

CHANGES IN PHOSPHORUS AND ITS GROUP COMPOSITION IN IRRIGATED MEADOW SEDGE SOILS

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Abstract

The article discusses phosphorus in soils and its state, changes in its quantitative indicators according to group composition during human irrigated agriculture, and reveals the greatest increase in phosphates of the first and second groups among the groups distinguished according to Chirikov.

Keywords: Meadow saz soils, phosphorus, salinity, readily water-soluble salts, phosphorus groups, total phosphorus, gypsum, carbonate.

Introduction

The accumulation and transformation of phosphorus in soils under irrigated agriculture differs from that in soils under natural conditions. Only 20% of the large amount of phosphorus released as fertilizers each year is used by plants, the rest remains in the soil and undergoes complex processes of transformation from monocalcium phosphate to water-insoluble dicalcium and tricalcium phosphates. Phosphorus absorbed by plants is protected from fixation in the soil, leaching, and other losses. The transformation of phosphorus into poorly soluble forms and its fixation in the soil depends mainly on the amount of calcium and, to some extent, magnesium, as well as aluminum and iron oxides in the soil. The main part of phosphorus applied to the soil as fertilizers is converted into a form that cannot be absorbed by plants within almost a day [1., 2]. This condition causes a shortage of water-soluble forms of phosphorus, which are necessary for plants, in the soil, and conducting additional research in this area is of great practical importance.

Research object and methods

The irrigated meadow saz soils of the Central Fergana desert region were selected as the research object. The gross form of phosphorus in the soil was determined by the Maltsevo-Gritsenko method from one sample, with the help of a 1% ammonium carbonate solution, phosphorus gray analysis was performed according to Chirikov.

Research results

In sandy and grassy soils, the accumulation of phosphorus in water-insoluble forms depends on the amount of colloidal-silt fractions and the abundance or deficiency of calcium and magnesium



carbonates. The conversion of water-soluble phosphorus from fertilizers applied to the soil to calcium di- and triphosphates increases with increasing hydromorphism of the soil.

Information on the forms in which phosphorus is bound to the soil and its dynamics is most often reflected in its soil analysis. Studies conducted on this topic often show that the constant use of phosphorus fertilizers increases the total amount of phosphorus in pasture peat soils, while increasing the content of group I and II phosphates, and reducing group III and IV phosphates, and decreasing group V phosphates [2, 3].

According to 2005 data [1., 2]. shows an increase in the total phosphorus content in soils compared to (1970). The total phosphorus content decreases from east to west from the right wing of the cone to the left wing in the arable layer of soils from 0.278% to 0.096% and from 0.164% to 0.088% in the sub-arable layer. According to the analysis of the data, the high calcium content in soils has a strong effect on the solubility of phosphorus compounds. Monophosphates bind with calcium and turn into triphosphates. For this reason, gypsum-rich, fertile soils are extremely poor in mobile forms of phosphorus. In cases where the arable layer is free of gypsum, the content of P₂O₅ is about 10-20 mg/kg, and in the presence of gypsum, the content of P₂O₅ does not exceed 5-10 mg/kg. In gypsum and mineralized layers, mobile phosphorus is generally characterized by a low value - 0-5 mg/kg (Isakov V.Yu., 1991; Komilov O.K., Isakov V.Yu., 1992).

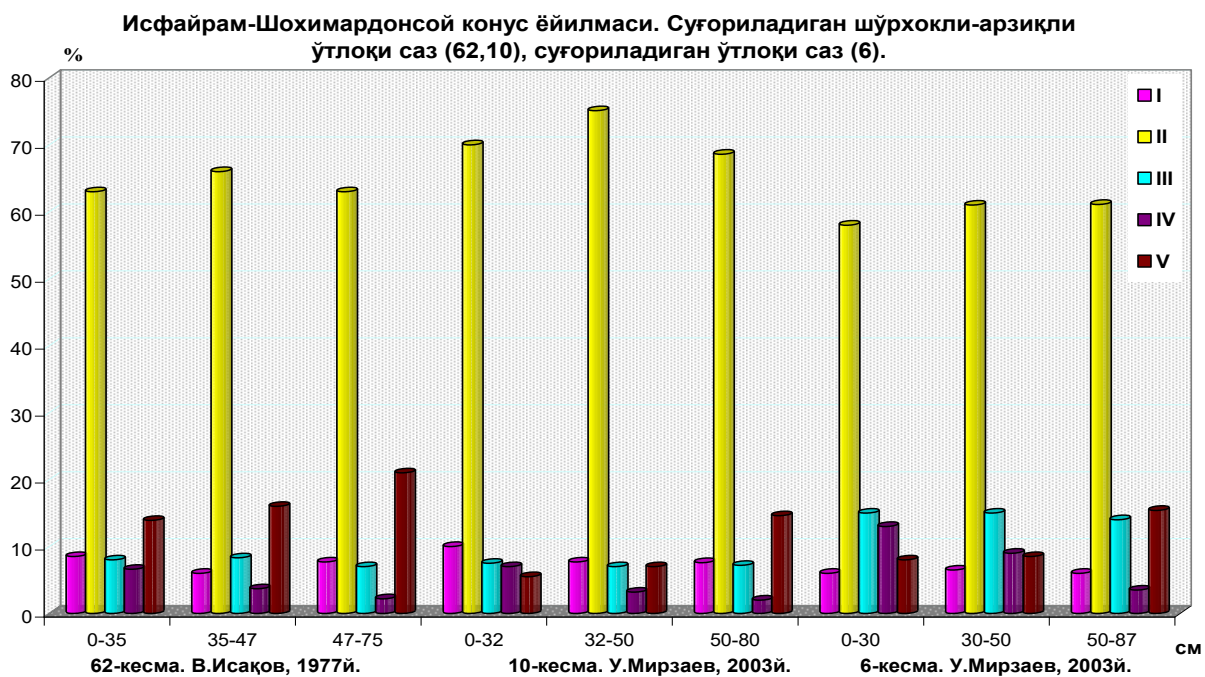


Figure 1. Changes in the amount of phosphorus in soils.

In the group composition of phosphorus determined by the Chirikov method, group I consists of phosphates isolated by means of carbonic acid. Group II consists of phosphates bound to calcium and magnesium carbonates isolated by the action of 0.5 N acetic acid. Group III phosphates are phosphates bound to iron and aluminum and other R₂O₃-type oxides, isolated by the action of 0.5 N hydrochloric acid. Group IV is organic phosphorus, which is determined by NH₄OH. Group V is the insoluble part of phosphates, determined by the difference between the total amount of phosphorus and the sum of the 4 groups.

Figure 1 shows the changes in the phosphorus group composition over the past 25-30 years. Section 62 describes the state of irrigated saline-salt meadow soils in 1977. The main mass of phosphorus in the group composition is composed of group II phosphates bound to calcium and magnesium carbonates - 1096 mg/kg (63%) in the arable medium-grained layer, 898 mg/kg (66%) in the arable strong carbonate-gypsum layer below it, and 794 mg/kg (63%) in the strong carbonate-gypsum layer below it. The abundance of group II phosphates is also associated with gypsum. Gypsum makes monophosphate more insoluble than calcium carbonate. The second place in the group composition is occupied by group V phosphates - insoluble residue in all layers. Their share in the cross section ranges from 13.9% to 21% from top to bottom. The third place belongs to the phosphates of the first group in the advective layer (85%), the third place belongs to the phosphates of the III group bound to oxides of the R₂O₃ type (Ge₂O₃, Al₂O₃) in the sub-award layer (8.3%), and the fourth place belongs to the phosphates of the III group (8-7.1%) and the I group in the lower layer (7.7%). The fourth place is occupied by phosphates of the III group (8-7.1%) and the I group, respectively. Finally, the last place is occupied by the IV group - organic phosphorus (from top to bottom 6.6; 3.7; 2.2%).

Comparison of the 1977 indicators with the 2003 phosphorus groups shows a significant difference between them. Group II phosphates dominate in all cases, as shown in the above section. In all nutrient soils, including deep nutrient soils, the amount of phosphates of this group increased compared to 1977. In irrigated pasture peat soils, the phosphates of this group are 9-12% lower than in the arable and subarable layers of nutrient soils. This can only be explained by the lack of carbonates and gypsum. In these soils, and also in deep nutrient soils, in the upper clean soil layer with a low content of gypsum and carbonates, group III phosphates significantly increased compared to the amount of this group in section 62, and in section 10 they decreased. Group I phosphates increased in 2003 in all irrigated fertile meadow-soil soils compared to 1977. Group V phosphates decreased in almost all cases of fertile and non-fertile soils over the 25-year period, while group IV organic phosphorus increased.

In our research of 2025, the change in the amount of phosphorus falling into the soil during the past period showed that the trend of increasing their amount is in a stable state.

According to the preliminary data, the amount of phosphorus in the soil during the period of irrigated agriculture changed in proportion to the standards of application of phosphorus fertilizers and the distance of irrigation.

According to the data analysis of 2005, it was noted that phosphorus is increasing due to its binding to the soil, and in our further studies, it can be seen that this process is also taking place according to the level of application of phosphorus fertilizers and the level of soil salinity. For example, according to our analysis, the quantitative indicators from the upper to the lower layers of the cross-section in non-saline soils varied around 0.170-0.137%, while in weakly saline soils, they varied in the range of 0.195-0.150%. In general, the rate of change is higher in saline soils, which leads to the conclusion that this situation is the effect of salinity.

This situation may also reflect the results of previous studies. That is, our study area also has a unique nature with a high content of carbonates. They form unique water-insoluble compounds, but they also store large reserves of easily soluble salts in water and, as a result of land reclamation measures, replace easily soluble salts washed out of the soil solution, thereby ensuring further salinization and, due to the released divalent cations, cause phosphorus fertilizers to bind to the



soil.

Conclusions

Thus, irrigated meadow peat soils, due to their properties and characteristics, due to their chemical and mineralogical composition, cause the fixation of phosphorus forms in the soil from phosphorus fertilizers applied as fertilizers, and this process increases its total reserves in the soil. Considering that more than 60 years have passed since the active fertilization of soils with phosphorus fertilizers began, this process results in a high reserve of phosphorus forms bound to the soil.

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