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EVALUAREA ÎN PEPINIERĂ A UNOR PORTALTOI PENTRU SPECIILE PIERSIC - NECTARIN, CAIS ȘI MIGDAL

ASSESSMENT OF SOME PEACH-NECTARINE, APRICOT AND ALMOND ROOTSTOCKS IN NURSERY

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Abstract

During 2019-2021 periodesomeautochthonousrootstocks of stonefruitwerestudied in at RIFG Pitești nursery: for peach and nectarine 'Adaptabil' and 'B83/8', for apricot, 'Apricor', 'Baroc', 'RoP8803001' and 'RoP8802011', for almond 'Miroper' and 'Aidared'. There were recorded: production of unrooted cuttings in mother plantation, rooting capacity using softwood cuttings, rate of rooted plants in first field of nursery and variety-rootstock interaction in second field of nursery. Besides 'Adaptabil', 'Baroc' and 'Miroper' new selections 'RoP8803001' and 'Aidared' proved good performances to be promoted in the next step: orchard behavior.

Cuvinte cheie: portaltoi, butași semilemnificați, soi, pepinieră.
Key words: rootstocks, softwoodcuttings, variety, nursery.

1. Introduction

The majority of peach rootstocks worldwide come from *Prunus persica*. In Europe and some regions of North America and South Africa, *P. persica* has been partially replaced by interspecific hybrids and plum species. The parents used in interspecific hybridizations are *Prunus persica, Prunus cerasifera, Prunus dulcis (Prunus amygdalus), Prunus salicina, Prunus davidiana* (Reighardet al, 2014). For apricot, the most widely used rootstocks in the world are the generative ones, clones of the *Prunus cerasifera*. However, even if they have an adaptability to soil conditions and groundwater, they are not suitable for orchards with high density, and with some varieties they show the phenomenon of incompatibility (Sitarek. et al. 2011; Milosevic et al, 2014). Other rootstocks used are apricot clones (*Prunus armeniaca*) of low vigor, or plum clones (*Prunus insititia, Prunus domestica*). *Prunus microcarpa* has been successfully tested in Turkey to reduce the vigor of grafted apricot trees (Ugur, 2022). For the almond species, the majority of rootstocks come from *Prunus amygdalus*, but there are also interspecific hybrids that come from combinations of *Prunus persica x Prunus amygdalus* and *Prunus persica x Prunus davidiana* (Duval, 2015).

In Romania, for the peach species, generative rootstocks were obtained from clones of the *Prunus persica* species ('T16', 'Tomis 1', 'P1s') and from intraspecific hybridizations ('Tomis 28', 'Tomis 39' and 'Tomis 79'), for apricot from clones of the *Prunus armeniaca* species ('Constanța 14' and 'Constanța 16'), and for almond clones of the species *Prunus amygdalus* ('Felix') (Ștefan et al, 2013).Since generative rootstocks impart unevenness to the planting material in the nursery, high vigor to the grafted varieties and late fruiting in the orchard, research has been directed towards obtaining vegetative rootstocks with good propagation yield, which impact to the grafted varieties a low-medium vigor, compatibility at grafting and later in the orchard precocity and productivity. Thus, for the peach-nectarine species, 'Adaptabil' and 'Miroper' rootstocks were approved, the latter being less used today. 'Apricor' and 'Baroc' vegetative rootstocks have been approved for apricot, and for almond there is currently no approved vegetative rootstock in Romania. Research for this species tends towards the use of 'Miroper' rootstock. All approved vegetative rootstocks are propagated by green cuttings.

Currently, at RSFG Constanța, variety improvement programs are ongoing for the peach-nectarine, apricot and almond species, and a series of selections with the prospect for registered are being tested.

The research in this paper aimed at the behavior of some rootstocks and rootstock selections in the nursery fields as well as their interaction with promising varieties or selections for the studied species.

2. Material and methods

The studies were carried out at RIFG Pitesti located in the southern part of Romania at 44°51'30" north latitude and 24°52' east longitude, in the experimental fields of the nursery, over a period of three years. For peach-nectarine species, 'Adaptabil' rootstock and 'B83/8' selection were studied, for apricot 'Baroc', 'Apricor' rootstocks and 'RoP8803001', 'RoP8802011' selections, and for almond 'Miroper' rootstock and 'Aidared' rootstock selection.

'Adaptabil' - peach-nectarine vegetative rootstock medium vigor, with a well-developed root system, resistant to drought and temporary excess moisture in the soil. It performs well on heavy soils.

'B83/8' – selection of vegetative rootstock for peach, resistant to foliar diseases, with good yield for vegetative propagation by softwood cuttings.

'Apricor' - vegetative rootstock for the apricot, resistant to foliar diseases, less so to the fungus *Coryneumbeyerinckii* which causes the loss of the leaves. It is more frost-resistant than apricot generative rootstock.

'Baroc' – vegetative rootstock for the apricot, tolerant to foliar diseases and well adapted to a varied range of soils. It has vigor similar to Apricor rootstock and trees grafted onto it are well anchored in the soil.

'RoP8803001' - selection of vegetative rootstock for the apricot, tolerant to foliar diseases, with good yield when multiplying.

'RoP8802011' – vegetative rootstock selection for the apricot, tolerant to foliar diseases.

'Miroper' – vegetative rootstock for the peach, more resistant than peach generative rootstock to frost and temporary excess moisture. It can also be used as a rootstock for almond varieties.

'Aidared' – selection of vegetative rootstock with red leaf, for almond, tolerant to foliar diseases and good yield when multiplying.

The experimental fields of the nursery where the research was carried out were: the mother plantation of cuttings, the solariums for rooting by softwood cuttings, field I and field II.

The mother plantations of cuttings were established in different years and at different densities (2500, 4000, 5000 plants/ha). In the spring, in the mother plantations, the cut was carried out at 3-5-buds. To limit the competitive effect of weeds, the plantation was maintained by weeding in row sand mechanized mowing at intervals. The nutritional status of the mother plantation was ensuring by applying soil and foliar fertilizers, and irrigation was done by drip. In order to ensure the health, treatments were carried out whenever necessary. In the mother plantation of rootstock cuttings, the number and average length of shoots/tree, the number of 25cm cuttings that can be obtained/tree and the production of unrooted cuttings/ha were determined according to age and planting distance

The softwood cuttings were planting at the beginning of July in solariums equipped with artificial fog, on raised beds with a substrate of sand washed by the river. The experiments were bifactorial (one factor the rootstock and the second factor the rooting stimulation treatment). The product Radistim V2 was used as a rooting biostimulator. The percentage of rooting was determined in November when the roots of the cuttings are lignified.

The rooted cuttings were planted the next spring in field I (in the nursery), at a distance of 0.9m x 0.15m, and in June the catch at planting was determined. In August, rootstocks were grafted made by chip-budding with varieties and perspective selections for the species under study. For the peach-nectarine, several promising varieties and selections were studied:

'Mona sel. 8' - selection of peach of medium vigor with flat fruit (100 g). The fruits reach harvest maturity between July 20-30.

'Fantasia '- vigorous nectarine variety, with large, spherical-ovoid fruits (200 g). The fruits reach harvest maturity between August 10-20.

'Florica' - variety of dessert peach, medium vigor, with round fruit (105 g). The fruits reach harvest maturity between August 20-30.

'Sel. F nectarine' - selection of low-vigor nectarine with large fruit (150 g). The fruits reach harvest maturity between August 20-30.

'R26P4' - peach selection of high vigor, with flat, medium fruit (100 g). The fruits reach harvest maturity between August 10-20

'VT10/79' – apricot selection of medium to large vigor, with medium to large fruit (45-60g). The fruits reach harvest maturity between July 19-28

'R8P22' - apricot selection of medium vigor, with oval fruit (50-55g). The fruits reach harvest maturity between June 27 and July 5.

'Canada 510915' - selection of low vigor apricot with slightly elongated round fruit of medium size (55 g). The fruits reach harvesting maturity between July 25-31.

'C4R8T147' - apricot selection of low to medium vigor with small fruit size (35 g). The fruits reach harvesting maturity July 17-27.

'C4R9T21' - apricot selection of low to medium vigor, with small to medium fruit size (40 g). The fruits reach harvest maturity July 20-30.

'Mirela' - almond variety, with large fruit, medium-large core (2.5 g), sweet, aromatic taste. The fruits reach harvest maturity between September 15-20.

'Veronica' - almond variety, with a medium kernel size (2.2 g), with a sweet taste. The fruits reach harvest maturity between August 20 - September 1.

'Supernova' - almond variety, with a medium kernel size (1.8 g), with a sweet taste. The fruits reach harvest maturity between: September 1-10.

In the next year, determinations were made regarding the influence of rootstocks on the grafted variety (average height of trees, average area of the trunk section 20cm above the grafting point, number and average length of shoots/tree).

Statistical analysis of rootstock rooting capacity data and cultivar-rootstock interaction was performed with the ANOVA version 14 test.

3. Results and discussions

At the beginning of July, the harvested shoots had an average length/tree between 86.61cm at the RoP802011 selection (apricot) and 140.14cm at the 'Aidared' rootstock selection (almond). Depending on the age, mother plant density and genotype, the production of unrooted cuttings with a length of 25cm ha varied from 232,000 pcs ('Miroper') to 994,680 pcs ('RoP8803001') (Table 1). In photos 1 and 2 are images of the mother plantation of the 'Baroc' apricot rootstock, and the mother plantation of the 'Aidared' almond rootstock selection.

Regarding vegetative propagation behavior by softwood cuttings cutting in peach-nectarine rootstocks, variant treated with Radistim V2 had a significantly higher rooting percentage (91.12%) than control variant (74.885). The maximum percentage of rooting was recorded by the rootstock 'Adaptabil' with 97.75% (Fig. 1).

In the apricot specie, the percentage of rooting was significantly higher (86.67%) in the variant in which the biostimulator was used, compared to the control variant (66.51%), with a maximum of 91.49% in 'Apricor'. The exception was the 'Baroc' rootstock where there were no significant differences between the control variant (86.93%) and the treated variant (89.75%) (Fig. 2).

In the case of the almond species in the 'Miroper' rootstock there were significant differences between the variants, unlike the 'Aidared' selection. The highest rooting percentage value was recorded in the 'Aidared' selection treated with Radistim V2 (87.35%) (Fig. 3).

In field I of the nursery, the rootstocks were planted at over 91.73%, the only exception being the 'Miroper' rootstock with 76.67% (Fig. 4).

Following the determinations in the grafted trees (field II) of the peach-nectarine species, there are no significant differences between the two rootstocks studied concerning of their influence on the grafted varieties (growth and sprouting indicators - average effect). However, the trees of the 'Florica' variety grafted on the 'B83/8' selection have a significantly higher average height (164 cm) than the trees grafted on the 'Adaptabil' rootstock (121.25 cm) and the trees of the 'Fantasia' variety grafted on the 'Adaptabil' rootstock have a higher number of shoots (12 shoots/ tree) compared to those grafted on 'B83/8' (7 shoots/tree) (Table 2).

In the apricot species, the height of the grafted trees varied between 93.75 cm for 'Canada510915' grafted on the 'RoP8802011' rootstock selection and 156 cm for the 'C4R9T21' grafted on the 'RoP8803001' rootstock selection. Trunk cross-sectional area was the lowest (87.18 mm^2) in the 'R8P22' selection grafted on 'RoP8802011' and the highest (247.92 mm^2) in the same selection grafted on 'RoP8803001'. As an average effect, rootstock selection ''RoP8803001' induces significantly higher vigor in grafted cultivars (expressed by height and trunk section area), and rootstock 'Baroc' and rootstock selection 'RoP8802011', the lowest vigor. Regarding the number and length of anticipated shoots, the highest values were recorded in trees grafted on selection 'RoP8803001' with an average number of shoots per tree of 8.58 and an average length of 44.11 cm (Table 3).

In the almond species, the influence of the rootstock on the grafted variety depends on the combination. If in the 'Mirela' variety the 'Aidared' rootstock gives greater vigor than the 'Miroper' (the average height of the trees being 146.08 cm and TCSA of 178.33 mm^2), in the 'Supernova' variety the situation is the

opposite, the 'Miroper' rootstock inducing a greater vigor than the 'Aidared' rootstock (the average height of trees being 122.73 cm and TCSA 115.05 mm^2). In the 'Veronica' variety, the vigor induced by the two rootstocks is similar. As an average effect, the rootstocks significantly influence the grafted varieties only in the case to the average length of the anticipated shoots, these being larger in the trees grafted on 'Miroper' (20.82c m) (Table 4).

4. Conclusions

The production of unrooted cuttings /ha is given by the shoot growth capacity of each genotype.

The rooting capacity of rootstocks of peach-nectarine and apricot species is significantly influenced by the use of the rooting biostimulator Radistim V2.

Selection of 'Aidared' almond rootstock has significantly higher rooting capacity than 'Miroper' rootstock.

Percentage of rooted cuttings caught in field I is over 91%, with the exception of the 'Miroper' rootstock with 76.67%.

In the peach-nectarine species, there are no significant differences between the grafted trees (varieties and selections) on the 'Adaptabil' rootstock and the 'B83/8' rootstock selection, in terms of the growth indicators studied.

The selection of apricot rootstock 'RoP8803001' induces the highest vigor in the grafted varieties, and the rootstock 'Baroc' and 'RoP8802011' the least vigor.

In the almond species, the vigor of the trees depends on both the grafted variety and the rootstock.

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Tables and Figures

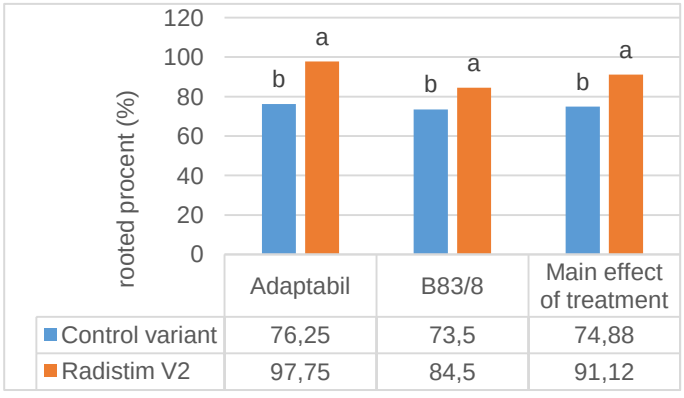
Table 1. Growth and production indicators in the mother cutting plantation

Species	Rootstock/ selection	Planting distance (m)	Age of the trees (years)	Average number of shoots/tree (pcs.)	Average length of shoots / tree (cm)	The average number unrooted cuttings/tree (pcs)	Production of unrooted cuttings / ha (pcs)
Peach-nectarin	Adaptabil	4.0 x 1.0	4	66.17	107,09	195.50	488,750
	B83/8	4.0 x 1.0	2	48.40	121.80	167.80	419,500
Apricot	Apricor	4.0 x 0.5	8	51.50	94.68	115.50	577,500
	Baroc	4.0 x1.0	4	40.83	109.16	131.00	327,500
	RoP8803001	5.0 x 0.5	12	85.33	110.10	248.67	994,680
	RoP8802011	5.0 x 0.5	12	63.33	86.61	157.33	629,320
Almond	Miroper	4.0 x 1.0	2	28.60	131.82	92.80	232,000
	Aidared	5x0,5	13	46,40	140,14	136,8	547.200

Photo 1. 'Baroc' - mother plantation

Photo 2. 'Aidared' – mother plantation

p≤0.05



p≤0.05

Fig.1. The effect of rooting biostimulator on rootstock for peach-nectarine

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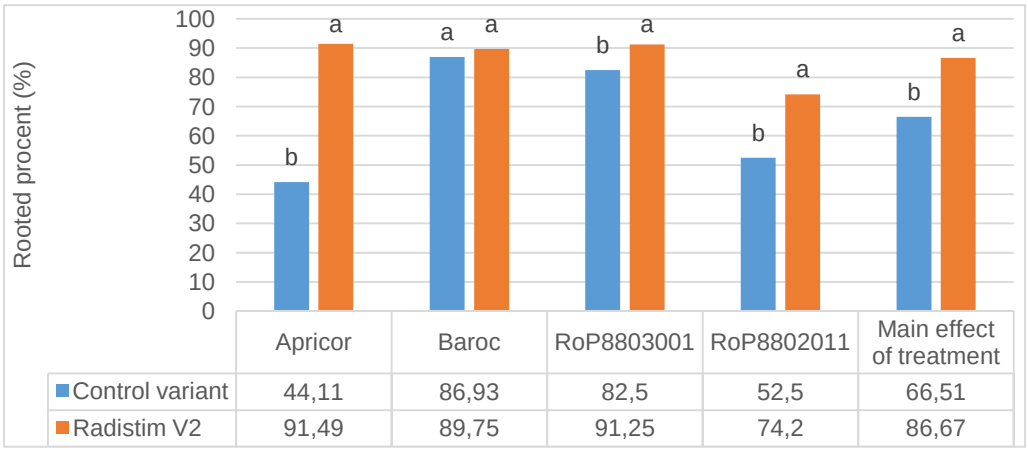
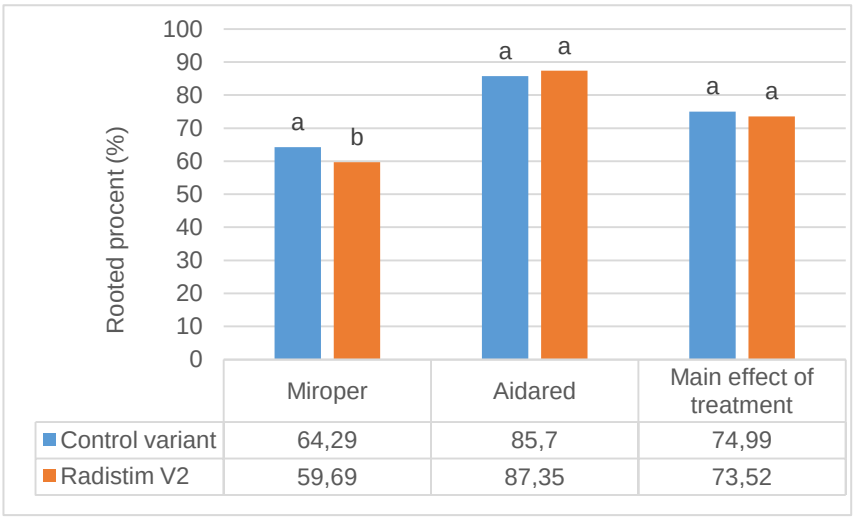


p≤0.05

Fig. 2. The effect of rooting biostimulator on rootstock for apricot



p≤0.05

Fig. 3. The effect of rooting biostimulator on rootstock for almond

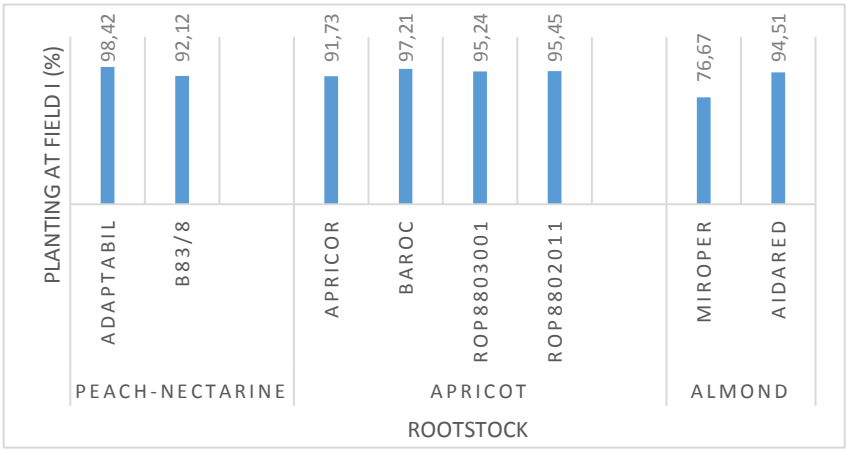


Fig. 4. Percentage of rooted cuttings caught in field I

Table 2. The influence of the rootstocks on the growth indicators for peach-nectarine cultivars/selections (average)

Growth indicator	Rootstock	Cultivars/selection										Main effect of rootstocks	
		Mona sel 8 cv.		Fantasia cv.		Florica cv.		Sel. F nectarin cv.		R26P4 cv.			
Tree height	Adaptabil	151.11	a	146.43	a	121.25	b	160.91	a	150.00	a	145.94	a
	B83/8	148.64	a	141.56	a	164.00	a	145.5	a	168.75	a	153.69	a
TCSA (trunk cross-section area)	Adaptabil	219.87	a	194.87	a	112.24	a	187.33	a	181.25	a	179.11	a
	B83/8	205.88	a	173.69	a	216.26	a	166.49	a	244.21	a	201.308	a
Number of shoots/tree	Adaptabil	14.56	a	12.00	a	8.75	a	11.09	a	8.33	a	10.95	a
	B83/8	12.64	a	7.38	b	11.60	a	8.30	a	8.75	a	9.73	a
Lenght of shoots/tree	Adaptabil	40.19	a	31.99	a	28.07	a	35.10	a	33.58	a	33.79	a
	B83/8	42.44	a	33.51	a	27.65	a	30.91	a	37.84	a	34.47	a

p≤0.05

Table 3. The influence of the rootstocks on the growth indicators for apricot selections (average)

Growth indicator	Rootstock	Selection of cultivars										Main effect of rootstock	
		VT10/79 cv.		R8P22 cv.		C4R9T21 cv.		C4R8T147 cv.		Canada 510915 cv.			
Tree height (cm)	Apricor	134.55	a	114.38	a	139.12	a	122.5	ab	113.13	b	125.75	b
	Baroc	106.67	b	142.35	a	111.11	b	116.67	ab	105.00	bc	116.35	c
	RoP8803001	134.55	a	147.50	a	156.00	a	138.33	a	134.55	a	141.22	a
	RoP8802011	131.43	a	120.00	a	103.89	b	112.50	b	93.75	c	110.16	c
TCSA (trunk cross-section area- mm^2)	Apricor	142.95	a	118.77	b	176.53	b	150.08	a	138.12	ab	147.24	b
	Baroc	81.65	b	109.14	b	97.84	c	113.26	a	108.59	b	100.02	c
	RoP8803001	157.53	a	247.92	a	244.18	a	171.77	a	165.93	a	189,72	a
	RoP8802011	146.78	a	87.18	b	101.95	c	156.29	a	112.65	ab	120,41	c
Number of shoots/tree (pcs)	Apricor	3.27	b	3.38	b	4.76	b	7.33	ab	4.21	b	4.45	b
	Baroc	1.57	b	3.76	b	3.5	b	5.42	b	3.08	b	3.27	b
	RoP8803001	5.82	a	14.25	a	8.9	a	11.22	a	6.82	a	8.58	a
	RoP8802011	3.57	ab	0.00	b	5.33	b	7.25	ab	2.38	b	3.9	b
Lenght of shoots/tree (cm)	Apricor	24.56	ab	26.36	ab	49.59	a	28.67	bc	27.09	ab	31.24	b
	Baroc	11.00	b	35.09	a	21.03	b	24.17	c	18.94	b	21.51	c
	RoP8803001	38.38	a	45.53	a	61.76	a	42.23	ab	34.82	a	44.11	a
	RoP8802011	25.40	ab	0.00	b	32.10	b	56.00	a	20.56	b	27.59	bc

p≤0.05

Table. 4. The influence of the rootstock on the growth indicators for almond cultivars (average)

Growth indicator	Rootstock	Cultivars						Main effect of rootstocks	
		Mirela		Veronica		Supernova			
Tree height	Miroper	101.07	b	95.00	a	122.73	a	105.54	a
	Aidared	146.08	a	101.88	a	76.92	b	107.83	a
TCSA (trunk cross-section area	Miroper	101.29	b	88.10	a	115.05	a	101.11	a
	Aidared	178.33	a	81.36	a	64.36	b	106.11	a
Number of shoots/tree	Miroper	2.14	b	4.08	a	6.82	a	4.16	a
	Aidared	11.92	a	1.25	b	4.15	a	5.45	a
Lenght of shoots/tree	Miroper	14.99	a	22.66	a	26.23	a	20.82	a
	Aidared	16.29	a	5.93	b	11.43	b	10.84	b

p≤0.05