Importance of humine preparation and organic fertilizers in improving the fertility of eroded typical gray soils

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Abstract. In the world, scientific work is being carried out in a number of priority directions on maintaining, restoring, and increasing soil fertility, as well as returning plant residues to the soil, minimal processing, and the preparation and use of organic fertilizers from household waste. In this regard, special attention is paid to studies aimed at optimizing the agrophysical, agrochemical and other properties of soils based on the soil-climatic conditions of the regions, developing agro-measures based on the soil-climatic conditions of each region, restoring, maintaining and increasing soil fertility. Effective use of land, water and other natural resources, providing the population with ecologically clean and high-quality products, maintaining and increasing soil fertility, and using high-performance modern resource-saving technologies in the care of agricultural crops are the main tasks in Uzbekistan today. In the article, the general physical properties of irrigated gray soils distributed in Piskent district of Tashkent region, the general physical properties of nitrogen, phosphorus, potassium in the environment of humus, poultry manure, the positive effect of their use on the development of cotton crops and the amount of yield were determined. Keywords: Erosion, irrigation, degradation, sodium humate, agrophysical, soil, volume weight.

1 Introduction

Soil is more important than ever in today's society. The increasing demand for land is related to the underlying facts, that is, the depletion of land areas due to the limited, improper use and management of the world's soil resources [1, 2].

In the Republic of Uzbekistan, it is recommended to carry out measures to prevent and combat the degradation of the soil cover of irrigated lands, irrigation erosion, to increase the productivity of soil protection from washing, to improve its agrophysical-agrochemical, melioration and ecological condition [3-5].

Effective use of land, water and other natural resources, providing the population with ecologically clean and high-quality products, maintaining and increasing soil fertility, and using high-performance modern resource-saving technologies in the care of agricultural crops are the main tasks in Uzbekistan today [6-8].

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Today, 33% of land resources have been degraded due to "erosion, compaction and salinization, lack of organic and nutrient substances, soil pollution and other processes [9, 10]. Population growth required a 60% increase in food production over the next 35 years. Scientifically based development of measures aimed at improving the efficiency of irrigated lands, protecting soil cover from degradation processes, preventing them and increasing its productivity is one of the urgent tasks [11-13]. From this point of view, in the cultivation of agricultural crops in the areas affected by irrigation erosion in Uzbekistan, scientific researches on increasing the fertility of the soil through the use of biopreparations, the use of modern invented agrotechnological biopreparations, including the obtaining of high fiber quality results from the cotton crop, are considered urgent.

Based on the above, we aimed to use biological methods for increasing soil fertility and crop productivity in our scientific research work.

2 Materials and Methods

The research was conducted in the territory of the farm "Ibrokhim Zoda Khondamir", Piskent district, Tashkent region. During the field research, the slope of the site, the degree of erosion was studied, and it was carried out in 3 options and 3 returns.

Field and laboratory analyzes of soils were performed using standard methods generally accepted in the field of soil science and microbiology. Statistical processing of the obtained results was carried out according to the dispersion B.A. Dospekhov method [9]. Soil analyzes were carried out according to E.V. Arinushkina's manual on "Chemical analysis of soil" [7], the amount of microorganisms in soil was carried out according to D.G. Zvyagintsev's "Methods of soil microbiology and biochemistry" [11]. Experimental field studies were conducted under "Methods of field and vegetative experiments with cotton under irrigation conditions" and "Methods of conducting field experiments".

3 Results and Discussion

In the Piskent district, where the irrigated lands of the Tashkent province (Uzbekistan) are constantly used for agriculture, scientific research was conducted on the changes in the agrochemical properties, biological activity, agrophysical physical-mechanical properties and productivity of the soils spread on the IV-V coastal terrace of the Angren River under the influence of irrigation and erosion.

Natural conditions (geological-geomorphological structure of the place, soil-forming rocks, climate, topography, flora and fauna, etc.). Field experiments were conducted to improve the biological activity of irrigated typical gray soils.

As a result of the application of biological preparations to the soil, the effect on the organic part of the soil increases, and the level of mineralization and humification increases, humus is synthesized. Achieving humus-free balance in irrigated soils under the influence of sodium humate is studied under the influence of non-traditional fertilizers. This sodium humate is an organo-mineral fertilizer obtained from coal mine waste, and agrophysical and agrochemical processes in the soil have been studied by applying it to the soil.

On the basis of sodium humate preparation from Angren coal mine, poultry manure mineral fertilizers, we conducted a field experiment with the presence of cotton plant on typical gray soils eroded by irrigated irrigation in Piskent district of Tashkent region.

Below applied field experiment options were given:

1.N_{200} P_{140} K_{100}-Natural

2. Natural+Humate-Na

3. Natural+Poultry manure

It is known that mineral uptake by plants on irrigated land, i.e. obtaining a high and quality harvest, is closely related to the vital activity of microorganisms in the soil. Therefore, the issue of connection between the development of agricultural culture and the composition and quality of mineral fertilizers applied to the land is being studied. This is the reason why the production of biological fertilizers and their practical application attract the attention of many scientists in foreign countries and in our country.

During the research, we observed changes in the general physical properties of the soil depending on the level of soil erosion based on humate sodium, poultry manure environment, its effect on the agronomic valuable properties of the soil on cotton productivity.

We can see the effect of humus biofertilizer, organic fertilizer, poultry manure fertilizers on the general physical properties of eroded typical gray soils. We conducted experimental work on the cotton plant. During the vegetation period, it was 1.30 g/cm^3 in the control option, 1.27 g/cm^3 in the option with mineral fertilizer and 1.29 g/cm^3 in the case of poultry manure (Figure 1).

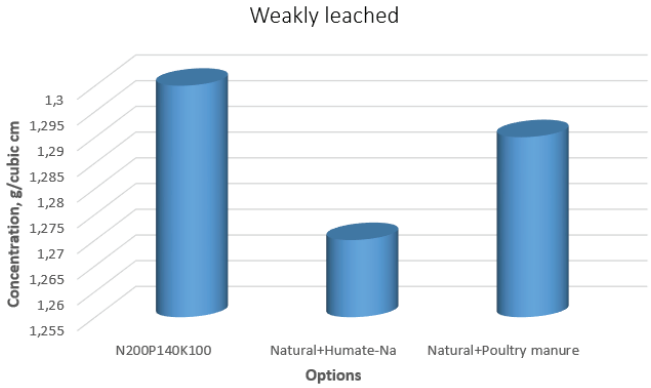

Fig. 1. Effect of the preparation, mineral and organic fertilizer on the volume weight of the soil.

The total porosity of the soil also changed in proportion to this indicator. The highest rate was found to be 52.78% when humate was applied with mineral fertilizer (Figure 2).

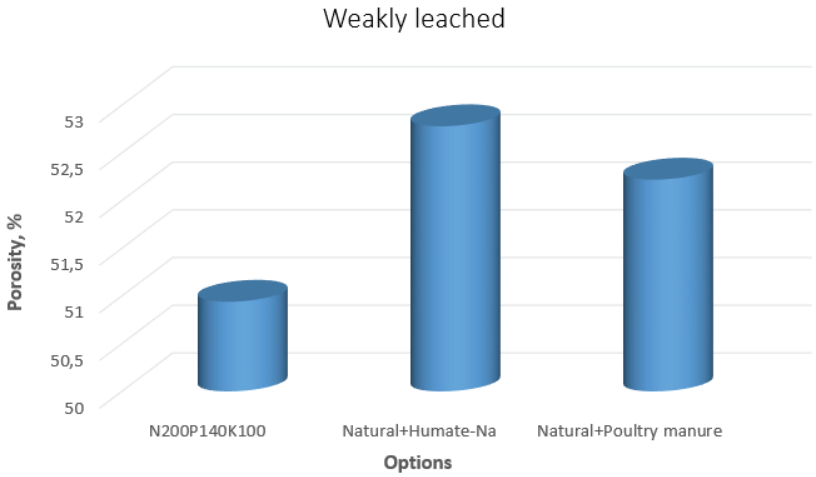

Fig. 2. Effect of the preparation, mineral and organic fertilizer on the total porosity of the soil.

Knowledge of agrophysical properties under irrigated farming conditions plays an important role in improving the productive properties of land. In particular, mobile and useful water and nutrients in the soil are often determined by physical and hydrophysical properties. Physical-water, physical-mechanical properties of the soil, density, volume weight, porosity, moisture capacity, water permeability and productivity depend on the mechanical composition of the soil.

It is worth noting that, according to our experiments, the most optimal indicator of the general physical properties of the soil was observed in the options where sodium humate was used with mineral fertilizer. In short, the general physical properties of the soil are manifested in all the flows that pass through it.

It is known that erosion causes a violation of the natural laws of the soil formation process. On the slopes washed by water, the thickness of the humus (humus) layer and genetic layers of the soil decreases, the mechanical structure becomes lighter, the supply of nutrients decreases, and the water regime changes. In order to characterize the productivity of typical eroded gray soils, elements that change under the influence of leaching, namely humus and nutrients, water resistance of the granulometric composition of aggregates, and other similar analyzes were carried out. The mechanical composition of the soil has a great influence on soil production and agricultural use. The process of soil formation depends on the mechanical composition of the soil and the parent rocks that form the soil, which affects the distribution and accumulation of organic and mineral compounds in the soil. Accordingly, soils with mechanical composition formed in different parent rocks in one type of natural soil conditions have different properties. Mechanical composition is one of the indicators that determine chemical, physical and biological properties. During the research, it was observed that erosion processes affect soil physical properties in particular. The high total porosity in the studied soils ensures the activity of microorganisms living in the soil. So, the agrophysical properties of the soil are manifested by the biological activity that takes place in it. In the first stage of research using the proposed agrotechnologies, the data obtained on the growth, development and productivity of cotton are presented in the research on cotton cultivation.

In the branching-flowering stage of cotton, the average height of the plant was 35.9 cm in the 1st control option, in which mineral fertilizers were used, and 34.4 cm in the 2nd control option, while it was 37.5 cm in the options using organic fertilizer (manure), sodium humate. was determined. That is, in the options where organic fertilizers and humate were used, the height of cotton was 0.5-3.4 cm higher than the control option 1 where mineral fertilizers were used.

According to the crop branch, it is 5.5 units in the 1st option, and this indicator is 5.7 in the organic background and humate experimental options; It was 5.6 units, which was 0.1-0.3 units more than control option 1.

According to the number of flowers, it was 0.5 pieces in the 1st control option, while the highest indicator was found to be 0.2-0.4 pieces in the options using humus and poultry manure + 2 tons/ha.

In the flowering-harvest stage of cotton, the height of the plant was 80.0 cm on average in the 1st control option, and it was 82.4 and 83.3 in options 2-3, where humate-Na and poultry manure + 2 tons/ha were applied.

At the stage of ripening of cotton, in the options where mineral fertilizers sodium humate and Rizacom and poultry manure were used, compared to control option I, where mineral fertilizer was used in full measure, the increase in plant growth, development and harvest indicators was even more evident.

According to the phenological observations, the differences obtained by the experimental variants on plant growth, development and accumulation of yield elements were shown in the yield of cotton.

According to the results of the harvest, the cotton yield was 30.7 q/ha in control option 1 (Figure 3). The average yield in the option using Natural+humate-Na was 33.7 q/ha, and in the option using Natural+poultry manure was 33.1 q/ha.

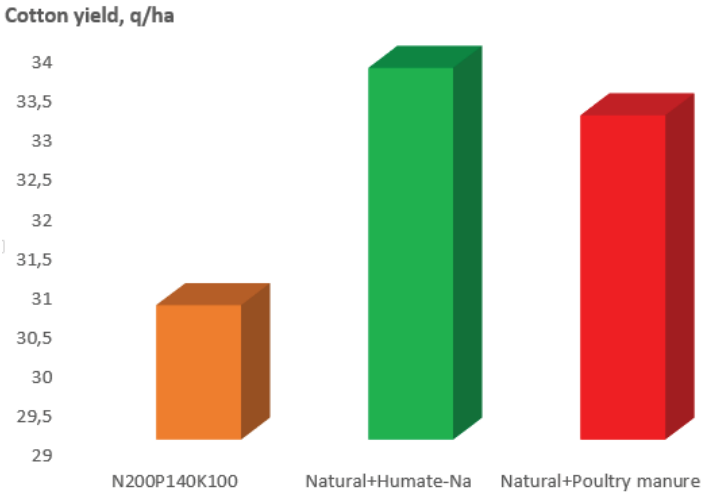

Fig. 3. Effect of minerals and preparations on cotton yield in typical gray soils with weak erosion.

According to the data, the reaction to fertilizers and preparations applied in eroded soils was significantly manifested. Statistical treatment of the obtained results shows that the smallest significant difference (HCP) was 2.95. This result confirms that there is a significant difference between the variants.

4 Conclusions

The topography of the research area is wide undulating, old irrigated, typical ice soil is medium cultured, soil-forming rocks are located in loess and loess-like rocks, weakly eroded.

The effect of organic mineral fertilizers and biopreparations in the soil had a significantly higher effect on the development of cotton directly according to the level of soil erosion.

It was found that an additional yield of 3.0 q/ha was obtained from cotton compared to the control option where the same amount of mineral fertilizers nitrogen 200, phosphorus 140, potassium 100 kg was used. In typical eroded gray soils, bulk density decreased by 0.03 g/cm^3 and porosity increased by 2% in the case of sodium humate compared to the control.

Agrotechnologies aimed at increasing soil fertility and cotton yield were used, and high indicators of plant growth and development were obtained when cotton was grown in humate variants with 2 tons of poultry manure per hectare.

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