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AGROPHYSICAL PROPERTIES OF SOIL FOR WINTER BARLEY CULTIVATION IN TRANSCARPATHIA OF UKRAINE

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Actuality. Soil fertility is determined by a complex of biological, chemical and agrophysical properties. In the process of production, the farmer modifies these properties, achieves the most favorable conditions for the growth and development of crops. Human intervention in soil processes should be based on the use of agricultural laws.

Agrophysical properties of soil determine a set of vital conditions for the growth of cultivated plants. Density and slitness (porosity) - the most important indicators of physical condition, which characterize the water, nutrient, air and heat regimes, conditions for the development of root systems and soil microflora, as well as the formation of crop yields.

Thus, the study of the peculiarities of growth, development and formation of winter barley productivity in Transcarpathia of Ukraine is currently relevant and has led to the choice of research algorithm.

Analysis of recent research and publications. Loosened in the process of mechanical cultivation of the soil during the growing season under the influence of its own weight, moisture and drying self-compacts to the equilibrium density, which is characteristic of a particular soil cover. Thus, for chernozems of medium loamy mechanical composition it is 1,0-1,3 g/cm^3, for sod-podzolic gleyed – 1,5-1,6 g/cm^3, for gray forest loams – 1,2-1,45 g/cm^3. In most cases, the equilibrium soil density exceeds the optimum for cultivated plants, so mechanical tillage is mandatory.

In recent years, many studies have been conducted to study the response of crops to the density of the tillage layer of the soil. Currently, soil density parameters for

cereals have been established in different soil and climatic zones. Regarding winter barley in Transcarpathia of Ukraine in terms of soil density in the literature there are contradictions, which are explained by soil differences of cultivated varieties of this culture, conditions and methods of research and many other factors.

The materials and methods for investigation. Experimental studies of the impact of intermediaries on winter barley were conducted during 2018-2020 in the experimental crop rotation of Mukachevo Vocational College of the National University of Life and Environmental Sciences of Ukraine, Transcarpathia region.

The soils of the experimental field are sod-podzolic gleyed, which contain on average 2,6% of humus in the humus horizon. With depth, the amount of humus decreases very gradually and at a depth of 100-130 cm reaches another 1,0-1,7%. The formation of non-carbonate source rocks and the influence of the podzolic process of soil formation led to high actual and potential acidity of soils, the pH of the salt extract ranges from 5,0 to 6,0.

The studied soil, according to agrochemical analysis of the initial samples, contains available forms of nitrogen - 35-45 mg/kg, mobile phosphorus (according to Kirsanov) - 130-160 mg/kg, mobile potassium (according to Kirsanov) - 120-170 mg/kg. The soil is typical for the research area, on average provided with mobile forms of phosphorus, potassium and nitrogen. Qualitative assessment of the surveyed soils showed that the soil requires constant use of organic and mineral fertilizers, liming and crop rotation.

The climate of the research area is temperate with unstable humidity. The average long-term precipitation rate for the year is 618,0 mm. Over the years of research, the amount of precipitation per year is: in 2018 – 568,3 mm, in 2019 – 558,1 and in 2020 – 513,1 mm, which is 10-13% less than normal.

Research results and their discussion. Soil density is an important indicator of physical properties of the soil, which affects not only the soil conditions, but also the technological properties and quality of tillage, which ultimately affects crop yields and quality.

It is established that the optimal density of the cultivated soil layer during the growing season of winter barley should be in the range of 1,1-1,3 g/cm^3. In the

experiments, this indicator varied significantly depending on the soil layer, the sampling period and the studied factors. Thus, for the period of sowing of winter barley, the most favorable indicators of the bulk density of 0-10 cm of the soil layer were provided by all systems of basic tillage without any significant difference. The average soil density on the options of the main cultivation ranged from 1,09 to 1,17 g/cm^3, for NiP_{05} = 0.01 g/cm^3. More pronounced differences between the options of basic tillage were with increasing depth of sampling. At a depth of 10-20 and 20-30 cm, the difference between the main tillage options was statistically significant and was manifested in an increase in bulk density in the variants with a decrease in the depth of the main tillage and the predecessor. At a depth of 10-20 cm, the average volumetric mass of the soil for plowing was 1,14 g/cm^3, for chisel tillage without significant differences – 1,15 g/cm^3. Conducting shallow by 12-14 cm and surface by 6-8 cm was accompanied by an increase in bulk density to 1,16 and 1,19 g/cm^3, respectively. In the soil layer 20-30 cm was similar: for shallow tillage the average density was at the level of 1,24 g/cm^3, and for the surface, respectively – 1,25 g/cm^3.

Therefore, it can be argued that shelf-free tillage leads to some soil compaction, which does not exceed the regulatory tolerances for winter barley.

Predecessors did not significantly affect the change in the density of the treated soil layer. However, after maize for grain and sunflower, there is a tendency to increase the bulk density of the soil after shelfless shallow and surface tillage, especially in the lower layers of the soil. This soil density was at the level of 1,24-1,26 g/cm^3, which did not exceed the optimum.

At the time of winter barley harvesting, the tendency to compact the soil persisted. The bulk density in the layers of 10-20 and 20-30 cm significantly exceeded the optimal values for all tillage and was the maximum for the surface shelfless after corn for grain and sunflower and was 1,34-1,37 g/cm^3. That is, for the period of harvesting winter barley indicators of bulk density of soil acquired natural values inherent in this type of soil.

This structure of the treated layer negatively affected the water and air regimes of the soil, the growth and development of the root system and, ultimately, the yield of winter barley.

The productivity of winter barley is an integral indicator of the effectiveness of various predecessors and tillage. Among the studied predecessors, the highest level of crop yield was obtained after its placement after buckwheat, winter rape and soybeans for chisel-free tillage to a depth of 20-22 cm. On average for three years in these variants the yield was from 6,0 to 6,3 t/ha.

Conclusions and prospects. In Transcarpathia of Ukraine on sod podzolic soils minimization of tillage leads to an increase in the density of the cultivation layer and a decrease in the overall gap (porosity). The density of the soil increased from sowing to full ripeness of grain, which did not exceed the optimal for most crops, including winter barley (1,30 g/cm^3) for plowing and tillage (chisel) by 20-22 cm for shallow tillage and surface tillage density was formed in the range of 1,35-1,37 g/cm^3, which exceeded the optimum for the culture.

The highest yield (6,0-6,3 t/ha) of winter barley was formed after placement after buckwheat, winter rape and soybeans with shelf-free chisel cultivation at 20-22 cm.