

## THE INFLUENCE OF ROOTSTOCK ON THE PHENOLOGICAL ASPECT FOR SOME APPLE TREE VARIETIES

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### ABSTRACT

The behaviour of apple tree varieties in various regions is different both because of the climate and soil conditions and because

of the affinity between the two partners variety-rootstock.

The varieties should have high production qualities, very good compatibilities with rootstocks on certain soils, high resistance to particular diseases and pests. The presence of annual branches within the tree crown is important since it provides the fruit continuity, respectively the production continuity. The Tenroy variety was characterised by fewer annual branches, therefore the tree vigour was smaller. The annual branches should be 30-60 cm long; better percentages were registered for Generos (26,0%), Florina (22,2%) and Romus 1 (21,6%).

There is a correlation between the number of shoots and their length during the tree growing process. For Romus 1 and Florina varieties, the shoot length was smaller, but the shoot number was higher. We noticed a higher percentage of fruit formation for Jonagold 60 %, then for Tenroy 41 % and Romus 1- 40 %. We noticed the highest percentage of developed fruit out of the total open flowers at early ripening varieties.

The fruit development lasted between 65 and 90 days. We noticed a shorter time of fruit development for the Romus 1 variety (65 days) and a longer time for the Tenroy variety (90 days). The fruit development within the analysed varieties presents an ascendancy, then a development maximum, and finally a slowdown followed by the end of the development.

In the southern area, in order to provide large fruit supplies, we may keep in range the following varieties: Romus 1, Florina, Jonagold and Generos.

### INTRODUCTION

The habit of growth of the apple tree varieties on regions is different both because of the climatic and pedological conditions and because of the two partners, namely variety-rootstock. By combining the varieties with different rootstocks, we may get trees having certain biological particularities. These particularities are different from the ones of the rootstock or from the ones of the graft, (Monin, A. 1974). The interaction between the variety and the rootstock and between the two of them and the climatic conditions in the area may influence the

vigour of the trees, (Hall-Beyer B. et al, 1983).

Physiologically, some apple tree varieties need more water during the growing season, thus the perspiration rate will be more intense (Remy P., 1962).

After making some cuts for four varieties of apple tree, namely Pinova, King Jonagold, Champion and Gala Must grafted on M 9, we noticed that the growing dynamics of the shoots influence the growing of the foliar surface, (Bălan V. et al, 2006).

After studying the properties of seven genotypes of indigenous apple trees growing in a Serbian region, we found that two varieties, namely Budimka and Kozara, have high quality fruit and are very resistant to apple scab, (Maric S. et al, 2013).

Within the apple tree growing program, there were presentations of the biological properties of certain promising selections of apple trees, namely: J/3/60, J/2/11, J/1/15, J/15/96, (Lukic M. et. al, 2013).

Within some research, there were presentations of the habit of growth of the Golden Delicious variety grafted on four

rootstocks, namely: M 9 EMLA, M 27, P 22 și PB – 4, (Jadczuk E. et al, 2007).

In the framework of East Malling program, the researchers got an AR 680-2 rootstock similar to M 9, a rootstock that may induce an augmentation of the fruit. Also, the AR 801-11, AR 835-11 selections produce the same vigour to the trees as the M 26 rootstock, but also high productivity, (Johnson D. et al, 2007).

The environmental factors together with the soil characteristics may influence the growing and the vigour of the plants in the respective area, (Grecu Florina et al, 2016). The influence of the low vigour rootstock on the tree growth was also presented by Cichi M., et al (2009).

## MATERIAL AND METHOD

The research referred to five apple tree varieties grafted on M 9 rootstock of low vigour, Tricroissillon Delbard crown shape and the researched varieties were: Romus 1, Florina, Generos, Jonagold, Tenroy.

The varieties were planted at a 2.5 m distance between rows and at 1.5 distance on the row.

The varieties were placed according to the randomized block method in 2 repetitions with 10 trees in repetition, respectively 20 trees in variation. The measurements and the observations were taken during the two years of research.

## RESULTS AND DISCUSSIONS

The presence of yearly branches in the tree crown is important as it provides the continuity of the fruit, respectively of the production.

Following our study, we found an average of 60 yearly branches on the control roofing for Romus 1 variety, 50 branches for Generos variety. The other varieties had an average of 45 branches – Florina variety, then 40 branches for Jonagold variety and 34 yearly branches for Tenroy variety.

The results were observed and the most useful and important conclusions were stated. The following goals were determined: the habit of growth of the varieties during the growing process; the habit of growth of the varieties during the fruiting process; the quantity and the quality of the studied apple tree varieties;

On this plantation, there were operations of leading the tree crowns, maintaining the crown characteristics during the relative rest season and also maintenance works applied to the trees.

Tenroy variety had fewer yearly branches therefore the tree vigour will be lower.

In the same framework, we also studied the presence of the yearly branches depending on their length, thus the established length categories were the following: 0-10 cm, 10-30 cm, 30-60 cm and more than 60 cm. By analysing the percentages we found that several branches up to 10 cm were present for Tenroy variety (47,0%), Jonagold variety (37,5%) and Romus 1 variety (36,0%).

Considering the studied varieties, there were several 10-30 cm long branches for the varieties of Florina (44,4%), Romus 1 (38,3%) and Jonagold (37,5%).

A good length of the yearly branches is to be among 30-60 cm and this was the case for the varieties of Generos (26,0%), Florina (22,2%) and Romus 1 (21,6%).

The branches longer than 60 cm were few, so the percentages were low (3,33 – 8,80%).

The presence of the yearly branches of different sizes may also be observed in figure 1. Within this study, we also highlighted the total length of the yearly growths, so we noticed a high total length of the yearly growths, namely 750.0 cm, for Romus 1 variety.

Next, there are the varieties of Generos with 650 cm, of Florina with 600 cm and of Jonagold with 560 cm. Percentage-wise, the number of yearly growths compared to the witness was between 117,6 and 176,4 %, (figure 2).

Percentage of annual branches becoming fruitful, the variety stands out Jonagold with 65,0 %, then the variety Florina with 55,5 % and varieties Romus 1 (41,6 %) and Tenroy (41,1 %). The Generos variety registered a percentage of 36.0% (figure 3).

The varieties having a larger number of proper fruit formation were Romus 1 and Jonagold with 24 formations, then there was a lower number of 16, respectively 18 formations for Florina and Generos varieties.

We observed a high percentage of 60% for Jonagold variety, then for the varieties of Tenroy with 41 % and Romus 1 - 40 %, (figure 4).

The presence of a large number of short formations such as spurs and thornes highlight the spur type with very low tree vigour and the large number of long formations, such as twigs, shoot show high vigour varieties, basically longer distances. After studying the number of the risen flowers, we noticed a larger number for the varieties of Romus

1, Florina and Generos, and a smaller number of flowers for the varieties of Tenroy and Jonagold.

A larger number of flowers was registered for the variety of Romus 1, then for Florina and Generos and a smaller number was registered for the variety of Tenroy.

Jonagold variety had an average number of flowers.

We achieved the growth dynamics of the shoots every 5 days, by meter measurements. Therefore, considering the data in table 6.8, we found the following: the shoot growth has always been ascending.

There is the beginning phase of shoot growth, then the phenophase of shoot intense growth, when the shoots reach to their maximum and the phenopase of stopping the shoot growth when the growth is smaller and smaller until it stops.

When shoots stopped growing, we measured them and found that the varieties of Jonagold and Tenroy had longer shoots (65 cm), Generos had 60 cm shoots and Romus 1 and Florina had smaller growths (50 – 55 cm).

During the fruit growing process, an ascending curve reaches the maximum growth at a certain point. Finally, this process knows a slowdown of the fruit diameter growth.

The daily average fruit growth was between 0,050 – 0,070 cm, thus the varieties of Romus 1 and Tenroy had an average growth of 0,070 cm, while Florina and Generos had growths of 0,060 – 0,065 cm.

Jonagold variety registered a smaller daily growth (0,050 cm), (figure 5).

We found that a smaller number of shoots in the tree leads to a bigger length of the shoots in the tree because sap is distributed to a smaller number of shoots.

In conclusion, there is a correlation between the number of shoots and the shoot length within the tree growing process. For the varieties of Romus 1 and

Florina, the shoot length was smaller but the number of shoots was higher.

The growing season of the apple tree shoots has between 55 and 61 days.

## CONCLUSIONS

1. The varieties of Romus 1, Generos, Jonagold registered a higher number of yearly growths.

2. The phenophase of the beginning of the blooming takes places between April 15<sup>th</sup> – May 6<sup>th</sup> and the end of the blooming takes place between April 27<sup>th</sup> – May 13<sup>th</sup>.

3. The tree vigour caused by the tree height, the tree crown diameter, the tree section surface is higher for the varieties of Tenroy and Generos.

4. The varieties of Romus 1, Generos and Jonagold have significant productions in the southern area of the country.

The growing season of the shoots and their length may be observed in figure 6.

5. The fruit growth within the analysed varieties is ascending, then it reaches its growth maximum and finally it slows down and their development stops.

6. There is direct correlation between the number of shoots in a tree and the shoot length.

7. The early ripening varieties have a higher percentage of developed fruit out of the total number of open flowers.

8. In the southern area, we may keep the varieties Romus 1, Florina, Jonagold, Generos and Tenroy in order to provide permanent fruit supplies.

## BIBLIOGRAPHY

1. **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), pag. 51 – 55.

2. **Cichi, M., Ileana, Popescu Larisa Păun, Ciobanu, A.**, 2009 -The study of the reaction of Starkrimson apple variety on different rootstocks in the south area of Oltenia. Editura Universitaria Craiova. Annals of the University of Craiova – Agriculture, Montanology, Cadastre, Vol XXXIX/A, p. 66-69. ISSN 1841-8317.

3. **Greco Florina, Pavel, Șt.**, 2016 - Pedological and chemical characterization of a brown-stagnic vertosoil in order to establish the fertilization plan. Annals of the University of Craiova - Agriculture, Montanology, Cadastre Series, Vol XLVI, p. 322-325. ISSN 1841-8317.

4. **Hall-Beyer, Bart, and Jean Richard**, 1983 - Ecological Fruit Production in the North.

5. **Jadczyk, E., Pietranek, A.**,

**Sadowski, A.**, 2007 - Early performance of Golden Delicious apple trees on four rootstocks. ISHS Acta Horticulturae 732: VIII International Symposium on Canopy, Rootstocks and Environmental Physiology in Orchard Systems, p. 203-206.

6. **Johnson, D., Spencer, J.E., Tobutt, K., Webster, A. D.**, 2007 - New apple rootstock selections from the East Malling breeding programme. ISHS Acta Horticulturae 732: VIII International Symposium on Canopy, Rootstocks and Environmental Physiology in Orchard Systems. Vol. I, p. 43-50.

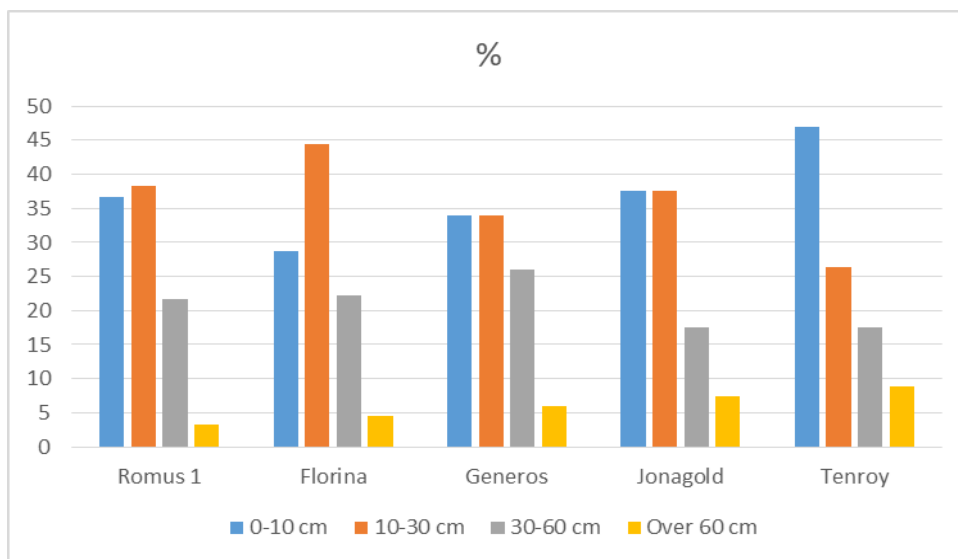
7. **Lukic, M., Marik, S.**, 2013 - Fruit research institute apple breeding programme: past, present and future. ISHS Acta Horticulturae 981, II Balkan Symposium on Fruit Growing- ISSN 0567-7572, p. 79-82.

8. **Maric, S., Lukic, M., Radicevik, S., Milosevic, N.**, 2013 - Properties of some indigenous apple genotypes grown in region of Serbia. ISHS Acta Horticulturae 981, II Balkan Symposium on Fruit Growing-ISSN 0567-7572, p. 53-58.

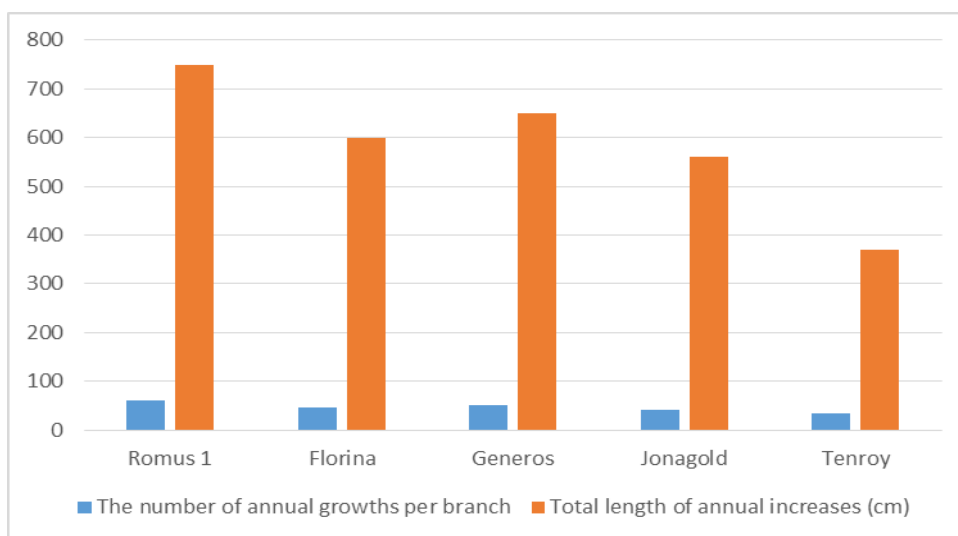
9. **Monin, A.**, 1974 - Etude de la greffe

intermediare chez le poirier. Le fruit belge  
nr. 368, tr.IV.  
10. **Remy, P.**, 1962 - Le chois des  
varietes des pommiers en fonction du

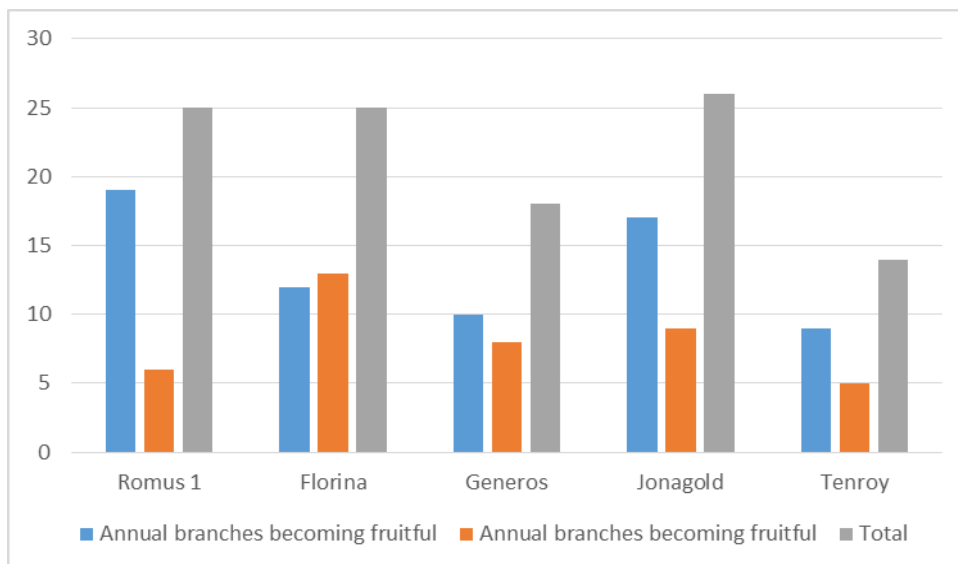
milieu. Rev. „L'Arboriculture fruitiere”,  
101-102.



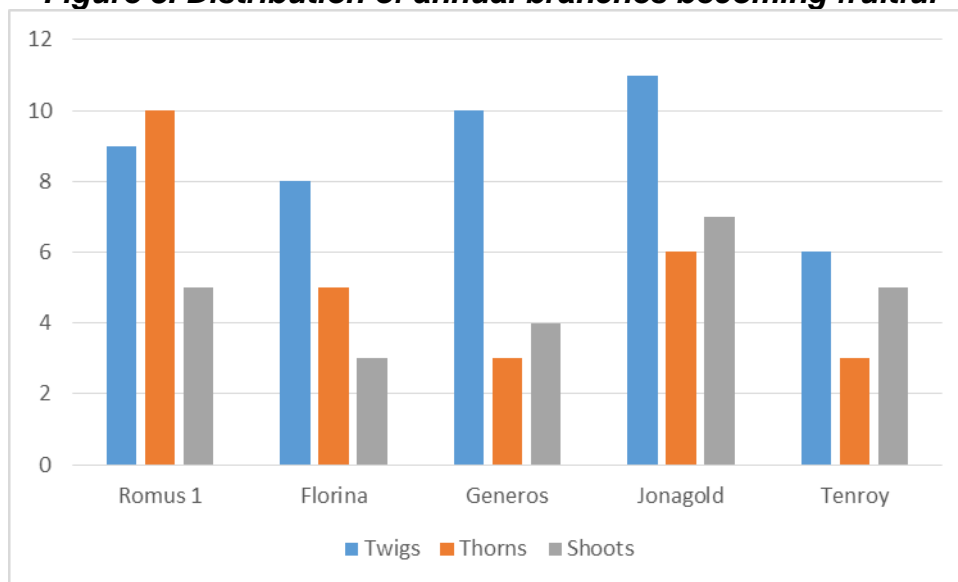
**Figure 1. Presence of annual branches by length categories (%)**



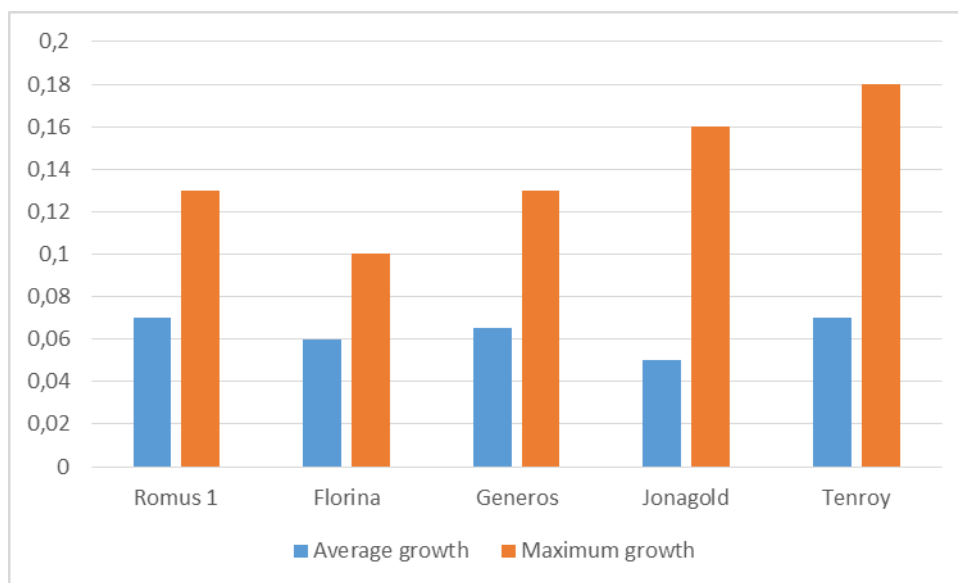
**Figure 2. Distribution of annual increases by length categories**



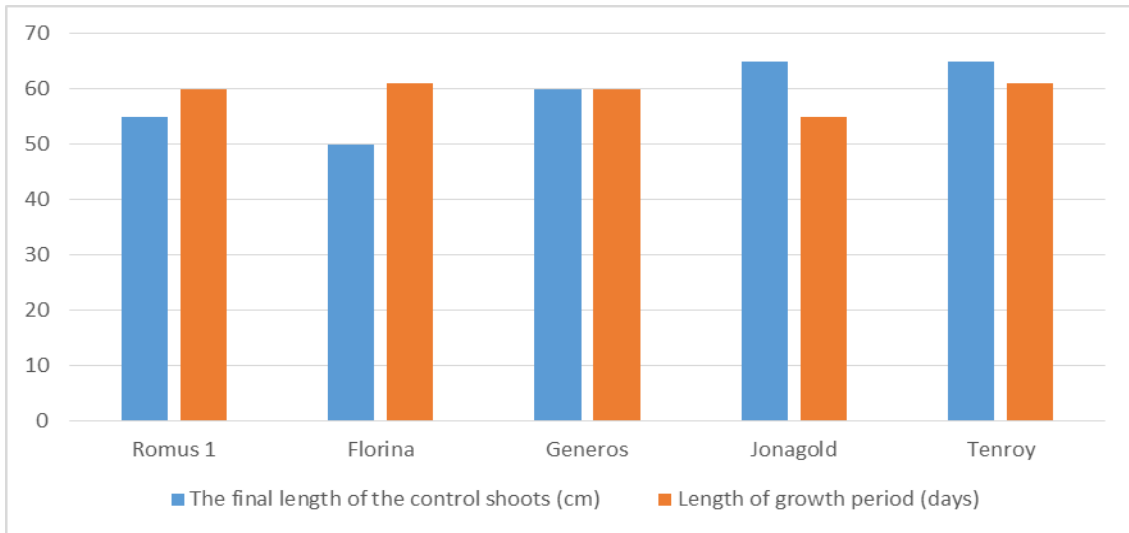
**Figure 3. Distribution of annual branches becoming fruitful**



**Figure 4. Distribution of fruit branches in fact**



**Figure 5. Daily fruit growth (medium and maximum)**



**Figure 6. The growth dynamics of the shoots**