



Influence of Methods and Degrees of Rejuvenating and Normalizing Pruning on the Growth Productivity of Intensive Apple Trees in the Conditions of Bukhara Oasis

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Abstract: *In this article, the influence of rejuvenating and standard methods and degrees of pruning on the growth and productivity of intensive apple trees in the soil and climatic conditions of Bukhara oasis was studied. In intensive apple orchards, as a result of the complex application of highly resource-efficient agricultural and technical measures to them, medium-slow-growing varieties with a small trunk size and with a plentiful and high-quality harvest were selected. It is possible to grow a quality crop of 25 – 30 centners / ha.*

Keywords: *Bukhara oasis, soil and climatic conditions, intensive varieties, rejuvenating and normalizing, pruning methods, productivity, quality indicators, efficiency.*

INTRODUCTION

It should be noted that a group of researchers in Uzbekistan and foreign countries conducted scientific research on methods of rejuvenation and normalization of pruning of apple tree branches and their influence on growth, development and productivity [1] [2] [3] based on the study of the influence of apple varieties on the characteristics of various soil and climatic conditions, various scientific data were obtained and, in turn, scientific recommendations corresponding to each specific condition were given. These branches bear fruit, do not provide full opportunities for their rejuvenation cycles and normalization cycles [8] [9] [10].

In recent years, accelerated (intensive) apple orchards have been laid in Uzbekistan, up to a 3 – 4-year cycle of rejuvenation and normalization of branches, the methods and levels of pruning activities have not been sufficiently studied in the soil and climatic conditions of Uzbekistan on a scientific basis.

Today, along with obtaining a plentiful and high-quality harvest from apple orchards in existing orchards, that is, 2 – 3 years after planting, it is necessary to ensure entry into the crop and access to a continuous plentiful and high-quality harvest. In many studies in intensive apple orchards, fruit varieties are selected with compact and small-sized, abundant and high-quality fruits, which are highly resource-efficient in these orchards, innovative care technologies are used, abundant and high-quality crops are grown every year [4] [5] [6] [7]. Based on the foregoing, we can say that the chosen direction of research is very relevant and is of great scientific and practical importance in a sharp increase in the productivity of apple trees and a fundamental improvement in their quality.

Purpose of experience:

In the soil and climatic conditions of Bukhara region, the most effective levels of cyclically (3 – 4 years) rejuvenating and normalizing pruning of the branches of the apple tree varieties zoned and associated with slow-growing grafts in our conditions of the republic were studied on a scientific basis and on existing apple trees in order to provide recommendations for the production of resource-saving and innovative technologies to obtain annually consistently plentiful and high-quality harvests.

To achieve the above goal, the following main tasks are solved:

To study the dependence of the method and degree of pruning of growing branches of trees in intensive apple orchards, to study the influence of the main phytometric indicators on growth, development and productivity;

Determine the degree of illumination of the inside of the tree trunk and the productivity of photosynthesis;

To study the formation of generative organs in tree branches (trunk) and their location, impact on yield and quality;

To give scientifically based recommendations on the production of the most optimal rejuvenating and normalizing techniques carried out on the cultivated and fruiting branches of 3 different varieties of apple trees released in intensive apple orchards, as well as determining pruning levels depending on the state of growth of trees, the economic is to calculate that these rates are high.

Results on vigor of apple varieties and type of pruning, planting density of trees, type of seedlings, age, rejuvenation conditions and other methods of resizing, as well as several meters in height, trees are used. High degree of resource-saving care measures such as pruning practices and levels of 8 – 4 meters in the growth of branches, formation of shoots, early harvesting of trees, abundant and high yields, continuous correct harvesting.

In intensive whey orchards, observing the method and level of pruning and using it wisely, a favorable environment is created for the growth and development of trees, internal and external conditions, generative organs (buds) are saved annually in large numbers, it became possible, which ensures regular, abundant and quality harvest every year. In this case, if the correct and clear rules for annual pruning of the same branches along the contours are observed, the formation of branches is prevented by limited pruning methods, unnecessary cones are removed from the inside of the tree trunk. As a result, the available branches of the apple tree make good use of light, air, nutrition, water and other substances, the annual growth of young branches is on average 40 – 60 cm, the average yield is 340 – 430 kg / ha.

Place and method of research. Research work and test results were carried out in 2009 – 2020 in “Amin Hayot Bogi” horticultural farm, located in Bukhara district of Bukhara region. The climate of the region is sharply continental, the average annual rainfall is 125 – 175 mm, hot sunny days last 240 days, the average temperature is 16 – 30 C, and the average relative humidity is 40 – 60%.

The soil of this farm belongs to the category of slightly saline soils, irrigated for a long time, differs in the location of the water level on the surface (2.3 – 2.5 m), according to the classification it is considered fine-earth, according to its mechanical composition.

According to the results of agrochemical studies, the amount of humus in old and new irrigated soils is very low. The amount of humus in the arable layers of the soil is 0.8 – 1.4%, N 0.6 – 0.12%. The total amount of P is 0.11 – 0.18 ha, and the amount of exchangeable K is 1.5 – 3.0%. The amount of nutrients in the soil of “Amin Hayot Bogi” horticultural farm in the area of the Rabotikalmok MFY of Bukhara region is presented in Table 1.

The number of nutrients in the soil of “Amin Hayot Bogi” horticultural farm of Bukhara district of Bukhara region

Incision	DEPTH, CM	HUMUS, %	P2O5, mg/kg	K2O, mg/kg
A	0-32	0,7708	15,0	171,0
B	32-62	0,7520	14,0	214,3
C	62-85	0,7332	13,0	195,0

The data presented in Table 1 show that the agrochemical properties of the soil of the intensive apple orchards of “Amin Hayot Bogi” horticultural farm of Bukhara district of Bukhara region are considered average. It can be noted that the amount of humus at a depth of 0 – 85 cm is 0 – 7332 – 0.7708%, this indicator is considered low for long-term irrigated soils, and the amount of P is 13.0 – 15.0 mg/kg and K is 171.0 – 214.3 mg/kg.

Table 2 shows the types and degrees of soil salinity in these intensive apple orchards.

Type and degree of salinity of soils of “Amin Hayot Bogi” horticultural farm of Bukhara district of Bukhara region are given in Table-2

transverse incision	Depth, cm	Salinity type	Salinity level
A	0-32	Chlorine sulfate	slightly salted
B	32-62	Chlorine sulfate	slightly salted
C	62-85	Chlorine sulfate	slightly salted
Sizot water	90 cm	Chlorine sulfate	slightly salted
The groundwater	10 m	chlorinated	slightly salted

The data presented in Table 2 show that the type of soil of “Amin Hayot Bogi” horticultural farm refers to sulfate-chloride, and in terms of salinity, it belongs to the category of slightly saline soils. During 2019 – 2020 the farm intensively grew apple varieties on alluvial soil, which has been irrigated since ancient times. The pH scale of these agricultural soils is 7.69 – 8.19 and the environment is slightly alkaline, and this situation creates the opportunity for growth, development and abundant production of apple trees on small vegetative scions in intensive orchards. To organize weather conditions, data from the Bukhara weather station are used, since “Amin Hayot Bogi” horticultural farm is located not far from this weather station. In intensive apple orchards, it consists in reducing the yield of 3 main zoned varieties and the effective use of rejuvenating and normalizing pruning of productive branches, giving practical and scientifically sound recommendations for production, and determining economically valuable indicators of fruit production.

Object of study:

The studies were carried out in 2009 – 2020. in the farm "Amin Hayet bogi" of the Bukhara region in 2 experiments, from apple trees, related to 3 biologically different undersized relative MM – 106 – Golden Delicious, Simirenko Rennet and Samarkand Firstling was carried out in varieties and designs garden – 2004, the shape of the tree trunk - is considered naturally improved. Arrangement of trees in the garden 6x4m. Watered 4 – 5 times during the growing season at the rate of 3200 – 3500 m³.

Experience system:

In order to study the methods and levels of pruning of branches in apple varieties, scientific work is carried out in 2 experiments.

In the first experiment, they study the determination of the levels of pruning and reduction of productive branches according to a three- and four-year cycle of rejuvenating pruning techniques in growing branches that have given fruit. The recommendations implemented in the Bukhara region use the pruning method, which consists in cutting off dry, diseased and transversely growing branches of the apple tree. Against the background of the method of grafting (control) used under production conditions to replace the 3-year cyclic grafting, the growing, fruit-bearing branches of each apple tree are annually rejuvenated in order to obtain new growing and fruit-bearing branches

next year. 2-3 jointed shoots are shortened. In the replacement options for a 4-year cycle, 4 productive branches are rejuvenated every year, and the next year new growing and productive branches are left to replace 2-3 segmented buds. In the process of rejuvenation of the branches of the apple tree, in order to leave the required number of eyelets, the branches are shortened, leaving 4-8, 8-12 and 12-16 eyelets, and for comparison, in the control variant, the branches are not shortened.

Experiment 2 option:

1. In order to rejuvenate and standardize fruit-bearing branches, cut off 2 – 3 segmented fruit-bearing and growing buds;
2. Pruning formed branches 10 – 12 cm long on unawaken shoots;
3. Pruning off branches from the main tree trunk to create new branches.

In all studied variants of the experiment, the branches growing on the side of the central cuttings are shortened to a height of 3.0-3.2 m, and this figure is maintained at the same height by further pruning.

In both options of the experiment: the experiment consists of three repetitions, and the number of trees to be accounted for in the variant is 8 – 10, and in 3 repetitions 24 – 30 trees. Options are arranged in a block, sequentially by variety and by return, options are randomized.

Methodology of the experiment:

In the course of the experiment, generally accepted methodological manuals for apple varieties were used, calculations and study of the phytometric parameters of the apple tree, light and photosynthetic productivity, yield and its quality indicators according to the methodology developed at the All-Union Research Institute of Horticulture (1982). Annually, at the end of the expiration date, metric measurements were made on the registered trees. At the same time, the length and thickness of the branches obtained in the process of pruning were measured, and the number of shoots in them was also determined. The studied varieties of apple trees were determined by the “pruning” method of A. A. Nichiparovich (1961) according to the leaf surface and the accumulation of dry matter on ordinary trees.

The distribution of sunlight in parts of the branches of a tree using a Yu-16 luxmeter, during the period when the leaves have optimal sizes, i.e. 15.06 – 16.06, open during the day at 8:00, 12:00, 15:00, 18:00 measured relative to the area. The productivity of photosynthesis was determined by the method of A.S. Ovsyannikov (1965) on 3 trees. The dynamics of crop formation was studied according to the variety study method (All-Russian Research Institute of Certification, 1976). The productivity indicators of the apple tree were studied in each tree left for all calculations, the average indicator was calculated per 1 ha. Fruit yield was determined in terms of 1 m², 1 m³ and 1 cm². Statistical processing of all experimental results obtained was carried out according to the method of B. A. Dospekhov (1979). According to the results of the study, as a result of the anti-aging-normalizing pruning method for a 3 – 4-year cycle, instead of the branches that yielded crops in 2009 – 2020, the number, size and structure of the branches were cut to the level, it was found that it increased accordingly. 3 – 4-year-old branches of an apple tree from a tree are cut off 1 – 2- and perennial branches of trees that have given and growing perennial crops. As a result of the experiment, it was found that in the pruning options, compared to the control option, 18 – 85 annual, 8 – 47 biennial and 1 – 18 perennial branches of the Golden Delicious variety were removed. It has been established that the mass of uncut branches is 18 – 25% more than the control option in other varieties. With an increase in the level of pruning, an increase in the number of branches removed from the tree, the mass of buds and branches was observed. As a result of the rejuvenation of productive branches by 3 – 4-year cyclic exchange pruning and standard shortening of the remaining branches, that is, the branches left for harvest are cut off with 4 – 8, 8 – 12 and 12 – 16 buds. It was established that these indicators increased with the increase in weight. 3.1 kg respectively compared to the control variant. In our experiments, Golden Delicious and Samarkand Firstling cultivars were left with 12 – 16 eyelet shoots, and Simirenko Rennet cultivar was left with 8 – 12 bud shoots. When

conducting research on the method of rejuvenating and normalizing pruning of fruiting branches in 3 different varieties of apple trees, it was found that the thickness of the tree trunk, which is a substitute for the optimal growth index, is 3. It is observed in 4-year rejuvenation cycles, where the thickness of the tree trunk is legally reduced as the cutting level decreases.

In the cases where pruning was carried out, the use of the area under the tree trunk was 47 – 54%, this indicator is considered to be at the ready level for modern industrial intensive type gardens. In the variety Golden Delicious, the length of the main branches is 38.0 – 55.5 cm, while maintaining 4 – 16 buds in the rudiment of the rejuvenating part according to a 3 – 4-year replacement cycle, while maintaining the buds of the main branches are preserved, in the variety Simirenko Rennet 39 – 7 – 57.0 cm and in the variety Samarkand Firstling this indicator was 37.5 – 54.0 cm, and in the control variant 44.0 – 62.0 cm, 47.0 – 63.0 cm and 44.0 – 46.0 cm, respectively, decreased by 12 – 18% compared with the control in the rejuvenating variant with a 3 – 4-year cycle when pruning the branches that gave fruit. It is shown that this reduction occurred mainly due to pruning of old fruit-bearing branches. Research results show that when productive branches are pruned, new, younger and more productive branches appear in their place.

The number of points of growth decreased from 10 to 120 in the variety Golden Delicious, from 14 to 118 in the variety Simirenko Rennet. In the structure of fruit formation, 59 – 62% of all studied 3 varieties, 9 – 13% of fruit trees are species for growth. Thus, as a result of rejuvenation and standardization of fruit-bearing branches, it was verified that the number of branches decreased by 21.1% in the Golden Delicious variety, and by 15.6% in the Samarkand Firstling variety. It was found that the number of fruiting bodies decreased by 20.1% and 15.4%, respectively. According to the biological characteristics of the apple tree, only 12 – 13% of the total (100%) number of buds are pruned, and the rest are showered. Therefore, the methods and levels of pruning, carried out in 3 – 4 cycles, create conditions for the correct and optimal development of physiological processes in the apple tree, as a result of which the remaining fruit cells are formed as high as possible. Among the 3 options found in the varieties Golden Delicious, Simirenko Rennet, Samarkand Firstling, the best option is to rejuvenate 3 – 4-year-old lignified varieties by leaving a hemp near the main place of the tree as a substitute (5 – 5 cm long) 7 cm is a cut. As a substitute, it is advisable to leave cut segmented buds mainly from their skeletons on the sides of the branches in the direction between the rows. In order to shorten the overgrown branches, the area of the leaf plate increased from 15 – 20% to 23 – 38% in variants with the use of rejuvenating and normalizing pruning and trees replacing it with an interval of 3 – 4 years. The branch area of the Golden Delicious apple tree was 11.8 – 13.0 m²/tree, and that of the Simirenko Rennet variety was 12.4 – 14.0 m²/tree.

Variety Samarkand Firstling was 11.2 – 12.4 m² / tree. These figures have been confirmed by other scientific results obtained with intensive care of the family garden. Also, the decrease in the projection area of the tree trunk and the size of the leaf plate depends on the biological characteristics of the studied varieties.

The distribution of the leaf surface of the branches located on the tree trunk is almost the same size, and the leaf surface area is up to 34% at the level of the rejuvenating and normalized trimming degrees of reduction of overgrown forms, it was found that in the middle tier it was up to 39%, and in the upper tier - 27%. Today, the weakest illumination during the day was observed at the base of the canopy, but here it was sufficient for the photosynthetic activity of the leaves at a moderate level and for the differentiation of flower buds and the formation of a high yield, since this was sufficient compared to the open area, since the illumination compared to the open area platform is 30 – 50%. All varieties have a higher productivity of solar radiation in the inner part of tree branches compared to the control variant in terms of method and pruning level. In the pruning method and tree pruning options, the productivity of photosynthesis increases with improved lighting and an increase in the degree of reduction of branches left for fruiting, which leads to an increase in the productivity of the apple tree. For 3 – 4 years of studying 3 varieties of apple trees, the number of flowers in the variety Golden Delicious was 12.3%, in the variety Simirenko Rennet 11.8%, in the variety Samarkand

Firstling 13.0%. In the branches shortened with 12-16 fruit buds, the apple tree makes up 11.5 – 11.8% of the varieties.

The average yield is 0.1 – 4.0 centners / apple tree for the Golden Delicious variety, for the Simirenko Rennet variety, when the fruit-bearing branches are rejuvenated in a 3 – 4-year cycle, and up to 4 – 16 fruit buds remain on the resulting branches. An additional yield of up to 0.1 – 3.5 c/ha was obtained, in the variety Samarkand Firstling up to 0.6 – 3.1 c/ha. The best results were obtained in variants with 8 – 16 buds left on fruit-bearing branches against the background of 3 – 4-year rejuvenation and normalization of fruiting. Also, apple varieties with the most optimal productivity and crop quality were obtained by rejuvenating the fruit-bearing branches in a 3 – 4-year cycle, leaving 8 – 16 eyelets on the fruit-bearing branches.

In the studied 3 different varieties of apple trees (grafted on a semi-slow-growing supply MM-106), when the trunk is formed by layering, after the 9th year of vegetation, trees are spliced along the rows and complete due to the expansion of the leaf area, as a result of the use of rejuvenating and normalizing techniques and felling levels, the same standard height of the tree trunk is maintained and it is possible to keep the size of the trees at the level of the standard level (2.4 – 2.84 m). Rejuvenation of apple trees with a certain required number of fruit-bearing branches reduced the number of fruit buds by 15 – 22%, the formation and growth of branches increased, and in the options for pruning branches with an average length, the length of the branches was 37 – 47 cm, which is quite enough. The best varieties Samarkand Firstling and Golden Delicious have pruning of fruit-bearing branches according to a 3-year cycle, and in the variety Simirenko Rennet, when pruning, leaving 12 – 16 eyes, and in the variants, pruning, leaving 4 – 8 eyes, according to a 4-year cycle of rejuvenation. Positive results have been obtained.

As a result of the improvement in the light transmission of branches due to the compaction of trees in the pruning options, the light indicators in the bowels of the trees averaged 54 – 78% during the day, while in the control options this figure was lower, reaching 36 – 55%, in the pruning options these indicators correspond to the optimal amount of light. With an increase in the degree of pruning on the branches of apple varieties left for fruiting, that is, in options pruned from 4 – 8 to 12 – 16 eyes, the size of the leaves decreases by 8 – 19% compared to the control variant, due to improved illumination, leaf sizes plates to 15 – 31%, an increase in photosynthesis processes was observed. In apple varieties, rejuvenating and normalizing pruning was used in a 3 – 4-year cycle. As a result of the reduction of the branches, the penetration of light into their internal parts improves, the productivity of photosynthesis increases by 4 – 20% compared to the control variant. Thanks to the positive results of pruning methods and levels applied to Olam varieties, the number of flowers on the trees is reduced and the pollination process is completed. The number of useful pollinated flowers is 12 – 13%, shedding of fruits is 17.5 – 18.6% in the varieties Samarkand Firstling and Golden Delicious when 12 – 16 fruit buds are left, and in the variety Simirenko Rennet, when 8 – 12 pieces are left, and amounted to 16.6%. As a result of the positive impact of methods and levels of pruning on trees, productivity increased by 18 – 35% for varieties, and quality indicators: the weight of one apple, the amount of sucrose in fruits, the amount of dry matter increased. As a result of rejuvenation and replacement of fruit reductions, the economic efficiency of apple cultivation turned out to be high, it was found that the net profit of varieties increased by 1980 – 2328 thousand UZS per hectare, and the level of profitability in pruning options increased by 91 – 121% compared to the control option.

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