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

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Abstract: *When amaranth plants are grown in light grey soils, it is appropriate to set the norms for mineral fertilisers at N150R100K150 kg/ha. Also, applying 30 kg/ha of nitrogenous fertilisers in the form of liquid manure during the plant's growing season ensures that the soil has the required amount of organic nutrients.*

Key words: *amaranth, mineral fertilisers, nitrogen fertilisers, manure, plant, soil, layer, dynamics, phosphorus, potassium.*

Introduction.

All over the world, great importance is paid to human health, and attention is being 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 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 given to the cultivation of medicinal plants. This requires studying the norms of mineral fertilisers that are acceptable for 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. Zh. Sulaimanov et al. [6; 25-27 б.] after the winter wheat repeated sowing of beet crops will have a positive effect on the size of the soil and 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.

According to scientists I.Zh.Sulaimonov et al. [8; 140-144 б.] in our studies, we verified that mineral fertilizers, mainly nitrogen fertilizers, are of great importance for the growth and high yield of sugar beet. For sugar beets in the form of sodium nitrate (NaNOi), N200R150K200 kg/ha normal is effective.

In our studies, we verified that mineral fertilizers, mainly nitrogen fertilizers, are of great importance for the growth and high yield of sugar beet. For sugar beets in the form of sodium nitrate (NaNOi), N200R150K200 kg/ha normal is effective (Sulaymonov, Ergashev, [7; 122-126 б.]).

Zhuraev A. A., Sulaimonov I. Zh. [5; 53-57 б.] To increase the efficiency of irrigated land use, it is advisable to grow sugar beet as a re-crop after harvesting winter wheat. Seed encapsulation of sugar beet seed sown as a second crop gives good results. To get higher yields, it is necessary to set the norms of mineral fertilizers N200P150K200 kg/ha. Sugar beet grows well during the growing season and provides a biological yield of up to 370 c/ha per root.

According to N.A. Kunitsin, O.A. Minakov [9; 57-60 б.] 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 grey soils of the Namangan region. According to the mechanical structure, the soils are mainly medium and light sandy; sandy loams are rare; in some places, gravel or jagged limestones are laid from 0.5 to 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 by 0.5-0.6%.

The experimental system is presented in Table 1. 10 options are arranged in 4 rows in one layer, the total area of each plot is 0.6 x 8.0 = 4.8 m x 50 =240 m^2, and the reference area is 100 m^2. The total area of the experiment was 240 x 4 = 960 m^2 x 10 = 0.96 hectares.

Before the experiment (ploughing the land freed from cotton), the mobile forms of humus and total nitrogen, phosphorus, potassium, and nutrients (HNO_3, R_2O_5, K_2O) were determined in the 0–30 and 30–50 cm layers of the soil at the beginning and end of the amaranth period.

Before planting the crop in the experimental field, samples were taken from the 0–10, 10–20, 20–30, 30–50 and 50–70 cm layers of the soil, 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 fertilisers were studied in the experiment, 100% of phosphorus and potassium fertilisers were applied before ploughing the field. Nitrogen fertilisers 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 fertilisation.

All observation, analysis, and calculations were adopted at UzPITI. "Methods of conducting field experiments" [1; p. 147], "Methods of agrochemical, agrophysical, and microbiological research in the agricultural field" [3; p. 187], and "Metodika polevyx opytov s xlopchatnikom" [4; p. 233] were carried out on the basis of methods. Experimental data of B.A. Dospehov [2; p. 352] Mathematical analysis was performed based on the "Metodika polevogo opyta" method.

Table 1

Experience system

Options	Standards of mineral fertilizers,			Under the n drive		By sowing	After the	When the stem 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 is given by the juice method at the expense of 30 kg/ha of nitrogen fertilisers.

Table 2

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

Layer	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 fertilisers applied to amaranth on soil nitrate and nitrogen dynamics, 2020, in mg/kg

Layer	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
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 fertilisers applied to amaranth on soil nitrate and nitrogen dynamics, 2021, in mg/kg

Layer	**Options**									
	1		**1**		**1**		**1**		**1**	
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

Analysis and results

We studied the effect of mineral fertilisers applied to amaranth on the dynamics of nitrate nitrogen in the soil in all years of the experiment (Tables 2, 3, and 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 mineral fertilisers were not applied at all. In option 2, when R100K150 kg/ha was given without nitrogen fertilisers, its amount decreased to 3.1 mg/kg, and when nitrogen fertiliser was given at the rate of 100 kg/ha with the same R100K150 kg/ha fertilisers, its amount decreased to 2.9 mg/kg. Nitrate nitrogen in the 0–30 cm layer of the soil decreased by 3.0 mg/kg with the application of nitrogen fertilisers at a rate of 150 kg/ha. Also, in option 5, which is a control for phosphorus (N150R0K150 kg/ha), its amount is slightly reduced to 2.1 mg/kg. This can be attributed to the lack of mineral fertilisers, as a result of which the growth and development of the plant are low and 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 fertilisers, is equal to the amount of nitrogen contained in the manure slurry. In this variant, the amount of nitrogen decreased by 4.1 mg/kg with nitrates, which can be attributed to the better absorption of nutrients by plants. Similarly, in the 10th variant, the nitrogen fertiliser at a rate of 30 kg/ha was replaced with manure and given only in the second feeding. However, the reduction of nitrate nitrogen in this variant was slightly lower, at 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.

Based on the determinations (Table 3) of 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. Depending on the rates of mineral fertilisers given to the amaranth plant, the difference between the variants in the assimilation of nutrients from the soil by the plant became larger than before. However, the amount of nitrate nitrogen in the 0–30 cm layer of the soil was slightly different from the previous year. Nitrate nitrogen was reduced to a range of 2.6–3.6 mg/kg according to the variants of the experiment. In this case, the least decrease was observed in the 8th option, where potassium fertilisers were not applied (N150R100K0 kg/ha). This means that amaranth plants need potassium fertiliser for good growth. 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.

Data from the third year of the experiment (2021) are presented in Table 4. According to him, according to the preliminary results, the amount of nitrate nitrogen in the soil was 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 and nitrogen in the soil across 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 option 2 (N0R100K150 kg/ha), 1.5 mg/kg in option 5 (N150R0K150 kg/ha), and option 8

(N150R100K0 kg/ha) decreased by 5 mg/kg. From these data, we can see that insufficient phosphorus and potassium will cause amaranth not to grow well. Also, the application of nitrogen fertilisers 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 caused a change in the amount of nitrate nitrogen in the soil, reducing it to 2.2 mg/kg in option 6 and 2.4 mg/kg in option 10. Nitrate and nitrogen content in the 0–30 cm layer of the soil remained the same.

Conclusion and recommendations

Based on the obtained results, it can be said that it is appropriate to set mineral fertiliser standards at N150R100K150 kg/ha when amaranth is grown in light grey soils. Also, applying 30 kg/ha of nitrogenous fertilisers in the form of liquid manure during the plant's growing season ensures that the soil has the required amount of organic nutrients.

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