

## PRODUCTION OF SEVEN-MONTH-OLD APPLE TREES IN AN ORGANIC NURSERY

### Summary

*The rootstock is an important element in the production of fruit trees. Proper selection of rootstocks affects the quality of trees produced in the nursery and their growth and fruiting in the orchard. In 2015, an assessment was performed of the effect of the rootstock on the quality of apple trees produced in an organic nursery. The assessment and measurements were made in a nursery located in the Experimental Ecological Orchard of the Research Institute of Horticulture in Nowy Dwór Parcela near Skierniewice. The studied objects included seven-month-old trees of four apple cultivars: 'Szampion', 'Gold Milenium', 'Topaz' and 'Pinova', which had been grafted onto rootstocks of different growth vigour: M.9, M.26 and M.7. The highest number of trees in relation to the number of the grafted rootstocks planted was obtained for apple trees growing on the M.7 rootstock. The best quality trees of the tested apple cultivars were also obtained on the M.7 rootstock.*

**Key words:** apple tree, rootstock, nursery, organic cultivation

## PRODUKCJA SIĘDMIOMIESIĘCZNYCH DRZEWEK JABŁONI W SZKÓLCE EKOLOGICZNEJ

### Streszczenie

*Podkładka jest ważnym elementem w produkcji drzewek owocowych. Odpowiedni jej dobór wpływa na jakość produkowanych drzewek w szkółce oraz na ich wzrost i owocowanie w sadzie. W 2015 roku oceniano wpływ podkładki na jakość drzewek jabłoni produkowanych w szkółce ekologicznej. Ocenę i pomiary przeprowadzono w szkółce zlokalizowanej na terenie Ekologicznego Sadu Doświadczalnego Instytutu Ogrodnictwa w Nowym Dworze Parceli koło Skierniewic. Materiał badawczy stanowiły siedmiomiesięczne drzewka czterech odmian jabłoni: 'Szampion', 'Gold Milenium', 'Topaz' i 'Pinova', które były szczepione na podkładkach o zróżnicowanej sile wzrostu: M.9, M.26 i M.7. Największą liczbę drzewek w stosunku do liczby posadzonych szczepów, uzyskano dla jabłoni rosnących na podkładce M.7. Również najlepsze jakościowo drzewka otrzymano dla badanych odmian jabłoni na podkładce M.7.*

**Słowa kluczowe:** jabłoń, podkładka, szkółka, uprawa ekologiczna

### 1. Introduction

The apple tree is the most important horticultural plant cultivated in Polish orchards [8]. For this reason, most of the plants produced in nurseries are apple trees. When selecting apple trees for planting, the fruit producer should pay particular attention to the quality of the purchased material and its health [1, 9]. This is especially true for trees that will be planted in an ecological orchard [5, 6, 9]. In this case, not only the quality and health of the material are important, but also the cultivar and the rootstock on which it is grafted. The cultivar should be characterized by resistance or low susceptibility to the most dangerous diseases and pests [3, 4, 11]. The rootstock, in turn, influences tree growth, fruit yield and quality, and tree life-span [3, 4, 11, 12]. The rootstock should develop a good graft union with the grafted or budded cultivar, provide the desired tree growth vigour, induce early and abundant fruiting, and improve the quality of the fruit. In addition, it should be resistant to frost and poor soil conditions, reduce the susceptibility of the tree to diseases and pests, and form a strong root system [3,10]. Polish nurseries offer nursery plant material of various types: seven-month-old trees, one-year-old maiden trees, two-year-old trees with one-year-old crown (knips), and two-year-old trees with an interstem, the production of which is much smaller than of the other material [7]. The price plays a large role when choosing a given ma-

terial. More and more often, fruit growers decide to buy seven-month-old trees, i.e. produced in a one-year cycle, from grafted rootstocks (bench-grafted in the winter) or obtained from rootstocks budded with a 'dormant eye'. The price of the latter trees is considerably lower than that of one-year-old maidens or two-year-old trees with one-year-old crown. However, in the case of seven-month-old trees, the buyer should also pay attention to their quality and health.

### 2. Aim of the study

The aim of the study was to determine the effect of the applied rootstock on the nursery productivity and the quality (trunk diameter, height) of seven-month-old apple trees in a nursery using ecological production methods.

### 3. Material and methods

The study was conducted in an experimental nursery at the Experimental Ecological Orchard in Nowy Dwór Parcela, near Skierniewice, in 2015. The study material consisted of 'Szampion', 'Gold Milenium', 'Topaz' and 'Pinova' apple trees grafted onto rootstocks of different growth vigour: M.9, M.26 and M.7. The rootstocks, all in the same thickness class of 6-8 mm, were whip-grafted in the winter of 2015. All the grafted rootstocks were stored in

a nursery cold store until they were planted in the nursery in the spring. They were planted at the beginning of April at a spacing of 0.8 x 0.3 m. The experiment was established using a random design method, in four replications of 20 grafted rootstocks per plot. After seven months, trees were obtained from the grafts, which were evaluated in terms of thickness and height, and the number of the trees obtained was counted in relation to the number of the grafted rootstocks planted. Measurements of tree trunk diameter were taken 10 cm above the graft union and tree height was measured from the ground surface. The soil in the nursery was kept in black mechanical fallow. The weeds in the rows of plants were removed by hand, and those in the inter-rows by means of a nursery rototiller. Plant care treatments were carried out in accordance with the recommendations for commercial nurseries. Plant protection treatments against pests and diseases were performed using agents permitted for use in organic fruit-growing. Based on the collected results, the effect of the rootstock on the nursery productivity and the quality (trunk thickness, height) of the obtained seven-month-old apple trees was determined.

The influence of the rootstocks on the individual apple cultivars was assessed using two-factor analysis of variance without random blocks. Comparisons of averages for the combinations were performed using the Duncan test at a significance level of  $p < 0.05$ . The results showing the percentages of the obtained trees in relation to the planted grafts were transformed using the Bliss function. The tabulated data that were not significantly different from one another are marked with the same letters. STATISTICA version 10 PL 2012 (StatSoft Polska) was used for the statistical calculations.

#### 4. Results

The results presented in Table 1 showed high suitability of the tested rootstocks for the production of seven-month-old apple trees in an organic nursery. The highest nursery productivity, expressed as a percentage of the trees obtained in relation to the number of the grafted rootstocks planted in the spring, was found for the cultivar 'Pinova' grafted on the M.9 dwarfing rootstock and the M.7 semi-dwarfing rootstock, as well as for the cultivars 'Szampion' and 'Topaz' growing on the M.7 rootstock. In all those cases, 100% productivity was obtained. The lowest productivity (only 40%) was obtained for 'Gold Milenium' grafted on the M.26 semi-dwarfing rootstock. Also, low productivity (65%) was obtained for trees of the cultivar 'Szampion' on M.9. Analyzing the productivity for the cultivars within the tested rootstocks, it was shown that the nursery productivity for the trees on the M.9 rootstock was significantly higher for the cultivar 'Pinova' than for the other three cultivars. With the M.26 rootstock, the highest nursery productivity was obtained for the trees of the cultivar 'Szampion', and the lowest for those of 'Gold Milenium'. By contrast, the productivity for 'Szampion', 'Topaz' and 'Pinova' trees on the M.7 rootstock was 100%. Significantly fewer trees were obtained on this rootstock with the cultivar 'Gold Milenium' (85%). Comparing the effect of the rootstocks on the final nursery productivity, it was shown that significantly more trees were produced on the M.7 rootstock than on M.9 and M.26.

Table 1 also includes data on the qualitative assessment of the obtained seven-month-old trees depending on the used

rootstock. In terms of trunk diameter of trees on the M.9 rootstock, no significant differences were found between the cultivars. In the case of the M.26 rootstock, trees of the cultivar 'Gold Milenium' had a significantly smaller diameter in comparison with the others. In contrast, the cultivar 'Pinova' on the M.7 rootstock had a significantly greater trunk diameter than the other cultivars. A slightly smaller diameter was obtained for the cultivar 'Szampion'. The smallest trunk diameters of trees on this rootstock were obtained for the cultivars 'Topaz' and 'Gold Milenium'. The results obtained for the height of trees indicate that in the case of the M.9 rootstock the tallest trees were obtained with the cultivar 'Pinova' and the shortest with 'Szampion'. Similar correlations were obtained for the M.26 rootstock, where the trees of the cultivar 'Pinova' were significantly taller than the trees of the other cultivars. In the case of the M.7 rootstock, the 'Pinova' and 'Gold Milenium' trees were of a similar height. However, they were significantly taller than those of the cultivars 'Topaz' and 'Szampion'. Analysis of the data shows that the best quality trees, regardless of the scion cultivar, were produced on the M.7 rootstock. Particular attention should be paid here to the height of the trees, which was significantly greater than that of the trees growing on M.9 and M.26. Generally, the lowest quality trees for all the cultivars were obtained on the M.9 rootstock whose height significantly differed from the height of the trees on M.26 and M.7. Among the tested apple cultivars, the strongest trees were obtained from the cultivar 'Pinova', regardless of the type of rootstock. By contrast, the lowest quality parameters were shown by trees of the cultivar 'Szampion' grafted onto the M.9 rootstock, which were the shortest, and by 'Gold Milenium' trees growing on M.26, which had the smallest trunk diameter.

#### 5. Discussion

The quality of the tree is strongly influenced by the growth vigour of the rootstock. This had been confirmed by the studies by Bielicki and Czynczyk [1], who showed that two-year-old trees with one-year-old crown of the apple cultivar 'Jonagored' grafted onto the M.26 semi-dwarfing rootstock were markedly taller and had a larger trunk diameter in comparison with trees of the same cultivar grafted onto the M.9 dwarfing rootstock. They had obtained similar correlations for two-year-old trees of the cultivars 'Lobo' and 'Jonica' on various rootstocks [2]. The present study showed that the rootstock had a big influence on the nursery productivity and the quality of apple trees produced in a 7-month cycle in an organic nursery. Unfortunately, there is little information in the literature about the production of such nursery material. This study showed that the M.7 rootstock was the best in terms of nursery productivity regardless of the scion cultivar.

Based on the results obtained from the organic nursery, it can be concluded that cultivars grafted on this rootstock are characterized by better growth, which means that the trees have a larger diameter and are taller. This is confirmed by the results of a study by Pańsko and Bielicki [9]. In their nursery experiments they found that two-year-old trees with one-year-old crown of the apple cultivars 'Szampion' and 'Gold Milenium' grafted on the M.7 semi-dwarfing rootstock were markedly taller than the trees of the cultivars growing on the M.26 semi-dwarfing rootstock and the M.9 dwarfing rootstock.

Table 1. Nursery productivity and quality of seven-month-old trees of four apple cultivars grafted onto different rootstocks in an organic nursery

Tab. 1. Wydajność oraz jakość siedmiomiesięcznych drzewek czterech odmian jabłoni szczepionych na różnych podkładkach w szkółce ekologicznej

Cultivar	Rootstock	Total productivity* [%]	Trunk diameter [mm]	Height [cm]
'Szampion'	M.9	65.0 b	8.8 b	83.2 a
'Gold Milenium'		85.0 c	8.8 b	89.7 ab
'Topaz'		80.0 bc	9.4 b	89.8 ab
'Pinova'		100.0 d	9.4 b	100.3 bc
'Szampion'	M.26	90.0 c	8.7 b	94.7 b
'Gold Milenium'		40.0 a	7.7 a	96.7 b
'Topaz'		80.0 bc	8.7 b	97.0 b
'Pinova'		75.0 bc	8.7 b	105.1 c
'Szampion'	M.7	100.0 d	10.0 bc	100.6 bc
'Gold Milenium'		85.0 c	9.5 b	119.1 d
'Topaz'		100.0 d	9.4 b	108.8 c
'Pinova'		100.0 d	10.5 c	120.3 d

\* percentage of obtained trees in relation to the number of grafted rootstocks planted in the nursery

Source: own work / Źródło: opracowanie własne

## 6. Conclusions

1. The quality of apple trees produced in a seven-month cycle in the nursery run by ecological methods is clearly influenced by the rootstock and the scion cultivar.
2. The strongest growth in the nursery and high nursery productivity were shown by the trees of the tested cultivars grafted onto the M.7 rootstock, and the weakest growth was shown by the trees on the M.9 dwarfing rootstock.
3. The best-developed trees were obtained with the cultivar 'Pinova', regardless of the type of rootstock.
4. The shortest trees were those of the cultivar 'Szampion' grafted onto M.9, whereas 'Gold Milenium' trees on M.26 had the smallest trunk diameter.

## 7. References

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