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Apple tree productivity depending on planting density and rootstock variety combinations

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Abstract. In this article has been studied the dependence of tree planting density, variety-rootstock combinations and water- and resource-saving technologies in providing the population of our country with fresh fruits and obtaining a constant plentiful and high-quality harvest. Fruit growing is one of the most important and unique areas of agriculture. The growth, development and productivity of young orchards from seed fruits depend on the planting density of seedlings, the combination of rootstock varieties, the use of water-resource-saving innovative technologies, and agrotechnological factors. In this area, a sharp increase in fruit production, a radical improvement in quality and a reduction in cost are mainly determined by the laying of new intensive orchards and the consistently plentiful and high-quality fruits of existing orchards, including apple tree care and the use of resource-saving technologies. At present, the total area of orchards in the Republic of Uzbekistan is 216,400 ha, of which 89,100 ha or 44.0% of the total area is occupied by seed fruits. On a scientific basis, such activities as the correct formation and pruning of fruit trees, biological characteristics, intensive varieties and planting density of seedlings, modern water-resource-saving agro-care technologies used in the laying of accelerated young fruit orchards in Uzbekistan are studied in detail.

1 Introduction

Decree and resolution of the President of the Republic of Uzbekistan Sh.M. Mirziyoyev “On measures to develop the fruit and vegetable and viticulture industry”, orders and resolutions of the Cabinet of Ministers of the Republic of Uzbekistan, the Ministry of Agriculture and Water Resources on the transformation of enterprises in these important industries into farms, agro-industrial companies and agro-cluster organizations, improvement and development of the fruit and vegetable network management system, says that the head of our state pays special attention to the agricultural sector.

It is important to say that the Action Strategy for the Further Development of the Republic of Uzbekistan pays special attention to "the consistent development of agricultural production, further strengthening the country's food security, expanding the production of environmentally friendly products, and significantly increasing the export potential of the Republic of Uzbekistan."

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Global demand for food is increasing each year, but the area of land suitable for farming is limited. Land degradation leads to smaller areas suitable for good yields [1].

The main purpose of a High-intensity cultivation system is to maximize the yield crop per area unit through planting more trees, exploiting efficient use of different resources. There are different factors that affect high-intensity cultivation that include Land-cost, planting spaces, tree size, Rootstock, and Practice management. Numerous benefits of intensive fruit cultivation include increase fruit yield per unit area, improving use efficiency of natural resources e.g. soil, light, water, and nutrients, enhancing fruit quality, improving soil properties and rising levels of organic carbon and nutrients in plant tissues ...etc. In addition, it is very effective in acid lime soil and achieves high income for the farmers [2].

One of the main factors in the creation of modern intensive orchards is the use of productive vegetative grafts for fruit orchards, which are virus-free, cleanly rooted cuttings, which are important in creating mother orchards, and promising consistently abundant and high-quality crops. In this regard, taking into account the biological properties of grafts and their maintenance in different soil and climate conditions, and the widespread introduction of water and resource-saving technologies into production is a demand of the times.

Today, intensive orchards, including dwarf apple orchards, along with the cultivation of quality fruits, require the creation of orchards with a quick fruiting period, that is, 2-3 years after planting them in the garden. Also, in intensive dwarf orchards, when selecting weakly growing, small-stemmed, high-yielding, high-quality varieties, as well as applying a complex of high-quality water-resource-saving agrotechnical measures to them, it is possible to obtain 25-30 t/ha of high-quality fruits with good qualities.

Carrying out these activities on a scientific basis is considered the most important agrotechnical factor in increasing productivity and improving the quality indicators of intensive fruit orchards, and at the same time, research conducted in this area is recognized as relevant and is of great scientific and practical importance in improving the productivity of crowns and the quality of fruit trees in existing gardens of the Republic of Uzbekistan.

Intensive horticulture, including fruit growing with seeds, has been the most important and unique branch of the agricultural sector in recent years. Apple varieties, planting area and average yield increase dramatically even in the soil and climatic conditions of the Bukhara region. Water- and resource-saving and promising high-yielding varieties of their content are also carefully studied [3-6].

When laying and developing intensive (accelerated) orchards, first of all, the apple tree variety and its rootstocks, the shape of the apple tree, the compactness of the trunk and branches, the timely transfer of water- and resource-saving innovative agrotechnological factors are taken into account, scientific care of trees, taking into account their biological characteristics, the continuous most important task is to focus on obtaining an abundant and high-quality harvest [4, 7-9].

Orchards are being created at a high pace, giving abundant and high-quality crops even in the soil and climatic conditions of the Bukhara region. When studying the quality and quantity of growth, the productivity of young fruit trees in these apple orchards, variety rootstock combinations have become widespread in recent years, the study of their biological properties, the widespread introduction of water and resource-saving technologies in production, receive high efficiency and profit.

The soils of the Bukhara region have their own agrochemical properties and characteristics, and irrigated soils have been cultivated since ancient times and are definitely formed in specific agro-irrigation layers. The existing agro-irrigation layer in places consists of a layer of 2.5-3.0 mm. When examining the obtained soil sections, the soil is gray in color, in different cases compacted, moistened, light in weight and differs sharply from zonal or regional soils in its morphological, physicochemical, mineralogical and other properties. It should be noted that in determining the classification of irrigated soils in Uzbekistan,

including the Bukhara region, taking into account the water regime of soils, subdividing them into irrigated hydromorphic soils or dividing them into irrigated hydromorphic soils, according to the conclusion, many studies have been carried out, complete information on the internal structure and mechanisms soil formation processes are not presented.

Most of the irrigated area is located in the Zerafshan delta. The appearance and structure of these landforms consist of low flat, undulating and bowl-shaped anthropogenic landscapes. These existing terraces are located on the old tributaries of the Zerafshan River.

Place and method of scientific research. Scientific research In 2020-2022, in the horticultural farm of Siyovush Agro LLC, located on the area of the MCC (MAKHALIN CONGRESS OF CITIZENS) "Bogi Kalon" of the Bukhara region, a productive dwarf variety of the Goldspur apple tree, located on an area of 52 hectares, planted on slow-growing grafted trees M-9. The soil of the horticultural farm "Siyovush Agro" belongs to the category of slightly saline, old-irrigated. The soil is of medium texture. Under the conditions of an irrigated field, soil formation processes are directly related to the collection of agro-irrigation deposits, such as parent rocks, relief, and seepage water.

The soils of the horticultural farm Siyovush Agro LLC of the Bukhara region MCC "Bogi Kalon" consist of alluvial slightly saline soils, which have been irrigated since ancient times, where there is a surface location of the groundwater level (0.90-1.5m), which differs sharply from other areas. The soil is of medium texture. It has been determined that in the processes of soil formation under irrigated field conditions, parent rocks, topography and groundwater are directly related to the irrigation regime.

Soil samples taken from the apple orchards of the horticultural economy of Siyovush Agro LLC, located on the area of the MCC (MAKHALIN CONGRESS OF CITIZENS) "Bogi Kalon" of the Bukhara region, were subjected to agrochemical analyzes in the laboratory of the department "Land project of the Bukhara region". Institute "Uzdavyerloikha" and changes in the agrochemical properties of the soil with the depth of the soil, the depth found that these indicators also decrease simultaneously with its increase (Table 1).

Table 1. Classification of agrochemical properties of the soils of the horticultural farm of LLC "SiyovushAgro" in the area of the "Boghikalon" MCC, Bukhara district.

Pruning	Depth cm	Alkalinity		Cl		SO ₄	
		HCO ₃ %	HCO ₃ ml	%	ml.equiv	%	ml.equiv
A	0-32	0.024	0.40	0.018	0.49	0.080	1.67
B	32-62	0.038	0.62	0.014	0.39	0.050	1.04
C	62-85	0.029	0.48	0.018	0.49	0.051	1.03
Ground water	90cm	0.195	3.20	0.175	4.99	0.400	8.33
Under ground water	10m	0.188	3.08	0.315	8.88	0.340	7.08
Pruning	Depth cm	Alkalinity		Ca		Mg	
		HCO ₃ %	HCO ₃ ml	%	ml.equiv	%	ml.equiv
A	0-32	0.024	0.40	0.022	1.10	0.005	0.40
B	32-62	0.038	0.62	0.016	0.80	0.006	0.49
C	62-85	0.029	0.48	0.015	0.75	0.007	0.54
Ground water	90cm	0.195	3.20	0.5	7.49	0.012	5.14
Under ground water	10m	0.188	3.08	0.136	6.29	0.072	5.93

The specific gravity of the soil in the root layer (0-70 cm) - 2.84 g / cm³, in the meter layer - 2.83 g / cm³, the limiting field moisture capacity - 21.2%, in the layer 0-50 cm - 21.1 % in a layer of 0.70 cm and 0-100 cm. In a layer of 21%. According to the results of agrochemical studies, the amount of humus in pastures, old-irrigated and new-irrigated fields is very low. It was established that the amount of humus in the arable layer of the soil was 0.8-1.4%, nitrogen - 0.06-0.12%, the total amount of phosphorus 0.11-0.18%, and the amount of exchangeable potassium - 1.5 -3.0%.

2 Methods

In apple trees, the productivity indicators of each remaining tree were studied for all calculations, the average indicator was calculated per 1 ha. Statistical processing of all obtained experimental results was carried out according to the method of B. A. Dospekhov (1979). Goldspur is a fast-growing apple variety. In 1960, it was obtained from a clone of the Golden Delishes variety in the USA. Goldspur is similar in characteristics to Golden Delishes. Productive, the seedling enters the harvest 2-3 years after planting. Requires fertile soil and high agricultural technology. The fruits ripen in early September. According to research conducted at the Research Institute of Horticulture, Viticulture and Winemaking. Academician M.Mirzayev, Goldspur is a spectacular, promising variety in the conditions of the Tashkent oasis. Variety Goldspur is currently recommended for planting in all regions of Uzbekistan and gives abundant and high-quality crops. Rootstock M-9 is the main rootstock for small apple trees. Apple seedlings associated with this rootstock consistently produce abundant and high-quality crops. Rootstock M-9 was established in 1920 by the East Malling Research Station (England) and is the rootstock used in most intensive apple orchards. "Paradise" rootstocks have been used in Europe for several centuries and still. Rootstock M-9 is the most widely used rootstock for dwarf apple trees. Rootstock M-9 differs from other rootstocks in its importance, quality and growth characteristics. There are cloned species. The main and biggest disadvantage of this rootstock is its susceptibility to the "Bacterial burn" disease.

In 2020, the dwarf apple cultivar 'Goldspur' was placed in an intensive orchard associated with a slow growing rootstock in the following order, i.e. 4.0x1.0m, 4.0x1.2m, 4.0x1.4m, 4.0x1.6m, 4.0x1.8m, 4.0x2.0m and On average, 1250-2500 seedlings are planted per 1 ha of an apple orchard, corresponding to the norm. As a rootstock in an experimental apple orchard, a slow-growing rootstock M-9 was used.

In the experimental garden, apple trees were formed with semi-thinned branches. In this intensive apple orchard, small apple trees are irrigated in a water- and resource-saving and efficient drip method.

Drip irrigation is an irrigation method in which water is supplied directly to the root zone of cultivated plants in regulated small portions using dropper dispensers. Allows you to get significant savings in water and other resources (fertilizers, labor costs, energy and pipelines). Drip irrigation also provides other benefits (earlier harvest, prevention of soil erosion, reduced chance of spreading diseases and weeds).

The method was first widely used in the development of Simcha Blass in Israel, where in the conditions of water shortage in the 1950s, experiments began on the introduction of a drip irrigation system.

Initially, it became widespread in greenhouse production, but today it is already widely used in open ground for growing vegetables, fruits and grapes, as well as landscaping, incl. vertical gardens. The use of drip irrigation gives the greatest effect in areas of insufficient moisture.

In the experimental garden, apple trees are watered through rubber pipes using drip irrigation. As a result, water consumption was saved by 2-3 times. With the method of

underground watering of plants, in which the hose with drip dispensers is not buried deep into the ground, water flows directly to the roots of plants through drip dispensers, which is the most efficient method of irrigation from an agrotechnical point of view. harvesting. for watering the soil, in which the hose with drip dispensers is located on the surface of the earth, and the drip dispenser is located near the root of the plant, moistening the root from above. Easy to install, reusable and fully absorbent soft hoses are used for irrigation. Drip irrigation system is a promising method of watering plants, automating the process of watering, increasing yields, allowing you to set the alternating arrangement of water and nutrients in the root layer of the soil, especially promising for farms. During the growth period, small apple trees are cleared of weeds between the rows and nitrogen fertilizers are applied - 250 kg / ha, phosphorus - 180 kg / ha, potash - 45-60 kg / ha by drip irrigation.

3 Results and discussion

The unique biological characteristics of apple trees, their development, yield and quality, the effect of planting seedlings, features of variety-rootstock combinations, water and resource-saving technologies in scientific research and test results are studied in the dwarf intensive garden of the horticultural economy of Siyovush Agro LLC. In these works, cases of growth and improvement of such parameters as illumination, foliage and photosynthesis productivity of the apple tree were recorded. Studies have shown that the highest illumination rates in 2020 were recorded in parts of the trunk and branches of the Goldspur dwarf apple tree. In 2021, as a result of optimal growth and development of the apple tree and an increase in the size of trees, the decrease in light indicators did not have a significant impact on the optimal growth and formation of crop elements in the dwarf apple variety. Even in 2022, growth, development, flowering, formation of fruit elements and fruit quality were not affected in the apple orchard, where experience and testing were carried out, and finally, the fruit growing efficiency indicators in the apple orchard were high.

In the horticultural farm of Siyovush Agro LLC, agrotechnological measures were taken in 2022, such as the full and high-quality application of all water- and resource-saving innovative agrotechnological factors, the full protection of dwarf apple trees from pests in a timely manner in cooperation with agronomists of this farm and, as a result, small apple trees. orchards give consistently plentiful and high-quality crops, and productivity increases sharply.

In 2022, apple trees were cared for at a high level in this horticultural farm based on water- and resource-saving innovative agricultural technologies, full consideration of biological characteristics, convenient variety-rootstock combinations, selection of a suitable planting of seedlings, because. As a result, two-year-old Goldspur apple trees will be branched, due to the correct position on the body, light indicators were high in all parts of the body. In September 2022, a medium quality crop of 1.0-4.0 kg was obtained from one dwarf apple tree, and the yield per hectare was 25.0-110.0 centners / ha, the quality is high, the efficiency of fruit cultivation in orchards has increased dramatically.

4 Conclusion

The results of scientific research and tests carried out during 2020-2022 indicate that due to the formation of branches of dwarf apple trees of the Goldspur variety of optimal size, light indicators turned out to be favorable for the growth and development of intensive dwarf apple trees, and as a result of the use of water- and resource-saving technological factors led to an improvement in phytometric indicators and biological properties, in apple trees of low growth the yield of varieties has increased.

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