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EFFECT OF MINERAL FERTILISERS APPLIED TO AMARANTH PLANTS ON THE DYNAMICS OF NITROGEN IN SOIL

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Abstract

When amaranth is grown in light gray soils, it is appropriate to set the norms of mineral fertilisers as N150 P100K150 kg/ha. Also, giving the plant 30 kg/ha of nitrogenous fertilizers after the single one during its vegetation period in the form of a slurry of manure ensures that the soil has the required amount of organic nutrients.

Key words

amaranth, mineral fertilisers, nitrogen fertilisers, manure, plant, soil, layer, dynamics, phosphorus, and potassium.

Introduction: All over the world, great importance is given to human health, and attention is paid to the products they consume so that they do not get sick. For this reason, measures are being taken to ensure that the products of the cultivated agricultural crops are of high quality. Taking into account that mineral fertilisers have a strong influence on the quality of plant products, it is important to take into account the amount of available nutrients in the soil when determining the norms and terms of their application.

Significant work has been done in this regard in recent years in our republic. Along with increasing the yield and quality of agricultural crops, there was a need to study their impact on the soil in order to maintain and increase soil fertility. Especially in recent years, great importance has been paid to the cultivation of medicinal plants. This requires studying the standards for mineral fertilisers acceptable to them.

That's why we set ourselves the goal of studying the norms of mineral fertilisers for the amaranth plant that is planned to be planted in our republic.

Literature review

According to I.J. Sulaimanov et al. [6; 25–27 p.], after the winter wheat, repeated sowing of beet crops will have a positive effect on the size of the soil and

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serve to increase its productivity. Although this crop, which has been studied in practice, yields relatively good results, it is important to select the optimal sowing standards for all repeated crops.

As noted by scientists I.J. Sulaymonov and others, we confirmed in our experiments that mineral fertilizers, especially nitrogen fertilizers, are of great importance for the growth and high yield of sugar beet. [8; pp. 140-144]. It is beneficial for sugar beet to use mineral fertilizers at the rate of N200P150K200 kg/ha from nitrogen fertilizers in the form of ammonium.

In the research conducted by scientists, they noted that mineral fertilizers, especially nitrogen fertilizers, are of great importance for the growth and high yield of sugar beet. It is especially effective to give nitrogen in the form of ammonium nitrate when mineral fertilizers at the rate of N150P100K150 kg/ha are used for sugar beet in the conditions of typical gray soils (Sulaymonov, Ergashev, [7; p. 122-126]).

A.A. Joraev, I.J.Sulaimonov [5; 53–57 b], in order to increase the efficiency of the use of irrigated land, it is desirable to plant sugar beet as a repeat crop after harvesting winter wheat. 100% soaking and encapsulation of replanted sugar beet seed ensures full germination. In order to get a high yield from the obtained flat seedlings, it is necessary to set the norms of mineral fertilizers (N200P150K200 kg/ha). As a result, good growth and development of sugar beet is achieved, and the root fruit yield from one hectare is ensured to be 370 s/ha.

According to N.A. Kunitsin and O.A. Minakov [9; 57–60 b], provided by the plant, the absorption of nutrients from the soil depends first on the biological characteristics of the plant, then on the application rates of mineral fertilizers given for the planned harvest.

Research Methodology

Our research was conducted in the light gray soils of the Namangan region. According to the mechanical composition, the soils are mainly medium and light sandy, sandy loams are rare; in some places, gravel or jagged limestones are covered from 0.5-1.2 m, and in the submountain plains, they are sometimes skeletal.

Depending on the diversity of the mechanical composition of the arable layer of the soil and the variety of agrotechnics, the amount of humus is found in a wide range from 0.79-0.98%, sometimes up to 1.75%. As it goes to the lower layers of the soil, its amount decreases 0.5- 0.6%.

The experimental system is shown in Table 1. Ten options are placed in four rows in one layer, and the total area of each plot is 0.6 x 8.0=4.8 m 4.8 x 50 =240 m2. It is 100 m2. The experiment had a total area of 240 x 4=960 m2 x 10=0.96 hectares.

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Before the experiment (plowing the land freed from cotton), at the beginning and at the end of the amaranth period, humus and mobile forms of total nitrogen, phosphorus, potassium and nutrients (HNO_3, R_2O_5, K_2O) were determined.

Before planting the crop in the experimental area, at the beginning of each month of amaranth vegetation, samples were taken from the 0–10, 10–20, 20–30, 30–50, and 50–70 cm layers, and the dynamics of nitrate nitrogen, mobile phosphorus, and exchangeable potassium were determined. These works were carried out in all years of the experiment.

Since the norms of mineral fertilizers were studied in the experiment, 100 % of phosphorus and potassium fertilizers were given before plowing the field. Nitrogen fertilizers were given 40 % of the total nitrogen rate before planting (20%), when 2-3 true leaves are produced (after the single one), and the remaining 40 % during fertilization.

All observation, analysis and calculations were adopted at UzPITI "Methods of conducting field experiments" [1;p.147], “Методы агрохимических, агрофизических и микробиологических исследований в полевых хлопковых раёнах” [3; 187-b.], “Методика полевых опытов с хлопчатником” [4; p. 233] was carried out on the basis of methods. Experimental data of B.A. Dospekhov [2; p. 352] “Методика полевого опыта” was analyzed mathematically based on the method.

Table 1

Experience system

Options	Standards of mineral fertilizers, a			Under the mn drive		By sowing	After the only	When the stem is ormed
	N	P	K	P	K	N	N	N
1	-	-	-	-	-	-	-	-
2	-	100	150	100	150	-	-	-
3	100	100	150	100	150	20	40	40
4	150	100	150	100	150	40	50	60
5	150	-	150	-	150	40	50	60
6	150	100	150	100	150	40	*50	60
7	150	150	150	150	150	40	50	60
8	150	100	-	100	-	40	50	60
9	150	100	100	100	100	40	50	60
10	150	100	150	100	150	40	50	*60

Note: In * and **, manure was applied using the juice method at a cost of 30 kg/ha of nitrogen fertilizers.

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Table 2

Effects of mineral fertilizers applied to amaranth on the dynamics of nitrate nitrogen in the soil, 2019, in mg/kg

layer, sm	Options									
	1	2	3	4	5	6	7	8	9	10
Initial (before planting)										
0–30	19,	20,3	20,4	20,	20,	20,	20,4	20,2	20,3	21,0
0–70	15,	16,4	16,5	15,	16,	16,	16,2	16,4	15,8	16,3
In May										
0–30	18,	19,2	19,6	19,	19,	19,	19,5	19,3	19,2	19,7
0–70	14,	15,5	15,7	15,	16,	15,	15,7	15,8	15,1	15,6
In June										
0–30	17,	18,0	18,4	18,	19,	17,	18,3	18,3	18,0	18,3
0–70	14,	14,3	14,4	13,	14,	14,	15,1	15,1	14,1	14,5
In July										
0–30	16,	17,2	17,5	17,	18,	16,	17,5	17,5	16,9	17,4
0–70	13,	13,7	13,9	13,	14,	13,	14,6	14,5	13,3	13,7

Table 3

Effects of mineral fertilizers applied to amaranth on the dynamics of nitrate nitrogen in soil, 2020, in mg/kg

Layer, sm	Options									
	1	2	3	4	5	6	7	8	9	10
Initial (before planting)										
0–30	19,	19,4	19,3	19,	19,	19,	19,3	19,4	19,3	19,6
0–70	13,	13,5	13,4	13,	13,	13,	13,4	13,3	13,5	13,6
In May										
0–30	18,	18,2	18,3	18,	18,	18,	18,2	18,6	18,3	18,2

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0–70	12,	12,8	12,6	12,	12,	12,	12,7	12,8	12,9	13,0
In June										
0–30	17,	16,8	17,2	17,	17,	17,	17,2	17,6	17,2	16,9
0–70	12,	12,1	12,0	12,	12,	12,	12,0	12,1	12,1	12,2
In July										
0–30	16,	15,8	16,0	16,	16,	15,	16,5	16,8	16,2	15,8
0–70	11,	11,6	11,3	11,	11,	11,	11,5	11,6	11,5	11,5

Table 4

Effects of mineral fertilizers applied to amaranth on soil nitrate nitrogen dynamics, 2021, in mg/kg

Layer, sm	Options									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Initial (before planting)										
0–30	21,	21,4	21,3	21,	21,	21,	21,2	21,4	21,4	21,3
0–70	14,	14,6	14,5	15,	14,	14,	14,4	14,7	14,5	14,7
In May										
0–30	20,	20,4	20,4	20,	20,	20,	20,3	20,8	20,5	20,3
0–70	13,	14,1	14,0	14,	14,	14,	13,9	14,3	14,0	13,9
In June										
0–30	19,	19,2	19,4	19,	20,	19,	19,3	20,0	19,6	19,0
0–70	13,	13,3	13,3	13,	13,	13,	13,2	13,7	13,3	13,1
In July										
0–30	18,	18,1	18,6	18,	19,	18,	18,6	19,4	18,9	18,0
0–70	11,	12,5	12,8	13,	13,	12,	12,7	13,2	12,7	12,3

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Analysis and results

We studied the effect of mineral fertilizers applied to amaranth on the dynamics of nitrate nitrogen in the soil in all years of the experiment (Tables 2, 3, 4). According to the data of the first year of the experiment, the amount of nitrate nitrogen in the 0-30 cm layer of the soil decreased by 2.9 mg/kg from the beginning to the end of plant growth in the control option where no mineral fertilizers were given at all. In option 2, when P100K150 kg/ha is given without nitrogen fertilizers, its amount is 3.1 mg/kg. When nitrogen fertilizer is given at the rate of 100 kg/ha with these P100K150 kg/ha fertilizers, its amount decreases to 2.9 mg/kg. Nitrate nitrogen in the 0–30 cm layer of the soil decreased by 3.0 mg/kg with the use of nitrogen fertilizers at the rate of 150 kg/ha. Also, in option 5, which was a control for phosphorus (N150 P0 K150 kg/ha), its amount was slightly reduced to 2.1 mg/kg. This can be attributed to the lack of mineral fertilizers, as a result of which the growth and development of the plant is low, as a result of which nutrients are poorly absorbed. In the 6th variant of the experiment, the norm of 50 kg/ha, which is given after the single application of nitrogen fertilizers, is equal to 30 kg/ha of the amount of nitrogen in the manure. It is in this variant that the amount of nitrate and nitrogen decreased by 4.1 mg/kg, which can be attributed to the fact that plants absorb nutrients better. Similarly, in the 10th option, the nitrogen fertilizer at the rate of 30 kg/ha was replaced with manure and given only in the second feeding. However, in this variant, the reduction of nitrate nitrogen was slightly less, and it corresponded to 3.6 mg/kg.

Similar data were obtained in the 0-70 cm layer of the soil, but their decrease from the initial indicator at the end of the vegetation period decreased in the range of 1.9–2.7 mg/kg according to the options.

Based on the determinations (Table 3) for the second year of the field experiment (2020), it can be said that the amount of nitrate nitrogen in the soil was close to each other in all options, but it was found to be slightly less than the previous year. The difference between the options in the plant's assimilation of nutrients from the soil increased over time, depending on the rates of mineral fertilizers given to the amaranth plant. However, the amount of nitrate nitrogen in the 0–30 cm layer of the soil was slightly different from the previous year. Nitrate nitrogen decreased in the range of 2.6-3.6 mg/kg according to the options of the experiment. In this case, the lowest reduction was observed in the 8th option, where potassium fertilizers were not applied (N150 P100 K0 kg/ha). This means that potassium fertilizers are necessary for the amaranth plant to grow well. The greatest reduction of nitrate nitrogen was in options 6 and 10, which was 3.6 mg/kg. Similar data were found in the 0-70 cm layer of the soil, and it was in the range of 2.3–3.1 mg/kg according to options.

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The data obtained in the third year of the experiment (2021) are given in Table 4. According to him, according to the preliminary results, the amount of nitrate nitrogen in the soil is slightly higher than in previous years. As a result of the growth and development of the amaranth plant, it absorbed nutrients from the soil. This resulted in different levels of nitrate nitrogen in the soil according to the options. The amount of nitrate nitrogen in the 0-70 cm layer of the experimental soil decreased by 1.7 mg/kg in the control option. 2.1 mg/kg in variant 2 (N0R100K150 kg/ha), in which no fertilizer was given in the experiment, 1.5 mg/kg in variant 5 (N150R0K150 kg/ha), variant 8 (N150R100K0 kg/ha) ga) decreased by 1.5 mg/kg. From these data, we can see that the lack of phosphorus and potassium causes amaranth not to grow well. Also, the application of nitrogen fertilizers in the form of a slurry of 30 kg/ha during the period of rapid development of the stem ensured the plant's good growth and development. This also led to a change in the amount of nitrate nitrogen in the soil, reducing it by 2.2 mg/kg in option 6 and 2.4 mg/kg in option 10. The nitrate nitrogen content in the 0–30 cm layer of the soil remained the same.

Conclusion/Recommendations

Based on the obtained results, it can be said that it is appropriate to set the norms of mineral fertilizers as N150 P100 K150 kg/ha when amaranth plants are grown in conditions of light gray soils. Also, giving the plant 30 kg/ha of nitrogenous fertilizers after the single one during its vegetation period in the form of a slurry of manure ensures that the soil has the required amount of organic nutrients.

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