**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

# INFLUENCE OF MINERAL AND ORGANIC FERTILIZERS ON THE PROPERTIES OF SEROZEM - MEADOW SOILS, NUTRITIONAL DYNAMICS AND YIELD OF AMARANTH

**ORTIKOV TULKIN**
Samarkand State University. E-Mail: ortikov@mail.ru

**SHONIYOZOV BOBUR**
Samarkand branch of Tashkent State Agrarian University. E-Mail: shoniyozov_b@mail.ru

**USMANOV RAVSHAN**
Independent Researcher.

**Abstract:**

From the agrochemical properties of soils, their nutritional regime is of great importance. Since, plant nutrition is associated with it. In serozem-meadow soils, the nitrogen regime is in the most vulnerable position. Since the content of ammonium and nitrate nitrogen in the soil is at a minimum. The introduction of nitrogen fertilizers improving the nitrogen regime of the soil has a positive effect on the growth, development and accumulation of amaranth grain yield. The most optimal fertilizer nitrogen rate was 250 kg / ha against the background of $P_{150}K_{200}$ (1-experiment), an increase in the nitrogen fertilizer rate to 300 kg / ha against this background did not significantly increase the yield of amaranth grain. The study of the norms of mineral fertilizers without applying manure and in combination with it showed that mineral fertilizers (NPK) and manure at a dose of 30 t / ha significantly improve the poor nutritional regime of serozem-meadow soils, creating a high level of nutrition for amaranth plants. At the same time, the highest level of the nutrient regime of the soil was observed with the combined application of mineral fertilizers with manure. The highest yield was obtained on the $N_{200}P_{140}K_{100}$ +30 t / ha option.

**Keywords:** Serozem-meadow soil, nutritional regime, nitrogen fertilization, mineral fertilizers, manure, plant nutrition, amaranth, plant growth, grain harvest.

## INTRODUCTION:

The natural property of the serozem-meadow soils of the Samarkand oasis will not be able to provide plants with nutrients sufficiently. Since, the natural content of mobile nutrients is, in most cases, in a low degree of security [1; 2; 3]. Cultivated plants, in particular amaranth, carry out nutrients in high quantities during the growing season with the accumulation of biomass and grain harvest. According to scientists [4], in order to obtain 10 centners of amaranth grain yield, plants must take out 20.6 kg of N, 13.2 kg of $P_2O_5$ and 5.6 kg of $K_2O$ from the soil. Amaranth green mass to take out even more nutrients. So, to create 100 centners of green mass, the plant takes out 25-30 kg of nitrogen, 18-22 kg of phosphorus and 75-85 kg of potassium [5, 6, and 7]. The need for amaranth for nutrients varies at different stages of development [8, 9]. The most critical periods in the nutrition of amaranth is the regrowth and flowering phase [8, 10], during this period amaranth very strongly absorbs nutrients from the soil and applied fertilizer, which requires a high concentration of nutrients in the soil. Some authors note that amaranth absorbs nutrients in large quantities throughout the growing season.

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

The physical condition of the soil plays an important role in the formation of mobile nutrients in the soil. In a loose state with good aeration, optimal water regimes, a favorable condition is created for the formation of mobile nutrients and their assimilation by plants [11, 12, 13, 14, 15, and 16].

This increases the utilization of nutrients from soil and fertilizers.

Therefore, in plant nutrition, the physical condition of the soil and its structure are of great importance. From soil with different physical properties and conditions, the plant assimilates nutrients even at the same concentration in different rates and quantities.

At the same time, amaranth is a very demanding crop for nutrients [8] and takes them out in large quantities [10, 17]. Growth, development [7, 8, 18], accumulation of fruit elements and yield [9, 10, 19, 20, 21, 22], product quality [18, 21, 22, 23, 24] depend on the nutrition of the culture.

An increase in the concentration of mobile nutrients in the soil to an optimal value is of great importance in a cardinal improvement in plant nutrition. For these purposes, in the conditions of Uzbekistan, mineral fertilizers are mainly used.

However, the nutrients of mineral fertilizers are not fully utilized by plants. The utilization rate, especially, of phosphorus and nitrogen from fertilizers is very low - 20 and 40%, respectively [25, 26, 27]. At the same time, most of the phosphates of fertilizers in the soil are converted into an indigestible form for plants [25, 26, 28, 29, and 30]. This is especially pronounced in carbonates soils and highly acidic soils.

Whereas the nitrogen of fertilizers, not assimilated by plants, is lost from the soil due to volatilization in the form of ammonia, oxides and molecular nitrogen [25, 27] and leaching during irrigation [25, 27]. Nitrogen losses during denitrification and irrigation depend on the physical condition of the soil. With high soil hardness, disturbed structure, aeration, low humus content, the loss of soil nitrogen and fertilization increases. [11, 14, 16].

The introduction of organic fertilizers improves the physical condition, water, thermal, air properties of the soil and creates a good condition for the growth, development of plant roots, as well as in the assimilation of nutrients and water, respiration [8, 11, and 19]. At the same time, organic fertilizers are the source of all nutrients and carbon dioxide, which has a positive effect on soil properties and growth, plant development [22, 23, and 24]. Improvement of soil properties under the influence of organic fertilizers increases the efficiency of mineral fertilizers.

Therefore, the study of the nutrition of amaranth plants, the effect of mineral and organic fertilizers on it, as well as soil conditions is of great importance.

## MATERIALS AND METHODS

To study these issues, field experiments were carried out in the gray-earth-meadow soils of the DJambay district with the amaranth culture. In the experiments, seeds of the amaranth variety Kharkovsky-1 were sown. In the first experiment, the effect of nitrogen

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

fertilizer rates on nutrition, growth, development of yield and quality of amaranth products was studied. In the second experiment, the effect of mineral and organic fertilizers was studied. In the first experiment, against the background of phosphorus-potassium fertilizers ($P_{150}K_{200}$), the effect of nitrogen was studied at rates of 150, 200, 250, 300 kg / ha. In the second experiment, the effect of manure (30 t / ha) and mineral fertilizers was studied. At the same time, mineral fertilizers were studied at different rates separately and in combination with 30 t / ha of manure.

Field experiments were laid in serozem-meadow soils of the Jambay district of the Samarkand region of Uzbekistan. The area of the plots was 224 m2, of which 112 m2 was registered.

Agrochemical characteristics of the soil of the experimental plot, where the effect of nitrogen fertilizers rate was studied: humus content 1.32%, gross nitrogen 0.128%, gross phosphorus 0.174%, gross potassium 2.8%, ammonium and nitrate nitrogen 8.8 and 17.6 mg / kg of soil, mobile phosphorus 22.6 mg / kg of soil, exchangeable potassium 200 mg / kg of soil. In the soil of the second experiment, where the effect of mineral and organic fertilizers on soil fertility and the yield of amaranth was studied, the humus content in the arable layer was 1.12%, total nitrogen - 0.108%, total phosphorus - 0.164%, total potassium - 2.38%, ammonium nitrogen ($N\text{-}NH_4$) 14.5 mg / kg soil, nitrate nitrogen ($N\text{-}NO_3$) 17.3 mg / kg soil, mobile phosphorus - 21.4 mg / kg soil, exchangeable potassium - 220 mg / kg soil. The reaction of the medium (pH) 7.35, that is, slightly alkaline.

In the experiments, nitrogen fertilizer was introduced in the form of ammonium nitrate, phosphate fertilizer-superphosphate, and potassium-potassium chloride.

## RESULTS AND DISCUSSION

The results of the study show that when only phosphorus-potassium fertilizers are applied, the nitrogen regime of the soil almost does not change, which does not significantly affect the nitrogen nutrition of plants. Nitrogen is of great importance in these conditions. Since the nitrogen content in the soil is at a minimum, and without increasing nitrogen nutrition, it is difficult to get good growth, development and yield of amaranth. Therefore, the issues of nitrogen nutrition should be addressed first. The study of the rate of nitrogen fertilizers from 150 to 300 kg / ha in active ingredients shows that the nitrogen of fertilizers sharply increases the content of both ammonium and nitrate nitrogen in the soil. With an increase in the rate of nitrogen fertilizers in the soil, the content of mineral nitrogen increases due to both forms of nitrogen.

The effect of nitrogen fertilizers on the content of mineral ammonium and nitrate nitrogen was observed within 25-30 days after their application, then the options almost leveled out and there was no significant difference in this indicator. With the introduction of high norms of nitrogen fertilizers, the concentration of ammonium and nitrate nitrogen, that is, mineral nitrogen, in the soil increases greatly (Table 1; Table 3). This contributes to an increase in nitrogen loss due to volatilization in the form of ammonia, nitrogen oxides and molecular nitrogen, as well as leaching of nitrates and partly

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

ammonium. Since, with a strong increase in the concentration of mineral nitrogen, the soil tends to reduce them with the help of microorganisms to a safe content. This was observed when nitrogen was applied at a rate of 300 kg / ha. On the other hand, the soil, with a low humus content, cannot absorb and retain ammonium and especially nitrate nitrogen. In serozem-meadow soils, the process of nitrification of ammonium nitrogen ends in 14 days, i.e. in two weeks, the ammonium nitrogen introduced by fertilizers is completely converted into nitrates. Nitrates are quickly washed out under irrigation conditions and volatilize during denitrification. Under irrigation conditions, nitrates are quickly washed out and volatilized during denitrification. When high rates of nitrogen fertilizers are applied, the stability of the content of ammonium and nitrate nitrogen in the soil is disturbed, that is, their content begins to decrease significantly to the concentration that the soil maintains stably for a relatively long time.

**Table 1: Influence of the rate of nitrogen fertilizers on the content of ammonium nitrogen in the soil, mg / kg of soil (2017) (1-experiment)**

| No | Variants | $N\text{-}NH_4$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 17.04 | 20.05 | 20.06 | 20.07 | 20.08 |
| 1. | Control without fertilization | 10,2 | 12,8 | 13,5 | 12,1 | 12,5 |
| 2. | $P_{150}K_{200}$- Background | 13,4 | 15,1 | 17,0 | 14,8 | 15,7 |
| 3. | Background+$N_{150}$ | 13,2 | 24,6 | 21,8 | 28,9 | 20,2 |
| 4. | Background+$N_{200}$ | 13,0 | 26,3 | 25,4 | 31,2 | 22,8 |
| 5. | Background+$N_{250}$ | 13,4 | 29,0 | 28,7 | 34,1 | 25,5 |
| 6. | Background+$N_{300}$ | 13,2 | 31,7 | 30,6 | 36,3 | 27,2 |

**Table 2: The effect of mineral and organic fertilizers on the content of ammonium nitrogen in the soil, mg / kg of soil (2019) (2-experiment)**

| No | Variants | $N\text{-}NH_4$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 5.05 | 5.06 | 5.07 | 5.08 | 1.09 |
| 1. | Control without fertilization | 10,8 | 12,5 | 15,0 | 13,5 | 10,8 |
| 2. | $N_{100}P_{70}K_{50}$ | 11,2 | 17,2 | 19,9 | 16,8 | 13,8 |
| 3. | $N_{150}P_{105}K_{75}$ | 10,7 | 20,0 | 23,0 | 21,0 | 14,5 |
| 4. | $N_{200}P_{140}K_{100}$ | 11,0 | 22,3 | 25,1 | 23,0 | 15,1 |
| 5. | $N_{250}P_{175}K_{125}$ | 11,2 | 24,8 | 27,8 | 24,8 | 16,0 |
| 6. | $N_{300}P_{210}K_{150}$ | 11,4 | 25,7 | 29,2 | 26,0 | 16,4 |
| 7. | 30 t / ha manure | 18,8 | 20,8 | 24,0 | 25,5 | 22,8 |
| 8. | $N_{100}P_{70}K_{50}$+30 t / ha manure | 18,8 | 24,5 | 28,8 | 27,7 | 23,0 |
| 9. | $N_{150}P_{105}K_{75}$+ t / ha manure | 19,0 | 27,0 | 31,1 | 30,0 | 24,4 |
| 10 | $N_{200}P_{140}K_{100}$+30 t / ha manure | 19,5 | 29,8 | 33,0 | 31,5 | 25,1 |

The introduction of a part of nitrogen in the form of organic fertilizers (manure) has a positive effect on the content of mineral-ammonium and nitrate nitrogen, and contributes to their high content during turning for a long time. This can be seen in the results of the second experiment, where the effect of different norms of mineral fertilizers was studied separately and in combination with 30 t/ha of manure. The introduction of only one manure without mineral fertilizers, although it increased the content of mineral nitrogen during the entire growing season of amaranth, but did not bring the concentration to the level of the variants where nitrogen fertilizers were applied. The application of full

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

mineral fertilizers against the background of 30 t / ha of manure increased the content of mineral nitrogen for a long time to a maximum, which was not even observed when very high doses of fertilizer nitrogen were applied (Table 2; Table 4).

Consequently, the increase in the content of mineral nitrogen in serozem-meadow soils when nitrogen fertilizers are applied occurs up to a certain limit, beyond which it is impossible to increase the content of ammonium and nitrate nitrogen due to a sharp increase in the loss of these forms of nitrogen in the conditions of irrigated agriculture in Uzbekistan due to leaching and denitrification.

**Table 3: Influence of the rate of nitrogen fertilizers on the content of nitrate nitrogen in the soil, mg / kg of soil (2017) (1-experiment)**

| No | Variants | $N\text{-}NO_3$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 17.04 | 20.05 | 20.06 | 20.07 | 20.08 |
| 1. | Control without fertilization | 13,5 | 16,8 | 17,5 | 15,5 | 17,3 |
| 2. | $P_{150}K_{200}$- Background | 15,6 | 19,0 | 20,5 | 18,2 | 19,6 |
| 3. | Background +$N_{150}$ | 15,8 | 28,5 | 26,7 | 34,6 | 23,8 |
| 4. | Background +$N_{200}$ | 15,5 | 30,6 | 28,4 | 37,2 | 27,0 |
| 5. | Background +$N_{250}$ | 15,6 | 33,4 | 31,2 | 39,8 | 30,1 |
| 6. | Background +$N_{300}$ | 15,8 | 34,3 | 33,0 | 41,3 | 31,5 |

**Table 4: The effect of mineral and organic fertilizers on the content of nitrate nitrogen in the soil, mg / kg of soil (2019) (2-experiment)**

| No | Variants | $N\text{-}NO_3$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 5.05 | 5.06 | 5.07 | 5.08 | 1.09 |
| 1. | Control without fertilization | 14,8 | 16,7 | 18,3 | 15,7 | 14,5 |
| 2. | $N_{100}P_{70}K_{50}$ | 15,3 | 21,5 | 23,3 | 19,3 | 15,8 |
| 3. | $N_{150}P_{105}K_{75}$ | 14,7 | 23,2 | 26,2 | 22,8 | 17,6 |
| 4. | $N_{200}P_{140}K_{100}$ | 14,7 | 25,6 | 29,8 | 23,9 | 18,2 |
| 5. | $N_{250}P_{175}K_{125}$ | 15,0 | 28,0 | 33,0 | 26,5 | 20,2 |
| 6. | $N_{300}P_{210}K_{150}$ | 15,3 | 29,2 | 33,7 | 27,2 | 20,9 |
| 7. | 30 t / ha manure | 21,4 | 24,8 | 27,7 | 29,3 | 25,5 |
| 8. | $N_{100}P_{70}K_{50}$+30 t / ha manure | 22,3 | 29,8 | 32,6 | 30,7 | 28,1 |
| 9. | $N_{150}P_{105}K_{75}$+ 30 t / ha manure | 23,0 | 33,1 | 37,0 | 32,3 | 30,5 |
| 10 | $N_{200}P_{140}K_{100}$+30 t / ha manure | 23,7 | 35,5 | 38,6 | 34,5 | 32,3 |

Thus, in serozem-meadow soils, the best nitrogen regime is created when 250 kg/ha of nitrogen is applied against the background of phosphorus-potassium fertilizers, or mineral fertilizers in the norm N200P140K100. Against the background of 30 t/ha of manure

The content of available phosphorus plays an important role in plant nutrition. The application of phosphorus fertilizers against the background of potassium fertilizers (1-experiment) and together with nitrogen and potassium fertilizers (1 and 2-experiments) significantly increased the content of mobile phosphorus in the soil (Table 5; Table 6). With the introduction of nitrogen fertilizers against the background of PK (1-experiment), a tendency to an increase in the content of mobile phosphorus in the soil was observed. This may be due to an increase in nitrates in the soil with the introduction of nitrogen

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

fertilizers and a decrease in pH, which contributes to the dissolution of phosphates in the soil. This was especially noticeable when applying high doses of nitrogen fertilizer.

**Table 5: Influence of the rate of nitrogen fertilizers on the content of mobile phosphorus in the soil, mg / kg of soil (2017) (1-experiment)**

| No | Variants | $P_2O_5$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 17.04 | 20.05 | 20.06 | 20.07 | 20.08 |
| 1. | Control without fertilizers | 20,3 | 22,6 | 24,5 | 26,7 | 23,5 |
| 2. | $P_{150}K_{200}$-Background | 32,5 | 30,6 | 28,8 | 33,5 | 27,6 |
| 3. | Background+$N_{150}$ | 34,0 | 32,3 | 30,6 | 34,4 | 29,1 |
| 4. | Background+$N_{200}$ | 34,8 | 34,2 | 32,9 | 36,2 | 30,8 |
| 5. | Background+$N_{250}$ | 35,7 | 35,0 | 34,2 | 37,8 | 32,5 |
| 6. | Background+$N_{300}$ | 37,0 | 36,3 | 36,0 | 39,3 | 33,4 |

The application of mineral fertilizers, including phosphorus fertilizers against the background of 30 t / ha of manure (2-experiment), led to a significant increase in the content of mobile phosphorus in the soil. Manure had a positive effect on the effectiveness of phosphate fertilizers, which is associated with a decrease in the transition of mobile phosphorus into an indigestible form when manure is applied (Table 6). On the other hand, manure is a source of organic phosphorus, the utilization rate of which is two times higher than phosphorus mineral fertilizers in the conditions of Uzbekistan. So, organic phosphorus of manure is more protected from the transition to indigestible phosphate than phosphorus of mineral fertilizers. In this regard, the best phosphate regime in serozem-meadow soil was observed when 30 t/ha of manure with mineral fertilizers (N200P140K100) was applied.

**Table 6: The effect of mineral and organic fertilizers on the content of mobile phosphorus in the soil, mg / kg of soil (2019) (2-experiment)**

| No | Variants | $P_2O_5$ content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 5.05 | 5.06 | 5.07 | 5.08 | 1.09 |
| 1. | Control without fertilizers | 15,8 | 18,3 | 20,7 | 18,5 | 15,4 |
| 2. | $N_{100}P_{70}K_{50}$ | 22,6 | 26,3 | 28,1 | 20,7 | 17,3 |
| 3. | $N_{150}P_{105}K_{75}$ | 26,2 | 30,0 | 31,8 | 23,6 | 19,2 |
| 4. | $N_{200}P_{140}K_{100}$ | 30,5 | 34,0 | 36,2 | 27,4 | 20,1 |
| 5. | $N_{250}P_{175}K_{125}$ | 32,3 | 36,8 | 40,0 | 30,0 | 21,3 |
| 6. | $N_{300}P_{210}K_{150}$ | 33,0 | 37,8 | 40,7 | 30,5 | 21,9 |
| 7. | 30 t / ha manure | 28,5 | 31,6 | 34,2 | 28,3 | 25,0 |
| 8. | $N_{100}P_{70}K_{50}$+30 t / ha manure | 31,1 | 35,5 | 38,5 | 32,0 | 26,7 |
| 9. | $N_{150}P_{105}K_{75}$+30 t / ha manure | 35,3 | 40,2 | 43,2 | 36,0 | 28,6 |
| 10 | $N_{200}P_{140}K_{100}$+30 t / ha manure | 37,6 | 41,3 | 44,1 | 37,3 | 30,4 |

In the soils of Uzbekistan, a high content of exchangeable potassium is always observed, especially in soils with a heavy texture. Only in sandy and sandy loam soils there is a low content of exchangeable potassium. The introduction of potassium fertilizers against the background of phosphorus fertilizers (1-opit) and together with nitrogen and phosphorus fertilizers (1 and 2-experiments) and manure (2-experiment) contributed to an increase in the content of exchangeable potassium in the soil (Table 7 and Table 8). When applying nitrogen fertilizers against the background of phosphorus-

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

potassium fertilizers (1-experiment), there was a tendency to an increase in the content of exchangeable potassium in soils. With an increase in the rate of nitrogen fertilizers, the content of exchangeable potassium increased (1-experiment). The highest content of exchangeable potassium was in the variant where mineral fertilizers were applied at the rate of $N_{200}P_{140}K_{100}$ against the background of 30 t / ha of manure.

**Table 7: Influence of the rate of nitrogen fertilizers on the content of exchangeable potassium in the soil, mg / kg of soil (2017) (1-experiment)**

| No | Variants | K2O content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 17.04 | 20.05 | 20.06 | 20.07 | 20.08 |
| 1. | Control without fertilizers | 180 | 200 | 210 | 190 | 210 |
| 2. | $P_{150}K_{200}$- Background | 240 | 250 | 240 | 260 | 240 |
| 3. | Background +$N_{150}$ | 250 | 260 | 240 | 270 | 250 |
| 4. | Background +$N_{200}$ | 250 | 270 | 250 | 270 | 250 |
| 5. | Background +$N_{250}$ | 260 | 270 | 250 | 280 | 250 |
| 6. | Background +$N_{300}$ | 260 | 270 | 260 | 280 | 260 |

**Table 8: The effect of mineral and organic fertilizers on the content of exchangeable potassium in the soil, mg / kg of soil (2019) (2-experiment)**

| No | Variants | K2O content, mg / kg soil (ppm) | | | | |
|---|---|---|---|---|---|---|
| | | 5.05 | 5.06 | 5.07 | 5.08 | 1.09 |
| 1. | Control without fertilizers | 180 | 190 | 200 | 210 | 190 |
| 2. | $N_{100}P_{70}K_{50}$ | 200 | 210 | 220 | 220 | 200 |
| 3. | $N_{150}P_{105}K_{75}$ | 210 | 220 | 230 | 220 | 210 |
| 4. | $N_{200}P_{140}K_{100}$ | 220 | 230 | 240 | 230 | 210 |
| 5. | $N_{250}P_{175}K_{125}$ | 230 | 250 | 250 | 240 | 220 |
| 6. | $N_{300}P_{210}K_{150}$ | 240 | 250 | 250 | 240 | 220 |
| 7. | 30 t / ha manure | 250 | 270 | 280 | 260 | 250 |
| 8. | $N_{100}P_{70}K_{50}$+30 t / ha manure | 260 | 290 | 300 | 270 | 260 |
| 9. | $N_{150}P_{105}K_{75}$+30 t / ha manure | 280 | 300 | 310 | 280 | 270 |
| 10 | $N_{200}P_{140}K_{100}$+30 t / ha manure | 290 | 300 | 320 | 280 | 280 |

Thus, the introduction of nitrogen fertilizers against the background of phosphorus-potassium fertilizers of a complete set of mineral fertilizers separately and together with 30 t / ha of manure will significantly improve the nutritional regime of gray-earth-meadow soils in the DJambay district of the Samarkand region of Uzbekistan, which creates a good background for the nutrition of amaranth plants.

This is confirmed in the growth and development of amaranth plants. Since, good growth and development of plants is formed with adequate nutrition of plants [21, 22]. In the control variant without fertilization, the plants grew very slowly and, therefore, their low growth was noted in the timing of plant height registration. The use of phosphorus-potassium fertilizers without nitrogen did not increase plant growth so much. This shows that the enhancement of nitrogen nutrition is of great importance in the formation of plant growth and development (Table 9). With an increase in the rate of nitrogen fertilizers, the growth of the plant increases, the number of leaves on one plant. The highest biometric indicators were at the application of nitrogen fertilizer at the rate of 250 and 300 kg / ha against the background of PK. In the second experiment, when

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

using mineral fertilizers at the rate of $N_{200}P_{140}K_{100}$ against a background of 30 t / ha of manure (Table 10). The introduction of some of the nutrients in the form of manure had a positive effect on the growth and development of amaranth compared to their use only in the form of mineral fertilizers. This is due to the fact that mineral forms of nutrients quickly become insoluble or are lost as a result of leaching or volatilization. Phosphorus, which passes into an insoluble form, is very difficult to turn back into an assimilable form. .Only potassium of mineral fertilizers remains in a mobile form for a relatively long time, and does not significantly transform into a stationary form. At the same time, potassium is adsorbed in the soil-absorbing complex, which contributes to its preservation in the soil and prevents its leaching. The nutrients that are in the manure are stored for a long time, since they are not immediately washed out in the manure, do not volatilize and do not turn into an insoluble form as a result of some kind of reaction. On the contrary, manure is gradually mineralized over time, releasing nutrients in free form. This contributes to the gradual replenishment of nutrients lost and used by plants over a long time, which maintains a high level of nutrients in the soil. Under such conditions, a high level of plant nutrition for a long time without sharp fluctuations and stresses, which is observed when using only mineral fertilizers, especially nitrogen fertilizers.

Table 9: Influence of the rate of nitrogen fertilizers on the growth and formation of leaves of amaranth plants (2017)

| No | Variants | Plant height, cm | | | Number of leaves, pieces / plant | | |
|---|---|---|---|---|---|---|---|
| | | 21.05 | 21.06 | 21.07 | 21.05 | 21.06 | 21.07 |
| 1. | Control without fertilization | 45 | 98 | 128 | 7 | 11 | 18 |
| 2. | $P_{150}K_{200}$- Background | 60 | 127 | 175 | 15 | 19 | 28 |
| 3. | Background+$N_{150}$ | 88 | 150 | 212 | 18 | 25 | 35 |
| 4. | Background+$N_{200}$ | 112 | 178 | 228 | 22 | 27 | 41 |
| 5. | Background+$N_{250}$ | 130 | 193 | 251 | 23 | 30 | 45 |
| 6. | Background+$N_{300}$ | 137 | 201 | 270 | 25 | 32 | 50 |

**Table 10: The effect of mineral and organic fertilizers on the growth and formation of leaves of amaranth plants (2019)**

| No | Variants | Plant height, cm | | | Number of leaves, pieces / plant | | |
|---|---|---|---|---|---|---|---|
| | | 15.05 | 15.06 | 15.07 | 15.05 | 15.06 | 15.07 |
| 1. | Control without fertilization | 39 | 89 | 118 | 5 | 9 | 16 |
| 2. | $N_{100}P_{70}K_{50}$ | 74 | 128 | 187 | 12 | 18 | 29 |
| 3. | $N_{150}P_{105}K_{75}$ | 81 | 142 | 207 | 16 | 23 | 36 |
| 4. | $N_{200}P_{140}K_{100}$ | 105 | 163 | 227 | 20 | 25 | 39 |
| 5. | $N_{250}P_{175}K_{125}$ | 118 | 180 | 237 | 24 | 31 | 43 |
| 6. | $N_{300}P_{210}K_{150}$ | 122 | 185 | 241 | 26 | 32 | 45 |
| 7. | 30 t / ha manure | 80 | 138 | 201 | 14 | 20 | 32 |
| 8. | $N_{100}P_{70}K_{50}$+30 t / ha manure | 112 | 170 | 221 | 21 | 28 | 40 |
| 9. | $N_{150}P_{105}K_{75}$+30 t / ha manure | 123 | 186 | 243 | 26 | 33 | 47 |
| 10 | $N_{200}P_{140}K_{100}$+30 t / ha manure | 127 | 197 | 256 | 28 | 36 | 51 |

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

Thus, the introduction of mineral and organic fertilizers, creating a high level of the nutrient regime of the soil, improves the nutrition and biometric parameters of amaranth plants. This creates the preconditions for a high yield accumulation.

With the introduction of mineral and organic fertilizers, the yield of grain and amaranth biomass significantly increased. Nitrogen fertilization significantly increased the yield and biomass of amaranth. With an increase in the rate of nitrogen fertilizers from 150 kg / ha to 300 kg / ha, the yield of amaranth increased. But with an increase in the dose of nitrogen in fertilizers from 250 kg / ha to 300 kg / ha, a significant increase in grain yield and amaranth biomass was not observed. This is due to the fact that an increase in the nitrogen norm of fertilizers from 250 to 300 kg / ha did not significantly increase the content of mineral nitrogen in the soil. Since, with an increase in the dose of nitrogen fertilizers to 300 kg / ha, the loss of mineral nitrogen from the soil increased. This contributed to the equalization of the level of nitrogen supply in these two variants (250 and 300 kg/ha N). In the second experiment, where the effect of mineral and organic fertilizers was studied separately and in combination, the highest yield was obtained with the combined application of organic and mineral fertilizers. So, on the option $N_{200}P_{140}K_{100}$ +30 t / ha of manure, the highest yield was obtained. So, in the control without fertilization, the average yield of amaranth grain for three years was 9.17 c / ha, against the background ($P_{150}K_{200}$) 13.43 c / ha, and with the application of nitrogen fertilizers at rates from 150 to 300 kg / ha per background $P_{150}K_{200}$ - from 24.32 c / ha to 36.21 c / ha. At the same time, on the $N_{150}P_{150}K_{200}$ variant, the grain yield was 24.32 c / ha, on the $N_{200}P_{150}K_{200}$ variant -28.32 c / ha, $N_{250}P_{150}K_{200}$ - 34.70 c / ha, on the $N_{300}P_{150}K_{200}$ variant - 36.21 c / ha (Table 11).

**Table 11: Influence of the rate of nitrogen fertilizers on the yield of amaranth (average for 2015-2017)**

| No | Variants | Amaranth grain yield, c / ha | | | Total, c | Average, c / ha | Addition to control | |
|---|---|---|---|---|---|---|---|---|
| | | 2015 | 2016 | 2017 | | | c / ha | % |
| **1.** | Control without fertilization | 7,26 | 9,55 | 10,7 | 27,51 | 9,17 | - | 100 |
| **2.** | $P_{150}K_{200}$- Background | 10,85 | 12,30 | 17,15 | 40,30 | 13,43 | 4,26 | 146,46 |
| **3.** | Background+$N_{150}$ | 22,31 | 24,60 | 26,05 | 72,96 | 24,32 | 15,15 | 265,21 |
| **4.** | Background+$N_{200}$ | 28,07 | 28,03 | 28,85 | 84,95 | 28,32 | 19,15 | 308,83 |
| **5.** | Background+$N_{250}$ | 32,20 | 37,33 | 34,58 | 104,11 | 34,70 | 25,53 | 378,41 |
| **6.** | Background+$N_{300}$ | 33,73 | 38,67 | 36,23 | 108,63 | 36,21 | 27,04 | 394,87 |

In the second experiment, where mineral and organic fertilizers were studied separately and in combination, the average yield of amaranth grain in the control without fertilizers for three years was 17.72 c / ha. With the introduction of manure and mineral fertilizers, the yield of amaranth grain increased significantly. So, the grain yield of amaranth in the variant where only manure was applied at a rate of 30 t / ha was 31.73 c / ha, and in the variants where only mineral fertilizers were applied - from 26.59 c / ha to 37.86 c / ha (Table 12). At the same time, with an increase in the rate of mineral fertilizers, the yield of amaranth grain increased. So, if on variants $N_{100}P_{70}K_{50}$, $N_{150}P_{105}K_{75}$ the yield of amaranth grain was 26.59 c / ha, 30.79 c / ha, respectively, then on variants

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

$N_{200}P_{140}K_{100}$, $N_{250}P_{175}K_{125}$, $N_{300}P_{210}K_{150}$ - 32.79, 35.89, 37.86 c / ha respectively. The application of mineral fertilizers at the rates of $N_{100}P_{70}K_{50}$, $N_{150}P_{105}K_{75}$, $N_{200}P_{140}K_{100}$ against the background of 30 t / ha of manure sharply increased the yield of amaranth grain to 34.28, 36.21, 38.37 c / ha, respectively (Table 12). Consequently, amaranth responds very strongly to the introduction of manure, as well as to the improvement of the agrochemical and agrophysical properties of the soil. This is due to the agrochemical and agrophysical properties of manure. The composition of manure feed nitrogen, phosphorus and potassium contains all other macro and microelements necessary for plants. This is of great importance in plant nutrition, since adequate nutrition leads to better growth, development and accumulation of the crop. In addition, manure, increasing organic matter in the soil, significantly improves the agrophysical properties of the soil and the conditions for the growth and nutrition of amaranth plants.

This is especially important in soils where the humus content is low and the physical properties are poor. Therefore, the introduction of manure against the background of mineral fertilizers has a positive effect on plant nutrition and, consequently, on their biometric indicators. Therefore, on the options where mineral fertilizers were applied together with 30 t / ha manure, the amaranth grain yield was the highest.

**Table 12: The effect of mineral and organic fertilizers on the yield of amaranth (average for 2017-2019)**

| No | Variants | Amaranth grain yield, c / ha | | | Total, c | Average, c / ha | Addition to control | |
|---|---|---|---|---|---|---|---|---|
| | | 2017 | 2018 | 2019 | | | c / ha | % |
| **1.** | Control without fertilizers | 15,35 | 19,03 | 18,78 | 53,16 | 17,72 | 0,00 | 100,00 |
| **2.** | $N_{100}P_{70}K_{50}$ | 25,43 | 26,5 | 27,83 | 79,76 | 26,59 | 8,87 | 150,04 |
| **3.** | $N_{150}P_{105}K_{75}$ | 28,98 | 30,9 | 32,5 | 92,38 | 30,79 | 13,07 | 173,78 |
| **4.** | $N_{200}P_{140}K_{100}$ | 30,83 | 33,38 | 34,15 | 98,36 | 32,79 | 15,07 | 185,03 |
| **5.** | $N_{250}P_{175}K_{125}$ | 34,08 | 36,6 | 36,98 | 107,66 | 35,89 | 18,17 | 202,52 |
| **6.** | $N_{300}P_{210}K_{150}$ | 35,78 | 38,55 | 39,25 | 113,58 | 37,86 | 20,14 | 213,66 |
| **7.** | 30 t / ha manure | 30,48 | 31,1 | 33,6 | 95,18 | 31,73 | 14,01 | 179,04 |
| **8.** | $N_{100}P_{70}K_{50}$+ 30 t / ha manure | 33,53 | 32,98 | 36,33 | 102,84 | 34,28 | 16,56 | 193,45 |
| **9.** | $N_{150}P_{105}K_{75}$+ 30 t / ha manure | 35,43 | 35,48 | 37,73 | 108,64 | 36,21 | 18,49 | 204,36 |
| **10** | $N_{200}P_{140}K_{100}$+ 30 t / ha manure | 37,53 | 37,7 | 39,88 | 115,11 | 38,37 | 20,65 | 216,53 |

## CONCLUSION

Thus, mineral and organic fertilizers significantly improve the agrochemical properties of serozem-meadow soils, which optimizes plant nutrition and has a positive effect on the growth, development and accumulation of amaranth grain yield.

The introduction of part of the nutrients in the form of manure increases the efficiency of the applied mineral fertilizers, which is expressed in an increase in the coefficient of utilization of nutrients from fertilizers. This is due to the creation of good conditions for

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

the preservation and assimilation of nutrients in mineral fertilizers. Amaranth plants respond strongly to the concentration of mobile nutrients in the soil and, therefore, to fertilization in mineral and organic forms.

At the same time, plant growth and the number of leaves increase significantly, which creates a good condition for the accumulation of biomass and the yield of amaranth grain.

Of the mineral fertilizers, nitrogen fertilization is of the greatest importance. Amaranth responds very well to nitrogen fertilization and the concentration of mineral nitrogen in the soil. Amaranth on serozem-meadow soils of Uzbekistan responds very well to the application of nitrogen fertilizers and the concentration of mineral nitrogen in the soil. The introduction of nitrogen fertilizers significantly improves the nitrogen nutrition of plants and the yield of amaranth. The amaranth plant is very demanding on nitrogen nutrition.

In the first experiment, where the rates of nitrogen fertilizers were studied against the background of $P_{150}K_{200}$, the application of 250 kg / ha of nitrogen turned out to be the optimal rate. In the second experiment, where different rates of complete mineral fertilizers were studied separately and in combination with 30 t / ha manure, the highest grain yield was obtained with the variants $N_{200}P_{140}K_{100}$ + 30 t / ha manure

**List of used literature:**

1) DJabbarov O.A., Ismanov A.Zh., Kalandarov N.N. Irrigated serozem-meadow soils of the Pakhtakor district of the Jizzakh region // Biological sciences, scientific review, No. 3, 2019. -P.57-62(in Russian)
2) Agrochemical characteristics of the soils of the USSR. Republics of Central Asia. Executive editor A.V. Sokolov. Moscow, Publishing house "Science", 1967. -368s. (In Russian)
3) Agrochemical characteristics of the main types of soils in the USSR. Managing editors A.V. Sokolov and V.M. Friedland. Moscow, Publishing House "Science", 1974. -447s. (In Russian)
4) Dudka N.I. Growing amaranth paniculata (Amaranthus paniculatus) in the northern steppe of Ukraine // Zernovye Kultury Journal. Volume 3, No. 1, 2019. -C.52-61(in Russian)
5) Chirikova T.V. Amaranth - culture of the XXI century // korm-amarant.com.ua. 1999(in Russian)
6) Dzanagov S.Kh., Siukaeva F.T., Dzanagov T.S. Influence of unconventional fertilizers on the yield and structure of the amaranth crop on leached chernozem // News of the Gorsky State Agrarian University, Volume 56, No. 2, 2019. -P.7-12(in Russian)
7) Dmitrieva O.F. Features of growth and development at different terms and methods of sowing in the soil and climatic conditions of the Chuvash Republic // Bulletin of the I.Ya. Yakovlev ChGPU. Biological Sciences. 2014, No. 4 (84). -S.63-67(in Russian)
8) Kuvshinova OR Ecological and morphological features of the development of the root system of Amaranthus L. When introduced in the natural climatic conditions of the Republic of Tatarstan // Abstract for the degree of candidate of biological sciences. Kazan, 2003. -18p. (In Russian)
9) Saratov L.I. The influence of fertilizers on the yield of fodder amaranth // Innovative technologies for the production of grain, leguminous, industrial and fodder crops. Conference scientific international conference. Voronezh, November 28, 2016. Voronezh, 2016. -S. 110-119(in Russian)

ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

10) Roshchina Zh.V. Cultivation of amaranth in the link of irrigated crop rotation on ordinary chernozems of the Rostov region // Dissertation for the degree of candidate of agricultural sciences. Novocherkassk, 2007.-156s. (In Russian)

11) Nesterova LB, Kudryavtsev AE, Kudryavtseva NF The influence of agrotechnical methods of processing on the physical properties of soils and the mobilization of mobile forms of nitrogen in the conditions of the Altai region // Bulletin of the Altai State Agrarian University, No. 6 (56), 2009. -P.13-17(in Russian)

12) Zakharov N.G. Influence of tillage on biological activity and nutritional regime of leached chernozem // Agrochemical Bulletin, No. 6, 2011. -P.5-6(in Russian)

13) Nomozov N.Ch., Diyarov G. The effect of mulching on the agrochemical properties of soils under irrigated gray soils // Actual problems of the development of agricultural science in modern economic conditions. Materials of the iV-th International Scientific and Practical Conference of Young Scientists. Volgograd, May 22-23, 2015. Volgograd, 2015. -S.167-170(in Russian)

14) Tsiganenko M.K., Galkina E.E., Prokopchuk V.F., Nemykin A.A. Nutrient regime of soils depending on the methods of basic soil cultivation // Science in Russia: advanced research and development. Collection of materials of the I All-Russian Scientific and Practical Conference. Novosibirsk, October 31, 2017. Novosibirsk, 2017. -S. 65-70(in Russian)

15) Tsilyurik A.I., Sudak V.N. The effect of mulch treatment on the nutrient regime of the soil in sunflower crops // Far Eastern Agrarian Bulletin, 2017, No. 2 (42). -S.53-62(in Russian)

16) Borontov O.K., Kosyakin P.A., Manaenkova E.N. The influence of the main processing and fertilizers on the nutritional regime and physical properties of the soil during the cultivation of sugar beet // Agriculture, No. 2, 2019. -P. 33-35(in Russian)

17) Vereshchagina E.N. Amaranth compound feed for broiler chickens // Abstract of the thesis for the degree of candidate of agricultural sciences. Sergiev Posad, 1998.26s. (In Russian)

18) Miller L.S. Development of technology elements for the cultivation of vegetable forms of amaranth in the conditions of the Non-Black Earth Region // Abstract of the dissertation of the candidate of agricultural sciences. Moscow, 1999.-26s. (In Russian)

19) Christopher O. Akinbile, Samuel Adefolaju and Fidelis O. Ajibade. Effect of organic and inorganic fertilizer on the growth and yield of amaranthus Curentus in akure, ondo state, Nigeria // 37 th Annual Conference and Annual General Meeting- "Minna 2016". -P. 337-343 (in English)

20) Olowoake A.A., and Lawal O.I. Effect of organomineral and NPK fertilizer application on growth and yield of grain amaranth (Amaranthus cruentus L.) // Trop. Agric. (Trinidad). Vol. 93, No. 2, April, 2016. -P.139-146 (in English)

21) Sanni K.O. Effect of compost, cow dung and NPK 15-15-15 fertilizer on growth and yield performance of Amaranth (Amaranthus hybridus) // International Journal of Advances in Scientific Research 2016, 2 (03). -P.76-82(in English)

22) Akanni D.I., Ojeniyi and Awodun M.A. Soil Properties, Growth Yield and Nutrient Content of Maize, Pepper and Amaranthus as Influenced by Organic and Organomineral Fertilizer // Journal of Agricultural Science and Texnology A, No1, 2011. -P.1074-1078(in English)

23) Kunene E.N., Masarirambi M.T., Gadaga T.H., Diamini P.S., Ngwenya M.P. and Vilane V.S. Effects of organic and inorganic fertilizers on the growth and yield of amaranth (Amaranthus hybridus) // Acta Hortic. 1238, 31-38. DOI 10.17660 / Acta Hortic. 2019.1238.4 (In English)

24) Cecilia M. Onyango, Jeremy Harbinson, Jasper K. Imungi, Solomon S. Shibairo and Olat van Kooten. Influence of organic and mineral fertilization on Germination, leaf nitrogen, nitrate accumulation and yield of vegetable amaranth // Journal of Plant Nutrition. Volume 35, 2012. -P. 342-365 (in English)

**Jilin Daxue Xuebao (Gongxueban)/Journal of Jilin University (Engineering and Technology Edition)**
ISSN: 1671-5497
E-Publication: Online Open Access
Vol: 41 Issue: 10-2022
DOI 10.17605/OSF.IO/XB56T

25) Dzyuin G.P., Dzyuin A.G. Coefficients of the use of nitrogen, phosphorus and potassium from mineral fertilizers, manure and soil by crops of crop rotation // International Journal of Experimental Education. -2016. -№5-1. -S.83-90(in Russian)

26) Kamenev R.A. Fertilization methods, nutrient utilization rate and yield // Agrochemical Bulletin, No. 4, 2008. -P.26-28 (in Russian)

27) Khashimov F.Kh. Ways of maintaining fertility and increasing the efficiency of nitrogen fertilizers on irrigation-eroded soils // Abstract of the thesis for the degree of Doctor of Agricultural Sciences. Moscow, 1990. -48s. (In Russian)

28) Ivanov A.L. Phosphate regime transformation of phosphorus fertilizers in irrigated light gray soils of the foothill plain of the Zailiyskiy Alatau // Abstract of the thesis for the degree of candidate of biological sciences. Moscow, 1990. -48s. (in Russian)

29) Mashrabov M.I. Scientific substantiation of the effect of phosphorus-containing fertilizers on cotton nutrition in conditions of soils with carbonate-magnesium salinity // Abstract of the dissertation of Doctor of Philosophy (P.D) in agricultural sciences. Tashkent, 2018.-38p. (in Russian)

30) Myachina O.V. Structural and functional features of microbial communities in a typical serozem under the influence of phosphorus fertilizers // Abstract of the thesis for the degree of Doctor (DSc) in biological sciences. Tashkent, 2018.-74p. (in Russian)

31) Shoniyozov B.K., Ortikov T.K. Fertilization and amaranth crop formation // Journal of Actual problems of modern science, Moscow 2022 No. 2 (125) 2022. -35-39 p.