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The structural state of agro-grey soil in various tillage conditions (based on aggregate and rheological analyses)

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The aggregate composition is one of the key characteristics of soils. Based on the use of aggregates of different sizes, one can draw conclusions about the anthropogenic load on soils in conditions of agricultural use. We investigated the aggregate composition of soil samples of the 0-20 cm layer of soils with application of four tillage techniques: plowing, energy-saving (surface tillage, without plowing), longline (surface tillage + chisel tillage), anti-erosion (chisel tillage). Stationary experience laid in 1995. The crops were: bare fallow, busy fallow and wheat. Soil samples were sieved with a standard set of sieves:> 10; 10-7; 7-5; 5-3; 3-2; 2-1; 1-0.5; 0.5-0.25; <0.25 mm, water resistance was determined by the Savvinov method with sieves of:> 5; 5-3; 3-2; 2-1; 1-0.5; 0.5-0.25; <0.25 mm with daily water saturation prior to analysis. Rheological parameters were studied using the amplitude sweep method on a modular compact rheometer MCR-302 (Anton Paar, Austria) with a parallel plateau PP-25 measuring system.

All 24 plots with all four treatments demonstrated an excellent water-resistant structure of agro-gray soils. The soils have a good structural state in terms of agronomically aggregates content and the structural coefficient. Water resistance of the structure is excessively high and good as well. The average diameter of the aggregates is from 3.6 to 6.1 mm, the average value is 4.7 mm. This gives us an idea of the structural condition in general, but we cannot track the structural condition of plots with different treatments in the field.

The Principal Component analysis and cluster analysis was used to determine the differences in soils of different types of use. We used STATISTICA. These statistics method successfully classified soils structural relatively treatments.

The study of the rheological properties of agro-gray soils with different processing methods showed that in the zone of linear viscoelastic behavior (LV[C1] B) during all treatments, the range of LVB did not differ significantly and averaged 0.0048% deformation. Differences were noted at Shear Stress max, for the energy-saving treatment application, the τ (632.67 Pa) was lower than the other treatments, an average of 661.83 Pa for 12 repetitions. The crossover occurred at 1.48% strain for an average of 12 reps. The smallest value for the deformation at which crossover occurred (1.22%) was observed for the variant with the use of anti-erosion treatment. The highest (1.72%) for energy efficient processing.

Thus, the use application of aggregate and rheological analyses has shown the promotion of energy-saving technologies application to form a relatively favorable structural condition of the studied soils.

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