INFLUENCE OF A FEW SEEDLING ROOTSTOCKS ON THE GROWTH, YIELD AND FRUIT QUALITY OF APRICOT TREES

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(Received May 19, 2011/Accepted November 7, 2011)

A B S T R A C T

In the field experiment, 5-year-old 'Morden 604' and 'Miodowa' apricot trees grafted on the seedling rootstocks Wangenheim Prune and Erunosid (both *P. domestica* L.), as well as Polish selection apricot (*P. armeniaca* L.) genotypes A4 and M46 were compared with trees of the same cultivars on the standard *P. divaricata* rootstock.

Vigour in apricot trees was affected by rootstock type. Trees of both cultivars on *P. divaricata* and 'M46' had the largest trunk cross-sectional area. The most dwarfing rootstock was 'Wangenheim Prune'. Rootstock had no effect on the fruiting of 'Morden 604' trees. In the case of the Miodowa cultivar, the highest cumulative yields were harvested from trees grafted on *P. divaricata* and 'M46', while the lowest from those on 'Erunosid'. The results revealed that 'Wangenheim Prune', in comparison to other rootstock tested, significantly reduced the mean fruit weight. In addition, trees grafted on this rootstock had the highest mortality. Mean content of soluble solids in fruits of 'Morden 604' and 'Miodowa' apricots was not affected by rootstocks in this study. Generally, the value of A4 and M46 genotypes used as seedling rootstocks for apricot trees in this experiment was higher than the *P. divaricata* standard rootstock.

Key words: apricot, rootstock, growth, yield, tree survival, tree productivity, fruit quality

INTRODUCTION

Seedlings from different local biotypes of apricot are the most widely used rootstocks for apricot cultivars in European and Asian countries (Vachun, 1995; Indreias et al., 2004; Orero et al., 2004). For lower scale, myrobalan, plum, almond and peach seedlings are also used. For example, myrobalan (*Prunus cerasifera var. myrobalana* Borkh.) as a rootstock for apricot trees is often used in Romania, Bulgaria, Hungary, the Czech Republic and France (Audergon et al., 1991; Vachun, 1995; Suranyi, 1999; Dimitrova and Marinov, 2002). In Poland, *P. cerasifera var. divaricata* Borkh. seedling is still the most popular rootstock not only for plum trees, but for apricot cultivars too (Grzyb et al., 1996; Jakubowski, 2004). However, using this rootstock for apricot scions can be risky, due to lack of compatibility between joined components. Incompatibility between apricot cultivars and *P. divaricata* rootstock in Polish growing conditions is very often expressed by rapid death of trees a few years after planting in the orchard or easy break down at the graft union (Grzyb et al., 1996; Jakubowski, 2004). Therefore. a more intensive search was undertaken to select new seedling rootstocks, having good compatibility with apricot cultivars and good adaptability to the cool climate of Poland.

The main purpose of this study was to assess the performance of five seedling rootstocks used for two apricot cultivars. This paper presents the results obtained during the first five years after planting.

MATERIAL AND METHODS

In the field experiment, 'Morden 604' and 'Miodowa' apricot trees grafted on seedling rootstocks Wangenheim Prune and Erunosid (both *P. domestica* L.), as well as Polish selection apricot (*P. armeniaca* L.) genotypes A4 and M46, were compared with trees of the same cultivars on the standard *P. divaricata* rootstock. One-year-old trees were planted in the spring of 2006, at the Experimental Station in Dabrowice, near Skierniewice, in the central part of Poland. The trees were planted in a grey-brown podzolic soil at a distance of 5 x 3 m. An arrangement of four random blocks with three trees per plot was used. Thus, a total number of 12 trees of each rootstock/cultivar combination were investigated. From 2006 to 2007, weeding was done by mechanical cultivation. During the following years, soil management included frequent grass mowing in the alleyways, and maintenance of 1-m-wide herbicide strips along the tree rows. Trees were trained with light pruning during each summer. The orchard was not irrigated and fruit thinning was not practiced in this experiment. Application of herbicides as well as other pesticides was done as recommended for sweet cherry commercial orchards in Poland. The data collected included tree survival, tree vigour (expressed as trunk cross-sectional area), yield, and fruit weight as well

as content of soluble solids in fruit. The results were processed using statistical analysis of variance. To evaluate the significance of the differences between means, the Duncan's Multiple Range test was employed at $p \leq 0.05$.

RESULTS

'Wangenheim Prune' seedling had the lowest survival while 'M46' had the highest (Tab. 1). Vigour in apricot trees was affected by rootstock type. Trees of both cultivars on *P. divaricata* and 'M46' had the largest trunk cross-sectional area. The most dwarfing rootstock was 'Wangenheim Prune' (Tab. 2).

The rootstock had no effect on the fruiting of 'Morden 604' trees. Depending on the rootstock, the mean cumulative yield of 'Miodowa' apricot trees collected during the five years of the experiment ranged between 18.0 kg and 26.4 kg (Tab. 3). The highest cumulative yields were harvested from trees grafted on *P. divaricata* and 'M46', while the lowest from those on 'Erunosid'. However, the highest yield efficiency in this study was recorded for 'Miodowa' apricot trees on 'Wangenheim Prune'. It is important to note that in 2009, fruiting of all trees was very low due to spring frost. Therefore, in general, the total yields and yield efficiencies of both apricot cultivars was lower than expected.

The results revealed that 'Wangenheim Prune', in comparison to other rootstock tested, significantly reduced the mean fruit weight (Tab. 4). No differences of fruit size between 'Morden 604' trees grafted on *P. divaricata*, 'A4' and 'M46' were observed. 'Miodowa' apricot trees on 'M46' produced the biggest fruits. The rest of the rootstocks, tested in terms of an effect on fruit weight of this cultivar, had a value similar to *P. divaricata*. Mean content of soluble solids in fruits of 'Morden 604' and 'Miodowa' apricots was not affected by rootstocks in this study.

DISCUSSION

Vigour of apricot trees is widely affected by rootstock type. In this trial, 'Wangenheim Prune' seedling depressed tree size the most. According to data obtained earlier by Sitarek and Jakubowski (2006), the trees of both cultivars, tested on this rootstock, were weaker in terms of all growth parameters than those grafted on *P. divaricata* already during tree production in the nursery. However, too much of a dwarfing effect along with the low survival of trees in an orchard can sometimes be a signal that there is an incompatibility between scion and rootstock. Grzyb et al. (1996) reported that usefulness of 'Wangenheim Prune' seedlings for apricot is very limited due to the short life span of trees. The preliminary results of this study are in accordance with this thesis. However, high mortality of apricot varieties on peach and myrobalan seedling rootstocks may also occur (Lapins, 1959; Bassi, 1999; Southwick et al., 1999; Suranyi, 1999). Therefore, further investigations are necessary before making the final conclusions.

Table 1. Effect of seedling rootstocks on survival of 'Morden 604' and 'Miodowa' apricot trees after five growing seasons (2006-2010)

Rootstock	Survival [%]		
	Morden 604	Miodowa	mean for rootstock
P. divaricata	91.7	58.3	75.0
Wangenheim Prune	58.3	75.0	66.7
Erunosid	83.3	66.7	75.0
A4	83.3	83.3	83.3
M46	83.3	91.7	87.5

Table 2. Effect of seedling rootstocks on trunk cross-sectional area (TCSA) of 5-year-old apricot trees

Rootstock	TCSA 2010				Mean for rootstock [%]
	Morden 604		Miodowa		
	[cm^2]	% of *P. divaricata*	[cm^2]	% of *P. divaricata*	
P. divaricata	100.2 c*	100.0	85.6 bc	100.0	100.0
Wangenheim Prune	53.7 a	53.6	60.9 a	71.1	62.4
Erunosid	85.8 b	85.6	73.0 b	85.3	85.5
A4	84.6 b	84.4	77.1 b	90.1	87.3
M46	94.6 bc	94.4	92.7 c	108.3	101.4

*Means within a column with the same letters are not significantly different at $p \leq 0.05$

Table 3. Effect of seedling rootstocks on fruit production of 5-year-old apricot trees

Rootstock	Cumulative fruit yield (2008-2010)			
	Morden 604		Miodowa	
	[kg/tree]	TCSA [kg/cm^2]	[kg/tree]	TCSA [kg/cm^2]
P. divaricata	13.0 a*	0.13 a	26.4 b	0.31 b
Wangenheim Prune	12.2 a	0.23 b	22.3 ab	0.37 c
Erunosid	12.3 a	0.14 a	18.0 a	0.25 a
A4	12.6 a	0.15 a	24.2 b	0.27 a
M46	11.5 a	0.12 a	26.0 b	0.28 ab

*Explanation: see Table 2

Table 4. Effect of seedling rootstocks on fruit quality of two apricot cultivars

Rootstock	Morden 604		Miodowa	
	mean fruit weight 2008-2010 [g]	mean content of soluble solids 2008-2010 [%]	mean fruit weight 2008-2010 [g]	mean content of soluble solids 2008-2010 [%]
P. divaricata	43.7 bc*	14.3 a	52.7 b	17.6 a
Wangenheim Prune	40.1 a	14.3 a	45.0 a	17.6 a
Erunosid	42.3 b	14.5 a	53.5 b	17.8 a
A4	45.1 c	14.1 a	53.6 b	17.4 a
M46	44.8 c	14.3 a	57.3 c	17.1 a

*Explanation: see Table 2

Productivity and fruit quality of apricot trees also depends on the rootstock used (McLaren et al., 1995; Jakubowski, 2004). In this trial, the 'Miodowa' apricot trees grafted on *P. divaricata* and 'M46' were very productive. Usually, those rootstocks that reduce tree growth also have smaller fruits (Grzyb et al., 1996; Dimitrova, 2001). Trees grafted on 'Wangenheim Prune' had the lowest trunk cross-sectional area and the highest yield efficiency but produced smaller fruits than those grafted on the other tested rootstocks. Still, it is difficult to comment about the influence of a rootstock on fruit size, generally due to low yielding of trees and lack of irrigation system in the orchard.

CONCLUSIONS

1. Results obtained after five years of investigations, indicate that among rootstocks tested, 'Wangenheim Prune' was the most dwarfing with the highest yield efficiency. However, due to the high mortality of trees and the low mean fruit weight, its use in a commercial orchard in Polish growing conditions can be limited.
2. 'A4' and 'M46' are valuable rootstocks for apricot cultivars. Trees grafted on those rootstocks had a higher survival than *P. divaricata*, and were very productive with a high quality of fruits.
3. 'M46' had a very positive effect on the fruit size of the Miodowa cultivar while 'Wangenheim Prune' strongly depressed mean fruit weight.
4. The studied rootstocks did not influence the soluble content in fruit of 'Morden 604' and 'Miodowa' apricots.

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WPŁYW KILKU PODKLADEK GENERATYWNYCH NA WZROST, PLONOWANIE I JAKOŚĆ OWOCÓW MORELI

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

W latach 2006-2010 w sadzie Doświadczalnym w Dąbrowicach oceniano wzrost, owocowanie i jakość owoców moreli odmian Wczesna z Morden i Miodowa szczepionych na pięciu podkładkach generatywnych: ałyczy, Węgierce Wangenheima, Erunosid, A4 i M46. Podkładki miały wpływ na siłę wzrostu moreli. Drzewa obu badanych odmian najsilniej rosły na siewkach ałyczy i moreli M46, najsłabiej zaś na siewkach Węgierki Wangenheima. Plonowanie drzew odmiany Wczesna z Morden było słabe i nie zależało od rodzaju zastosowanej podkładki. W przypadku odmiany Miodowa najwyższe plony sumaryczne zebrano z drzew na siewkach ałyczy i M46, a najniższe z drzew na 'Erunosid'. Drzewa szczepione na siewkach 'Węgierki Wangenheima' miały najmniejsze owoce i na tej podkładce zanotowano najwięcej wypadów. Nie stwierdzono wpływu podkładek na poziom ekstraktu w owocach badanych odmian moreli. Wyniki uzyskane w doświadczeniu wskazują na większą przydatność nasiennych typów moreli A4 i M46 niż siewek ałyczy do zakładania sadów morelowych.

Słowa kluczowe: morela, podkładka, przeżywalność drzew, wzrost, owocowanie, jakość owoców