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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

INFLUENCE OF MAIN CULTIVATION METHODS ON PRODUCTIVITY AND QUALITY INDICATORS OF VIRGINIA TYPE TOBACCO VARIETIES UNDER IRRIGATION CONDITIONS OF SHAKINSKY-ZAGATALI ECONOMIC REGION

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OVERALL QUALITY OF WORK

Relevance of the topic and degree of elaboration. Despite the fact that the tobacco plant has been planted and cultivated in our republic for a long time, the mechanization of manual labor, the achievements of science and the application of the work experience of pioneers are at a very low level. The current level of tobacco production does not meet the demand of the industry. The soil and climatic conditions of our country make it possible to meet the industry's demand for tobacco raw materials, especially aromatic tobacco, by expanding tobacco fields. During the time of the Soviet Union, local varieties were planted and cultivated in large areas in our republic. However, those tobacco varieties were mainly cultivated using manual labor. So, the harvests were carried by hand and arranged on the rope, and sheds were required for drying. All this ultimately had a negative effect on the quality indicators of tobacco and led to a decrease in the yield of the product[1].

Virginia-type aromatic tobacco varieties, on the other hand, are quick-maturing and significantly lighten manual labor. Also, these varieties are not harvested by hand but by special combine harvesters. They are dried in drying chambers instead of in sheds without stringing, they are used to transport them in bags by means of special compression devices, they are less demanding on nitrogen fertilizer, they have favorable cultivation technology, good weight quality, and sugars in the commodity product. They differ in that they have a lot of nicotine[2].

Considering the above, if we take into account the growing demand for Virginia-type tobacco varieties and the production of high-quality leaf products from them, it is determined that the conducted research is relevant.

The object and subject of the research. For conducting the research work, the regionalized aromatic Virginia type "Kokker-347"

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[1] Abbasov, B.H. Tobacco / B.H. Abbasov. - Baku: Abilov, Zeynalov and sons. - 2008. - 206 p.

[2] Lecours, N. The harsh dangers of tobacco farming // - Canada: International Development Research Centre, - 2014. No. 6, - p. 117-128.

tobacco variety of American origin was used.

The object and subject of the research. It consists of studying the influence of the main cultivation methods (food area, feeding conditions and irrigation norms) on the productivity and quality indicators of the Virginia type "Kokker-347" tobacco variety and determining the optimal norms of these factors.

Research goals and objectives. The main goal of the study was to examine the effect of optimal cultivation methods selected for increasing the productivity of the Virginia type "Kokker 347" tobacco variety and obtaining a high-quality dry leaf product in the irrigation conditions of Sheki-Zagatala economic region, and applying the obtained results to private, private and farm farms.

The fulfillment of the following main tasks set for conducting the research is considered appropriate for the purpose:

1. Studying the effect of the main cultivation methods on the general development of the tobacco plant under irrigation conditions;
2. Determining the effect of different cultivations under irrigation conditions on dry and wet productivity of tobacco plant leaves, quality indicators and yield of commodity species;
3. Investigating the effect of the main cultivation methods on the number of annual and perennial weeds growing in the experimental area;
4. Determination of economically profitable cultivation methods at the end of the research;
5. Refinement of results analysis using SPSS 26 electronic package.

Research methods. The 3-factor research study was carried out in 4 rows and 4 replicates with the length of each patch being 7 m, width of 4.3 m on average, experimental area of 1152 m^2, total area of 1450 m^2, in the territory of Sheki Experiments Station of the Agricultural Scientific Research Institute, on alluvial-meadow type soils according to the following scheme has been performed.

Factor 1: Irrigation rates-%:

70-80-50%

70-80-60%
70-70-60%

Factor 2: Nutritional conditions:

$N_{30}P_{90}K_{90}$
$N_{45}P_{120}$ +20 tons of manure
$N_{60}P_{150}K_{120}$

3rd factor: Food area - cm:

120×40- (21 thousand plants per hectare)
110×40- (23 thousand plants per hectare)
90×40- (27 thousand plants per hectare)

- The standard methods currently used in practice were used.
- In the soil samples taken from the experimental area, the pH suspension was determined by the "Orion -525 Aplus" brand pH meter, the amount of total humus by Tyurin, the amount of carbonates (CaCO3) by Scheibler, the total nitrogen by Keldal, the amount of exchangeable phosphorus and exchangeable potassium by Machig's methods[3].
- During the irrigation of the experimental area, the moisture capacity of the field and the amount of water to be used in m^3 were specifically determined by A.S. Pirkov, L.Q. Smirnova, L.V. It was calculated by the Chilingarov formula[4].
- 200 leaves from the middle layer on each plant, i.e. 50 typical leaves from each of 4 replicates, measuring the width and length of one leaf in sq.cm, F.P. It was determined according to Gubenko's table[5].
- To determine the dry leaf yield, 5 pieces (total 25 pieces) of each replicate were taken from the center of the wet leaves, near the

[3] Hajimammadov, I.M. Methods of agrochemical analysis of soil, plants and fertilizers / I.M. Hajimammadov, C.M. Talai, E.M. Kosayev - Baku: Teacher. – 2016. - 130 p.
[4] Pyrkov A.S., Smirnova L.G., Chilingarova L.V. Научные основы мелорации почв. Book / A.S. Pyrkov, L.G. Smirnova, L.V. Chilingarov. - Moscow: Nauka. - 1972. - 247 p.
[5] Gubenko F.P. Площадей табачных листьев / Ф.П. Gubenko. - Simferopol: Gosizdat, - 1936. - 45 c.

midevening, by means of 2 special tools (sleeves). productivity is determined.

- The dry leaf product is sorted by the 1st, 2nd and 3rd commodity types according to the requirements of the State Standard No. 8073-77[6].
- Nicotine in dry leaf product with "Jenevey 3606" apparatus essential oil was determined by passing through a Soxhlet apparatus, by burning tar in petroleum oil, proteins according to Mohr, sugars by Bertrand method, crude ash by burning in a Muffle furnace at 600ºC.
- The economic efficiency of the experiment was calculated and the variance analysis of the results obtained at the end of the study was carried out in the electronic SPSS 26 software package.

Main points presented to the defense of the dissertation. The main arguments defended in the research work are as follows:

- The main cultivation methods affected tobacco plant phenophases, retention percentage, height dynamics, number of leaves, leaf area and number of flowers.
- The application of irrigation norms, regulatory conditions and field area has led to an increase in the dry and wet yield of tobacco leaves, improved quality indicators and increased the value of the commodity product in the yield of commodity species.
- As a result of the application of the selected optimal cultivations, the increase in profitability and economically advanced cultivation methods have been determined.

Scientific novelty of the research. The scientific innovation of the research work carried out in 2018-2020 consisted of the following: 1. For the first time, under the irrigation conditions of the Sheki-Zagatala economic region, by applying the determined norms of nitrogen mineral fertilizer to the Virginia-type aromatic Kokker 347 tobacco variety in private, private groups and farms (Sheki,

[6] GOST 8073-77. Tobacco - raw unfermented. Technical conditions. – M: Gosstandart- USSR, Standard Publishing House, - 1977. - 15 c.

Gakh, Zagatala, Balakan, Yadimli), the number of seedlings compared to the cultivated areas an increase in the percentage of catch in the field, an increase in height, and an increase in the number of leaves were achieved. It has also been proven that the farmer's crops productivity was 11.2% higher compared to the fields. Also, while diseases and pests (false powdery mildew, root rot, trips) were observed in the fields of the farmers, no diseases and pests were identified in the experimental field.

2. For the first time, in order to save on vegetation irrigation, the quantity of irrigation norms was determined and submitted to production.

3. For the first time, the number of one-year and two-year weeds was determined in the economic region, and as an agrotechnical control measure, the 1st, 2nd and 3rd soil cultivations were carried out in the fields, and their number was reduced.

4. For the first time, taking into account that the tobacco plant is very demanding on soil nutrients, by replacing a part of mineral fertilizers with manure ($N_{45}P_{120}$+20 tons of manure against the background), the optimal options for the effect on their growth, development, productivity and quality indicators were determined.

5. For the first time, the corresponding 70×30, which is currently used in private, private groups and farms across the republic; As an alternative to the 70×25 cm sowing schemes, the 90×40 cm sowing scheme was developed and recommended on scientific grounds.

Theoretical and practical significance of research. In the research years of 2018-2020, the scientific study of the cultivation of the American-origin Virginia-type aromatic tobacco variety "Kokker 347" in accordance with local conditions in the Sheki-Zagatala economic region is of significant economic and economic importance. The dry and wet productivity of that tobacco variety was studied through experiment, regardless of the place of planting in local conditions. So, since tobacco is demanding on the nutrients in the soil, it exhausts them in the first stage of its development (it takes

60 kg of nitrogen, 16 kg of phosphorus and 38 kg of potassium from the soil during the growing season for 1 ton of product)[7].

As a result, at the end of the growing season, the plants develop poorly and the productivity and quality parameters decrease. Therefore, the replacement of these nutrients is one of the most important conditions. In our study, this measure was achieved by replacing some of the mineral fertilizers with manure for the purpose of soil fertilization. That is, based on the 3-year results of the research, we can say that the yield on the background of $N_{45}P_{120}$ +20 tons of manure was higher compared to other options with the norms of $N_{30}P_{90}K_{90}$ kg and $N_{60}P_{150}K_{120}$ kg of mineral fertilizers. Buda raised the practical importance of the research work.

Approbation and application of the work. The results of the research work were presented at the scientific report meetings of the Scientific Research Institute of Agriculture (2018-2020), at the online scientific-practical conference "New directions of agricultural development and environmental protection" held at the Caspian-Western University (Baku, 2021), Village At the online scientific-practical conference "Sustainable development of agriculture: global implications and reforms in Azerbaijan" held at the Agrarian Research Center of the Ministry of Economy (Baku, 2020), "Soil-ecological problems of agrocenoses and their solution" held at the Institute of Agrochemistry and Soil Science of ANAS ways" (Baku, 2021), discussed at the 3rd International Scientific-Practical Conference "Scientific Support of Technological Development in the Food and Processing Industry and Increasing Competitiveness" held in Kuban (Russia, 2023).

According to the results of the dissertation work, 14 articles were published. Out of it, 7 articles are foreign and 7 articles are domestic publications.

[7] Novothy, T., Turson E. The environmental and health impacts of tobacco agriculture // - Geneva: Bulletin of the World Health Organization. - 2018. No. 16, - p. 8-11.

Name of the organization where the dissertation was performed. The research field experiments were carried out in 2018-2020 in the territory of the Sheki Support Station of the Scientific Research Institute of Agriculture. Analyzes related to the dissertation work, Azerbaijan Village. It was carried out at the Institute of Agricultural ET of the Ministry of Economy and in the laboratories of "Baku International Tobacco" OJSC.

The total volume of the dissertation in characters, along with the separate volumes of the structural units, is as follows. The dissertation consists of an introduction, 4 chapters, a conclusion, production recommendations, abbreviations, a bibliography, appendices and figures. According to the content of the dissertation, the title page and table of contents make up 3 pages of 3304 characters, the introduction is 9 pages of 16497 characters, the first chapter is 29 pages of 60401 characters, the second chapter is 11 pages of 19296 characters, the third chapter is 22 pages of 37853 characters, the fourth chapter is 66 pages of 104432 characters, results are 1 page of 1026 characters, production recommendations are 1 page of 1008 characters, the list of references is 31 pages of 50792 characters, the volume of the dissertation is 236 pages of computer writing and the total volume is 334489 characters (figures, tables, list of used literature excluding appendices and abbreviations volume is 227938 characters) consists of the text of the work uses 13 tables, 5 figures (47 tables in appendices) and 263 literary sources (97 local, 12 Turkish, 103 Russian, 51 English).

THE MAIN CONTENTS OF THE WORK

The introduction, the relevance of the topic, the goals and objectives of the research, the methods of application, the main defenses, the scientific innovation of the research, the scientific and practical importance of the research are given.

Introduction. The introduction indicates the relevance of the topic, the goals and objectives of the research, methods of application, the main means of protection, scientific novelty, as well as the scientific and practical significance of the research.

Chapter I. This chapter contains the headings "History of Growing Tobacco Plant", "Growing Tobacco Seedlings in the Nursery", "Watering Requirements of Tobacco Plant", "Nutrient Needs of Tobacco Plant". A broad literature review of research papers and authors' information in local, Russian and English languages on these publications in the country and the world was also conducted.

Chapter II. This chapter presents the physical and geographical conditions of the study area, i.e. - general characteristics of the soils of the Sheki-Zagatala economic region, a summary of the climatic conditions of the Sheki-Zagatala economic region, agrochemical indicators of the soils of the Sheki-Zagatala economic region, study sites and agrometrological data of long-term experience. It was found that about 30,0% (291,0 thousand hectares) of the total land fund of the region are mountain-forest lands. Together with grassy mountain-forest lands, the area of brown forest lands is 249,1 thousand hectares or 52,3% of the land area located in the total area of the mountain. Since the soil pH (0-50 cm) in the planting layer of the study area fluctuates between 8,02-8,25, it is considered slightly alkaline. The total humus content is 1,6-2,5% of average quality.

The absolute temperature of the air (14^{o}C) and the total amount of rains (741.3 mm) in the research years are considered favorable for the cultivation of tobacco, as they correspond to the multi-year norm. The climatic conditions of the Sheki-Zagatala economic region are very favorable for the cultivation of tobacco. Because the air humidity in this region is normal[8] [9].

Chapter III describes the biological characteristics of the Virginia type tobacco variety, which is the object of the research, the main cultivation of the soil before planting (identification of the

[8] Abbasov, B.H., Ismayilov N.M. The effect of different nutrition conditions on the development and productivity of Virginia and Barley type tobacco varieties // - Baku: Collection of Scientific Works of the Agricultural ET Institute, - 2021. C. 3(32), No. 1, - p. 75-80.

[9] Nuri, A.O. Azərbaycan iqtisadiyyatı. Kitab / A.O. Nuri, E. Süleymanov. - Bakı: Şərq-Qərb, - 2016. - s. 426

predecessor, covering of the ridge, giving mineral fertilizers before plowing, plowing, harrowing, soil compaction) technology, post-planting operations (leaf transportation, drying in fire-drying chambers, sorting, fermentation information about the experiment (irrigation rates, feeding conditions, food area) and method (performed phonological observations, measurement, analysis and calculations) was included.

Chapter IV. This chapter presents the main experimental data of the dissertation, the influence of the main cultivation methods on the percentage of seedlings in the field, growth and development, the number of leaves per plant, leaf productivity, quality indicators of leaves, the number of weeds, as well as the economic efficiency of tobacco of the Virginia variety "Kokker 347" after planting.

4.1. The effect of main cultivation methods on the percentage of seedling retention in the field after planting. A high percentage of seedlings after planting in the field results in a normal number of plants per hectare. So, the more the number of plants in the field, the higher the productivity in the future.

E.M. Tyutnikova says that our main goal in conducting the experiment is to plant the seedlings grown in the greenhouse in the open field and to monitor their development cycle. In the end, it was found that one of the decisive stages of the tobacco plant in the best version of the experiment is the fattening phase. This phase plays an important role in the formation of the product and lasts only 15 days[10][11].

The analysis of table 4.1 shows that despite the planting of 233 plants in a 120×40 cm nutrient field against the background of $N_{45}P_{120}$+20 tons of manure, 227.0 plants (97.4%), 70-80- 229.0 units (98.3%) at 60% irrigation norm, 226.0 units (97.0%) at 70-70-60%

[10] Tyutnikova, E.M. Use of a growth regulator when growing tobacco // Collection of materials of the II All-Russian scientific and practical conference “Young Scientists and Graduate Students”, - Krasnodar: - August 31 - June 2, - 2014. - p. 16-21.

[11] Kazımov, Q.A. Virciniya tipli “Kokker 347” tütün sortunun şitilərinin inkişafına və məhsuldarlığına becərmə üsullarının təsiri // - Bakı: Əkinçilik ET İnstitutunun Elmi Əsərlərinin məcmuəsi, - 2019. C. 1(30), №1, - s. 82-87.

irrigation norm; despite the planting of 256 plants in a 110×40 cm nutrient area, 245.6 plants (95.7) at 70-80-50% irrigation rate until the ist harvest, 248.3 plants at 70-80-60% irrigation rate (96,9%), 248.0 units (96.5%) at 70-70-60% irrigation rate; despite the planting of 311 plants in a 90×40 cm nutrient field, 301.6 plants (96.4%) were planted in the 70-80-50% irrigation rate, and 307.0 plants (98.4%) in the 70- 80-60% irrigation rate, 304.3 (97.7%) seedlings have grown in 70-70-60% irrigation rate. Thus, the highest seedling percentage was 229.0 pieces (98.3%) at 70-80-60% irrigation rate in a 120×40 cm nutrient field against the background of $N_{45}P_{120}$+20 tons of manure; 307.0 units (98.4%) in the 70-80-60% irrigation norm in the 90×40 cm food area and 304.3 units (97.7%) in the 70-70-60% irrigation norm. In the end, the 90×40 cm food area and 70-80-60% irrigation norm in the same background differed with a higher percentage of seedlings (98.4%) with a number of 307.0 plants.

Table 4.1.

The effect of the main cultivation methods on the percentage of seedling retention in the field after planting, in numbers (average for 2018-2020)

Food area cm	Irrigation rate %	$N_{30}P_{90}K_{90}$		$N_{45}P_{120}$+20 tons manure		$N_{60}P_{150}K_{120}$	
		Number of planted plants,	Number of plants caught in the field	Number of planted plants,	Number of plants caught in the field	Number of planted plants,	Number of plants caught in the field
120×40	70-80-50	233	223,3	233	227,0	233	225,6
	70-80-60	233	224,0	233	229,0	233	226,0
	70-70-60	233	223,3	233	226,0	233	224,0
110×40	70-80-50	256	241,3	256	245,6	256	242,6
	70-80-60	256	245,3	256	248,3	256	246,3
	70-70-60	256	245,0	256	248,0	256	245,6
90×40	70-80-50	311	297,0	311	301,6	311	298,6
	70-80-60	311	301,0	311	307,0	311	303,6
	70-70-60	311	299,0,	311	304,3	311	300,3

4.2. Effect of main cultivation methods on growth and development of tobacco. In order to determine the height dynamics, 25 plants from each replicate were marked and taken under control in the experimental field. Observations were made on those plants taken under control. The observations were continued every 15 days and the figures were measured and obtained in table 4.2 below.

Table 4.2.
Effect of main cultivation methods on tobacco growth and development (cm)

Food area cm	Irrigation rate %	$N_{30}P_{90}K_{90}$		
		30 days after sowing	45 days after sowing	End of vegetation
120×40	70-80-50	81,3	123,4	235,7
	70-80-60	81,8	128,2	238,2
	70-70-60	79,8	125,2	237,0
110×40	70-80-50	74,1	125,9	234,9
	70-80-60	74,6	124,0	234,1
	70-70-60	74,7	124,9	234,1
90×40	70-80-50	71,7	123,4	231,8
	70-80-60	72,0	124,9	234,1
	70-70-60	71,1	121,7	232,5
$N_{45}P_{120}$+20 tons manure				
120×40	70-80-50	95,6	213,5	263,2
	70-80-60	97,3	214,5	266,4
	70-70-60	95,8	214,7	262,2
110×40	70-80-50	90,6	212,1	260,1
	70-80-60	92,3	211,9	258,9
	70-70-60	90,9	211,0	259,7
90×40	70-80-50	88,5	208,7	253,1
	70-80-60	89,3	207,8	256,9
	70-70-60	87,7	210,9	254,7

From the analysis of table 4.2, it is clear that according to the final result of the research, the proportions of the mixture of mineral fertilizers and manure had a positive effect on the growth of plant height dynamics. The highest height growth was higher in the

120×40 cm food area than in the 110×40 cm and 90×40 cm food area. This is explained by the fact that in the 120×40 nutrient areas, the nutrient rate and air space per plant is more. Thus, it was 263.2 cm in the 70-80-50% irrigation norm, 266.4 cm in the 70-80-60% irrigation norm, and 262.2 cm in the 70-70-60% irrigation norm. That is, in the 120×40 cm food plot, an average of 8-10 cm additional height growth was observed compared to other food plots.

4.3. Effect of main cultivation methods on the number of leaves per plant in the field. It is known that the product of the tobacco plant, unlike other agricultural (mainly technical) plants, is considered to be its leaves. Therefore, the large number of leaves in a plant is accompanied by an increase in productivity in the future.

Q.N. Jikalkina, I.V. Pavlyuk notes that the results of many years of research show that the tobacco varieties of American origin (Virginia, Burley) were significantly different from the Trebizond-182 tobacco variety in terms of the number and area of leaves. Thus, while the average number of leaves in the Trebizond-182 tobacco variety was 26-29, this number was 36-42 in those varieties, and in some cases more, i.e. 51-56. Therefore, these varieties are more productive and of good quality[12].

In order to determine the number of leaves in the experimental field, after counting the leaves on 10 controlled plants from each replicate, the numbers obtained were grouped and the average number of leaves per plant was determined and the results are given in figure 4.3.

The analysis of figure 4.3 shows that the highest number of leaves according to the sum of repetitions was 32.7 in the 70-80-50% irrigation norm, 33 in the 70-80-60% irrigation norm in the 120×40 cm food plot against the background of $N_{45}P_{120}$+20 tons of manure. 2 units, 31.9 units at 70-70-60% irrigation rate; 28.7 units in the 70-80-50% irrigation norm, 30.8 units in the 70-80-60% irrigation norm,

[12] Zhigalkina, G.N., Pavlyuk I.V. Evaluation of new hybrid combinations of the Trapezond-182 tobacco variety // Materials of the International scientific-practical conference "Innovative research and development for the scientific support of production and storage of ecologically safe agricultural and food products", - Krasnodar: - April 06-26, - 2015. - c. 104-108

28.0 units in the 70-70-60% irrigation norm in the 110×40 cm food area; 28.8 units at 70-80-50% irrigation norm, 28.6 units at 70-80-60% irrigation norm, 28.8 units at 70-norm, 28.6 at 70-80-60% irrigation norm in 90×40 food area units, and 70-70-60% irrigation rate 27.8 leaves were formed.

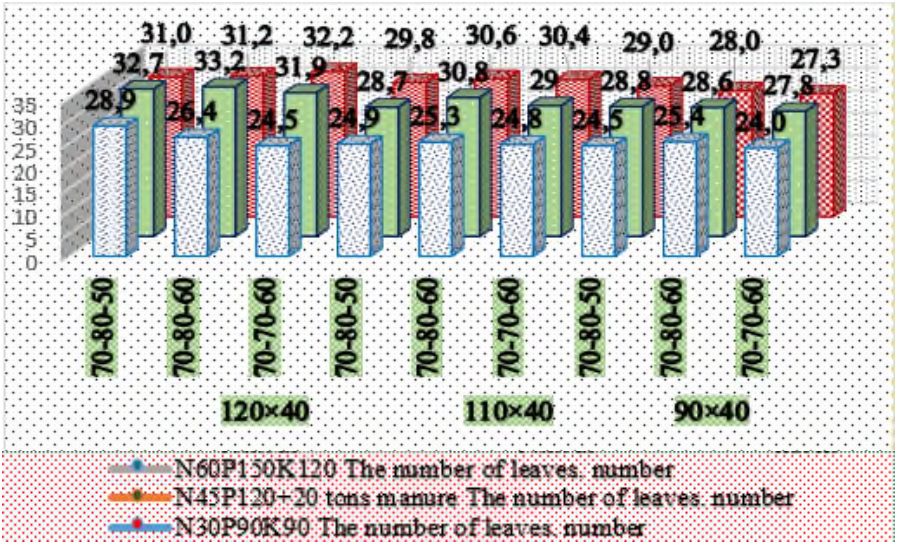

Figure 4.3. The effect of the main cultivation methods on the number of leaves per plant in the field, (average of 10 plants), in numbers (average for 2018-2020)

Thus, according to the results of the research, compared to other options, the highest number of leaves is 32.7 in the 70-80-50% irrigation norm, 33.2 in the 70-80-60% irrigation norm in the 120×40 cm food plot against the background of $N_{45}P_{120}$+20 tons of manure. It was 31.9 units at 70-70-60% irrigation rate. The highest indicator of the number of leaves in this nutrient ratio, i.e. 32.7, was in the 70-80-50% irrigation ratio.

4.4. Effect of main cultivation methods on dry leaf yield of Virginia-type tobacco cultivar. From each replication, 5 pieces (total of 25 pieces) were taken from the center of wet leaves, and 2 pieces (total of 50 pieces) were taken from the center of wet leaves, and 2 pieces (total of 50 pieces) were dried in a drying cabinet at a

temperature of 105°C for 24 hours until the dry weight was obtained 4.4 is also given[13].

The analysis of the figures of figure 4.4 shows that the highest average dry leaf yield for 2018-2020 is the total yield in 2018 at 70-80-50% irrigation rate in a 120×40 cm food area against the background of $N_{45}P_{120}$+20 tons of manure, 9 c/ha, 21.7 c/ha in 2019, 21.1 c/ha in 2020, 3-year average 22.2 c/ha, 70-80-60% irrigation

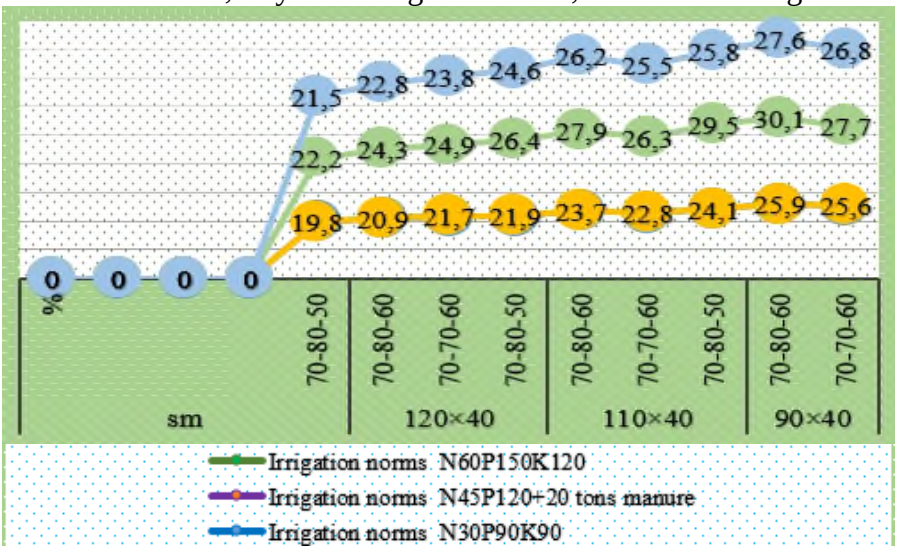

Figure 4.4. Effect of main cultivation methods on dry leaf yield of tobacco, (2018-2020 average)

rate in 2018 total yield 26.5 c/ha, 23.1 c/ha in 2019, 23.8 c/ha in 2020. 3-year average 24.3 c/ha, 70-70-60% irrigation rate Total yield in 2018 25.9 c/ha, 24.8 c/ha in 2019, 24.1 c/ha in 2020, 3-year average 24.9 c/ha; In the 110×40 cm food area with 70-80-50% irrigation rate, the total yield in 2018 is 27.2 c/ha, in 2019 25.2 c/ha, in 2020 26.7 c/ha, 3 -annual average 26.4 c/ha, with 70-80-60% irrigation rate, total yield in 2018 29.6 c/ha, 26.7 c/ha in 2019, 27.4 c/ha in 2020 c/ha, 3-year average 27.9 c/ha, 70-70-60% irrigation

[13] Mehtiyev, T.V. Şəki-Zaqatala bölgəsinin payızlıq əkinlərində, alaq otlarının yayılması və növ tərkibinin öyrənilməsi // - Bakı: Azərbaycan Aqrar Elmi, - 2009, №6, - 188-190

rate total yield 27.1 c/ha in 2018, 24.9 c/ha in 2019, 2020 27.0 c/ha, 3-year average 26.3 c/ha; in the 90×40 cm food area with 70-80-50% irrigation rate, the total yield in 2018 is 29.8 c/ha, in 2019 27.3 c/ha, in 2020 28.8 c/ha, 3 -annual average 29.5 c/ha, with 70-80-60% irrigation rate, the total yield in 2018 is 32.7 c/ha, was achieved.

Thus, the final result of the research shows that after drying the wet leaf product obtained from common skins in a fire-drying chamber, the drying coefficient of the wet mass product was 14% on average. The highest average dry leaf yield in 2018-2020 was 29.5 c/ha in 70-80-50% irrigation norm in 90×40 cm food plot against the background of $N_{45}P_{120}$+20 tons of manure, 30 in 70-80-60% irrigation norm, 1 c/ha, 70-70-60% irrigation rate was 27.7 c/ha. This means 11.2% more product compared to other options.

4.5. The effect of the main cultivation methods on the weeding of the field. Weeds are a harmful and important major component of the flora. There are 56 types of weeds in the steppe conditions of Sheki-Zagatala economic district, i.e. 10.7% are early spring weeds, 23.2% are baby weeds, 8.9% are winter weeds, 3.65% are autumn weeds, 39.25% are perennials, 12.9% dicots, and 1.85% others are developing[14].

Experimental area were counted after the 1st, 2nd and 3rd cultivations of the replicates and the results are given in the following figure 4.5.

It can be seen from figure 4.5 that the highest number of weeds was in the background of $N_{45}P_{120}$+20 tons of manure. In a 120×40 cm food plot, the number of weeds up to the 1st cultivation at the 70-80-50% irrigation rate is 142, 69 at the 2nd cultivation, 31 at the 3rd cultivation, and at the 70-80-60% irrigation rate, the number of weeds at the 1st cultivation number 145, 76 until the 2nd cultivation, 36 untilthe 3rd cultivation, 70-70-60% irrigation rate, the number of

[14] Əhmədova, S.B. Gənc tələbə oğlanlar arasında siqaret şəkmə ilə depressiya arasında əlaqə: / klinik psixologiya üzrə mag. dissertasiyası) / - Bakı, 2016.-71 s.

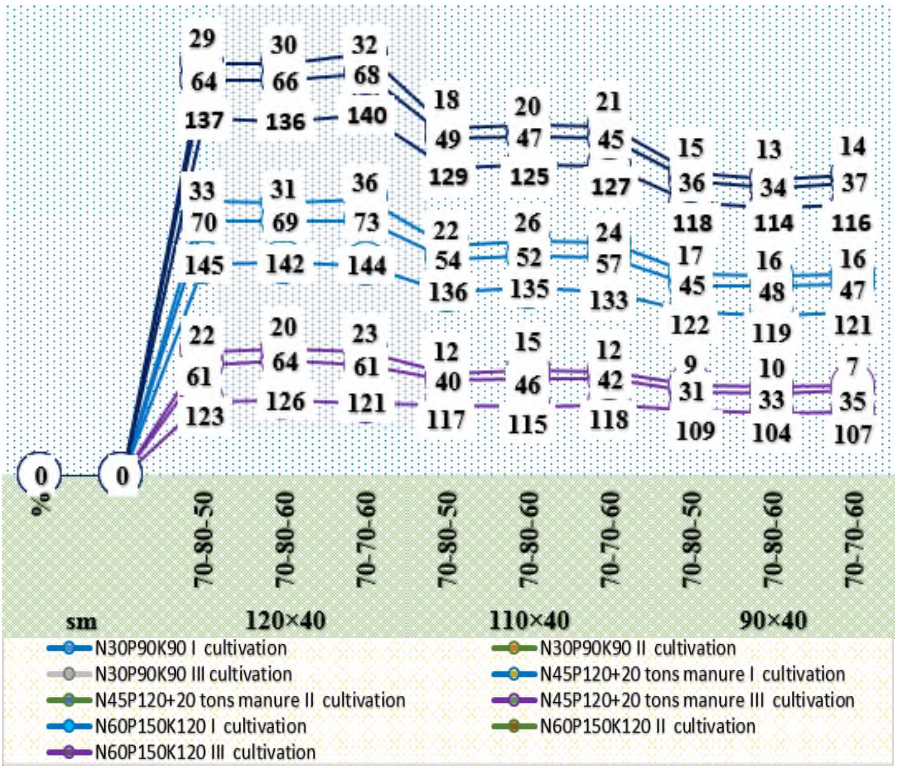

Figure 4.5. Effect of main cultivation methods on field weeding, in numbers (2018-2020 average)

weeds before the 1st cultivation 144, 73 before the 2nd cultivation, 36 before the 3rd cultivation; In the 110×40 cm food area, the number of weeds until the 1st cultivation at the 70-80-50% irrigation rate is 136, 54 at the 2nd cultivation, 22 at the 3rd cultivation, at the 70-80-60% irrigation rate, the number of weeds at the 1st cultivation number 135 pieces, 52 pieces before the 2nd cultivation, 26 pieces before the 3rd cultivation, 70-70-60% irrigation rate, the number of weeds before the ist cultivation 133 pieces, 57 pieces before the 2nd cultivation, 24 pieces before the 3rd cultivation; In the 90×40 cm food area, the number of weeds until the 1st cultivation at the irrigation rate of 70-80-50% is 122, 45 at the 2nd cultivation, 17 at the 3rd cultivation, at the irrigation rate of 70-80-60%, the weeds at

the 1st cultivation number of weeds was 119,48 until the 2nd cultivation, 16 until the 3rd cultivation, 70-70-60% irrigation rate, the number of weeds before the 1st cultivation was 121,47 before the 2nd cultivation, 16 before the 3rd cultivation. Thus, according to the final result of the conducted research, the amount of weeds in 1 m^2 area during the vegetation period was the highest among the options in the 120×40 cm nutrient area on the background of $N_{45}P_{120}$+20 tons of manure.

4.6. Effect of irrigation rates and nutritional conditions on quality parameters of Virginia-type tobacco variety. One of the most important stages of the research work is the determination of the quality indicators of the tobacco plant. Dry tobacco leaf contains 12 alkaloids with similar chemical structure[15].

Nicotine ($C_{10}H_{14}N_2$) was first discovered in 1828 by German chemists Wilhelm Posselt and Ludwig Reimann and named it "nicotine" in honor of the French doctor Jean Nicot de Villemayne, who played an important role in the spread of tobacco to Europe[15].

To determine the quality indicators of tobacco, the samples of dry leaves taken from the variants were crushed and passed through a 0.25 mm sieve. The chemical composition was determined in the laboratory of "European Tobacco Baku" OJSC, and the results are given in table 4.6.

Comparison of the figures of table 4.6 shows that 120×40 cm food area, 70-80-50% irrigation rate nicotine 2,7%, essential oil 2.0%, resin 6.4%, protein 10.1%, sugar 12.5%, ash 15.3%, Schmuck number 1.23%, 70-80-60% irrigation rate nicotine 2.6%, essential oil 2.1%, tar 6.8%, protein 10.0%, sugar 12.9%, ash 15.6%, Schmuck number 1.29%, 70-70-60 % of irrigation rate nicotine 2.6%, essential oil 2.2%, resin 6.7%, protein 9.7%, sugar 13.0%, ash 15.4%, Schmuck number 1.34%; 110×40 cm food area, 70-80-50% irrigation rate nicotine 2,6%, essential oil 1.7%, tar 6,1%, protein 10,0%, sugar 12,3%, ash 15,7%, Schmuck number 1,23%,70-80-60% irrigation rate nicotine 2,5%, essential oil 2,1%, tar 6,4%, protein

[15] Er, C., Mustafa Y. Keyf bitkileri. Ders kitabı. / C. Er, Y. Mustafa - Ankara: Ankara Universitesi Zirrat Fakultesi yayımları, - 2014. - 251 s.

10,1%, sugar 13,0%, ash 15,5%, Schmuck number 1.28%, 70-70-60% irrigation rate nicotine 2,5%, essential oil 1,9%, tar 5.7%, protein 9.7%, sugar 13.2%, ash 15.8%, Schmuck number 1.36%; 90×40 cm food area, 70-80-50% irrigation rate nicotine 2,1%, essential oil 1.7%, tar 5.8%, protein 9.9%, sugar 13,0%, ash 15.2%, Shmuck number 1,31%, 70-80-60%

Table 4.6. The effect of the main cultivation methods on the quality parameters of the Virginia type tobacco variety (in %)

Food area cm	Irrigaton norms %	$N_{30}P_{90}K_{90}$						
		Nikotin	Essential oil	Tar	Protein	Sugar	Ash	Schmuck number
120 × 40	70-80-50	2,9	2,2	6,6	10,3	12,5	16,0	1,21
	70-80-60	2,9	2,2	6,8	9,8	11,9	15,8	1,21
	70-70-60	2,9	2,3	6,9	9,7	12,4	15,9	1,27
110 × 40	70-80-50	2,7	2,2	6,5	9,7	12,0	15,8	1,23
	70-80-60	2,6	2,2	6,4	10,0	12,4	15,8	1,24
	70-70-60	2,9	2,2	6,1	9,4	12,6	15,7	1,29
90 × 40	70-80-50	2,6	2,1	6,1	9,5	12,3	15,5	1,29
	70-80-60	2,8	1,7	5,9	10,3	12,3	15,4	1,19
	70-70-60	2,5	2,1	6,0	9,4	12,5	15,6	1,32
$N_{45}P_{120}$+20 tons								
120 × 40	70-80-50	2,7	2,0	6,4	10,1	12,5	15,3	1,23
	70-80-60	2,6	2,1	6,8	10,0	12,9	15,6	1,29
	70-70-60	2,6	2,2	6,7	9,7	13,0	15,4	1,34
110 × 40	70-80-50	2,6	1,7	6,1	10,0	12,3	15,7	1,23
	70-80-60	2,5	2,1	6,4	10,1	13,0	15,5	1,28
	70-70-60	2,5	1,9	5,7	9,7	13,2	15,8	1,36
90 × 40	70-80-50	2,1	1,7	5,8	9,9	13,0	15,2	1,31
	70-80-60	2,0	1,6	5,6	9,9	13,5	15,0	1,36
	70-70-60	2,5	1,9	5,8	9,8	13,1	15,3	1,33

continuation table 4.6

$N_{60}P_{150}K_{120}$								
120 × 40	70-80-50	2,2	2,2	6,2	10,0	12,8	15,9	1,28
	70-80-60	2,7	2,0	6,5	10,1	12,6	15,7	1,25
	70-70-60	2,8	2,3	6,5	10,5	12,8	15,9	1,22
110 × 40	70-80-50	2,7	2,2	6,2	9,7	12,4	15,7	1,28
	70-80-60	2,5	2,7	5,9	10,2	12,4	15,9	1,21
	70-70-60	2,6	2,0	5,7	9,7	12,5	15,7	1,29
90 × 40	70-80-50	2,4	1,8	5,2	10,3	12,3	15,6	1,19
	70-80-60	2,2	1,4	5,3	10,0	12,5	15,3	1,25
	70-70-60	2,6	1,9	5,0	9,8	12,5	15,7	1,28

irrigation rate nicotine 2,0%, essential oil 1,6%, tar 5.6%, protein 9.9%, sugar 13,5%, ash 15,0%, Schmuck number 1,36, 70-70-60% irrigation rate nicotine 2,5%, essential oil 1,9%, tar 5.8%, protein 9,8%, sugar 13.1%, ash 15.3%, Shmuck number was 1.33%.

Thus, according to the final results of the study, Schmuck's number, which is an indicator of the quantity and quality of nicotine in dry tobacco leaves in all variants, corresponds to the international norm approved for Virginia-type tobacco varieties.

4.7. The effect of irrigation rates and nutritional conditions on the economic efficiency of the experiment. The profit indicator, which is the most important of the indicators of economic efficiency, is an important means of income for meeting the demand for increasing productivity, ensuring repeated production, and improving the living well-being of producers[16].

The economic efficiency of the experiment was calculated with reference to the 3-year figures obtained at the end of the study, and the obtained results are given in table 4.7.

The analysis of table 4.7 shows that the highest economic indicators are 4262.4 manats from the sale of 22.2 s/ha of dry leaf

[16] İbrahimov, İ. Aqrar sahənin iqtisadiyyatı. Monoqrafiya. / İ. İbrahimov. - Bakı: [n.y.], -2016. – 656 s.

products in a 120×40 cm food field with 70-80-50% irrigation rate on the background of $N_{45}P_{120}$+20 tons of manure, 1 hectare of land the goods and materials required for cultivation are 1826.0 manats in total, the net income from one hectare is 2436.4 manats, the cost of one kilogram of the product is 0.82 manats, the profitability is 133.4%, 24.3 at 70-80-60% irrigation rate c/ha from the sale of dry leaf products is 4665.6 manats, the goods and materials required for the cultivation of 1 hectare are 1826.0 manats in total, the net income from one hectare is 2839.6 manats, the cost of one kilogram of the product is 0.79 manats, the profitability is 155,5%, 4780.8 manats from the sale of 24.9 c/ha of dry leaf products at 70-70-60% irrigation rate, 1826.0 manats for goods and materials required for cultivation of 1 hectare area, net income from one hectare area is 2954, 8 manats, the cost of one kilogram of the product is 0.73 manats, the profitability is 161.8%; 5068.8 manats from the sale of 26.4 c/ha of dry leaf products in the 110×40 cm food plot, 1865.0 manats for the goods and materials required for the cultivation of 1 hectare area, net income from 1 hectare area at 70-80-50% irrigation rate 3203.8 manats, the cost of one kilogram of the product is 0.71 manats, the profitability is 171.7%, 5356.8 manats from the sale of 27.9 c/ha of dry leaf products at the irrigation rate of 70-80-60%, required for the cultivation of 1 hectare of land 1865 in total to goods and materials manats, net income from one hectare area is 3491.8 manats, the cost of one kilogram of the product is 0.66 manats, profitability is 178.2%, 5049.6 manats from the sale of 26.3 s/ha of dry leaf products at 70-70-60% irrigation rate, the goods and materials required for the cultivation of 1 hectare are 1865.0 manats in total, the net income from one hectare is 3184.6 manats, the cost of one kilogram of the product is 0.70 manats, profitability 170.7%; 5683.5 manats from the sale of 29.5 c/ha of dry leaf products in the 90×40 cm food plot, 2018.0 manats for the goods and materials required for the cultivation of 1 hectare of land, net income from one hectare of land at 70-80-50% irrigation rate 3652.5 manats, the cost of one kilogram of the product is 0.68 manats, the profitability is

Table 4.7.

The effect of irrigation rates and nutrition conditions on the economic efficiency of the experiment, (in %)

Food area	Irrigation norms	$N_{30}P_{90}K_{90}$					
		producti-vity	general income	cost incurred 1ha	net income	cost price	profita-bility
sm	%	c/ha	mans	mans	mans	man	%
120 × 40	70-80-50	19,8	3801,6	1826,0	1975,6	0,92	108,2
	70-80-60	20,9	4012,8	1826,0	2186,8	0,87	119,8
	70-70-60	21,7	4166,4	1826,0	2340,4	0,84	126,5
110 × 40	70-80-50	21,9	4204,8	1865,0	2339,8	0,85	125,5
	70-80-60	23,7	4550,4	1865,0	2685,4	0,78	143,9
	70-70-60	22,8	4377,6	1865,0	2512,6	0,82	134,7
90 × 40	70-80-50	24,1	4627,2	2018,0	2609,2	0,95	129,2
	70-80-60	25,9	4972,8	2018,0	2954,8	0,78	146,4
	70-70-60	25,6	4915,2	2018,0	2897,2	0,79	144,0
$N_{45}P_{120}$+20 tons manure							
120 × 40	70-80-50	22,2	4262,4	1826,0	2436,4	0,82	133,4
	70-80-60	24,3	4665,6	1826,0	2839,6	0,73	155,5
	70-70-60	24,9	4780,8	1826,0	2954,8	0,73	161,8
110 × 40	70-80-50	26,4	5068,8	1865,0	3203,8	0,71	171,7
	70-80-60	27,9	5356,8	1865,0	3491,8	0,66	178,2
	70-70-60	26,3	5049,6	1865,0	3184,6	0,70	170,7
90 × 40	70-80-50	29,5	5683,5	2018,0	3652,2	0,68	180,9
	70-80-60	30,1	5779,2	2018,0	3761,2	0,67	186,3
	70-70-60	27,7	5318,4	2018,0	3300,4	0,72	163,5
$N_{60}P_{150}K_{120}$							
120 × 40	70-80-50	21,5	4128,0	1826,0	2302,0	0,84	126,1
	70-80-60	22,8	4377,6	1826,0	2551,6	0,80	139,2
	70-70-60	23,8	4569,6	1826,0	2743,6	0,76	150,3
110 × 40	70-80-50	24,6	4723,2	1865,0	2858,2	0,75	153,2
	70-80-60	26,2	5030,4	1865,0	3165,4	0,71	159,7
	70-70-60	25,5	4896,0	1865,0	3031,0	0,73	158,5
90 × 40	70-80-50	25,8	4953,6	2018,0	2935,6	0,78	145,4
	70-80-60	27,6	5299,2	2018,0	3281,2	0,73	160,6
	70-70-60	26,8	5145,6	2018,0	3127,6	0,75	155,0

180.9%, 4993.5 manats from the sale of 30.1 s/ha of dry leaf products at the irrigation rate of 70-80-60%, the requirement for cultivating 1 hectare of land in total 2018.0 manats, net income from one hectare area is 3761.2 manats, cost of one kilogram of product is 0.67 manats, profitability is 186.3%, 27.7 c/ha at 70-70-60% irrigation rate 5318.4 manats from the sale of dry leaf products, 2018.0 manats for the goods and materials required for the cultivation of 1 hectare, net income from one hectare is 3300.4 manats, the cost of one kilogram of the product is 0.72 manats, the profitability is 163.5% organized.

Thus, according to the results of the research, a high profitability percentage was obtained against the background of $N_{45}P_{120}$+20 tons of manure. So, an average of 2018.0 mants was spent on the cultivation of the experimental area. Taking into account that the average purchase price of I, II, and III types of dry tobacco is 1.92 manats, a net income of 3281.2 manats was obtained. Profitability was 186.3%. In general, the profitability in all options is higher than the 100% threshold.

Conclusions

The final results of the research conducted in 2018-2020 are as follows:

1. According to the results of phenological observations, the vegetation period on the background of $N_{45}P_{120}$+20 tons of manure was extended by 12-14 days compared to other options;

2. The highest percentage of seedling retention in the background of $N_{45}P_{120}$+20 tons of manure in the 90×40 cm food area is 99.4% in the irrigation norm of 70-80-60%, in the same background the height dynamics is 266.4 cm in the 120×40 cm food area, the number of leaves is 33,2 units, the area is 1468 cm^2, and the number of flowers is 227.0 units;

3. On the background of $N_{45}P_{120}$+20 tons of manure, in a 90×40 cm nutrient plot, at 70-80-60% irrigation rate, the wet mass yield was 215.0 c/ha and the dry leaf yield was 30.1 c/ha;

4. The highest yield of the commodity type $N_{45}P_{120}$+20 tons of manure in the 90×40 cm food area at 70-80-60% irrigation norm 30.1 s/ha of the total yield 65.9% of the first type, 25.2% the second type, and 9.0% were sorted as the third type;

5. The number of weeds was 145 before the 1st cultivation, 76 before the 2nd cultivation, and 36 before the 3rd cultivation in the 120×40 cm food area against the background of $N_{45}P_{120}$+20 tons of manure at the 70-80-50% irrigation norms;

6. The Shmuk number, which is considered the main quality indicators, was 1.36%, and the profitability was 162.7% in the 90×40 cm nutrient field against the background of the highest $N_{45}P_{120}$+20 tons of manure at the rate of 70-80-60%.

Recommendations for breeders and producers

The following is recommended to private institutions and farmers engaged in tobacco growing in the territory of the republic, regardless of economic regions:

1. It is more appropriate to keep the field moisture capacity (FMC) in the soil after irrigation in the norm of 70-80-60% on average.
2. Due to the fact that the dry leaf yield and quality indicators of tobacco are high against the background of $N_{45}P_{120}$+20 tons of manure, this norm should be given wider preference.
3. The 90×40 cm sowing scheme, which is an alternative to the 70×30 and 70×45 cm sowing scheme, is recommended to be widely used in farms.

List of ublished scientific works on the topicof the dissertation

1. Kazimov, G.A. The influence of cultivation methods on the development and productivity of seedlings of the Virginia-type "Kokker 347" tobacco variety // - Baku: Collection of Scientific Works of the Agricultural ET Institute, - 2019. C. 1(30), No. 2, - p. 82-87.

2. Kazimov, G.A. Productivity indicators of the tobacco plant in the irrigation conditions of the Sheki-Zagatala region for 2018-2019 // Materials of the online scientific and practical conference "Sustainable development of agriculture: global implications and reforms implemented in Azerbaijan" held at the Agrarian Research Center. - Baku: - December 15, - 2020, - p. 93-98.
3. Kazimov, G.A. The role of various agromethods in increasing tobacco productivity in the irrigation conditions of Sheki-Zagatala region // Materials of the international scientific-practical conference on "Modern problems and innovative concepts of animal husbandry" dedicated to the 90th anniversary of the establishment of the Livestock Scientific Research Institute and the 120th anniversary of the birth of Academician Firuz Malikov, - Goygol: - December 22 - 24, - 2021. - p. 372-377.
4. Kazimov, G.A. The role of organic fertilizers in the purchase of organic tobacco products by saving irrigation water in the Sheki-Zagatala region // Materials of the republican scientific conference held at the Western Caspian University on "New directions of agricultural development and environmental protection", - Baku: - January 30, - 2021. - etc. 407-414.
5. Kazimov, G.A. Jumshudov I.M. General characteristics of the soils of Sheki-Zagatala region (in the example of Sheki DM) // Azerbaijan national academy of sciences division of biological and medical sciences institute of soil Science and Agrochemistry International Scientific-Practical Conference "Soil-ecological problems of agrocenoses and ways to solve them", - Baku: - 3-4 June, - 2021, - p. 50-54.
6. Kazimov, G.A. Scientific methods of increasing the yield of aromatic tobacco (Virginia) in the irrigation conditions of Sheki-Zagatala region // - Baku: News of Azerbaijan Pedagogical

University, Mathematics and natural sciences series, - 2022. C.70, 4, - p. 68-75.
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10. Kazimov G.A. Influence of different doses of fertilizers on growth dynamics and tobacco yield // - Ural, Russia: Agrarny vestnik Urala, - 2022. No. 03 (218), - p. 2-12. DOI: 10.32417/1997-4868-2022-218-03-2-12.
11. Kazimov G.A. Influence of various methods of cultivation on the quantity of leaves, green mass and yield of dry leaves of aromatic tobacco varieties of Virginia type // - Volgograd: Izvestiya Nizhnevolzhskogo agrouniversitetskogo complex: science and higher professional education, Volgograd GAU, - 2023. №1(69), - p. 303-314. DOI: 10.32786/2071-9485-2023-01-322023.

12. Kazimov G. A., Akhmedov Sh. G. Изучение influence of soil processing before sowing tobacco and methods of cultivation on productivity in the conditions of irrigation of Sheki-Zakatalskogo economic district // Rostov-on-Don: Vestnik Donskogo GAU. Общее земледелие и растениеводство, - 2023. №1(47), - p. 36-46.
13. Kazimov G.A. Cultivation methods affecting the yield and profitability of tobacco on fully saturated soils // Collection of materials of the 3rd International Scientific and Practical Conference "Scientific support of technological development and increasing competitiveness in the food and processing industry". Kubansky branch of FGBNU «ФНЦ пищевых систем им. V.M. Горбатова» РАН, - Краснодар, Россия: - 28-29 ноября, - 2023, - с. 371-375.
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