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# TESTING OF APPLE ROOTSTOCK/SCION COMBINATIONS IN VARIOUS ORCHARD SYSTEMS

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A B S T R A C T

In the autumn of 2001, a trial apple orchard was planted with two cultivars 'Jonathan Csány 1' and 'Šampion' to compare 2 training systems (slender spindle and vertical axis), 8 rootstocks (M.9 T.337, M.9 Burgmer 984, Jork 9, B9, M.26, MM.106, MM.111 and B118), and 8 planting densities (3.6-4.5 x 0.75-1.75 m). For the proper development of trees a trellis system was constructed, and for irrigation micro-sprinklers wre installed. The objective of this trial was to select the best new, promising rootstocks – not yet used in Hungary – the most suitable for the natural conditions of N.E. Hungary. Also the study was to determine the influence of each rootstock and training system on the performance of trees. In the first three years after planting, growth of the cultivars on various rootstocks is presented.

**Key words:** apple, roostocks, planting system

## INTRODUCTION

Modern fruit growing creates an ever-increasing demand for a variety of cultivars and rootstocks. The importance of rootstocks is more and more widely recognised, which, in terms of their influence on yield productivity, are not less important than the grafted scions. Because of the differences in climate and soil in various regions, several apple rootstocks with different vigour are being used in Hungary; the most frequently used are MM.106, M.26 and M.9. We are planning to introduce some new apple rootstocks which may show a better performance in comparison with those commonly used. The objective of the trial was to test some new rootstocks and select those which can best adapt to the ecological conditions of our region.

## MATERIAL AND METHODS

Experimental orchard was planted in September 2001. In the same year, grafts were made in February and kept in plastic containers until August. This resulted in whips of standard size, which are widely used as planting material in Hungary.

### Layout of the experimental orchard

Rootstocks were divided into two groups according to their vigour; the first were those of weak and the second of moderate vigour. Two training systems were applied in two separate blocks (Tab. 1). Different scion-rootstock combinations and various planting densities were arranged in a split-plot design with 4 trees per plot in 5 replications. As a result, 1440 trees were planted. For the benefit of the development a trellis system was established and micro-sprinklers were set up.

T a b l e 1 . Characteristics of the trial orchard

| Training system | 1. | 2. |
|---|---|---|
| Canopy form | slender spindle | vertical axis |
| Cultivar | 'Jonathan Csány1'<br>'Šampion' | 'Jonathan Csány1'<br>'Šampion' |
| Rootstock | M.9 T337<br>M.9 Burgmer 984<br>Jork 9<br>B9<br>M.26* | MM.106<br>MM.111<br>B118<br>M.26* |
| Planting density [m] | 3.6 x 0.75<br>3.6 x 1.00<br>3.6 x 1.25<br>3.6 x 1.50 | 4.5 x 1.00<br>4.5 x 1.25<br>4.5 x 1.50<br>4.5 x 1.75 |

*Control

## RESULTS

To investigate the growth of planted trees, trunk girths were measured and the trunk cross-section area was determined. Statistically significant differences found between the tree growth (Tab. 2) are expected to increase with age. In the first year the strongest vegetative growth was observed for 'Šampion' grafted on MM.106, and the weakest for 'Jonathan Csány 1' on M.9 Burgmer 984. 'Šampion' proved to be more vigorous than 'Jonathan Csány 1' on almost all of the rootstocks in the first and the second year, but in 2003 the tendency reversed (Tab. 2).

Table 2. Growth performance of trees in different scion-rootstock combinations (Újfehértó, 2001-2003)

| Rootstock | 'Jonathan Csány 1' | | | 'Šampion' | | |
|---|---|---|---|---|---|---|
| | trunk circumference [mm] | | | trunk circumference [mm] | | |
| | 2001 | 2002 | 2003 | 2001 | 2002 | 2003 |
| B9 | 29.68 c | 51.95 ab | 62.66 a | 30.20 b | 54.81 ab | 61.57 a |
| M.9 Burgmer 984 | 26.83 a | 52.37 ab | 65.08 ab | 29.98 ab | 56.65 ab | 65.01 ab |
| M.26* | 28.91 bc | 55.18 b | 71.96 c | 30.85 b | 60.06 bc | 69.85 bc |
| M.9 T337 | 29.21 c | 51.48 a | 64.13 a | 28.18 a | 53.1 a | 61.62 a |
| Jork 9 | 27.58 ab | 54.52 ab | 68.07 b | 30.65 b | 61.79 c | 72.27 c |
| | *** | *** | ** | ** | *** | *** |
| B118 | 27.63 a | 56.26 a | 56.25 a | 33.00 a | 60.66 b | 57.22 a |
| MM.106 | 30.23 b | 60.22 b | 78.80 b | 35.20 b | 63.36 b | 79.16 b |
| M.26* | 30.43 b | 54.71 a | 68.93 ab | 31.87 a | 55.42 a | 65.56 a |
| MM.111 | 29.70 b | 60.33 b | 83.11 b | 32.97 a | 61.56 b | 80.66 b |
| | *** | *** | n.s. | *** | *** | *** |

*Control **P = 0.05 ***P = 0.01 n.s. – not significant

Observations concerning the rootstock M.26 agree with those of international literature: it proved to be the strongest in the group of weak rootstocks (1. training system), and the weakest within those of medium vigour (2. training system). The only exception was 'Šampion' on 'Jork 9', which was growing quite strongly in the group of weak rootstocks.

The first crop was obtained in 2003. Analysis of yield data shows that trees on weak rootstocks produced significantly more apples than on those of medium vigour (Tab. 3). The Jork 9/'Šampion' combination proved to be the most productive, while the MM.111/'Jonathan Csány 1' – the least. 'Šampion' cropped better than 'Jonathan Csány 1' on every rootstock, except M.9 T337.

Table 3. Growth performance and yield of trees in different scion-rootstock combinations (Újfehértó, 2003)

| Roostock | 'Jonathan Csány 1' | | 'Šampion' | |
|---|---|---|---|---|
| | canopy volume [$m^3$] | yield [pcs apples/tree] | canopy volume [$m^3$] | yield [pcs apples/tree] |
| B9 | 0.4434 a | 13.08 | 0.2543 | 15.82 bc |
| M.9 Burgmer 984 | 0.5787 ab | 15.15 | 0.3190 | 15.31 bc |
| M.26* | 0.7196 b | 11.08 | 0.3162 | 12.52 ab |
| M.9 T337 | 0.5049 a | 13.53 | 0.2249 | 11.42 a |
| Jork 9 | 0.6779 b | 15.11 | 0.4868 | 17.80 c |
| | *** | n.s. | n.s. | **** |
| B118 | 0.4619 a | 4.85 a | 0.2123 a | 8.36 a |
| MM.106 | 0.9798 c | 3.40 a | 0.4174 b | 12.67 b |
| M.26* | 0.7139 b | 11.60 b | 0.2973 a | 11.82 b |
| MM.111 | 0.9073 bc | 2.03 a | 0.3144 a | 8.00 a |
| | ** | **** | *** | **** |

*Control **P = 0.1 ***P = 0.05 ****P = 0.01 n.s. – not significant

# BADANIE PRZYDATNOŚCI RÓŻNYCH PODKŁADEK DLA WYBRANYCH ODMIAN JABŁONI W DWÓCH SYSTEMACH PROWADZENIA SADU

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## S T R E S Z C Z E N I E

Jesienią 2001 roku założono sad doświadczalny z dwoma odmianami jabłoni (’Jonathan Csány 1’ i ’Szampion’) dla porównania przydatności 8 rodzajów podkładek (M.9 T.337, M.9 Burgmer 984, Jork 9, B9, M.26, MM.106, MM.111 i B118) w dwóch systemach prowadzenia sadu (korona typu smukłe wrzeciono i osiowa) przy zastosowaniu zróżnicowanej rozstawy (3,6-4,5 x 0,75-1,75 m). Dla uzyskania właściwego rozwoju drzew, zastosowano system podpór poziomych oraz zainstalowano nawadniające mikrozraszacze. Celem doświadczenia było wytypowanie podkładek jabłoni, dotychczas na Węgrzech nie stosowanych, które byłyby najbardziej odpowiednie dla warunków klimatycznych rejonu sadowniczego w północno-wschodniej części kraju. Badano wpływ poszczególnych podkładek i systemów prowadzenia drzew na ich wzrost w ciągu trzech lat oraz plonowanie w ostatnim roku doświadczenia.

**Słowa kluczowe:** jabłoń, podkładki, system prowadzenia