soybeans, and is suitable for regions with adequate rainfall. Verti-Till is a vertical tillage technology used to loosen compacted soils at various depths. Compacted soils hinder capillarity and water penetration, which impedes crop root development. In Verti-Till, crop residues are shredded and accumulated on the soil surface to reduce moisture evaporation and increase organic matter accumulation [5].

This technology employs machinery with wave discs set at slight angles and multiple shanks to loosen various compacted soil layers. A key feature of vertical tillage is avoiding horizontal soil displacement, preventing soil clumping, and avoiding compaction at different depths.

Research into innovative tillage technologies shows that each method has advantages and disadvantages, with their effectiveness influenced by natural-climatic and soil characteristics, production conditions, tractor and machinery availability, crop rotation systems, and crop cultivation technologies.

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UDC 636.085.55.4

EVALUATION OF THE PRODUCTIVITY OF THE MACHINE FOR THE SURFACE TREATMENT OF CEREALS

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In addition to humidity and temperature, the elastic-kinetic properties of grain are significantly influenced by the rate of deformation. During grinding of grain in rolling machines, due to the high relative speeds of the working elements, the time of destruction is very short, and intermolecular bonds in the grain do not have time to break, elastic stress does not relax, and plastic deformation does not develop [2, 3, 5]. In this case, the grain exhibits all the characteristics of an elastic-fragile body. The low rate of deformation leads to the fact that stresses and strains increase at the moment of their occurrence, as a result of which the grain acquires the properties of an elastic-plastic body [1, 3, 5].

To evaluate the resistance of the endosperm and outer coverings to plastic deformations, it is recommended to use the microhardness index. The higher the microhardness of the grain, the greater its resistance to plastic deformation, and vice versa, the lower this indicator, the easier the grain changes its shape and the more plastic it is [2, 4]. When the humidity of the shells increases to 20%, and the endosperm to 25%, the hardness of all types of grain (wheat) becomes approximately the same, and a decrease in temperature to 4 °C causes an increase in the hardness of the shells and endosperm, which leads to an increase in their fragility, which is a negative factor both during peeling and during grain grinding [2, 4, 5].

In order to indirectly assess the strength of the connection between the shells and the endosperm of wheat, depending on the parameters of the hydrothermal treatment, a technique was developed and data were obtained that confirm the possibility of its application based on the change in the dispersed composition of the bran.

For the tangential assessment of the strength of the bonds between the shell and the endosperm of wheat, a method was developed that takes into account the parameters of hydrothermal treatment. The obtained data confirm the possibility of using this approach based on a change in the dispersed composition of bran.

When evaluating the characteristics of shells in terms of deformation, their reaction during processing of the surface of the grain is taken into account, taking into account such factors as elasticity, stiffness, moisture, structure of the shell and chemical composition. Shells with a moisture content of approximately 12.5% show the highest level of stiffness, while increasing the moisture content to 43.0% results in a decrease in stiffness. At sub-zero temperatures, the wheat husk becomes more brittle and undergoes significant grinding during grain processing. It was established that the strength of the shells when loaded along the longitudinal axis of the wheat grain is 1.44...2.06 times greater compared to the transverse axis, which can be explained by the interweaving of three fibrous layers of the fruit shell. and the transverse tubular layer. The seed coat, which has a more uniform structure, is primarily attached to the fruit coat by means of an adhesive bond, creating favorable conditions for their successful separation. It is necessary to have data on their change, since the technological operation of peeling consists in the separation of covering tissues. The indicator of the strength of their separation is a good way to assess the strength of the connection between the shells and the core. The choice of a rational principle of action and technological technique, which creates prerequisites for the most complete mechanical separation of shells, can be carried out to create dry and moistened grain in the working zones of machines with the most complete use of external and internal friction under the conditions of the above-mentioned factors. Productivity is determined by the dependence on the flow of grain at the exit from the machine and the change of the static moment by the lever-loading device:

$$Q_T = KeQm$$

where Ke is the experimental coefficient (2.4 ... 2.8).

An increase in more significant indicators of the coefficients of external and internal friction has a significant impact on the process of grain peeling and creates the possibility of the most effective separation of the shells from the core of the grain.

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UDC 636.085.55.4

EFFICIENCY OF SURFACE TREATMENT OF GRAIN TO ELIMINATE THE ACTIVITY OF MICROORGANISMS

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Processes involving microorganisms in grain occur very quickly. Within a few days, toxins are formed in the freshly harvested grain and a musty smell persists. When favorable conditions for the growth of microorganisms are created in the grain mass, mold fungi are the first to develop. Molds have less harsh living conditions than bacteria and are activated already at the early stages of grain storage, causing significant changes in its quality [7, 9]. However, when the fungal outbreak ends, its effects cannot be eliminated, and the grain batches become unsuitable for long-term storage. If the grain quality indicators deviate from the standards, its technical characteristics seriously deteriorate [1, 2, 3]. For example, moldy grain produces mycotoxins. Mycotoxins are the life products of many mold fungi and are very toxic to humans and animals. Under the influence of microbial activity, first of all, the main indicators of grain freshness (color, shine, smell and taste) change. In addition to changing the color of the grain, microbial outbreaks cause rotting of the grain, which leads to the appearance of various odors. The smell of grain changes for two reasons: due to the deterioration of grain quality - self-heating, spoilage and growth of mold - and due to the adsorption of foreign substances on the grain. It is generally believed that the mold of the genus Penicillium grows on the grain and causes a musty smell after a few days [1, 4, 5]. It has been proven that the treatment of grain with ultraviolet and ozone has a significant effect on microorganisms and their suppression. When processing grain with UV radiation and ozone, only the thinnest surface layer is processed, the bulk of the material is not affected, and therefore the biochemical properties remain unchanged [4, 5]. This is an important advantage of UV treatment compared to other known disinfection methods. Today, more and more companies in various industries are choosing UV disinfection. The popularity of this type of disinfection is explained by its numerous advantages and a small number of disadvantages.

Determination of changes in grain quality and safe storage periods of grain as a raw material for the production of flour, cereals, compound feed and other products. Intermediate samples were taken through a sieve with holes of 6 mm and histological characteristics were determined. Before measuring organic quality indicators in grain samples at below room temperature, the samples were stored in closed jars until the grain temperature reached room temperature. Odor was measured on whole or freshly ground grain. Freshly ground grain has a better smell than whole grain. The change in grain condition and the presence or absence of odor according to intensity category J was evaluated using the following odor intensity categories.

Wheat grains with a moisture content of 13%-14% were used as the starting material for the research. Measurements were carried out for one month under conditions of relative humidity of 78% and temperature of 180°C. The results showed that during processing, wheat grain changes its moisture