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ABSTRACT

of the dissertation for the degree of Doctor of Philosophy

STUDY OF SİDERATE PLANTS İN İNCREASİNG SOİL FERTİLİTY AND COTTON CROP PRODUCTİVİTY İN GANJA-GAZAKH REGİON

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Field of science: **Agrarian sciences**
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Ganja – 2024

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GENERAL DESCRIPTION OF THE RESEARCH

Relevance and degree of completion of the topic. Cotton-growing played a great role in the economy of our republic and was the main source of income for the population in the lowlands. Cotton is a technical plant of strategic importance. Fiber, its main product, is in constant demand in the world market. One of the most important factors in obtaining a stable, high yield from cotton is soil fertility. Proper organization of the plant's diet also depends on this factor. Even the optimal application of mineral fertilizers does not solve the problem of increasing productivity and increasing soil fertility. The experience of developed countries in the field of agriculture and the results of research show that high yields of mineral fertilizers can be obtained on fertile soils. That is, the soil must contain a large amount of organic matter, trace elements, and beneficial microorganisms, various enzymes that activate microbiological processes, normalize and optimize the nutritional, thermal and water-physical properties of the soil. This can be achieved by regular application of plant residues and organic fertilizers to the soil.

The "State Program for the development of cotton growing in the Republic of Azerbaijan for the years 2017-2022" approved by the decree of Mr. President I. H. Aliyev dated July 13, 2017 is aimed at strengthening the state support for cotton growing and solving problems in this field[1].

However, in recent times, there are many common problems for the world's cotton producers, including decreasing economic profitability, increasing energy use in agriculture, increasing greenhouse gas emissions, drought and salinity, decreasing water quantity and quality, etc.[2]

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[1] Aliyev, I.H., State Program for the development of cotton cultivation in the Republic of Azerbaijan for 2017-2022: [electronic resource] / official website of the President of the Republic of Azerbaijan. July 13, 2017. URL: https: //president.az/articles

[2] Elchin N. The relationship between sustainable agriculture and the environment in Azerbaijan / Doctoral thesis in the field of agricultural economics / Bursa - 2021, p. 72-76

Also, chemically applied annual neutral salt fertilizers increase the salinity of the soil and thus adversely affect the yield and quality of the plant. In addition, toxic elements such as cadmium, lead, nickel, arsenic and copper are released into the soil from fertilizers and pesticides used in agriculture. These heavy metals are mainly formed due to phosphorus fertilizers and the raw materials of these fertilizers.

Plants can develop carcinogenic substances such as nitrosamines in soils where high levels of nitrogen fertilizers are used. The increase in the use of nitrogen fertilizer can lead to the release of ammonia and nitrogen oxide gases, which have a negative effect on the air. An increase in the amount of nitrogen monoxide gas entering the atmosphere leads to the destruction of the ozone layer. Since 2000, greenhouse gases released into the atmosphere due to the use of chemical fertilizers have been increasing in Azerbaijan, and this increase has gained a sharp growth rate after 2013.

According to the law of the Republic of Azerbaijan, taking into account the needs of future generations, in order to meet the socio-economic requirements of the society, it should be based on the efficient and economical use of natural resources without disturbing the ecological balance of the environment[3].

One of the urgent problems is the development of alternative farming systems and new cultivation agrotechnologies in order to obtain ecologically clean products in rural areas from the point of view of environmental and soil protection. Siderate plants-green fertilizers play an important role in increasing soil fertility. Research in world agriculture shows that, the most reliable way to increase soil fertility and cotton productivity is the application of green manures. Therefore, in today's globalized world, there is a great need to create new biological farming systems in agriculture. From the point of view of environmental and soil protection, the development of alternative farming systems and new cultivation technologies to

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[3] The Law of the Republic of Azerbaijan on Environmental Protection / [electronic resource]/ https://www.e-ganun.az/framework/3852

obtain ecologically clean products in agriculture is one of the urgent problems.

The purpose and tasks of the research. Given the urgency of the problem, the main purpose of the study is to develop effective alternative agro-technological methods to obtain high-quality products from cotton and increase soil fertility in gray-brown (chestnut) soils, poorly supplied with nutrients in the Ganja-Gazakh region.

The study aims to study the following issues: 1) Study of agrochemical, physicochemical and water-physical properties of the soils of the experimental field; 2) To study the effect of siderate plants on the agrochemical, water-physical indicators of the soil and the degree of soil fragmentation; 3) Study of biomass, chemical composition and amount of nutrients entering the soil of cotton, barley, autumn peas; 4) To study the effect of siderate plants, mineral fertilizers on the height and development of cotton plants in terms of growth phases; 5) Study of the effect of siderate plants, mineral fertilizers on cotton productivity, economy and quality indicators; 6) Determining economic efficiency.

Research methods. Ganja-114 variety of cotton plant was taken as the object of research. The goal was achieved experimentally. Experimental studies were carried out in the field, and soil and plant samples were analyzed using laboratory methods.

Main points presented to the defense of the dissertation: The dissertation consists of the results of the scientific-theoretical points on the following scientific research:

-Agrochemical, physicochemical and water-physical properties of the soils of the experimental area; -Biomass, chemical composition and nutrients of cotton and siderate plants; -Effect of soil mass buried in soil on soil moisture, volume, porosity and degree of fragmentation; -Depending on siderate plants and mineral fertilizers, the height, development, productivity and quality of the cotton plant; - Economic efficiency.

Scientific novelty of the research. For the first time in the study, siderate plants were identified in irrigated gray-brown

(chestnut) soils to obtain high and quality raw cotton products from Ganja-114 variety of cotton plant. Due to the influence of siderate plants buried in the soil, the agrochemical, water-physical properties of the soil improved, productivity and product quality indicators increased.

Theoretical and practical significance of the research. When the surface mass of cotton, barley and autumn peas were chopped and buried together, an average of 39.4 s/ha of raw cotton was obtained in 3 years, the increase was 14.7 s/ha or 60.0% compared to the control option.

The results of field experiments were applied in 2020 on an area of 2 hectares in Fakhrali village of Goranboy region. As a result of application, due to the influence of siderate plants, the yield of raw cotton increased to 38.5 s/ha, and the net income was 1150.5 man/ha.

Approbation and application of the work. Results of the research Proceedings of the 8th International Scientific-Practical Conference on "Development of agricultural science, food security and international cooperation in environmental protection" Volume II (Ganja, October 3-04, 2016); Proceedings of the Republican Scientific Conference on "Actual problems of soil science" of the Institute of Soil Science and Agrochemistry (Baku, December 21-22, 2017); "Scientific works of ASAU" (Ganja-2018, №1); International Scientific Conference on "Actual problems of modern natural and economic sciences" (Ganja, 04-05 May 2018); Materials of the Scientific-Practical Conference of young researchers on "Study of the scientific heritage of Academician Jalal Aliyev" dedicated to the 90th anniversary of Academician Jalal Aliyev (Ganja 28.09.2018); Materials of the Republican Scientific-Practical Conference on "Academician Jalal Aliyev and genetic resources of biological diversity" dedicated to the 90th anniversary of Academician Jalal Aliyev (Ganja 30.11.2018); Materials of the scientific-practical conference dedicated to the 100th anniversary of ASAU on "Development of cotton growing in Azerbaijan: achievements and prospects" (Ganja, December 5, 2019); from foreign publishers: Multidisciplinary Scie¬ntific Edition International Academy Journal,

Web of Scholar 5 (14), (August 2017 RS¬ Global Media LLC, Kiev, Ukraine); Multidisciplinary Scientific Edition International Academy Journal Web of Scholar 9 (18), Vol.1, (December 2017 Scientific Educational Center Warsaw, Poland); Economic And Social Analysis Journal "The Cau¬casus" (Georgia, Tbilisi October 2018); Eurasian Scientific Congress Abstracts of III International Scientific and Practical Conference (Barcelona, Spain 22-24 March 2020); Scientific journal "Globus" multidisciplinary collection of scientific publications "Achievements and problems of modern science" (St. Petersburg 7 (53) August 3, 2020); Scientific-theoretical and production journal "Agrarian Science" (International publication of the International Council on Agrarian Science and Information of the CIS countries Volume 342, № 10.2020); Abstracts of IV International Scientific and Practical Conference (London, United Kingdom 11-13 November 2020), Turkish Journal of Computer and Mathematics Education (Trabzon, Turkey 2021).

Name of the organization where the dissertation was performed: The dissertation work was completed in Ganja Regional Agrarian Science and Innovation Center of the Ministry of Agriculture of the Republic of Azerbaijan.

Total volume of the dissertation in characters with an indication of the separate volumes of the structural units. The main part of the work includes an introduction, 5 chapters, conclusions, recommendations for breeders and producers, a list of 208 references, and appendices. The dissertation contains 28 tables, and 36 appendices and 3 pictures. In the introduction-6 pages with 11789 characters, the first chapter-17 pages with 36547 characters, the second chapter-18 pages with 26911 characters, the third chapter-10 pages with 17465 characters, the fourth chapter-50 pages with 39612 characters, the fifth chapter-38 pages with 45743 characters, conclusions-2 pages with 5650 characters, recommendations for breeders and producers 1 page with 1031 characters, the list of references 23 pages with 38933 characters. The total volume of the dissertation is 208 pages, the general part of the text (excluding

pictures, tables, appendices, and list of references) consists of 105 pages of computer typing or 207407 characters.

CONTENT OF THE WORK

The introductory part of the dissertation gives a brief description of the relevance of the work, its importance for science and practice.

The first chapter is "Literature Review", and this chapter briefly comments on the literature collected on research in this field in many foreign countries, in our country, as well as in the Ganja-Gazakh region.

The second chapter "Importance, origin, distribution, botanical description, biological features, requirements of external environmental factors and development of cotton growing in Azerbaijan" here description (Gossypium hirsutum L.) and biological characteristics, flower groups, cones, type of bush and leaf, information on heat, light, soil, water and nutrient requirements.

The third chapter reflects the "soil-climatic conditions of the study area, the object and methodology of the study, the agrochemical, physicochemical and hydro-physical properties of the soils of the experimental area".

To study the effect of organic and organic-mineral fertilizer norms on the productivity, quality and nutrient balance of cotton plants, field experiments were conducted in 2016-2019 in gray-brown (chestnut) soils in Samukh region.

The experiment is set out in the following scheme:

1) Control (each year the rest of the cotton *(remaining of cotton bush or straws after has been collected)* is taken out from the field); 2) $N_{90}P_{120}K_{90}$ (each year the rest of the cotton) is taken out from the field); 3) Every year the rest of the cotton cut in autumn and given to the main plow; 4) Before the last vegetation irrigation, barley is sown and in December the whole surface mass, together with the rest of the cotton is chopped and given to the main plow; 5) Autumn peas are sown before the last vegetation irrigation, and in December the whole surface mass is cut together with the rest of the cotton and

given to the main plow; 6) Before the last vegetation irrigation, autumn peas are sown in a mixture of barley and lice, and in December, all the above-ground mass is chopped along with the rest of the cotton and given to the main plow.

Field experiments were carried out in 4 repetitions with Ganja-114 variety of cotton plant, the total area of each variant was 120.0 m2 (40 x 3m), in the sowing scheme of 60x15 (1 plant) cm by row method, in the 2nd decade of April (50 kg per hectare seeds) were carried out. Barley was sown at 100 kg / ha and peas at 60 kg / ha. Mineral fertilizers in the form of nitrogen-ammonium nitrate (34.7%), phosphorus-simple superphosphate (18.7%) and potassium-potassium sulfate (46%), phosphorus and potassium 80% under plowing in autumn, the remaining 20% was fed, and nitrogen was given twice. Agro-technical measures adopted for Ganja-Gazakh region were carried out in the field of practice.

Irrigation of cotton in the study area was carried out in the traditional way, in three irrigation modes. The first irrigation was carried out on the eve of the flowering phase, the second irrigation was carried out depending on the water capacity of the soil, the period between irrigations was not more than 14-17 days, and the third irrigation was carried out in the 1st decade of August.

The variety was regionalized in the republic in 2014. The authors of the variety are A. A. Tagiyev, M. I. Rzayeva, T. K. Burjaliyeva, S. R. Aliyeva, D. G. Aliyeva. The variety was created by the method of experimental mutagenesis by multiple-directional selection from the Mutant-4/11 form Ganja-114 cotton variety belongs to *G.Hirsutum L.* medium fiber type[4].

To study the agrochemical and physicochemical properties of the soils of the experimental field, 0-30 in the form of an envelope from 5 places of the field before the experiment; 30-60; Soil samples were taken and analyzed from 60-100 cm layers. During the budding, flowering and harvesting of cotton plants, plant samples and mixed

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[4] Tagiyev, AA, Ganja-114: [electronic resource] / Scientific Research Institute of Plant Protection and Technical Plants. 2020. URL: https://www.bmtbeti.az/en/opennews/663.html

soil samples from 0-30 and 30-60 cm layers were taken from 3 places (beginning, middle and end) of the section from I and III repetitions, air-dried, ground and analyzed by laboratory methods.

Results of field experiments, calculation of productivity, accuracy of experiment and mathematical analysis of correlative relations B.A. Dospekhov, V. N. Peregudov, P. N. Konstantinov and economic efficiency were carried out by N. N. Baranov methods.

In order to determine the amount of nutrients in the field, the potential reserve nutrients of the soil, total humus, nitrogen, phosphorus, potassium, and effective fertility — nutrients that are easily assimilated by the plant-were identified before the experiment. Analysis of soil samples shows that gray-brown (chestnut) soils are not highly supplied with assimilated forms of nitrogen, phosphorus and potassium. The pH was 7.8 in the 0-30 cm layer in the aqueous solution, and 8.2 in the 60-100 cm layer in the lower layers. Total humus, nitrogen, phosphorus and potassium in a layer of 0-30 cm, respectively are 2.13; 0.17; 0.18; 2.53%. However, it gradually decreased to the lower layers, 0.88 in the 60-100 cm layer,

respectively; 0.05; 0.07; 1.75%. Easily hydrolyzed nitrogen 113.5-20.3, mobile phosphorus 18.5-4.5; exchangeable potassium fluctuated between 275.5-105.3 mg /kg;

Due to the gradation accepted in our republic, these lands are poorly supplied with nutrients. Therefore, the combined application of organic and organic-mineral fertilizers is very important for the growth, development, high yield and maintenance of soil fertility of cotton in these soils.

The fourth chapter is devoted to "The effect of siderate plants on the water-physical properties of the soil, the amount of nutrients entering the soil and the degree of soil fragmentation." Soil samples were taken from three depths (0-10, 10-20 and 20-30 cm) at the beginning and end of the vegetation in two stages. Siderate crops (mixed with autumn peas before the last vegetation irrigation, and in December the whole surface mass, along with the rest of the cotton *is* chopped and fed under the main plow) had a significant effect on the water-physical properties of the soil under the cotton plant had a

significant impact on the change of water-physical properties of the soil, and the total porosity of the soil increased, and the volume mass (density) decreased significantly. Thus, at the beginning of the vegetation, in the control layer of 0-30 cm of soil layer (each year the rest of the cotton is taken out from the field) the moisture content is 15.6- 16.1%, the volume weight is 1.29-1.31 g/cm^3, the total porosity is 51, 05-51.81%, 11.7-12.2% at the end of the growing season, respectively; 1.32-1.34 g/cm^3 and 49.69-50.43%. Under the influence of mineral fertilizers and chopped plowed siderate plants, the volume mass decreased at the beginning and end of the growing season, and the moisture and total porosity increased. Against the background of mineral fertilizers in the variant $N_{90}P_{120}K_{90}$ (each year the rest of the cottonis taken out from the field). at the beginning of vegetation in the layer of 0-30 cm moisture content is 16.0-16.5%, volume weight is 1.26-1.28 g / cm3 and total porosity is 52, 18-52.68%, moisture at the end of vegetation 12.2-12.7%, volume weight 1.29-1.31 g/cm^3 and total porosity 50.80-51.56%, year-round cut and plowed version Moisture in the layer of 0-30 cm at the beginning of vegetation is 16.5-17.2%, volume weight is 1.24-1.26 g/cm^3 and total porosity is 52.93-53.56%, moisture at the end of vegetation is 12.7- 13.2%, volume weight 1.27-1.29 g / cm^3 and total porosity 51.68-52.43%, barley sown between rows before the last vegetation irrigation, along with the surface mass, chopped and plowed in December, 0-30 cm at the beginning of vegetation Moisture in the layer is 17.1-17.7%, volume weight is 1.23-1.24 g / cm^3 and total porosity is 53.43-54.06%, humidity at the end of vegetation is 13.3-14.4%, volume mass 1.25-1.28 g/cm^3 and total porosity 51.93-53.18%, sown between rows before the last vegetation irrigation In the variant of plowing, chopped and plowed in December with the surface mass of autumn peas, at the beginning of the vegetation in the layer of 0-30 cm moisture 17.5-18.3%, volume weight 1.21-1.23 g/cm^3 and total porosity 53.93-54 , 81%, moisture at the end of vegetation 13.6-14.2%, volume mass 1.23-1.26 g/cm^3 and total porosity 52.81-53.93%, minimum volume weight, high humidity and porosity Autumn peas sown with barley between the rows before the last

vegetation irrigation were observed in the chopped and plowed variant in December together with the surface mass. At the beginning of the vegetation, the moisture in the 0-30 cm layer was 19.6-20.1%, volume weight was 1.18-1.20 g/cm^3 and total porosity is 54.93-55.68%, moisture at the end of vegetation is 16.0-16.7%, volume weight is 1.20-1.22 g/cm^3 and total porosity is 54.18-54.93% has done. Autumn peas sown with barley between rows before the last vegetation irrigation, along with the surface mass of cotton, chopped and plowed in December, the volume weight decreased by 0.10-0.14 g/cm^3 in 0-30 cm layer, moisture and total porosity 4.3-4.5 % and 3.75-5.24% control (each year the rest of the cotton is taken out from the field) increased relative to the option.

From the agronomic point of view, the best soils are considered to be in size 10...<10 mm. According to the results obtained, in the control variant (each year the rest of the cotton is taken out from the field) in the soil layer of 0-30 cm the particles with the size of 10...<10 mm were 51.75-56.02%. Due to the effect of mineral fertilizers and chopped plowed siderate plants, the particle size of 10...<10 mm increased significantly. Thus, in the variant $N_{90}P_{120}K_{90}$ (each year the rest of the cotton is taken out from the field) it was 57.47-58.34%. In December of each year, 10...<10 mm particles of 59.51-61.89% in the 0-30 cm soil layer in the cut-and-plowed variant, with barley surface mass sown between the rows before the last vegetation irrigation 10...<10 mm particles in the 0-30 cm layer in the chopped and plowed variant in December together 62.52-64.42%, in the variant chopped and plowed in December together with the surface mass of autumn peas sown between the rows before the last vegetation irrigation 0 In the -30 cm layer, particles with a size of 10... <10 mm are 64.66-66.89% and the highest amount of particles with a size of 10...<10 mm is sown with barley between the rows before the last vegetation irrigation. Autumn peas together with the surface mass in December were 67.46-70.68% in the chopped and plowed variant. Thus, siderate plants had a significant effect on the degree of fragmentation in the soil layer of 0-30 cm under the cotton plant. In the 0-30 cm layer of soil at the end of the vegetation,

the amount of particles with a size of 10...<10mm increases by 11,44-18,93 % compared to the control variant in the variant chopped and plowed in December with barley before the last vegetation irrigation.

Analysis of the biomass, chemical composition and amount of nutrients entering the soil of cotton and siderate plants shows that the annual mass of cotton is 65.8-77.3 s/ha, the total nitrogen in the surface mass is 0.68-0.88%, total phosphorus 0.38-0.62%, total potassium 0.88-1.25%, NPK entering the soil 44.7-68.0, respectively; It was between 25.0-48.5 and 58.0-96.6 kg / ha.

Green mass of barley 68.6-97.6 s/ha, dry matter in green mass 19.5-20.7%, dry mass 13.4-20.7 s/ha, total NPK in dry mass 0.47-0, 58%; 0.18-0.25% and 0.95-1.08%, NPK entering the soil 6.3-11.3, respectively; 2.4-4.9 and 12.7-21.2 kg/ha.

Green mass of autumn peas is 45.2-55.3 s / ha, dry matter in green mass is 19.8-21.8%, dry mass is 9.0-12.1 s / ha, according to NPK entering the soil is 10.4 -14.0; 2.6-4.0 and 4.0-6.4 kg/ha.

Thus, when the surface mass of autumn peas and cotton sown together with barley before the last vegetation irrigation was chopped and plowed in December, the nitrogen entering the soil was 61.4-87.5 kg/ha, phosphorus 30.0-54.3 kg/ha and potassium fluctuated between 74.7-116.2 kg/ha. This shows that without the use of mineral fertilizers, it is possible to increase soil fertility and increase productivity by sowing autumn barley and peas in the rows of cotton before the last vegetation, and at the end of the growing season by cutting and plowing the surface mass with cotton.

The fifth chapter deals with the "Impact of siderate plants on the development, productivity, quality and economic efficiency of cotton plants." Under the influence of mineral fertilizers and plowed plants, height and development indicators have increased significantly in each of the development phases.

As can be seen from the table, the highest amount of height and development indicators is observed in the 2nd and 6th variants, and the average of 2 years in the 2nd variant according to the development phases, respectively: height in budding 31.1 cm,

sympodial branches 6.5 pieces, buds 6.1 pieces; height at flowering 47 cm, sympodial branches 10.8 pieces, buds 11.9 pieces, cones 5.3 pieces and at maturity 107.1 cm, 16.1 pieces, 8.4 pieces, 6.4 pieces respectively; In the 6th variant, the height in budding is 31.1 cm, sympodial branches are 6.5, buds are 6.1; The height at flowering was 47 cm, sympodial branches 10.8 pieces, buds 11.9 pieces, cones 5.3 pieces and at maturity 107.1 cm, 16.1 pieces, 8.4 pieces, 6.4 pieces respectively.

Table 5.1.1.

The effect of siderate plants and mineral fertilizers on the growth and development of cotton (217-2019, average of 3years)

Options for practice	Budding			Blossom				Ripening			
	Height, sm	Sympodial branchs	Buds	Height, sm	Sympodial branchs	Buds	Cones	Height, sm	Sympodial branchs	Buds	Cones
					In one plant, piece				In one plant, piece		
1st (control)	19,7	4,0	3,7	29,7	6,5	7,6	3,2	82,9	10,1	5,2	4,0
2nd	33,2	6,6	6,4	49	10,9	12,6	5,3	108,5	16,5	8,5	6,3
3rd	23,3	4,5	4,4	35,3	7,7	8,9	3,9	92,1	11,6	6,0	4,7
4th	26,2	5,3	5	40,6	8,9	10,2	4,4	96,5	13,1	6,7	5,4
5th	28,8	5,6	5,4	42,9	9,5	11,2	4,8	101,9	14,5	7,6	5,8
6th	31,1	6,5	6,1	47	10,8	11,9	5,3	107,1	16,1	8,4	6,4

Thus, biomass and mineral fertilizers buried in the soil have a significant impact on the growth and development of cotton plants in the developmental phases. In the second variant, at the end of the vegetation, the height is 25.6 cm, the sympodial branches are 6.4, the cones are 3.3, and the open cones are 2.3; In the 6th variant, the height is 24.2 cm, the sympodial branches are 6, the cones are 3.2, and the open cones are 2.4, which is higher than in the control variant. $P = + 0.994 \pm 0.005$, $r = + 0.975 \pm 0.010$ between the height (cm) of raw cotton product (s / ha), $p = + 0.975 \pm 0.010$, between sympodial branches (pieces) of raw cotton product (s / ha) under the influence of siderate plants and mineral fertilizers $= + 0.993 \pm 0.006$, $r = + 0.993 \pm 0.006$, there is a strong correlation between the raw cotton product (s / ha) and the number (number) of cones per plant,

$p = + 0.979 \pm 0.020$, $r = + 0.987 \pm 0.011$ and these relationships have changed over the years.

Our research shows that siderate plants and mineral fertilizers have a significant effect on the productivity of cotton plants (Table 5.2.1). Productivity of cotton plant on average for 3 years the raw cotton yield was 24.7 s/ha in the control variant. Under the influence of mineral fertilizers and chopped plowed crops, the yield of raw cotton has increased significantly.

Table 5.2.1.

Effect of siderate plants and mineral fertilizers on cotton productivity (2017-2019)

Options for practice	2017			2018			2019			After 3 years		
	Produc t s/ha	Increase		Produc t s/ha	Increase		Produc t s/ha	Increase		Produc t s/ha	Increase	
		s/ha	%		s/ha	%		s/ha	%		s/ha	%
1st control	25,8	-	-	24,3	-	-	24,0	-	-	24,7	-	-
2nd	42,5	16,7	65	41,5	17,2	71,0	39,3	15,3	63,8	41,1	16,4	66
3rd	28,3	2,5	10	29,3	5,0	21,0	26,9	2,9	12,0	28,2	3,5	14
4th	32,8	7,0	27	33,8	9,5	39,0	30,3	6,3	26,3	32,3	7,6	31
5th	35,5	9,7	38	36,3	12,0	49,0	34,0	10,0	41,7	35,3	10,6	43
6th	39,5	13,7	53	40,3	16,0	66,0	38,5	14,5	60,0	39,4	14,7	60

Thus, in option 2, 41.1 s/ha, the increase is 16.4 s/ha or 66.0% compared to the control; In variant 3, 28.2 s/ha, the increase compared to the control was 3.5 s/ha or 14.0%. 32.3 s/ha in option 4, an increase of 7.6 s/ha or 31.0% compared to the control; In option 5, 35.3 s/ha, the increase was 10.6 s/ha or 43.0% compared to the control. In option 6, 39.4 s/ha, the increase was 14.7 s/ha or 60.0% compared to the control. Mathematical calculation of the efficiency of the application of siderate plants and mineral fertilizers under the cotton plant proves the accuracy of the experiment. Thus, the increase in the options is more than three times higher than the indicator E, s/ha, E=0.87-1.0 s/ha, and the accuracy of the experiment is P=2.56-2.94 % organized.

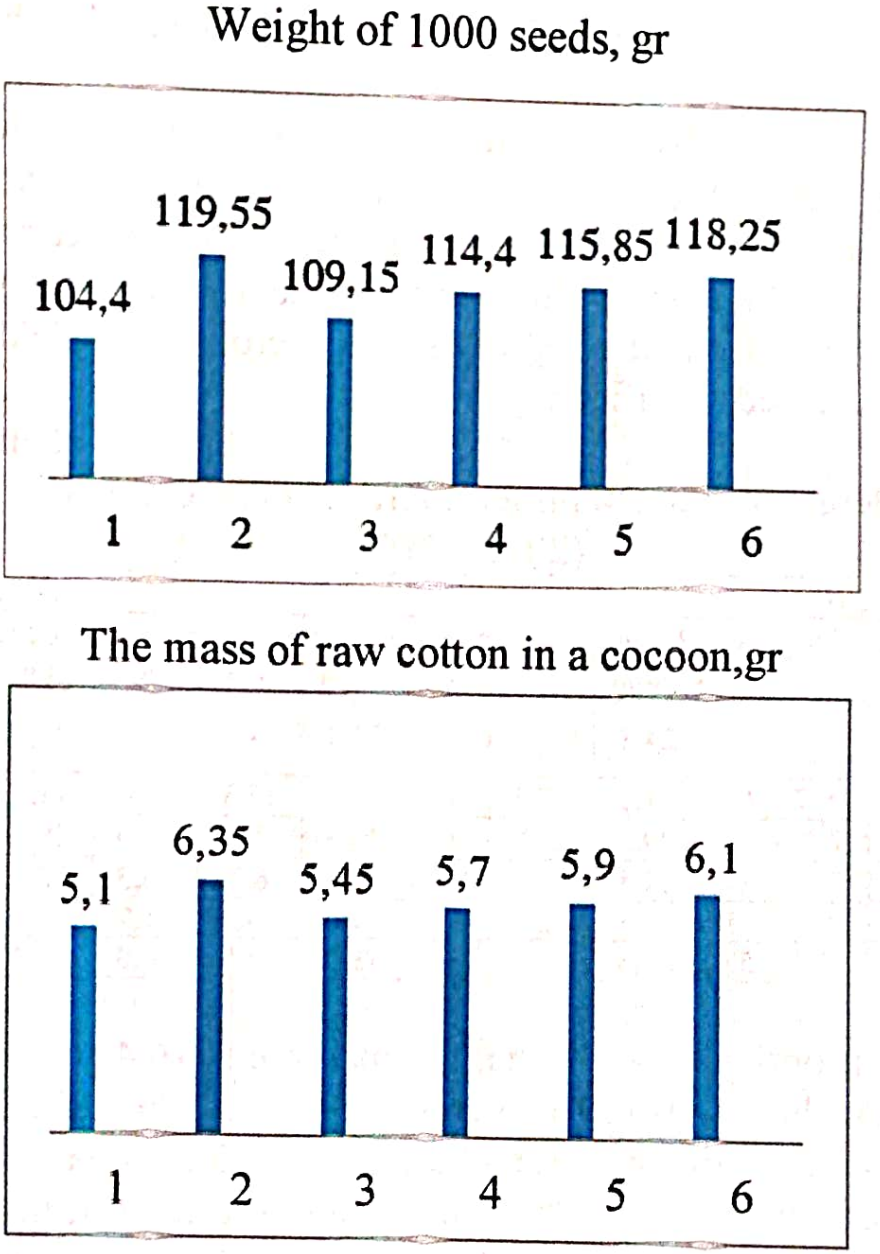

Figure 5.2.1. Influence of siderate plants and mineral fertilizers on economic value of cotton plant (average from 2 years)

The effect of siderate plants and mineral fertilizers on the economic value of cotton has also been studied. As can be seen, in the control variant of the rest of the cotton weight of 1000 seeds is 103.5-105.3 grams, the weight of raw cotton in one cone is 5.0-5.2 grams, the length of the fiber is 34.8-35.1 mm, fiber yield is 35.3-35.6%, fiber yield is 8.6-9.2 s/ha. In the second variant, the weight of 1000 seeds is 119.7-120.8 grams, the weight of raw cotton in a cocoon is 6.3-6.4 grams, the length of the fiber is 36.1-36.3 mm,

fiber yield is 38.5-38.7%, fiber yield is 16.1-16.4 s/ha, fiber yield increase is 7.2-7.5 s/ha or 78.8-87.0%. The weight of 1000 seeds is 108.5-109.8 grams, In the 3th variant, 5.4-5.5 grams, the length of the fiber is 35.3-35.6 mm, the fiber yield is 36, 0-36.2%, fiber yield 10.2-10.6 s / ha, fiber yield increase 1.0-2.0 s/ha or 11.0-23.0%; In the 4th variant the weight of 1000 seeds was 113.6-115.2 grams, the weight of raw cotton in a cocoon was 5.6-5.8 grams, and fiber length was 35.5-35. 8 mm, fiber yield 36.5-36.7%, fiber yield 12.0-12.4 s/ha, fiber yield increase 2.8-3.8 s / ha or 30.0-44.0% ; In the 5th variant, 35,7-36,0 mm, fiber yield 37.5-38.0%, fiber yield 13.3-13.8 s/ha, fiber yield increase 4.1-5.2 s/ha or 45.0-60.0 %; In the 6th variant, wos 117.8-118.7 grams, 6.0-6.2 grams, 35.9-36.2 mm, 38.3-38.6%, 15.1-15.6s/ha, 6.0-7.0 s/ha or 65.0-80.0%.

Thus, the application of siderate crops and mineral fertilizers under the cotton plant, along with productivity, also had a significant impact on the economic value of raw cotton. The highest indicators of economic value of raw cotton are due to the effect of mineral fertilizers $N_{90}P_{120}K_{90}$ 1.0-1.5 mm, fiber yield 2.9-3.4%, fiber yield 7.2-7.5 s/ha, In the 6th variant, the weight of 1000 seeds is 12.5-15.2 grams, the weight of raw cotton in one cocoon is 0.8-1.2 grams, the fiber length is 0.8-1.4 mm, the fiber yield is 2.7-3, 4%, fiber yield increases to 6.0-7.0 s / ha compared to the control option). Under the influence of siderate plants and mineral fertilizers, it was found that between the mass of 1000 seeds (grams) and raw cotton product (s/ha) for years $p = + 0.988 \pm 0.010$, 0.982 ± 0.015, the weight of raw cotton in a cocoon (grams) - between cotton product (s / ha) $p = + 0,958 \pm 0,034$, $0,986 \pm 0,011$, between raw cotton product (s / ha) fiber length (mm) $r = + 0,921 \pm 0,062$, $r = + 0,947 \pm 0,042$, raw -fiber yield (%) between cotton product (s / ha) $r = + 0,981 \pm 0,016$, $r = + 0,985 \pm 0,012$, between raw cotton product (s / ha) and fiber product (s/ha) $r = + 0.993 \pm 0.006$, $r = + 0.997 \pm 0.003$ has a high correlation.

The effect of breaking quality, linear density, relative breaking length and staple length on the technological quality of cotton fiber has also been studied in our research. In the control variant, the breaking load of raw cotton is 4.5-4.6 g, linear density is 5860-5880

m.tex, relative breaking length is 26.4-27.1 g/tex and staple length In the case of 30/31-32/33 mm, In the second variant, significantly increased, respectively 4.8-4.9 kg, 5980-5990 m.tex, 28.6-29, 3 gg/tex and 34/35-35/36 mm, In the 3th variant, 4.5-4.6 g, linear density is 5910-5920 m.tex, relative breaking length is 26, 6-27.2 gg / tex and staple length was 31/32-32/33 mm. In the 4th variant, The breaking load of raw cotton was 4.6-4.7 g, linear density was 5930-5940 m.tex, and the relative breaking length was 27.3-27.9 g/tex and staple length 33/33-33/34 mm, In the 5th variant, 4.6-4.7 kg, linear density 5950-5960 m. tex, relative fracture length was 27.4-28.0 gg/tex and staple length was 33/34-33/34 mm. In the 6th variant, 4.8-4.9 kg, 5970-5980 m.tex, 28.7-29.3 gg/tex and 34/35-35/36 mm.

Thus, the application of siderate plants and mineral fertilizers under the cotton plant, along with productivity, had a significant impact on the technological qualities of raw cotton fiber. Fracture load of cotton fiber under the influence of mineral fertilizers is 0.3 g, linear density is 100-130 m.tex, relative fracture length is 2.2 g/tex and staple length is 3/4 mm, fracture load of cotton fiber under the influence of siderate plants is 0.2- 0.4 g, linear density 90-120 m.tex, relative fracture length 1.6-2.9 g/tex and staple length 2/5 mm increases compared to the control variant. As a result of application of siderate plants and mineral fertilizers under cotton, it was found that between the raw cotton product (s/ha) the breaking load (kg) of cotton fiber was $r = + 0.903 \pm 0.080$, $r = + 0.853 \pm 0.110$, with the raw cotton product (s/ha) between the linear density of cotton fiber (m.tex) $r = + 0.973 \pm 0.023$, $r = + 0.977 \pm 0.020$ and between the raw cotton product (s/ha) and the relative breaking length of cotton fiber (g/tex) $r = + 0{,}981 \pm 0{,}016$, $r = + 0{,}910 \pm 0{,}070$ correlation was determined, which confirms the accuracy of the obtained results.

The effect of siderate crops and mineral fertilizers on economic efficiency under cotton has been studied. Siderate crops and fertilizers not only improved the agrochemical, water-physical properties, productivity and quality of the soil, but also increased the cost of additional products. When calculating the economic efficiency, all the costs of application of siderate plants and mineral

fertilizers and production of additional products were taken into account. 2019 estimates were used to calculate the results of the experiments. The price of one ton of mineral fertilizers in physical weight is 430 manats of ammonium salt, 129 manats with 70% discount; simple superphosphate 520 manats, 156 manats with 70% discount; potassium sulfate is 649 manat, with a 70% discount is 194.7 manat. The cost of mineral fertilizers to be applied per hectare is 12 manat, barley seeds 100x0.5 = 50 manat / ha, peas 60x0.7 = 42 manat / ha, sowing 35.0 manat / ha, cutting the surface 30 manat/ha., plowing was taken 35.0 manat /ha.

Net income is determined based on all costs incurred in the additional product and the market selling price of that product. The market selling price of one kilogram of raw cotton was 0.65 manat.

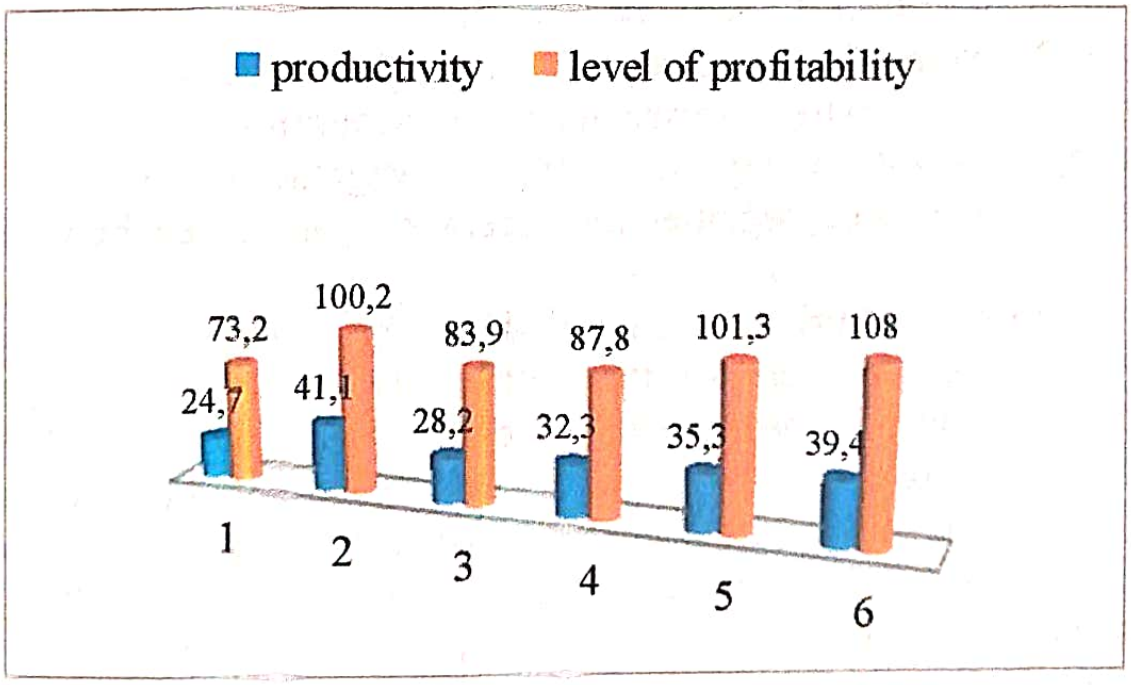

Figure 5.3. Effect of siderate plants and mineral fertilizers on the economic efficiency of cotton (average of 3 years)

Depending on mineral fertilizers and agro-technical measures, the net income from one hectare of cotton was 1336.8 manat, the level of profitability was 100.2%. When the surface part of barley, peas and cotton sown together was cut and put under plowing, the higher net income was 1330.0 man/ha, and the level of profitability was 108.0%.

Conclusions

1. The conducted agrochemical analysis and study of water-physical properties of soils show that due to the gradation accepted in our republic, these soils are poorly supplied with nutrients. Therefore, the application of siderate plants and mineral fertilizers is very important for the growth and development of cotton plants in these soils, high yields, maintenance of soil fertility, improvement of soil water and physical properties.

2. Autumn peas sown with barley between rows before the last vegetation irrigation, together with the surface mass of cotton, chopped and plowed in December, the volume weight decreased by 0.10-0.14 g / cm3 in 0-30 cm layer, humidity 4.3-4.5%, total porosity 3.75-5.24%, the amount of particles with a size of 10 .... <10 mm increases compared to the control option 11.44-18.93% (each year the rest of the cotton is taken out from the field).

3. Nitrogen 61.4-87.5 kg / ha, phosphorus 30.0-54.3 kg / ha and potassium 74 when the surface mass of autumn peas and cotton sown together with barley before the last vegetation irrigation were chopped and plowed together in December. Fluctuated between 7-116.2 kg / ha.

4. Biomass buried in the soil has a significant effect on the height and development of the cotton plant in terms of growth phases. Autumn peas sown with barley in the middle of the highest indicators, along with the surface mass, were cut and plowed in December, height 20.3-28.1 cm, sympodial branches 5.3-6.7, cones 2.8-3.7 , the number of opened cones increases from 2.1 to 2.7 units compared to the control option (each year the rest of the cotton is taken out from the field).

5. While the productivity of cotton is 24.7 s / ha on average for 3 years in the control variant, the highest productivity is 41.1 s / ha in the variant $N_{90}P_{120}K_{90}$ (each year the rest of the cotton is taken out from the field), growth compared to control 16.4 s / ha or 66.0% and autumn peas sown with barley between rows before the last vegetation irrigation, together with the surface mass, chopped and plowed in December, respectively, 39.4 s / ha, 14.7 s / ha or 60, was

0%.

6. Siderate crops and mineral fertilizers, along with productivity, also had a significant impact on the economic performance of raw cotton. Due to the highest indicators of economic value of raw cotton $N_{90}P_{120}K_{90}$ (each year the rest of the cotton is taken out from the field) the weight of 1000 seeds is 14.7-15.6 grams, the weight of raw cotton in a cocoon is 1.2-1.3 grams, fiber length is 1, 0-1.5 mm, fiber yield 2.9-3.4%, fiber yield 7.2-7.5 s / ha, autumn peas sown with barley before the last vegetation irrigation, chopped and plowed in December together with the surface mass respectively, the weight of 1000 seeds is 12.5-15.2 grams, the weight of raw cotton in one cone is 0.8-1.2 grams, the length of the fiber is 0.8-1.4 mm, the fiber yield is 2.7-3.4. %, fiber production increases by 6.0-7.0 s / ha compared to the control option (each year the rest of the cotton is taken out from the field).

7. Siderate plants and mineral fertilizers have significantly affected the technological qualities of cotton fiber. Fracture load of cotton fiber under the influence of mineral fertilizers is 0.3 g, linear density is 100-130 m.tex, relative fracture length is 2.2 g/tex and staple length is 3/4 mm, fracture load of cotton fiber under the influence of siderate plants is 0.2- 0.4 g, linear density 90-120 m.tex, relative fracture length 1.6-2.9 g/tex and staple length 2/5 mm increases compared to the control variant (each year the rest of the cotton is taken out from the field).

8. The highest net income was 1336.8 manat in $N_{90}P_{120}K_{90}$ variant, yield level was 100.2%, 1330.0 manat/ha was obtained when the surface part of barley, peas and cotton sown together before the last vegetation irrigation was cut and plowed, and yield level was 108.0%. organized.

Recommendations for the farm. The following recommendations are made to farms to obtain a high quality product from the cotton crop and to maintain soil fertility:

1. The application of cotton rotation farming systems ensures a high, stable yield from cotton and restores soil fertility.

2. In order to increase the fertility of the soil and thereby obtain a high and quality product from the cultivated plants, it is necessary to use siderate plants to the maximum.

3. In order to achieve high productivity in cotton crops, at the same time to increase soil fertility and to ensure environmental protection, it is recommended to sow autumn pea + barley mixture in the fields of cotton before the last irrigation of vegetation, chop it together with cowpea and put it under the plow in December.

List of published scientific works on the topic of the dissertation

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4. Gahramanova R.F. The importance of cotton growing in the socio-economic development of Azerbaijan // All-Republic Scientific Conference named after Jalal Aliyev, 2018, p.417-422 (Co-author A.O. Hsanova)

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The defense of the dissertation will be held on 25 noyabr 2024 at 14^{00} at the meeting of the Dissertation council BFD 4.28 of Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at Azerbaijan State Agricultural University.

Adress: Az 2000, Ganja city, Ataturk avenue, 450

Dissertation is accessible at the library of Agrarian Science and Innovation Center, Research Institute of Crop Husbandry.

Electronic versions of the dissertation and its abstract are available on the official website of the Azerbaijan State Agricultural University.

Abstract was sent to the required addresses on 22 oktyabr 2024.

Signed for printing: 07.10.2024

Paper format: 210x297 1\4

Volume: 39196 characters

Number of hard copies: 20