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AMARANT'S MOBILE PHOSPHORUS DYNAMICS ARE AFFECTED BY THE RATE OF MINERAL FERTILIZER APPLIED TO THE SOIL

A. Khabibullaev *is a researcher of Namangan State University*

Email: abdullazizxonx@gmail.com

Annotasiya: Amarant o'simligi uchun och tusli bo'z tuproqlar sharoitida o'stirilganda mineral o'g'itlarni N150R100K150 kg/ga me'yorda qo'llash va bunda yaganadan keyin beriladigan 50 kg/ga azotni 30 kg/ga sini go'ng shaltog'i sifatida berish yuqori samara beradi. Shuningdek, o'simlik uchun oziqa moddalarini yetarli bo'lishi yaxshi o'sib-rivojlanishini ta'minlaydi va tuproqdan harakatchan fosforni o'zlashtirishi yaxshilanadi.

Kalit so'zlar: amarant, o'simlik, o'sish, rivojlanish, hosildorlik, tuproq, oziqa moddalar, xarakatchan fosfor, mineral o'g'it.

Аннотация: Применение минеральных удобрений из расчета N150R100K150 кг/га и затем 50 кг/га азота с 30 кг/га в качестве навоза высокоэффективно для растений амаранта при выращивании их на светло-серых почвах. Кроме того, достаточное снабжение растений питательными веществами обеспечивает хороший рост и поглошение подвижного фосфора из почвы.

Ключевые слова: амарант, растение, рост, развитие, продуктивность, почва, элементы питания, подвижный фосфор, минеральное удобрение.

Annotation: The use of mineral fertilisers at the rate of N150R100K150 kg/ha and then 50 kg/ha of nitrogen with 30 kg/ha as manure is highly effective for amaranth plants when they are grown in light grey soils. Also, an adequate supply of plant nutrients ensures good growth and the absorption of mobile phosphorus from the soil.

Key words: amaranth, plant, growth, development, productivity, soil, nutrients, mobile phosphorus, mineral fertilizer.

The soil and climatic conditions of the Republic of Uzbekistan require efficient use of each hectare of irrigated land. In order to efficiently use irrigated areas, the task facing the republic's agriculture is to increase the area of fertile, industrially processed crops. The general and mobile forms of phosphorus in the soil of our republic are not enough to obtain high-quality crops from plants. That is why soil cartograms are used to determine the rates of fertilisers for agricultural crops. Tillage and the application of mineral fertilisers are the most powerful human effects on the soil. This enriches the soil with nutrients and ensures a high yield of agricultural crops. Many scientists have conducted scientific work in this regard.

At the present time, the global changes taking place on a global scale are causing negative changes in natural processes and phenomena along with the positive results that led to its high development. This, in turn, requires turning back to nature, using it wisely, preserving, and studying natural resources [16; pp. 129–136].

According to F.B. Namozov [5; p. 303–305], in Uzbekistan's opinion, about 70% of the crop is still formed at the expense of soil resources. This leads to a violation of the ratio of nutrients in the soil and increases the plant's need for one or another substance. Currently, crops absorb 40–50 percent of nitrogen, 15-20 percent of phosphorus, and 30–40 percent of potassium.

I.V. Ilyushenko [4; p. 27–29], as a result of studying the efficiency of using phosphorus and potash fertilisers in his research, concluded that the use of mobile phosphorus in the soil depends on the increase in the productivity of sugar beet. The studied subtypes of black soil increase the level of provision of mobile phosphorus and reduce the yield increase due to phosphorus fertilisers. The relationship between the increase in sugar beet productivity and the amount of

mobile potassium in the soil and the amount of potassium in applied fertilisers is unstable and poorly expressed, that is, it varies little depending on the level of effective potassium fertiliser.

S.I. Tyutyunov, P.I. Solntsev, and N.K. Shapovalov [11; p. 10–14], according to information, soil fertility decreases due to the non-application of fertilisers, and on the contrary, the use of nitrogen, phosphorus, and potassium fertilisers leads to maintaining the amount of nutrients in the soil. At the same time, it provides 2.96 t/ha of winter wheat, 15 t/ha of sugar beet, 1.95 t/ha of barley, and 2.7 t/ha of corn.

L.E. Chmeleva, A.A. Borodin, and A.D. Chetin [9; 12–13 p.], in his opinion, according to the data obtained as a result of studies aimed at studying the effect of various humic fertilisers, the highest root fruit yield was 38.3 t/ha, and the sugar content was 16.8% in the variants of Fitosporina M applied at the rate of 1.5 l/ha. made it possible. The use of humic fertilisers in combination with mineral fertilisers ensures an increase in the yield of sugar beet and the amount of sugar obtained from 1 hectare of land.

With the introduction of new varieties of intensive types of crops created in foreign countries into production, scientific information aimed at increasing productivity and crop quality by optimising feeding with mineral fertilisers is obtained [12; 136-b; 13; 49–57 p]. According to many researchers in this field, one of the main factors in increasing crop yield and product quality is the correct and effective use of mineral fertilisers, the residues of previous crops [14; pp. 47–56, 15; pp. 147–156].

According to Sulaymanov and others, sugar beet is a very demanding plant for nutrients. Therefore, it is very important to use mineral fertilisers in the right amount, form, and timing to get a high yield from sugar beet. Among mineral fertilisers, not all nitrogen fertilisers have the same effect on the growth and yield of sugar beet. At the same time, they had different effects on the amount of mobile phosphorus in the soil.

A.A. Juroev [2.28; 69–72 p.], as a repeated crop of sugar beet, seeds moistened by 80–100%, encapsulated with 75% biohumus, and 25% soil ensured obtaining flat seedlings. As a result, it has led to the absorption of a large amount of nutrients from the soil. By the end of the growing season, we can see that the plant absorbed 14.2–28.34 kg/ha of phosphorus from the soil with leaves and 20.12–38.9 kg/ha with roots.

Omonilloevich F.Kh. According to the information provided by the researchers, the calcium and micro- and macroelements in chicken eggshells can be used as various fertilisers and bioactive compounds to find high-performance fertilisers for the cultivation of amaranth medicinal plants, both in medicine and in agronomic fields. It is a unique raw material, and it is said that it will give good results if used in the cultivation of the amaranth plant.

Based on these, we set the norms for mineral fertilisers for the amaranth plant as shown in Table 1. According to this experimental system, we aimed to study the effect of mineral fertilisers applied to amaranth plants on the amount of mobile phosphorus in the soil.

Experimental options are placed on 1 level with 4 turns, the plots are 50 m long and 4.8 m wide, the total area of the plot is 240 m2, and the reference area is 100 m2. The total area of the experiment was 11,520 m2. In the experiment, mineral fertilisers were used: ammonium nitrate (N-34%), simple superphosphate (P2O5-14%), potassium chloride (K2O-56%). Before ploughing the experimental field, 100% of the planned phosphorus and potassium fertilisers were given according to the options. Nitrogen fertilisers were given at a rate of 20% before planting the amaranth seedling in the field, 40% after the single one and the remaining 40% when the amaranth stem was fully formed (before development).

All observation, analysis and calculations were adopted at UzPITI «Methods of conducting field experiments» and «Metodika polevyx opytov s xlopchatnikom v usloviyax oroshenia» [1.9; 147-p.] was carried out on the basis of procedures. The composition of the soil and plant samples obtained in «Методы агрохимических, агрофизических и микробиологических исследований на хлопковых полях.» [1.5; p. 656, 1.10; p. 187], [1.11; p. 220] was analysed based on their styles. The accuracy of the data obtained in the experiment by B.A. Dospehov [1.8; p. 248–255] A mathematical analysis was performed based on the «Metodika polevogo opyta» method.

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Table 1

Experience system

Options	Standards of mineral fertilizers, kg\ ha			Under the autumn drive		By sowing	After the single	When the stem is fully formed (in development)
	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 juice method at the expense of 30 kg/ha of nitrogen fertilizers.

Using the information from the above-mentioned literature, we also conducted an analysis of the experimental results.

During the experiment, the dynamics of mobile phosphorus in the soil during the initial and plant vegetation phases were determined. These observations were made in all years of the experiment (Tables 2, 3, and Figures 1, 2). According to the data obtained in the first year of the experiment, the control, in which no mineral fertilisers were applied to amaranth, was characterised by a lower initial amount of active substances in the soil in option 1 (26.8 mg/kg) than in other options. Also, by the end of the growing season, its amount decreased, like other options, this decrease was 1.8 mg/kg at 0–30 cm of soil, and 0.9 mg/ha at 0–70 cm. In options 2, 5, and 8, where none of the mineral fertilisers were given, the amount of mobile phosphorus in the 0–30 cm layer of the soil was 27.6, respectively; this corresponded to 25.5 and 27.3 mg/kg. By the end of the growing season, this indicator is 25.6; it has decreased to 23.4 and 25.5 mg/kg. According to these data, the reduction was greatest with no phosphorus (2.1 mg/kg), followed by nitrogen (2.0 mg/kg), and lastly with no potassium (1.8 mg/kg). From this data, we can see that potassium nutrients are very important for amaranth, if there is not enough, it will not absorb other nutrients. Mineral fertilisers are given at the same rate of N150R100K150 kg/ha in options 4, 6 and 10. The rate of mobile phosphorus in the 0–30 cm layer of the soil is initially 27.2; 27.3; and 27.5 mg/kg, at the end of the growing season, it is 24.5; 24.3; and 24.7 mg/kg. in which the maximum decrease in the amount of mobile phosphorus in the soil was observed in the 10th option. In this option, good conditions were created for the plant, and its growth and development were high due to the fact that 30 kg/ha of nitrogen were given with manure in the last feeding with nitrogen fertilisers. The same law is preserved in the 0-70 cm layer of the soil.

Table 2

Effect of rates of mineral fertilizers applied to amaranth on the dynamics of mobile phosphorus in the soil of the experimental field, in mg/kg, 2020.

Soil layer, cm	options									
	1	2	3	4	5	6	7	8	9	10
	Initial									
0-30	26,8	27,4	27,3	27,2	26,5	27,3	28,4	27,5	27,7	27,5
0-70	18,5	19,9	19,4	19,7	18,5	19,6	20,0	19,4	19,7	19,6
April										
0-30	26,3	26,6	26,4	26,2	24,9	26,2	27,4	26,8	26,9	26,3
0-70	18,3	19,6	19,0	19,2	18,2	19,0	19,5	19,1	19,1	19,0

May										
0-30	25,5	25,7	25,4	25,1	24,0	25,0	26,3	26,0	26,0	25,0
0-70	17,9	19,1	18,4	18,3	17,7	18,0	18,6	18,4	18,3	17,9
June										
0-30	25,0	25,1	24,9	24,5	23,4	24,3	25,6	25,5	25,4	24,7
0-70	17,6	18,7	17,9	17,7	17,3	17,5	18,0	18,1	18,0	17,3

According to the observations made in the second year of the field experiment, the amount of mobile phosphorus in the soil was slightly higher than that of the field in the previous year. According to experimental options, after application of phosphorus fertilisers, it was in the range of 27.5–30.5 mg/kg in the 0–30 cm layer and 19.1–20.4 mg/kg in the 0–70 cm layer. By the end of the growing season of the amaranth plant, the difference between them increased due to the absorption of phosphorus nutrients by the plant in different amounts. In option 1, which was controlled for mineral fertilisers, the amount of mobile phosphorus in the 0–30 cm layer of the soil decreased by 1.5 mg/kg from the beginning, while nitrogen fertilisers were not given (on the basis of N0R100K150 kg/ha); in option 2, it decreased by 2.2 mg/kg. In options 4, 6, and 10, where mineral fertilisers are given in the norms of N150R100K150 kg/ha, this change is 2.5, 2.9, and 2.1 mg/kg, respectively. In the 10th variant of the experiment, the relatively small decrease in the amount of mobile phosphorus is probably due to the fact that the annual rate of nitrogen fertiliser, 30 kg/ha, is given at the expense of manure during the development of the amaranth stem. When phosphoric fertilisers were given in a higher amount than other options (N150R150K150 kg/ha), the amount of mobile phosphorus in the soil was 30.5 mg/kg in the first determinations at a depth of 0–30 cm. By the end of the vegetation period of the plant, it had decreased to 28.4 mg/kg and then to 2.1 mg/kg. It can be said that the high rate of phosphorus fertilisers does not ensure good growth of the plant.

Table 3

Effect of rates of mineral fertilizers applied to amaranth on the dynamics of mobile phosphorus in the soil of the experimental field, in mg/kg, 2021.

Soil layer, cm	options									
	1	2	3	4	5	6	7	8	9	10
	Initial									
0-30	27,5	29,7	29,5	29,6	27,6	29,3	30,5	29,6	29,4	29,3
0-70	19,1	19,8	19,9	19,7	19,3	19,8	20,4	19,9	19,8	19,7
April										
0-30	27,1	29,0	28,9	28,7	27,0	28,3	29,7	29,0	28,7	28,2
0-70	18,8	19,5	19,5	19,3	19,0	19,3	20,0	19,5	19,2	19,0
May										
0-30	26,4	28,3	28,1	27,8	26,4	27,3	29,0	28,3	27,9	27,1
0-70	18,4	19,0	18,9	18,6	18,5	18,5	19,3	18,9	18,6	18,1
June										
0-30	26,0	27,9	27,6	27,1	25,9	26,4	28,4	27,7	27,1	26,2
0-70	18,1	18,6	18,5	18,2	18,2	18,0	18,9	18,6	18,3	17,5

When we analysed the data obtained in the third year of the experiment (Figures 1 and 2), the initial indicators of phosphorus were higher than those of previous years (25.4–28.5 mg/kg at 0–30 cm, 16.7–18.3 at 0–70 cm in the range of mg/kg) but differed by much less. However, the amount of mobile phosphorus in the soil has decreased compared to previous years. In option 1, where no mineral fertilisers were applied, the amount of mobile phosphorus in the 0–30 cm

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layer of the soil decreased by 1.8 mg/kg and in the 0–100 cm layer by 0.9 mg/kg. The highest reduction of organic phosphorus in the soil is achieved with mineral fertilisers when given at the rate of N150R100K150 kg/ha. In the experiment, this norm is divided into three options (Options 4, 6, and 10), which differ from each other in the form of nitrogen fertilisation. In the 4th variant of the experiment, nitrogen fertilisers were given only in mineral form, in the 6th variant, 50 kg/ha of the fertiliser planned to be given after the single one was given was given in the form of 30 kg/ha of manure, in the 10th variant, 60 kg/ha of nitrogen, which should be given when the stems are fully grown and developed, also differs in that the amount of 30 kg/ha is given in the form of manure.

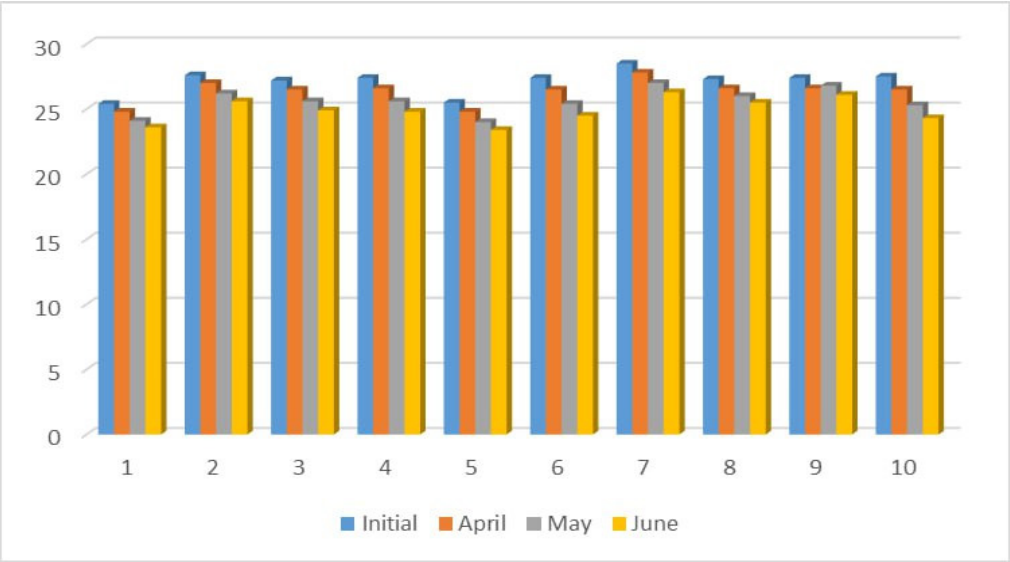


Figure 1: Impact of mineral fertilizer rates on the dynamics of mobile phosphorus in the 0-30 cm soil layer, in mg/kg, 2022.

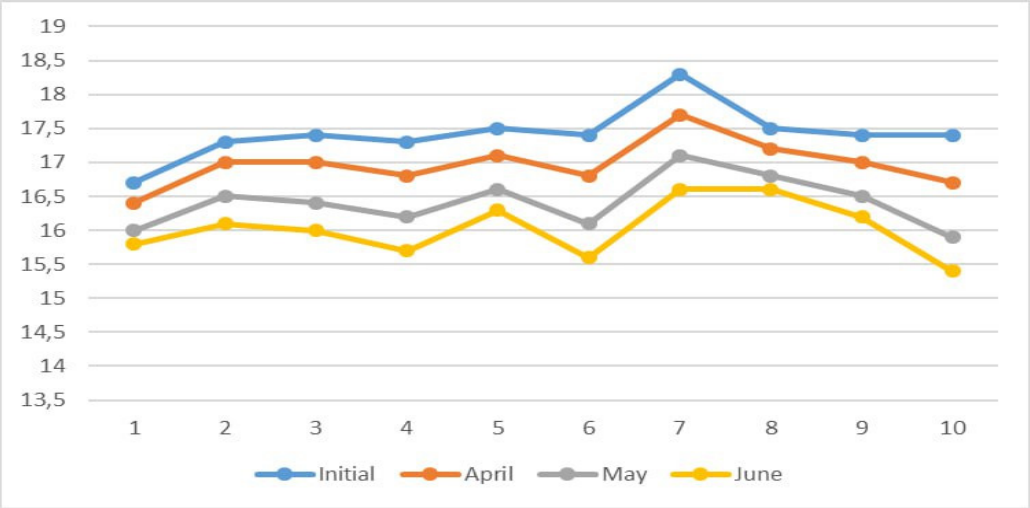


Figure 2: Impact of mineral fertilizer rates on the dynamics of mobile phosphorus in the 0-70 cm soil layer, in mg/kg, 2022.

Accordingly, there was a difference in the amount of mobile phosphorus in the soil. In option 4, where only nitrogenous minerals are given, the amount of mobile phosphorus in the 0–30 cm layer of the soil is 2.6 from the beginning; a reduction of 2.9 and 3.2 mg/kg was achieved in options 6 and 10, respectively. In the 0-70 cm layer of the soil, it is 1.6 according to the options; a reduction of 1.8 and 2.2 mg/kg was provided. Also, when we studied the variants (var. 2, 5, and 8), in which none of the mineral fertilisers were given, it was determined which nutrients are most necessary for the plant to grow well. According to the obtained data, when potassium is not given (var. 8), 1.8 in the 0–30 cm layer, it decreases to 2.0 and 2.1 mg/kg when nitrogen is not given (var. 2) and phosphorus is not given.

In conclusion, it should be said that for the amaranth plant, when it is grown in light grey soils, it is highly effective to apply mineral fertilisers at the rate of N150R100K150 kg/ha and to give 50 kg/ha of nitrogen after the single 30 kg/ha as manure. Also, an adequate supply of plant nutrients ensures good growth and the absorption of mobile phosphorus from the soil.

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