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# INFLUENCE OF ROOTSTOCKS GF677 AND GXN 15 (GARNEM) ON SOME PHENOPHASES OF PEACH CULTIVARS

**Sava Tabakov*, Anton Yordanov, Mladen Petrov**

Agricultural University – Plovdiv

***E-mail: sgtabakov@abv.bg**

**Abstract**

The influence of the peach-almond hybrid rootstocks GF 677 and GXN 15 (Garnem) on the flowering, fruit ripening and the end of vegetation phenophases were studied for the Redhaven, UFO 4 peach cultivars and Big Top nectarine cultivar over a period of three years. It was found that the rootstock GXN 15 (Garnem) induced the onset of flowering up to two days earlier in all cultivars throughout the study period, whereas the rootstock GF 677 increased the flowering duration. Our results demonstrate that both rootstocks do not induce differences in the fruit ripening and end of vegetation periods. Furthermore, the Big Top cultivar tends toward earlier development at the end of winter which makes it highly sensitive to late spring frost.

**Keywords:** Peach-almond hybrid rootstocks, GF 677, Garnem, flowering, ripening period.

## INTRODUCTION

The producing of peach and nectarine fruits In Europe is concentrated mainly in the Mediterranean countries (FAOSTAT, 2016). Attempts to grow peaches on different rootstocks are also taking place in more northern countries than Bulgaria, but this culture is not of commercial importance for these regions (Ondrásek and Krska, 2015). Bulgaria is the northern border of the industrial growing of peaches and nectarines in Europe. In all regions of our country there is a risk of frost damages and compromising the crop during the flowering period. Early flowering fruit species like almond, apricot and peach are particularly sensitive to damages caused by late spring frosts (Mitov et al., 1993 (a); Karlidag and Ercisli, 2010). Cultivars of the same fruit species may differ in the flowering period (Mitov et al., 1993 (b); Milatovic, 2005; Mratinić et al., 2010).

The choice of proper rootstock for fruit cultivars is an important task because the rootstocks can influence not only the vigour, productivity, fruit quality and the life-span of the tree (Southwick и Weis, 1999; Dimitrova, 2001; Kaska, 2006; Sosna, 2006; Sosna and Licznar-Małańczuk, 2012), but also on beginning and duration of some phenophases. The influence of the rootstocks on the flowering of different fruit species has been investigated by Egea et al. (2003), Giorgi et al. (2005), Ganji Moghadam and Mokhtarian (2007), Ben Mimoun et al. (2015). In regions where frosts are common, delaying of flowering under the influence of the rootstocks even for only one-two days can prevent significant losses of a crop. The use of peach-almond hybrids as rootstocks in the growing of peach and nectarine orchards is becoming more and more popular.

The aim of the study was to compare the influence of GF 677 (*Prunus dulcis x Prunus persica*), (Reighard and Loreti, 2008) and GXN 15 (Garnem) (*Prunus dulcis x Prunus persica*) (Filipe, 2009) on the flowering period, the ripening period of the fruits and the end of the vegetation in the peach cultivars Redhaven and UFO 4 as well as the nectarine cultivar Big Top.

## MATERIALS AND METHODS

The experimental orchard was established in the spring of 2014 in the region of the town of Plovdiv (Central South Bulgaria). The peach cultivars Redhaven and UFO 4 as well as the nectarine cultivar Big Top were grafted onto GF 677 and GXN 15 (Garnem) rootstocks which were in vitro propagated. One-year-old nursery trees were planted at spacing 5 x 3.5 m.

The trees were drip irrigated and a sod-mulch system was applied between the rows. The soil in the rows was maintained with herbicides. Pest and disease control, as well as fertilization, followed the local recommendations for commercial orchards. Trees were formed as a peach free growing crown. The experiment was set up in a randomized block design with four replications and three plants per plot in each variant. The phases of the flowering period and ripening period were evaluated during three consecutive years. Beginning of flowering was evaluated at 10% open flowers, beginning of full flowering – 25% open flowers, end of full flowering – 75% overblown flowers, end of full flowering – 10% not overblown flowers. The beginning of the harvest is determined on the basis of the fruit softening measured with a penetrometer. The end of the vegetation was recorded in more than 75% fallen leaves. The air temperature was measured with Pessl Instruments® automatic weather station. Frost damages were assessed two weeks after the freeze. Eighty flower buds of each variant were cut and the damage of the pistil was assessed.

## RESULTS AND DISCUSSION

In 2016 the trees of the three cultivars grafted on GXN 15 (Garnem) rootstock blossomed one to two days earlier than those on GF 677 (fig. 1). The end of flowering also occurs with a difference of one or two days, and the trees on rootstock GXN 15 (Garnem) finished flowering earlier than those on GF 677. In the second year of the survey (2017), the flowering of the experimental trees took place in a similar sequence but in relatively shorter terms (fig. 2).

Regardless of the later start of flowering in 2018, the sequence of its flow is retained (fig. 3). During the three years of the study in all cultivars, it was noted that the onset of flowering induced by the rootstock GXN 15 (Garnem) starts 24 to 48 hours earlier compared to the trees on well-known GF 677 rootstock (pic.1). The behavior of the same rootstocks grown under different environmental conditions is not unidirectional. In the Czech Republic Ondrásek and Krska (2015), reported results of a rootstock trail including these rootstocks, but they didn't find a difference at the beginning of the flowering.

Apart from the beginning of flowering, an important feature is its duration. In the present study, we found that a longer flowering period of the three cultivars induces the rootstock GF 677. An exception for the last year is the cultivar Big Top. The flowering period of the trees on both rootstocks has the same duration, which may be due to the noted frost damages. Apart from the rootstocks cultivar features also have great influence on the flowering. Among all the cultivars included in the study, we observed the longest flowering period of the cultivar UFO 4. During the study period, the earliest beginning of flowering was recorded in the combination Big Top/GXN 15 (Garnem). This result confirms the information reported by Filipe (2009) that the rootstock GXN 15 (Garnem) has relatively low chilling requirements.

From 26 February to 2 March 2018, temperatures in the experimental orchard were below zero degrees, with the lowest temperature being recorded on 1 March – minus 11.4°C. This resulted in a significant level of frost damages of the flower buds only in the cultivar Big Top in combination with both studied rootstocks (table 1). This result gives us reason to assert that this cultivar has a relatively short dormancy period and its vegetation begins early. In the warm environmental conditions of some Mediterranean countries this problem probably does not exist because there is evidence of abnormal patterns of bud-break and development with an erratic bud-break, delayed flowering date and extended flowering period due to lack of chilling (Alonso et al., 2005; Elloumi et al., 2013). Under the environmental conditions of Spain, Iglesias et al. (2004; 2012) do not note the significant influence of the GXN 15 (Garnem) on the flowering period. This feature probably not occurs in regions with a warmer climate than ours. The obtained results give us reason to determine the cultivar Big Top in combination with the peach-almond hybrids GXN 15 (Garnem) and GF 677 as being at risk for late spring frost damage in many of the regions of our country. Under the conditions of our trail the rootstocks GXN 15 (Garnem) and GF 677 did not affect the beginning of harvest and end of vegetation in all the cultivars included in the study contrary of the results reported by Iglesias et al. (2004).

## CONCLUSIONS

1. The rootstock GXN 15 (Garnem) induces an early occurrence of the flowering phenophase in all cultivars involved in the study.

2. The rootstock GF 677 induces a prolonged flowering period for all the cultivars involved in the study.

3. The rootstocks GF 677 and GXN 15 (Garnem) do not affect the fruit ripening period and the end of vegetation in all the cultivars involved in the study.

4. The cultivar Big Top in combination with the both tested rootstocks has the earliest start of flowering compared to the other cultivars included in the study. This feature makes its combination with the GXN 15 (Garnem) rootstock very sensitive to late spring frosts.

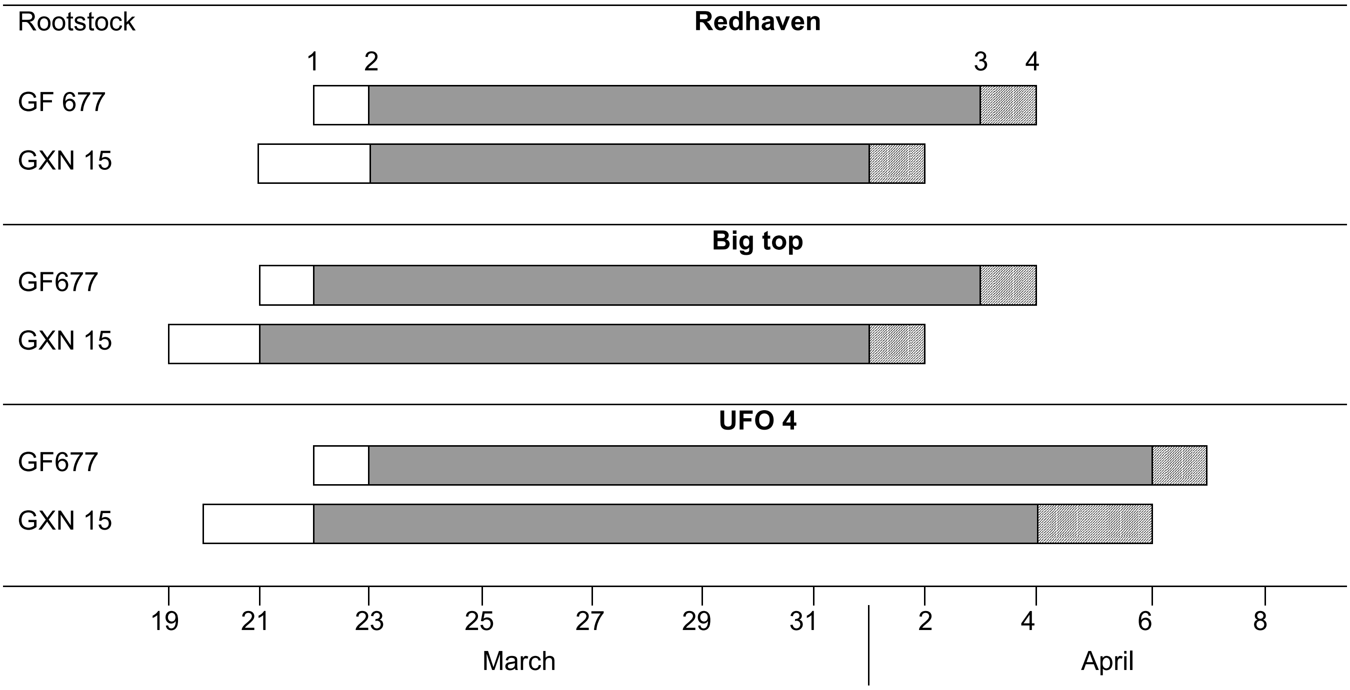


***Fig. 1.*** *Date and duration of flowering stages in 2016; 1 – Beginning of flowering; 2 – Beginning of full flowering; 3 – End of full flowering; 4 – End of flowering*

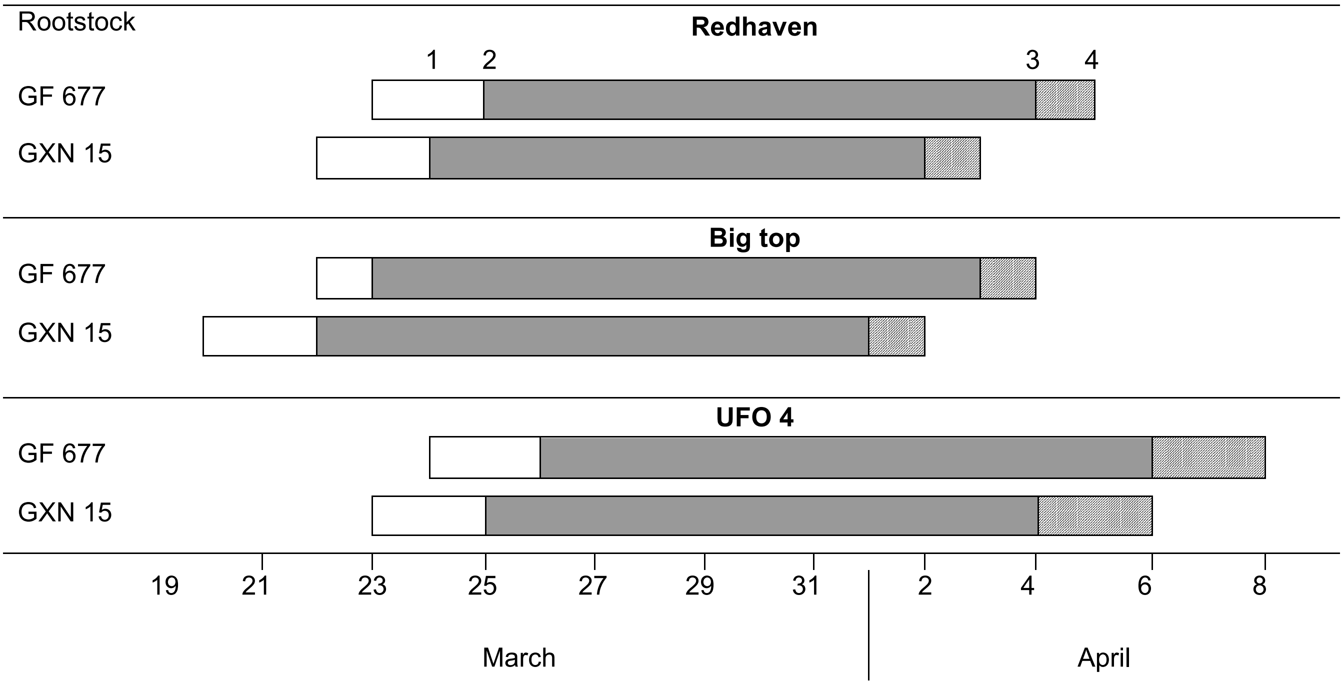


***Fig. 2.*** *Date and duration of flowering stages in 2017; 1 – Beginning of flowering; 2 – Beginning of full flowering; 3 – End of full flowering; 4 – End of flowering*


***Pict. 1.*** *UFO 4 cultivar on GXN 15 (Garnem) (left) and GF 677 (right) rootstock*

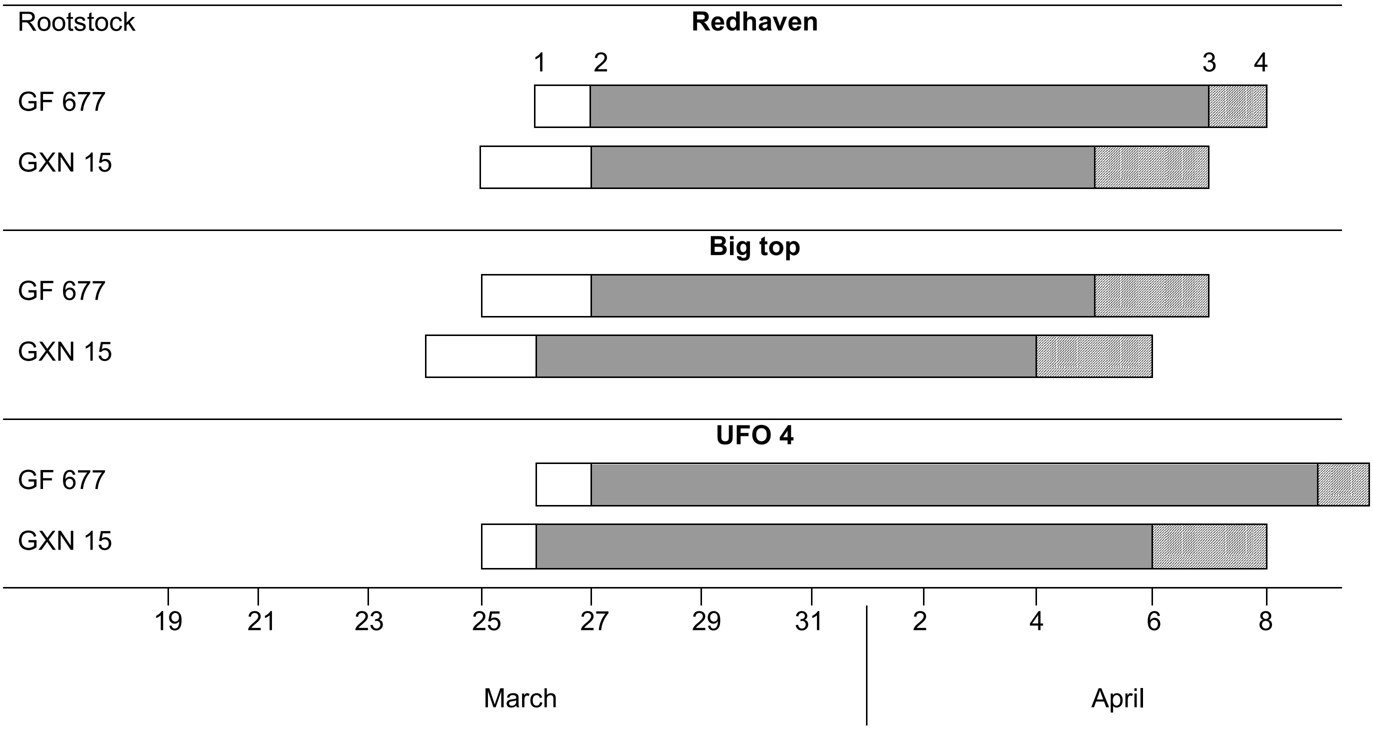


***Fig. 3.*** *Date and duration of flowering stages in 2018; 1 – Beginning of flowering; 2 – Beginning of full flowering; 3 – End of full flowering; 4 – End of flowering*

**Table 1.** Percentage of frost damage, beginning of harvest, end of the vegetation of three peach cultivars

| Rootstocks | Percentage of frost damage | Beginning of harvest | | | End of vegetation | | |
|---|---|---|---|---|---|---|---|
| | | 2016 | 2017 | 2018 | 2016 | 2017 | 2018 |
| **Redhaven** | | | | | | | |
| GF 677 | 0 | 05.07 | 17.07 | 10.07 | 29.10 | 24.10 | 22.10 |
| GXN 15 (Garnem) | 0 | 05.07 | 17.07 | 10.07 | 29.10 | 24.10 | 22.10 |
| **Big top** | | | | | | | |
| GF 677 | 31,2 | 27.06 | 11.07 | 3.07 | 29.10 | 24.10 | 22.10 |
| GXN 15 (Garnem) | 46,2 | 27.06 | 11.07 | 3.07 | 29.10 | 24.10 | 22.10 |
| **UFO 4** | | | | | | | |
| GF 677 | 0 | 19.06 | 26.06 | 20.06 | 1.11 | 27.10 | 26.10 |
| GXN 15 (Garnem) | 1,54 | 19.06 | 26.06 | 20.06 | 1.11 | 27.10 | 26.10 |

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**REFERENCES**

*Alonso, J. M., Ansón, J. M., Espiau, M. T. and Socias i Company, R.,* 2005. Determination of endodormancy break in almond flower buds by a correlation model using the average temperature of different day intervals and its application to the estimation of chill and heat requirement and blooming date. J. Amer. Soc. Hort. Sci. 130: 308–318.

*Ben Mimoun, M., Dabbabi, S., Ben Yahmed, J., Chaouch, Z., Ajem, F., Ghrab, M., Pinochet, J., Gogorcena, Y. and Moreno, M.A.*, 2015. Results on the performance of several *Prunus* rootstocks for peach. Acta Hortic. 1084, 147–152
DOI: 10.17660/ActaHortic.2015.1084.19
https://doi.org/10.17660/ActaHortic.2015.1084.19

*Dimitrova, M.,* 2001. The influence of rootstock on the growth and productivity of three apricot cultivars. Bulgarian Journal of Agricultural Science. Vol. 7, 161–166.

*Egea, J., Ruiz D., Martínez-Gómez P.*, 2004. Influence of rootstock on the productive behaviour of 'Orange Red' apricot under Mediterranean conditions. Fruits., vol. 59, 05: 367–373.

*Elloumi, O., Ghrab, M. and Ben Mimoun, M.*, 2013. Chilling accumulation effects on performance of pistachio trees cv. 'Mateur' in dry and warm area climate. Sci. Hort. 159: 80–87.

FAOSTAT, 2016. FAO statistical databases. http://faostat.fao.org/.

*Filipe, A.*, 2009. 'Felinem', 'Garnem', and 'Monegro' Almond × Peach Hybrid Rootstocks. HortScience, vol. 44, № 1, 196–197.

*Ganji Moghadam, E., Mokhtarian A.*, 2007. Evaluation of the effects of plum rootstocks on time of flowering in apricot ('Shahroudi' and 'Lasgerdi' cultivars) trees. Acta Hort., (ISHS) 734: 163–165.

*Giorgi, M., Capocasa, F., Scalzo, J., Murri, G., Battino, M., & Mezzetti, B.*, 2005. The rootstock effects on plant adaptability, production, fruit quality, and nutrition in the peach (cv. "Suncrest "). Scientia Horticulture, 107, 36–42.

*Iglesias, I., Carbó, J. and Bonany, J.*, 2012. The effect of rootstock on agronomical performance and fruit quality of 'Elegant lady®' peach cultivar. Acta Hortic. 962, 613–619.

*Iglesias, I., Montserrat, R., Carbó, J., Bonany, J. and Casals, M.*, 2004. Evaluation of agronomical performance of several peach rootstocks in Lleida and Girona (Catalonia, NE-Spain). Acta Hortic. 658, 341–348.
DOI: 10.17660/ActaHortic.2004.658.49
https://doi.org/10.17660/ActaHortic.2004.658.49

*Karlidag, H., Ercisli S.,* 2010. The influence of rootstocks on frost damage in apricot cultivars. Kabaasi and Hacihaliloglu. Acta Horticulturae (ISHS), 862: 313–316.

*Kaska, N.*, 2006. Orchard management in apricots. Acta Horticulturae, 717: 287–294.

*Milatović, D.* 2005. The flowering of apricot cultivars in the region of Belgrade. Voćarstvo, vol. 39, 151: 285–293.

*Mitov, P., Dyakov D., Lichev V., Govedarov G.,* 1993 (a). Comparative testing of newly introduced peach varieties. Plant Science, 7–8, 114–118.

*Mitov P., Dyakov D., Lichev V., Govedarov G.,* 1993 (b). Testing of cultivated in Bulgaria and newly introduced nectarine varieties. Plant science, 7–8, 119–124.

*Mratinić, E., Milatović D., Đurović D.*, 2010. Biological properties of Serbian apricot cultivars and selections grown in the region of Belgrade. Voćarstvo, vol. 44, 169–170: 13–19.

*Ondrásek, I. and Krska, B.*, 2015. An evaluation of two peach varieties new to the Czech Republic, grown on six different rootstocks. Acta Hortic. 1084, 283–289.
DOI: 10.17660/ActaHortic.2015.1084.40
https://doi.org/10.17660/ActaHortic.2015.1084.40

*Reighard, G. L. and Loreti F.*, 2008. Rootstock development. In: Layne D. R., Bassi D. (Eds.), The Peach, Botany, Production and Uses. CAB International, Wallingford, U.K., pp. 193–220.

*Sosna, I.*, 2006. Estimation of several plum cultivars on four rootstocks. Scientific works of the Lithuanian Institute of agriculture and Lithuanian University of agriculture. Sodininkyste ir darzininkyste. 25 (3) 250–257.

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

*Southwick, S. M., Weis, K. G.*, 1999. Propagation and rootstocks for apricot production. Acta Hort. 488: 403–410.