

RESULT OF THE ASSOCIATION VARIETY x ROOTSTOCK ON THE GROWTH AND DEVELOPMENT OF AERIAL AND UNDERGROUND SYSTEMS IN THE SPECIES OF APPLE AND PEAR

Cichi M.

University of Craiova, Faculty of Agronomy

Keywords: variety, rootstock, affinity

ABSTRACT

The extension of some varieties of pear and apple, as well as their way of behaviour in new areas of the country, impose the verification of their biological particularities and their accentuation. It has interest also on the interaction of the two partners – rootstock/variety in the respective area, vigour, phenological aspects and resistance to diseases, pests and viruses.

To this purpose, we proposed to search several varieties of pear and apple on different rootstocks on the region of Oltean county, in order to improve the present assortment. MM 106 rootstock presents a more superficial development of the roots, and M 4 and P.F. Crețesc presented more profound roots in soil. The affinity between partners was very good for the Jonathan variety on rootstocks M 4 and MM 106, and in the case of species of pear in the varieties Passe Crassane and Untoasă Precoce Morettini on the rootstock quince type A with intermediary Cure.

INTRODUCTION

The species of apple and pear hold the first positions within the fruit trees species in the country, the assortment is completed year by year with new assortments, numerous researches being carried out to specify the qualities of introduced varieties, of the behaviour of the variety/rootstock (Ciobanu A. et al, 2013).

Some researchers (Branîște N. et al, 2008) carry out researches on some varieties of pear, specifying the objectives, the research methods and the performances of the programmes for improving the assortments. It was found out that the resistance genes for some diseases and certain pests are originating from the Japanese pear (*Pyrusserotina*), Andreieș N., (1993).

The researches carried out in Iași Fruit-growing Station showed the fact that the fructification of trees is influenced by the distance between the lines, but also by the supporting system (Roșca C. et al, 1993). Testing of some varieties of apple in Moldova with the presentation of agrobiological characteristics and some criteria for the creation of plantations with trees of Knip-baum type was studied by Gudumac E., (2008). It was researched the leaf area in some varieties of apple, taking into account the used foliar feeding, by Bălan V. et al, (2012). The study for growing and developing the varieties of apple depending on the practiced way to cut them was studied by Bălan V. et al, (2006). The increase of roots influences the growing of sprouts from the crown, relation researched by Qu Zezhou Han Qiqian (1983).

Also, the scab disease was maintained in some varieties of apple following the application of appropriate treatments (Grauslund et al, 1996). Following the researches, it was found out that the rootstocks have much higher values of the leaf area index and the content of chlorophyll in the leaves (Bosa K. et al, 2016). The influence of rootstock on growth and fructification phenophase main plum varieties studied is not very large, the values recorded by the four rootstocks being close, (Ciobanu A. et al, 2010).

MATERIAL AND METHODS

The experiences were placed in Oltcounty, on a reddish preluvosoil with a high degree of favourability (Popescu, 1998; Popescu, 2015). An experience with five varieties of pear grafted on the rootstock quince type A with intermediary Cure at the distance of 4,0/3,5 m, the form of the crown was of classic vase. The varieties were placed in three repetitions with 4 trees in repetition, meaning 12 trees in each variant. The used varieties were: Untoasă Precoce Morettini, Favoritalui Clapp, Williams, Conferance, Pässe Crassane.

The second experience comprised a variety of Jonathan apple grafted on three rootstocks, which are MM 106, M4 and P.F. Crețesc at the distance of 4,0/2,0 m and the form of non-tiered palm crown. The variants were placed in three repetitions with five trees in repetition, therefore 15 trees in variant.

Determination of the number of horizontal roots, the thickness and the depth at which is installed the mass of roots were carried out by the method of profile. The scion/rootstock ratio was calculated using the electronic calibre immediately measuring above the grafting point and then immediately below the grafting point, to determine compatibility of the two partners.

At the end of the vegetation there were performed measurements on the length of annual growth, diameter of the crown, height of trees, thickness of the trees' trunk. The data was statistically calculated with the statistics programme Anova Manova.

RESULTS AND DISCUSSIONS

The development of the radicular system has positive or negative effects on the growth of trees, fertilization of fruits, growth of fruits, and this is why the study of the architectonics of radicular system is necessary to discover and eliminate the negative factors. Thus, in the case of the species of apple, Jonathan variety on the rootstock MM 106 records a total number of 71 roots, the rootstock M 4 a number of 84 roots and the rootstock P.F. Crețesc a number of 102 roots.

On the interval 20-30 cm were found roots at the rootstocks M 4 and P.F. Crețesc, proving a more profound rooting in the soil. At the same rootstock a great number of roots were found at the depth of 30-60 cm.

The rootstock MM 106 presents a greater number of roots at the depth of 30-40 cm. At the depth of 60-70 cm there are no roots, thus proving a more superficial radicular system.

The roots formed after 10-15 cm help the trees in the normal growing and developing of roots, avoiding drought in the more superficial layers.

As for the annual growths at the apple variety Jonathan on the three rootstocks, we can specify that, as compared to the average X, positive significances, thus greater growth, we have at Jonathan variety on the rootstock P.F. Crețesc and negative significances on the rootstock MM 106. The data emphasised the great vigour which the rootstock P.F. Crețesc gives and much smaller of the other two rootstocks M 4 and MM 106. The average of growth at the varieties of pear was of 46,6 cm/tree, with positive significances as compared to the average X we have the variety Clapp's Favourite, and with negative significances we have the varieties Williams and Pässe Crassane.

As for the dynamics of the growth of sprouts in the two species, this was performed every 3 days by measurements with the meter. The duration of sprouts growth depends first of all on the species, but also depends on the climate conditions in the region. The growth period at the apple variety Jonathan on the three rootstocks was comprised between 55 and 63 days, and the daily average growth was between 0,60 – 0,78, (Figure 1).

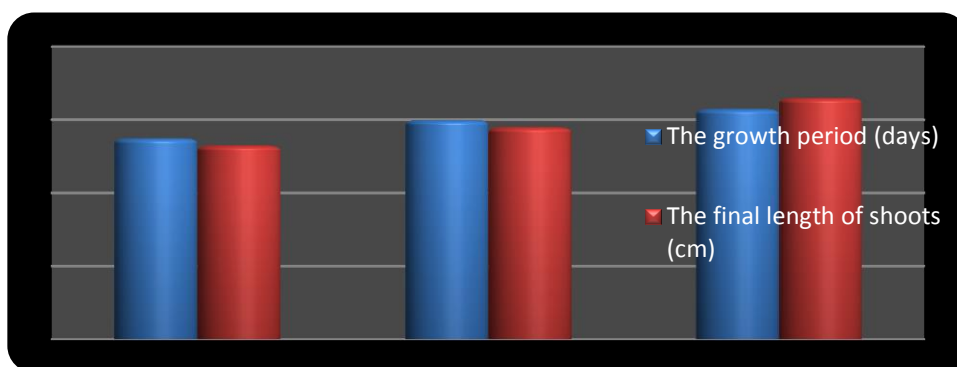


Fig. 1. Dynamic growth of shoots the variety Jonathan

In case of pear varieties, the sprouts growth period was comprised between 55 and 66 days, the daily growth was of 0,50 – 0,59 cm for the carrying out of a growth comprised between 45,0 and 59,0 cm, (Figure 2).

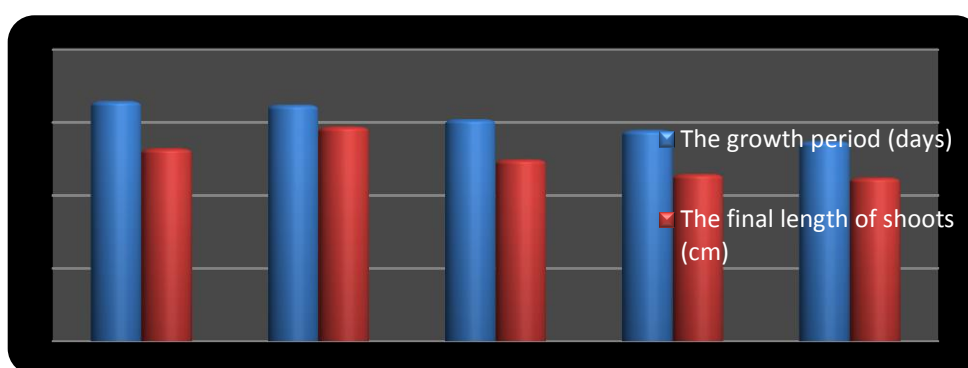


Fig. 2. Dynamic growth of shoots the varieties pear

A great vigour given by the thickness of the tree's trunk is noticed in the rootstock P.F. Crețesc where the recorded value was of 165,0 cm²/tree, the significance being distinctly positive significant as compared to the average, and the rootstock MM 106 has a value lower than 111,0 cm²/tree with significantly negative significance as compared to the average X. With greater sizes of the trunk's diameter are the varieties Clapp's Favourite - 140,0 cm²/tree and Untoasă Precoce Morettini -135,0 cm²/tree, statistically are very significantly positive as compared to the average X. The varieties Conference – 117,0cm²/tree, Williams – 113,0 cm²/tree and Passe Crassane – 109,0 cm²/tree have values lower than the average, statistically are significantly and very significantly negative as compared to the average X.

The varieties of the two species have fruits on harvest long formations, but also on short formations. At the varieties which have fruits more on short formations, it can be performed a reduction of the distance between the tiers of the tree's crown, but also between the 2nd order branches and the semi-skeleton branches.

A good result of the affinity of the two partners was achieved between the variety Jonathan and the rootstocks MM 106 and M 4, where the ratio value was of 0,99 close to the unit. A more distant ratio from the unit was obtained at the variety Jonathan with the rootstock P.F. Crețesc the ration being of 0,97. The ratio does not present however a very distant value from 1, but it can be noticed the growth vigour higher than that of the rootstock P.F. Crețesc, (Figure 3).

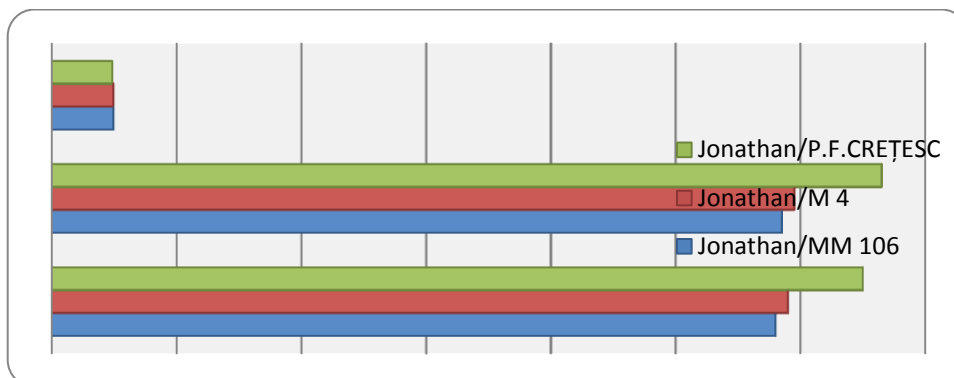


Fig. 3. Report scion/rootstock (apple species) - average years - 2012-2014

The pear varieties analyzed in these two years recorded a ratio very close to the unit, as are specified the varieties Untoasă Precoce Morettini – 0,99, PasseCrassane – 1,01. The varieties Clapp’s Favourite and Conference have ratio values of 0,98, and the variety Williams has a ration of 0,97, (Figure 4).

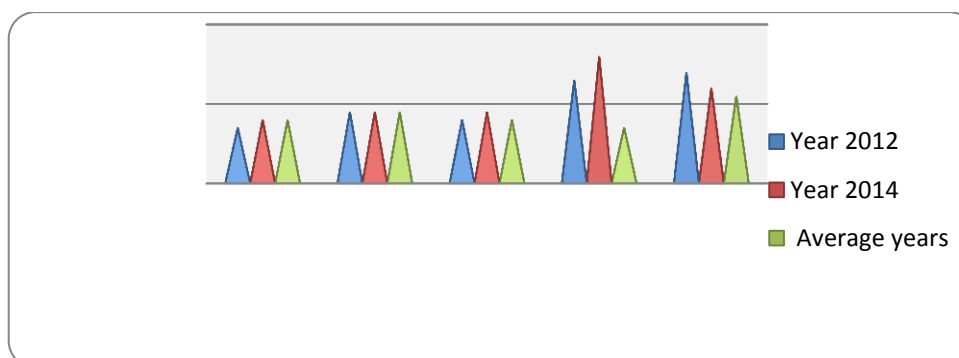


Fig. 4. Report scion/rootstock (pear species)- average years - 2012-2014

The average of years for all the varieties of pear in regard to the degree of affinity of partners in all these years, was of 0,986, therefore a very good behaviour between the two partners.

Analysing the presence of diseases or pests in the apple variety Jonathan and the studied pear varieties, we can specify that the apple variety presented aslight affectation caused by mildew and scan (note 3). A slight attack of scab and mildew was noticed in the pear varieties Clapp’s Favourite and Passe Crassane (notes 2-3).

The content of soluble dry substance is comprised between 12,5 and 18,4 %, and the content of sugar between 8,7 and 9,6 g at 100 g.s.p. The high content of soluble dry substance is recorded at the varieties Williams and PasseCrassane (17,4 – 18,4 %), but also an increased level of sugar– 9,6 g at 100 g.s.p. reduced content of acidity is noticed in the varieties Untoasă Precoce Morettini and Conference – 0,17 - 0,18 g at 100 g.s.p. In general, the varieties with reduced content of sugar and acidity confer the fruits a flavourless taste.

CONCLUSIONS

The species of apple and pear through the researched varieties proved an very good growth and development under the climate conditions in șiOlt county.

Among the apple’s rootstock, MM 106 presents a more superficial radicular system, and M 4 and the rootstock P.F. Crețesc has a more profound rooting.

Higher vegetative growths presented Jonathan/ P.F. Crețesc and the pear varieties Clapp’s Favourite and Untoasă Precoce Morettini. Smaller growths presented the varieties Conference, Williams and Passe Crassane.

A very good affinity presents the variety Jonathan on the rootstocks M 4 and MM 106, and in the pear varieties – Passe Crassane and Untoasă Precoce Morettini grafted on quince type A.

The resistance to diseases and the more important pests was very good, both at the apple and especially at the pear. There can be retained in the assortment and extended to the varieties Jonathan, Conference, Clapp's Favourite, Untoasă Precoce Morettini, Williams.

REFERENCES

1. **Andreieș, N., 1993.** *Hibridi de păr rezistenți la Venturia Pirina și Psylla Sp. obținuți la Voinești. Lucrările științifice ale I.C.P.P Pitești-Mărăcineni, Vol. XVI. București, 71-73.*
2. **Bălan, V., Șăganean, R., 2006.** „Potențialul de creștere al pomilor de măr în funcție de sistema de tăiere”. *Agricultură - Știința și practică. Nr. 3-4, (59-60), 51 – 55.*
3. **Bălan, V., Vămășescu, S., 2012.** „Influența îngrășămintelor foliare asupra creșterii suprafeței foliare la măr”. *Știința agricolă, nr.1. ISSN 1857-0003, 36 – 40.*
4. **Brașiște, N., Andrieș, N., Ghidra, V., 2008.** *Pear genetic breeding to improve the romanian varieties. ISHS Acta Horticulture, Number 800. Proceedings of the tenth International pear Symposium, Volume 1, 491-496.*
5. **Bosa, K., Jadczyk-Tobjasz, E., Kalaji, M.H., 2016.** *Photosynthetic productivity of pear trees grown on different rootstocks. Annali di Botanica, Coenology and plant ecology. Volume 6, 1-7.*
6. **Ciobanu, A., Cichi, M., Mirela Călinescu, Iancu, D., 2010.** *Rootstock influence on the main phenophase of growth and fructification in some varieties of plum located in the center of Oltenia. The Annals of University of Craiova, Series Agriculture, Montanology and Cadastre, vol. XL/1, pag.29-34.*
7. **Ciobanu, A., Mirela Călinescu, 2013.** *Aspects regarding graft/rootstock biosystem of apricot cultivars NJ 42 and Ceamaibună de Ungaria on reddish preluvosoil from the central zone of Oltenia. Fruit Growing Research, Vol. XXIX, 64-71.*
8. **Grauslund, J., Bertelsen, M., 1996.** *Comparison of integrated and conventional production of apples. Acta Horticulturae 442.*
9. **Gudumac, E., 2008.** *Ghid Informativ. Înființarea și exploatarea livezilor superintensive de măr (cu pomi de tipul Knip-Baum). Chișinău.*
10. **Qu Zezhou Han Qi-qian, 1983.** „Studies on the relationship between root and top growth of apple”. *Acta Horticulturae Sinica. Vol. 10, nr. 1.*
11. **Popescu C., 1998.** *Cercetări privind solurile din bazinul hidrografic al Raznicului și proprietățile lor agroproductive. Teză de doctorat. Universitatea din Craiova.*
12. **Popescu C., 2015.** *Physical and chemical characterization of main soils from north west part of Dolj district. Annals of the University of Craiova- Agriculture, Montanology, Cadastre series, vol. XLV, 227-231.*
13. **Roșca, C., Dumitrescu, Gh., 1993.** *Comportarea în livadă a șase soiuri de păr, cu și fără sistem de susținere. Lucrările științifice ale I.C.P.P Pitești-Mărăcineni, Vol. XVI, 43-46.*