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INFLUENCE OF BIOLOGIZATION OF SUGARMALI AGRICULTURE OF TURKESTAN REGION ON SOIL FERTILITY

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Abstract

The content of humus and NPK elements for root residues in soils according to the variants of the experiment is given in the article, for the period of 3 rotations of 3 rotations of crop rotation (1.sec.svetka, soya, winter wheat, 2-sugar beet, maize and winter wheat) in conditions of irrigated agriculture.

Keywords: crop rotation, sugar beet, corn, organic-mineral fertilizers, root and side residues

The level of soil fertility is a determining factor in obtaining high and stable yields of agricultural crops. In the creation of soil fertility, the leading role belongs to organic matter, which, being the main source of humic substances, prejudges all processes occurring in the soil. All the basic properties of the soil largely depend on its quantity and quality: thermal, water, air, absorption capacity, biological activity, etc. There is a direct relationship between the quantitative and qualitative accumulation of organic substances in the soil and the level of productivity of cultivated crops.

A necessary technique for regulating the balance of humus in soils is the development of biologized crop rotations that allow the use of organic fertilizers. It is known that organic fertilizers, as well as the accumulation of root and crop residues, increase the content of organic matter in the soil. Even high doses of mineral fertilizers contribute to humus replenishment lower than manure, mainly increasing the productivity of agricultural crops.

Biologization of farming systems is the introduction and development of biologized crop rotations with the sowing of perennial and annual legumes and legume-cereal grass mixtures, intermediate and crop crops for green fertilizer. At the same time, it provides for the use of all types of organic fertilizers, including grain straw, leaf-stem mass of corn, sorghum and sudanka for grain, moderate use of mineral fertilizers and rapidly decomposing and non-toxic pesticides in combination with energy-saving technologies of cultivated crops, to ensure the reproduction of soil fertility and production of environmentally friendly products [1].

In agronomy, the theoretical basis for the formation of crop rotations is the fruit exchange, that is, the periodic alternation of crops that differ in agrotechnical and economic properties. In any soil and climatic conditions, without a rational crop rotation, it is impossible to obtain

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high sustainable yields. At the same time, some issues related to fruit-bearing have not yet been sufficiently studied [2].

Currently, the biggest environmental problem of arable soils is the problem of dehumification, that is, a decrease in the humus content in arable horizons [2].

The specialization of agriculture requires the highest possible saturation of crop rotations with leading crops, which determines their small set in advance. At the same time, the rejection of classical crop rotation schemes is inevitable and there are problems of soil fatigue, and consequently, the preservation and increase of fertility.

Long-term research conducted at the Zhambyl agricultural Experimental Station has shown that the humus content in the soil is constantly changing depending on crops and the correct alternation in crop rotation, the intensity of tillage, weather conditions during the growing season, as well as the amount of organic and mineral fertilizers applied in a scientifically based ratio of nutrients. This indicates the need to monitor the dynamics of humus in the soil, to determine its content through each rotation of the crop rotation.

Methods

Based on this, we have selected two schemes of 3-full beet crop rotation:

I. 1-sugar beet, 2-soy, 3-winter wheat.
II. II. 1-sugar beet, 2-corn, 3-winter wheat.

On the above-mentioned three-field crop rotations, the following doses of organomineral fertilizers were applied directly to sugar beet:

1. Without fertilizers (control- 1)
2. Estimated dose N $_{300}$, $P_{66,}$ K_{270}, (background) control- 2
3. Background + straw 4 t/ha + manure 60 t/ha
4. Straw 4 t/ha + manure 60t/ha

After sugar beet and the 2nd and 3rd culture, the aftereffect of organo-mineral fertilizers was studied. According to the mechanical composition, this soil belongs to medium loams, the humus content in the arable layer is equal to 1.76%, total nitrogen-0.106-0.127% and total phosphorus -0.135-0.153%, nitrate content -12.3, mobile phosphorus-45.0 and exchangeable potassium -211mg/kg of absolutely dry soil.

The level of groundwater is at a depth of 100-120cm. The profile of medium loamy soils is characterized by the following indicators: volume weight 1.30-1.50g / cm^3, specific gravity 2.53-2.75g / cm^3, marginal field moisture capacity (PPV)-18.6-19.2%. The reaction of the soil solution is slightly alkaline, PH is 7.2-7.3.

Organo-mineral fertilizers were applied once only for sugar crops during the growing season of a 3-month crop rotation. The stationary experiment was carried out in 1989-2016 in Zhambyl village. experimental station. The experience is based on a 4-fold repetition, the plot area is 200 m2, the accounting area is 100 m2, the total area is 2.0 hectares.

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The research was carried out by staging stationary experiments and laboratory analyses of soil and plant samples. The study is based on the methodology of field experience, the implementation of which was guided by the methodological provisions of P.N.Konstantinov, B.A.Dospekhova (1986), the methodology of N.Z. Stankov modified by N.A. Pankova, N.S.Savvinova (1965). As well as the methodology studied on sugar beet of the All-Union Scientific Research Institute of Sugar Beet (VNIISS 1977,1986)

Results

Root and crop residues in the cultivation of agricultural crops, the main natural source of enriching the soil with humus substances, replenishing it with nutrients are root and crop residues of plants. Scientists of Kazakhstan and other countries have found that their annual intake into the soil ranges from 6 to 190 kg/ ha and depends both on the biological characteristics of crops, their yield level and applied agricultural technology, and on soil and climatic conditions [3,4,5].

Plant residues of field crops are one of the types of organic matter commonly used to replenish nutrient reserves in the soil. Their most important role is especially increasing in connection with the creation of a modern biological system of agriculture. It is based on the gradual mineralization of plant residues. The measures of this system in combination with modern agricultural practices ensure the achievement of the ultimate goal of obtaining sufficiently satisfactory yields and the preservation of soil fertility. To this end, it is necessary to optimize the complex of factors regulating the normal development of plants, which will create favorable conditions for the subsequent use of post-harvest residues.

Humus is a collection of organic substances that have completely lost the features of the anatomical structure of organisms. Humus consists of two large groups of substances: non-specific organic compounds that can be isolated from the soil, identified and quantified (sugars, amino acids, proteins, tannins, etc., which make up units of percent of the total organic matter content); and humus substances that make up 80-90% of the total organic matter content [6].

Due to the fact that humus is one of the main sources of plant nutrition elements, soil fertility depends on its content.

In studies conducted by S.B. Kenenbaev on dark chestnut soils of the Urals, it was found that when manure was applied, the humus content for 1 rotation of the crop rotation provided a significant increase by 0.19-0.24%, and for 2 rotation by 0.29 -0.39% compared with the control. In the variant with manure plowing in combination with mineral fertilizers, the humus content increased by 0.24-0.35% for 1 rotation of crop rotations, and by 0.37-0.46% for 2 rotations [7].

The main source of humus formation is organic residues. The process of humus accumulation in the soil is associated with the decomposition of organic fertilizers as root and crop residues.

The accumulation of humus significantly improves the water-physical, chemical and biological properties of the soil. In addition, humus has a much larger absorption capacity than clay minerals of the soil, therefore it keeps many cations from migrating along the profile and absorbs toxic substances, heavy metals entering the soil, preventing their entry into groundwater and plants [8].

In the studies of I.O.Baitulin [9-10], it was established that in meadow-gray soils formed under conditions of periodic or constant capillary moistening by groundwater, they are

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characterized by waterlogging of the lower horizons, oglenie and clogging. Therefore, the root system of even inherently deeply rooted plants does not reach such a depth of penetration as on ordinary serozems.

The greatest accumulation of sugar beet root residues was noted in the third variant, where mineral (N300P66K270) fertilizers were introduced in combination with organic (crushed straw 8.5 t/ha + manure 60 t/ha) fertilizers, so according to the predecessor of the first crop rotation scheme 39.1 c/ha, and in the second crop rotation scheme 41.7 c/ha, which is respectively 35.8 and 32.2 % more from absolute control.

The conditions of soil nutrition of plants (natural soil fertility, fertilization) significantly affect the development of the root system and plant productivity in general.

Optimal doses of organo-mineral fertilizers applied to sugar beet had a positive effect on the accumulation of root and by-product residues of subsequent crops cultivated in a 3-full beet crop rotation. So, on average, for three rotations from the joint application of organo - mineral fertilizers, the greatest accumulation of root, straw and stem residues was noted: soybeans for sugar beet 54.6 c/ha and corn -187.0 c/ha, respectively, by 35.1 and 51.4% more from the control variant, and with separate application of mineral and organic fertilizers for soybeans, 47.1 and 48.3 c/ha were accumulated respectively, which is 16.6 and 19.5% more from the control and corn 156 and 166.3 c/ha, which is 26.3 and 34.6% more than the control variant. Whereas in the control variant, these indicators were -40.4 c/ha for soybeans and 123.5 c/ha for corn. The aftereffect of organo-mineral fertilizers had a positive effect on the accumulation of root and by-product residues and on the third year of cultivation of agricultural crops in a 3-full beet crop rotation.

The results of the research show that during the cultivation of winter wheat by corn soybean precursors, on average, 76.6 and 97.2 c/ha of root and straw and stem residues were accumulated on the control variant during three and two rotations, respectively, and 98.9 and 104.1 c/ha were accumulated after the aftereffect of mineral and organic fertilizers after winter wheat for soybeans, respectively.ha, which is 29.1 and 35.9% more than from the control variant, for corn 121.5 and 131.3 c /ha, which is 25.0 and 35.1% more from the control variant.

The highest effect was achieved by the combined use of organic and mineral fertilizers, where, after harvesting winter wheat, 128.2 and 158.8 kg/ha of root and by-product residues were accumulated, respectively, respectively, by 67.3 and 63.4% more than from the control, and the difference between them by 30.6 kg/ha or 23.4% more, than for soybeans in favor of winter wheat for corn.

If we analyze the accumulation of root soil residues of winter wheat biomass depending on the precursors, then it can be noted that the maximum amount of them remained for the corn precursor, where 97.2 c/ha was obtained in the control variant, which is 26.9% more than for the soybean precursor.

Organo-mineral fertilizers contribute to the powerful development of the root system of plants not only in the fertilized horizon, but in the lower layers of the soil: this achieves the coverage of a significantly larger volume of soil, the best are provided with moisture and nutrients, which ultimately ensures a high yield of crops.

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The used straw and stem biomass of winter wheat, soybeans and corn in crop rotations provides an additional supply of organic residues, which ultimately affects soil fertility and crop productivity in crop rotation.

Thus, precursors and organo-mineral fertilizers have a positive effect on the accumulation of root, straw and stem residues of soybeans, corn and winter wheat in beet crop rotations.

Based on the above data, it is estimated that in an average of up to three rotations of three-field beet crop rotations, depending on the precursors and organo-mineral fertilizers, positively contributed to the accumulation of organic residues of cultivated crops in the crop rotation, so with the use of mineral and organic fertilizers alone, winter wheat, sugar beet on average for three rotations of crop rotation and soybeans in the soil were accumulated by plants, respectively, 178.2 and 187.2 c/ha of root and straw residues, which is 22.6 and 28.8% more than the control variant, and when alternating winter wheat, sugar beet and corn, 313.1 and 334.3 c/ha were accumulated on average for 2 rotations, which is 24.1 and 32.5% more than the control variant.

The greatest accumulation of organic residues during the rotation of crop rotation was noted with the combined use of organic and mineral fertilizers, so when alternating winter wheat–sugar beet–soybeans accumulated 221.9 c /ha, and when alternating winter wheat– sugar beet-corn 387.5 c / ha, which is 52.2 and 53.5% more than compared with the control in the control variant, respectively, it amounted to 145.3 and 252.2 c/ha, root and straw (stem) residues.

If we compare the crop rotation schemes with each other, it can be noted here that during the rotation of the three-field beet crop rotation, the maximum accumulation of root and straw residues is observed in the third variant (background + straw 4t/ha + manure 60t/ha), with alternating winter wheat - sugar beet + corn was 387.5 c/ha, which is 74.6% more than from the 3rd variant of the first crop rotation scheme.

The same pattern is observed depending on the crop rotation scheme in the first, second and fourth versions of the experiment.

Thus, the saturation of 3 full crop rotations with by-crop biomass + the use of organo–mineral fertilizers in three rotations (the first scheme) and in two rotations of crop rotations contributed to a higher accumulation of organic substances.

An increase in the humus content was noted in the variants where organic–mineral fertilizers were used, compared with each other by the predecessor, winter wheat for soybeans and corn, humus was 1.66 and 1.77%, respectively, or 0.11% more than the first crop rotation scheme.

The highest humus content was noted in the variants where organic and organo-mineral fertilizers were used, respectively, winter wheat and after soy humus was 1.58 and 1.66%, which is 0.26 and 0.34% higher from absolute control and 0.32 and 0.24% from mineral background, winter wheat for corn humus was 1.64 and 1.77%, which is 0.28 and 041% higher from the absolute control and 0.18 and 0.31% from the mineral background.

Thus, depending on the sugar beet precursors and the application of organic and organo–mineral fertilizers, it contributed to an increase in the humus content in the soil.

Thus, on average, for three rotations on 3 full beet crop rotations, the separate use of organic and combined organic-mineral fertilizers, as in the year of action for sugar beet and aftereffects on winter wheat after soy and corn, increased the humus content, and the

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application of calculated doses of mineral fertilizers for three rotations of crop rotation contributed to the preservation of the original content humus in the soil.

Our research has established that for all the studied crops in the three-field beet crop rotation, depending on the action and aftereffect of organo-mineral fertilizers, the placement of the bulk of the roots in the upper 20 cm soil layer is characteristic.

On the non-fertilized variants, the root mass in the 0-20 cm layer is a percentage of the root mass of the 20-40 cm layer higher than on the fertilized variants, this is due to the fact that the lower soil horizon is more compacted on the non-fertilized variant and the development of the root system worsens.

The density of the soil is one of the strongly acting factors on the development of the root system of plants. For each type of plant in a particular soil difference, there is an optimum density when the mobility of water in the soil is in conflict with the provision of oxygen to the root mass of soil air. Such a favorable ratio of water and air in the soil is created at a density of 1.3-1.4 g / cm3. With an increase in soil density from 1.4 to 1.5 g / cm3, the root growth of many cultivated plants slows down sharply or even stops [11].

On meadow-gray soils, sugar beet, depending on the precursors and the use of organic-mineral fertilizers, leaves not the same amount of plant residues after harvesting. The accumulation of sugar beet root residues in a layer of 0-40 cm in an average of three rotations on the fertilized version according to the predecessor, winter wheat amounted to 28.8 c/ha (crop rotation 3.2) and on winter wheat by crop rotation 3.3-31.5 c/ha, whereas on the variant using only mineral (N300 P 66K270) and organic (manure 60 t / ha + straw of the actual crop (F, U.) of fertilizers, the root mass of sugar beet according to scheme 3.2. it was respectively 32.2 and 34.8 c/ha, which is 11.8 and 18.7% more compared to the control, and according to scheme 3.3 it was 35.6 and 36.7 c/ha, which is 13.0 and 16.5% more compared to the control variant.

Conclusions

The highest humus content on winter wheat crops after soybeans and corn on average for three rotations of crop rotations in the 0-40cm layer on organo-mineral variants, respectively, was 1.87 and 1.92% or 0.60% more than from the control.

The greatest accumulation of 3 complete crop rotations by by-crop biomass+organo-mineral variants averaged 22.2 t/ha in three rotations (Scheme 1), and 38.7 t/ha in two rotations (scheme 2), and 14.5 and 25.2 t/ha in the control variant, respectively.

The largest intake of NPC batteries in the first and second crop rotation schemes on organic-mineral fertilizers is correspondingly equal to N_{225} P_{82} K_{155} и N_{315} P_{52} K_{312} kg/ha, and on the control N_{153} P_{44} K_{94} и N_{204} P_{28} K_{198} N_{153} P_{44} K_{94} и N_{204} P_{28} K_{198} kg/ha.

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