HANDLING, TRANSPORTING, STIRAGE AND PROTECTION OF AGRICULTURAL PRODUCTS

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INFLUENCE OF FERTILIZERS ACCUMULATION OF NUTRIENTS IN SOILS AND VEGETABLE BEANS

Research article

Abstract

The article discusses the impact of different norms and ratios of organic and mineral fertilizers on the productivity and quality of Zulal beans on irrigated gray-brown soils of the Absheron Peninsula. Depending on the fertilizers used, the accumulation of nutrients in the soils and aboveground and underground phytomasses of vegetable beans has changed. The content of nutrients in the soils and in the organs of plants on fertilized variants was comparatively high in than on the control.

Keywords: vegetable bean, irrigated gray-brown soils, organic fertilizers, mineral fertilizers, nutrient.

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ВЛИЯНИЕ УДОБРЕНИЙ НА НАКОПЛЕНИИ ПИТАТЕЛЬНЫХ ВЕЩЕСТВ В ПОЧВАХ И ОВОЩНОЙ ФАСОЛИ

Научная статья

Аннотация

В статье рассматриваются вопросы влияния разных норм и соотношений органических и минеральных удобрений на продуктивность и качество фасоли сорта Зулал на орошаемых серо-бурых почвах Абшеронского полуострова. В зависимости от применяемых удобрений накопление питательных элементов в почвах и надземной и подземной фитомассах овощной фасоли изменилось. Содержание питательных элементов в почвах и в органах растений на удобряемых вариантах сравнительно было высокое, чем на контроле.

Ключевые слова: овощная фасоль, орошаемые серо-бурые почвы, органические и минеральные удобрения, питательные вещества

1. Introduction

The most important factor in the intensification of agricultural production is the improvement of existing technologies and the creation of new ones based on the development of modern and effective methods of agricultural technology. In addition to food purposes, the cultivation of legumes is of great agricultural importance, since they are good precursors for many crops in a crop rotation. Vegetable beans are a valuable food crop, which is also of great agricultural importance in vegetable crop rotation [1]. Legumes are considered as an essential source of proteins for human food and animal feed. They have the ability to fix atmospheric nitrogen (N_2) via symbioses with rhizobia bacteria. This characteristic allows them to ensure their nitrogen nutrition apart from any chemical fertilization unlike other crops [18]. Increasing the production of legumes allows solving several problems at once: legumes are a valuable crop rotation crop that allows saturating the soil with nitrogen of biogenic origin. It has important agroeconomic and ecological interests through its ability to fix N_2 [18]. In the third world countries, legume-cereal intercropping is commonly practiced due to its advantages over yield stability and low risk of crop failure associated with the monoculture [12], [19]. Formerly, this practice was also common in other parts of the world. Meanwhile, the use of chemical fertilizers, mechanization and pesticides gradually eliminated it. This type of crop is still used in the western world, particularly in biological farming [14] reported that yield improvement in intercropped species is mainly due to the increase of nutrients (P, N and Fe) uptake efficacy. On average, the soil contains 0.02–0.5% of soluble phosphorus. Thus, it is added to the soil in the form of chemical phosphate fertilizers. However, only 1% is used by plants, the rest is rapidly transformed into insoluble complexes, for example: calcium phosphate, iron phosphate and aluminum phosphate. This leads to the need for frequent application of phosphate fertilizers, however, its regular use has become expensive and ecologically disagreeable [13]. Li et al. [17] suggested that intercropping may change the microbial community of the rhizosphere a soil, thus enhancing the nutrient availability for both intercropped species. Biological N 2 fixation by rhizobia in the legume-cereal intercropping systems increases the availability of N in comparison to the unfertilized crops. In turns, the cereal N uptake results in the stimulation of N 2 fixation of the legume [11], [15], [21]. Rhizobia may also enhance the availability of P in the rhizosphere via several solubilizing mechanisms [16]. Intercropping cereals with highly efficient legumes symbioses is of great importance and may contribute to cope with soil nutrient deficiencies problems such as phosphorus.

This is especially important when growing organic products; legumes are an effective source of vegetable protein, which significantly increases their nutritional value; legumes can be grown on low-fertile lands, they are resistant to drought, and the crop is well stored. All this makes them a valuable culture that can improve the food security situation in the world. The expansion of the cultivation area of leguminous vegetables, in particular vegetable beans, has important food, economic and agricultural value for the Republic. Obtaining high and sustainable harvests of vegetable beans with a favorable quality of marketable products is impossible without the use of a science-based fertilizer use system [2], [3], [9], [10]. Along with other methods of agricultural technology, the use of fertilizers helps to obtain high and stable yields of marketable vegetables, including vegetable beans [3], [4], [5], [8].

The aim of the study was to study the effect of the use of mineral and organic fertilizers on the growth, productivity and productivity of vegetable beans and the fertility of gray-brown soils.

2. Objects and methods

Studies on the influence of the use of mineral and organic fertilizers on soil fertility and the yield of vegetable beans (Zulal cultivar) were carried out in a field experiment on irrigated gray-brown soil at the experimental site of the Azerbaijan Scientific Research Institute of Vegetable Growing (Absheron Peninsula) in 2018–2019. The average annual air temperature varies between 12.9-15.20C. The coldest temperature is observed in January (3.1-4.10 °C), and the highest - in the months of July-August (21.5-28.00 °C). On the Absheron Peninsula, the amount of annual precipitation is 142.0-316.0 mm, and the manageability exceeds several times (1000-1200 mm).

Gray-brown (in WRB Qypsic calcisols) soils were formed as a result of centuries-old activity of the Caspian Sea. Climatic conditions are characterized by a sufficient amount of heat and a long growing season for cultivating crops in open ground under irrigation conditions. In the irrigated gray-brown soils, the humus content is 1.5–1.9%, the soil reaction is slightly alkaline (8.3–8.5), and the soil is saline (chloride – sulfate salinization). The experimental plot for sowing beans was plowed in the fall and introduced manure and mineral fertilizers under the main plowing (half the norm of nitrogen, phosphorus and potassium), the rest of the fertilizer was used as top dressing. Harrowing and furrowing were carried out in early spring. The seeding rate of bean seeds, depending on their germination, was 60-80 kg / ha per hectare (approximately 350-400 thousand seeds).

The experiments were carried out in 4-fold repetition according to the procedure [6]. The area of one plot was 5 × 6 = 30 m^2. Experiment design: option I - control (without fertilizers), option II - organic fertilizers (10 t / ha) - Background, option III - Background + $N_{30}P_{30}K_{30}$, option IV - Background + $N_{60}P_{60}K_{30}$, option V - Background + $N_{90}P_{60}K_{60}$. When laying the experiment as a nitrogen fertilizer, NH_4NO_3 (a.s. 34%) was used, phosphorus - $Ca(H_2PO_4)_2$ (a.s. 20%), potassium - K_2SO_4 (a.s. 45%).

The agricultural technology of cultivating vegetable beans is generally accepted zonal for gray-brown soils of the Absheron Peninsula. The accounting for the crop is a solid sub-land plot. Harvesting dates are the 3rd decade of July. The data were processed statistically using standard descriptive statistics programs Microsoft Excel. Statistical comparisons were made using Student's coefficients.

The content of total nitrogen in the aboveground and underground parts of the beans was determined by the Keldahl method, total phosphorus by a spectrometer in a Barton solution, and total potassium by an Atomic Absorption Spectrometer.

We studied the dynamics of nutrient content in soil (0-20; 20-40; 40-60; 60-80 and 80-100 cm) and plant (in the phases of flowering, fruit formation and at the end of the growing season) samples. Total nitrogen - micro-kjeldahl, phosphorus - in the underground and aboveground parts of the legume plant is determined by spectrophotometric and atomic absorption potassium spectrophotometric method in Barton's solution. The age setting was performed to determine all three parameters. A 1: 4 nitrate-perchlorate acid ratio was used for K and P. Sulfuric acid was used for N analysis and incubated in Micro Kyeldahl incinerator.

Soil samples according to agrochemical indicators 0-20; 20-40; 40-60; It was taken from a depth of 60-80 and 80-100 cm by the envelope method. Seeds, during flowering, mass fruiting and at the end of the growing season at the end of the legume plant (roots, stems and leaves) and 0-20; In soil samples taken at depths of 20–40 and 40–60 cm, nutrients were determined in dynamics. The field for sowing legumes was assimilated in the fall: manure, half nitrogen from fertilizers, phosphorus and potassium under the main plume, and the remaining nitrogen - feed. In early spring, the cows were picked, and the sprouts were open. 60-80 kg per hectare is used depending on the speed of germination of bean seeds. About 350-400000 seeds per hectare were sown in the experiment.

Sowing of leguminous protein plants was carried out in the third decade of April according to the tape pattern of 50 + 20 × 10 cm. The distance between the two plants was 40-45 cm, with two rows of beans planted at a distance.

3. Results and discussion

An important role in adaptive agriculture is played by legumes, which are capable of providing plant nutrition and reproduction of soil fertility due to symbiotic nitrogen fixation [7]. The authors note that after plowing, the organic matter of leguminous plants received 276 thousand tons of total nitrogen (or 18 kg / ha), which will be used by crop rotation following the legume predecessors. Considering that 1 ton of half-burnt manure contains 5 kg of nitrogen [8], with the crop-root residues of legumes, the amount of nitrogen left in the soil is equivalent to its application with manure at a dose of 3.6 t / ha.

In the conducted studies, a certain difference was found in the biomass in the aboveground and underground parts of the beans under the influence of mineral and organic fertilizers. In all variants of the experiment, the underground mass of Zulal beans varied within 0.030-0.151 g / plant (by fresh weight), and the underground mass in the range 12.0-20.5 g / plant.

The weight of the seeds and beans of the vegetable bean was determined. The number of beans in one plant of Zulal vegetable beans varied in the range of 5-12 pcs, and the number of seeds - 4-7 pcs. The length of one bean was 8-13.3 cm.

In most agroecosystems, nitrogen is in the first minimum among the elements of plant mineral nutrition. The problem of nitrogen balance and nitrogen nutrition of plants has been and remains one of the central problems of agriculture [9]. The interest in the problem of microbiological fixation of atmospheric nitrogen is caused not only by the main role of this process in the nitrogen balance of the Earth's biosphere, but also the role of biological nitrogen in solving the problem of protein production. Bean grain contains up to 30–40% protein and up to 20% fat [9]. Since nitrogen biologically bound by legumes is not completely alienated from the crop and a significant part of it remains in the root and crop residues in the soil, due to the symbiotic nitrogen fixation by legumes and incorporation of their crop-root residues into the soil, it is possible to stabilize the main indicators of soil fertility. The agrochemical value of the crop and root residues of legumes is that they contain relatively much nitrogen (1.8–2.8% in dry matter), while in the biomass of plant cereals it is usually less than 1%. This contributes to their rapid decomposition by microorganisms and the release of nitrogen in the form of ammonia, which undergoes rapid nitrification in the soil [10].

In comparison, the values of nitrogen, phosphorus and potassium between non-fertilized and fertilized options were also studied. Based on the results, it can be said that in all cases, the total nitrogen of the Zulal beans varied in the roots from 1.20 to 1.31, in the stems - 0.99-1.33, in the leaves - 2.88-3, 44 and fruits - 2.52-2.87%; and the value of phosphorus, respectively, amounted to 0.04-0.06; 0.03-0.15; 0.12-0.19 and 0.18-0.27%; potassium -1.02-1.63; 1.30-1.94; 0.97-1.65 and 1.86-2.26%.

It should be borne in mind that decomposing plant residues release, in addition to nitrogen, also phosphorus, potassium, calcium, sulfur, trace elements, which are a means of microbiological mobilization in the soil of hard-to-reach scarce nutrient elements due to the energy of organic matter, which is of great importance in increasing soil fertility and yield of subsequent crop rotation crops [9].

The study observed differences in surface and underground biomass, the height and development of legumes from exposure to mineral and organic fertilizers. The surface weight of 1 plant for all varieties of bean protein varieties was shaken between 0.030-0.151 g / plant (by weight) and underground weight 12.0-20.5 g / plant.

The weight of the seeds of vegetable beans and beans was calculated. In varieties of proteins, the number of beans per plant ranged from 5 to 12, the number of seeds per bean was 4-7, and the length of one bean was 8-13.3 cm.

The study observed various differences in surface and underground biomass, height and development of leguminous plants in fertilized and fertilized versions (mineral and organic fertilizers). The surface mass of one plant in all protein variants during the full period of maturation and harvest is 0.030-0.151 g / plant (underweight), with an underground mass of 12.0-20.5 g / plant, with an underground mass of 9.0-11, one%. and organized. Productivity ranged on average between 185-223 centners per option. In variants with fertilizers, biomass and plant productivity were higher than in the unfertilized version.

The amount of total nitrogen, phosphorus, and potassium accumulated in the surface and underground bodies of the beans was compared with the unfertilized variant. Based on the results of the analysis, the protein content in the bean in all cases shows that the total nitrogen content in the stem is 1.20-1.31 in the stem, 0.99-1.33 in the stem, 2.88-3.44 in the leaves and 2.52-2.87% in fruits and 0.04-0.06; 0.03-0.15; 0.12-0.19 and 0.18-0.27%; potassium 1.08-1.63; 1.30-1.94; In the range from 0.97-1.65 to 1.86-2.26%.

Thus, the biological properties of legumes, fertilizer rates and so on. The amount of total nitrogen and potassium accumulated in the root, stem, leaves and fruits of the plant varied significantly, without a significant difference in the amount of phosphorus.

The protein variety was collected in the form of cotton at the time of its maturation, and the yield was 155.3-199.6 sen / ha compared with the control.

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Thus, depending on the biological properties, doses, and ratios of fertilizers applied to the roots, stems, leaves, and fruits of a vegetable bean, the amount of nitrogen and potassium was significantly different; no sharp differences were found in the phosphorus content.

Studies have established certain differences in the size of the aboveground and underground parts, in the growth and development of beans in fertilized and fertilized (mineral and organic fertilizers) options. During the phase of complete ripening and harvesting, in all variants of vegetable beans, the value of the aboveground mass varied within 0.030-0.151 g / plants, the underground mass - 12.0-20.5 g / plants.

Beans and dried fruits of vegetable beans are used in food and the yield of vegetable beans in all cases varied from 185-223 kg / ha. Biomass and yield in fertilized options was higher than in non-fertilized ones.

4. Conclusions

The amount of nutrients collected in the underground and terrestrial bodies of the beans was greater than that of the control variant in all variants.

The amount of nutrients in the soil under the bean was higher than that of the control variant in all variants.

Conflict of Interest

None declared.

Конфликт интересов

Не указан.

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