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EFFECT OF FERTILIZERS ON QUALITY PARAMETERS OF GARLIC IN GRAY-BROWN SOILS

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Abstract. In the presented article, the effect of organic and mineral fertilizers on the quality indicators of the soil in the gray-brown soils of the western region was given. The main purpose of the research is to determine the effective norms of mineral fertilizers on the background of manure, which affect the growth, development, productivity, quality, biological and economic indicators of garlic in irrigated gray-brown (chestnut) soils in Ganja-Dashkasan economic region. It was determined that mineral fertilizers on the background of manure significantly increase the quality indicators of garlic in irrigated gray-brown soils that are poorly supplied with nutrients. Compared to the control (no fertilizer) version, dry matter 2.1-3.8%, total sugar 0.2-1.4%, vitamin C 0.5-1.9 mg%, nitrates in wet weight 12.3-28.6 mg/kg and essential oils 0.05-0.13% increased between The amount of nitrates was lower than the permissible limit (80.0 mg/kg in wet weight). The highest indicators were observed in the variant Fon+N_{60} P_{90} K_{60}.

Keywords: *Garlic, gray-brown, soil, manure, mineral fertilizers, dry matter, total sugar, vitamin C, nitrates, essential oils.*

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1. Introduction

The cultivated area of garlic in the world is 1.438 million ha, the average yield is 16.87 t/ha and the production is 24.255 million tons. In the Russian Federation, the area is 27,498 ha, the average productivity is 8.47 t/ha and the production is 0.233 million tons. Important producers of garlic are China - 19.234 million tons, India - 1.259 million tons, South Korea - 0.412 million tons, Egypt - 0.234 million tons. The highest productivity was 39.49 t/ha in Uzbekistan, 25.17 t/ha in Egypt, 24.66 t/ha in China and 20.0 t/ha in Tajikistan (Mamedov, 2015).

Garlic contains vitamins B, B_1, B_2, C, D, PP, essential oils, phytoncides, sulfur compounds, protein substances 27-42%, dry matter 7.9% and its ash contains 17 elements, including potassium, phosphorus, sulfur, iron, etc. is available. Garlic is widely used in canning industry, sausage production, medicine and household. Since it contains substances that kill microbes, infectious diseases, etc. they can't stand it. Garlic is the best medicine for stomach and intestinal disorders and colds and its juice kills the germs of dysentery, cholera and influenza. Garlic regulates the movement of blood in the veins, sclerosis, etc. prevents terrible diseases, increases gastric juice, has a good effect on food digestion. Garlic products are used in the treatment of kidney diseases, heart attacks, angina pectoris, sclerosis, paralysis (Huseynzade, 2020).

Autumn garlic is very demanding on nutrients that are easily absorbed by the plant. The correct use of fertilizers increases the product's commodity quality, rapid growth, the amount of dry matter, vitamins, sugar and other nutrients (Bashkov *et al*., 2014).

When determining the rate of nitrogen fertilizer for vegetables, melons and potato crops, it is very important to take into account the amount of mineral nitrogen that can be formed in the soil. So, the more fertile the soil, the more nitrogen it contains. Thus, the amount of nitrates collected in the product is closely related to the fertilizer dose given to the soil, the speed of the process of mineralization of organic residues in the soil and the increase in the amount of nitrogen easily absorbed by plants. One of the main problems of the use of agrochemical means is the direct and correct application of organic and mineral fertilizers and optimization of the balance in the agricultural-farming balance. In other words, the main goal is to achieve ecologically clean, safe, high yield of vegetables, melons and potatoes by preventing contamination of the product with nitrogen compounds-nitrates and nitrites (Borisov, 2007).

Organic and mineral fertilizers are the most important technologies required in the cultivation of agricultural plants.Fertilizers increase the amount of nutrients in the soil - and increase the resistance of plants to harmful organisms (Shadrina *et al*., 2013).

In the research conducted by A.A. Koshevarov, S.M. Nadejkin and A.F. Agafonov in Russia, the effect of mineral fertilizers on valuable economic indicators of garlic was studied. It was determined that mineral fertilizers have a significant effect on the growth and development of the Dubkovsky variety of garlic. More vegetative mass and marketable yield of 13.6 t/ha was obtained in 90 variants of mineral fertilizers (NPK). In the increased norms of mineral fertilizers (NPK), the average weight of 90 onions increased between 20.0-31.2 grams compared to the non-fertilizer version, and the number of teeth needed for planting increased (Koshevarov *et al*., 2012).

Shabandayev D.Z. and Abbasov R.A. field experiments were conducted with the aim of increasing soil fertility and obtaining a high yield from garlic at the Absheron Auxiliary Experimental Farm of the Horticulture Institute. It was determined that a high yield of garlic was obtained depending on the planting schemes in the given variant of manure 20 t/ha+$N_{100}P_{120}K_{90}$ kg/ha, the mass of 1 head of garlic was 65.6 grams on average and the mass of 1 tooth was 6.3 grams (Shabandayev & Abbasov, 2017).

It is known that nitrates can accumulate in vegetable crops after high doses of nitrogen fertilizers are applied to the soil, as well as under unfavorable conditions. The amount of nitrates in the product of Absheronskaya ozimaya of white cabbage, Sabir of onion and Jalilabad varieties of garlic in the experiments was within the permissible limit (500 mg/kg in cabbage, 80 mg/kg in onion and 80 mg/kg in garlic). The amount of nitrates in white cabbage and garlic in all fertilized variants was higher than in the non-fertilized (control) variant. Other results were obtained in onions - the amount of nitrates varied depending on the dose of fertilizers given. The amount of nitrates was determined in small (20-30 grams), medium (40-60 grams) and large (more than 100 grams) sized onions. The amount of nitrates in onions has changed within the permissible limit. Nevertheless, more nitrate accumulation was found in large onions than in small ones (Guliyev & Soluyanova, 2018).

In the studies carried out in the gray-brown soils of Absheron in our republic, the effect of organic and mineral fertilizers on the development, growth, productivity and quality of this plant was studied in order to study the nutritional conditions of garlic. Planting was carried out in a row method, and the distance between the plants was 5-8 cm. Sowing was carried out in the second decade of October and the seeds were buried 4-5 cm deep. 500-800 kg of planting material was harvested per hectare. The amount of dry matter in garlic bulbs was 35.5%, total sugar was 6.1%, and vitamin C was 9.9 mg% in the controlled version of the effect of organic and mineral fertilizers. In the variant

with organic fertilizer 30 t/ha, dry matter was 36.1%, total sugar was 6.3%, vitamin C was 10.4%, which is 0.6%, respectively, compared to the non-fertilizer variant; 0.2% and 0.5 mg% increased. While the productivity was 103.6 s/ha in the control, it was 121.7 s/ha in the manure 30 t/ha (background) option, the increase was 18.1 s/ha or 17.47% compared to the control, and 174 in the background+NPK 180 option, 5 s/ha, compared to the control, the increase was 70.9 s/ha or 68.43%, dry matter 37.4%, total sugar 6.8%, vitamin C 11.1%, 1.9%, 0.7% and 1.2 mg% increased respectively compared to the variant (Mammadov, 2012).

Vegetables and melons are one of the main sources of vitamins, minerals and other important substances. Nitrates enter the human body mainly through plant products (especially vegetables) and water. During the day, 40-80% of the nitrates that enter the human body come from vegetables and melons and 20% from drinking water. Meat, milk, fish, etc. products included in daily food also contain nitrates. Therefore, the best way to eliminate the harmful effects of this substance on the human body is to prevent the accumulation of nitrates in vegetables and melons. It has been established that the application of mineral fertilizers, especially nitrogen, to plants during the period of crop formation causes excessive accumulation of nitrate in vegetables and melons. In addition to fertilizers, excessive accumulation of nitrates in fruit and vegetable products has been caused by global environmental degradation, soil erosion and salinization, unexpected changes in natural conditions, disruption of the crop rotation system, lack of irrigation water, etc. Researches show that partial application of nitrogen fertilizer to the soil allows to prevent excessive accumulation of nitrates in vegetables and orchards. At this time, the fertility of the soil and the amount of the intended crop should be taken into account. It is known that entrepreneurs are not interested in the quality of the harvested product, and besides increasing productivity, they also increase the amount of nitrate in the product (Abbasov, 2011).

Accumulation of excessive amounts of nitrates in crop products is also dangerous because nitrates cause the synthesis of carcinogenic nitrose compounds with the presence of amines and amides. It has been established that nitrites also have a carcinogenic effect. Many scientists believe that intermediate products formed during nitrate reduction have embryotoxic and mutagenic properties. Currently, more than 80% of nitroso compounds known to science cause cancer. Vitamin C has a particularly important role in preventing nitrate poisoning. Nitrates enter the human body mainly through vegetables and water. During the day, 40-80% of the nitrates that enter the human body come from vegetable products and up to 20% from drinking water. Meat, milk, fish, sausages, etc. included in daily food products also contain nitrates. Calculations show that up to 150 mg of nitrate enters the human body with plant products every day. The amount of nitrates in the food of people who keep a diet and eat a lot of fruits and vegetables reaches 300-400 mg. In general, the amount of nitrates that enter the human body depends on the composition of food, the amount of vegetable plants and the level of nitrates they collect. Calculations show that depending on the weight of people, their resistance to the toxic effects of nitrates and nitrites varies. It was determined that the amount of nitrate and nitrite taken by a person in one day should not exceed 3.6 and 0.139 mg per kg of his weight. 60-80% of nitrate enters the human body with vegetable products. Therefore, the best way to eliminate the harmful effects of this substance on the human body is to prevent the accumulation of nitrite in vegetable plants. Nitrate accumulation in plants is closely related to nitrogen exchange in the soil. The amount of nitrogen depends on the fertility of the soil, the intensity of

decomposition of organic matter, etc. depends on factors. From the point of view of plant physiology, the accumulation of nitrates in plant products, their assimilation, delivery from the root system to above-ground organs and their assimilation to those organs, that is, the intensity of their breakdown and joining to protein synthesis, are highly dependent. These processes, in turn, are determined by soil-ecological conditions, applied agrotechnics and genetic factors (Movsumov & Agayev, 1994).

Despite the fact that garlic is of special importance among vegetable plants due to its chemical composition, nutritional value and medicinal properties, its production does not meet the demand of our republic. The soil and climate conditions of most regions of the country are favorable for the cultivation of garlic. But he is not so busy with its cultivation.

Ganja-Dashkasan economic region occupies one of the crucial places in the production of agricultural products in our republic. Taking into account the importance of garlic in terms of food security in the region, determining effective mineral fertilizer norms on the background of manure to increase its productivity and quality is one of the urgent problems that need to be solved in modern times.

The main goal of the research is to determine the effective norms of mineral fertilizers on the background of manure, which affect the growth, development, productivity, quality, biological and economic indicators of garlic in irrigated gray-brown soils in Ganja-Dashkasan region.

The object and methodology of the research. Research works were carried out in Ganja Regional Agrarian Science and Innovation Center of the Ministry of Agriculture located in Samukh district on irrigated gray-brown soils with the Jalilabad variety of garlic in the following scheme: 1. Control (without fertilizer); 2. Manure 20 t/ha (background); 3. Fon+$N_{30}P_{60}K_{30}$; 4. Fon+$N_{60}P_{90}K_{60}$; 5. Fon+$N_{90}P_{120}K_{90}$. Field experiments were carried out in 3 replicates with a total area of 54 m^2 (30 x 1.8 m) in a 45 x 5 cm planting pattern. The planting of garlic was carried out in the 2nd decade of October, the planting rate was 1 ton per hectare and the cloves were buried one by one in a straight hot field to a depth of 4-5 cm. Manure 100%, phosphorus and potassium 60% were given in autumn before the main plowing, and the rest together with nitrogen in the form of 2 feedings, rice feeding was done when the bulbs were formed and the second feeding was done in early March. Phenological observations were carried out in 2 replicates on 25 plants, agrotechnical measures were carried out in the order adopted for the region.

In the collected soil samples: pH in the potentiometer, total humus I.V. According to Tyur, absorbed ammonia was determined by D.P. Konev, nitrate nitrogen by Grandval-Lyaju, total nitrogen, total phosphorus by K.E. Ginzburg and G.M. Sheglov, activated phosphorus by B.P Machig's method, total potassium by Smith's method, exchangeable potassium by P.B. Protasov's method in a flame photometer. Analysis of soil samples shows that these soils are highly deficient in nitrogen, phosphorus and potassium. The pH in the water solution was 7.8 in the 0-30 cm layer and 8.4 in the 60-100 cm layer going down. Total humus, nitrogen, phosphorus and potassium in the 0-30 cm layer are 2.16 respectively; 0.16; 0.14; It is 2.41%. However, it decreases significantly to the lower layers, corresponding to 0.83 in the 60-100 cm layer; 0.06; 0.07; It is 1.53%. Absorbed ammonia nitrogen 18.7-6.8; nitrate nitrogen 10.3-2.8, active phosphorus 16.5-4.8; exchangeable potassium fluctuated between 265.5-108.5 mg/kg. In plant samples : absolute dry matter at 105 ^{0} C thermostat, total nitrogen, phosphorus - and potassium according to K.E. Ginzburg, G.M. Sheglova and E.V. Wulfus, total sugar

(sucrose) by Bertrand, vitamin C by I.K. Murry, essential oils by Kryshenko methods, nitrates by ionometer (EV-74) was assigned.

2. Discussion and analysis of research results

As a result of our research, it was determined that mineral fertilizers on the background of manure increased the quality indicators of garlic, including dry matter, total sugar, vitamin C, nitrates and essential oils. The results are given in the table . As can be seen from the table, depending on the mineral fertilizer norms, the quality indicators change significantly compared to the control (without fertilizer) option.

Thus, in the control (without fertilizer) variant, dry matter is 27.4-28.5%, total sugar is 5.8-6.2%, vitamin C is 9.6-10.0 mg%, nitrates in wet mass are 34.0- 35.3 mg/kg and essential oils 0.24-0.28%, manure 20 t/ha (background) dry matter 28.7-29.6%, total sugar 6.2-6.4%, vitamins C 10.0-10.4 mg%, nitrates 39.5-41.8 mg/kg and essential oils 0.28-0.32% in wet mass , dry matter 30 in Fon+$N_{30}P_{60}K_{30}$ variant, 2-31.3%, total sugar 6.4-6.6%, vitamin C 10.3-10.8 mg%, nitrates 46.8-50.2 mg/kg in wet weight and essential oils 0.32 -0.33%, and the highest indicators are taken in the Fon+$N_{60}P_{90}K_{60}$ option, dry matter 31.0-31.8%, total sugar 6.7-7.2%, vitamin C 10.8-11, 5 mg%, nitrates in wet mass 54.6-56.5 mg/kg and essential oils 0.36-0.39%, as mineral fertilizer norms increase in the background of manure, N_{90} $P_{120}K_{90}$ quality indicators $N_{60}P_{90}K_{60}$ decreasing dry matter 30.6-31.5%, total sugar 6.5-6.7%, vitamin C 10.6-11.2 mg%, nitrates in wet weight 60.3-62.6 mg/kg and essential oils were 0.34-0.36%.

Table 1. Effect of fertilizers on quality parameters of garlic in gray-brown soils

s/s	of experience Options	dry matter, %	total sugar, %	Vitamin C, mg/%	Nitrate nitrogen, in wet mass, mg/kg	Essential oils, %
2018						
1	Control (no fertilizer)	28,5 _	6 , 0	10 , 0	35 , 3	0 , 28
2	Manure 20 t/ha (background)	29 , 1	6 , 3	10 , 2	40,6 _	0 , 32
3	Background+N $_{30}$P $_{60}$K $_{30}$	30 , 6	6 , 4	1 0, 6	48 , 7	0 , 33
4	Background+N $_{60}$P $_{90}$K $_{60}$	31 , 5	6,7 _	11 , 2	56,5 _	0 , 39
5	Background+N $_{90}$P $_{120}$K $_{90}$	31,0 _	6 , 5	11 , 0	61 , 2	0 , 36
2019						
1	Control (no fertilizer)	27 , 4	6.0 _	9 , 8	34 , 5	0 , 2 6
2	Manure 20 t/ha (Background)	28 , 7	6 , 2	1 0, 0	39,5 _	0 , 28
3	Background+N $_{30}$P $_{60}$K $_{30}$	30 , 2	6 , 5	1 0, 3	46 , 8	0 , 32
4	Background+N $_{60}$P $_{90}$K $_{60}$	31 , 0	7.0 _	1 0, 8	54 , 6	0,3 6 _
5	Background+N $_{90}$P $_{120}$K $_{90}$	30 , 6	6,6 _	1 0, 6	60 , 3	0 , 34
2020						
1	Control (no fertilizer)	28 , 0	5,8 _	9 , 6	34 , 0	0 , 2 4
2	Manure 20 t/ha (Background)	29 , 6	6 , 4	1 0, 4	41,8 _	0 , 30
3	Background+N $_{30}$P $_{60}$K $_{30}$	31 , 3	6 , 6	1 0, 8	50 , 2	0 , 32
4	Background+N $_{60}$P $_{90}$K $_{60}$	31 , 8	7,2 _	1 1, 5	55 , 8	0.37 _ _
5	Background+N $_{90}$P $_{120}$K $_{90}$	31 , 5	6,7 _	1 1, 2	62 , 6	0 , 35

3. Results

Thus, the application of fertilizers under garlic significantly increased the quality indicators along with productivity. Compared to the control (no fertilizer) version, dry matter 2.1-3.8%, total sugar 0.2-1.4%, vitamin C 0.5-1.9 mg%, nitrates in wet weight

12.3-28.6 mg/kg and essential oils 0.05-0.13% has increased. The amount of nitrates was lower than the permissible limit (80.0 mg/kg in wet weight). The highest indicators were observed in the variant background +$N_{60}P_{90}K_{60}$.

Our mathematical analysis shows that the application of mineral fertilizers under garlic on the background of manure shows a high correlation between yield and quality indicators and this relationship has changed regularly over the years. Thus, between yield (s/ha) and dry matter (%) r=+0.993±0.006 and r=+0.981 ±0.017; r=+0.963±0.033 and r=+0.984±0.014 between sugar (s/ha) and total sugar (%) ; r=+0.967±0.030 and r=+ 0.984±0.014 between yield (s/ha) and vitamin C (mg%), r=+0.926 between nitrate nitrogen (mg/kg) in fruit (s/ha) wet mass ±0,063 and r=+0,915±0,073, fruit (s/ha) essential oils (%) were found to have a correlation of r=+0,930±0,060 and r=+0,941±0,05. These once again prove the accuracy of the obtained results.

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