Effect of organic fertilizers on agrochemical properties of soil and growth, development and yield of cotton

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Abstract. At present, the yield of cotton depends on the applied agrotechnological measures, the timing of application, the norm and type of mineral or organic fertilizers, as well as on the natural fertility of the soil, the level of crops and a number of similar measures. Maintaining and improving soil fertility is essential for sustainable agriculture. Its agrochemical properties play an important role in soil fertility. Maintaining and improving soil fertility is essential for sustainable agriculture. Its agrochemical properties play an important role in soil fertility. Cotton nutrition, growth development, yield and product quality depend on the agrochemical properties of the soil and its nutrition regime. Organic fertilizers play an important role in improving soil fertility, especially its agrochemical properties. Organic fertilizers have a complex effect on the soil and have a positive effect on the growth, development and productivity of agricultural crops, including cotton. The main substance that determines soil fertility is humus. The higher the quantity and quality of humus, the higher the yield. However, according to most scientists, the amount of humus in the soil has decreased significantly over the past 30-40 years. Organic fertilizer in fact is an effective influencing factor that improves the quality of the crop. Therefore, it is important to maintain and increase soil fertility, taking into account the properties of organic fertilizers in the soil.
Keywords: Organic fertilizers, agrochemical properties of the soil, soil fertility, growth and productivity of cotton, quality.

1 Introduction

Today, manure is the most valuable fertilizer for effective use in agriculture. It contains about 75% water, 21% organic matter, 0.5% nitrogen, 0.25% easily digestible phosphorus, 0.6% potassium oxide [1]. Nutritional quality depends on the type of animal, diet, litter and even manure storage. Fertilizers are applied before autumn or spring planting. This method allows you to provide plants with the necessary nutrition for the entire period of their development. The average consumption of organic fertilizers is 6-8 kg per 1 sq.km. In heavy clay soils, organic material is located at a depth of 15 cm, and in chernozem and light soils it can reach 25 cm [2, 3].

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Manure is transferred during planting or seed sowing. Such nutrition gives young plants at the beginning of nutrition, they have strong roots. In the future, they will be negatively affected by weather conditions and pests [4].

Organic fertilizers have a complex effect on the soil and have a positive effect on the growth, development and productivity of agricultural crops, including cotton. However, to increase their effectiveness, organic fertilizers, including semi-decomposed cattle manure, must be carefully studied in each soil-climatic state and each crop [5].

The main role in this is played by the state of soil fertility. The main substance that determines soil fertility is humus [6-8]. The higher the quantity and quality of humus, the higher the yield. However, according to most scientists, the amount of humus in the soil has been decreasing significantly over the past 30-50 years. One of the main reasons for this process is the lack of organic fertilizers in agriculture. Because the stocks of manure, which is the main organic fertilizer, are currently very small. According to scientists, manure must be applied at the rate of at least 17-18 t/ha for a deficit-free balance of soil humus. Organic fertilizers dramatically affect soil fertility, significantly increasing the amount of humus, which is the main substance of the soil. For a long time (125 years), the annual application of mineral fertilizers (N48P48K48) keeps the amount of humus at its original level. The application of organic fertilizers in the first 20 years increased the amount of humus from 1.2% to 2%, but in the next 100 years, the lack of application of organic fertilizers reduced the amount of humus from 2.0% to 1.6%. Regular use of organic fertilizers for 125 years increased the amount of humus in the soil by 3 times [9, 10].

According to the calculations of major and leading scientists of Uzbekistan, 75 million tons of organic fertilizers are needed to obtain a high and stable crop yield. But at present, only 20-25 million tons of organic fertilizers are collected in the republic. It increased from 0.04% to 0.08% when using organic fertilizers (20-30 t/ha of manure), it is difficult to apply 10-15 t/ha of poultry manure against the background of mineral fertilizers, the amount of humus increased slightly. The use of fiber mill waste at a rate of 30 t/ha, together with mineral fertilizers, increased the amount of humus in the soil to 0.08%. Manure and biohumus increased the yield of cotton even against the background of mineral fertilizers, but the value of the additional yield taken into account was lower than when they were used separately. Even against a high background of mineral fertilizers, organic fertilizers continue to increase yields. However, the number of additional crops has further decreased. For example, manure and biohumus against the background of the mineral fertilizer "$N_{150}P_{100}K_{75}$" gave an increase in yield of 2.7 and 1.7 q/h, and against the background of the mineral fertilizer "$N_{200}P_{150}K_{100}$" they gave an increase in yield of 2.3 and 1.2 q/ha, respectively. Against this background, an increase in the norm of biohumus from 10 t/ha to 15 t/ha and an increase in the dose of manure from 20 t/ha to 30 t/ha did not have a positive effect on the yield of cotton by Karimberdieva [7].

The yield of cotton increases significantly under the influence of mineral fertilizers, manure and compost prepared from various wastes. Manure and composts prepared from it have a positive effect on the growth, development and yield of cotton even on light gray soils. In this case, the productivity of photosynthesis in cotton, the number of bolls, flowers, bolls and open bolls will significantly increase. Productivity increases by 4.4-6.3 q/ha due to manure and compost. According to research by scientists from the Samarkand Agricultural Institute, manure enhances the positive effect of mineral fertilizers on meadow soils.

For the production of 1 ton of humus in the soil, 25-30 tons of humus are required. Due to the additional accumulation of humus in such fields, it is possible to grow 36-41 q of cotton per hectare, that is, 5-6 q more than with the usual method. The stability and ecological cleanliness of the soil biolayer is important. Improving the biological state of the soil is enriched by enriching it with organic matter and applying local fertilizers to the soil.

To study the effect of organic fertilizers on the agrochemical properties of irrigated typical gray soils, as well as on the growth, development, yield and quality of cotton products. To achieve this goal, it is necessary to perform the following tasks.

1. Determination of the effect of organic fertilizers on the agrophysical properties of irrigated typical gray soils.
2. Influence of organic fertilizers on the chemical and agrochemical properties of the soil.
3. Study of the effect of organic fertilizers on nutrition, growth, development, productivity and quality of cotton.
4. To study the degree of assimilation of nutrients from fertilizers and their removal from the soil.
5. Economic efficiency of the use of organic fertilizers in the cultivation of cotton. definition.

2 Materials and Methods

The research was carried out on cotton crops on typical serozem farms in the Pastdargomsky district. The soil contained 0.98% humus, 0.124% gross nitrogen, 0.20% gross phosphorus, 2.4% gross potassium, mobile batteries were as follows:

"N-NH_4" -20.7 mg/kg in soil, "N-NO_3" - 21.3 mg/kg of soil, mobile phosphorus 22.5 mg/kg, exchangeable potassium 250 mg/kg of soil. The reaction of the soil environment (pH) was 7.1.

The presence of mobile nutrients in the soil ensures good growth and development of plants. Thus, the introduction of organic fertilizers into the soil significantly increases the amount of nitrate and ammonium nitrogen in the soil during the entire period of cotton growth, which indicates that the nitrification process proceeds more strongly than ammonification in the soil. Since if the amount of ammonium in the soil reaches a very high concentration, it is dangerous for living organisms, including microorganisms.

The amount of mineral nitrogen in the soil, consisting of the sum of ammonium and nitrate nitrogen, provides more complete information about the nitrogen nutrition of plants. A complete conclusion can be drawn depending on the amount of mineral nitrogen in the soil. In the control without fertilizers, the content of mineral nitrogen in the soil also showed seasonal fluctuations. With warming days in early spring, the amount of mineral nitrogen in the soil increased both due to ammonia and nitrate nitrogen. This situation continued until the beginning of summer. As the growing season of cotton increased, the amount of mineral nitrogen in the soil decreased, and by the end of the growing season of cotton, this amount began to increase again. Therefore, the natural change in the amount of mineral nitrogen in the soil coincides with the dynamics of ammonia and nitrate nitrogen, and they depend on the patterns of change. The share of nitrate nitrogen in the composition of mineral nitrogen was higher than the share of ammonium nitrogen in all periods of analysis.

In general, it has been found that the natural amount of mineral nitrogen accumulated due to ammonifying and nitrifying abilities is rather low. These quantities do not allow a high cotton yield. As a result of the use of organic fertilizers, the amount of mineral nitrogen in the soil increased significantly due to both ammonia and nitrate. In early spring and at the beginning of the growing season, the amount of mineral nitrogen in the soil was strongly influenced by the application of organic fertilizers, nitrogen fertilizers, and again at the end of the growing season. While the effect of mineral fertilizers was short-term, organic fertilizers had a long-term effect on the content of mineral nitrogen.

This was due to both ammonium nitrogen and nitrate nitrogen. For example, the amount of mineral nitrogen in the control soil on April 1 was 27.9 mg/kg, on June 1 - 37.6 mg/kg, on July 1 - 34.0 mg/kg, on September 1 - 39.6 mg/kg. If present, this indicator is 57.3 in accordance with the above in the variant 30 t/ha of poultry manure; 68.1; 62.2; 58.6 mg/kg,

30 t/ha of semi-decomposed cattle manure 50.1; 53.6; 49.6; 49.5 mg/kg, respectively. Therefore, the use of organic fertilizers, including semi-decomposed cattle manure and poultry manure, significantly increases the amount of mineral nitrogen in the soil. In general, poultry manure and semi-rotted cattle manure have a significant positive effect on the nitrogen regime of the soil, i.e., strengthen it. Poultry manure has a stronger effect than cattle manure.

3 Results and Discussion

Reactive phosphorus is another important nutrient in the soil. The phosphorus regime of the soil also plays an important role in determining soil fertility. The transition of phosphates to a mobile state in the soil occurs very slowly. Phosphates are less mobile than nitrogen in soil (Table 1 and Figure 1).

Table 1. Influence of non-organic fertilizers on the amount of mineral nitrogen ($N\text{-}NH_4+N\text{-}NO_3$) in soil.

Options	Amount of mineral nitrogen ($N\text{-}NH_4+N\text{-}NO_3$), mg/kg in soil					
	1.04	**1.05**	**1.06**	**1.07**	**1.08**	**2.09**
Without fertilizer (control)	27.9	34.3	37.6	34.0	36.5	39.6
30 t/ha poultry manure	57.3	55.6	68.1	62.2	66.7	58.6
30 t/ha manure	50.1	50.5	53.6	49.6	51.0	49.5

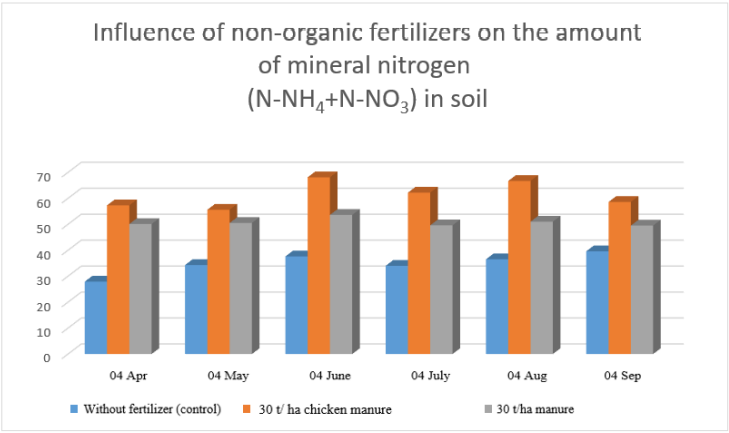

Fig.1. Influence of non-organic fertilizers on the amount of mineral nitrogen ($N\text{-}NH_4+N\text{-}NO_3$) in soil.

In the soil without fertilizers, the amount of mobile phosphorus in the control variant increased from early spring to summer, then the amount of mobile phosphates decreased with the beginning of the cotton vegetation, and increased again at the end of the vegetation. As a result of the use of poultry manure, the amount of mobile phosphorus increased significantly compared to the control. This w as especially evident towards the end of the growing season.

When poultry manure was applied, the amount of mobile phosphorus in the soil was higher during the entire growing season compared to the control variant without fertilizer. The use of cattle manure also increased the amount of mobile phosphorus in the soil. The

effect of semi-decomposed cattle manure on the amount of mobile phosphorus in the soil was significant.

For example, in the control without fertilizers, the amount of mobile phosphorus in the soil was 15.3 mg/kg of soil on April 1, 21.5 mg/kg of soil on June 1, 17.0 mg/kg of soil on July 1, 22.1 mg/kg on July 1 soil. soil on September 1st. mg/kg of soil, in the case of 30 t/ha of poultry manure, this figure is 25.8, which corresponds to the above; 30.4; 27.8; 25.5 mg/kg of soil, respectively 20.6 in the variant using 30 t/ha of semi-decomposed cattle manure; 25.2; 23.0; 25.0 mg/kg in soil has been reported (Table 2 and Figure 2).

Table 2. Influence of organic fertilizers on the amount of mobile phosphorus in soil.

Options	Active phosphorus amount, P_2O_5 mg/kg of soil					
	1.04	**1.05**	**1.06.**	**1.07**	**1.08**	**1.09**
Without fertilizer (control)	15.3	17.6	21.5	17.0	19.2	22.1
30 t/ha poultry manure	25.8	28.0	30.4	27.7	31.6	25.5
30 t/ha manure	20.6	23.4	25.2	23.0	24.6	25.0

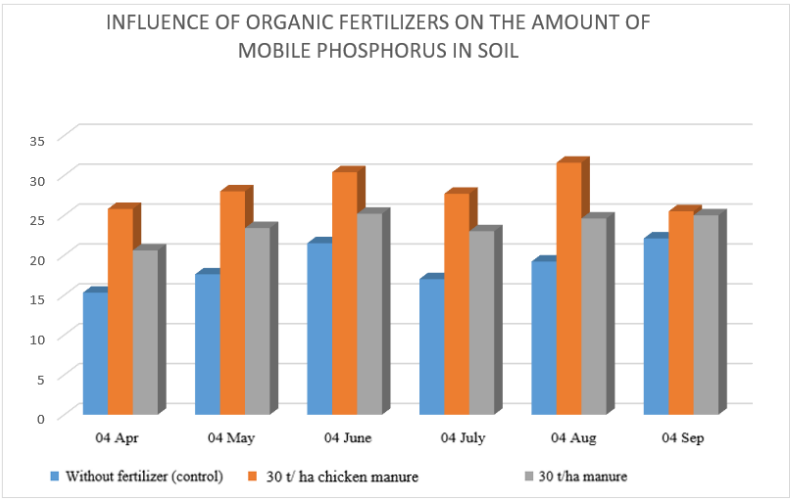

Fig. 2. Influence of organic fertilizers on the amount of mobile phosphorus in soil.

Organic fertilizers including chicken and cattle manure significantly increases the amount of mobile phosphorus in the soil. This leads to an improvement in the phosphate regime of the soil. In addition, manure increases the solubility of phosphates. This serves to optimize the phosphorus nutrition of cotton.

Another important soil nutrient is exchangeable potassium. Potassium nutrition has a strong influence on the growth and development of cotton. In this case, cotton removes potassium from the soil in large quantities. In general, the amount of exchangeable potassium in the soil is several times higher than the amount of nitrogen and mobile potassium. In the control, i.e., without fertilization, the natural amount of exchangeable potassium in the soil was 200–250 mg/kg, and this amount increased from early spring to summer. With increased growth and development of cotton, the amount of exchangeable potassium in the soil decreased. By the end of the growing season, the amount of exchangeable potassium in the soil began to increase again. The introduction of poultry manure at the rate of 30 t/ha

increased the amount of exchangeable potassium in the soil. This was especially evident in the middle of the growing season. Field and laboratory experiments have shown that the effect of poultry manure on the amount of exchangeable potassium in the soil is much greater than that of cattle manure.

The introduction of semi-decomposed cattle manure led to a significant increase in the exchangeable potassium in the soil compared to the control. Although at the beginning and middle of the growing season of cotton, half-decomposed manure of cattle was lower than that of mineral fertilizers, by the end of the growing season it equalized, and in some cases even increased the amount of exchangeable potassium in the soil. For example, in the control without fertilizers, the amount of exchangeable potassium in the soil was 200 mg/kg of soil on April 1, 250 mg/kg of soil on June 1, 210 mg/kg of soil on July 1, and 240 mg/kg of soil on September 1, if at 30 t/ha poultry manure, this figure is 250 in accordance with the above280; 250; 250 mg/kg of soil at 30 t/ha of cattle manure, 240; 270; 230, respectively. This was 260 mg/kg of soil (Table 3 and Figure 3).

Table 3. Effect of organic fertilizers on exchangeable potassium in soil.

Options	**The amount of exchangeable potassium, mg/kg of soil**					
	1.04	**1.05**	**1.06**	**1.07**	**1.08**	**2.09**
Without fertilizer (control)	200	220	250	210	230	240
30 t/ha poultry manure	250	270	280	250	250	250
30 t/ha manure	240	250	270	230	250	260

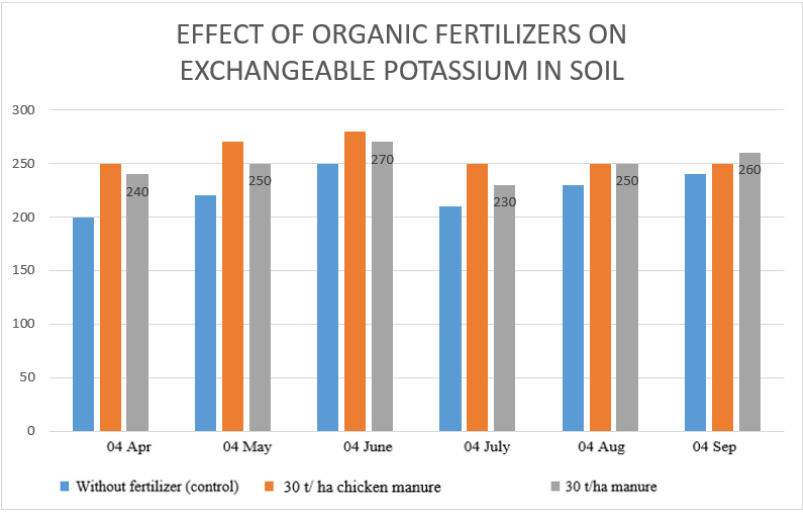

Fig. 3. Effect of organic fertilizers on exchangeable potassium in soil.

Therefore, organic fertilizers significantly increased the amount of exchangeable potassium in the soil. At the same time, organic fertilizers had a convincing effect on the amount of exchangeable potassium in the soil.

After the introduction of organic fertilizers, the growth and development of cotton accelerated, especially as a result of a change in the soil nutrition regime and an increase in cotton nutrition. It follows that the increase in soil fertility, including the number of mobile nutrients, as a result of the use of organic fertilizers, had a positive effect on the growth and development of cotton.

4 Conclusions

Poultry manure and semi-decomposed cattle manure, applied as organic fertilizers, increase the content of mobile nutrients in the soil - ammonium nitrogen, nitrate nitrogen, mineral nitrogen, mobile phosphorus and exchangeable potassium throughout the growing season, steadily increasing compared to the control. This situation is observed even when using organic fertilizers.

The introduction of organic fertilizers at the rate of 30 t/ha has a positive effect on the development of cotton growth. Compared with the control, the height of the cotton plant, the number of leaves, the number of sympodial branches, the number of cobs, the number of flowers and the number of bolls were significantly increased.

When cultivating cotton on typical sierozems, the application of organic fertilizers, including poultry manure and semi-decomposed cattle manure, under the plow at a rate of 30 t/ha, gives good agronomic and economic results.

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