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METHODOLOGY AND EXPERIMENTAL PLANNING FOR EVALUATING WHEAT GRAIN PHYSICOCHEMICAL AND BAKING PROPERTIES

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Abstract. The article examines experimental design planning and methods for determining the physicochemical and baking properties of wheat grain. Special attention is given to the application of active experimental design methods, which make it possible to optimize the number of experiments and increase the reliability of the obtained results. The principles of selecting factors and their variation levels, as well as the processing of experimental data using regression analysis, are presented.

Keywords: wheat grain, experimental design, physicochemical properties, baking properties, grain moisture, gluten, quality, regression analysis, grain infestation, technological properties, flour quality.

1. Introduction. The effect of microwave radiation on the physicochemical properties and baking qualities of wheat grain was studied under laboratory conditions. Laboratory and production tests were conducted in the production and technical testing laboratory of JSC Andizhondonmakhsulot, the State Unitary Enterprise Agroinspectsiya, and the State Unitary Enterprise UzTest (Andijan).

Table 1

Initial data for experimental design

Characteristic	Conditional designations	Xi processing time, s	X2 specific power, W/m²
Upper level	+1	210	180
Main level	0	180	160
Lower level	-1	150	140
Star point	-a	120	120
Variation interval	+a	120	100

Under these conditions, the primary objective is to develop an experimental design that, with a minimum number of trials, will yield the most reliable information for subsequent implementation of the method in production (Table 2.1). Therefore, the concept of active experimentation is important in planning theory, allowing for the establishment of cause-and-effect relationships between microwave field exposure and wheat grain properties, as well as performance indicators. It should be noted that the use of mathematical experimental design methods significantly increases the informativeness of studies by simultaneously varying several factors and subsequently analyzing their interactions. This provides a deeper understanding of the processes occurring in grain under the influence of electromagnetic radiation, including changes in physicochemical characteristics such as moisture content, gluten structure, and degree of contamination. Furthermore, the use of regression models makes it possible not only to describe the obtained experimental data but also to predict the system's behavior when changing processing parameters. This approach contributes to the optimization of the technological process, increasing its efficiency, and reducing energy consumption during the industrial implementation of microwave grain processing.

Methods and Materials The method is based on the development of optimal plans that allow for the study of factors influencing grain storage technology with a minimum number of experiments. Table 2.2 shows a diagram of the active experimental planning.

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Table 2

Experimental Options	Modes of Exposure to Microwave		
	Time, s	Power, W/m²	Parameter under study
1	180	210	$Y_,$
2	120	150	y_2
3	180	210	Y_3
4	120	150	Y_4
5	180	210	y_5
6	120	150	Y_6
7	140	180	y_7
8	140	180	y_8
9	140	180	y_9
10	**Control**		$Y_{,0}$

Regression analysis and plotting of graphical dependencies were performed using Excel spreadsheets. A two-factor experimental design was employed.

In accordance with active design methods, a multi-factor experimental design of the Konno-2 type was also chosen [1, 2,3,4]. Wheat grain, the characteristics of which are presented in Table 2.3, was used as the primary raw material for microwave disinfection.

Table 3

Physicochemical Parameters of Wheat Grain

№	Physicochemical Parameters of Wheat Grain	
1	Weight, g/l 770	770
2	Moisture, %; 10.5	10,5
3	Vitreousness, %; 53	53
4	Gluten, %; 25	25
5	Parameter, IDK units of measurement 25/80	25/80

The object of disinfection was wheat grain, which is characterized by the parameters given in Table 2.3. To objectively assess the impact of the microwave electromagnetic field on the grain, its main physicochemical properties were analyzed.

The experimental part of the study was conducted in the laboratories of the State Unitary Enterprise "Uz Test" and the Andijan branch of the State Unitary Enterprise "Agroinspectsiya", and production tests were carried out at the enterprises of JSC "Andijondonmahsulot" and JSC "Kurgontepadonmahsulot".

Wheat grain analysis was performed according to the following methods:

Wheat grain was tested for compliance with the requirements of GOST 52554-2006 [5].

Wheat grain sampling method according to GOST 13586.3-2014 [5].

Pest infestation determination method according to GOST 13586.6-93 [6] Method for determining grain moisture content GOST 13586.5-2015 [7].

The quantity and quality of wet gluten were analyzed according to GOST 13586.1-68 [8].

Crumb porosity was determined according to GOST 5669-96 [9].

Crumb moisture content was determined according to GOST 21094-75 [10].

Crumb acidity was determined according to GOST 5670-96 [127; P.1-8].

Results. Grain stored in bulk at sites and warehouses is sampled using a storage probe. Spot samples are taken within a 200 m² section of the bulk at six points on the surface, located 2.5 m from

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the section boundaries, the walls of the warehouse, or the edge of the site; two of these points must be located on the crest of the bulk.

At each selected point, samples are taken from a depth of 50 to 100 cm. The combined sample from each section of the bulk or elevator silo must weigh at least 2 kg.

When the silos are completely full, spot samples are taken using a storage probe from the top layer (at a depth of approximately 10 cm) and from deeper layers (from 50 to 100 cm). During grain unloading, samples are taken from the flow of transported grain at the drop-off points using a mechanical sampler or a special bucket, 100 g per ton (for the first 10 tons). For partially filled silos, samples are also taken during unloading: 100 g per ton for the first 20 tons. The combined sample obtained from each silo must be at least 2 kg.

Grain sampled for infestation determination is packaged and labeled. Average samples are placed in thick fabric bags, then placed in hermetically sealed containers and tightly tied with string to prevent the escape of insects and mites. Labels are used for labeling, which are attached to the neck of the bag through special holes; labels can also be placed inside the bag or in a tightly sealed container containing the sample. The label must indicate that the sample is intended for determining grain infestation. Average samples must be analyzed no later than 48 hours after collection. To prevent pest death during transportation, samples are packaged in protective containers (metal cans with airtight lids or fabric bags with polyethylene liners).

REFERENCES

1. Koman O.A. Biological efficiency of disinfection of processed grain products with a microwave electromagnetic field. Krasnoyarsk, 2004. -P 5-121.
2. GOST 13586.3-2014. Wheat grain sampling.: - M. Publishing house of standards. -2014. -P 9.
3. GOST 13586.6-93. Determination of pest infestation.: - M. Publishing house of standards. -1993. -P.1-19.
4. GOST 13586.5-2015. Method for determination of moisture content.: - M. Publishing house of standards. -2015. -P.1-4.
5. GOST 13586.1-68. Determination of mass fraction and quality of gluten. : - M. Publishing House of Standards. - 1968. - P. 1-15.
6. GOST 5669-96. Determination of crumb porosity. : - M. Publishing House of Standards. - 1996. - P. 1-5.
7. GOST 21094-75. Determination of crumb moisture. : - M. Publishing House of Standards. - 1975. - P. 1-5.
8. GOST 5670-96. Determination of crumb acidity. : - M. Publishing House of Standards. - 1996. - P. 1-8.
9. Rules for organizing and maintaining the technological process at flour mills. Moscow: VNPO Zernoprodukt, 1991.
10. Tsuglenok N.V., Petrov N. Technology and technical means for disinfecting and preparing vegetable crop seeds for sowing using high-frequency and microwave energy: Recommendations. Moscow: VO Agropromizdat, 1989.
11. Tsuglenok N.V. et al. Electrical technology in the fight against seed infection of grain crops // Tractors and agricultural machinery, 1988, no. 4, pp. 39-41.