are not recommended for other rootstocks (Morettini, 1963; Scaramuzzi and Fiorino, 1981; Barbera *et al.,* 1994; Maja de Souso and Gomez Pereira, 1994).

The utilization of almond as rootstocks is limited by the scarce availability of good clones. Since most of the almond rootstocks used are seedling populations showing non homogenous characters, this problem obstacle a more diffused utilization.

The availability of almond clonal rootstocks with good horticultural characteristic and satisfactory rooting ability could provide a resolution to this problem. In fact, healthy clonal selections show a more regular behaviour and also their compatibility with peach cultivars is higher. Cloned material can be obtained through the *in vitro* culture, as widely reported for several other fruit species, and with this technique is also possible to induce satisfactory rooting response in difficult to root woody species, like almond, which can be hardly propagated by traditional techniques like stem cutting (Caboni and Damiano, 1994).

In this work, we evaluated 7 almond genotypes, in the field, for the "horticultural performance" for their utilization as rootstocks for almond and peach, and *in vitro*, for their rooting ability.

Material and methods

Material

Seven almond (*Prunus amygdalus*, Batsch) seedlings (M49, M50, M51, M52, M53, M54, M55) have been evaluated in the last years as rootstocks for peach and almond in the Fruit Tree Institute (ISF) of Rome. These seedlings were chosen by Monastra among numerous others in the "Neptunia" farm of Eboli (Campania region-Southern Italy) after observation of the successful results obtained grafting the peach cultivar Merril Gem Free on these genotypes. In fact, the plants grafted on the chosen genotypes had shown good affinity and grew vigorously.

Field evaluation

M50, M51 were used in the experimental farm of Capocotta (Rome) as peach rootstocks (cultivar Emilia), M51 and M55 as nectarine (cultivar Nectaross) and almond (cultivars Supernova, Ferragnes, Tuono and Lauranne) rootstocks. The well known peach x almond rootstock GF677 was used as control. In an other experiment, located in the Fiorano experimental farm (Roma), M51 was compared to GF677, PSA5 and PSB2, using Emilia as peach cultivar and Supernova as almond cultivar. The average rainfall of the areas is 900 mm per year and the soil has a clay loam texture in Fiorano and a sandy clay loam one in Capocotta. In both the experiment, trees were spaced at 5 x 5 m and regularly cultivated and irrigated. The experiment was set up in a randomized block design with 3 replicates and 10 plants per treatment. Trunk sections were measured at 20 cm above the grafting point. Data herein reported, concern 2 year collecting, were subjected to Anova and Tukey's test.

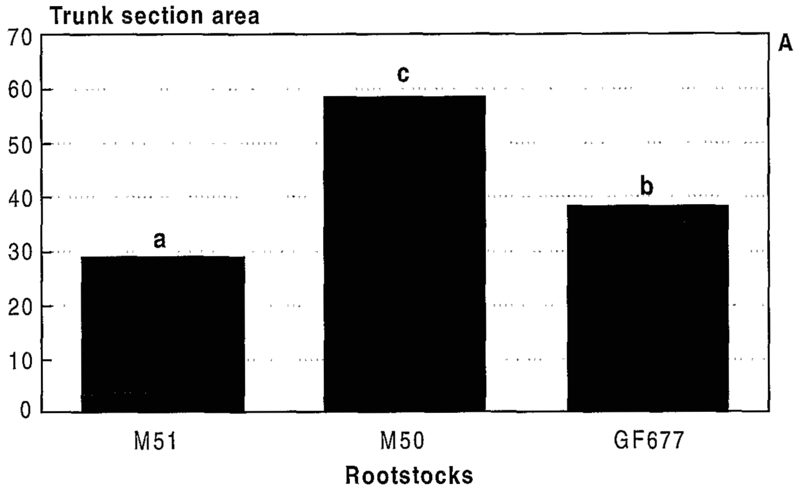
In vitro rooting evaluation

Microcuttings, 1.5 to 2.0 cm in length, were excised from 15 day old cultures of the 7 genotypes and transferred, for 5 or 10 days, into a root inducing medium consisting of bi-distilled water, 4.9 μM indolebutyric acid (IBA), naphtalenacetic acid (NAA), indoleacetic acid (IAA) or without auxin (HFM), sucrose (43.8 mM), and maintained 10 days in dark or in light (only with the IBA treatment). At the end of the induction period, the explants were transferred to an other medium, the expression medium consisting in MS salts and vitamins (Murashige and Skoog, 1962), 87.6 μM sucrose and solidified with 7 gl^{-1} Rudy Point (Eurobase, Milan-Italy) agar. The pH was adjusted to 5.6 in both media, prior autoclaving. Microcuttings were maintained for 10 days in dark, then transferred to the light. When transferred to the light, cultures were maintained in a 16 h photoperiod under a cool white light, density of 30 $\mu E\ m^{-2}\ s^{-1}$, provided by Osram I40 white fluorescent tubes at 21±1°C.

Rooting percentage was recorded 30 days after the transferring. Triplicate treatments, consisting of 10 plants each, were used. The experiment was repeated twice. Percentage scores of explants forming roots were transformed with the formula arcsin $\sqrt{\%+1}$ before calculating standard error.

Results and discussion

A good grafting compatibility with both the peach and the nectarine cultivars was showed by M51, M50 and M55 clones, according to the preliminary results previously obtained (Monastra *et al.*, 1993). It was evident that M50 induced higher vigour than M51 on Emilia peach, while M51 induced less vigourous plants even than the control (GF677) (Fig. 1A). Furthermore, M55 and M51 induced less vigour than GF677 in the nectarine Nectaross and in all the almond cultivar tested (Figs 1B and 2). M51 compared to PSA5 and PSB2 showed smaller trunk sections, when it was used as rootstock for Emilia, while induced higher vigour than PSA5 and not significant different from PSB2 when grafted with Supernova was grafted on them (Figs 3 and 4).



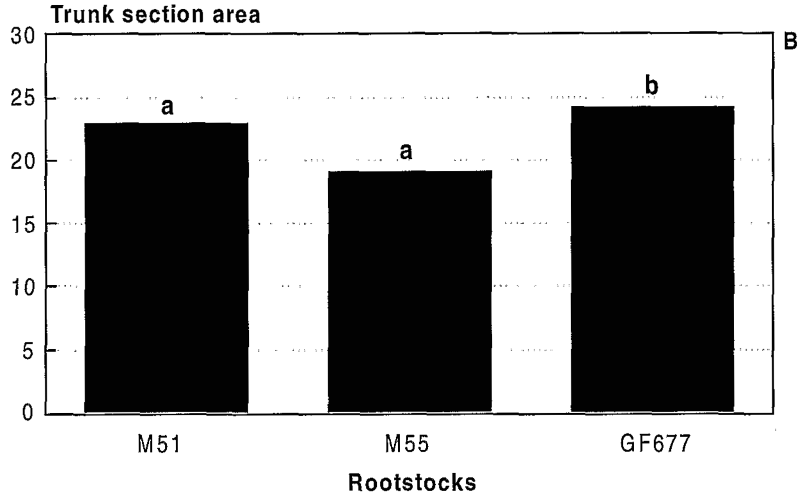


Fig. 1. Influence of the rootstocks on the vigour of the peach cultivar Emilia (A) and of the nectarine cultivar Nectaross (B). Bars with common letters are not significantly different at 5% level.

From the results (Table 1) of our *in vitro* evaluation of these genotype rootability using various auxins, it was evident that M51 has the higher root formation capacity, as already shown in *in vivo* (Nicotra and Pellegrini, 1989) experiment, and that in this clone it is possible to obtain 90% of rooting using 4.9 μM IAA in the light; NAA was also more effective than IBA but it induced also abundant callus formation. Furthermore, this genotype and M55 rooted also in the HFM. The most suitable auxin for all the other genotypes was IBA; in fact, when NAA was as effective as IBA, it was induced also callus formation. From data of Table 2 it is evident that the dark treatment induced higher root formation in all the genotype except in M51. Longer IBA treatment did not affect the rooting response in most of the genotypes and it was even inhibiting in M54, this data confirm that the presence of auxin in the medium is necessary only in the early phase of rooting also in almond as reported for other species (De Klerk and Ter Brugge, 1992). Only in M55 a longer IBA treatment was more effective in inducing higher rooting response. The rooted explants were successfully acclimatized.

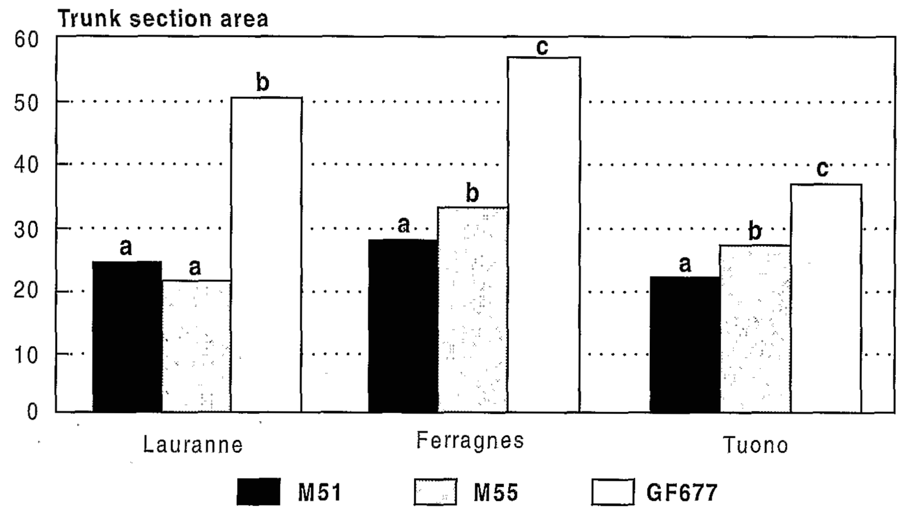


Fig. 2. Influence of the M51 and M55 rootstocks on the vigour of almond cultivars. Bars with common letters are not significantly different at 5% level.

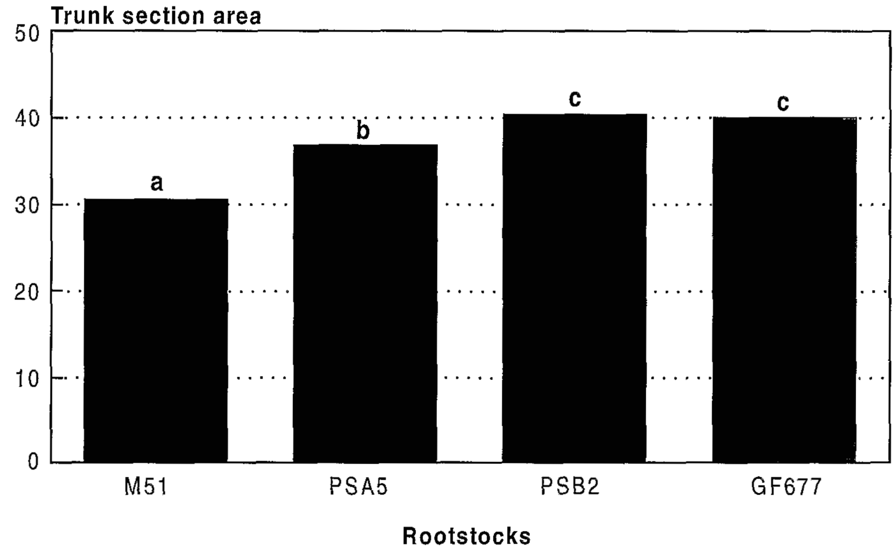


Fig. 3. Comparison of the effect of M51 with various rootstocks on the vigour of the peach cultivar Emilia. Bars with common letters are not significantly different at 5% level.

Conclusions

From our preliminary results, it could be inferred that some of these new almond selections seem to be very promising as rootstocks for peach and almond for their effect in reducing the plant size and for all of them it was possible to obtain satisfactory rooting results for all the genotypes acting on chemical and physical factors as already reported in the very few references available for this topic in other genotypes (Rugini and Verma, 1983; Caboni and Damiano, 1994). Only M50 rooted less than all the others, in fact, 22.1% was the maximum rooting percentage obtained, but other chemicals factors are now been testing to improve this response.

More agronomical evaluations are also now in progress in the fields in different countries, using *in vitro* cloned material, to reach a complete characterization of all the genotypes with particular attention to their response to limiting soil condition.

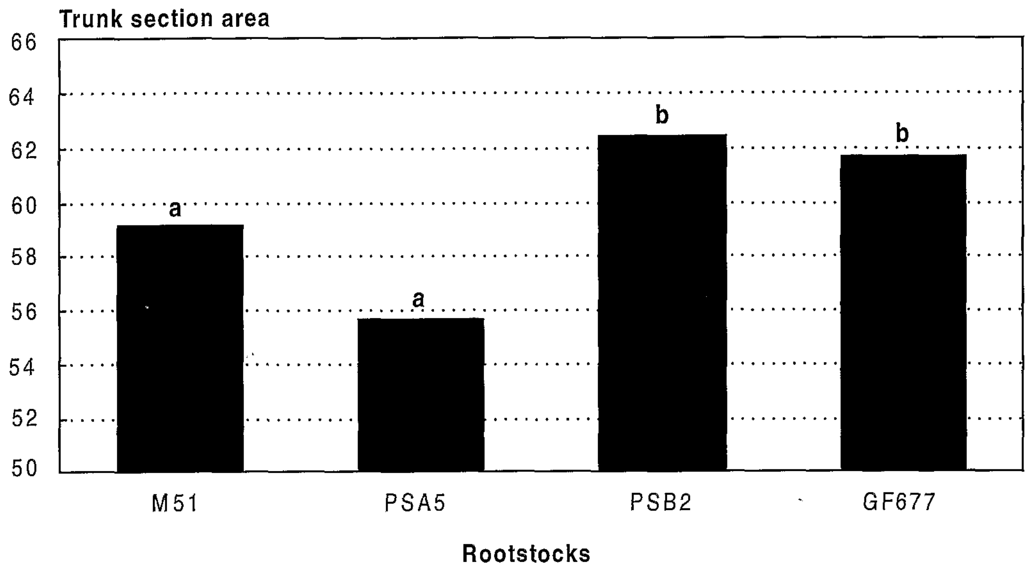


Fig. 4. Comparison of the effect of M51 with various rootstocks (PSA5, PSB2 and GF677) on the vigour of the peach cultivar Emilia. Bars with common letters are not significantly different at 5% level.

Table 1. Rooting percentage of almond genotypes (GN) treated with 3 different auxins (4.9 μMIAA, IBA or NAA) and without hormone (HFM), (SE <10%)

GN	HFM	IAA	IBA	NAA
M49	0	14.2	36.8	33.0
M50	0	14.3	22.1	15.0
M51	15.5	90.0	60.0	90.0
M52	0	14.2	42.0	40.0
M53	0	39.2	57.1	39.2
M54	0	25.8	61.7	37.5
M55	9.0	45.0	68.8	45.0

Table 2. Rooting percentage of almond genotypes (GN) treated with 4.9 μMIBA and maintained for 10 days in dark or light (SE <10%)

GN	Light		Dark (10 days)	
	5 d†	10 d	5 d	10 d
M49	5.1	6.3	35.8	36.8
M50	0	0	21.5	22.1
M51	70.0	68.9	68.0	60.0
M52	3.2	6.7	38.8	42.1
M53	16.4	19.3	64.2	57.1
M54	45.0	21.9	64.3	41.7
M55	50.8	56.8	66.2	85.8

†Days of auxin treatment

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