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EFFECT OF TREE PRUNING AND CROWN FORMATION IN YOUNG APRICOT (*Armeniaca vulgaris* Lam.) TREES ON THEIR GROWTH AND YIELDING

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Abstract. The cultivation of apricot (*Armeniaca vulgaris* Lam.) is possible only in some regions of Poland, but there is still not too much information about trees pruning and forming in our climatic conditions. Studies were carried out in the years 2004–2006 in Przybroda near Poznań. Studies concerned effect of different tree pruning methods on growth and yielding of 3 apricot cultivars: 'Goldrich', 'Hargrand' and 'Sirena'. During the first 3 years, tree crowns were shaped in a 'vase' form and pruning was carried out on three levels of intensity: intensive pruning, medium-intensive pruning and slight pruning. During the first 3 years after plantation, the effects exerted by the three pruning intensities were studied in reference to the growth, morphology of tree crown, flower buds setting and fruit yield. Obtained results showed that the most intensive pruning system increased width and projection of crowns. It also resulted in beneficial changes in fruiting zone of crowns by increasing number of branched longshoots and shortshoots, and higher length of not branched longshoots and sylleptic shoots. There was also better flower buds setting and yielding of trees pruned intensively. The highest yield was obtained from trees intensively pruned, the best yielded were trees cultivars: 'Hargrand' and 'Sirena' but the lowest yield was obtained from trees of 'Goldrich' cultivar.

Key words: cultivar, tree height, crown projection, shoot, flower bud

INTRODUCTION

Apricots were domesticated over 5,000 years ago in the wide area of Middle Asia and in the 1st century BC apricots were spread to European countries [Faust et al. 1998; Ercisli 2009].

Tree pruning and crown formation belong to the most difficult and to the most important cultivation treatments in orchard. They exert an effect on the correlation mechanism of many interrelated life processes. Throughout the tree's life, pruning ensures that

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shoots are strong enough to support fruits and that branches are properly angled to allow for flower buds to develop and for fruit to ripen in sufficient sunlight [Demirtas et al. 2010a]. Branches broken and with diseases should be removed from trees [Rom and Ferree 1985; Marini 1986; Kuden and Kaska 1995]. Pruning significantly improves regeneration processes of damaged branches after severe winter and also reduces excessive tree height and the size of tree crowns [Carlson 1982; Mika 1986; Radajewska and Szklarz 2008; Szklarz and Radajewska 2009]. According to Lang [2001] proper pruning is important to keep a right relationships among shoot growth, leaf area, photosynthesis, annual building of storage reserves and good yields of high quality fruits. Pruning induces hydrolysis of reserves and an accumulation of certain metabolites [Daie 1985; Clair-Maczulajtys et al. 1996]. Studies conducted on apples, apricots, peaches and almonds proved that leaf areas increased after pruning [Myers and Ferree 1984].

The chosen crown form decides not only about the tree size, but primarily about its productivity. Apricot trees in a young age and in a good locality are characterized by a high elongation and monopodial growth, while their crowns show a very loose structure. Pruning assures good air flow throughout the tree canopy, which helps prevent some tree diseases [Demirtas et al. 2010a]. It must be stressed that apricot trees in climatic conditions of Poland are a rather difficult species for cultivation because they are susceptible to diseases caused by different fungi pathogens which destroy not only tree branches but also the whole trees. That is the reason why apricot trees cannot be too intensively pruned. In the flowering period in Poland, the trees are frequently injured by spring frosts and later, they easily become the victims of alternate fruiting. Therefore, tree pruning must be very skilful and considerate in order not to make the treatment excessively labour consuming, but giving at the same time the expected economic effects.

Demirtas et al. [2010a] classified pruning according to time of this treatments (winter and summer pruning) or tree age (young, middle and older trees). Traditionally in many countries, fruit trees are pruned in its dormant stage, which is a late winter to an early spring. Pruning of apricot trees can also be made at the end of summer to cut back upright shoots on side branches and to remove new, superfluous shoots. In other studies found that tree pruning in summer had also positive influence on flower bud formation, increased fruit quality and allow to control tree development [Miller 1982]. Burtoiu et al. [2006] found that the number of annual shoots pruned in summer increased depending from pruning date (from 15.05 through 30.05 to 21.06). Summer pruning promotes an accumulation of carbohydrates [Demirtas et al. 2010b]. Better fruit coloration after summer pruning was proved in peaches and nectarines [Day et al. 1989; Walsh et al. 1989], some apple cultivars [Barden and Marini 1984].

According to the common opinion, young trees of the majority of species should be sparingly pruned because this treatment delays their fruiting. Our studies are expected to offer an advise regarding a rational pruning method for young apricot trees.

MATERIAL AND METHODS

Studies were carried out on the area of the Agricultural-Pomicultural Experimental Farm in Przybroda belonging to the University of Life Sciences in Poznań. Apricot trees, on apricot seedling rootstock were planted in spring of 2004 year in 4.0 × 2.5 m spacing on a grey-brown podzolic soil created on boulder clay. A two-factorial experiment, including cultivar and pruning method as factors, was established in a random block design in four replications with 3 trees in each replication.

Our studies included three ways of crown formation and tree pruning was used in reference to three apricot cultivars: 'Goldrich', 'Hargrand' and 'Sirena'. Licznar-Małańczuk and Sosna [2005a, 2005b] found that cultivar 'Hargrand' on the combined basis of blooming period, harvest time, yielding, fruit quality and low susceptibility to *Monilinia laxa* Sacc. is one of cultivars suitable for commercial production in Lower Silesia region in Poland. In our experiment after plantation, the trees were pruned in spring to the height of 60 cm, while in August, they were radically pruned and the crowns were shaped in the 'vase' form.

Crown formation and tree pruning included three combinations:

a) intensive pruning – crowns with 10–12 branches, in August of the first year longshoots were shortened to the length of 20 cm,

b) medium-intensive pruning – crowns with 7–9 branches, in August of the first year longshoots were shortened to the length of 40 cm,

c) control combination – slight pruning, tree crown with 4–6 branches, in August of the first year longshoots were shortened to the length of 60 cm.

In the following years, the number of branches in the tree crowns was controlled and sanitary pruning was carried out. The following estimations were carried out: tree growth and tree crown morphology, branch morphology, flower bud setting, tree yielding. Results of studies were statistically elaborated using the STAT program of the variance analysis for two-factorial experiments. The significance of differences was estimated using the Duncan's test at the significance level $\alpha = 0.05$.

RESULTS AND DISCUSSION

Young trees planted in a carefully prepared, fertilized and well irrigated soil showed a very strong growth. In autumn, after the first year of growing, measurements of trunk cross-section area (TCSA) did not show any differences between the particular variants of trees pruning and forming and also no differences between cultivars (19.1–23.8 cm^2). After the second year of growing, differentiated trees pruning and forming also did not exert any significant effect on the TCSA values. 'Goldrich' cultivar trees were higher (2.3 m) than the trees of the remaining cultivars (2.0–2.1 m) (tab. 1).

Pruning and crown formation did not exert any significant effect on the tree height, however, there was an effect exerted by the pruning and crown formation on the projection of the crown in the young trees. The intensively pruned trees showed the greatest crown projection (3.6 m^2). Their crowns were more patulous than the crowns of the medium-intensive pruned trees (3.1 m^2) (tab. 1). In the previous studies of Carlson [1982], Mika [1986], Radajewska and Szklarz [2008], Szklarz and Radajewska [2009] pruning reduced excessive tree height and the size of tree crowns. In our experiment in spite of a rich tree flowering, the 2-year old apricot trees did not bear fruits. Early spring frosts completely destroyed the flowers and fruit sets.

Table 1. Growth of apricot trees of 3 cultivars depending from method of tree forming
Tabela 1. Wzrost drzew 3 odmian moreli w zależności od sposobu formowania drzew

	Cultivar Odmiana	Level of trees pruning Poziom cięcia drzew: intensive silne	medium-intensive średnio silne	slight (control) słabe (kontrola)	Mean for cultivar Średnia dla odmiany
TCSA, 2004 PPPP, 2004 (cm^2)*	Goldrich	21.3 a**	19.7 a	23.6 a	21.5 ab
	Hargrand	21.4 a	21.7 a	19.1 a	20.7 a
	Sirena	23.1 a	22.3 a	23.8 a	23.1 b
	mean for pruning level średnia dla poziomu cięcia	22.0 a	21.2 a	22.2 a	
TCSA, 2005 PPPP, 2005 (cm^2)	Goldrich	28.0 a	25.6 a	31.1 a	28.2 a
	Hargrand	27.8 a	28.6 a	24.8 a	27.0 a
	Sirena	30.1 a	28.0 a	30.6 a	29.6 a
	mean for pruning level średnia dla poziomu cięcia	28.7 a	27.4 a	28.9 a	
Tree crown height, 2005 Wysokość koron drzew, 2005 (m)	Goldrich	2.2 bc	2.3 c	2.4 c	2.3 b
	Hargrand	2.1 ab	2.0 ab	2.1 ab	2.1 a
	Sirena	2.1 ab	2.0 a	2.0 a	2.0 a
	mean for pruning level średnia dla poziomu cięcia	2.1 a	2.1 a	2.1 a	
Tree crown projection, 2005 Projekcja koron drzew, 2005 (m^2)	Goldrich	3.5 abc	3.2 bc	3.7 c	3.5
	Hargrand	3.6 bc	3.4 abc	2.9 ab	3.3
	Sirena	3.6 abc	2.9 a	3.1 abc	3.2
	mean for pruning level średnia dla poziomu cięcia	3.6 b	3.1 a	3.3 ab	

*TCSA – trunk cross sectional area (cm^2)
* PPPP – powierzchnia przekroju poprzecznego pnia (cm^2)
**Means indicate by the same letter do not differ significantly at $\alpha = 0.05$ [Duncan's test]. Statistical analysis was made separately for each characteristic.
**Średnie oznaczone tą samą literą nie różnią się istotnie przy $\alpha = 0,05$ [test Duncana]. Analiza statystyczna została wykonana oddzielnie dla każdej cechy.

Detailed measurements referring to crown morphology showed that the greatest number of branched longshoots (11.2) were found on intensively pruned trees, as well as on trees of 'Sirena' cultivar (11.3), the greatest their summarized total length was on trees pruned intensively and medium-intensively (11.6–11.7 m). It is true that on branched longshoots, there is a significantly smaller number of flower buds which are valuable for future fruiting [Marini 1984, 1985, 2002], but the well developed fruits are very shapely. Strong, not branched longshoots are the most valuable ones for the future yielding because on them the most shapely fruits are produced. Differentiated pruning and forming did not exert any influence on the number and on the summaric not branched shoots length. On 'Goldrich' and 'Sirena' trees pruned intensively and slight, number and the summaric not branched shoots length were the highest. Not branched longshoots developed on the trees of 'Goldrich' cultivar were the longest (86.2 cm), less longer were the longshoots of 'Sirena' (72.8 cm), but the shortest were cultivar 'Hargrand' (66.2 cm). Intensive tree pruning, both the very intensive and the medium intensive one stimulated the shorting of sylleptic shoots on branched longshoots. On sylleptic shoots, there develop less numerous, weak flower buds and later they show equally poor fruit sets which are the first to shatter (tab. 2).

Table 2. Characteristic of fruit-bearing zone of apricot trees, 2005
Tabela 2. Charakterystyka strefy owoconośnej drzew moreli, 2005

	Cultivar Odmiana	Level of trees pruning Poziom cięcia drzew: intensive silne	medium-intensive średnio silne	slight (control) słabe (kontrola)	Mean for cultivar Średnia dla odmiany
Branched longshoots number on tree Liczba rozgałęzionych długopędów na drzewie	Goldrich	9.6 abc**	10.8 a-d	8.5 ab	9.6 a
	Hargrand	11.3 cd	8.7 abc	8.2 a	9.4 a
	Sirena	12.6 d	11.2 a-d	10.2 bcd	11.3 b
	mean for pruning method średnia dla sposobu cięcia	11.2 b	10.2 ab	9.0 a	
Summaric length of branched longshoots on tree Sumaryczna długość rozgałęzionych długopędów na drzewie (m)	Goldrich	10.1 ab	13.5 c	9.2 a	10.9 a
	Hargrand	12.6 bc	10.4 ab	8.9 a	10.6 a
	Sirena	12.3 bc	11.2 abc	10.2 ab	11.2 a
	mean for pruning method średnia dla sposobu cięcia	11.6 b	11.7 b	9.4 a	
Not branched longshoots number on tree Liczba długopędów nierozgałęzionych na drzewie	Goldrich	13.1 bc	12.6 abc	15.9 c	13.9 b
	Hargrand	10.4 ab	12.0 abc	8.2 a	10.2 a
	Sirena	15.8 c	15.2 bc	15.1 bc	15.4 b
	mean for pruning method średnia dla sposobu cięcia	13.1 a	13.3 a	13.1 a	
Summaric length of not branched longshoots on tree Sumaryczna długość nierozgałęzionych długopędów na drzewie (m)	Goldrich	11.2 cd	10.1 bc	14.5 d	11.9 b
	Hargrand	6.8 ab	7.3 ab	5.4 a	6.5 a
	Sirena	12.2 cd	10.2 bc	11.4 cd	11.3 b
	mean for pruning method średnia dla sposobu cięcia	10.1 a	9.2 a	10.4 a	
Longshoots length not branched longshoots on tree Długość długopędów nierozgałęzionych długopędów na drzewie (cm)	Goldrich	85.8 de	84.0 cde	88.9 e	86.2 c
	Hargrand	72.2 bc	59.9 a	66.5 ab	66.2 a
	Sirena	77.8 b-e	66.1 ab	74.0 bcd	72.8 b
	mean for pruning method średnia dla sposobu cięcia	78.6 b	70.0 a	76.6 b	
Summaric length of sylleptic shoots on tree Sumaryczna długość pędów syleptycznych na drzewie (m)	Goldrich	5.2 a*	8.1 cd	5.9 abc	6.4 a
	Hargrand	9.8 d	8.1 bcd	6.8 abc	8.2 b
	Sirena	7.3 abc	6.9 abc	5.6 ab	6.6 a
	mean for pruning method średnia dla sposobu cięcia	7.4 b	7.7 b	6.1 a	
Shortshoots number on branch Liczba krótkopędów na gałęzi	Goldrich	14.6 a	13.3 a	10.9 a	12.9 a
	Hargrand	12.5 a	9.9 a	9.8 a	10.7 a
	Sirena	16.0 a	15.4 a	10.7 a	14.0 a
	mean for pruning method średnia dla sposobu cięcia	14.4 b	12.9 ab	10.4 a	

** Explanation, see Table 1.

Intensive pruning of young trees did exert a distinct effect on the number of shortshoots. The more intensive was the tree pruning, the greatest was the number of shortshoots on a branch (respectively: 14.4; 12.9; 10.4) (tab. 2). According to Marini [2002], on shortshoots, there usually appear very numerous flower buds, however, the fruits developing from them are smaller. Shoots shortening by the removal of the competing top of the main axis caused that to the buds localized below the pruning place, there flowed from the roots an increased amount of nutrients and hormones and this fact was one of the factors which promoted the development of new buds. When the buds, localized most close to the spot of decapitation, started developing, they increased the production of auxin which stimulated their growth improving still more the supply of nutrients and hormones [McIntyre 1964, Jankiewicz et al. 1973]. The higher is the inclination of trees to create fruit-bearing shoots, the smaller is the effect of tree pruning exerted on the creation of flower buds.

The flower bud distribution on the tree was interesting. The greatest flower bud number (in the total number) was on the longshoots and, depending on the cultivar, it was from 48 to 57%; on sylleptic shoots it was 21–37%, and on shortshoots 15–22% (fig. 1). Pruning and crown formation only slightly modified the flower bud distribution on the particular fruit-bearing formations. More valuable buds were on longshoots intensively pruned (58%) and on slightly pruned trees (56%) (fig. 2).

Measurements of TCSA in 3-year old trees did not show any effect of their pruning and crown formation exerted on the trunk cross sectional area. On the other hand, there were differences between the trees of the studied cultivars. The TCSA values of ‘Sirena’ cultivar (41.3 cm^2) and of ‘Goldrich’ cultivar (40.3 cm^2) were higher. On the other hand, trees of ‘Hargrand’ cultivar showed the smallest TCSA value (34.5 cm^2) (tab. 3).

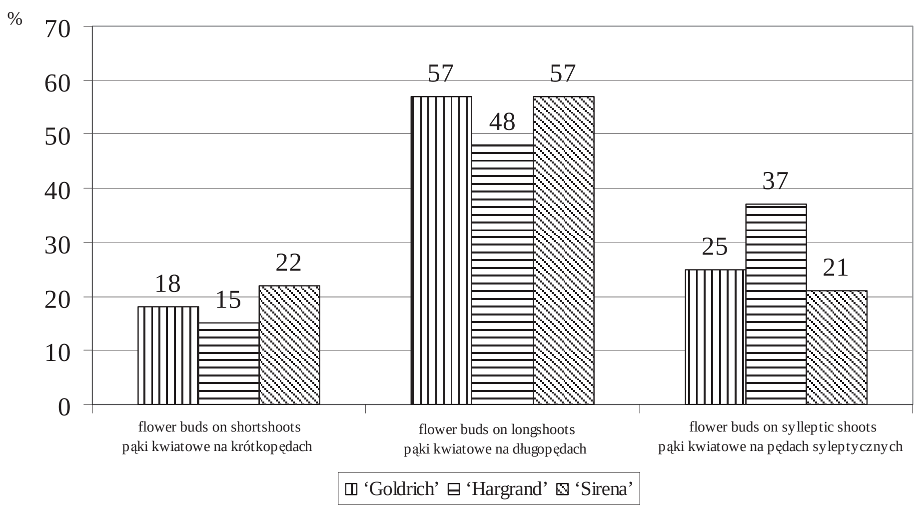

Fig. 1. Location of flower buds on culivar shoots of apricot cultivars in 2005 (%)
Rys. 1. Rozmieszczenie pąków kwiatowych na pędach odmian moreli w 2005 (%)

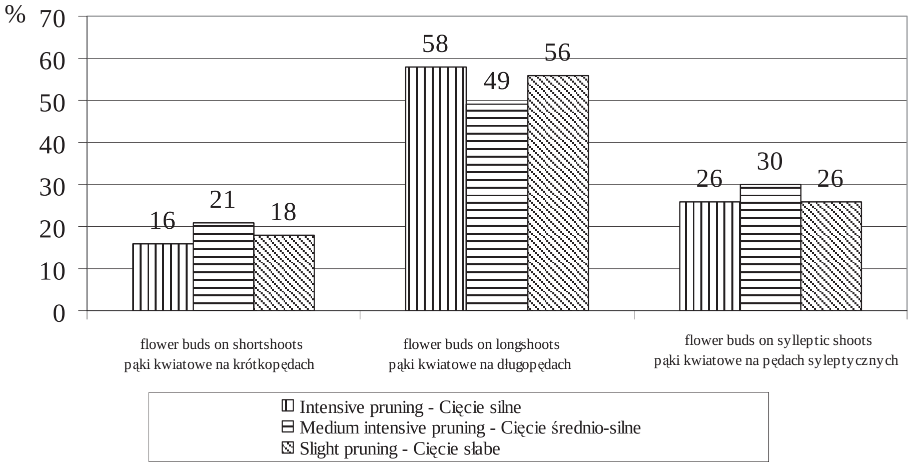

Fig. 2. Effect of trees pruning and forming levels on location of flower buds on shoots of apricot cultivars in 2005 (%)

Rys. 2. Wpływ poziomów cięcia i formowania drzew na rozmieszczenie pąków kwiatowych na pędach odmian moreli w 2005 (%)

Table 3. Growth of apricot trees of 3 cultivars depending from method of tree forming, 2006

Tabela 3. Wzrost drzew 3 odmian moreli w zależności od sposobu formowania drzew, 2006

	Cultivar Odmiana	Level of trees pruning Poziom cięcia drzew intensive silne	 medium-intensive średnio silne	 slight (control) słabe (kontrola)	Mean for cultivar Średnia dla odmiany
TCSA PPPP (cm^2)*	Goldrich	39.7 bc**	40.8 bc	40.4 bc	40.3 b
	Hargrand	36.0 ab	35.2 ab	32.3 a	34.5 a
	Sirena	40.8 bc	40.5 bc	42.6 c	41.3 b
	mean for pruning level średnia dla poziomu cięcia	38.7 a	38.8 a	38.4 a	
Tree crown height Wysokość koron drzew (m)	Goldrich	2.9 abc*	3.0 bc	3.1 c	3.0 b
	Hargrand	2.7 ab	2.9 abc	2.8 abc	2.8 ab
	Sirena	2.6 a	2.7 ab	2.8 abc	2.7 a
	mean for pruning level średnia dla poziomu cięcia	2.7 a	2.9 a	2.9 a	
Tree crown projection Projekcja koron drzew (m^2)	Goldrich	4.0 a	4.2 ab	4.8 ab	4.3 a
	Hargrand	4.5 ab	3.9 a	3.8 a	4.0 a
	Sirena	4.2 ab	4.2 ab	5.1 b	4.5 a
	mean for pruning method średnia dla sposobu cięcia	4.2 a	4.1 a	4.6 a	
Yielding ($kg \cdot tree^{-1}$) Plonowanie ($kg \cdot drzewo^{-1}$)	Goldrich	2.5 a	1.6 a	3.1 a	2.4 a
	Hargrand	14.0 c	9.1 b	8.7 b	10.6 b
	Sirena	9.8 b	8.8 b	9.6 b	9.4 b
	mean for pruning method średnia dla sposobu cięcia	8.8 b	6.5 a	7.1 a	

* and ** Explanations, see Table 1.

The young trees not being burdened with fruits were growing very strongly. Three-year old trees were high. Their height reached 3.0 m. Differentiated pruning and crown formation did not exert any influence on their height. However, they showed differences pertaining to the particular cultivars. The greatest height was shown by 'Goldrich' cultivar (3.0 m), but the lowest height was shown by the trees of 'Sirena' cultivar (2.7 m). Trees of different levels of tree pruning and forming and different cultivars had similar crown projection (tab. 3).

However, there was a significant difference in the number and length of longshoots. The greatest number of longshoots valuable for yielding was developed on trees intensively pruned (5.0 on one examined comparable branch) and on trees with medium intensive pruning (4.8 on one branch). Significantly less longshoots were found on trees pruned with the slight intensity (3.4 on one branch). Analogical differences were shown in the summaric length of longshoots. Their highest length was recorded for trees with intensive pruning (3.8 m on one branch), then on trees with medium-intensive pruning (3.2 m). The shortest summaric length was recorded on trees slightly pruned (2.4 m) (tab. 4). Similar results showing a more abundant density and development of the fruit-bearing zone in peach trees and nectarine trees after an intensive regeneration pruning was obtained by us in our earlier studies [Radajewska and Szklarz 2009a, 2009b].

Table 4. Characteristic of fruit-bearing zone of apricot trees, 2006
Tabela 4. Charakterystyka strefy owoconośnej drzew moreli, 2006

	Cultivar Odmiana	Level of trees pruning Poziom cięcia drzew: intensive silne	medium-intensive średnio silne	slight (control) słabe (kontrola)	Mean for cultivar Średnia dla odmiany
Longshoots nonbranched number on branch Liczba nierozgałęzionych długopędów na gałęzi	Goldrich	5.0 bc**	5.0 bc*	3.0 a	4.3 a
	Hargrand	5.7 c	4.5 abc	3.5 ab	4.6 a
	Sirena	4.2 ab	5.0 bc	3.7 ab	4.3 a
	mean for pruning method średnia dla sposobu cięcia	5.0 b	4.8 b	3.4 a	
Longshoots summaric length on branch Sumaryczna długość długopędów na gałęzi (m)	Goldrich	3.8 de	3.7 de	2.3 a	3.3 a
	Hargrand	4.1 e	2.7 abc	2.2 a	3.0 a
	Sirena	3.5 cde	3.2 bcd	2.6 ab	3.1 a
	mean for pruning method średnia dla sposobu cięcia	3.8 c	3.2 b	2.4 a	
Flower buds number on branch Liczba pąków kwiatowych na gałęzi	Goldrich	164.4 ab	217.4 b	182.8 ab	188.2 a
	Hargrand	150.5 a	194.5 ab	173.2 ab	172.8 a
	Sirena	161.5 ab	216.6 b	166.0 ab	181.4 a
	mean for pruning method średnia dla sposobu cięcia	158.8 a	209.5 b	174.0 a	

** Explanation, see Table 1.

Demirtas et al. [2010a] reported that summer pruning in preharvest time before bud differentiation had positive influence on flower bud formation of apricot trees. Day et al. [1989], Furukawa et al. [1992] and Myers [1993] proved that pruning increased flower bud formation on different fruit trees. In our experiment detailed observation of the localization of flower buds on tree branches showed that the greatest number of them was on trees pruned with a medium intensity (209.5) (tab. 4). Similar results were obtained by Morgaś and Gwałkiewicz [2000] in their experiment on the effect of three levels of tree pruning on flower bud setting in sweet cherry tree 'Burlat' cultivar.

Three-year old trees gave their first yield, but it was small because the early spring frosts destroyed a significant part of their flowers. Differentiated crown formation and tree pruning exerted a significant influence on the yielding. The highest first yield was obtained from intensively pruned trees (on the average 8.8 kg from one tree). The yield from medium-intensively pruned trees was significantly lower (6.5 $kg \cdot tree^{-1}$) and from the slightly pruned trees it was 7.1 $kg \cdot tree^{-1}$ kg (tab. 3). In previous studies [Radajewska 1987] on various pruning methods of peaches found that the highest yielding was from trees pruned medium-intensively with 5–6 branches in crown. In our experiment high differences were observed also in the yielding of apricot tree cultivars. The greatest yield of fruits was obtained from the intensively pruned trees of 'Hargrand' cultivar (14.0 $kg \cdot tree^{-1}$) and the lowest yield from 'Goldrich' trees cultivar independent from levels of pruning and forming (1.6–3.1 $kg \cdot tree^{-1}$) (tab. 3). In the experiments of Son and Kuden [1998] young 1-year old apricot-trees, which were pruned in August, gave in the following year a yield which was twice as high as the yield obtained from not pruned trees. As reported Demirtas et al. [2010a] the highest average yield as trunk section unit area was obtained from apricot trees pruned preharvest in summer, but the lowest was observed for trees pruned postharvest in summer. Different results of trees pruning for some fruit species were found by other authors [Daulta et al. 1986; Miller 1987; Tehrani and Leuty 1987; Chitkara et al. 1991, Akcay 2001].

CONCLUSIONS

1. Intensive pruning of young apricot trees causes their expansion, it increases the width and projection of tree crown, but it does not exert any effect on tree height and on the trunk cross-sectional area.

2. Trees pruned intensively had a favourable densification of the fruit-bearing zone of tree crowns. They had the higher number of branched longhsoots and shortshoots, the higher length of not branched longshoots and sylleptic shoots, and more intensive development of flower buds on shoots.

3. The highest first yield was obtained from apricot trees 'Hargrand' and 'Sirena' but the lowest yield was obtained from 'Goldrich' cultivar. Intensive pruning of young apricot trees exerts a favourable influence on yielding.

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WPŁYW CIĘCIA I FORMOWANIA MŁODYCH DRZEW MORELI (*Armeniaca vulgaris* Lam.) NA ICH WZROST I PLONOWANIE

Streszczenie. Uprawa moreli (*Armeniaca vulgaris* Lam.) jest możliwa jedynie w niektórych rejonach Polski, jednak wciąż jest mało informacji na temat cięcia i formowania drzew w naszych warunkach klimatycznych. Badania prowadzono w latach 2004–2006 w Przybrodzie koło Poznania. Dotyczyły one wpływu różnych sposobów cięcia drzew na wzrost i plonowanie 3 odmian moreli: 'Goldrich', 'Hargrand' i 'Sirena'. W okresie formowania korony kotłowej młodych drzew cięto je w pierwszym roku w sadzie: silnie, średnio silnie i słabo. W pierwszych 3 latach po posadzeniu oceniano wpływ intensywności cięcia drzew na wzrost, morfologię koron drzew, zawiązywanie pąków kwiatowych i plonowanie. Badania wykazały, że intensywne cięcie drzew spowodowało zwiększenie szerokości i projekcji koron. Wywołało ono również korzystne zmiany w strefie owoconośnej koron drzew poprzez zwiększenie ilości rozgałęzionych długopędów oraz krótkopędów, a także zwiększenie długości nierozgałęzionych długopędów oraz pędów syleptycznych. Stwierdzono także lepsze zawiązywanie pąków kwiatowych oraz plonowanie drzew ciętych intensywnie. Najwięcej owoców zebrano z drzew ciętych silnie, najlepiej plonowały drzewa odmian: 'Hargrand' i 'Sirena', a najsłabiej drzewa odmiany 'Goldrich'.

Słowa kluczowe: odmiana, wysokość drzew, projekcja korony, pęd, pąk kwiatowy

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