



STUDYING THE DIFFERENT FORMATIONS OF APPLE TREES IN INTENSIVE ORCHARDS

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Article history:	Abstract:
<p>Received March 30th 2021 Accepted: April 11th 2021 Published: April 29th 2021</p>	<p>In Uzbekistan in connection with the intensification development in horticulture, becomes especially relevant development of a scientifically grounded zonal technology introduction for the fruit crops cultivation, in particular apple trees. This article provides the rationale for the intensive gardens design, soil maintenance and processing system, fertilization, irrigation, tree crown care, complex mechanization of technological processes. In our studies, it was found that growth rate of the tested apple varieties almost the same and little depended on the types of crown formation. The studied varieties highest yield and average fruits weight obtained when formed in the volumetric crown form.</p>

Keywords: Shaping trees, apple varieties, pruning, tree stump, annual growth, branch removal, crown size, average shoots length, fruits yield and weight.

INTRODUCTION.

In recent time, in connection with the intensification development in horticulture, a scientifically grounded zonal technology development for the fruit crops cultivation is of particular relevance.

The cultivation technology provides for well-grounded designs of intensive gardens, systems for keeping and cultivating the soil, applying fertilizers, caring for the trees crown, and comprehensive mechanization of technological processes. The introduction of spur apple varieties began quite recently and the methods of caring for them are being refined with the plantings expansion.

Type and design of fruit plantations are among the leading factors determining the orchards productivity and the fruit quality, an increase in the mechanization proportion of technological processes and an increase in labor productivity [1,2,3,4,11].

Crown formation, influencing the trees growth and development, affects the fruiting intensity, including the rational use of solar energy by plants [2,7,10], the labor costs level per unit area of production [5,8], fruits yield and quality, plantings longevity, the production costs degree [1,9].

The presence of fertile soil, sufficient heat and solar radiation served as a basis to assume that with irrigation and a high level of agricultural technology of plantations and spur apple varieties productivity can be significantly increased up to 30-35 t/ha by developing the most acceptable crown forms and designs, mechanized pruning and harvesting of fruits that meet the requirements.

Materials and research methods for these purposes in 2016-2020 in the experimental fruit-growing farm in Bukhara the main growth indicators and apple trees fruiting were studied depending on the crown formation types. The research objects were various biological properties of the variety zoning - Golden Delicious, Korey and Starkrimson, grafted on medium-sized rootstocks - MM-106, irrigated garden, laid in 2016 with annual seedlings, the scheme is placed 6x4.

The experimental garden soil is old-irrigated alluvial meadow. The content of humus 0.5-0.8%, mobile phosphorus 16-20mg/kg exchangeable potassium 2.20-2.30mg/kg, ground water is located at 2.7-3.1 m depth from the soil surface. During the growing season, 4-5 furrow irrigation is carried out, where the irrigation rate is 3200-4000 m³/ha. The soil maintenance system is black steam. Average annual air temperature + 16.0°C, the sum of effective temperatures for the growing season is 4650-4700°C. The frost-free period is 216-225 days. Annual precipitation is 125-220mm [6.8].

In the experimental garden, the following crown formation types were tested:

1- Sparse tiered; 2- volumetric crown with minimal pruning during formation; 3- simple loose palmette (Golden Delicious and Korey varieties)

Sparsely - tiered crown. When sparse-tiered seedlings formation after planting in the garden, they were shortened at 60-70 cm height from the soil surface in order to form boles and main skeletal branches of the first order. During the second - third years of the growing season, the first tier of the crown and the guides' leader were laid. In the first, 2-3 main skeletal branches with obtuse angles of deviation were left. At 3-4 years of growing season, a second crown tier was created, forming 1-2 main skeletal branches of the first order at 60-70 cm height from the first crown tier and semi-skeletal branches of the second order. The third order branches were placed densely, at 25-30 cm distance from each other. In the fifth or sixth year, the central conductor was cut at 2.8-3.2 m height on the lateral growing branches.

Bulky crown with minimal pruning during forming.

In the first tier of the crown, 2-3 skeletal branches and 2-3 skeletal branches were left - sparse along the trunk: singly or in pairs. The distance from the first tier to the next single branch is 30-50cm. After the laying of annual branches from 3-4 years of vegetation until the appearance at the fruiting time, the trees were left without pruning. With the beginning of fruiting, the trees height was limited to 3.0-3.5 m.

Simple free palmette. After planting, seedlings pruning was carried out in early spring. Annual seedlings without branching in the crown formation zone were cut at 60-70 cm height.

In the second year, two shoots were chosen, located on opposite sides of the central conductor and directions along the row. The rest of the shoots were cut out "on the ring". The guide was shortened 50-60 cm height above the upper left shoot.

In the third, fourth and fifth years, skeletal branches of the first order were laid in pairs or singly, with a denser distance, without observing strict rules, but maintaining the minimum required distance between them (30-35cm). In total, 5-6 skeletal branches were laid, after which the central conductor was shortened at the lateral branch, at 2.5-2.8 m height.

Repetition for each variety three times. Record trees in one repetition of 10-20 trees, in the variant 30-60 trees.

During the research period on varieties, variants and repetition of the generally accepted methodology, analyzes were carried out, providing information on the main growth indicators, plants fruiting and the fruits quality.

Research results. The branches removal during formative pruning is a forced agrotechnical method, since a lot of nutrients are consumed in the removed wood formation. Shaping and pruning techniques should be aimed primarily at reducing the removed wood mass. [4,5,7,9,10,11].

In our experience, the following results were obtained (table 1)

Table 1

The number, weight and average length of branches removed from apple pruning (average for 2016-2020).

	Crown formation type	weight kg/tree	branch diameter, cm	average length, cm	number of branches, pcs/tree.
Golden Delicious variety					
	Sparse tiered	0,80	0,75	48,7	10,2
	Volumetric crown	0,91	0,78	52,0	11,0
	Simple palmette	0,78	0,72	48,0	10,1
Korey Variety					
	Sparse tiered	0,69	0,73	55,0	10,3
	Volumetric crown	0,71	0,75	56,1	12,3
	Simple palmette	0,65	0,69	54,0	10,1
Starkrimson variety					
	Sparse tiered	0,62	0,68	45,1	7,0
	Volumetric crown	0,64	0,70	44,0	4,1

The data given in Table 1 show that when comparing different types of formation, the studied varieties did not reveal significant differences in the number, weight and average length of branches removed during pruning.

The trunk circumference is one of the most stable indicators of the growth strength and the trees response to the ecological conditions of growth and agronomic techniques, including the formation and pruning [1,3].

In the experiment, a little more when forming in the volumetric crown form with minimal pruning. So, the circumference of the stem of sexennial apple trees with this formation in the Golden Delicious varieties is 0.9-3.3 cm, in the Korey variety - by 1.3-3.5 cm, and in the Starkrimson variety - by 2.5 cm more compared to other crown types.

During the young trees formation grafted onto rootstocks - MM-106, moderate pruning somewhat stimulated vegetative growth and thickening of boles.

In our studies, it was found that the tree growth intensity in the tested varieties was almost the same and depended little on the crown formation types (table 2).

Table 2

Crown size of sexennial apple trees, depending on the formations and variety types, cm, 2020.

Crown formation type	Golden Delicious			Korey			Starkrimson		
	tree height m	Crown size, m		tree height m along the row	Crown size, m		tree height m	Crown size, m	
		along the row	across the row		along the row	across the row		along the row	across the row
Sparsely tiered	380	277	228	371	280	238	338	190	135
Volumetric crown	396	284	230	402	298	240	340	198	147
Simple palmette	370	340	150	376	348	152	-	-	-

From the data in Table 2, it indicates that the highest indicators for the height and diameter of the trees crown were for the Golden Delicious variety and the minimum for the Starkrimson variety. The sexennial apple trees height was observed in all studied varieties when crowns were formed in a volumetric crown form with minimal pruning. In our experience, it was found that high crown size values were observed when crowns were formed in a simple palmette form. This indicator is higher for the Golden Delicious variety 51-63cm, for the Korey variety 50-68cm, for the Starkrimson variety when forming the volumetric crown, the crown height along the row was more than 2-8cm.

The area development under the crown projections is one of the main absorption possibility indicators by trees: solar radiation energy, per unit of plantation area, on which the agrophytocenosis productivity depends to a certain extent [1,5].

We found that this indicator in sexennial apple trees is better with sparse-tiered and voluminous crowns. So, with these formations, the area development under projections and crowns is more in the Golden Delicious variety by 8.6-9.9%, in the variety Koreas from 6.4-8.1% than formed in the palmette form. A good annual growth in the continuation shoots length is a positive growth processes activity. In our experiment, the average length values of the continuation shoots in the studied varieties, depending on the studied types of crown formation, significantly differ (Table 3).

Table 3

Average length of shoots and their total growth depending on crown formation cultivar (average for 2016-2020)

Crown formation type	Golden Delicious		Korey		Starkrimson	
	Average length of shoots, cm	Cumulative gain, m	Average length of shoots, cm	Cumulative gain, m	Average length of shoots, cm	Cumulative gain, m
Sparsely tiered	74,3	33,1	70,5	34,0	52,5	23,9
Volumetric crown	66,9	35,8	64,5	36,9	50,4	25,2
Simple palmette	56,3	19,7	62,7	19,1	48,6	14,3
HCP ₀₉₅	6,5		5,0		3,4	
P, %	3,1		2,5		2,0	

From the data in Table 3, it can be seen that in the Golden Delicious variety, the shoots average length, depending on the formation options, is 2.4-16.8 cm longer than that the Korey and Starkrimson varieties.

The total growth of continuation shoots in the studied varieties, depending on the crown formation, ranges from 14.2 to 36.8 m. The highest value of this indicator is observed for trees formed according to the volumetric crown with minimal pruning.

In the experimental fruit growing economy in Bukhara, intensive orchards were planted in 2016 (varieties Golden Delicious, Korey and Starkrimson grafted on a medium-sized rootstock MM-106) gave the first harvest in 2020 in the order of 22.5-65.7 s/ha. (Table 4)

Table 4

The apple trees yield and their fruits mass, depending on the crown and varieties formation, 2020.

Crown formation type	Golden Delicious			Korey			Starkrimson		
	harvest		fetal weight, g	harvest		fetal weight, g	harvest		fetal weight, g
	kg/ tree	s/ha		kg/ tree	s/ha		kg/ tree	s/ha	
Sparsely - tiered	10,5	43,7	144	12,5	52	138	5,4	22,5	146
Volumetric crown	11,4	47,4	149	13,4	53,7	142	6,0	25,0	154
Simple palmette	6,4	34,4	137	10,4	42,4	130			
HCP ₀₉₅		2,7			3,1			2,9	
P, %		3,8			2,7			2,1	

From the data in Table 4, the following is that the studied varieties have the highest yield and the average weight of fruits obtained when forming in a volumetric crown form. Differences in yields within the variety are significant when comparing options.

Conclusions 1. In sexennial apple trees among the studied varieties, there are differences in the main growth indicators: height, crown size, trunk circumference, average length of continuation shoots and their total growth, volume and development of the area under the crown projections insignificant depending on the formation.

2. Higher first commercial yield for Starkrimson, Golden Delicious and Korey plantings in 2016 received preforming a volumetric crown form, respectively, 25.0-47, 4-55.7 s/ha. In this version, large fruits, the average weight of the fruit are from 142 to 154 g.

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