THE INFLUENCE OF MAIDEN TREE QUALITY ON GROWTH AND CROPPING OF TWO PEAR CULTIVARS IN THE ORCHARD
STĀDU KVALITĀTES IETEKME UZ DIVU BUMBIERU ŠĶIRŅU AUGUMU UN RAŽOŠANU DĀRZĀ

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Kopsavilkums

Izmēģinājums tika ierīkots Augļkopības Izmēģinājumu stacijā pie Vroclavas (Polijas dienvidrietumos) 2001.-2004. gadā. Izmēģinājumā tika pētīta viengadīgu un divgadīgu dažādas kvalitātes sazarotu stādu ietekme uz koku augumu un ražību divām bumbieru šķirnēm 'Carola' un 'Dicolor', kas potētas uz cidonijas S_1 un stādītas 2001. gada pavasarī. Koki stādīti 1.2 x 3.5 m attālumos (2381 koki ha^{-1}). Visiem kokiem veidots vārpstveida vainags pēc V-Güttingen sistēmas. Līdz ceturtajam augšanas gadam koku augums un ražība atšķīrās atkarībā no stādu kvalitātes. Viengadīgi acoti stādi deva labāko pieaugumu dārzā, bet viengadīgi potēti auga krietni vājāk, īpaši 'Carola'. Divgadīgu stādu stādīšana nedeva būtisku ražas palielinājumu. Sākotnējie pētījuma rezultāti rāda, ka viengadīgi acoti stādi dod augstākās ražas. Mazākie potētie koki deva mazāku ražu un bija ar zemāko ražas efektivitātes indeksu.

Abstract

The experiment was conducted at the Fruit Experimental Station near Wrocław (south-western part of Poland) in 2001-2004. Wrocław area belongs to the warmest regions in Poland. The influence of maiden trees quality on growth and cropping of 2 pear cvs. was estimated. The experiment was carried out on 'Carola' and 'Dicolor' trees budded on quince S_1 rootstock and planted in spring 2001 in a randomised block design in 4 replications with 6 trees per plot. Trees were spaced in rows at 1.2 m whereas the distance between rows equalled 3.5 m (2381 trees per hectare). The maiden trees varied in age from 2-year-old (the oldest) to 1-year-old grafted trees (the youngest). All pear tree canopies were formed as a spindle and were trained in a V-Güttingen system. Until the fourth year after planting, growth and yield were significantly affected by maiden trees quality. One-year-old budded trees were characterised by the strongest vigour in the orchard, while one-year-old grafted trees grew rather weak (especially with 'Carola'). Planting 2-year-old maidens didn't have positive influence on tree cropping in the orchard. Preliminary results of the study proved that 1-year-old budded trees, irrespective of cultivar, gave the highest yield. The smallest grafted trees cropped less and had the lowest crop efficiency index. Maiden trees quality of both cultivars had no clear influence on mean fruit weight.

Key words: pear, maiden trees quality, growth, cropping

Introduction

In the recent years, more and more interest in pear cultivation is observed in Poland. Until recently, it has been less profitable than apple cultivation and much more risky in terms of production. In comparison to apple trees, pear trees start bearing later and yield worse. Pear trees have higher climate-soil requirements and their fruits show worse storage ability. The number of cultivars and rootstocks suitable for pear orchards is limited, too (Mika, 1995).

Early and high productivity of pear trees first of all depends on cultivar, rootstock and maiden tree quality. According to Deckers and Schoofs (2001), for pear trees planted in high density planting systems the quality of the planting material should be high. It should be a 2-year-old tree with 6 to 8 laterals obtained by pruning back the 1-year-old trees in the fruit tree nursery. There is an important difference in productivity between a 1-year-old feathered tree and a 2-year-old feathered tree during the first year after planting. When a 1-year-old whip is planted, the productivity will be delayed by a period of 2 years during which the frame of the tree has to be developed. For intensive high density pear plantings only 2-year-old trees are recommended. Feathered 2-year –old trees for modern apple orchards are the best, because they give high and early yields (Oosten, 1978; Czynczyk, 1989;

Sadowski, 2005). Such trees cannot be pruned after planting (Mika, 2001. High quality nursery material is essential for a successful production system, with the goal of early production (Green, 1991). In Jacyna (2004) study, branching was better with dwarf Quince MA rootstock than on standard 'Bartlett' seedling rootstock, probably because maiden pear trees have a limited branching capacity in comparison with the tress of other fruit species, such as apples or sour cherries. Planting material is produced in the nursery for 2 (1-year-old trees) or for 3 years (2-year-old trees). By winter grafting the three-year-cycle of production could be shortened to two years. This method might be cheaper than traditional ones and may reduce the stress connected with older trees transplanting (Ferree, 1976). To decrease the harmful influence of transplanting on tree growth, more often (for example in Holland or Norway), maiden trees are produced in plastic containers. These trees without their root system damaged, grow much better after planting in the orchard (Czynczyk, 1989).

The aim of this study was to compare the growth, yield and fruit quality of 2 pear cultivars depending on maiden tree quality in the Lower Silesia region SW Poland.

Materials and Methods

The experiment was conducted at the Fruit Experimental Station-Samotwór near Wrocław (south-western part of Poland) in 2001-2004. The Wrocław area belongs to the warmest regions in Poland. The influence of maiden tree quality on growth and cropping of 2 pear cultivars was estimated. The experiment was carried out with 'Carola' and 'Dicolor' trees budded on quince S_1 rootstock, planted in spring 2001 in a randomised block design in 4 replications with 6 trees per plot. Trees were spaced in rows at 1.2 m whereas the distance between rows equalled 3.5 m (2381 trees per hectare). The maidens varied in age from 2-year-old trees (the oldest – their production took 3 years), 1-year-old budded trees (production – 2 years) to 1-year-old grafted trees (the youngest – production took 1 year). The youngest trees were whip grafted during wintertime and dug out from the nursery in autumn of the same year. Irrespective of maiden's age, all trees were without feathers. Pear tree canopies were formed as a spindle with minimum pruning after blooming time and shoots bended down by using concrete weights. The trees were not irrigated and were trained in a V-Güttingen system. Since the first year, there was a herbicide fallow in the rows and sward between them. Chemical protection was carried out according to the current recommendations of the Orchard Protection Programme.

The following data were recorded: growth of trees (trunk cross-sectional area, number and length of annual shoots), yield and fruit quality – mean fruit weight. The circumference of the trunk of each tree (up to third year – diameter) was measured at the height of 30 cm above the level of soil. The obtained results were analysed statistically, using the analysis of variance. Significant differences at P=0.05 were calculated using Duncan's multiple range t-test.

Results and Discussion

Till the 4th year after planting, growth and yield were significantly affected by cultivar and mainly by maiden tree quality. One-year-old budded trees were characterised by the strong vigour of the orchard, while one-year-old grafted trees grew rather weak (especially with 'Carola') – Tab. 1.

Table 1. Vegetative growth of 2 pear cultivars depending on maiden tree quality

Treatment	Trunk cross-sectional area , cm^2			Total number of shoots per tree, 2001-2003	Total shoot length, cm tree^{-1}, 2001-2003
	Spring 2001	Autumn 2004	Annual increment		
			Carola		
2-year-old maidens	1.8 d*	15.1 b	4.8 ab	60.2 c	1350 ab
1-year-old budded maidens	1.4 c	18.4 bc	5.8 bc	92.7 d	1801 c
1-year-old grafted maidens	0.6 a	11.4 a	3.8 a	35.7 a	936 a
			Dicolor		
2-year-old maidens	1.0 b	14.8 ab	5.7 bc	37.6 a	1308 ab
1-year-old budded maidens	1.2 b	20.6 c	7.0 c	56.4 bc	1828 c
1-year-old grafted maidens	0.5 a	16.7 b	6.5 c	50.0 b	1558 bc

* Means followed by the same letters do not differ at P=0.05 according to Duncan's multiple range t-test

In comparison with trees planted as 1-year-old budded whips, older 'Dicolor' trees grew significantly weaker. In autumn 2004, even grafted 'Dicolor' trees were more vigorous. These observations are not consistent with those reported by other scientists (Deckers and Schoofs, 2001; Mika, 2001; Sadowski, 2005). Probably because of the quality of 2-year-old maidens which were not very high (without feathers, rather thin – 'Dicolor'). Irrespective of age, all planted trees had no laterals. This corresponds with Jacyna's (2004) opinion, that such is the result of a limited branching capacity of some pear cultivars. Moreover, the root system of older trees could be more damaged and maiden's had bigger stress connected with transplanting. During the first four years of this research, trees planted as 1-year-old budded whips grew stronger as compared with 1-year-old grafted whips. Similar data (trunk cross-sectional area) are presented by Gudarowska and Szewczuk (2003).

In this experiment, pear trees, irrespective of cultivars, started to bear in the third year after planting and higher yields were obtained than in the Błaszczyk (2005) experiment (Tab. 2).

Table 2. Cropping of 2 pear cultivars depending on maiden tree quality

Treatment	Yield, kg tree^{-1}			Cumulative yield, kg tree^{-1}
	2002	2003	2004	
Carola				
2-year-old maidens	0.1	3.0 b	4.4 ab	7.5 b
1-year-old budded maidens	0.0	5.3 c	5.6 b	10.9 cd
1-year-old grafted maidens	0.0	1.3 ab	2.2 a	3.5 a
Dicolor				
2-year-old maidens	0.1	1.9 ab	6.1 b	8.1 bc
1-year-old budded maidens	0.0	2.9 b	9.4 c	12.3 d
1-year-old grafted maidens	0.0	0.8 a	6.9 bc	7.7 bc

* Explanation – see Table 1

High productivity of trees on dwarf Quince rootstocks is confirmed by other authors (Kosina, 1997; Iwaniszyniec and Hołubowicz, 1998; Castro and Rodriguez, 2002). On the contrary, according to Loreti *et al*. (2002), yielding of 'Conference' cultivar on Quince rootstocks up to sixth year after planting was low. Planting 2-year-old maidens didn't have positive influence on tree cropping in the orchard. Preliminary results of the study proved that 1-year-old budded trees, irrespective of cultivars, gave the highest yield. The smallest grafted trees yielded less and had the lowest crop efficiency indices (Tab. 3).

Table 3. Mean fruit weight and crop efficiency index (CEC) of 2 pear cvs. depending on maiden tree quality

Treatment	Mean fruit weight, g			CEC, kg cm^{-2}, 2002-2004
	2003	2004	2003-2004	
Carola				
2-year-old maidens	258 b	207 b	233 c	0.50 b
1-year-old budded maidens	210 a	200 b	205 b	0.59 b
1-year-old grafted maidens	286 b	195 b	241 c	0.31 a
Dicolor				
2-year-old maidens	189 a	163 a	176 a	0.55 b
1-year-old budded maidens	188 a	152 a	170 a	0.60 b
1-year-old grafted maidens	203 a	160 a	182 ab	0.46 b

* Explanation – see Table 1

Different results were obtained by Gudarowska and Szewczuk (2003). In their experiment, the grafted apple trees, irrespective of rootstock, gave higher crops as compared with the budded ones. Pear cultivars estimated in the experiment differed significantly between each other in mean fruit weight (Tab. 3). Considerably larger fruit were picked from 'Carola' trees but "Dicolor' fruit were not small either, but equalled about 180 g. In contrast, Błaszczyk (2005) reported that 'Dicolor' fruit weighted only 108 g. On the other hand, in Czech experiment (Paprštein and Bouma, 1999), 'Dicolor' had a fruit weight of just 146 g but, due to the full red blush, it belongs to the most attractive pear cultivars.

Maiden tree quality of both cultivars had no clear influence on mean fruit weight. Only trees planted as 1-year-old budded whips had significantly the smallest fruit due to high productivity in 2003 (third year after planting).

Conclusions

Preliminary results of the four year study proved that estimated new pear cultivars are suitable for commercial production. 'Carola' and 'Dicolor' gave high and early yields as well as good quality fruit.

Maiden tree quality had significant influence on pear tree growth and cropping in the orchard. Till the 4th year after planting, one-year-old budded whips grew strongly and gave the highest yields. Planting two-year-old maidens did not have a positive influence on tree cropping.

Maiden tree quality of both pear cultivars had no clear influence on mean fruit weight.

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