THE INFLUENCE OF ROOTSTOCKS AND CULTIVARS ON EFFICIENCY, GROWTH AND QUALITY OF MAIDEN PLUM TREES IN A NURSERY

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Abstract. *The influence of three rootstocks and chosen plum tree cultivars on the growth, efficiency and quality of maiden plum trees was checked in the experiment. A better efficiency of maiden plum trees was found for Prunus tomentosa rootstock. A strong growth of the maiden plum trees was observed on Prunus tomentosa and Prunus cerasifera and a weak one on Wagenheim Prune. It influenced a smaller compatibility of maiden plum trees obtained on this rootstock with Polish Norm PN-R-67010 compared with the two remaining ones.*

INTRODUCTION

Scientific studies concerning fruit tree nursery concentrate mainly on looking for new dwarf rootstocks, especially for strongly growing fruit trees species, the group of trees a plum tree undoubtedly belongs to. The following rootstocks have been known for plum trees: Pixy (Beakbane 1968; Beakbane and Fuller 1971; Jacob 1980; Webster 1980; Stebbins 1981; Hartmann 1984; Embree et al. 2000), Citation (Perry and Carlson 1983; Okie 1987), Saint Julien K (Glenn 1961, 1968; Webster 1980; Okie 1987), Eruni (Trajkowski and Anderson 1988; Świerczyński 1998; Sitarek et al. 2000), Ferlenain (GF 2038) and Marianna 8-6 (Maridon), (Webster and Wertheim 1993; Webster 1997). The following seedlings have also been tested as dwarf rootstocks for plum trees: *Prunus angustifolia* (Helton 1976), *Prunus besseyi* (Bernhard and Mesnier 1975; Van Oosten 1979; Putov and Puchkin 1982), *Prunus cistena* (Kuppers 1982), *Prunus glandulosa* (Kuppers 1981), *Prunus hortulana*, *Prunus maritima*, *Prunus injucunda* (Brenhard and Mesnier 1975), *Prunus pumila* (Hartman 1995), *Prunus spinosa* (Helton 1976), *Prunus triloba* (Van Oosten 1979; Kuppers 1981), *Prunus prostrata* (Kishore and Randhawa 1983), *Prunus subcordata* (Okie 1987) *Prunus tomentosa* (Hartman 1995). Unfortunately, so far none of them have been widely applied in nursery practice.

The aim of these studies was the evaluation of the usefulness of *Prunus tomentosa* Thunb. as dwarf rootstocks for the production of maiden trees of chosen plum tree cultivars.

MATERIAL AND METHODS

The experiment was carried out in 2003-2006. It was set up in four replications, with 25 rootstocks per plot. In spring of the three following years the rootstocks *Prunus*

cerasifera, Prunus tomentosa, Wagenheim Prune were planted into a nursery ground. In summer they were budded with four plum tree cultivars: 'Herman', 'Cacańska Rana', 'Amers', 'Cacańska Lepotica'. In autumn the following features of maiden plum trees were observed and measured: number of obtained maiden plum trees, compared with the number budded rootstocks (%), height of maiden plum trees, their thickness (measured 30 cm above the ground), number and average length of lateral shoots. On the basis of the obtained results consistency with Polish Norm PN-R-67010 was checked.

Statistical analysis of the results was carried out using two-factor variance analysis (cultivar, rootstock) using Duncan's test for a confidence level α = 0.05. The results presented in tables are mean values from three years.

RESULTS

Both the applied rootstocks and cultivars differentiated significantly the percentage of the obtained maiden plum trees. A better efficiency of maiden trees was obtained on *Prunus tomentosa,* a worse one on *Prunus cerasifera* and Wagenheima Prune. Among cultivars most trees were obtained for 'Cacańska Lepotica' and the least for 'Amers'. The other two cultivars were located between the above mentioned ones (table 1).

The height of maiden plum trees depended mainly on the applied rootstock, less on the budded cultivar. The highest trees were obtained on *Prunus cerasifera,* the lowest on Wagenheim Prune. The medium height was observed for trees growing on *Prunus tomentosa.* Independently from the applied rootstock the height of maiden trees of 'Herman' cultivar was significantly bigger that of 'Amers' i 'Cacańska Rana' and did not differ from 'Cacańska Lepotica' (table 2).

Maiden plum trees growing on *Prunus tomentosa* and *Prunus cerasifera* were much thicker and had a bigger number of lateral shoots compared with those growing on Wagenheim Prune. Also trees of 'Amers' and 'Cacańska Lepotica' differed significantly with thickness and number of lateral shoots from 'Herman' and 'Cacańska Rana' cultivars (table 3, 4).

The applied rootstocks also influenced the average length of lateral shoots. The trees on *Prunus tomentosa* and *Prunus cerasifera* had significantly higher values of this parameter of growth compared with Wagenheim Prune (table 5). The budded cultivars did not differ with the mean length of lateral shoots.

A better consistency of the maiden plum trees with the norm was obtained on *Prunus tomentosa* and *Prunus cerasifera*, a smaller one on Wagenheim Prune. The budded cultivar did not affect the quality of maiden plum trees defined in Polish Norm PN-R-67010 (table 6).

DISCUSSIONS

There are some opinions in literature that as a rootstock *Prunus tomentosa* blends well with plum tree cultivars (Tretjak 1983, Michev 1990, Krychev and Jankova 1999; Świerczyński 2001). The percentage of the maiden plum trees obtained in this experiment confirms the above mentioned opinions.

The percentage of the obtained maiden plum trees depended on the applied rootstock. A similar dependence was observed by Gąstoł and Poniedziałek (1998). However, such influence of the rootstock on the final number of maiden plum trees was not found by Grzyb and Sitarek (1996).

In the discussed experiment the maiden plum trees obtained on *Prunus tomentosa* rootstock had the growth parameters similar to those on *Prunus cerasifera,* with the exception of height. It is not consistent with the results obtained by Karycheva and Jankovej (1999), who had noticed much worse growth of maiden plum trees on *Prunus tomentosa* comparison with *Prunus cerasifera.* Also Gąstoł and Poniedziałek (1998) observed differences in the growth of maiden plum trees depending on the power of growth of the applied rootstock. However, on the basis of their results, Grzyb and Sitarek (1996) did not notice any influence of Pixy dwarf rootstock on weakening the growth of maiden plum trees in a nursery in comparison with *Prunus cerasifera* i Wagenheima Prune.

It was proved that genetic conditions of the power of growth of individual plum tree cultivars caused the differences in maiden trees growth, independently from the rootstock.

Significantly weaker growth of maiden plum trees on Wagenheim Prune caused their smaller consistency with the Norm. The average result obtained on this rootstock (43.7%) should be considered not satisfactory in a nursery production. *Prunus tomentosa*, in turn, seems to be a very promising rootstock and requires more advanced studies in an orchard.

Table 1

Percentage of obtained maiden trees depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	45.2 b *	49.9 c	42.2 a	71.7 f	52.3 a
Wagenheim Prune	46.9 b	48.6 bc	42.0 a	69.1 f	51.7 a
Prunus tomentosa	55.2 de	57.7 e	52.6 d	75.6 g	60.3 b
Mean value for cultivar	49.1 b	52.1 c	45.6 a	72.1 d	

*Means followed by the same letters do not differ significantly at p = 0.05.

Table 2

Height of maiden trees depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	158.4 d *	149.4 cd	142.7 bcd	149.0 cd	149.9 c
Wagenheim Prune	136.2 abc	129.4 ab	123.8 a	125.9 ab	128.8 a
Prunus tomentosa	147.8 cd	133.5 abc	136.7 abc	147.6 cd	141.4 b
Mean value for cultivar	147.5 b	137.4 a	134.4 a	140.8 ab	

* Explanation: see table 1

Table 3

Thickness of maiden trees depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	13.9 de *	13.8 de	15.6 g	15.6 g	14.8 b
Wagenheim Prune	11.6 ab	11.4 a	13.2 cd	12.4 bc	12.1 a
Prunus tomentosa	13.6 de	14.6 ef	15.3 fg	16.0 g	14.9 b
Mean value for cultivar	13.0 a	13.3 a	14.7 b	14.7 b	

* Explanation: see table 1

Table 4

Number of lateral shoots of maiden trees depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	3.6 ab *	3.4 ab	6.6 cd	4.6 bc	4.6 b
Wagenheim Prune	1.6 a	1.7 a	1.6 a	4.7 bc	2.8 a
Prunus tomentosa	3.0 ab	3.1 ab	3.0 ab	8.0 d	5.1 b
Mean value for cultivar	2.7 a	2.7 a	5.4 b	5.8 b	

- Explanation: see table 1

Table 5

Average length of lateral shoots of maiden trees depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	48.3 d *	40.5 cd	41.4 cd	37.0 bcd	41.8 b
Wagenheim Prune	25.3 ab	17.9 a	28.8 abc	25.5 ab	24.4 a
Prunus tomentosa	40.0 cd	37.8 bcd	38.5 bcd	45.7 d	40.5 b
Mean value for cultivar	37.9 a	32.0 a	36.2 a	36.0 a	

* Explanation: see table 1

Table 6

Compatiblity of maiden trees with Polish Norm PN-R-67010 depending on rootstock and cultivar

Rootstock	Cultivar				Mean value for rootstock
	Herman	Cacańska Rana	Amers	Cacańska Lepotica	
Prunus cerasifera	82.5 bc *	74.3 b	80.0 bc	82.1 bc	79.8 b
Wagenheim Prune	40.1 a	43.8 a	44.8 a	46.4 a	43.7 a
Prunus tomentosa	78.4 bc	80.0 bc	81.8 bc	84.9 c	81.4 b
Mean value for cultivar	68.1 a	66.8 a	69.9 a	72.5 a	

* Explanation: see table 1

CONCLUSIONS

1. The efficiency of maiden plum trees in a nursery depended both on the rootstock and a budded cultivar. The best efficiency of the maiden trees was obtained on *Prunus tomentosa* rootstock, worse on *Prunus cerasifera* and Wagenheim Prune.

2. Much weaker growth of maiden plum trees was observed on Wagenheim Prune in comparison with the two remaining rootstocks.

3. The percentage of the maiden trees, the most consistent with the norm was found for those growing on *Prunus tomentosa and* comparison with *Prunus cerasifera Prunus cerasifera.*

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