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DEVELOPMENT OF OPTIMAL NUTRİTİON REGIMES FOR VEGETABLE BEANS IN IRRIGATED GRAY-SOILS OF ABSHERON

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SYNOPSIS

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INTRODUCTION

Relevance and development of the topic. The development of the agricultural sector is aimed at overcoming the problem of food security, directly in the production of food products. In modern times, it is impossible to achieve sustainable food without the application of fertilizers. Due to the reduction in the use of fertilizers in the agro-industrial complex, the productivity of the soil has significantly decreased, resulting in reduced food production and deteriorating quality.

Ensuring food security and sustainability of the agro-industrial complex of the country in recent years, the export of high quality agricultural products to foreign and domestic markets and the transfer of agricultural production to ecological agriculture are among the important issues ahead [82, p. 4].

The Development Concept “Azerbaijan 2020: Strategic Vision” was approved by the Decree signed by the President of the Republic of Azerbaijan Mr. Ilham Aliyev on December 29, 2012. Based on the export-oriented economic model, the development concept “Azerbaijan 2020: Vision for the Future” envisages that increasing the competitiveness and improving the structure of the economy will lay the foundation for the development of the non-oil sector, especially agriculture at world standards[1].

Agro-technical measures applied in the cultivation of agricultural crops, surface and underground residues entering the soil after the destruction of plants, applied organic fertilizers often can not restore the losses caused by the mineralization of humus. In this regard, the use of organic and mineral fertilizers, the cultivation of plants capable of fixing atmospheric nitrogen while maintaining soil fertility, it also provides plants with additional biogenic nutrients and fertilizers. Increases the absorption rate of nutrients. In modern

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[1] Azerbaijan 2020: Vision for the Future Development Concept // Decree of the President of the Republic of Azerbaijan dated December 29, 2012. - Baku, - 2012, - 39 p. https://president.az/files/future_en.pdf

times, the provision of the population with food is urgent, and one of the ways to solve this problem is to expand the sown areas of valuable legumes rich in protein and increase their productivity. Increasing the sown area and productivity of plants with more protein is an important issue for agricultural production. From this point of view, vegetable beans, which are widely used for various purposes in the food industry, are of special importance in providing the population with protein. That is why when growing vegetable beans, the main focus should be on obtaining high yields, taking into account zonal farming techniques. Application of organic and mineral fertilizers under vegetable beans in irrigated gray-brown soils of Absheron, determination of effective norms, study of their ratio and impact on the environment are urgent. The use of unscientific high doses of mineral fertilizers and the use of chemicals in plant protection in modern times have had a negative impact on the agrochemical properties of irrigated gray-brown soils, which significantly affects the productivity of agrocenosis and product quality. The main problem of agricultural production in modern times is to increase the productivity of crops. The implementation of agricultural production at the present stage requires the improvement of crop rotation technologies and the search for alternative sources of plant nutrition. First of all, it is important to study the use of surface and underground remains of predecessors as a food source for plants. Subject of research. Determination of optimal organic and mineral fertilizer norms for obtaining economically efficient and high productivity of "Zulal" variety of vegetable beans in irrigated gray-brown soils of Absheron peninsula.

The purpose and objectives of the study. The main purpose of the work is to increase the potential productivity of blue beans and seeds of vegetable beans and determine the optimal fertilizer rates to maintain the fertility of irrigated gray-brown soils of Absheron, improve the quality of commodity products, determine the balance of nutrients and economic and bioenergetic efficiency.

The following measures have been taken to achieve the set goal:

- study of physical and chemical properties of irrigated gray-brown soils used for many years under agricultural crops;

- Carrying out phenological observations and biometric measurements on vegetable beans during the growing season;

- to study the effect of organic and mineral fertilizers on the growth and development of beans;

- study of the effect of organic and mineral fertilizers on the productivity of vegetable beans;

- to study the effect of organic and mineral fertilizers on the quality of vegetable beans;

- Determination of the condition and accumulation of basic biogenic elements in irrigated gray-brown soils, depending on the stage of development of vegetable beans;

- to study the dynamics of changes in the amount of nitrogen, phosphorus and potassium accumulated in the vegetative and generative organs (stems, leaves and fruits) of vegetable beans depending on the stage of development;

- Determining the balance of nutrients in the cultivation of vegetable beans;

- to determine the correlation between the applied fertilizer norms and the development phases and productivity of vegetable beans;

- Calculation of bioenergetic and economic efficiency of application of organic and mineral fertilizers in the cultivation of vegetable beans.

Object of research: The object of research was the irrigated gray-brown soils of the Absheron Auxiliary Experimental Farm of the Vegetable Research Institute of the Ministry of Agriculture of the Republic of Azerbaijan and the regionalized "Phaselous L." variety of vegetable beans.

Research methods. The period of the study covers 2018-2020. The experiments were performed in 5 variants and 4 repetitions with vegetable beans on irrigated gray-brown soils. The total area was 1000 m2 with an area of 50 m2. The experiments are set out in the following scheme: 1. Control (without fertilizer); 2. 10 t of manure (farm option); 3. N30P30K30; 4. N60P60K30; 5. N90P60K60. Manure was used as organic fertilizer, ammonium nitrate as nitrogen fertilizer (active substance - t.e.m. 34%), superphosphate as phosphorus fertilizer (t.e.m. 20%) and potassium chloride (t.e.m. 45%) as potassium fertilizer. Sowing of vegetable beans was carried out according to the scheme of 45 × 10 cm. In practice, the following observations and measurements were made on vegetable beans in the field:

-phenological observations - initial and mass performance, initial and mass flowering, technical maturity, number of interfacial days;

-biometric measurements in plants during the growing season - plant height, number of beans in the plant and length of beans.

Vegetable beans were harvested during technical maturity (blue beans) and 5-6 times during the growing season. Dispersion analysis of productivity, mathematical calculations of productivity and correlation dependence - variational-statistical analysis B.A. Conducted according to Dospekhov.

Sections were made to study the physical and chemical properties of the soils of the study object, soil samples were taken from the genetic layers and envelope depths of 0-20 and 20-40 cm during the growing season to study the dynamics of nutrients in the experimental soils. The analysis of physical and agrochemical indicators in the soil was carried out in accordance with generally accepted methods. According to NA Kaczynski, the granulometric composition is pipetted by working with sodium pyrophosphate; hygroscopic moisture - thermal method; reaction of the medium in water suspension - with pH-meter; absorbed bases - Ca and Mg - according to DV Ivanov; carbonate content ($CaCO_3$) - by Schebler method with calcimeter; humus İ.V. According to Tyurin; total nitrogen by the Kyeldal method; determination of absorbed ammonia (NH4) by Nessler reagent according to DM Konev; nitric nitrogen (NO3) - with disulfophenolic acid; mobile phosphorus (P_2O_5) - according to B.P.Machigi and exchangeable potassium (K_2O) - according to P.V.Protasov.

The surface mass of the plant in the area of 25-25 cm was dried and drawn in air and the mass was calculated in s/ha. The root mass of the plant was cleaned from the soil, washed and sifted through a 1 mm sieve, all root parts were collected and dried in air and the mass was calculated in s/ha. The experiments were performed in 4 repetitions.

In the analysis of plant samples, the combustion to get rid of ash elements was carried out according to KE Ginsburg, nitrogen-micromethod by Kyeldal method, phosphorus-photoelectrocolorimeter and potassium-flame photoelectrocalorimeter. The amount of crude protein in vegetable beans was calculated by multiplying the total nitrogen content of the plant by a factor of 6.25, ie $Z\% = K \times N$.

Mathematical calculation of the obtained results was performed in Microsoft Excell with the help of a standard program. Statistical comparisons were calculated using BA Dospekhov using the Student's coefficient. Economic efficiency was made according to SO Babirova and bioenergetic efficiency according to VG Mineyev.

The main provisions of the defense. The following provisions have been added to the defense:

1. The effect of the application of organic and mineral fertilizers on irrigated gray-brown soils in the formation of nutrients in the soil-plant system;

2. The effect of organic and mineral fertilizers on the formation of vegetable bean product quality on irrigated gray-brown soils;

3. The effect of organic and mineral fertilizer rates on the productivity of vegetable beans;

4. Balance of nutrient intake by vegetable beans:

5. Assessment of economic and bioenergetic efficiency of the use of different fertilizer norms in the cultivation of vegetable beans.

Scientific novelty of the research. The effect of organic and mineral fertilizers applied on gray-brown soils for the first time under irrigation on the size and development of vegetable beans, the regularity of changes in biogenic elements in the soil-plant system, productivity and product quality, soil fertility and productivity, economic and bioenergy efficiency studied. Regression and variance analyzes revealed a reliable relationship between vegetable bean productivity and fertilizer rates.

Theoretical and practical significance of the research. As a result of the research, the application of organic and mineral fertilizers on a scientific basis under the bean plant has allowed to maintain the fertility of irrigated gray-brown soils and increase their productivity.

Farms were offered to use optimal fertilizer norms for growing vegetable beans on irrigated gray-brown soils. The proposed fertilizer rate allows optimizing the nitrogen regime of the soil, obtaining high and quality products from cultivated plants, maintaining soil fertility and reducing the cost of the product.

Approbation and application of research. Results of the research in the annual scientific reports of the Vegetable Research Institute of the Ministry of Agriculture of the Republic of Azerbaijan (2018-2020), International and Republican scientific-practical conferences abroad and in the country, including the Republican Scientific Conference "Modern Problems of Biology" (Sumgayit, October 23-24 , 2018); Conference of young scientists and students “Innovations in Biology and Agriculture to Solve Global Challenges” (Baku, October 31, 2018); International scientific-practical conference “Actual problems of modern natural and economic sciences” (Ganja State University, May 03-04, 2016); It was discussed at the International Scientific-Practical Conference of Young Scientists "Ecology and Land Reclamation of Agricultural Landscapes: Prospects and Achievements of Young Scientists" (Volgograd, November 6-9, 2019).

As a result of the research, the recommendation “Optimal food regime for growing vegetable beans on irrigated gray-brown soils in Absheron” was proposed for application to “AzerSun Agricultural Products” LLC.

Name of the organization where the dissertation work is performed. AR KTN Vegetable Research Institute Absheron Auxiliary Experimental Farm of a public legal entity.

Volume and structure of the dissertation. The dissertation consists of an introduction, 6 chapters, results, a bibliography of 181 sources, 257,626 characters, 168 pages of printed material with 29 figures and 28 tables.

Personal presence of the author. The author is personally responsible for the implementation of experiments in the implementation of the dissertation, the mathematical processing of the actual figures obtained, the generalization of the results obtained during the research.

Publication. The author has published 6 articles, 3 theses (including 4 articles, 1 thesis) reflecting the results of the dissertation.

The introductory part of the dissertation shows and substantiates the importance of increasing the demand for legumes in the world, the urgency of determining the effective norms and proportions of organic and mineral fertilizers under vegetable beans, the purpose of the work, scientific novelty, practical importance of research.

The first chapter examines modern problems in the application of organic and mineral fertilizers in vegetable growing, especially in the cultivation of legumes, with reference to literary sources.

In the second chapter, the physico-chemical indicators of the study soil based on the cut sections and the degree of nutrient supply of the experimental soil were determined as a result of relevant analyzes, biological characteristics of vegetable beans and results of phenological, biometric measurements on plants.

In Chapter III, the effect of organic and mineral fertilizers on the productivity of blue beans and seeds, biomass (aboveground and underground parts) of vegetable beans, the amount of protein and nutrients accumulated in blue beans and seeds was studied.

In Chapter IV, the effect of organic and mineral fertilizers on the degree of nutrient supply of irrigated gray-brown soils (nitrate nitrogen, absorbed ammonia, mobile phosphorus, exchangeable potassium) was studied, regression-correlation relations between the productivity of vegetable beans and nutrients were determined.

In Chapter V, the balance is calculated based on the amount of nutrients in the irrigated gray-brown soils, which enter the soil with organic and mineral fertilizers and are removed from the soil by the main and additional products of vegetable beans.

Chapter VI calculates the bioenergetic and economic efficiency of the application of organic and mineral fertilizers to the cultivation of vegetable beans.

MAIN CONTENT OF THE WORK

Agrochemical properties of research soils. Biological features and developmental phases of vegetable beans

The study of physicochemical properties of irrigated gray-brown soils according to the sections shows that the amount of physical clay fluctuates between 53.0-70.6%, the highest amount in the subsoil, dust fractions fluctuate between 43.7-55.0% along the profile in the upper layers. was high, the amount of water-resistant aggregates varied between 15.1-23.5% along the profile. In irrigated gray-brown soils, the high content of humus was in the sown (1.57%) and subsoil (1.24%) layers, 0.38-1.57% in the 0-137 cm layer and relatively high carbonate content in the middle layers, ranging from 8.3-17.8% in profile length. Thus, irrigated gray-brown soils can be classified as heavy-clay and light-clay soils with low granulometric composition, low fertility, carbonate and alkaline environment along the profile.

In the experimental area of the research object, the amount of humus in the 0-60 cm layer is 1.02-1.48%, the amount of nitrate is 7.2-12.1 mg/kg, the absorbed ammonia is 10.4-15.3 mg / kg, the mobile phosphorus is 5.4-8.3 m /kg and exchangeable potassium - between 172-228 mg / kg, and the soils were poorly supplied with nutrients (Table 1).

Table 1

Fertility parameters of experimental field soils

Depth, sm	**Humus, %**	**Nitrogen,%**	N/NO_3 mq/kg	N/NH_4 mq/kg	P_2O_5 mq/kg	K_2O mq/kg	$CaCO_3$ %	pH
0-20	1.48	0.128	12.1	15.3	8.3	228	9.2	8.1
20-40	1.25	0.113	10.3	13.1	6.2	204	12.3	8.3
40-60	1.02	0.099	7.2	10.4	5.4	172	16.5	8.5

Beans - Phaseolus (Phaseolus) belongs to the family Fabaceae and includes 97 species. Vegetable beans play an important role in providing the population with fresh, frozen, canned high-quality food, protein-rich foods.

According to the average figures for 2018-2020, the weight of 1000 seeds in the control variant of vegetable beans is 273.6 g, in the variant of 10 tons of manure - 287.9 g, in the variant of NPK fertilized in the norm of 1: 1: 1. 277.9 g, 309.7 g in the 2: 2: 1 variant of the NPK and 313.2 g in the 3: 2: 2 variant of the NPK.

Based on the results of the study, it can be noted that the relationship between the yield of blue beans and seeds of vegetable beans and the mass of 1000 seeds was r = 0.50.

The results of biometric measurements in 2018-2020 show that in the early stages of development of vegetable beans - until the flowering phase, plant growth accelerated, until the fruit formation phase, this process weakened and near the end of the growing season, the growth process almost stopped. During the years of research, the vegetation period of vegetable beans lasted 86-91 days, depending on the options.

The effect of organic and mineral fertilizers on the height, productivity and quality of vegetable beans

According to the average figures of the three-year study, the height of the plant in the control variant was minimal, and in the fertilized variants it was 35.6-76.4% higher than the control, the maximum value of this indicator was observed in the norm of 3: 2: 2 during technical maturity). Statistical calculation of the height of the vegetable bean plant shows that this indicator varied between 53.9 ± 5.31 cm in 2018, 54.3 ± 4.79 cm in 2019 and 54.6 ± 4.97 cm in 2020 for all variants.

In the bi-national experiment, the correlation between the given amount of fertilizer and the height of the bean plant was high (r = 0.944) based on the average three-year indicators of the effect of fertilizers on plant height.

In the application of fertilizers to vegetable beans grown on irrigated gray-brown soils, the average yield in the first year of the study varied between 159.3-227.8 s, in the second year 154.2-220.8 and in the third year 153.3-221.8 s / ha (Figure 1). Based on the three-year averages, almost as a result of manure application, productivity was 24.6 s/ha (15.8%) higher than the control. It should be noted that the application of mineral fertilizers in the norm N90P60K60 limited the increase in productivity.

Control in 2018-2020, productivity in 10 t manure, $N_{30}P_{30}K_{30}$, $N_{60}P_{60}K_{30}$ and $N_{90}P_{60}K_{60}$ variants 22.2-22.8, respectively; 25.4-26.3; 31.5-32.8; Fluctuated between 34.7-35.2 and 33.6-33.7 s / ha. The increase in vegetable bean seed productivity was between 3.2-12.4 s / ha or 14.2-54.9% on average three-year figures, and the highest increase was observed in the $N_{60}P_{60}K_{30}$ variant, but the N90P60K60 fertilizer norm limited the increase in seed productivity.

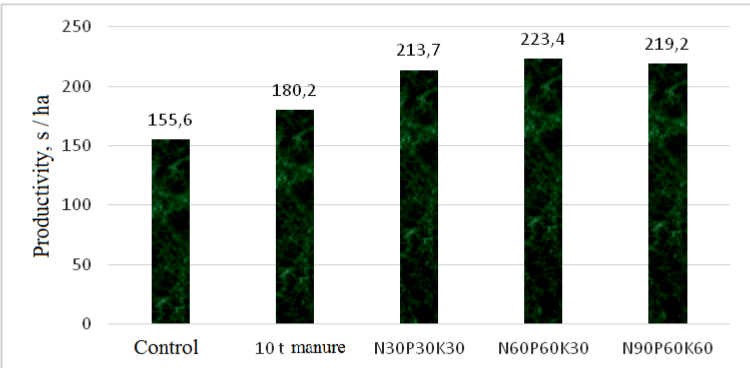

Figure 1. The effect of fertilizer on the productivity of blue beans

According to the three-year averages, the productivity of the green mass of vegetable beans varies between 128.8-220.9 s / ha for variants, and 21.5-92Sh1 s/ha or 16.7-71.5% for control. The figures show that the given fertilizer rates have a significant impact on the productivity of vegetable bean biomass. The dependence between fertilizer and phytochemical productivity was high.

During the study period, the amount of protein accumulated in the beans and seeds of vegetable beans according to the variants was between 14.1-18.3% and 21.9-25.2%, respectively. The highest amount of protein in the beans and seeds of the plant was recorded in the given version of the fertilizer N60P60K30. The figures obtained during the years of the KMF05 study show a significant increase in the amount of protein in both the bean and the seed in the fertilized variants.

According to the three-year averages, the nitrogen content is 0.84-3.51% in the control variant, 0.95-3.73% in the 10 t manure variant, 1.15-3.89% in the $N_{30}P_{30}K_{30}$ variant, 1.28-4.03% in the $N_{60}P_{60}K_{30}$ variant and $N_{90}P_{60}K_{30}$ depending on the stage of plant development. in the variant was 1.22-3.92%. If we look at the development dynamics of beans, despite the relatively high nitrogen content at the beginning of the growing season, a decrease in the flowering phase was observed.

The maximum amount of nitrogen coincided with the formation of beans and fruits. In the non-fertilized variant, the average nitrogen content in blue beans for 3 years is 2.26% and 2.59% in the fertilized variant, in the variants with different doses of mineral fertilizers 2.80-2.93%, and in the seeds these indicators are 3.51%, respectively; 37.3% and 3.89-4.03%. The amount of nitrogen accumulated in the seeds of vegetable beans was 1.12% higher than in blue beans. A comparison of the options for the amount of nitrogen shows that the highest amount was recorded in the variant where the fertilizer was given in the norm $N_{60}P_{60}K_{30}$.

During the study period, the amount of phosphorus in the control variant of beans was 0.78-0.80% in the bush phase, 0.40-0.48% in the flowering phase, 0.83-0.87% in the pulse formation phase and 0.72% in the tissue formation phase. Was 0.76%. A comparison of the options for phosphorus content shows that the least amount was in the control option.

The results of three-year observations showed that the amount of potassium, depending on the stage of plant development, was 0.86-1.30% in the control variant, 0.96-1.70% in the 10 t manure variant, 1.01-1.82% in the $N_{30}P_{30}K_{30}$ variant, and 1.07 in the $N_{60}P_{60}K_{30}$ variant. -1.92% and 0.94-1.86% in the $N_{90}P_{60}K_{30}$ variant, the amount of potassium was higher in the budding and pulse formation phases than in the flowering and tissue formation phases. It was observed that in the variant of mineral fertilizer $N_{60}P_{60}K_{30}$, more potassium was accumulated in the organs and fruits of beans. During the budding and bean formation phases, the accumulation of nitrogen and potassium in the plant was higher than that of phosphorus. During the flowering period, the amount of potassium exceeded that of phosphorus by 1.5-2.0 times.

The results of three years of research show that the most concentrated element in the phyto-mass of vegetable beans (aboveground and underground) was nitrogen (0.8-1.1%). The amount of potassium and phosphorus was 2.5-3.0 times less, 0.32-0.40% and 0.16-0.32%, respectively. In the formation phase of beans and seeds, the amount of nitrogen increased 3.0-4.0 times and amounted to 2.26-4.03%, which is due to the increase in phosphorus (0.74-1.54% and potassium (0.86-1.65). %) was 2.5-3.0 times more than the amount.

The effect of organic and mineral fertilizers on the amount of nutrients in irrigated gray-brown soils

The results of three-year research conducted in 2018-2020 show that the amount of nitrate under all options under vegetable beans is 7.0-18.6 mg/kg in 0-20 cm layer, 6.0-16.0 mg in 20-40 cm layer. /kg, the amount of ammonia was 9.9-24.0 and 7.5-19.3 mg/kg in the soil, respectively. At all stages of the study, the nitrate form of nitrogen was higher in the sowing layer (0-20 cm) than in the sowing layer (20-40 cm). The amount of ammonia absorbed, as in the form of nitrogen nitrate, has changed in the direction of germination, flowering and full maturation.

The figures show that the amount of nitrate and ammonia absorbed in the soils under the vegetable beans increased with the increase of fertilizer norms in the variants, but decreased in all variants until the final stage of development by phases.

The high amount of nutrients under vegetable beans was recorded in the given variant of $N_{90}P_{60}K_{60}$ fertilizer norm. Thus, the amount of nitrate during the emergence of seedlings was 7.2 mg/kg (40.2%)

compared to the control, 5.9 mg/kg (38.1%) in the flowering phase and 7.0 mg/kg (48.1%) in the full ripening phase. %), 8.7 mg/kg (40.1%), 7.4 mg/kg (40.0%) and 6.5 (42.3%) more than the absorbed ammonia, respectively.

In irrigated gray-brown soils, the final limits of sampling error were calculated with a probability of 95% for the amount of nitrate and absorbed ammonia from nutrients for 2018-2020. As a result of the calculation, it was determined that the three-year average amount of nitrate and ammonia is 12.8 and 15.4 mg/kg, respectively.

When nutrient deficiencies in arable land are not compensated, they lead to further depletion, which affects the level of productivity and the efficiency of agricultural production in general [89, p. 4]. In all variants of mineral and organic fertilizers, the amount of nutrients assimilated during the flowering phase is significantly increased, but decreased at the end of the development phase [22, p. 10].

A correlation was established between the percentage of nitrogen in vegetable beans and the amount of nitrate in the soil, and correlation-regression equations were determined between these dependencies depending on the stages of plant development.

Thus, there is a great need for nutrients, especially nitrate and ammonia forms of nitrogen, to accumulate nitrogen in the plant, which is provided by the given fertilizer.

During the experiment, the maximum amount of mobile phosphorus compared to the soil under vegetable beans was recorded in the early stages of development, and the minimum amount was observed during the full ripening of beans. Thus, in 2018-2020, the amount of mobile phosphorus in the fertilizer-free variant is 4.6-6.9, depending on the stage of development, 10 tons of manure in the given variant is 5.5-7.8, in the fertilizer norm $N_{30}P_{30}K_{30}$ 6.2-9.2, It varied between 8.0-11.9 mg in the $N_{60}P_{60}K_{30}$ variant and 9.0-14.4 mg/kg in the $N_{90}P_{60}K_{60}$ variant. The application of fertilizers increased the average amount of phosphorus in three years by 52.1% in the $N_{90}P_{60}K_{60}$ variant, 48.2% in the flowering phase and 48.9% in the full maturity period during the emergence of seedlings compared to control.

The relationship between the percentage of phosphorus in vegetable beans and the amount of mobile phosphorus in the soil varied depending on the stages of germination and full maturity of the plant. Correlation-regression equations depending on the developmental stages of the plant have been determined.

In the control years, the amount of exchangeable potassium in the soil in the control variant was 23 mg/kg compared to the flowering phase in the bushing phase, 39 mg/kg compared to the full ripening phase, 25 and 37 mg/kg respectively in the 10 t manure variant, 23 and 38 kg/mg in $N_{30}P_{30}K_{30}$ fertilizer norm. , 20 and 40 mg/kg in the $N_{60}P_{60}K_{30}$ variant, 31 and 52 mg/kg in the $N_{90}P_{60}K_{60}$ variant. According to the triple averages, the amount of exchangeable potassium in the bushing phase was 58 mg/kg more than in the $N_{90}P_{60}K_{60}$ variant, 57 mg/kg more in the flowering phase and 45 mg/kg in the full maturity phase.

As a result of fertilizer application, the average potassium exchange rate increased by 22.3% during the seedling period, 24.9% during the flowering phase and 21.6% during the full ripening period compared to the control in the $N_{90}P_{60}K_{60}$ variant.

In the cultivation of vegetable beans, the relationship between the phases of potassium in the plant and the exchange of potassium in the soil was determined in the phases of bushing ($r = 0.793$), flowering ($r = 0.899$) and full ripening ($r = 0.892$), and the correlation between these indicators was quite reliable. The dependences between these indicators, depending on the stage of development of the plant, are expressed by the following regression equations:.

In 2018-2020, the nutrient reserves in the irrigated gray-brown soils were higher in the $N_{90}P_{60}K_{60}$ variant. According to the options, the reserves of nitrogen nitrate form varied between 11.7-19.5, absorbed ammonia - 11.0-18.5, mobile phosphorus - 7.6-15.1 and exchangeable potassium - 237-304 t/ha. The amount of nitrogen nitrate in the $N_{90}P_{60}K_{60}$ variant is 6.0 t/ha compared to the control, 2.8 t/ha compared to the $N_{30}P_{60}K_{30}$ variant, 0.9 t/ha compared to the N60P60K30 variant, the amount of ammonia absorbed is 9.8, respectively; 5.6; 3.5 and 1.3 t/ ha, mobile phosphorus - 7.5; 6.6; 5.0 and 2.4 t/ha and potassium - 67; 52; 38 and 50 t/ha more.

Thus, the obtained figures show that the increase in fertilizer rates plays an important role in increasing the amount of nutrients in irrigated gray-brown soils.

Carrying nutrients with vegetable beans, fertilizer absorption coefficient and balance

The study of the effect of different fertilizer rates on the amount of nutrients (nitrogen, phosphorus and potassium) in vegetable beans and legumes in 2018-2020 shows that the three-year average value of nutrients in beans and phytochemicals is 51.5%. 29.5 kg/ha, 11.0-27.2 kg/ha for phosphorus and 15.2-29.0 kg/ha for potassium. Thus, the increase in productivity has also increased the amount of nutrients extracted. The results of the three-year study show that a relatively high amount of nutrients was observed in the bean of vegetable beans in the variant N60P60K30, and the amount of nitrogen was 51.5 kg/ha, phosphorus 27.2 kg/ha and potassium 29.0 kg/ha. ha has been.

The relatively high amount of nutrients accumulated in the phyto-mass of vegetable beans was recorded in variant $N_{60}P_{60}K_{30}$, and according to the three-year average of experiments, the amount of nitrogen was 17.9 kg/ha, phosphorus 5.5 kg/ha and potassium 7.5 kg/ha. In the control variant of vegetable beans, the amount of nitrogen accumulated in beans was 3.4 relative to biomass, phosphorus 6.0, potassium 4.1, 10 tons of manure, respectively 3.2; 7.8 and 4.3, 3.4 in the $N_{30}P_{30}K_{30}$ variant; 6.6 and 4.3; 2.9 in the $N_{60}P_{60}K_{30}$ variant; 4.9 and 3.9, 3.1 in the $N_{90}P_{60}K_{60}$ variant; 5.2 and 4.7 times more. The figures once again confirm that beans are more nutritious than vegetable beans.

According to the three-year results, the relationship between the yield of vegetable beans and nitrogen was $r_N = 0.999$, between phosphorus $r_{P2O5} = 0.985$, between potassium $r_{K2O} = 0.996$, between biomass productivity $r_N = 0.988$, $r_{P2O5} = 0.998$, r_{K2}, respectively. .

The results of the study in 2018-2020 show that the amount of nitrogen carried out by beans in vegetable beans was 29.5 kg/ha, phosphorus 11.1 kg/ha and potassium 15.2 kg/ha, and in the fertilized variants these figures were relatively high. , 38.8-51.5, respectively; It ranged between 19.5-27.2 and 21.5-29.0 kg/ha. According to the results of the three-year experiment, 8.8-17.9 kg/ha of nitrogen, 1.8-5.5 kg/ha of phosphorus and 3.7-7.5 kg/ha of potassium were carried out with the phyto-mass of vegetable beans. Compared to the price of these indicators, the control minimum was the maximum in the N60P60K30 variant.

According to the three-year averages, the amount of nitrogen produced by the bean crop during the application of fertilizers is 9.2 kg/ha or 31.2% compared to the control in 10 tons of manure variant, 19.1 kg/ha or 64.7% in $N_{30}P_{30}K_{30}$ variant, $N_{60}P_{60}K_{30}$ 22.0 kg/ha and 74.6% in the variant and 20.8 kg/ha or 70.8% in the variant N90P60K60, phosphorus conduction 8.4 (76.7%) respectively; 14.3 (30.1%); 16.2 (47.0%) and 14.5 kg / ha (131.9%), potassium intake 6.2 (41.0%); 11.8 (77.6%); 13.8 (90.7%) and 13.5 kg/ha (89%) more. The results show that both beans and phytochemicals of vegetable beans contain less phosphorus than nitrogen and potassium.

The amount of nutrients in the phyto-mass of vegetable beans increased in the fertilized variants, an increase of 3.4-9.1 kg/ha for nitrogen (38.6-103.4%), 0.7-3.7 kg/ha for phosphorus. ha (38.9-205.6%) and for potassium it fluctuated between 1.3-3.8 kg/ha (35.1-64.9%). The figures show that the nutrients in vegetable beans are higher than in phytochemicals.

The productivity of vegetable beans is ensured by nutrients. Plants get the nutrients they need from the soil and fertilizers.

The amount of nitrogen carried by the root, leaves and stem along with the main and additional product of vegetable beans was 38.3 kg/ha in the control variant. Considering that the total amount of nitrogen produced in 10 t of manure variant is 12.6 kg/ha more than the control, the absorption coefficient of 50 kg of nitrogen fertilizer for manure is 25.2%, in $N_{30}P_{30}K_{30}$ variant it is more than 24.6 kg/ ha. The coefficient of absorption of 60 kg of nitrogen fertilizer was more than 31.1 kg/ha in the variant $N_{60}P_{60}K_{30}$, 51.8% and the absorption coefficient of 90 kg of nitrogen fertilizer was more than 28.3 kg/ha in the variant $N_{90}P_{60}K_{60}$ was 31.4%. In the control variant, the extraction of phosphorus from the surface and underground parts of vegetable beans was 12.8 kg/ha, and the increase in the fertilized variants was 9.1-17.6 kg/ha. The absorption coefficient of phosphorus fertilizer in the given variant of 10 t/ha manure was 36.6%, in the variant $N_{30}P_{30}K_{30}$ 54.4%, in the variant $N_{60}P_{60}K_{30}$ 33.2% and in the variant $N_{90}P_{60}K_{60}$ 29.4%. Potassium extraction by plant organs is 18.9 kg/ha under control, 26.5 kg/ha in 10 t/ha manure, 33.3 kg/ha in $N_{30}P_{30}K_{30}$ variant, 36.5 kg/ha in $N_{60}P_{60}K_{30}$ variant and 34.9 kg in $N_{90}P_{60}K_{60}$ variant. % was kg/ha. The application of different doses of manure and mineral fertilizers also affected the amount of potassium absorbed by the surface and underground organs of vegetable beans, and the absorption coefficient varied depending on the options. Depending on the applied fertilizer, the potassium absorption coefficient of 10 t/ ha of manure was 12.6% in the given variant, 48.0% in the $N_{30}P_{30}K_{30}$ variant, 58.6% in the $N_{60}P_{60}K_{30}$ variant and 26.6% in the $N_{90}P_{60}K_{60}$ variant.

Thus, referring to the obtained figures, it can be said that the maximum absorption coefficient of fertilizers during the application of fertilizers was $N_{30}P_{30}K_{30}$ and $N_{60}P_{60}K_{30}$, this indicator was 82.0% and 51.8% for nitrogen fertilizers, 54.4% and 33.2% for phosphorus fertilizers and potassium fertilizers, respectively. were 58.6% and 48.0% respectively. Thus, the coefficient of assimilation of nitrogen, phosphorus and potassium from fertilizers was more favorable in the variants where $N_{30}P_{30}K_{30}$ and $N_{60}P_{60}K_{30}$ fertilizer norms were applied in the cultivation of vegetable beans (table 2).

In the calculation of the income part of the nitrogen balance, fertilizers (organic and mineral), seeds with planting material, nitrogen fixation of atmospheric nitrogen, plant biomass and atmospheric sediments, plant products (beans) in the expenditure part, soil loss (soil washing, erosion) gas loss, etc. taken into account.

Table 2

The balance of mineral nutrition of vegetable beans (three-year average, 2018-2020 average)

Options	Product-narrownes s,s / ha	Revenue, kg / ha			Expenditure, kg / ha			Balance, + -			Balance intensity, %		
		N	P	K	N	P	K	N	P	K	N	P	K
Control (without fertilizer)	155,6	41,5	2,7	16,2	39,5	13,0	18,2	2	-10,3	-15	105.1	20,8	89,0
10 t of manure	180,2	91	8,5	53,3	51,2	22,7	27,5	+8.6	-14,2	25,8	177,7	37,4	193,8
$N_{30}P_{30}K_{30}$	213,7	120,7	35,0	59,5	63,0	34,8	33,4	57,7	0,2	26,1	191,6	100,6	178,1
$N_{60}P_{60}K_{30}$	223,4	182,6	66,6	60,8	70,3	44,2	35,4	112,3	22,4	25,4	259,7	150,7	171,5
$N_{90}P_{60}K_{60}$	219,2	232,3	66,1	98,3	73,6	37,5	38,4	158,7	28,6	59,9	315,6	176,3	256,0

The income part of the nitrogen balance fluctuated between 41.5 in the control variant, 91.0 in the 10 ton manure variant, 120.7 in the $N_{30}P_{30}K_{30}$ variant, 182.6 in the $N_{60}P_{60}K_{30}$ variant and 232.3 in the $N_{90}P_{60}K_{60}$ variant and ranged from 41.5 to 232.3 in the variants. The maximum value was recorded in the given variant with 159 kg/ha due to nitrogen. The expenditure part of the nitrogen balance was 39.5 in the controlled variant, 51.2 in the 10 ton manure variant, 63.0 in the $N_{30}P_{30}K_{30}$ variant, 70.3 in the $N_{60}P_{60}K_{30}$ variant and 73.6 in the $N_{90}P_{60}K_{60}$ variant, 39.5-73.6 in the variants. Changed between 6.

According to the results of the research, it can be said that there is a positive nitrogen balance in the fertilized and fertilized variants under vegetable beans. Due to the ability of legumes to meet their nitrogen needs by fixing atmospheric nitrogen, no negative nitrogen balance was recorded under vegetable beans during the study years. The intensity of the balance was the minimum value for nitrogen in the non-fertilized variant (105.1%), varying between 177.7-315.6% in the fertilized variants, the maximum value was recorded in the variant $N_{90}P_{60}K_{60}$. In the calculation of the phosphorus balance, the income part is 2.7 in the control variant, 8.5 in the 10 ton variant of manure, 35.0 in the $N_{30}P_{30}K_{30}$ variant, 66.6 in the $N_{60}P_{60}K_{30}$ variant and 66.1 in the $N_{90}P_{60}K_{60}$ variant, and 13.0 in the expenditure part, respectively; 22.7; 34.8; 44.2 and 37.5, 16.2 for potassium; 53.3; 59.5; 60.8 and 98.3, 18.2 in the expenditure part; 27.5; 33.4; Were 35.4 and 38.4. The variance interval of the income part of the balance was 2.7-66.6 for phosphorus and 16.2-98.3 for potassium.

In the years of the study, the yield of phosphorus balance fluctuated between 2.7-66.6, the lowest balance was without fertilizer, the highest balance was in the variant $N_{60}P_{60}K_{30}$. Negative balance was observed between the income and expenditure part of the balance in the given variants without fertilizers (-10.31) and manure (-14.2). There was a negative balance of nutrients in the control of the farm balance, a positive balance of phosphorus in the given variant, and a positive balance of nitrogen, phosphorus and potassium in the remaining variants. The intensity of the balance varies between 20.8-176.3%, weak intensity was observed in fertilizer-free and maximum $N_{60}P_{60}K_{60}$ variants. The difference between the income and expenditure parts of the balance of potassium under vegetable beans varied from 2.01 to 59.9 in the variants, the negative balance was in the non-fertilized variant, the difference in the variants with manure and mineral fertilizers was positive. The intensity of the potassium balance was minimal (89%) in the non-fertilized variant and high (193.8-256%) in the remaining variants.

Fertilizers in the cultivation of beans bioenergetic and economic efficiency

In modern times, agronomic, energy and economic efficiency indicators are widely used to assess the effectiveness of the use of organic and mineral fertilizers in the cultivation of agricultural crops.

In addition to traditional methods of assessing the efficiency of agricultural production, the method of energy evaluation, which takes into account both the amount of energy used in production and the amount of energy stored in the product, is of great importance. This method allows comparing different technologies, determining the structure of energy flow in agrocenoses and identifying the main needs for technical energy savings in agriculture.

As a result of the application of different doses of organic and mineral fertilizers in the cultivation of vegetable beans, energy efficiency varied in the range of 1.40-5.28, depending on the options. It was 1.40 units in the 10 t manure variant, 5.28 units in the $N_{30}P_{30}K_{30}$ variant, 3.55 units in the $N_{60}P_{60}K_{30}$ variant and 2.18 units in the $N_{90}P_{60}K_{60}$ variant (Table 3). Energy efficiency was higher in the $N_{30}P_{30}K_{30}$ variant compared.

Thus, the intensification of agricultural production is associated with an increase in non-renewable energy costs.

According to the results of the study conducted in 2018-2020, while the total cost of the control option in the cultivation of vegetable beans is 2118 man/ha, 2398 man/ha in the 10 t/ha manure

Table 3

Bioenergetic efficiency of fertilizers applied to vegetable beans

Options	Product increase due to fertilizer, s / ha	Total energy increase in product due to fertilizer, MC / ha V_f^0	Energy consumption for production and application of fertilizers, MC/ha A_0	Bioenergetic ratio $(BR)=\frac{V_f^0}{A_0}$
Control	-	-	-	-
10 t peyin	3.3	5867.4	4200.0	1.40
$N_{30}P_{30}K_{30}$	9.6	17068.8	3231.0	5.28
$N_{60}P_{60}K_{30}$	12.1	22047.2	6213.0	3.55
$N_{90}P_{60}K_{60}$	11.1	19735.8	9066.0	2.18

variant, 2697 man/ha in the $N_{30}P_{30}K_{30}$ variant, 2726 man/ha in the $N_{60}P_{60}K_{30}$ variant and $N_{90}P_{60}K_{60}$ in the variant was 2975 man/ha (Table 4). The increase in productivity in the variant of 10 tons of manure for vegetable beans was 24.6 s/ha compared to the control, 58.1 s/ha in the variant $N_{30}P_{30}K_{30}$, 67.8 s/ha in the variant $N_{60}P_{60}K_{30}$ and 63.6 s/ha in the variant $N_{90}P_{60}K_{60}$. The cost of production of vegetable bean beans varied between 12.20-13.60 manat per 1 s of product. The cost of vegetable beans was in the highest control variant, the lowest in the variant $N_{60}P_{60}K_{30}$. The application of fertilizers on irrigated gray-brown soils provided economic efficiency of income from sale of vegetable beans (3890-5585 man/ha) and higher income (5585 man/ha) of income from cultivation of vegetable beans with application of fertilizer in $N_{60}P_{60}K_{30}$ norm. Conditional net income from growing vegetable beans varied in the range of 1772-2859 man/ha, depending on the variants of the study, compared to the lowest conditional net income in the control variant (1772 man/ha) and the highest in $N_{60}P_{60}K_{30}$ variant (2859 man/ha). In the $N_{90}P_{60}K_{60}$ variant, the conventional net income was 2505 man/ha, and despite the high fertilizer rate compared to other variants, it did not justify itself economically. The yield of green beans in the cultivation of vegetable beans varied between 83.7-104.9%, which was higher in the $N_{60}P_{60}K_{30}$ variant (104.9%) and the application of fertilizer at the same dose was justified. In the $N_{90}P_{60}K_{60}$ variant, the costs incurred with the

Table 4

Economic efficiency of vegetable beans (three-year average, 2018-2020 average)

Indicators	Unit of measurment	Options				
		Control	10 t manure	$N_{30}P_{30}K_{30}$	$N_{60}P_{60}K_{30}$	$N_{90}P_{60}K_{60}$
Productivity	s/ha	155,6	180,2	213,7	223,4	219,2
Product growth	s/ha	-	24,6	58,1	67,8	63,6
Production costs	man/ha	2118	2398	2697	2726	2975
Cost, 1 s product	man	13,60	13,30	12,60	12,20	13,60
Selling price of the product	man/ha	3890	4505	5343	5585	5480
Conditional net income	man/ha	1772	2107	2646	2859	2505
Profitability	%	83,7	87,9	98,1	104,9	84,2

increase of the fertilizer rate also increased, but the level of economic profitability (84.2%) was low.

The results of a three-year study of vegetable beans showed that in the irrigated gray-brown soils of Absheron it is more effective to apply mineral fertilizers in a dose of $N_{60}P_{60}K_{30}$. Thus, the application of this dose against the background of the recommended zonal agro-technical measures provides a higher yield (223.4 s/ha), which in turn leads to a higher net income per unit area (2726 man/ha). and allows the economy to operate at a high level of profitability (104.9%).

RESULTS

1. Fertilizer norms have significantly affected the height of vegetable beans grown on irrigated gray-brown soils. The height of the plant varied according to the options and the growth relative to the control fluctuated between 35.6-76.4% on average and was the maximum in the $N_{90}P_{60}K_{60}$ fertilizer norm.
2. It was determined that the increase in the productivity of vegetable beans under the influence of fertilizers was 58.1-63.6 s/ha or 37.3-43.6%, depending on the options, the seed yield was 21.4-35.8. s/ha. A higher increase in bean and seed yields was recorded in the $N_{60}P_{60}K_{30}$ variant. Self-sufficiency of fertilizers with increase in yield is 1.6-3.1 kg according to the options

   This indicator was recorded in the $N_{30}P_{30}K_{30}$ variant the most and in the $N_{90}P_{60}K_{60}$ variant the least. The results of statistical analysis show that the effect of variant factor on the productivity of blue beans was higher at 97.4%, the effect of repetitions was insignificant at 0.69% and the effect of other factors was 1.95%. The increase in the biomass of vegetable beans depending on the fertilizer norms compared to the control on the variants was 21.5-92.1 s/ha or 16.7-71.5% and a reliable difference was observed between all variants.

The application of different doses of fertilizers had a positive effect on the amount and chemical composition of protein in the green beans and seeds of vegetable beans. According to the options, the amount of protein in blue beans fluctuated between 14.3-18.3% and 21.9-25.2% in seeds.\

3. The amount of nitrogen, phosphorus and potassium accumulated in the organs of vegetable beans (leaves, stems, roots) was studied in the dynamics of the phases of budding, flowering, pulse formation and tissue formation. The amount of nitrogen in the bushing phase of the plant is 1.05-1.61%, phosphorus - 0.79-1.25% and potassium - 1.30-1.92%, in the flowering phase - 0.84-1.28%, respectively; 0.44-0.87% and 0.95-1.35%, 2.26-2.93% during the period of bean formation; 0.85-1.54% and 1.17-1.65%, 3.51- 03% during tissue formation; Fluctuated between 0.74-1.01% and 0.86-1.07%. There was a high correlation between plant nutrients and legumes (nitrogen r = 0.967, phosphorus r = 0.942 and potassium r = 0.949) and seed productivity (nitrogen r = 0.943, phosphorus r = 0.888 and potassium r = 0.727).
4. As a result of the application of various fertilizer norms, the amount of nutrients in the gray-brown soils irrigated under vegetable beans was dynamic depending on the phase of plant development and decreased from the period of seedling formation to full maturity. The results of the three-year research show that the amount of nitrate in all variants under vegetable beans in the 0-20 cm layer is 7.0-18.6 and in the 20-40 cm layer is 6.0-16.0 mg/kg, the amount of absorbed ammonia is 9, respectively. , 9-24.0 and 7.5-19.3 mg/kg, motor phosphorus - 5.5-16.9 and 3.7-12.8 mg/kg, exchangeable potassium - 172.7-281.5 and 12.2-195.2 mg/kg in the soil. 3. Application of fertilizer in the norm $N_{90}P_{60}K_{60}$ increased the amount of nutrients in the soil more than other options. In the $N_{90}P_{60}K_{60}$ variant of the plant in the bushing phase, the amount of nitrate in the soil was 7.2 mg/kg compared to the control, 5.9 mg/kg in the flowering phase and 7.0 mg/kg in the full ripening phase, the amount of am-

monia absorbed was 7.9; 8.1 and 6.5 mg/kg, motor phosphorus - 7.5; 5.4 and 4.4 mg/kg, exchangeable potassium - 58 mg/kg; There were more than 50 and 45 mg/kg. 4. Correlation was established between the amount of nitrogen in the organs of vegetable beans and the amount of nitrate in the soil, and the dependence depends on the stages of germination, flowering and full maturity of the plant r=0.923-0.965, between the amount of phosphorus and mobile phosphorus in the soil 0.627-0.755, potassium and r = 0.793-0.899 between exchangeable potassium. 5.The amount of nutrients carried by the phyto-mass of vegetable beans varied according to the variants and the relatively high amount of accumulated nutrients was recorded in the variant $N_{90}P_{60}K_{60}$, where the amount of nitrogen was 17.9 kg/ha, phosphorus 5.5 kg/ha and potassium was 7.5 kg/ha. The application of fertilizers has increased productivity as well as the amount of nutrients they carry. Depending on the productivity of vegetable beans (pH = 0.999 between nitrogen, r_{P2O5} = 0.985 between phosphorus, r_{K2O} = 0.996 between potassium) and phytop mass (r_N = 0.988, r_{P2O5} = 0.998, r_{K2O} = 0.937), the dependence on them was quite high.

5. During the full ripening period of vegetable beans, the amount of nutrients carried by beans and phytochemicals and the coefficient of fertilization assimilation varied according to the options, the amount of nitrogen carried by beans was 29.5 kg/ ha, phosphorus 11.0 kg/ha and potassium 15.2 kg/ha, in the fertilized variants these indicators are relatively high and are 38.7-51.5, respectively; Fluctuated between 19.5-27.2 and 21.5-29.0 kg/ha, with phytochemicals 8.8-17.9 kg/ha nitrogen, 1.8-5.5 kg /ha phosphorus and 3,7-7.5 kg/ha of potassium was produced. The price of these indicators was the lowest in the control compared to the maximum in the $N_{60}P_{60}K_{30}$ variant.
6. The income part of the balance for nitrogen is 41.5-232.3 kg/ ha according to the variants, 2.7-66.6 kg/ha for phosphorus and 16.2-

98.3 kg/ha for potassium, the expenditure part of the balance is 39 , 5-73.6 kg/ha, 13.0-44.2 kg/ha for phosphorus and 18.2-38.4 kg/ha for potassium. Nitrogen balance was positive in all variants, phosphorus control and negative in 10 t/ha manure and potassium control. The intensity of the balance was between 105.1-315.6% for nitrogen, 20.8-176.3% for phosphorus and 89.0-256.0% for potassium.

7. The application of different doses of organic and mineral fertilizers in the cultivation of vegetable beans has led to a wide range of changes in bioenergetic efficiency. Bioenergetic efficiency in the application of fertilizers was 1.40 units in 10 t manure variant, 5.28 units in $N_{30}P_{30}K_{30}$ variant, 3.55 units in $N_{60}P_{60}K_{30}$ variant and 2.18 units in $N_{90}P_{60}K_{60}$ variant, higher than in N30P30K30 variant. Intensive technology cultivation of vegetable beans is profitable and energy efficient.
8. Expenditures on cultivation of vegetable beans were 2118 man/ ha in control variant, 2368 man/ha in 10 t manure variant, 2697 man/ha in N30P30K30 variant, 2726 man/ha in $N_{60}P_{60}K_{30}$ variant and 2975 man/ha in $N_{90}P_{60}K_{60}$ variant. The increase in productivity in the variant of 10 tons of manure for vegetable beans was 24.6 s/ha, in the variant $N_{30}P_{30}K_{30}$ 58.1 s/ha, in the variant $N_{60}P_{60}K_{30}$ 67.8 s/ha and in the variant $N_{90}P_{60}K_{60}$ 63.6 s/ha, yeast The cost was in the highest control variant, the lowest in the $N_{60}P_{60}K_{30}$ variant. The yield of blue beans of vegetable beans varied between 83.7-104.9%. Evaluation of profitability shows that this indicator was higher in the variant $N_{60}P_{60}K_{30}$ (104.9%) and the application of fertilizer at the same dose was justified. In the $N_{90}P_{60}K_{60}$ variant, the yield was 84.2% and the costs incurred with the increase in the fertilizer rate also increased, but were not economically viable.
9. Expenditures on cultivation of vegetable beans were 2118 man / ha in the control variant, 2368 man/ha in the 10 t manure variant, 2697 man/ha in the $N_{30}P_{30}K_{30}$ variant, 2726 man/ha in the $N_{60}P_{60}K_{30}$ var-

iant and 2975 man/ha in the $N_{90}P_{60}K_{60}$ variant. The increase in productivity in the variant of 10 tons of manure for vegetable beans was 24.6 s/ha, in the variant $N_{30}P_{30}K_{30}$ 58.1 s/ha, in the variant $N_{60}P_{60}K_{30}$ 67.8 s/ha and in the variant $N_{90}P_{60}K_{60}$ 63.6 s/ha, the highest cost control variant, at least in the $N_{60}P_{60}K_{30}$ variant. The yield of blue beans of vegetable beans varied between 83.7-104.9% by variants. Evaluation of profitability shows that this indicator was higher in the variant $N_{60}P_{60}K_{30}$ (104.9%) and the application of fertilizer at the same dose was justified. In the $N_{90}P_{60}K_{60}$ variant, the yield was 84.2% and the costs incurred with the increase in the fertilizer rate also increased, but were not economically viable.

PROPOSAL FOR PRODUCTION

According to the results of the study, it is proposed to cultivate vegetable beans in order to maintain soil fertility, given that the irrigated gray-brown soils of the dry subtropical zone are poorly supplied with nutrients. It is proposed to cultivate vegetable beans to meet the food needs of the population and to satisfy protein hunger.

Given the fact that vegetable beans are expensive to fix atmospheric nitrogen in conditions where fertilizers are expensive, more conditions should be created for growing legumes to use nitrogen fertilizers less and to meet the plant's nitrogen needs at the expense of atmospheric nitrogen rather than nitrogen fertilizers.

In the $N_{60}P_{60}K_{30}$ variant where fertilizers are applied, it is recommended to apply them to farms, taking into account the productivity of 223.4 s/ha (an increase of 67.8 s/ha compared to control) and profitability.

RECOMMENDATIONS FOR PRODUCERS

1. Mammadova Sh.A. Influence of fertilizers on nutrients accumulated in bean crops grown on irrigated gray-brown soils of Absheron / Modern problems of biology Materials of the republican scientific conference October 23-24 Sumgayit 2018, p. 129-131.

2. Mammadova Sh.A. İnfluence of the mineral fertilizers on a nutrient quantity in bean plant and in soil / Conference of Young Scientists and Students İnnovarions in Biology and Agrisulture to Solve Global Challenges Ostober 31, 2018 Baku p. 156.
3. Mammadova Sh.A. Influence of fertilizers on biomass and nutrients of beans grown in Absheron region // Azerbaijan Agrarian Science 2019 2 p. 198-199.
4. Mammadova Sh.A. The effectiveness of the use of mineral fertilizers in the cultivation of beans / Actual problems of modern natural and economic sciences. International scientific conference, 0-04 May 2019, part III, Ganja 2019 p. 156-159.
5. Mammadova Sh.A. Gray-brown soils / Ecology and reclamation of agricultural landscapes: prospects and achievements of young scientists materials international. Scientific and Practical Conf. Young scientists. Volqoqrad, 6-9 noyabr, 2019, p. 148-149
6. Mammadova Sh.A. Influence of fertilizers accumulation of nutrients in soils and vegetable beans // Journal of Agriculture and Environment, - 2019. 4 (12), - 5 p. DOI: https:/doi.org/10.23649/jae.2019.4.12.17
7. Mammadova Sh.A. The influence of fertilizers on the chemical composition of vegetable beans // Bulletin of Science and Practice, - 2020. V. 6., No. 11, - p. 188-196. https://www.bulletennauki.com; https://doi.org/ 10.33619 / 2414-2948 / 61
8. Mammadova Sh.A. Influence of organic and mineral fertilizers on the dynamics of nutrients in irrigated gray-brown soils of the Absheron Peninsula // Bulletin of Science and Practice, -2020.V.6, No. 12, -c.86-99. https://www.bulletennauki.com; https://doi.org/10.33619/2414-2948/61
9. Mammadova Sh.A. Bioenergetic and economic efficiency of growing leguminous plants // Bulletin of Science and Practice, -2021.V.7, No. 1,-c.986-106. https://www.bulletennauki.com; https://doi.org/10.33619/2414-2948/62
10. Mustafayev I.I., Mammadova.Sh.A //Influence of organic and mineral fertilizers on the productivite of vegetable beans. ransactions of Pedagogical University Series of mathematics and natural scienses Baku, 2021, C.69,№2 page 182-191

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