

## ASPECTS REGARDING VARIETY/ROOTSTOCK RELATIONSHIP IN SOME SPECIES OF FRUIT SPECIES

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### Abstract

*Obtaining large and quality productions requires, in addition to agrotechnical measures, the establishment of the most appropriate symbiosis between grafts (varieties) and rootstocks. This variety/rootstock union particularly influences tree growth, production and quality.*

*Knowing the growth of the root system has an important role in choosing the system of use and tillage, in choosing the land.*

*The varieties of nectarine on the frank peach rootstock had different vigor, vigor represented by the height, the diameter of the crown, respectively a lower vigor was recorded in the Marina variety, the other varieties being noted with much greater vigor.*

*Compatibility between nectarine varieties and rootstocks was very good, with no split at the grafting point. Deeply developed roots were found in Costin, Tina and Romamer 2 nectarine varieties.*

*Varieties from the pear species namely Williams red, Clapp's Favorite and Daciana showed average vigor and very good rooting - the same varieties together with the Williams white variety.*

**Key words:** pear, nectarine, radicular system, variety

### INTRODUCTION

The growth of the stem, respectively the fruiting and finally the production obtained is influenced above all by the root system, its development, the vertical or horizontal distribution of the roots.

Under the influence of the two cultivar/rootstock partners, of the differentiated way of growing the root system, the vigor of the trees, the affinity of the two partners, was analyzed, highlighting better this symbiosis between rootstock and graft.

The result of the graft/rootstock interaction is reflected on the biological characteristics of the trees, which are different from variety to variety.

The compatibility or affinity between the partners is a very important aspect for the growth and development of the tree during the vegetation period, it is necessary to approach the value 1 of the diameters of the rootstock and the graft.

The results of this variety/rootstock interaction are practically the purpose of this experience.

The biological particularities of the trees are the result of the interaction, of the symbiosis of the variety/rootstock partners, these particularities being different from symbiosis to symbiosis, (Monin A., 1974).

Research on the pear species continues in many countries from Europe, thus in the Czech Republic some valuable varieties such as Radana, Elektra, Erika, Dita and many others are highlighted for the establishment of intensive plantations, (Paprstein F., 2008).

Also, in France, the areas with the pear species are reduced, respectively with some varieties sensitive to *Erwinia amylovora*, and certain varieties such as Williams, Conference or Doyenne du Comice are maintained, (Guiheneuf Y., 1989).

In Asian countries, pears production is higher, especially in China where the

production of pear varieties has increased greatly, representing over 90% of the total fruit production, and in Japan this production has decreased by 10%, (Gemma H., 2008).

Following recent research in Norway, new varieties have appeared such as Celina Q which is a very attractive variety, Ingrid variety which is an early variety along with Kristina variety, (Hjeltness S.H. et al., 2015).

The variety/rootstock interaction was also studied in Holland between the Conference variety and five rootstocks, (Mass F., 2015), where high productions of the Conference variety were obtained on Adams, MC and Eline rootstocks.

The influence of the rootstock on the tree stem was also evident in the case of pear and apricot varieties grown on sand, thus some apricot varieties Venus, Neptun and Umberto found favorable conditions on these soils, the roots of the soils exploiting the soil up to 80 cm deep, (Cichi M. et al., 2016).

In Brazil, some varieties grafted on *Pyrus calleryana* rootstock like Williams, Rocha, Santa Maria have proven to be very valuable varieties from a qualitative and quantitative point of view, (Klamer de Almeida G. et al., 2015). In Russia, following research, it was found that the quince rootstock is not suitable for use in regions with temperatures below 25°C, (Deckers T. et al., 2008).

The influence of the rootstock M 9 had a special role on the growth dynamics of the shoots, on the number of inflorescences that appeared, respectively in the varieties Jonagold, Romus 1 and Generos, (Cichi M. et al., 2020).

Pear variety Doyenne du Comice had good growth on BA 29 rootstock, William Bovey variety with good growing results on Cts 214 rootstock and Barlett variety less growth on EMA rootstock, (Rivalta L. et al., 1989).

The variety and the rootstock have a major influence on some physiological aspects, namely on photosynthesis, respiration, the chlorophyll content of the

leaves, with an important role in the growth and fruiting of trees, (Cichi M. et al., 2018).

Climatic conditions are favorable for the development of diseases such as Bacterial blight for some pear varieties, thus the Curè variety proved to be more sensitive, (Mirela Paraschivu et al., 2020). The creation of genotypes resistant to diseases such as bacterial blight and respectively with better resistance to some periods of high humidity and temperature, can be a solution for obtaining quality productions, (Mirela Paraschivu et al., 2021).

The author Uman J., (2005), presents the program of multiplication of pear varieties in South Africa, objectives that must be met for the needs of the market.

## **MATERIALS AND METHODS**

The research was carried out during 2019-2021 in a plantation established in 2010 in the area of Breasta, Dolj county (Oltenia) on a preluvosol type soil with 5 varieties of pear.

The experiment was placed according to the method of randomized blocks in three repetitions with four trees per repetition, returning twelve trees per variant.

The rootstock for the five varieties was the type A quince with intermediate.

The data in the present study refer to the following five varieties, namely: White Williams, Red Williams, Conference, Clapp's Favorite and Daciana.

The works were uniform for all the varieties, and the trees were led in the form of vessel shape and are planted at a distance of 4/3.5 m, with a short trunk of 60 cm.

The second plantation was established in the fall of 2010 in the same region with a number of 4 varieties of nectarines.

The planting distance is 4/3,5 m, and the trees are grown as improved vessel. The rootstock for the four varieties of nectarines is frank peach.

The placement of the varieties, respectively the variants, was done according to the method of randomized

blocks in two repetitions, with four trees in the repetition, respectively eight trees per variant. The nectarine varieties used in the experiment were: Costin, Romamer 2, Tina and Marina.

Within the framework of the two experiences, the architecture of the root system was analyzed using the profile method (Pomologia României, vol. I-IX, -2013), respectively the vigor of the trees which was represented by the height, the diameter of the crown, the thickness of the tree trunk surface.

The compatibility of the variety with the rootstock in the conditions of the Breasta area was also studied.

The important objectives studied within the experience were:

- observing the growth and development of the root system horizontally;
- the influence of the rootstock on the growth and development of the variety;
- studying the compatibility of the two partners, respectively variety/rootstock.

## RESULTS AND DISCUSSIONS

The profile method is the method of visualizing the horizontal roots, their thickness and number, but also their depth in the soil.

For the observation of horizontal roots, we made a trench, 1 m deep and at a distance of 1 m from the tree trunk, and all roots with sizes between 1-3 mm, 4-8 mm and over 8 mm in diameter observed on the wall on part of the trunk, were marked on graph paper.

In the case of studied varieties of nectarines grafted on the frank rootstock, we can see that a number of 112 roots were observed at different depths.

Analyzing by the profile method the number of grown roots, we observe a higher number in the Costin variety (33.0), then in the Romamer 2 (28.0) and Tina (31.0) varieties.

We observed a smaller number of roots in the Marina variety - 20.0, (figure 1). Roots up to a greater depth, respectively 80-85 cm, were highlighted in the Costin and Romamer 2 varieties.

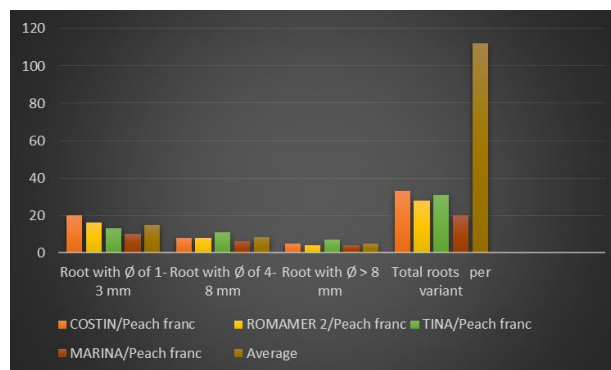


Fig. 1 – Root system growth in some nectarine cultivars

These varieties prove by this aspect a much deeper, deeper rooting, a solid anchoring in the soil.

With less deep rooting only up to a depth of 65 – 70 cm, the Marina variety stands out, and the Tina variety shows a deeper rooting and stands out with a greater number of roots with a diameter of more than 8 mm.

A high degree of absorption of nutrients is shown by the varieties with a greater number of absorptive roots with a diameter of 1-3 mm, namely the varieties Costin, Romamer 2 and Tina.

In conclusion, the root system was well developed in the case of the frank peach rootstock, this aspect presenting a positive criterion for the development and growth of the aerial part, of the skeleton, respectively of the fruits.

According to the data, a very good compatibility can be observed between the four nectarine varieties and the frank peach rootstock, especially in the case of the combination with the Romamer 2 variety and the Tina variety, where the recorded ratio was 0.98 and 0.99.

And in the other two combinations Costin/frank peach and Marina/frank peach, the ratio was a good 1.02.

It should be noted that the good compatibility between the grafts and the variety is given by the closeness to the value of 1.0. The compatibility values of the varieties with the rootstock are also graphically represented in figure 2.

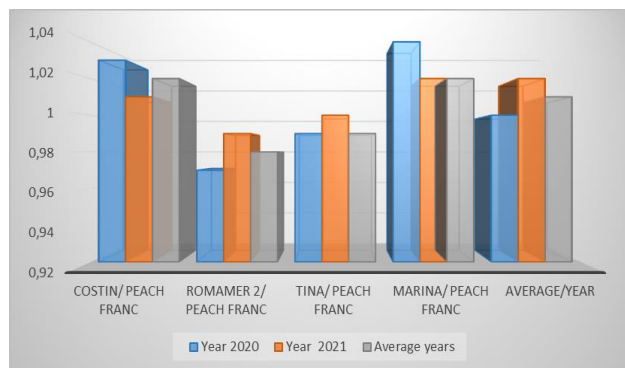


Fig. 2. Compatibility between graft and rootstock

The high growth vigor reflected by the sum of vegetative growth, tree height, crown diameter, trunk section surface stood out in the Tina variety.

The Costin and Romamer 2 varieties stood out with medium to high vigor, and the Marina variety with medium vigor.

The nectarine varieties studied proved to be productive with yields between 28 kg/tree (Costin and Marina varieties) and 30 kg/tree (Tina and Romamer 2 varieties).

Regarding the destination, the Costin variety is suitable for fresh consumption, and the other varieties for fresh consumption but also for industrialization.

The study of the root system of trees brings great support in solving some theoretical and practical problems.

This study facilitates the understanding of the complex interdependence between the root system and the aerial part, between the plant and the soil, establishing the relationship between the root system, the trunk and the crown of the tree.

Carrying out the study of the root system of the pear varieties grafted on the quince rootstock type A with intermediate, we found that a greater number of horizontal roots is presented by the white Williams (38 - 30.4%) and red Williams (33 - 26.4%) varieties).

An average number of roots was recorded in the variety Daciana (22 - 17.6 %), in the variety Favorita lui Clapp (18 - 14.4 %) and a smaller number of horizontal roots in the variety Conference (14 - 11.2 %).

The mass of horizontal roots in the case of the Conference variety was distributed in

the soil from 0-10 cm to 70-80 cm deep, and in the case of the other varieties, from 0-10 cm to 90-100 cm.

The Conference variety has a very well-developed root system (45.0%) at a depth of 0-20 cm, but so does the red Williams variety (35.0%), thus taking into account the fixing of the guidelines regarding the maintenance and fertilization works.

This aspect is positive regarding the distribution of fertilizers, because they will reach the area of land explored by most of the absorbing roots, an aspect favorable to the development of the trees.

The white Williams variety presented a very small number of roots at the depth of 0-20 cm, namely 5.0% of the total number of roots.

At the depth of 40-60 cm, a small percentage of roots is noticeable in the white Williams variety (6.00 %) and in the Conference variety (7.00 %).

A higher percentage of roots was observed in red Williams (25.0 %) and Clapp's Favorite (15.5 %).

In the Conference variety, the horizontal root system was distributed up to a depth of 80 cm, where at the 60-80 cm level, the percentage of roots was 23.0%.

In conclusion, the Conference variety stands out with a slightly shallower root system on the soils of this area.

Among the varieties at a depth of 60-80 cm, a higher percentage of horizontal roots was observed in the Favorita lui Clapp and Daciana variety (21.0 %), and in the rest of the varieties the percentage of roots was between (10.8-8.82 %).

On the final portion of 80-100 cm, the horizontal root system was highlighted in a higher percentage in the white Williams variety (17.3%), lower in the red Williams varieties (9.0%), in Clapp's Favorite, respectively Daciana (6.30 %).

In conclusion, these varieties have a deeper root system. The rooting depth, as well as the way of branching, is a genetic characteristic of the variety and species.

A greater number of thick roots of 1-3 mm and 4-8 mm, respectively, was observed in the white Williams and red Williams

pear varieties, and with roots over 8 mm in thickness, the Conference variety stood out (figures 3).

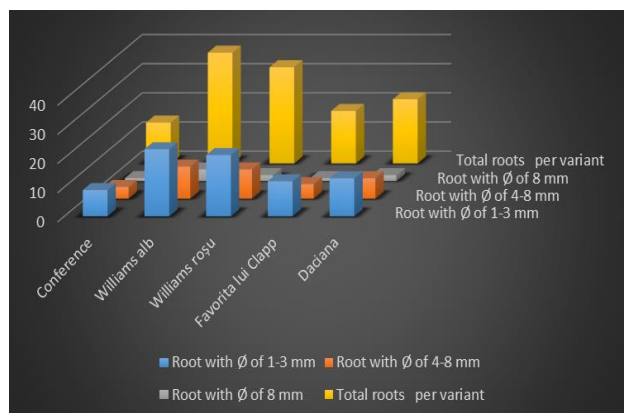


Fig. 3 – The number of roots by diameter

By measuring the graft and the rootstock immediately above and below the grafting point, then calculating the ratio between the partners, we found minor differential values for each individual combination. Thus, the ratio of growth in thickness in the grafting area was close to unity in all varieties in the experiment, but with small differences.

With a growth ratio further from 1, the Daciana variety stood out, registering an average of 1.05 years, (figure 4).

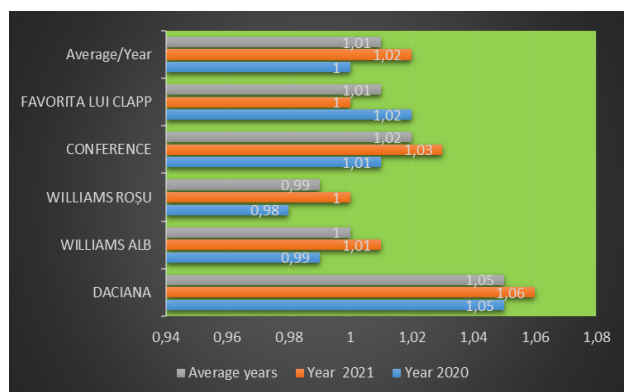


Fig. 4 – Compatibility varieties of pear with quince rootstock

A very good compatibility of the two partners, obtaining a ratio closer to 1, was recorded for the Williams white (1.00) and Williams red (0.99) varieties.

But also for Clapp's Favorita (1.01) and Conference (1.02) varieties.

The correlation between the root system and grafting is evident by the vigor of the

tree given by the height, the diameter of the crown, the area of the trunk section.

The ripening time for the summer varieties was between July 25 and August 10 (Daciana, Clapp's Favorite), and for the autumn varieties the fruit ripening period was between August 20 and September 10 (Williams white, Williams red, Conference).

In the culture of any fruit species, the varieties or hybrids that, in addition to production and quality, also show resistance to diseases and pests are increasingly appreciated. Thus, the pear varieties proved to be resistant to some diseases such as scab, moniliosis and white spotting of the leaves, and the pear worm slightly affected the red Williams variety (3.0%).

The nectarine varieties within this experience generally show good and very good resistance to diseases such as leaf spotting, moniliosis, powdery mildew, provided that the specific treatments are applied in the periods imposed by the calendar.

## CONCLUSIONS

The conditions in the study area for all studied nectarine and pear varieties were favorable.

The growth and development of the root system of the rootstock is influenced by the genetic characteristics of the species but also by the climatic conditions, especially the characteristics of the soil.

Angers quince rootstock and frank peach rootstock have a major influence on tree vigor and a slight influence on tree fruiting. The root system was well developed in the case of the frank peach rootstock, this aspect presenting a positive criterion for the development and growth of the aerial part, the skeleton, respectively the fruits.

In the case of the nectarine varieties, a deeper rooting and with a more intense absorption of substances from the soil was noted in the Costin, Romamer 2 and Tina varieties.

The white Williams, red Williams, Clapp's Favorite and Daciana pear varieties

showed a highly developed architectural system in depth.

Very good compatibility between the two partners (variety/rootstock) was observed for all nectarine varieties, and among the pear varieties, the Daciana variety recorded a ratio greater than 1, regarding the increase in diameter of the graft and the rootstock.

In conclusion, it is necessary to maintain the performing varieties in the favorable areas, but also to expand them in other regions of the country.

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