

## RESEARCH REGARDING THE METHODS OF PRUNING A PEACH TREE IN ORADEA FRUIT-GROWING BASIN

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### Abstract

*The fruit tree basin Oradea is very favourable for peach-tree and the influence of the cuttings are studied. The research was carried out at Fruit Tree Research Station Oradea in two experiments during 2009-2013. The fructification pruning method applied influences both the vigour and the growth of trees, which is made evident by the size of the crown, of the trunk as well as the number and length of branches.*

*Fruit yield and its quality are significantly influenced by the pruning method applied. The best results in terms of vegetative growth and fruiting of the peach tree were obtained in Oradea in the case of differently shortening the mixed branches on the scaffold length and in the case of the modern pruning (V2), these methods proving to be the most appropriate for the biological characteristic of the peach.*

*The multiannual average ranged from 50.3 kg / tree in the case of long pruning and 87.5 kg / tree in mixed pruning. Mixed pruning favours the highest yields since it corresponds to the specific growth and fruiting of the peach tree. Yield differences were statistically-assured in all the years of experimentation.*

*The total yield on a fruit formation has increased with decreasing intensity of pruning. The number of fruit and total yield was even bigger when the mixed branch was shortened less.*

**Key words:** peach-tree, mixed branch, bud, experiment, variants

### INTRODUCTION

Fructification pruning is applied differently depending on cultivar, age of trees and their physiological state, on the load of fruit buds, the size of the trimming area, the number and vigour of annual growth, the crown system and other factors. The principle of fructification pruning of a peach tree consists of “replacing the two-year-old branches with one-year-old ones getting them closer to the scaffold branch”(Fideghelli, 2011, Lorenzo 2012, Sarca 1998, 2005, abc,2009) . Only by the annual continuous renewal of the fruit branches and by keeping them as close to the scaffolds as possible one can prevent their rapid disappearance, depletion of trees due to abundant fructification, trimming the scaffolds, making the trees sensitive to the attack of diseases and pests and the decrease in the quantity and quality of the fruit production. (Chira et al 1995, Ivascu et al 2001)

By peach pruning to encourage fruiting the aim is to keep an optimal number of mixed branches in the tree crowns, branches that must ensure the planned productions and encourage the formation of new branches on the length of the scaffold branches needed for the productions of the following year. (Sarca, Ciobanu 2006, Sarca 2009)

From a practical standpoint, the renewal of fruit branches of the peach-tree crown can be achieved through several pruning systems, which have been developed over time, such as: *classic pruning, long pruning, modern pruning with sterns and mixed branches.* (Sarca et al 2003)

## MATERIAL AND METHOD

The research has been conducted at the Fruit-Growing Station in Oradea on a side slope of 15% with terraces. The soil of the research field contains 32% clay, low content of humus and phosphorus and medium content of potassium. Two experiments were conducted as follows:

- the budding Cardinal cultivar on the mirabelle plum was used in the first experiment. The trees were planted at a distance of 5/4 m and directed in the shape of a palm-leaf with oblique arms. The experiment was made during the years 2009 and 2013 and it included five variants: V1 – Unshortened mixed branch (whole), witness; V2 – Shortening the mixed branches in 4 groups of buds; V3 – Shortening the mixed branches in 8 groups of buds; V4 - Shortening the mixed branches in 12 groups of buds; V5 - Shortening the mixed branches in 16 groups of buds.

Each variant contained 4 repetitions, each of them with a tree. 50 mixed highly-vigorous branches (70 - 110 cm), 50 mixed medium-vigour branches (40 - 70 cm) and 50 mixed low-vigour branches (20 - 40 cm) were studied in each tree.

The aim was to observe the influence of shortening intensity on the ability to ramify of the mixed cultivar as well as the possibility for the provision of the “*fruiting wood*” for the following year.

- the second experiment aimed at establishing the fructification pruning methods, their effectiveness from an economic standpoint in the environmental conditions in the western part of the country – around the city of Oradea. These were studied, by comparison, using the classical and modern methods used in our country and abroad during 2009-2013. The trees of Cardinal cultivar were planted in an intensive orchard at 5 meters distance between the rows and 4 meters on each row - directed in the shape of a palm-leaf with oblique arms on three levels with two branches on each level, branches that were spaced 8 to 10 cm apart. The experiment was made on the shape of palm-leaf crown because flattened crowns in larger plantations have an increasing usage due to the multiple advantages they present. The shapes of flattened crowns allow the increased mechanization of works in the peach tree plantations and a better fruit exposure to light. The volume of the works to create flattened crowns in a peach tree is lower in the first two years and then it increases, reaching a maximum level in the second and fourth years since planting the trees in the orchard.

The fructification pruning are started in the third and fourth year; depending on the years of the trees and their shape, a number of fruit branches are not cut so as to ensure both the greatest possible fruition and a good growth of trees.

The experience included five variants:

V1 – *Long pruning* with mixed branches, thinned at 15-20 cm (witness, American).

V2 – *Modern pruning*, by which a third of the mixed branches were shortened to 5-8 groups of buds, and two thirds were shorted to 12 - 14 groups of buds.

V3 - *Classic pruning* - crochet variant (two buds on the stern and mixed branch of 3 - 4 groups of buds).

V4 – *Mixed pruning* – differential shortening of the mixed branches on the length of scaffolds.

V5 – *The alternative suppression* of fruit. On scaffolds 1, 3 all the branches that have produced fruit and the possible mixed and vegetative branches are cut to 1 - 3 buds (or 3 – 5, depending on the vigour of the branch on the scaffold) while scaffolds 2,4 are not subjected to any kind of fructification pruning.

## RESULTS AND DISCUSSIONS

It is known that the peach has an extremely large range of varieties. (Braniste et al 2010, Ivascu 2002, a, b, Sarca 2006, 2007, 2011). As in the other species of trees, many of its varieties are of interest in terms of production and fruit quality. Nevertheless, in various environmental conditions, these varieties behave differently – both in terms of resistance to winter temperatures, late spring frosts, behaviour towards pests, and especially in terms of crop size and fruit quality. Therefore, of the entire assortment one must choose the ones which prove the best features and qualities in given circumstances and which can represent the standard assortment for production.

One must establish which varieties of the current assortment worldwide, including the domestic one, can represent, in various circumstances, the assortment to achieve conver in fresh peach for consumption for as long and uninterrupted period of time as possible during the year. Equally interesting are the varieties that are suitable and can provide superior finished products in industrial processing, dehydration and refrigerated storage, etc. It requires choosing the varieties with traits as universal as possible, which, for the next stage, will be the standard peach assortment for various areas and fruit-growing centres in Romania.

### *Features of the fructification pruning intensity of the mixed peach branches*

The main fruit branch of the peach is the mixed branch. As for its shortening or leaving it whole on the occasion of fructification pruning, there are different opinions that recommend leaving the mixed branches whole (uncut) to the opposite extreme, that of cutting them at 4-6 groups of buds.

The branching ability depends of the shortening intensity of the mixed branches as well as their vigour. Thus, the total length of the new growth was bigger (188 cm) when the mixed branches were shortened to 4 groups of buds and, within them, at the branches with a higher vigour (250 cm). The total length of annual growths decreased along with the shortening intensity, yet it was noticed an increase in their number. Mixed vigorous branches, regardless of the cutting intensity, formed the fewest annual growths and the lowest at the same time.

*Table 1*

**Shortening influence on mixed branches Oradea 2009-2013**

Shortening intensity	Vigour of the mixed branch	Old wood		Total		Annual growth				
		Length -cm-	0 -mm-	pieces	cm	Mixed branches		Necklaces	Bunches	Spurs
						pieces	cm	Pieces	pieces	pieces
At 4 groups of buds	high	20.4	12.8	6.2	250	4.0	58.8	0.5	2.0	0.2
	medium		8.9	6.3	188	3.1	56.1	0.4	2.2	0.7
	small		6.1	6.2	130	2.3	41.1	0.6	2.2	0.3
	Average:		9.2		188	3.1	52.0	0.5	2.1	0.4
At 8 groups of buds	high	25.3	12.8	10.4	204	3.6	52.0	0.5	4.9	1.8
	medium		9.8	10.0	190	3.0	50.2	0.7	4.6	2.0
	small		6.6	9.7	108	1.8	38.1	1.2	4.0	2.8
	Average:		9.7	10.0	166	2.8	46.7	0.8	4.5	2.2
At 12 groups of buds	high	30.9	1.8	14.6	200	3.0	42.0	2.6	5.7	2.8
	medium		12.8	12.8	150	1.9	40.0	2.3	5.3	3.2
	small		10.0	11.4	114	1.7	35.0	1.9	5.0	3.8
	Average:		6.1	12.7	151	1.8	39.0	2.3	5.3	3.3
			9.3							
At 16 groups of buds	high	41.6	11.9	12.4	206	2.2	39.1	3.4	7.0	3.9
	medium		9.0	9.6	20	1.3	33.0	2.4	6.	4.3
	small		6.4	8.4	91	1.0	31.1	2.1	6.0	4.8
	Average:		9.1	10.5	160	1.5	33.3	2.8	6.4	4.3
Whole Mixed branch	high	76.8	11.8	28.1	188	0.8	35.4	3.9	14.4	8.0
	medium		9.8	25.0	136	0.6	30.6	3.7	12.2	8.2
	small		6.3	23.1	86	0.4	30.0	2.1	11.0	9.5
	Average:		9.3	25.3	136	0.6	32.0	3.2	12.5	8.5

The mixed branches cut at 4 and 8 groups of buds each formed towards their peak, on average, three new mixed branches of medium length, capable to provide “*the fruiting wood*” for the following year.

The new annual **increases** were the mixed branches in the shape of necklaces, bunches and spurs. In longer pruning (12-16 groups of buds) less, yet more vigorous, mixed branches were created. The mixed branches, which were left whole and especially the weak ones, did not provide the formation of new mixed branches required for their replacement.

Most increases were short and became necklaces, bunches and spurs. Some researchers, Mihăiescu Gr et al (2002), show that mixed branches that have not been cut short react differently depending on their length and thickness. According to the research conducted by Mihăiescu Gr (2002), mixed full-length vigorous branches provides “*the fruiting wood*” better than those less vigorous, but totally insufficient to obtain adequate crops. The shortening intensity also causes the change in productive characteristics of the mixed branches.

*Table 2*

The influence of shortening intensity of the mixed branches on peach crops, Oradea 2009-2013

No	Variant	Production on branch		Difference		Statistic. Signif.
		G	%	g	%	
1	Uncut mixed branch	532	100	-	-	Mt
2	Shortening a mixed branch – 4 groups of buds	395	74,3	-137	-25,7	0
3	Shortening a mixed branch – 8 groups of buds	410	77,0	-122	-23,0	0
4	Shortening a mixed branch – 12 groups of buds	400	75,2	-132	-24,8	0
5	Shortening a mixed branch – 16 groups of buds	508	95,5	-24	-4,5	-

LSD<sub>5%</sub> 110

LSD<sub>1%</sub> 157

LSD<sub>0,1%</sub> 220

The total production on a formation (table 2) has increased once the cutting intensity has decreased. Compared to the full-length mixed branch considered to be a witness, the shortening variants of the branch to 4, 8 and 12 groups of buds show negative characteristics. The number of fruit as well as the total production was even bigger when the mixed branch was shortened less.

#### ***Methods of fructification pruning***

By fructification pruning in peach trees the aim is primarily to achieve a balance between growth and fruiting or, in other words, to get fruit and new growths that would ensure fruiting the following year. Secondly, by fructification pruning performed correctly, production is standardized according to the biological potential of each cultivar of peach.

The branches of the trees on which routing a fructification pruning does not apply become too thick, thus hindering the penetration of light and air into the crown of the tree, which promotes skeletal and semi-skeletal trimming as well as obtaining fruit that is not coloured enough and of inadequate quality.

As for peach, one must bear in mind that a fruit branch normally fructifies once, and then it becomes weak and produce little or not at all. Therefore, the branches that have yielded fruit are cut and replaced by the more vigorous one-year-old ones. For this reason it is necessary to obtain mixed branches of medium vigour (50-60 cm length) each year as these are the only ones that can provide qualitative and quantitative fruiting. Some varieties, which bear fruit in the upper third part of the mixed branches, are usually extremely vigorous. In this respect, mixed branches will not be shortened in these varieties even though their length exceeds 60 cm, but they will be inclined although this is not the best choice – the tilting ( inclination ) being made at an angle of 45-60 ° .

Following such pruning, the crown habitus and the tree vigour were directly influenced by the method used when doing fructification pruning, thus recording the smallest sizes for the alternative suppression of the fruit on the scaffold. Compared with a witness, all variants show negative differences, provided at different levels. The average diameter of the tree crown was obviously influenced in that, when compared to the witness, in all cutting methods studied, the differences are very significant. Smaller crowns allow strengthening the peach culture and the easier application of work.

Table 3

Biometrics data on trees and the weight of the wood removed by pruning,  
average 2009-2013

Pruning method	The height of tree	Crow diameter	Trunk diameter	Trimming area	Wood removed when cutting
	m	m	cm	m	Kg
V1- Long pruning (witness)	4.70	6.37	16.04	2.94	5.94
V2-Modern pruning	4.00 <sup>00</sup>	5.36 <sup>000</sup>	11.8 <sup>000</sup>	1.9	6.90 <sup>+++</sup>
V3-Classical-crochet pruning	4.30 <sup>000</sup>	6.02 <sup>000</sup>	13.88 <sup>00</sup>	2.4 <sup>0</sup>	7.33 <sup>++</sup>
V4-Mixed pruning	4.15 <sup>0</sup>	5.33 <sup>000</sup>	16.22 <sup>+</sup>	0.9 <sup>00</sup>	6.6*
V5-The alternative removal of the fruit from the scaffolds	3.75 <sup>000</sup>	5.20 <sup>00</sup>	13.10 <sup>000</sup>	0.9 <sup>00</sup>	7.7***
<b>LSD<sub>5%</sub></b>	0.41	0.18	0.64	1.64	0.53
<b>LSD<sub>1%</sub></b>	0.60	0.27	0.98	2.38	0.72
<b>LSD<sub>0.1%</sub></b>	0.90	0.40	1.41	57	1.15

Trimming the branches in the basal area is a phenomenon that occurs and tends to become more pronounced once the trees become older, with direct implications on fructification and production area. This phenomenon can be affected by pruning, being poorly expressed when shortening mixed branches differently on the scaffold length.

The biggest quantity of wood removed by pruning was in the case of the alternative removal of the fruit on the scaffold (1.1) and the smallest one when applied to the long pruning (5.94) and mixed pruning (6.6).

The smallest quantity of removed wood is an indicator of a proper pruning in the previous year and it expresses the existence of a balance between the growing processes and the fructification ones.

Shortening the fruit branches makes it easier to thin the fruit, which is a painstaking operation that requires a large amount of work. Rational shortening or thinning of mixed branches helps the growth of medium vigour suckers that will form the fruiting branches for the following year.

The pruning method also influences the number and vigour of the mixed branches.

Table 4

Average number and length of mixed branches, 0 grade 2009-2013  
(average on 2009-2013)

Pruning method	Mixed branches – pieces		Length Cm
	Before pruning	After pruning	
V1- Long pruning (witness)	321	244	34,2
V2- Modern pruning	336 <sup>o</sup>	288 <sup>+</sup>	46 <sup>+++</sup>
V3- Classical-crochet pruning	366 <sup>+</sup>	250	25.6 <sup>+++</sup>
V4- Mixed pruning	504 <sup>+++</sup>	336 <sup>+++</sup>	50 <sup>+++</sup>
V5- The alternative removal of the fruit from the scaffolds	372	331 <sup>+++</sup>	53 <sup>+++</sup>
LSD <sub>5%</sub>	57.24	35.44	4.02
LSD <sub>1%</sub>	83.76	50.72	5.80
LSD <sub>0.1%</sub>	124.90	74.44	8.48

Mixed pruning has ensured the formation of a large number of mixed branches while, in the case of long pruning, these were much less.

Mixed branches formed by applying different methods of pruning have a length between 34.2 cm and 53.0 cm when alternatively suppressing the fruit on the scaffold. From a quantitative and qualitative standpoint, as Elena Voica shows (2001), the fructification process gives the best results on 35-70 cm long mixed branches.

In all the fruiting years different values have been recorded different - these are based on the pruning method applied.

Table 5

Fruit production kg / tree and its quality (g fruit), Oradea 2011-2013

Pruning method	2011	2012	2013	Average 2011-2013	
				production in kg/tree	Average weight of a fruit
V1-Long pruning (witness)	50.80	54.2	4.50	50.3	66.0
V2-Modern pruning	60.0 <sup>+++</sup>	68.9 <sup>+++</sup>	72.3 <sup>+++</sup>	68.2 <sup>+</sup>	88.3 <sup>+++</sup>
V3-Classical-crochet pruning	70.0 <sup>+++</sup>	62.4 <sup>++</sup>	50.1	60.0 <sup>o</sup>	74.7 <sup>+</sup>
V4-Mixed pruning	82.3 <sup>+++</sup>	84.2 <sup>+++</sup>	96.4 <sup>+++</sup>	87.5 <sup>+++</sup>	98.6 <sup>+++</sup>
V5-The alternative removal of the fruit from the scaffolds	51.00	62.2 <sup>++</sup>	67.3 <sup>++</sup>	57.7 <sup>+</sup>	90 <sup>+++</sup>
LSD <sub>5%</sub>	5.12	5.10	3.96	15.15	7.74
LSD <sub>1%</sub>	7.19	7.16	54	22.0	1.25
LSD <sub>0.1%</sub>	10.50	9.90	7.90	33.06	16.88

The multiannual average ranged from 50.3 kg / tree in the case of long pruning and 87.5 kg / tree in mixed pruning. Mixed pruning favours the highest yields since it corresponds to the specific growth and fruiting of the peach tree. Yield differences were statistically-assured in all the years of experimentation.

The average weight of a fruit in all the years of experimentation and in all variants, is significantly positive or significant distinct from the control variant. The data presented in table 5 show that the fruit is smaller on the whole mixed branches (cut long).

To improve the quality of the yield, it is necessary to increase the fruit - or to standardize the production.

## CONCLUSIONS

The research conducted during 2009-2013 in two experiments made at the Fruit-Growing Station in Oradea led to the following conclusions:

1. The new mixed replacing branches are created in the case of shortening the mixed branches in 4-12 groups of buds. The uncut mixed branches continue their growth by their terminal bud, it is trimmed towards its base and it creates necklaces, bunches and spurs and mixed branches at the side.

2. The shortening intensity determines change in the yielding characteristics of the mixed branches. The number of fruit increases along with the decrease in the pruning intensity. Total yield on a formation increases along with a decrease in the pruning intensity.

3. Shortening the mixed branches in 8-12 groups of buds when the fruit is not thinned for unirrigated crops, provides both higher fruit yielding and "wood replacement" for the following year.

4. The fructification pruning method applied influences both the vigour and the growth of trees, which is made evident by the size of the crown, of the trunk as well as the number and length of branches.

5. Fruit yield and its quality are significantly influenced by the pruning method applied. The best results in terms of vegetative growth and fruiting of the peach tree were obtained in Oradea in the case of differently shortening the mixed branches on the scaffold length and in the case of the modern pruning (V2), these methods proving to be the most appropriate for the biological characteristic of the peach.

6. The multiannual average ranged from 50.3 kg / tree in the case of long pruning and 87.5 kg / tree in mixed pruning. Mixed pruning favours the highest yields since it corresponds to the specific growth and fruiting of the peach tree. Yield differences were statistically-assured in all the years of experimentation.

7. The total yield on a fruit formation has increased with decreasing intensity of pruning. The number of fruit and total yield was even bigger when the mixed branch was shortened less.

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