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EFFECTS OF FERTILIZERS ON THE PRODUCTIVITY, QUALITY AND NUTRITION BALANCE OF TOMATO PLANT IN GANJA-KAZAKH REGION

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GENERAL CHARACTERISTICS OF THE WORK

Relevance and development of the topic. According to the State Statistics Committee, in 2019, 19767 ha of tomatoes were planted in the Republic, including covered and open areas, 697817 tons of products were produced and the average productivity was 195 s / ha. In Ganja-Gazakh economic region 169361 tons of tomato products were produced from 2811 ha area, the average productivity was 188 s / ha. In Shamkir region, where the research was conducted, tomatoes were planted on 1748 ha, the total production was 141673 tons, and the average productivity was 198 s / ha [www.stat.gov.az, 2019]. Tomatoes are one of the most valuable vegetable crops. Tomatoes are rich in biologically active substances, which greatly increases their nutritional value. Fully ripe fruits contain 4-8% dry matter, 3-4% sugar, up to 1% malic and citric acids, 0.6-0.8% protein, 0.13% pectin, 93.5% water, 4 , Contains 2% carbohydrates, 0.8% cellulose, 0.4% ash, 220 kcal per 1 kg of product energy, 85% edible part of the product, 38% acidity, 62% alkalinity and 0.6% minerals. Each 100 grams of fruit contains an average of 4 mg of sodium, 268 mg of potassium, 11 mg of calcium, 12 mg of magnesium, 0.6 mg of iron, 0.27 mg of phosphorus, 0.097 mg of copper and other substances. Fruits are also rich in 2 mg% provitamin A1, 0.08 mg% B1, 0.045 mg% B2, 15-45 mg% PP, 80 mg% vitamin P and other vitamins [10, p.84-89]. 151.6 million in 2017 and 177.4 million in 2018. Tomatoes were exported in US dollars. In 2018, compared to 2017, tomato exports increased by 17% in value and 12% in volume. Analyzes show that tomato exports from Azerbaijan have been growing steadily over the past five years. Thus, the export of tomatoes, which was 49 million US dollars in 2014, increased 3.6 times in 2018 and reached 177.4 million US dollars. As a result, in 2018, poidor maintained the status of the most exported product in the non-oil sector. According to statistics from the International Trade Center, global tomato export sales in 2017 are estimated at $ 8.9 billion. From 2016 to 2017, revenues from tomato exports increased by 3%. In 2017, European countries accounted for 49.1% of tomatoes, or $ 4.49 billion in value terms. In 2017, 30.3%

of the global tomato export market fell to North American, 12.2% to the Asian region, and 7.8% to African exporters. In 2017, Azerbaijan ranked 13th among the 15 most profitable countries in the tomato export market, with a fairly high market share. It should be noted that in 2017, the market share of our republic in global tomato exports was 1.7% [116, p.138-142].

Ganja-Gazakh region occupies one of the key places in the production of agricultural products, including vegetables. In recent years, fertilization of tomato plants on the studied variety has been almost not studied in the region. In this regard, taking into account the importance of tomatoes in exports to the non-oil sector in Azerbaijan, in order to increase the productivity and quality of tomato plants in the region, effective organic, organic-mineral fertilizer standards The determination of substances on the basis of their balance is of great scientific and practical importance. The study of the solution of such an important problem shows the relevance of our research in modern times.

Object and subject of research. The object of research is "Titan" variety of tomato plant, soil, organic and mineral fertilizers.

Objectives and tasks of the research. The purpose of the research is to determine the norms of effective organic and organic-mineral fertilizers, nutrients, which create the basis for obtaining high and ecologically clean products from tomato plants grown in the arid climate of Ganja-Gazakh region. consists of determining on the basis of balance.

The following tasks have been set to solve the problem:

- study of physical, chemical and agrochemical properties of tomato growing soils;
- analysis of soil and climatic conditions of the area in the years of research;
- Study of the effect of fertilizers on the developmental stages of tomato plants on changes in the nutrient regime in the soil;
- Study of the effect of fertilizers on the accumulation of nutrients in the surface mass and fruits of tomato plants on the stages of development;

- To study the effect of fertilizers on the growth and development of tomato plants;

- to determine the effect of fertilizers on the productivity and quality of tomato plants;

- determination of the economic balance of nutrients;

- calculation of economic efficiency.

Research methods. The researches were carried out in 2014-2016 in Aliyagublu village of Shamkir region on gray-brown (chestnut) lands on the share land belonging to the resident of the village E.Aliyev.

The experiment was based on the following scheme: 1. Control (without fertilizer); 2. Manure 20 t / ha; 3. Peyin 30 t / ha; 4. Manure 40 t / ha; 5. Peyin 10 t / ha + N50P25K60; 6. Peyin 15 t / ha + N75P37,5K90; 7. Peyin 20 t / ha + N100P50K120. Field experiments were carried out with Titanium tomato.

The size of the accounting unit of each variant was 2.8x20 (56 m2), the experiment was performed in 4 repetitions, 1.0 m protective strip between each replication, sowing was carried out in the scheme 70x35 cm. 30-40-day-old seedlings were transplanted to the experimental field in the first decade of May, depending on weather conditions. Nitrogen-ammonium nitrate 34.7%, phosphorus-simple superphosphate 18.7% and potassium-potassium sulfate 46%, and manure in the decomposed state (nitrogen 0.5%, phosphorus 0.25) %, potassium 0.6%) were used. Manure, phosphorus and potassium fertilizers are applied at full plowing before sowing, 50% of nitrogen is applied together with seedlings, and 50% is fed at the beginning of budding.

0-30 in the form of an envelope from 5 places of the field before fertilization to study the agrochemical properties of the soils of the experimental field; 30-60; Soil samples were taken from 60-100 cm layers, samples were mixed in layers, dried in the laboratory, beaten in a porcelain bowl and analyzed through a 1 mm sieve. In the years of the study, 0…30 and 30…60 cm from all variants to determine the amount of mobile nutrients in the soil from the 3rd place (beginning, middle and end) of the first and third iterations of the main height and development stage of tomato (mass flowering,

fruiting and end of vegetation) Mixed soil samples were taken from the layers, phenological observations were made, plant height was measured in 25 branches, number of flower clusters and side shoots were determined. Soil and plant samples taken from the field were analyzed. Samples were taken from atmospheric sediments for analysis every month, and from irrigation water during irrigation, and their composition was determined. Ripe tomatoes were harvested by hand at different times and reported. The main quality indicators of tomato fruits, volume and composition of root and stem residues were studied. The results of the experiment were confirmed by mathematical calculations. The economic efficiency of fertilizer application was calculated based on the cost of additional products.

In soil samples taken: total humus I.V. According to Tyurin, in the pH potentiometer, the granulometric composition was determined by N.A.Kachinski, the absorbed bases were determined by the method of K.K.Hedroys. Q.M.Sheglova, motor phosphorus B.P. According to the method of Machik, water-soluble phosphorus according to Deniz, total potassium Smith, according to Alexandrov, water-soluble potassium, according to the method of exchangeable potassium P.B.Protasov in the flame photometer. In plant samples: absolute dry matter in a thermostat at 105 ° C, total nitrogen, phosphorus and potassium according to K.E.Ginsburg, Q.M.Sheglova and E.V.Vulfus, sugar (sucrose) by optical method in a sacherometer, according to vitamin C by I.K. Murry, by titration with acid-base alkali. for malic acid, nitrates were determined on an ionometer (EV-74) [32, p.264].

Results of field experiments, calculation of productivity, accuracy of experiment and mathematical analysis of correlative relations B.A.Dospekhov [143, 351p.], V.N.Peregudov [17, 310 p.], PNKonstantinov [17, 310 p.], Economic efficiency N.N. Baranov [128, p. 182]. The results of the study were processed by mathematical calculations.

The main provisions of the defense: The effect of the application of fertilizers under the tomato plant on the changes in the nutrient regime in the soil, vegetative mass and fruits in terms of development phases;

- development, productivity and quality of tomato plant depending on fertilizer norms;

-food balance and economic efficiency.

Scientific novelty of the research. For the first time in the Ganja-Gazakh region, effective norms for the application of organic and organic-mineral fertilizers under the tomato plant were determined, along with productivity and product quality indicators, the plant's soil and fertilizer utilization rate The production of ecologically safe tomato products has been achieved and the economic balance of nutrients has been calculated.

Theoretical and practical significance of the research. It was found that the application of organic and organic-mineral fertilizers under the tomato plant has a significant impact on productivity and product quality. Feeding at the rate of 30 t / ha of manure increased the productivity of tomatoes to an average of 52.0 t / ha in 3 years, and the growth was 22.6 compared to the uncontrolled variant. t / ha or 77.0%, replacing half of the norms of organic fertilizers with the equivalent amount of mineral fertilizers, and when organic-mineral fertilizers are given together, 15 t / ha + N75P37,5K90 53.6 t / ha, 24.2 t / ha or 82.3%, respectively, at the same time the quality indicators of commodity products with control variant The amount of nitrates was significantly lower than the permissible level (150 mg / kg in wet weight).

Approbation and application of research work. The results of the study were presented at the Department of Soil Science and Agrochemistry of the Azerbaijan State Agrarian University, the Scientific Council of the Faculty of Agronomy (2014-2016). , Acad. At the Azerbaijan State Agrarian University. Republican science on the theme "Ways to increase soil fertility in Azerbaijan", dedicated to the 80th anniversary of MI Jafarov -practical conference (Ganja, July 08, 2016), dedicated to the 110th anniversary of HA Aliyev at the Institute of Soil Science and Agrochemistry of ANAS At the Republican Scientific Conference on "Actual Problems of Soil Science" (December 21-22, 2017), at the XXIII International Scientific-Practical Conference "EurasiaScience" in the Russian Federation (August 15, 2019, Moscow), at the XXIV International

Scientific-Practical Conference on "Russian science in the modern world" (August 31, 2019, Moscow), Department of Soil Science and Agriculture of ANAS Reported at the scientific-methodical seminar of the Institute of Chemistry (2021).

The results of the research were obtained in 2017 at the Ganja Regional Agrarian Science and Information Consulting Center of the Ministry of Agriculture in Samukh region. t / ha and 15 t / ha + N75P37,5K90 variants were applied in 2 ha area. As a result of the application, the commodity yield of tomatoes (70% of the total yield) is up to 34.1 t / ha in the 30 t / ha variant of manure, 15 t / ha + In N75P37.5K90, the net income increased to 36.3 t / ha and amounted to 5216.0 man / ha and 5690.0 man / ha, respectively.

Name of the organization where the dissertation work is performed. The dissertation work was carried out at the "Agrochemistry" department of the Azerbaijan State Agrarian University.

The total volume of the dissertation with a sign, indicating the volume of the structural units of the dissertation separately. The dissertation consists of an introduction, 6 chapters, results, 19 tables, 6 figures, 189 bibliography, 37 tables and 1 appendix. The volume of the dissertation is 155 pages and consists of 243242 (213528 excluding the list of references).

Personal participation of the author: Problem setting in the dissertation work, conducting experiments and relevant analyzes, analysis and generalization of the obtained results were performed by the author.

Publication: 12 articles and __ theses reflecting the results of the research were published. 4 of them articles and __ theses were published abroad.

The urgency of the problem aimed at solving it, the goals and objectives of the research, its scientific novelty, theoretical and practical significance, the object and subject of research, methods are widely explained in the introduction.

The first chapter analyzes the degree of study of the problem in foreign countries, in our republic, as well as in the Ganja-Gazakh region, with reference to the literature.

The second chapter examines the origin of the tomato plant, its value, biological characteristics, as well as the need for environmental factors.

The third chapter describes the soil and ecological conditions of the Ganja-Gazakh sloping plain, the physical, chemical and agrochemical properties of the dominant gray-brown (chestnut) (Castanozems) soils formed in the area.

The fourth chapter analyzes the effects of the application of fertilizers under the tomato plant on the soil nutrition regime, the dynamics of nutrients in the vegetative organs and fruits of the plant.

The fifth chapter examines the effect of fertilizers on the development of the tomato plant, its productivity and quality.

In the sixth chapter, the balance of nutrients in gray-brown (chestnut) soils operated under the tomato plant, the coefficient of absorption of nutrients from the soil and economic efficiency were determined.

MAIN CONTENT OF THE WORK

Degree of study of the problem

It is estimated that the use of chemicals protects 50-60 and sometimes 70% of crop yields from diseases and pests. According to other estimates, 30% of the world's population, ie more than a quarter, is supplied with food through mineral fertilizers [100, p.246].

Certain proportions of organic and mineral fertilizers in the crop rotation system studied in Russia improve the agrophysical properties of dark gray forest soils, moisture reserves and mineral nitrogen are higher than natural fertility in the plowing layer. Systematic application of mineral fertilizers on the basis of organic fertilizers keeps the humidity 9-21% relative to control. The lowest moisture loss was observed in 30 variants of siderate and rhizome (NPK) compared to control [167, p.39-41].

Changes in soil fertility in different soil layers in the South Caucasus have been studied by many authors in different years. It has been determined that soil fertility decreases every year. In order to restore and increase it, the authors consider it important to use

organic and mineral fertilizers [129, p.32-35], [182, p.6-8], [181, p.8-11].

According to Russian scientist VN Bocharov, the need of plants for fertilizers depends on the type of fertilizer and the developmental stages of the plant. Vegetable plants need more phosphorus in the early stages of development. Phosphorus has a better effect on the development of the root system. During the intensive growth phase of the plant, the need for nitrogen increases and is the main element that affects the color. The need for potassium increases from the time of fruit formation to the time of wilting. Therefore, it is necessary to provide plants with the necessary amount of nutrients in a timely manner [130, p. 13].

According to a study conducted by specialists at the Azerbaijan Institute of Vegetable Growing, organic and mineral fertilizers had a significant impact on the biochemical composition of vegetable products. According to the authors, the nutritional value of vegetables is largely determined by their biochemical composition. The quality of vegetable products is formed under the influence of agro-technical, ecological and soil-climatic factors in the process of vegetation. An important place among these factors is the effect of fertilizers used, especially organic and mineral fertilizers [37, p.40-42].

As a result of research on “Leyla” and “Zarrabi” tomato varieties, it was determined that in the 70x30 cm and 70 + 50x30 planting schemes, the productivity of the feeding area and plant density was 588-611 and 628-634 s / ha, respectively, 70x60 cm and 90 + 50x60. In the food field, these indicators decreased to 448-454 and 428-437 s / ha [9, p.643-645].

Biological characteristics and ecology of the tomato plant the need for factors

Here is a description of the origin and importance of the tomato plant for the human body, its chemical composition, history of cultivation in Russia and Azerbaijan, botanical description (Lykopersicon Esculentum Mill.L) and biological characteristics. flowers, flower clusters, fruits, type of shrub and leaf, heat, heat,

light, soil, water and nutrients. Information was provided on the needs of the population.

The taste of tomatoes is greatly affected by the ratio of the percentage of sugar in the fruit to the percentage of acid. Thus, tomato fruits have the highest taste, when this ratio is 4-5 and more. Varieties containing 0.5-0.7% acid (malic and citric acids) in the fruit are more valuable for taste. As the acidity decreases, the taste quality decreases. When the sugar percentage is 2.5-3.5 and the acid percentage is 0.5-0.7, the sugar-acid index is 4-5 and more.

Immature fruits are rich in pectin and protopectin. During the ripening process, under the influence of enzymes and gases (ethylene), they break down into aqueous carbon and water, and as a result, the fruit begins to soften. As the fruit matures, the green and chlorophyll pigments are replaced by orange and red lycopene, lycodin, and carotene pigments. Normal production of lycopene and carotene has a positive effect on the quality of tomatoes. However, when the weather is very hot and dry, tomato fruits ripen compulsorily, more lycodin (yellowish-red) pigment is formed, resulting in a lower quality product. Tomatoes are of better quality because they contain more dry matter and acids in the hot southern regions.

Soil-ecological conditions of Ganja-Gazakh region, physical, chemical and agrochemical features of experimental soils

The lands of Ganja-Gazakh region in different years Salayev MM, Mammadov Q.Sh., Babayev MP, Mammadov R.H., Hasanov V.H. etc., and climatic conditions in Madatza AM, Shikhlinsky AM, Eyyubov AA. and has been studied by others in different years.

The amount of sludge fractions along the soil profile in the experimental area is 25.1-23.6%, and the amount of physical clay is 25.1-23.6%, these soils are considered light clay according to the granulometric composition RH Mammadov. According to the amount of humus, these soils are considered low-humus according to the gradation accepted in our republic (SA Aliyev, RHMammadov, FHAkhundov (1981). The total of absorbed bases in the absorption complex was 28.5 mg / eq in the 0-30 cm layer and decreased to 20.5 mg / eq in the 60-100 cm layer.

Prior to conducting experiments to determine the amount of nutrients, the potential reserve nutrients of the soil are easily determined by the total humus, nitrogen, phosphorus, potassium, and effective fertility of the plant. Recommended nutrients have been identified. Analysis of soil samples shows that irrigated gray-brown (chestnut) soils are not well supplied with assimilated forms of nitrogen, phosphorus and potassium. Total humus, nitrogen, phosphorus and potassium in a layer of 0-30 cm, respectively 2.15; 0.15; 0.14; Is 2.41%. However, the lower layers are gradually reduced to 0.78 in the 60-100 cm layer, respectively; 0.06; 0.07; 1.52%. Absorbed ammonia nitrogen 20.5-7.1; nitrate nitrogen 10.5-3.1, mobile phosphorus 19.8-6.5; Metabolic potassium fluctuates between 283.8 and 106.5 mg / kg.

According to the gradation accepted in our republic (Gulahmedov AN, Akhundov FH, Ibrahimov SZ, 1980) these lands are poor in nutrients. provided. Therefore, in order to grow, develop, give high yields and maintain soil fertility in these lands, it is necessary to use organic and organic-mineral fertilizers. It is very important to apply it together.

Influence of application of fertilizers under tomato plant on soil soil regime, dynamics of nutrients in vegetative mass and fruits of plant

According to the research conducted by Professor PBZamanov, it is determined that in Azerbaijan very low humus content (humus content in the soil is less than 1) is 40-50 tons, low-income (1-3%) is 30-40 tons. , 20-30 tons of organic fertilizers (manure) should be given to middle-class people (3-5%) and 10-20 tons to normal people (5-10%). Depending on the quality of organic fertilizers applied to the soil and the coefficient of humus application, their application rate may increase or decrease.

Soil samples were taken from two depths (0-30 and 30-60 cm) in three stages at the end of mass flowering, fruiting and vegetation. Fertilizers have had a significant effect on the soil nutrient regime under tomato plants and have significantly increased the amount of nutrients in the soil that are easily assimilated by plants.

Thus, in the control (fertilizer-free) variant, the ammonia nitrogen and nitrate nitrogen absorbed in the mass flowering phase are 18.3-19.8 and 10.2-10.8 mg / kg in the 0-30 cm layer. , 15.1-16.3 and 7.0-7.5 mg / kg, respectively, in the layer of 30-60 cm, 18.5-19.3 and 15.8-16, respectively, of mobile phosphorus and metabolic potassium, 1 mg / kg; 263.8-270.3 and 200.2-207.5 mg / kg, ammonia nitrogen and nitrate nitrogen 0-30 and 30, respectively, at the end of the growing season -13.1-13.6 and 10.2-10.8 mg / kg in a layer of 60 cm; 5.1-5.6 and 3.2-3.8 mg / kg, motor phosphorus and exchangeable potassium 13.1-13.7 and 10.5-10.8 mg / kg respectively ; 210.8-220.5 and 155.3-163.5 mg / kg.

As a result of the application of organic fertilizers, the amount of nutrients easily absorbed by plants in the soil has increased significantly. Thus, ammonia nitrogen and nitrate nitrogen absorbed in layers of 0-30 and 30-60 cm in the 20 t / ha version of manure in the mass flowering phase are 23.7-24.1 and 19, 3-20.8; 11.8-12.7 and 8.8-9.7 mg / kg, while motor phosphorus and metabolic potassium are 23.2-24.1 and 20.6-21.3; 275.3-278.6 and 207.4-215.6 mg / kg, ammonia nitrogen absorbed at the end of the growing season 15.7-16.3 and 12.8-13.5, nitrate nitrogen 6.3-6.8 and 3.6-4.2, mobile phosphorus 15.6-16.1 and 12.7-13.3, exchangeable potassium 215.3-226.8 and 155.3-168.6 mg / kg formed..

Ammonia nitrogen and nitrate nitrogen absorbed in layers of 0-30 and 30-60 cm in the mass flowering phase of manure 30 t / ha variant 25.3-26.0 and 22.1-22.6; 13.5-14.7 and 10.7-11.8 mg / kg, and motor phosphorus and metabolic potassium 25.4-26.5 and 21.8-22.5; 280.2-285.5 and 210.2-218.3 mg / kg, ammonia nitrogen absorbed at the end of the growing season 16.3-17.4 and 13.8-14.6, nitrate nitrogen 7.6- 8.3 and 4.5-5.2, mobile phosphorus 17.2-18.1 and 14.1-14.7, exchangeable potassium 220.5-230.6 and 157.3-168.6 mg / kg.

Ammonia nitrogen and nitrate nitrogen absorbed in layers of 0-30 and 30-60 cm of manure in the 40 t / ha variant of mass flowering phase 28.5-29.4 and 25.1-25.6; 14.7-15.8 and 12.5-13.7 mg / kg, while motor phosphorus and metabolic potassium are 27.3-28.2 and 24.2-24.7; 285.5-290.3 and 215.6-221.6 mg / kg, ammonia nitrogen absorbed at the end of the growing season 18.5-19.6 and 16.1-16.7, nitrate nitrogen 8.8-9, 1 and 5,6-6,3, mobile phosphorus 18,3-18,8 and 15,2-15,7, exchangeable potassium 225,5-233,5 and 160,8-171,6 mg / kg was.

By replacing half of the organic fertilizer norms with the equivalent amount of mineral fertilizers, the amount of nutrients in the soil has increased significantly compared to the single organic fertilizer variants as a result of the combined application of organic and mineral fertilizers. Thus, ammonia nitrogen and nitrate nitrogen absorbed in layers of 0-30 and 30-60 cm at 10 t / ha + N50P25K60 of manure in mass flowering 24.6-25.4 and 21.5-22.5 ; 12.6-13.7 and 9.8-10.6 mg / kg, while motor phosphorus and metabolic potassium are 24.8-25.3 and 21.7-22.4; 283.5-290.3 and 210.8-215.6 mg / kg, ammonia nitrogen absorbed at the end of the vegetation 17.0-18.1 and 13.1-14.1, nitrate less ¬ grass 7,6-8,1 and 4,8-5,6, motor phosphorus 16,8-17,5 and 13,5-14,1, exchangeable potassium 226,8-231, 5 and 158.8-160.8 mg / kg.

Ammonia nitrogen and nitrate nitrogen absorbed in mass flowering in layers of 0-30 and 30-60 cm in manure 15 t / ha + N50P25K60 26.8-27.2 and 23.8-24.5; 14.7-15.6 and 11.5-12.8 mg / kg, and motor phosphorus and exchangeable potassium 26.6-27.7 and 23.8-24 , 4; 288.6-293.5 and 213.5-218.3 mg / kg, ammonia nitrogen absorbed at the end of the growing season 18.5-19.3 and 15.1-15.8, nitrate nitrogen 8.5-9.3 and 5.4-5.8, motor phosphorus 18.3-19.1 and 15.0-15.8, metabolic potassium 233.8-240.5 and 160.8-163.5 mg / kg. stop.

The highest amount of nutrients was observed in the variant of manure 20 t / ha + N100P50K120. Ammonia nitrogen and nitrate nitrogen absorbed in layers of 0-30 and 30-60 cm in mass flowering 30.6-31.1 and 27.8-27.2; 15.8-17.0 and 13.7-14.8 mg / kg, and motor phosphorus and metabolic potassium 30.2-31.5 and 26.8-27.3; 295.3-300.5 and 220.7-225.6 mg / kg, ammonia nitrogen absorbed at the end of the growing season 20.3-21.5 and 17.6-18.1, nitrate nitrogen 9.5-10.3 and 6.3-6.8, motor phosphorus 19.7-20.3 and 16.5-17.5, metabolic potassium 235.3-245.8 and 161.5-165.8 mg / kg. made clay.

Application of organic and organic-mineral fertilizers under tomato plant, nutrients easily absorbed by plants in 0-60 cm layer on irrigated gray-brown soils poorly supplied with nutrients. The amount of absorbed ammonia nitrogen is 4.7-15.7 mg / kg, nitrate nitrogen is 1.1-8.2 mg / kg, mobile phosphorus is 4.1-13.9 mg / kg and Potassium exchange increases between 6.3 and 33.0 mg / kg, depending on fertilizer rates, relative to the non-fertilizer option, which in the end is higher than that of the tomato plant. has a substantial effect on product acquisition. Mathematical-statistical calculations of the application of organic and organic-mineral

fertilizers under the tomato plant show that the amount of nutrients (mg / kg) in the soil with the product (t / ha) depending on the fertilizer norms There is a correlation between the two, and this relationship has legally changed over the years as follows: r = + 0.853 ± 0.103 and r = + 0.850 ± 0.103. The effect of fertilizers on changes in total nitrogen, phosphorus and potassium in the vegetative mass of tomato plants was studied at the beginning and end of mass flowering and fruit set. The minimum amount of total NPK in the control (without fertilizer) variant is 3.25-3.30% of total nitrogen, 0.65-0.68% of total phosphorus and 2.81-2.91% of total potassium in mass flowering, in fruiting. 3.65 - 3.73%, respectively; 0.73 - 0.75%; 3.01 - 3.13%, 3.15-3.18% at the beginning of the collection; 0.60-0.63%; 2.15-2.23% and finally 1.41-1.45%; 0.60-0.65%; 1.35-1.43%. As a result of the application of organic fertilizers, the total amount of nitrogen, phosphorus and potassium in each of the growth phases in the surface mass of tomato plants increased significantly. Thus, in the mass flowering of 20 t / ha of manure, total nitrogen is 3.48-3.53%, total phosphorus is 0.75-0.78% and total potassium is 3.15-3.28%, fruit 3.88-3.91%, respectively, in the formation; 0.87-0.91%; 3.35-3.46%, 3.38-3.41% at the beginning of the collection; 0.68-0.71%; 2.30-2.41% and 1.53-1.58% at the end of the harvest; 0.63-0.68%; 1.43-1.51%.

In the mass flowering of 30 t / ha of manure, total nitrogen is 3.68-3.71%, total phosphorus is 0.88-0.91% and total potassium is 3.91-4.05%, in fruit formation respectively, 4.31-4.35%; 0.97-1.01%; 4.15-4.31%, 3.68-3.71% at the beginning of the collection; 0.81-0.85%; 2.57-2.65% and 1.68-1.73% at the end; 0.70-0.71%; 1.51-1.61%, the amount of total NPK in the 40 t / ha variant of manure was significantly higher than in the 30 t / ha variant of manure.

When half of the organic fertilizer norms were replaced by the equivalent amount of mineral fertilizers, and the combined organic-mineral fertilizers were applied, the total NPK increased significantly compared to the single organic fertilizer variants. The highest amount of total NPK was observed in 20 t / ha + N100P50K120 variant.

The effect of fertilizers on the total NPK in tomato fruits was determined at the beginning and end of the harvest. In the control-fertilizer variant, total nitrogen, phosphorus and potassium are 2.31-2.35% at the beginning of the harvest; 0.73-0.75%; 3.88-4.01%, and at the end of the collection 2.18-2.21%; 0.69-0.73%; It was 2.92-3.01%.

In the 20 t / ha version of manure, 2.48-2.51% and 2.27-2.30% of the total nitrogen at the beginning and end, and 0.77-0.80 and 0.73% of the total phosphorus. 0.75%, total potassium is 4.15-4.28 and 3.01-3.15%, manure in the 30 t / ha variant is 2.65-2.68% at the beginning and end of the total nitrogen harvest and 2 , 42-2.45%, total phosphorus 0.85-0.88 and 0.78-0.81%, while total potassium 4.38-4.51 and 3.25-3.33%, manure 40 t In the / ha variant, 2.71-2.75% and 2.50-2.58%, total phosphorus 0.95-0.98 and 0.82, respectively, at the beginning and end of the total nitrogen accumulation, respectively. -0.85%, and total potassium was 4.65-4.73 and 3.33-3.41%.

When half of the organic fertilizer norms were replaced with equivalent amounts of mineral fertilizers, the total amount of nitrogen, phosphorus and potassium was significantly increased compared to the single organic fertilizer variants when organic-mineral fertilizers were applied together. Thus, in the variant of manure 10 t / ha + ¬N50P25K60, 2.53-2.56% and 2.31-2.35%, total phosphorus 0.83-0 at the beginning and end of the total nitrogen harvest. , 85 and 0.75-0.78%, while total potassium is 4.28-4.38 and 3.25-3.11%, manure 15 t / ha + N50P25K60 variant 2.68- at the beginning and end of total nitrogen collection 2.71% and 2.45-2.48%, total phosphorus 0.88-0.92 and 0.80-0.85%, and total potassium 4.55-4.65 and 3.31-3, It was 38%.

The highest amount of total NPK in the variant of manure 20 t / ha + N100P50K120 is 2.75-2.78% and 2.56-2.63% at the beginning and end of total nitrogen accumulation, total phosphorus 0.98-1.03 and 0.85-0.90%, and total potassium was 4.68-4.81 and 3.48-3.57%.

Organic and organic-mineral fertilizers significantly increase the amount of total nitrogen, phosphorus and potassium in tomato fruits at the beginning and end of harvest in irrigated gray-brown soils, which are poorly supplied with nutrients. Under the influence of fertilizers, the total nitrogen in the fruits of tomato plants at the beginning and end of the harvest is 0.16-0.44 and 0.09-0.42%; total phosphorus increases between 0.04-0.28 and 0.03-0.17% and total potassium between 0.27-0.80 and 0.09-0.65% relative to the non-fertilized variant. The highest content of total nitrogen, phosphorus and potassium in tomato fruits was observed in the variant of manure 20 t / ha + N100P50K120.

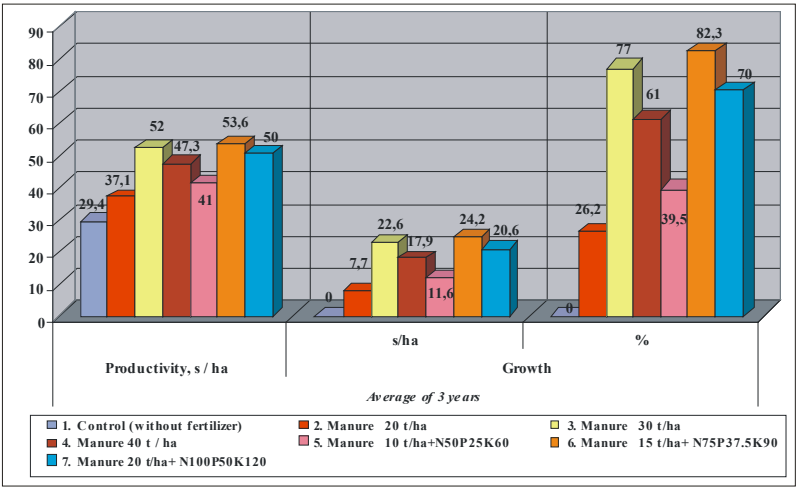
Mathematical-statistical calculations of the application of organic and organic-mineral fertilizers under tomato plants show that, depending on the fertilizer norms, there is a correlation between the amount of total

nitrogen, phosphorus and potassium in tomato products and tomato fruits and surface mass, and This relationship has changed according to the law over the years as follows: tomato yield (t / ha) between the total NPK (%) in the composition of tomato fruits r = + 0.847 ± 0.110 and r = + 0.858 ± ¬0.100 , r = + 0.930 ± 0.050 and r = + 0.900 ± 0.072 between the tomato product (t / ha) and the total NPK (%) in the surface mass.

Influence of fertilizers on tomato plant development, productivity and quality indicators

Norms of organic and organic-mineral fertilizers in irrigated gray-brown (chestnut) soils significantly increase the height of tomatoes, the number of flower clusters and stems at each stage of development, which in turn increases the yield. Increases wealth. In the mass flowering phase, the height of the tomato is 29.2-31.3 cm, the number of flower clusters is 3.3-3.5, the number of stems is 2.1-2.3, and in the fruiting phase, respectively. 50.3-51.8 cm, 4.1-4.3 and 3.5-3.8 cm, and at the end of the vegetation 62.5-63.8 cm, 5.5-5.8 and 4, There were 8-5.2 units. At 20 t / ha of manure, these indicators are 35.7-37.6 cm in mass flowering, 4.0-4.3 units and 2.4-2.6 units, 55 in fruit formation. , 2-57.5 cm, 5.1-5.4 pieces and 4.3-4.6 pieces, and at the end of the vegetation 68.3-70.1 cm, 6.0-6.4 pieces and 6 , 0-6.5 units. In the case of 30 t / ha of manure, these indicators are 45.6-47.8 cm in mass flowering, 5.4-5.6 units and 3.5-3.8 units, 76.5-78.6 cm in fruit formation, 6.8-7.4 pieces and 7.5-7.8 pieces, and at the end of the vegetation - 87.3-89.6 cm, 7.6-8.0 pieces and 8.1-8.5 In the case of 40 t / ha of manure, these indicators were significantly lower than in the case of 30 t / ha of manure. By replacing half of the organic fertilizer norm with an equivalent amount of mineral fertilizer and applying organic-mineral fertilizers together, the plant height, number of flower clusters and stems increased significantly compared to the single organic fertilizer variants. Thus, in the variant of manure 10 t / ha + N50P25K60, in the mass flowering space, the height of the tomato is 38.4-40.5 cm, the number of flower clusters is 4.3-4.8. The number of seeds is 2.8-3.1, 62.8-64.6 cm, 5.5-5.8 and 4.8-5.1, respectively at the stage of fruit formation, and 71.2-73 at the end of the vegetation. It was 6 cm, 6.3-6.8 and 6.8-7.3 pieces. The highest amount of the studied indicators was observed in the variant of manure 15 t / ha + N75P37,5K90, 50,3-53,6 cm, 5,7-6,0 units and 4,3 -4,8 pieces, 80,6-83,5

cm in fruit set, 7,6-8,0 pieces and 8,3-8,6 pieces, vegetation at the end it was 90.8-92.8 cm, 7.8-8.3 units and 8.2-8.8 units, and in the variant of manure 20 t / ha + N100P50K120 these indicators decreased. Depending on the fertilizer rate, there is a correlation between tomato yield and height, number of flower clusters and number of stems, and this relationship has changed over the years: between height (cm) and number of flower clusters (units) r = + 0.930 ± 0.050 and r = + 0.980 ± ⁻0.010; r = + 0,920 ± 0,060 and r = + 0,930 ± 0,050 between tomato height (cm) and number of stems (pieces); r = + 0.990 ± 0.008 and r = + 0.980 ± 0.015 between tomato height (cm) and vegetative mass (t / ha). The effect of fertilizers on tomato crop productivity is shown in Figure 1. As can be seen, the average yield of tomatoes for 3 years is 29.4 t / ha in the control (without fertilizer) variant, 37.1 t / ha in the 20 t / ha version of manure, and the increase in control is 7.7 s / ha or 26.2%, manure in the variant of 30 t / ha 52.0 t / ha, increase compared to the control 22.6 t / ha or 77.0%, and in the variant of manure 40 t / ha These indicators decreased significantly compared to the 30 t / ha version of manure and were 47.3 t / ha, 17.9 t / ha or 61.0%, respectively.

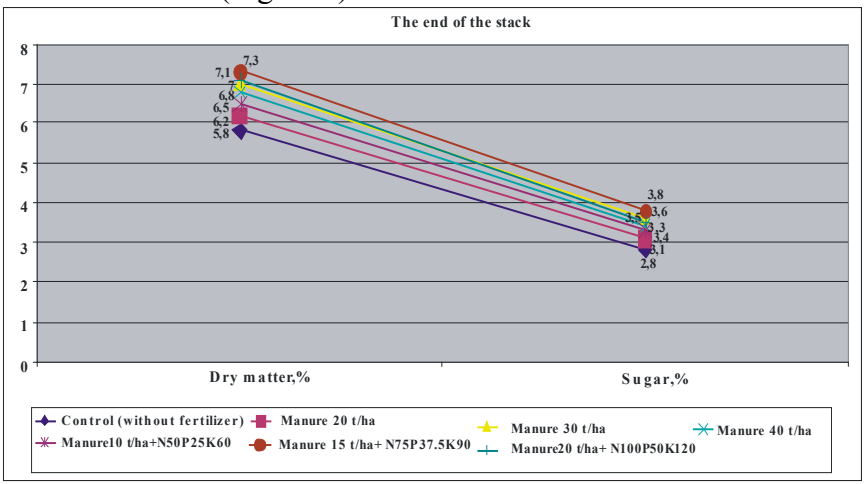


E=1,00-1,25 t/ha$ P=2,20-2,91%

Figure.1 Effect of fertilizers on tomato yield (average 3 years)
1. Control (without fertilizer); 2. Manure 20 t / ha; 3. Manure 30 t / ha; 4. Manure 40 t / ha; 5. Manure 10 t / ha + N50P25K60; 6. Manure 15 t / ha + N75P37.5K90; 7. Manure 20 t / ha + N100P50K120

By replacing half of the organic fertilizer norm with an equivalent amount of mineral fertilizer and applying organic-mineral fertilizers together, the tomato yield increased significantly compared to the single-organic fertilizer variants. Thus, the yield of manure in 10 t / ha + N50P25K60 variant was 41.0 t / ha, the increase was 11.6 t / ha or 39.5% compared to the fertilizer variant, and the highest yield was 15 t / ha of manure. + N75P37,5K90 was 53.6 t / ha, 24.2 t / ha or 82.3%, respectively. 0 t / ha, 20.6 t / ha or 70.0%. The accuracy of the experiment was p = 2.20-2.91%, the increase in variants was three or more times higher than E, s / ha (E = 1.00-1, 25 t / ha).

In addition to the productivity of the application of fertilizers under the tomato plant, the quality indicators of tomato fruits include dry matter, sugar, acidity, vitamin C and also had a significant effect on nitrate content (Figure 2).



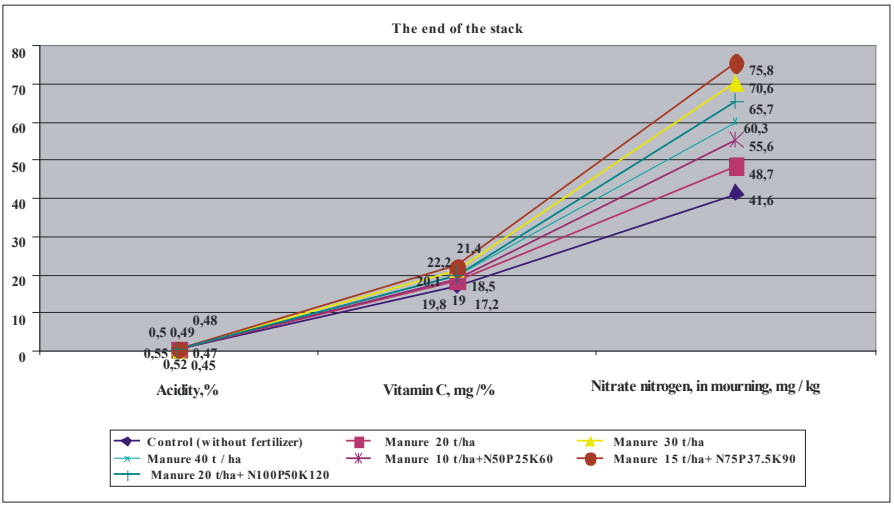


Figure 2 The effect of fertilizers on the quality of tomato fruits (Average from 2 years) 1. Control (without fertilizer); 2. Manure 20 t / ha; 3. Manure 30 t / ha; 4. Manure 40 t / ha; 5. Manure 10 t / ha + N50P25K60 6. Manure 15 t / ha + N75P37.5K90; 7. Manure 20 t / ha + N100P50K120

Although the amount of dry matter, sugar, vitamin C and nitrate was high at the beginning of the harvest, it decreased at the end of the growing season, while the acidity increased. Thus, in the control (without fertilizer) option, the dry matter is 6.5-6.8% at the beginning of the harvest, 5.8-6.1% at the end of the harvest, sugar is 3.2-3.3% and 2, 8-3.0%, acidity 0.41-0.45% and 0.51-0.55%, vitamin C 18.2-19.6 mg% and 17.2-17.8 mg%, nitrate nitrogen 47.6-50.5% and 38.5-41.6 mg / kg in wet weight, and the highest values were observed in the variant of manure at 30 t / ha, respectively, 7.5-8.0% and 7.0 - 7.5%; 3.9-4.2% and 3.6-4.0%; 0.35-0.36% and 0.44-0.47%; 22.3-23.5 mg% and 21.4-22.6 mg% and 75.5-80.3 mg / kg and 70.6-75.5 mg / kg, respectively.

When half of the organic fertilizer norms are replaced with the equivalent amount of mineral fertilizers and the organic-mineral fertilizers are given together, the quality indicators of the tomato are higher than those of the single organic fertilizers. has increased significantly. The highest values are observed in the variant of

manure 15 t / ha + N75P37,5K90, 8.0-8.2% at the beginning of the dry matter harvest, 7.3-7.8% at the end of the harvest, 4.2-4 sugar , 4% and 3.8-4.3%, acidity 0.33-0.35% and 0.41-0.45%, vitamin C 23.2-24.6 mg% and 22.2-23, 5 mg%, nitrate nitrogen was 85.7-88.6% and 75.8-80.2 mg / kg in wet weight.

Balance of nutrients and economic efficiency in the soil under the tomato plant

Nutrients extracted from the soil by fruits and vegetative mass of tomato plant, atmospheric sediments, irrigation water, composition and amount of nutrients entering the soil with tomato root, stem residues, nitrogen, phosphorus and The balance of lime, the nutrient uptake ratio and the effect of the application of fertilizers under the tomato crop are reflected in the economic efficiency.

According to Academician G.Sh.Mammadova, in determining the correct application of the fertilization system in agriculture, it is very important to determine the balance of nutrients in plants. Properly applied fertilization system can not only restore the natural flow of elements in the biological cycle, but also eliminate the deficiency or excess of elements observed in some areas. The main sources of income of the balance of nutrients are: 1) mineral fertilizers; 2) organic fertilizers; 3) plant remains; 4) sowing material; 5) biological fixation by microorganisms; 6) access through precipitation. The outstanding part of the food balance includes the following: 1) removal of the main product from the field; 2) removal of plant remains from the field; 3) groundwater infiltration or surface washing; 4) loss as a result of erosion processes; 5) loss in the form of gas, etc.

According to Professor ZRMovsumova, all three nutrients (nitrogen, phosphorus, potassium) are in negative balance in our country, as the amount of nutrients (NPK) extracted from the soil in the gross product is many times less than that given to the soil in the form of fertilizers. that is, they are in high deficit.

The total amount of nutrients extracted from the soil depends on the yield, fertilizer norms, the chemical composition of the fruit of

the tomato plant and the vegetative mass, nitrogen 63 , 6-173,6, phosphorus 22,3-64,9 and potassium 75,8-203,1 kg / ha, 1 ton of tomato fruits 2,16-3,23 kg of nitrogen, phosphorus 0 , 75-1.21 kg and 2.57-3.78 kg of potassium.

Annually, 6.27-6.60 kg / ha of nitrogen, 1.01-1.16 kg / ha of phosphorus, 3.44-3.70 kg of potassium are deposited in the experimental field with atmospheric sediments. / ha, 3.40-3.70 kg / ha in accordance with irrigation water; 1.10-1.21 kg / ha; It fluctuated between 28.30-30.00 kg / ha.

In the control (without fertilizer) variant with root and stem residues, nitrogen is 8.6-9.7 kg / ha, phosphorus is 1.1-1.4 kg / ha, and potassium is 8.8-10.0 kg / ha. case, manure 16.0-17.0 at 30 t / ha; 3,1-3,5 and 17,6-19,2 kg / ha, kg / ha, manure 15 t / ha + nitrogen in N75P37,5K90 17,2-18,1, phosphorus 3,5- 3.9 and potassium was 19.4-20.8 kg / ha.

The balance of the tomato plant is based on the income and expenditure of nutrients. The balance was calculated by the "difference method". In the "soil-plant" system, in the non-fertilized version, all the elements of the balance are negative. The balance of nitrogen, phosphorus and potassium in the control variant is negative 43.9-47.0; 18.64-21.88 and 33.8-36.16 kg / ha. As a result of the application of organic and organic-mineral fertilizers, the negative balance of nutrients is completely eliminated. The best indicators are obtained with a single manure of 30 t / ha of nitrogen positive 15.4-23.1 kg / ha, phosphorus positive 22.36-24.52 kg / ha , potassium 44.0-51.24 kg / ha, manure of organic-mineral fertilizers 15 t / ha + nitrogen positive in the variant N75P37,5K90 4.5-4.7 kg / ha, phosphorus positive 16.26- 16.32 kg / ha, potassium was positive 29.7-32.84 kg / ha.

Cədvəl 1

Üzvi və üzvi mineral gübrələrin pomidorun iqtisadi səmərəliliyinə təsiri (2014-2016)

s/s	Practice	Commodity options tomato product t / ha, (70% of the total product)	Cost of the product, man / ha	Expenditure on fertilizers, man / ha	Expenditures on agrotechnical measures and harvesting, man / ha	Total expenses, man / ha	From the total product net income received, man / ha	Cost of 1 ton of tomato product, man	Net income received from fertilizers, man / ha	Profitability,%
1	Control (without fertilizer)	20,6	6180,0	-	3654,0	3654,0	2526,0	177,4	-	69,0
2	Manure 20 t / ha	26,0	7800,0	64,0	4086,0	4150,0	3650,0	159,6	1124,0	88,0
3	Manure 30 t / ha	36,4	10920,0	96,0	4918,0	5014,0	5906,0	137,8	3380,0	118,0
4	Manure 40 t / ha	33,1	9930,0	128,0	4594,0	4722,0	5208,0	142,7	2682,0	110,3
5	Manure 10 t / ha + N50P25K60	28,7	8610,0	145,0	4302,0	4447,0	4163,0	155,0	1637,0	93,6
6	Manure 15 t / ha + N75P37.5K90	37,5	11250,0	194,0	5006,0	5200,0	6050,0	138,7	3524,0	116,3
7	Manure 20 t / ha + N100P50K120	35,0	10500,0	242,0	4806,0	5048,0	5452,0	144,2	2906,0	108,0

Fertilizer application rate at 30 t / ha of nitrogen, phosphorus and potassium 87.3-98.0 kg / ha or 58.2-65.3%; 30.6-36.1 kg / ha or 40.8-48.1%; 101.4-111.4 kg / ha or 56.3-62.0%. Manure at 15 t / ha + N75P37.5K90, respectively 106.9-110.0 kg / ha or 71.3-73.3%; 39.2-42.6 kg / ha or 52.3-56.8%; 121.6-127.3 kg / ha or 67.6-70.7%.

In our research, the economic efficiency of the application of organic and organic-mineral fertilizer norms under the tomato plant was studied. It has been found that the application of fertilizers under the tomato plant not only increases productivity and quality, but also increases the cost of production (Table 1). . Therefore, the analysis of the results of the application of fertilizers, the productivity and quality of tomatoes from an economic point of view allows to accurately determine the effectiveness of experiments. When calculating economic efficiency, all costs incurred in the application of fertilizers and the production of by-products, the cost of fertilizers,

loading, transportation, and delivery to the site were taken into account.

The highest net income from the gross product in the variant of 30 t / ha of manure was 5906.0 man / ha, 1 The cost of the product is 137.8 manat per ton, the net income from manure is 3380.0 manat per hectare, the level of profitability is 118.0%, the yield of manure is 15 t / ha + N75P37.5 K90. Iraq 6050.0 man / ha; 138.7 man; 3524.0 man / ha and 116.3%.

RESULTS

1. It was determined that the irrigated gray-brown (chestnut) soils are poorly provided with the assimilated forms of nutrients due to the gradation accepted in the republic. The application of organic and organic-mineral fertilizers in these lands, in addition to increasing fertility, creates favorable conditions for a stable, high-quality and high yield of tomato plants.
2. Application of organic and organic-mineral fertilizers under tomatoes increases the amount of ammonia and nitrate nitrogen, mobile phosphorus and exchangeable potassium in 0-60 cm layer of soil. As a result, the effective fertility of the soil increases, the agrochemical properties improve, which, in turn, creates the basis for high yields of tomato plants.
3. Organic and organic-mineral fertilizers have a significant effect on the accumulation of nutrients in the vegetative mass and fruit of the tomato plant on the stages of development. Nitrogen, phosphorus and potassium accumulate more in the vegetative mass during the fruiting period, and decrease accordingly at the end of the harvest. At the beginning of the harvest, the total amount of nitrogen, phosphorus and potassium in tomato fruits was high, but at the end it was low.
4. Studies show that the height of the tomato plant, the number of flower clusters, side stems and the formation of tomato fruit depends mainly on fertilizer norms. The highest values were observed in 30 t / ha of manure and 15 t / ha of manure

+ N75P37,5K90. Reduced and increased fertilizer rates did not have much effect on height and development.

5. As a result of application of organic and organic-mineral fertilizers under tomato plant, the highest yield was 52.0 t / ha in 30 t / ha variant of manure from single manure variants as organic fertilizer. 22.6 t / ha or 77.0% of the non-fertilized variant, replacing half of the organic fertilizer norms with the equivalent amount of mineral fertilizers, and when organic-mineral fertilizers are given together. 53.6 t / ha, 24.2 t / ha or 82.3% were obtained in 15 t / ha + N75P37,5K90 variant, respectively.
6. The application of fertilizers under the tomato plant, along with productivity, also has a significant impact on the quality of tomato fruits. Compared to the control (fertilizer-free) option in tomato fruits due to the effect of fertilizers, at the beginning of the harvest the dry matter is 0.3-1.5%, sugar 0.3-1.1%, vitamin C 1.1-5.0 mg%, nitrate nitrogen increased by 5.2-41.0 mg / kg, and acidity decreased by 0.02-0.12%. The amount of nitrates in tomato fruits was much lower than the permissible level (150 mg / kg in wet weight).
7. The total amount of nutrients extracted from the soil depends on the yield, fertilizer norms, the chemical composition of the fruit and vegetative mass of the tomato plant. depending on the amount of nitrogen 63.6-173.6, phosphorus 22.3-64.9 and potassium 75.8-203.1 kg / ha, 1 ton of tomato fruits 2.16-3.23 kg of nitrogen extracted from the soil , 0.75-1.21 kg of phosphorus and 2.57-3.78 kg of potassium. Therefore, in order to get a high-quality product from the tomato plant, the nutrients extracted by the plant must be returned to the soil.
8. In the "soil-plant" system, all elements of the balance (economy) in the control (without fertilizer) option are negative. The application of fertilizers has completely eliminated the negative balance.
9. The economic analysis of the application of fertilizers under the tomato plant shows that the highest net income is 5906.0 manat / ha in the 30 t / ha variant of manure, the level of

profitability is 118.0%, the equivalent amount of half of the manure. Among the variants replaced by mineral fertilizers, manure was 6050.0 man / ha and 116.3% at 15 t / ha + ¬N75P37,5K90.

RECOMMENDATIONS TO FARMS

1. In order to obtain high and high-quality ecologically safe products from tomato plants on irrigated gray-brown soils in Ganja-Gazakh region and to maintain soil fertility, fertilizers should be applied on farms on a balanced basis.
2. It is recommended that farms apply 30 t / ha of manure as an organic fertilizer and 15 t / ha of manure as an organic-mineral fertilizer + N75P37,5K90 annually under the tomato plant.

The main content of the dissertation is reflected in the following articles done:

1. The effect of organic and mineral fertilizers on the change of nutrients in the soil under the tomato plant // Azerbaijan Agrarian Science, Baku, 2016, №2, p. 11-21 (Co-author - HA Aslanov)
2. The effect of fertilizers on the accumulation of total nitrogen, phosphorus and potassium in the fruits of tomato plants // Scientific works of ADAU, Ganja: ADAU Publishing House, 2016, №2, p.63-67
3. The effect of fertilizers on the accumulation of total nitrogen, phosphorus and potassium in the surface mass of tomato plants / ADAU, Ways to increase soil fertility in Azerbaijan: Proceedings of the national scientific-practical conference dedicated to the 80th anniversary of Academician Mammadtagi Ibrahim oglu Jafarov (July 08 2016). Ganja: ADAU Publishing House, 2016, pp.190-196
4. The main agrochemical and physical-chemical properties of vegetable soils // Newsletter of Ganja branch of ANAS. Ganja:

Elm Publishing House, 2016, №2 (64), p. 66-70
5. The effect of fertilizers on the absorption of nutrients by tomato plants in gray-brown soils // News Bulletin of Ganja branch of ANAS. Ganja: Elm Publishing House, 2017, №2 (68), p. 71-75
6. The effect of fertilizers on the transport of nutrients in the soil with the fruits and vegetative mass of tomato plants // Scientific works of ADAU, Ganja: ADAU Publishing House, 2017, №2, p.84-88
7. Efficiency of fertilizers under tomato plant / "Actual problems of soil science" dedicated to the 110th anniversary of HA Aliyev at the Institute of Soil Science and Agrochemistry of ANAS Proceedings of the Republican Scientific Conference (December 21-22, 2017). Baku: "MSV PUBLICATION", 2017, p.110
8. Influence of fertilizers on the growth and development of tomato plant on gray-brown soils // Soil Science and Agrochemistry of ANAS v.23, Baku: "MSV PUBLICATION", 2018, p.314-317 (Coauthor - HA Aslanov)
9. Influence of fertilizers on yield and quality of tomato fruits in Ganja-Kazakhstan zone of Azerbaijan // Bulletin of Ryazan State Agrotechnological University named after PA Kostycheva, 2018, № 1 (37), p.5-8 (co-author Hajieva RT)
10. Influence of fertilizers on the balance of nutritious substances // Bulletin of Science and Practice 2019, № 9, p.217-226
11. The effect of organic and mineral fertilizers on the nutrients of the harvest of tomatoes. / Materials XXlll Mejd. Scientific-practical conference of NIC "Actuality.RF", "Russian Science", Moscow, Moscow State University, 2019, №124, p. 3-6
12. Quantity and composition of nutritious substances entering the soil by atmospheric sediments and irrigation water / Materials XXlV International. scientific-practical conference of NIC "Actuality.RF" "Russian science in the modern world", Moscow, Moscow State University, 2019, №124.5, p.12-15

The defense of the dissertation will be held at 0900 in 2021 at 1100 at the meeting of the Dissertation Council FD.1.32 operating under the Azerbaijan National Academy of Sciences, Institute of Soil Science and Agrochemistry.

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The dissertation is available in the library of the Institute of Soil Science and Agrochemistry of ANAS.

Electronic versions of the dissertation and abstract are posted on the official website of the office @ tai.science.az.

The abstract was sent to the required address on "21" 11 2021.