Journal of Fruit and Ornamental Plant Research Vol. 14, 2006: 135-141

PERFORMANCE OF YOUNG PEACH TREES PLANTED IN RIDGES AND MULCHED IN TREE ROWS

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(Received 31 July, 2006/Accepted September 7, 2006)

A B S T R A C T

In the spring of 2003, peach trees of 'Early Redhaven' on seedling rootstock *Prunus mandshurica* (Maxim.) Koehne were planted in two different ways: in the traditional way and in ridges. For both of these planting methods, four methods of soil management were applied in the tree rows: 1) herbicide fallow, 2) mulching with sawdust, 3) mulching with black polypropylene fabric, 4) mulching with peat + black polypropylene fabric.

The trees were planted at a spacing of 1.0 x 3.8 m (2631 trees per ha) in a randomised block design in four replications with 5 trees per plot.

Planting in ridges and mulching with polypropylene fabric positively affected the yields of young peach trees. In the year of planting, the trees planted in ridges grew more vigorously in comparison with those planted in the traditional way. In the next year, significantly more vigorous growth was observed for the trees planted conventionally and mulched with sawdust and black polypropylene fabric. In the year of lower yields (due to frost damage), the peach trees planted in the traditional way and with the herbicide fallow in the tree rows grew more intensively in comparison with the ones planted in ridges. Taking into consideration the number of shoots removed in 2004-2005, more intensive growth was observed for the trees planted in ridges. Because of the higher number of pruned shoots, greater manual labour input in pruning in 2004-2005 was recorded for the trees planted in ridges.

Key words: peach, planting in ridges, mulching, polypropylene fabric, yield, growth

INTRODUCTION

The cultivation of peach trees is risky in Polish climatic conditions because of the possibility of frost damage to the trees in the winter and flower buds in the spring. As a consequence of the frequent destruction by frost, short exploitation times are observed for peach orchards. That is why obtaining high fruit yields already from the second year after planting is so important.

One of the factors determining early bearing of peach trees is planting them at high density (Szewczuk, 2000), or creating the best growing conditions for young trees by mulching or planting them in ridges (Szewczuk, 2001). Planting in ridges consists in setting trees on the top of the ground and hilling the soil up around their root system by means of a lister.

Bootsma (1995) reported that planting in ridges is suitable for the replanting of trees. According to Perry (1996), this method of planting can be useful for establishing an orchard in an area with a high water table and was found to improve yields in peach and sour cherry trees. In the case of apple trees, Treder and Mika (2001) reported that planting in ridges had no influence on the yield or the quality of fruit. However, Szewczuk and Gudarowska (2004) found that planting apple trees in ridges improved the growth and yielding of young trees in comparison with trees planted in the traditional way and growing with a herbicide fallow in the tree rows. In the same experiment, the authors observed that irrigation and mulching with pine bark positively affected the yield of apple trees planted in ridges (Szewczuk and Gudarowska, 2004). Sako and Laurinen (1986) suggested that apple trees planted in ridges grew more vigorously than those planted in a traditional way. However, this tendency changed in the case of older trees. According to Treder and Mika (2001), the growth of trees planted in ridges was weaker from the third year after planting. The results obtained in Bootsma's experiment confirmed more intensive growth of trees planted in ridges, but only in the first years after planting the trees soon after clearing the old orchard (Bootsma, 1995).

The biggest problem with the method of planting in ridges is severe drying-up of the soil and high exposure of trees to drought (Perry, 1996; Treder and Mika, 1996). However, the use of mulches reduces the loss of water from the soil (Szewczuk and Gudarowska, 2004) and increases the productivity of apple trees, as well as improvies the thermal conditions of the soil (Sako and Laurinen, 1986). The use of mulches such as pine bark or black polypropylene fabric in the rows of trees was a good method for improving yielding in young peach trees (Szewczuk, 2001).

The aim of this study was to determine the effect of soil mulching on the growth and yielding of peach trees planted in a traditional way and in ridges.

MATERIAL AND METHODS

In the spring of 2003, peach trees of 'Early Redhaven' on seedling rootstock *Prunus mandshurica* (Maxim.) Koehne, were planted in two different ways: in the traditional (standard) way and in ridges. In both cases, four methods of soil management were applied in the tree rows: 1) herbicide fallow, 2) mulching with sawdust, 3) mulching with black polypropylene fabric, 4) mulching with peat + black polypropylene fabric. The herbicide fallow was maintained by applying to humid soil Casaron 6,75 GR (dichlobenil) at a rate of 60 kg per ha at the beginning of March. Additionally, in the summer, Glifogan 360 SL (5 l/ha) + Chwastox Extra 300 SL (2 l/ha) were applied locally in the herbicide fallow and to the sawdust mulch. Mulching with polypropylene fabric effectively controlled the growth of weeds during the experiment. Pruning of the trees after planting consisted in shortening strong shoots and removing weak shoots, as well as pruning the leader at 20 cm below its tip. The trees were trained as a slender spindle by removing strong shoots and shortening the weak ones every year. Fruit yield and mean fruit weight were recorded for each tree in the years 2004-2005. For the years 2004-2006, the number of the shoots removed and the length of the pruning time were also recorded for each tree.

The trees were spaced at 3.8 x 1.0 m (2631 trees per ha) in a randomized block design in four replication with 5 trees per plot. The results of the experiment were evaluated statistically by means of an analysis of variance. The significance of the differences between means was evaluated according to Duncan's multiple range t-test at P=0.05.

RESULTS AND DISCUSSION

The peach trees of 'Early Redhaven' started bearing fruit in the second year after planting (2004). Higher yields were recorded for the young peach trees planted in ridges, mainly due to better conditions for growing. In 2004-2005, the highest yield was obtained from the trees planted in ridges with black polypropylene fabric as mulch (Tab. 1). This agrees with the results obtained by Szewczuk (2001), and Szewczuk and Gudarowska (2005). The authors found that mulching with pine bark or polypropylene fabric positively affected the yield of peach and nectarine trees. However, the positive effect of planting in ridges and mulching was not observed for apple trees. In that experiment, trees planted in a traditional way and in ridges with mulching gave yields of the same size (Szewczuk and Gudarowska, 2004).

However, the high level of yielding of young peach trees grown in ridges and with polypropylene fabric as mulch resulted in lower fruit weight (Tab. 1).

In the next year, yields were very low due to a spring frost. However, for the same extent of damage to flowers, the trees planted in ridges and mulched with polypropylene fabric produced the highest yield (Tab. 1).

Table 1. Effect of the planting and mulching methods on the yield and mean fruit weight of peaches

Method of planting	Method of soil management			
	herbicide fallow	sawdust	black polypropylene fabric	peat + black polypropylene fabric
Yield 2004 [kg tree^{-1}]				
Standard planting	1.65 a	1.60 a	1.35 a	1.88 a
Planting in ridges	3.50 b	3.62 b	4.85 c	3.52 b
Difference |d|	1.85*	2.02 *	3.50*	1.64*
Yield 2005 [kg tree^{-1}]				
Standard planting	1.70 ab	0.64 a	1.51 a	1.48 a
Planting in ridges	3.06 c	2.09 b	3.57 d	2.78 c
Difference |d|	1.36*	1.45*	2.06*	1.30*
Mean fruit weight 2004 [g]				
Standard planting	151 c	146 c	132 b	129 b
Planting in ridges	120 ab	117 a	113 a	113 a
Difference |d|	31*	29*	19*	16*
Mean fruit weight 2005 [g]				
Standard planting	168 c	163bc	160 b	160b
Planting in ridges	161 b	157 ab	152 a	152 a
Difference |d|	7*	6*	8*	8*

Means followed by the same letter do not differ significantly at P=0.05 according to Duncan's t-test
*significant difference

The growth of the trees expressed as the increment in TCSA depended on the method of planting. In the year of planting, the peach trees planted in ridges grew more intensively in comparison with the trees planted in the traditional way (Tab. 2). These results confirm the results reported by Szewczuk and Gudarowska (2004), as well as Sako and Laurinen (1986).

In the second year after planting, significantly more vigorous growth was observed for the trees planted in the traditional way and mulched with sawdust and black polypropylene fabric. According to others authors (Engel et al., 2001; Kawecki et al., 1999; Krawiec, 1998), mulching contributed to more intensive growth of trees.

In the next year, the year of lower yields (due to frost damage), the peach trees planted in the traditional way and with the herbicide fallow in the tree rows, grew more intensively in comparison with the ones planted in ridges (Tab. 2). However, taking into consideration the number of shoots removed in 2004-2005, more intensive growth was observed for the trees planted in ridges and mulched with sawdust and black polypropylene fabric (2004), as well as for the trees growing in the herbicide fallow and mulched with black polypropylene

Table 2. Effect of the planting and mulching methods on the growth of peach trees expressed as the increment in TCSA and the number of shoots removed

Method of planting	Method of soil management			
	herbicide fallow	sawdust	black polypropylene fabric	peat + black polypro-pylene fabric
Increment in TCSA spring – autumn 2003 [tree cm^{-2}]				
Standard planting	2.61a	2.92 ab	2.64 a	2.64 a
Planting in ridges	3.60 c	3.52 bc	3.34 bc	3.36 bc
Difference |d|	1.01*	0.60	0.70*	0.72*
Increment in TCSA spring – autumn 2004 [tree cm^{-2}]				
Standard planting	6.38 a	9.25 c	8.93 c	8.46 bc
Planting in ridges	5.99 a	7.18 ab	6.97 ab	7.10 ab
Difference |d|	0.39	2.07*	1.96*	1.36
Increment in TCSA spring – autumn 2005 [tree cm^{-2}]				
Standard planting	4.94 bc	5.49 c	4.74 abc	4.94 bc
Planting in ridges	3.57 a	4.62 abc	4.07 ab	3.98 ab
Difference |d|	1.37*	0.87	0.67	0.96
Number of shoots removed per tree in 2004				
Standard planting	17.1 ab	12.8 a	11.8 a	17.6 ab
Planting in ridges	23.8 bc	24.4 c	25.6 c	23.6 bc
Difference |d|	6.7	11.6*	13.6*	6.0
Number of shoots removed per tree in 2005				
Standard planting	60.7 ab	59.0 ab	57.7 ab	67.6 cd
Planting in ridges	74.6 e	56.8 a	70.0 de	63.5 bc
Difference |d|	13.9*	2.2	12.3*	4.1
Number of shoots removed per tree in 2006				
Standard planting	90.3 a	122.1 d	121.4 d	113.7 cd
Planting in ridges	98.7 ab	114.9 cd	108.8 bcd	104.3 abc
Difference |d|	8.4	7.2	12.6	9.4

TCSA – trunk cross-sectional area
*For explanation, see Table 1

fabric (2005). Because of the higher number of pruned shoots, greater manual labour input in pruning in 2004-2005 was recorded for the trees planted in ridges (Tab. 3).

The preliminary results obtained in this study suggest that in the case of 'Early Redhaven' peach trees planting in ridges combined with mulching with polypropylene fabric may be a good method for obtaining higher yields in the first years after planting.

It turned out that the threat of the increased risk of freezing of the peach trees planted in ridges was not justified. The trees planted in this way were able to withstand the temperature of -25°C in the winter of 2005/2006. An assessment of the degree of frost damage to one-year-old shoots did not show any differences between the experimental combinations.

Table 3. Effect of the planting and mulching methods on the input of labour hours per hectare in pruning the peach trees

Method of planting	Method of soil management			
	herbicide fallow	sawdust	black polypropylene fabric	peat+black polypropylene fabric
Input of labour hours per hectare in 2004				
Standard planting	26.31	17.54	17.54	26.31
Planting in ridges	39.47	48.24	48.24	43.85
Input of labour hours per hectare in 2005				
Standard planting	87.7	87.7	92.09	100.86
Planting in ridges	127.17	109.63	131.55	122.78
Input of labour hours per hectare in 2006				
Standard planting	149.09	153.48	153.48	157.86
Planting in ridges	171.02	166.63	149.09	157.86

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OCENA MŁODYCH DRZEW BRZOSKWINI SADZONYCH W REDLINY I ŚCIÓŁKOWANYCH W RZĘDACH DRZEW

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

Drzewa odmiany ‘Early Redhaven’ na podkładce siewki ‘Brzoskwini mandżurskiej’ posadzono wiosną 2003 roku dwoma sposobami: tradycyjnym i w redliny. W obu systemach sadzenia zastosowano cztery sposoby utrzymania gleby w rzędach drzew: ugór herbicydowy oraz ściółki: z trocin, czarnej tkaniny polipropylenowej oraz torfu przykrytego tkaniną polipropylenową. Drzewa posadzono w rozstawie 1,0 x 3,8 m (2631 drzew/ha) w układzie zależnym, w czterech powtórzeniach, po pięć drzew na poletku.

Zastosowanie tkaniny polipropylenowej w technologii sadzenia i prowadzenia drzew w redlinach wpłynęło na poprawę plonowania młodych drzew brzoskwini. W pierwszym roku drzewa posadzone w redliny charakteryzowały się silniejszym wzrostem w porównaniu z sadzonymi tradycyjnie. W następnym roku istotnie silniejszym wzrostem charakteryzowały się drzewa sadzone tradycyjnie i dodatkowo ściółkowane trocinami i czarną tkaniną polipropylenową. W roku słabszego plonowania, z powodu uszkodzeń przymrozkowych, drzewa sadzone tradycyjnie i rosnące w ugorze herbicydowym rosły silniej niż drzewa sadzone w redlinach. Biorąc pod uwagę liczbę wycinanych pędów, drzewa sadzone w redlinach rosły silniej. Dlatego wymagały większych nakładów pracy na cięcie wykonane w latach 2004-2005.

Słowa kluczowe: brzoskwinie, sadzenie w redliny, ściółkowanie, tkanina polipropylenowa, trociny