GROWTH OF PEACH TREES ON PUMISELECT® ROOTSTOCK, IN THE FIRST YEARS AFTER PLANTING

Adam Szewczuk and Ewelina Gudarowska

Wrocław University of Environmental and Life Sciences
Department of Horticulture, Pl. Grunwaldzki 24a, 53-363 Wrocław, POLAND
e-mail: adam.szewczuk@up.wroc.pl

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A B S T R A C T

The aim of the study, conducted during 2005-2007 at the Experimental Station in Samotwór, near Wrocław, was to estimate the growth of peach trees on Pumiselect® rootstock, depending on the age of planting material and density of planting, in comparison to peaches grafted on seedling rootstocks. In the spring of 2005 one-year-old and two-year-old peach trees cvs 'Inka' and 'Redhaven' on Pumiselect® rootstock were planted at a spacing of 4 x 1 m and 4 x 1.5 m. As a control, maiden trees on *Persica mandshurica* rootstock were planted 4 x 1 m and 4 x 3 m apart. The trees planted at 4 x 3 m were trained as a vase canopy, without leader. The trees planted at spacing 4 x 1-1.5 m were trained as an axial canopy with central leader. The trees on Pumiselect® rootstock planted at the higher density (4 x 1 m apart) were characterized by 17-37% weaker growth, expressed by TCSA, in comparison with the trees on seedling rootstock planted at the same spacing and by 49-63% in comparison with the trees on generative rootstock planted at the spacing of 4 x 3 m.

Key words: peach, rootstock, Pumiselect®, age of planting material

INTRODUCTION

In climatic conditions of Poland, strong winters and spring frosts are very dangerous for peach trees. Therefore, high yielding since the second year after planting is very important in cultivation of this species. This is possible when peach trees are planted at high density (Szewczuk, 2000). However, an intensification of peach cultivation is difficult due to a lack of the dwarf rootstock for this species. In Poland, peach trees are produced on seedling rootstocks and are planted at wide

distances because of the strong growth. According to Reighard (2002) and Fideghelli et al. (1998), new dwarf rootstocks tolerant to unfavourable soil conditions and resistant to diseases and pests are necessary for peach cultivations. The preliminary results suggest that the rootstock Pumiselect®, selected by Prof. F. Jacob at Geisenheim Institute, may be suitable for peach trees (Danilovich and Shane, 2004). In research done within the network of NC 140 project, peach trees planted on Pumiselect® were blooming in the second year after planting but flowers were destroyed by spring frost. The obtained yield (2.2 kg tree^{-1}) was lower in comparison with trees growing on more vigorous rootstocks like Cadaman (13.1 kg tree^{-1}) and Lovell (8.3 kg tree^{-1}). However, the peach trees on Pumiselect® gave higher yield than the trees on Adesto rootstock (0.8 kg tree^{-1}), which have growth vigour similar to Pumiselect®, and than the trees budded on dwarf VSV1 rootstock (1.1 kg tree^{-1}). According to the results obtained in American conditions, the fruit obtained from trees on Pumiselect® were smaller (142 g) than these growing on trees grafted on other rootstocks (171-211 g) (Aution and Krupa, 2005).

The aim of the study presented was to evaluate the growth of peach trees on Pumiselect® rootstock, depending on the age of planting material and density of planting, in comparison to trees grafted on seedling rootstocks.

MATERIAL AND METHODS

Research was conducted during 2005-2007 at the Experimental Station in Samotwór, belonging to University of Environmental and Life Sciences in Wrocław. In the spring of 2005, one-year-old and two-year-old peach trees cvs 'Inka' and 'Redhaven' on Pumiselect® rootstock were planted at spacings of 4 x 1 m and 4 x 1.5 m. As a control, maiden trees on *Persica mandshurica* rootstock were planted 4 x 1 m and 4 x 3 m apart. The trees planted at 4 x 3 m spacing were trained as a vase canopy, without leader. The trees planted at the spacing of 4 x 1-1.5 m were trained as an axial canopy with central leader.

The experiment was established in randomized block design with 4 replications consisted of 3 trees per plot. The obtained results were evaluated statistically using the analysis of variance. The significance of differences between means was evaluated according to Duncan's multiple range t-test at $p = 0.05$.

Tree vigour was estimated on the basis of trunk cross-sectional area (TCSA) and a number and total length of one-year-old shoots. In 2006, the trees did not bear fruit and in 2007 the yield was very low because flower buds were damaged by frost.

Weeds in the orchard were controlled with herbicides in tree rows and by mechanical weeding between rows. All trees were irrigated by rain gun during the periods of drought.

RESULTS AND DISCUSSION

Peach tree vigour, expressed by trunk cross sectional area, was affected by the type of the rootstock, age of nursery material and spacing of the planting. The obtained results correspond with the opinion of Szewczuk (2000) and Furakava (1998) that peach trees planted in high density grow weaker. Such a relationship was observed in the 3rd year after planting of one-year-old 'Inka' trees on *Persica mandshurica* rootstock and since the 2nd year after planting trees on Pumiselect® rootstock (Tab. 1). In the case when two-year-old trees of 'Inka' budded on Pumiselect® rootstock were planted, they grew stronger during 3 years than the trees planted as maidens. The growth of 'Inka' trees planted on Pumiselect® at the spacing of 4 x 1 m was weaker by about 37% in comparison with the trees on seedling rootstock planted at the same spacing and by about 63% in comparison with the trees on *Persica mandshurica* planted 4 x 3 m apart (Tab. 1). 'Redhaven' tress budded on Pumiselect® and planted at the spacing of 4 x 1m grew weaker by about 17% in comparison with the trees on seedling rootstock planted at density of 2500 trees per ha (4 x 1 m apart) and weaker by about 49% in relation to the trees planted at density of 833 trees per ha (4 x 3 m apart) (Tab. 2). This relationship was noted on the base of trunk cross-sectional area of the trees after 3 years of growing in the orchard. (Tab. 1 and 2). It corresponds to the results obtained by Reighard et al. (2007). According to Autio and Krupa (2006), growth of 'Redhaven' trees was reduced by 47% in comparison with control treatment. The weaker growth of the peach trees on Pumiselect® rootstock planted as one-year-old material was further evidenced by smaller number and total length of shoots (Tab. 3 and 4). When these trees were planted as two-year-old material, they produced higher number of all shoots but the tendency to weaker branching of one-year-old shoots was observed

Furakava (1998) noted higher productivity of peach trees planted at high density – 2500 trees per ha – in comparison with trees planted at density of 1250 trees per ha. However, according to Loreti and Massai (2002), peach trees should be planted at densities 700-1500 per ha, depending on shape of canopy and soil conditions. According to Salvador and Fideghelli (1993), peach trees planted at density of 1388 trees per ha can be trained as V-shape and spindle, but labour inputs for training in the spindle shape was approximately 6% higher and the total yield for 5 years was lower by 14 tons per ha, in comparison with system V. Also Caruso et al. (1998) noted the yield higher by about 27% for the trees trained as "tatura" in comparison with spindle canopy. The peach trees trained as spindle gave bigger fruit in the lower part of canopy. The trees in "tatura" shape produced bigger peaches in middle part of the tree and more fruit with better colour (Caruso et al., 1998). In Poland, Radajewska and Andrzejewski (2004) regarded

Table 1. Trunk cross-sectional area of 'Inka' peach trees in the first three years after planting depending on the rootstock, age of the planting material and spacing

Treatment			Trunk cross-sectional area [cm^2]			
Rootstock	spacing	planting material	spring 2005	autumn 2005	2006	2007
Pumiselect®	4 x 1 m	one-year-old	1.4 a*	4.2 a	8.6 a	15.2 a
		two-year-old	7.7 b	12.0 c	18.9 c	25.8 bc
	4 x 1.5 m	one-year-old	2.1 a	5.9 ab	13.7 b	22.6 b
		two-year-old	7.8 b	12.2 c	19.7 c	29.2 c
Persica mandshurica	4 x 1 m	one-year-old	3.0 a	7.5 b	16.4 bc	24.1b
	4 x 3 m	one-year-old	2.5 a	8.3 b	19.9 c	40.7 d

*Means followed by the same letter are not significantly different at p = 0.05

Table 2. Trunk cross-sectional area of 'Redhaven' peach trees in the first three years after planting depending on the rootstock, age of the planting material and spacing

Treatment			Trunk cross-sectional area [cm^2]			
Rootstock	spacing	planting material	spring 2005	autumn 2005	2006	2007
Pumiselect®	4 x 1 m	one-year-old	1.3 a*	4.0 a	9.2 a	17.2 a
		two-year-old	8.4 b	13.0 c	19.8 d	27.5 c
	4 x 1.5 m	one-year-old	2.3 a	6.0 ab	11.8 ab	20.7 b
		two-year-old	7.1 b	11.6 c	17.6 cd	25.7 c
Persica mandshurica	4 x 1 m	one-year-old	3.2 a	7.2 b	14.4 bc	20.7 b
	4 x 3 m	one-year-old	2.1 a	6.8 b	16.2 cd	33.7 d

*For explanations, see Table 1

seedling rootstock *Persica mandshurica* as the best for peach trees and did not note the influence of the shape of the canopy on tree growth and yield.

The obtained results proved high usefulness of Pumiselect® rootstock for peach trees planted an high density because it significantly reduces growth vigour. Planting two-year-old trees on Pumiselect® at high density is ambiguous because the growth of these trees is similar to those grafted on generative rootstock. However, the weaker branching of the trees planted as two-year-old material could be useful for training trees as axial canopy.

Table 3. Number and total length of one-year-old shoots on 'Inka' peach trees depending on the rootstock, age of the planting material and spacing (mean for first tree years after planting)

Rootstock	Treatment		Number of shoots		Total length of shoots [m]	
	spacing	planting material	all shoots	branches of shoots	all shoots	branches of shoots
Pumiselect®	4 x 1 m	one-year-old	65 a*	27 ab	19.7 a	5.8 a
		two-year-old	102 b	20 a	26.9 b	4.7 a
	4 x 1.5 m	one-year-old	105 b	38 c	29.9 b	7.3 b
		two-year-old	127 b	32 bc	32.3 b	5.8 a
Persica mandshurica	4 x 1 m	one-year-old	118 b	39 c	33.5 b	7.8 b
	4 x 3 m	one-year-old	216 c	121 d	71.7 c	28.8 c

*For explanations, see Table 1

Table 4. Number and total length of one-year-old shoots on 'Redhaven' peach trees depending on the rootstock, age of planting material and spacing (mean for first tree years after planting

Rootstock	Treatment		Number of shoots		Total length of shoots [m]	
	spacing	planting material	all shoots	branches of shoots	all shoots	branches of shoots
Pumiselect®	4 x 1 m	one-year-old	50 a*	17 ab	20.5 a	4.8 bc
		two-year-old	91 b	15 a	26.8 ab	3.4 ab
	4 x 1.5 m	one-year-old	81 b	24 bc	28.3 bc	4.9 c
		two-year-old	107 b	14 a	29.7 bc	2.7 a
Persica mandshurica	4 x 1 m	one-year-old	104 b	25 c	34.7 c	5.5 c
	4 x 3 m	one-year-old	138 c	53 d	47.2 d	11.5 d

*For explanations, see Table 1

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WZROST DRZEW BRZOSKWINI NA PODKŁADCE PUMISELECT® W PIERWSZYCH LATACH PO POSADZENIU

Adam Szewczuk i Ewelina Gudarowska

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

Doświadczenie przeprowadzono w latach 2005-2007 w Stacji Badawczo-Dydaktycznej w Samotworze należącej do Uniwersytetu Przyrodniczego we Wrocławiu. Celem badań było określenie wzrostu drzew brzoskwini na podkładce wegetatywnej Pumiselect® przy zróżnicowanym wieku materiału szkółkarskiego i rozstawie sadzenia w porównaniu z drzewami na podkładce generatywnej. Jednoroczne i dwuletnie okulanty odmian 'Inka' i 'Redhaven' na podkładce Pumiselect® posadzono w rozstawie 4 x 1 m i 4 x 1,5 m wiosną 2005 roku. Kontrolę stanowiły jednoroczne okulanty obu odmian na podkładce siewka Mandżurska posadzone w rozstawie 4 x 1 m oraz 4 x 3 m. Drzewa formowano w bezprzewodnikową koronę kotłową w rozstawie 4 x 3 m lub przewodnikową osiową w rozstawie 4 x 1 m i 4 x 1,5 m. Doświadczenie założono metodą losowanych podbloków w 4 powtórzeniach po 3 drzewa na poletku. W przypadku gęstego sadzenia, w rozstawie 4 x 1 m, wzrost drzew na podkładce Pumiselect® mierzony polem przekroju poprzecznego pnia był słabszy o 17-37% w porównaniu z drzewami na siewce sadzonymi w takiej samej rozstawie. Porównując te drzewa do rosnących na podkładce siewka Mandżurska w rozstawie 4 x 3 m, osłabienie wzrostu w zależności od odmiany wynosiło od 49% do 63%.

Słowa kluczowe: brzoskwinie, podkładka, Pumiselect®, wiek materiału szkółkarskiego