**Аграрен университет – Пловдив, Научни трудове, т. LXVII, кн. 1, 2025 г.**
**Юбилейна научна конференция *„80 години Аграрен университет – Пловдив: Традиции срещат иновации “***
**Anniversary Scientific Conference**
***"80 Years Agricultural University – Plovdiv:Traditions Meet Innovations"***
**Agricultural University – Plovdiv, Scientific Works, vol. LXVII, book 1, 2025**

DOI: 10.22620/sciworks.2025.01.022

# INFLUENCE OF DIFFERENT ROOTSTOCKS AND INTERSTOCKS ON THE GROWTH CHARACTERISTICS OF THE APRICOT CULTIVAR HARGRAND IN A NURSERY

**Sava Tabakov, Anton Yordanov*, Todor Donkov**

Agricultural University – Plovdiv, Bulgaria
***E-mail: aiyordanov@abv.bg**

## Abstract

Cultivars of *Prunus armeniaca* have a wide geographical distribution. Their cultivation under conditions of a dynamically changing climate, various soil types, and the increasing demand for higher productivity necessitates the use of a diverse range of rootstocks. During the period 2022–2024, a study was conducted in a fruit tree nursery located in Central South Bulgaria to assess the influence of different rootstocks on the growth characteristics of the apricot cultivar 'Hargrand'. The following combinations were evaluated: rootstocks GF677 and GXN15 (Garnem) with interstocks 'Stanley' (*Prunus domestica L.*) and 'Redhaven' (*Prunus persica Batsch.*); Myrobalan seedling rootstock (*Prunus cerasifera Ehrh.*) with 'Stanley' as an interstock; and the commonly used Myrobalan seedling rootstock without interstock.

The lowest bud-take rate for 'Hargrand' was recorded on Myrobalan seedling rootstock, both with and without 'Stanley' as interstock (78–83%). Higher bud-take rates (84–88%) were observed in the other combinations. Regarding vegetative growth, all tested variants produced trees of acceptable size for planting in commercial orchards. The best branching potential was observed in trees budded on the peach–almond hybrid rootstocks GF677 and Garnem, combined with the interstocks 'Stanley' and 'Redhaven', while the weakest branching was noted in trees on Myrobalan seedling, both with and without an interstock.

**Keywords:** *Prunus armeniaca*, rootstock, interstock, GF677, Garnem, lateral shoots, nursery

## INTRODUCTION

A primary objective in modern fruit growing is the rapid achievement of full fruit bearing and the maintenance of high yields of large fruits over many years (Robinson et al., 2011). One of the approaches to attaining this goal is the choice of proper rootstocks. Tree vigor, the onset of fruiting, tree productivity, fruit quality, and life span of the tree depend on the choice of rootstock (Southwick and Weis, 1999; Dimitrova, 2001; Kaska, 2006; Sosna, 2006; Sosna and Licznar-Małanczuk,

2012). It should be emphasized that the use of identical rootstocks in different regions leads to variable results (Hartmann et al., 2007), which is attributed to differences in the environmental conditions of each specific region. Consequently, the evaluation of different scion–rootstock combinations under the conditions of a certain region is of great importance for fruit growers (Stefanova et al., 2009, 2010; Monte et al., 2010; Stassen and Reinten, 2011). Most studies concerning the effect of different rootstocks on the vegetative and reproductive characteristics of fruit species are conducted in orchard trials (Swierczyn'ski and Stachowiak, 2009; Grzyb et al., 2010; Ogasanovic et al., 2011a, b; Grzyb and Rozpara, 2012). A key requirement of modern fruit growing is the rapid entry of trees into full fruit bearing, which can be achieved by ensuring fast canopy formation. This is closely related to the quality of planting material produced in nurseries (Sadowski and Gorski, 2003; Lewko et al., 2007; Baryła et al., 2014). The use of the peach–almond hybrids GF677 and Garnem significantly accelerates canopy development due to their strong vegetative growth and abundant branching with wide crotch angles, which they induce in the grafted cultivars (Tabakov et al., 2023). The available literature provides limited data on the use of GF677 in combination with apricot cultivars in Italy (Giorgio and Gallotta, 2000; Ferlito et al., 2022) and Romania (Stănică et al., 2020). Erdoğan et al. (2018) reported incompatibility between peach–almond hybrid rootstocks and the apricot cultivars used in their study, necessitating the use of an interstock. Research focused on the use of interstock has reported their impact on the vegetative and reproductive characteristics of the tested cultivars (Milosevic et al., 2012, 2013; Tabakov et al., 2015; Kaymakanov et al., 2015; Rakonjac et al., 2016; Miodragović et al., 2019; Rahnemoun, 2020; Ferlito et al., 2022; Sotirov and Dimitrova, 2022).

The peach–almond hybrid rootstocks GF677 and GXN15 (Garnem) have not yet been evaluated with apricot cultivars in Bulgaria. In this study, we present the first results of their use as rootstocks for the apricot cultivar 'Hargrand'.

## MATERIALS AND METHODS

The experiment was conducted over three consecutive years during the period 2022–2024 in a nursery near Plovdiv, Central South Bulgaria. The rootstocks Myrobalan seedling (*Prunus cerasifera* Ehrh.), GF677, and GXN15 (Garnem)—were pre-budded with the plum cultivar 'Stanley' (*Prunus domestica* L.) and the peach cultivar 'Redhaven' (*Prunus persica* Batsch.) and grown with a one-year-old scion part. These plants were grafted with the apricot cultivar 'Hargrand' using the tongue grafting method between 15–30 January, with grafting performed at a height of 15–20 cm above the first graft union. For comparison, 'Hargrand' was also grafted directly onto the commonly used Myrobalan seedling rootstock (Pr. cerasifera Ehrh.) without an interstock. All plants were planted between 20–30 March at a spacing of 120 × 30 cm. The trial was set up using a randomized block design with six replications, each consisting of sixteen trees. All trees were grown under the same conditions: drip irrigation and removal of all shoots up to 60 cm above the soil surface, while all branches above this height were retained. Trees with the highest and lowest values for both height and scion diameter were excluded from the analysis. At the end of each growing season, the following

parameters were recorded: rootstock diameter (measured 5 cm below the graft union, interstock diameter (measured at the midpoint of the interstock), scion diameter (measured 10 cm above the graft union), scion height, cumulative scion growth, mean number of lateral shoots per tree (longer than 10 cm), mean length of a lateral shoot, and graft take percentage. The data was statistically processed using a variance analysis and Tukey's test at 5% level of significance.

## RESULTS AND DISCUSSION

The diameters of the rootstock, interstock, and scion are parameters characterizing the interaction with respect to the growth of the entire grafted organism they form (Tabakov and Yordanov, 2019). The data presented in Table 1 show that there were no significant differences in rootstock diameter among the tested variants. The largest interstock diameter, although not statistically significant for all variants, was recorded for plants of the cultivar 'Hargrand' grafted on Myrobalan seedling rootstock with 'Stanley' as an interstock. The smallest scion diameter was observed in trees grafted on GF 677 rootstock with 'Stanley' as an interstock. The results concerning scion height revealed a clear trend toward the formation of taller trees when grafted on GF 677 and Garnem rootstocks, compared with those grafted on the traditionally used Myrobalan seedling rootstock, regardless of the interstock used (Table 1).

Cumulative scion growth is another important parameter that can be used to assess the vigor of nursery trees. The degree of lateral branching reflects the natural branching propencity of each scion–rootstock combination, which is an important characteristic for the quality of planting material and is closely related to the genetic traits of the cultivar (Licznar-Małańczuk and Sosna, 2006; Milošević and Milošević, 2010; Tabakov and Yordanov, 2019). The results of our study, presented in Table 2, indicate that, irrespective of the interstock used, the peach–almond hybrids GF 677 and Garnem produced trees with a significantly greater cumulative scion growth, higher mean number of lateral shoots per tree, and longer mean lateral shoot length compared to those grafted on Myrobalan seedling rootstock with or without an interstock. The lowest values for the above-mentioned parameters were recorded in trees of 'Hargrand' grafted on the traditionally used Myrobalan seedling rootstock.

**Table 1.** Growth characteristics of nursery trees induced by different rootstock/interstock combinations of the apricot cultivar 'Harggrand' (average for the period 2022–2024).

| **Rootstock/interstock** | **Rootstock diameter (mm)** | **Interstock diameter (mm)** | **Scion diameter (mm)** | **Scion height (cm)** |
|---|---|---|---|---|
| Myrobalan/Stanley | 19,65 | 18,75 | 14,03 | 174,77 |
| Garnem/Stanley | 20,20 | 18,0 | 13,43 | 187,65 |
| GF677/Stanley | 19,06 | 17,43 | 12,41 | 180,13 |
| Garnem/Redhaven | 20,07 | 18,42 | 13,40 | 180,27 |
| GF677/Redhaven | 19,09 | 17,40 | 12,93 | 181,70 |
| Myrobalan seedling | 19,97 | | 13,90 | 171,33 |
| $LSD_{0.05}/R_{0.05}$ | **1,50** | **0,89** | **0,76** | **6,77** |

**Table 2.** Branching characteristics of nursery trees induced by different rootstock/interstock combinations of the apricot cultivar 'Harggrand' (average for the period 2022–2024).

| Rootstock/ interstock | Cumulative scion growth (cm) | Mean number of lateral shoots per tree | Mean length of a lateral shoot (cm) |
|---|---|---|---|
| Myrobalan/Stanley | 305,73 | 7,00 | 18,71 |
| Garnem/Stanley | 545,69 | 15,50 | 23,10 |
| GF677/Stanley | 525,13 | 14,75 | 23,39 |
| Garnem/Redhaven | 541,40 | 16,75 | 21,56 |
| GF677/Redhaven | 558,96 | 17,25 | 21,87 |
| Myrobalan seedling | 247,70 | 5,75 | 18,01 |
| $LSD_{0.05}/R_{0.05}$ | **6,77** | **2,68** | **1,54** |

The use of the peach–almond hybrids GF 677 and Garnem with 'Stanley' and 'Redhaven' interstocks favored branching. In these combinations, a greater proportion of the cumulative scion growth was formed by lateral shoots (Fig. 1), whereas in plants grafted on Myrobalan seedling rootstock with or without an interstock, more than 57% of the cumulative scion growth was contributed by the central axis.

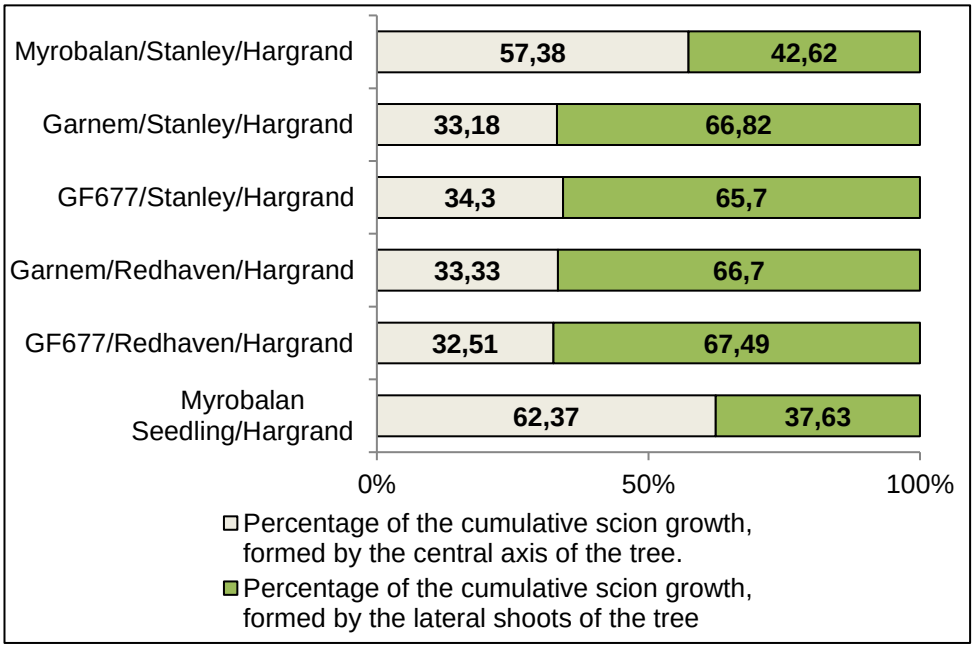


**Figure 1.** Percentage distribution of the cumulative scion growth formed by the central axis and the lateral shoots in tested scion-rootstock combinations (average for the period 2022-2024).

Graft take percentage is a very important parameter for nursery tree producers, but at the same time it depends on several factors, such as the physiological condition of the rootstocks and the climatic conditions after grafting (Pedersen, 2010).

On average over the study period, a lower graft take percentage was recorded in trees grafted on the traditionally used Myrobalan seedling rootstock compared with the other rootstocks included in the trial (Table 3).

**Table 3.** Percentage of graft-take of apricot cultivar Hargrand (average for the period 2022–2024).

| ***Rootstock/Interstock*** | ***%*** |
|---|---|
| Myrobalan/Stanley | 83,3 |
| Garnem/Stanley | 87,6 |
| GF677/Stanley | 88,2 |
| Garnem/Redhaven | 85,7 |
| GF677/Redhaven | 84,4 |
| Myrobalan Seedling | 78,1 |

## CONCLUSIONS

During the study period, the highest graft take percentage of the cultivar Hargrand was recorded in the combinations involving the peach–almond hybrid rootstocks GF 677 and Garnem, whereas the lowest graft take percentage was observed on Myrobalan seedling rootstock without an interstock.

All combinations of rootstock, interstock, and scion produced trees with acceptable size for planting in commercial orchards, and no unidirectional effect of the rootstocks on scion diameter was established.

The greatest cumulative scion growth, as well as the highest degree of branching were obtained on the peach–almond hybrid rootstocks GF 677 and Garnem with 'Stanley' and 'Redhaven' interstocks, whereas the least-branched trees were produced on Myrobalan seedling rootstock with or without an interstock.

## REFERENCES


Baryła, P., Kapłan, M., and Krawiec, M. (2014). The effect of different types of rootstock on the quality of maiden trees of sweet cherry (*Prunus avium* L.) cv. 'Regina'. Acta Agrobot. *67* (*4*), 43–50 https://doi.org/ 10.5586/aa.2014.051.

Dimitrova, M. (2001). The influence of rootstock on the growth and productivity of three apricot cultivars. *Bulg. J. Agric. Sci*. *7*, 161–166.

Erdoğan, A., Yiğit, T., Şahin, S., Yılmaz, K.U., Demirtaş, M.N., Öylek, H.Ş. and Ercişli, S. (2018). Clonal rootstock selection suitable for apricot cultivars 'Hacıhaliloglu' and 'Kabaası'. *Acta Hortic.* 1214, 193-198 https://doi.org/10.17660/ActaHortic.2018.1214.33

Ferlito, F., Torrisi, B.F., Allegra, M., Principio, L., Ciccoritti, R., Ciaccia, C., Lodolini, E.M., Cutuli, M. and Ceccarelli, D. (2022). Bioagronomic traits of eighteen apricot cultivars grafted on 'GF677' with *Prunus persica* L. as interstock in a semi-arid environment in Sicily. Acta Hortic. 1346, 829-836. https://doi.org/10.17660/ActaHortic.2022.1346.106

Giorgio, V., and A. Gallotta.(2000). Performance of three apricot cultivars on five rootstocks. Informatore Agrario 56 (29), 61-63.

Grzyb, Z.S., and Rozpara, E. (2012). Effect of rootstock on the growth and yielding of 'Jojo' plum trees in an ecological orchard. *Acta Hortic*. *968*, 133–136 https://doi.org/10.17660/ActaHortic.2012.968.18.

Grzyb, Z.S., Sitarek, M., and Rozpara, E. (2010). Evaluation of vigorous and dwarf plum rootstocks in the high density orchard in central Poland. Acta Hortic. *874*, 351–356 https://doi.org/10.17660/ActaHortic.2010.874.50.

Hartmann, W., Beuschlein, H.D., Kosina, J., Ogasanovic , D., and Paszko, D. (2007). Rootstocks in plum growing-results of an international rootstock trial. Acta Hortic. *734*, 141–148 https://doi.org/10.17660/ ActaHortic.2007.734.16.

Kaska, N. (2006). Orchard management in apricots. Acta Hortic. *717*, 287–294 https://doi.org/10.17660/ ActaHortic.2006.717.58.

Kaymakanov, P., S. Tabakov, and A. Yordanov. (2015). Growth characteristics of two cherry cultivars grafted on interstocks. Agrarni Nauki 7 (17), 71-78.

Lewko, J., Scibisz, K., and Sadowski, A. (2007). Performance of two pear cultivars on six different rootstocks in nursery. Acta Hortic. *732*, 227–231 https://doi.org/10.17660/ActaHortic.2007.732.32.

Licznar-Małańczuk M., Sosna, I. (2006). Quality of maiden apricot trees depending on rootstock and cultivar. Sodininkyste ir Darzininkyste *25*(3), 57-61.

Milošević T., Milošević, N. (2010). Growth and branching of pear trees (*Pyrus domestica*, Rosaceae) in nursery. Acta Sci. Pol. Hortorum Cultus, *9*(4), 193-205.

Milošević, T., Milošević, N., & Glišić, I. (2012). Effect of tree conduce on the precocity, yield and fruit quality in apricot on acidic soil. Revista Ciência Agronômica, 43, 177-183.

Milosevic, T., Milosevic, N., Glisic, I., & Sekularac, G. (2013). Influence of stock on physical and chemical traits of fresh apricot fruit. International Agrophysics, 27(1).doi: 10.2478/v10247-012-0075-x

Miodragović, M.; Magazin, N.; Keserović, Z.; Milić, B.; Popović, B.; Blagojević, B.; Kalajdžić, J.(2019). The early performance and fruitproperties of apricot cultivars grafted on Prunus spinosa L. interstock. Sci. Hortic. 250, 199–206

Monte, M., Impallari, F.M., Sala, G., Sottile, F., and De Michele, A. (2010). The Italian plum rootstock trial: results for Sicilian environmental conditions. Acta Hortic. *874*, 269–274 https://doi.org/10.17660/ActaHortic.2010.874.37.

Ogasanovic , D., Miletić , R., and Mitrović , M. (2011a). Čomparative evaluation of different vegetative plum rootstocks. J. Sci. Agric. Res. *72* (*2*), 45–54.

Ogasanović , D., Miletić , R., and Mitrović , M. (2011b). Effects of vegetative rootstocks PČK-77 and GF 655.2 on vigour, yield and fruit traits of plum cultivars. J. Sci. Agric. Res. *72* (*2*), 55–63.

Pedersen, B.H. (2010). Early performance of two European plum cultivars on thirteen plum rootstocks. Acta Hortic. *874*, 261–268 https://doi.org/10.17660/ActaHortic.2010.874.36.

Rahnemoun, H.(2020). The influences of myrobalan rootstock and Saint Julian A interstock on some growing characteristics of five commercial cultivars of apricot. Research Achievements for Field and Horticulture Crops. 8 (2), 271-285. DOI: 10.22092/RAFHC.2020.120118.1113

Rakonjac, V., Nikolić, D., Fotirić-Aksić, M. and Čolić, S. (2016). Rootstock and interstock influence on vigor, fruit and leaf properties of sour cherry cultivars. Acta Hortic. 1139, 231-236 https://doi.org/10.17660/ActaHortic.2016.1139.40

Robinson, T., Fazio, G., Hoying, S., Miranda, M., and Iungerman, K. (2011). Geneva® rootstocks for weak growing scion cultivars like 'Honeycrisp'. New York Fruit Quarterly *19* (*2*), 10–16.

Swierczynski, S., and Stachowiak, A. (2009). The usefulness of two rootstocks for some plum cultivars. J. Fruit Ornament. Plant Res. *17* (*2*), 63–71.

Sadowski, A., and Gorski, M. (2003). Quality of apple planting stock depending of its method of production. Rastenievudni Nauki *40* (*5*), 394–398.

Sosna, I. (2006). Estimation of several plum cultivars on four rootstocks. Scientific works of the Lithuanian institute of agriculture and Lithuanian university of agriculture. Sodinink. Darzinink. *25* (*3*), 250–257.

Sosna, I., and Licznar-Małanczuk, M. (2012). Growth, yielding and tree survivability of several apricot cultivars on Myrobalan and 'Wangenheim Prune' seedlings. Acta Sci. Pol. Hortorum Čultus *11* (*1*), 27–37.

Sotirov, D., & Dimitrova, S. (2022). Influence of some rootstocks and interstocks on the growth and fruiting of cherry cultivar Summit. *Bulg. J. Agric. Sci*, *28*, 413-416.

Southwick, S.M., and Weis, K.G. (1999). Propagation and rootstocks for apricot production. Acta Hortic. *488*, 403–410 https://doi.org/10.17660/ActaHortic.1999.488.63.

Stănică, F., Butcaru, A. C., Mihai, C. A., Florea, I. M., & Șerban, D. (2020). Preliminary results regarding the behaviour of some new apricot cultivars in București area. Romanian Journal of Horticulture, 1, 59.

Stassen, P.J.Č., and Reinten, E.Y. (2011). Performance of rootstocks for plums (*Prunus salicina*) on different soil types. Acta Hortic. *903*, 555–562 https://doi.org/10.17660/ActaHortic.2011.903.77.

Stefanova, B., Dragoyski, K., and Dinkova, H. (2009). Reaction of some rootstocks for plums to soil and climatic conditions of Troyan. Acta Hortic. *825*, 435–440 https://doi.org/10.17660/ActaHortic.2009.825.68.

Stefanova, B., Dragoyski, K., Dinkova, H., and Dzhuvinov (Djouvinov), V.. (2010). The plum cultivar 'Jojo' grown under conditions of the Čentral Balkan mountains in Bulgaria. Acta Hortic. *874*, 281–288 https://doi.org/ 10.17660/ActaHortic.2010.874.39.

Tabakov S., Yordanov A., Donkov T. (2023). Use of peach-almond hybrid rootstocks and two interstocks for the apricot cultivar 'Hargrand'. Acta horticulturae. (in press).

Tabakov, S., Kaymakanov, P., Yordanov, A. and Govedarov, G. (2015). Reproductive characteristics on two cherry cultivars, grafted on interstocks. Agrarni Nauki, 7(17), 79-86.

Tabakov, S.G. and Yordanov, A.I. (2019). Influence of different rootstocks on growth characteristics of cultivars of the species *Prunus domestica* in nursery. Acta Hortic. 1260, 209-214. https://doi.org/10.17660/ActaHortic.2019.1260.33