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VI Міжнародна науково-практична інтернет-конференція

«Сучасний рух науки»

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THE HUMUS STATE OF SOIL AND GRAIN SORGHUM PRODUCTIVITY WITH DIFFERENT TILLAGE AND FERTILIZATION SYSTEMS IN CROP ROTATION ON IRRIGATED

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The humus state of soils is a specific feature of their potential fertility, therefore its preservation, maintenance and restoration is one of the most important

tasks of agrarian science of Ukraine. It is the content of humus that the physical and chemical properties of the soil, its aggregate state, water and nutrient regimes are associated with. It determines the degree of enzymatic activity, intensity of carbonic acid production in the soil and the surface layer of the atmosphere, and is the most powerful source of solar energy accumulation. The realization of the productive potential of agricultural crops depends primarily on the potential fertility of soils, which is formed under the influence of hydrothermal conditions and agrotechnical measures aimed at restoring humus content by increasing the availability of fresh organic matter in the soil, improving the conditions for the humification of plant residues, and reducing the processes of humus mineralization. Today, leaf, stem and root postharvest residues of agricultural crops have become the main source of fresh organic matter entering the soil, which, under the influence of microorganisms, oxidation and polymerization processes, turns into new substances that are not contained in the original organic residues and microbiological products.

The aim of the study was to provide scientific substantiation of the systems of basic soil tillage and fertilization in the technology of cultivating grain sorghum in an irrigated crop rotation. The objective of the study was to determine the effects of various rates of mineral fertilizers combined with the burial of leaves and stems of agricultural crops of the crop rotation in the soil using implements with different design of the working parts on the humus state, soil nutrient regime and grain sorghum productivity.

In our experiment, we used field, quantitative and weight, visual, laboratory, comparative calculation, mathematical-statistical methods as well as widely recognized methods and methodological recommendations in Ukraine. The research was carried out in the stationary experiment of the irrigated agriculture department of the Institute of Irrigated Agriculture of the National Academy of Agrarian Sciences of Ukraine in 2016-2018. Grain sorghum was sown after winter wheat in a 4-field grain and row crop rotation under irrigation in the area of the Ingulets irrigation system. We investigated five systems of basic soil tillage with different methods and depth of loosening at the background of three organo-mineral fertilizer systems. The

soil of the experimental field is dark chestnut medium loam with low nitrate availability and medium availability of mobile phosphorus and exchangeable potassium; humus content in the 0-40 cm-layer is 2.15%. At the initiation stage of the experiment we used the following soil-cultivating implements: mounted bottom plow ПЛН -5-35 and disc-chisel harrow БДВП -3.0-01. The zoned hybrid Prime was seeded, plant density being 180 thousand pcs per hectare. The technologies of growing agricultural crops in the crop rotation are generally recognized for irrigated conditions except for the factors investigated. The irrigation mode ensured maintaining the pre-irrigation moisture threshold for all the crops in the rotation at a level of 70% LM in the soil layer of 0-50 cm.

It was determined that without fertilization average grain sorghum productivity by factor B was 2.58 t/ ha. Mineral nutrition at a rate of $N_{90}P_{60}$ contributed to its 2.5 fold increase. Increased fertilizer rates up to $N_{120}P_{60}$ under sorghum did not ensure a corresponding increase in crop yield. Crop increment, compared to the $N_{90}P_{60}$ rate, was 0.19 t / ha, which was within the experiment error (HIP_{05} - 0.25 t / ha).

In addition to grain yield, sorghum formed a powerful leaf, stem and root mass that was used for fertilization. Plowing to a depth of 23-25 cm buried 5.44 t / ha, chisel cultivation at the same depth - 4.65; shallow in-disking - 4.18; disc-chiselling - 5.64 t / ha of by-products, respectively. The application of mineral fertilizers at a rate of $N_{90}P_{60}$ favoured an increase in the yield of grain, leaf and stem mass which was used as a fertilizer. In the variants of basic tillage, there were buried in the soil: 9.26; 8.97, 6.91, 10.27 and 8.61 t / ha.

Under further increase in the rate of mineral fertilizers up to $N_{120}P_{60}$ the mass of postharvest residues increased only by 2.1-2.5% and was, according to the basic tillage variants, as follows: 9.46; 9.20; 7.09; 10.50; 8.78 t / ha.

The estimation of humus formation from stubble residues in the soil indicates that a negative balance of humus was observed at the unfertilized background, except for the combined tillage, where it was + 0.03 t/ha. Against fertilized backgrounds, there was recorded an increase in the estimated humus content under all systems of basic soil tillage. Under combined tillage, when shallow disk loosening was

combined with soil slitting up to 38-40 cm, the calculated growth of humus was maximal and amounted to +1.06 t / ha (under a rate of $N_{90}P_{60}$), and to + 1.11 t / ha (under a rate of $N_{120}P_{60}$), that is, the growth, compared with the control - plowing, reached 26.2% and 26.1%, respectively. The growth of humus was also positive under mouldboardless soil treatment for grain sorghum in the systems of multi-depth, single-depth shallow cultivation, while it was significantly lower compared to the control (multi-depth plowing).

The application of fertilizers at a rate of $N_{90}P_{60}$ and $N_{120}P_{60}$ together with plant residues provided more nitrogen, phosphorus and potassium (by 70-80%) getting into the soil than at the unfertilized background, with the advantage in the crop rotation of a differentiated system of basic tillage with combined disk-chisel loosening under grain sorghum.

Thus, when growing irrigated grain sorghum in the grain-row crop rotation under the conditions of the Southern Steppe of Ukraine, a differentiated system of basic soil tillage is economically and ecologically sound. It involves (once in the rotation of crops in the crop rotation) combined disk-chisel loosening under grain sorghum at a depth of 12-14 cm with soil slitting up to 38-40 cm against the background of mineral fertilizers ($N_{90}P_{60}$) and winter wheat plant residues as fertilizers. Over the years of research, the system provided an average annual profitability level of 210 - 218% per one hectare of crop rotation area compared with the control (160-184%).