

QUALITY OF TWO-YEAR-OLD TREES WITH ONE-YEAR-OLD CROWN OF TWO APPLE CULTIVARS GROWN IN AN ORGANIC NURSERY DEPENDING ON THE ROOTSTOCK USED

Summary

The quality of fruit trees obtained from a nursery is very important; it determines their precocity and productivity, and thus helps to obtain a better economic effect. In the years 2015-2016, the quality of two-year-old apple trees with a one-year-old crown (knip trees) was assessed in an organic nursery in relation to the rootstock used. The assessment and measurements were conducted in a nursery located in the Experimental Ecological Orchard of the Research Institute of Horticulture in Nowy Dwór Parcela near Skierniewice. The studied material consisted of two-year-old trees with one-year-old crown of the apple cultivars 'Szampion' and 'Gold Milenium', which were grafted onto rootstocks of different growth vigour: M.9, M.26 and M.7, in two thickness classes (8-10 mm and 10-12 mm). For both cultivars, the best quality of two-year-old trees with a one-year-old crown was obtained on the M.7 rootstock in both thickness classes.

Key words: apple tree, rootstock, nursery, knip, organic farming, quality

JAKOŚĆ DWULETNIICH DRZEWEK Z JEDNOROCZNĄ KORONĄ DWÓCH ODMIAN JABŁONI UZYSKANYCH W SZKÓLCE EKOLOGICZNEJ W ZALEŻNOŚCI OD ZASTOSOWANEJ PODKŁADKI

Streszczenie

Jakość drzewek ze szkółki jest bardzo ważna, wpływa ona na wcześniejszy okres owocowania i plonowanie, co pozwala uzyskać lepszy efekt ekonomiczny. W latach 2015-2016 oceniono jakość dwuletних drzewek z jednoroczną koroną w szkółce ekologicznej w zależności od zastosowanej podkładki. Ocenę i pomiary przeprowadzono w szkółce zlokalizowanej na terenie Ekologicznego Sadu Doświadczalnego Instytutu Ogrodnictwa w Nowym Dworze Parceli koło Skierniewic. Materiał badawczy stanowiły dwuletnie drzewka z jednoroczną koroną jabłoni odmian 'Szampion' i 'Gold Milenium', które zostały zaszczerpione na podkładkach o różnej sile wzrostu w dwóch klasach grubości (8-10 mm i 10-12 mm): M.9, M.26 i M.7. Najlepsze jakościowo dwuletnie drzewka z jednoroczną koroną dla obu badanych odmian uzyskano na podkładce M.7 w obu klasach grubości.

Słowa kluczowe: jabłoń, podkładka, szkółka, knip, uprawa ekologiczna, jakość

1. Introduction

Modern fruit growing is very intensified, especially when it comes to the cultivation of apple trees. Therefore, for planting new apple orchards it is necessary to obtain trees that can be planted at a close spacing, in the amount of several thousand per hectare. When selecting suitable nursery material, fruit growers pay particular attention mainly to the quality of the trees prepared in the nursery because it has an effect on achieving good economic results [1, 2]. This is especially important when establishing organic orchards [11, 12]. Two-year-old trees with a one-year-old crown are particularly useful for planting such orchards [7]. To produce them, one-year-old maidens should be left for a year in the nursery, and in the following year they should be suitably formed [15]. After planting them in the orchard, the trees prepared in this way require practically no pruning, and can be left as they are. As a result, the trees will begin to bear fruit earlier, and the yields will be considerably higher than those produced by trees that were pruned after planting or were planted as one-year-olds without distinct branches [15, 16]. Already in the 1980s and 1990s, two-year-old trees with a one-year-old crown were found to have a fruit-growing advantage over one-year-old maidens [6, 7, 8, 10].

2. Aim of study

The aim of the study was to compare the quality of two-year-old trees with a one-year-old crown (so-called knips) produced on various rootstocks in an organic nursery.

3. Material and methods

The study was conducted in an experimental nursery in the IO Experimental Ecological Orchard in Nowy Dwór Parcela near Skierniewice in the years 2015-2016. The studied material consisted of apple trees of the cultivars 'Szampion' and 'Gold Milenium' grafted onto rootstocks of different growth vigour: M.9, M.26 and M.7, from two thickness classes: 8-10 mm and 10-12 mm. These vegetative apple rootstocks were bench-grafted in the winter of 2015. Before being planted in the nursery, they were kept in a nursery cool store, and in the spring planted out at a spacing of 0.8 × 0.3 m. During the first year, these improved rootstocks produced single-shoot trees. In mid-April 2016, the trees were cut down to a height of 60 cm above the ground. Crowns were then formed from the shoots growing out sylleptically from apical buds. The soil in the nursery was maintained in black mechanical fallow. Weeds in the rows of trees were removed by hand, and in the inter-rows

with a tiller. Plant care treatments were carried out in accordance with the recommendations for commercial nurseries. Plant protection treatments against pests and diseases were carried out using products allowed for use in organic fruit-growing. In the autumn of 2016, just before digging up the trees from the nursery, the diameter of the tree trunk and tree height were measured. The number of trees with lateral shoots was also determined, and then the length of the shoots was measured. These measurements enabled calculations of the percentage of trees with lateral shoots, the average number of shoots per tree, and also the average length of a lateral shoot and the total length of lateral shoots.

The results were statistically analyzed by means of one-way analysis of variance. Comparisons of mean values for the combinations were performed using Duncan's test at a significance level of $p < 0.05$. The data in the tables that do not differ significantly from each other are indicated by the same letters. STATISTICA version 10 PL 2012 (StatSoft Polska) was used for the statistical calculations.

4. Results

The results shown in Tables 1 and 2 concern the parameters of trees with a one-year-old crown of the apple culti-

vars 'Szampion' and 'Gold Milenium' depending on the rootstock used and its thickness. In the case of the cultivar 'Szampion', the rootstocks in the 8-10 mm thickness class were not found to have an effect on the quality of the trees. Only the M.7 rootstock significantly increased their height. The remaining parameters did not differ significantly. The 'Szampion' trees grafted on the 10-12 mm thick rootstocks were qualitatively similar. None of the tested rootstocks had a significant effect on the measured parameters. Only the trees growing on the M.7 semi-dwarfing rootstock were significantly taller than the trees growing on the M.9 dwarfing rootstock and the M.26 semi-dwarfing rootstock. In this thickness class, too, the tested rootstocks did not affect the other measured parameters of the trees (Table 1). In the case of the cultivar 'Gold Milenium', the type of rootstock and its thickness had no effect on the quality of the trees in terms of the trunk diameter of the maidens, the number of trees with lateral shoots and the number and length of lateral shoots (Table 2). The 8-10 mm thick M.7 rootstock had significantly increased the height of the 'Gold Milenium' apple trees. A similar tendency was observed for this rootstock in the 10-12 mm thickness class. The trees growing on this rootstock were significantly taller than the trees on the other rootstocks.

Table 1. Quality of two-year-old 'Szampion' apple trees with a one-year-old crown depending on the rootstock grown in an experimental organic nursery

Tab. 1. Jakość dwuletnich drzewek jabłoni z jednoroczną koroną odmiany 'Szampion' w zależności od zastosowanej podkładki z ekologicznej szkółki doświadczalnej.

Rootstock	Trunk diameter* [mm]	Tree height [cm]	% of trees with lateral shoots	Average number of lateral shoots per tree	Average length of lateral shoot [cm]	Total length of lateral shoots [cm]
Rootstock thickness: 8-10 mm						
M.9	13.2 a	142.8 a	100.0 a	5.2 a	15.2 a	82.8 a
M.26	13.5 a	144.8 a	100.0 a	7.0 a	12.2 a	88.6 a
M.7	14.5 a	164.3 b	97.5 a	7.4 a	11.4 a	86.4 a
Rootstock thickness: 10-12 mm						
M.9	12.6 a	143.7 a	95.0 a	5.0 a	9.5 a	50.2 a
M.26	13.1 a	142.6 a	92.3 a	5.2 a	12.2 a	58.2 a
M.7	14.0 a	158.7 b	95.0 a	6.0 a	10.4 a	66.0 a

* diameter of the trunk measured at a height of 10 cm above the graft union

Source: own work / Źródło: opracowanie własne

Table 2. Quality of two-year-old 'Gold Milenium' apple trees with a one-year-old crown depending on the rootstock grown in an experimental organic nursery

Tab. 2. Jakość dwuletnich drzewek jabłoni z jednoroczną koroną odmiany 'Gold Milenium' w zależności od zastosowanej podkładki z ekologicznej szkółki doświadczalnej.

Rootstock	Trunk diameter* [mm]	Tree height [cm]	% of trees with lateral shoots	Average number of lateral shoots per tree	Average length of a lateral shoot [cm]	Total length of lateral shoots [cm]
Rootstock thickness: 8-10 mm						
M.9	13.0 a	146.0 a	100.0 a	8.6 a	12.8 a	112.6 a
M.26	11.6 a	152.8 a	97.4 a	7.8 a	10.8 a	86.4 a
M.7	13.5 a	167.6 b	100.0 a	11.0 a	14.0 a	162.2 a
Rootstock thickness: 10-12 mm						
M.9	11.5 a	151.8 ab	100.0 a	9.0 a	15.0 a	78.8 a
M.26	13.0 a	142.1 a	100.0 a	7.4 a	12.4 a	99.4 a
M.7	13.1 a	161.3 b	100.0 a	9.0 a	11.0 a	130.6 a

* diameter of the trunk measured at a height of 10 cm above the graft union

Source: own work / Źródło: opracowanie własne

5. Discussion

According to Bielicki and Czynczyk, the quality of a two-year-old tree is greatly influenced by the growth vigour of the rootstock [1]. As shown by these authors, two-year-old trees with a one-year-old crown of the apple cultivar 'Jonagored' grafted on the M.26 semi-dwarfing rootstock were significantly taller and had a greater trunk diameter than trees of the same cultivar grafted on the M.9 dwarfing rootstock [1]. Trees on the M.26 semi-dwarfing rootstock were characterized by a greater number of spurs and sylleptic shoots than those on the M.9 rootstock. Similar correlations were obtained by the same authors for two-year-old trees of the cultivars 'Lobo' and 'Jonica' growing on different rootstocks [3]. The results of our own research have shown that the rootstock and its thickness have no pronounced effect on the quality of trees in the organic nursery, which does not coincide with the results of the above-mentioned authors [1, 3]. Two-year-old trees with a one-year-old crown of the apple cultivars 'Szampion' and 'Gold Milenium' grafted on the M.7 semi-dwarfing rootstock were markedly taller in both rootstock thickness classes than those growing on the M.26 semi-dwarfing and M.9 dwarfing rootstocks. None of the tested rootstocks has any pronounced effect on the other parameters such as trunk diameter, the number of trees with lateral shoots, and the number of shoots and their length. The results obtained for the three rootstocks with different growth vigour were similar, regardless of their thickness or cultivar. Many authors emphasize that when evaluating the quality of two-year-old trees with a one-year-old crown, an important parameter is the number of lateral shoots, which affects the yielding of trees [4, 13, 14, 15, 16]. This is also supported by Dutch studies in which trees with a larger number of well-developed lateral shoots produce better yields in the first years after planting than those with fewer shoots [5]. Similar dependencies are observed in Polish orchards [9]. Our own studies have shown that the thickness of the rootstock does not affect the number of lateral shoots or their length.

6. Conclusions

1. The thickness of the M.9, M.26 and M.7 rootstocks has no significant effect on the quality of two-year-old apple trees with a one-year-old crown (knips).
2. The height of two-year-old apple trees with a one-year-old crown is significantly increased by the M.7 semi-dwarfing rootstock, irrespective of its thickness.

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7. References

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