

PHYSICAL PROPERTIES OF WHEAT GRAIN

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***Abstract.** Wheat grain strength indicators are characterized by variable properties in its different layers. Such a feature of grains leads to the need to take into account such variable features in the technological processes of preparation and processing of wheat grain into various products. According to the determined data, its aleurone layer is characterized by the greatest hardness. It was established that the shells of grains have the minimum hardness, and an increase in humidity leads to a decrease in the hardness of the shells.*

***Key words:** wheat, characteristics, hardness, moisture, analysis*

Introduction. The hardness of the object is understood as the ability of the surface layers to create resistance during the occurrence of local deformations. Hardness and microhardness can be estimated as the size of the mark left by the action of the diamond pyramid that acted on the surface of the grain.

The peculiarity of the hardness indicator is that it is one of the features of the varietal characteristic. Wheat grain with high vitreous properties and more floury grain have their own properties depending on the genetically determined characteristics of the crop grain variety [2].

It has been established that wheat varieties with firm parameters can be characterized by the value of the specific index of the flour surface, which passes through the holes of sieves with a size of 74 μm , taking into account the coarseness of grinding [3].

According to existing practice, wheat varieties with a specific surface area of less than 2600 cm^2/g are considered hard. For soft varieties, the specific surface should

be more than 3000 cm²/g. According to established data, the indicators of durum wheat grains increase with increasing grain density. Similar characteristics for different varieties of wheat occur with an increase in the amount of protein, and the comparison of correlation data that takes into account glassiness and hardness is insignificant and ranges from 0.42 to 0.61[2,3].

The hardness and microhardness indicators are significantly affected by the change in temperature, so with a decrease in temperature, the indicators increase, and the fragility of the grain also increases. For wheat that has undergone hydrothermal treatment, a decrease in endosperm hardness indicators is observed.

Research materials and methods. Hardness is considered a conditional indicator of the physical and mechanical characteristics of the grain, and highlights the flour-milling qualities of the grain and is dependent on the strength of the endosperm.

Hardness is evaluated in different ways. The most common method is the method that takes into account the particle size of the flour obtained.

It is known that the endosperm of durum wheat breaks in the direction along the cells, then the flour becomes coarse, but it is well sifted, and small particles resemble the shape of a cube [1].

Grinding of soft varieties of wheat leads to the rupture of the endosperm along the inner side of the cells. As a result, the flour particles take an irregular shape with a high content of crushed cell fragments and some starch grains. Then, the increased content of bran and vitrified particles in such grinding significantly complicates the separation of flour and closes the working holes of the sieve.

Hard varieties of wheat are well crushed, and bran has little starch. Soft wheat is characterized by a strong intercellular connection between the subaleurone and aleurone layers, which leads to poor grinding of the bran.

Research results. The outer shell of a wheat grain with a moisture content of 12-13% is characterized by a microhardness index of 50...70 MPa. For endosperm, it is 70...170 MPa. With a change in humidity and when it increases to indicators of 16...17%, the hardness and microhardness indicators of the layers, respectively, change with a decrease in indicators, for the shells to 20... 30 MPa, and for the endosperm to the level of 40...70 MPa. At a humidity of about 25%, the microhardness of the endosperm of different grain varieties is the same.

A decrease in the effect of temperature causes an increase in the microhardness of wheat kernels and is the basis for an increase in brittleness. For wheat with a glassiness of 60-90%, the hardness of wheat increases linearly from 70 to 140 MPa.

It was established that in grains with a significant volume and mass, there is a decrease in the influence of the weakening surfaces, and the dependence of the average microhardness index of the endosperm can be characterized by the empirical formula:

$$H_e = H_{3M} + k q V_3, \text{ where:}$$

H_{3M} - average microhardness of small grain;

k and q - are coefficients, the numerical values of which are determined by the botanical features of the grain.

V_3 - is the volume of grain.

Conclusions. An increase in the microhardness of the anatomical layers is observed with an increase in vitreous visibility.

It was determined that the microhardness of the endosperm is directly dependent on the volume of the grains.

References

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