Technological properties and safety indicators of local wheat varieties

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Abstract. In the article, using source of the world collection of onion, promising productive lines were selected and valuable economic characteristics were studied. In the process of studying the selected lines and conducting scientific research, the variety named "Gulkhan" was created, and the valuable economic characteristics of the new variety were highlighted.

1 Introduction

The volume of grain procurement and production of the main types of grain products increases from year to year, and the demand for them also grows. However, it cannot be said that grain and its processed products are used with maximum efficiency and expediency. The industry's operating technological equipment is outdated, scientific and technical programs for the creation of new, domestic equipment and the use of innovative processing technologies remain unrealized. Consequently, a comprehensive reorganization is necessary based on scientific developments of new organizational forms of integration and a mechanism for economic relations between grain producers and processors in relation to the conditions of the republic's regions [1-10].

The issues of complex and rational use of grain resources of the republic predetermine: [11-21].

- development of theoretical foundations, mathematical models of software for obtaining reliable data on grain properties for multi-criteria optimization by multi-processor means of technical systems for complex grain processing;

- creation of new and improvement of existing technological processes and equipment, including for preliminary processing of grain mass. First of all, this is due to the fact that in recent years the harvested grain mass had a moisture content of up to 18.0%, which significantly reduced the productivity and quality of the machines for its cleaning. In this regard, there was a need to store freshly harvested grain mixture in piles on covered or open areas of grain threshing floors. This, in turn, requires additional technical equipment of grain receiving points and farms.

Today, more than 100 varieties of grain crops are grown in the republic. Each variety of grain has its own physical and chemical composition and mechanical characteristics.

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Despite this, they are fed simultaneously and in the same operating mode for cleaning and fractionation, as well as for grinding in a roller mill. This grain processing process leads to the release of low-quality flour, as well as bread and other flour products. In such a process, the wear of the shafts increases. Successful resolution of these issues will create an effective scientific and production base for the introduction of innovative technologies, raise production to a qualitatively high level that meets international requirements, and provide the population with high-quality products. The purpose of the study was to determine the technological potential and the degree of food safety of wheat grain of various varieties grown in Uzbekistan [22-33].

2 Materials and Methods

According to GOST 9353–90, the quality indicators of wheat grain that determine its class and purchase price are: typical composition, smell, color, vitreousness, naturalness, presence of impurities and sprouted grains, mass fraction and quality of gluten.

The indicators of the physical and mechanical properties of grain allow solving a large number of applied problems of practical importance. Thus, according to the indicators that determine the grain size, one can indirectly judge the content of endosperm in the grain, which is important for predicting the yield of finished products. The geometric dimensions of the grain also allow modeling separation processes, selecting the operating parameters of grinding, hulling and other machines. According to the indicators that determine the characteristic features of the endosperm, for example, vitreousness, the parameters of hydrothermal treatment of grain are selected, the yield of intermediate products of the initial stage of flour technology is predicted, and the number of systems of the technological process is approximately determined. Based on the parameters that determine flowability, the behavior of grain is modeled as it moves through sieves, gravity drains, containers, etc.

During the experimental studies, the grain of wheat varieties "Nota", "Bobur", "Chillaki", "Starshina", "Asr", "Zimnitsa" and "Khisorak" grown in different regions of the republic were used. In the grain of all varieties, indicators characterizing their technological properties and safety were determined using generally accepted standard methods.

3 Results and Discussion

The results of the study are presented in tables 1-3 and in figures 1, 2.

The studies showed that the grain of the studied wheat varieties can be characterized as quite large and even. The nature of the studied wheat varieties is average (746 - 776 g / l), "Zimnitsa" - at a high level; vitreousness is average (49-53%), the weight of 1000 grains is above average (31.5 - 35.9 g), the density varies from 1.18 to 1.21 g, PSI - varies from 18.40% to 19.10%.

The requirements for the chemical composition of the main types of grain are presented in Table 2.

The protein content is regulated within the range of 11.0...19.0%, since deviations from these limits contribute to deterioration of bread quality. With an increase in the protein content in grain from 11.0 to 17.0%, the gluten yield increases from 16.0 to 32.0%.

According to research data, an increase in the hydrothermal coefficient during vegetation by 1 unit leads to a decrease in protein content by 3.78%, an increase in the fertilizer dose by 1 centner / ha contributes to an increase in protein content by 0.63%.

There is evidence that an increase in the protein content in wheat grain by only 1.0% is equivalent to an increase in grain yield by 6.0-7.0 centners per hectare. This can be

achieved by increasing the efficiency of using mineral and organic fertilizers, maximizing the expansion of grain crops on irrigated lands, creating and introducing high-yielding varieties and hybrids, improving agricultural technology and raising the qualifications of farm managers. Post-harvest grain processing is also important, as one of the main stages aimed at obtaining high-quality and storage-resistant grain.

Table 1. Physicomechanical indicators of wheat grain quality

Indicators	**The importance of quality indicators of wheat grain varieties**						
	Nota	***Bobur***	***Chillaki***	***Starshina***	***Asr***	***Zimnitsa***	***Khisorak***
Humidity, %	12,3	11,8	12,2	12,6	11,6	12,30	12,60
Mass fraction of impurities, % - weed - grain	 3,5 1,9	 2,9 3,3	 3,1 2,2	 3,1 2,2	 2,8 3,2	 3,5 1,9	 2,9 3,3
Nature, g/l	776	754	768	775	764	808	764
Weight of 1000 grains, g	41,5	37,0	38,2	40,2	38,0	41,5	37,0
Bulk density, g/l	807	792	767	782	765	807	790
Vitreousness, %	51,0	49,0	50,0	49,5	49,0	52,0	49,0
Density, g/cm^3	1,19	1,18	1,19	1,21	1,18	1,19	1,21
Porosity, %	37,5	39,7	36,3	34,7	37,2	37,5	39,7
Angle of natural slope, deg	41,0	40,0	42,0	39,0	38,0	41,0	40,0
Grinding degree index (GDI), %	18,6	19,2	18,8	19,1	18,4	18,4	19,1

Table 2. Average standard chemical composition of the main types of wheat grain

Type of wheat	**Mass fraction of ingredients, g/100 g grain**					
	Water	**Protein**	**Fats**	**Carbohydrates**	**Dietary fiber**	**Ash**
Hard (durum)	14,0	13,0	2,5	57,5	11,3	1,7
Soft	14,0	11,8	2,2	59,5	10,8	1,7

In order for the protein and gluten content in the grain to be high enough, plants must receive the required amount of nitrogen during critical development phases - tillering, stem growth and immediately before heading. It should be noted that ear diseases (black, septoria and fusarium) lead to a decrease in the protein and gluten content, a decrease in the nature and weight of 1000 grains and contamination with microtoxins. Damage to leaf diseases (spotting, various types of rust and powdery mildew) also reduces the protein and gluten content, reduces the yield of flour. Lodging leads to germination of grains, a decrease in the number of falls and the yield of flour. Then the studies were carried out with the grain of the wheat varieties "Zimnitsa" (high grain unit) and "Khisorak" (medium grain unit), grown in the Tashkent region,

The "Zimnitsa" variety was bred by the method of intraspecific hybridization and individual selection in F2 from the hybrid combination Zimorodok 151 / Lutescens 1221k7-2-14. The variety is medium-sized, resistant to lodging. It is distinguished by field resistance to brown rust; moderately susceptible to yellow rust, powdery mildew and septoria; moderately susceptible to stem rust; susceptible to fusarium head blight. It is distinguished by high frost resistance (exceeds the Zimorodok variety). Increased drought resistance. Average yield up to 77.7 c / ha. In terms of grain quality, it belongs to the "valuable" varieties. Protein content is 14.4%, gluten content is 28.86%. It is included in the list of varieties that form “valuable” grain.

The Khisorak variety was bred from the hybrid combination Marzhon x Kauz by individual selection. The variety is low-growing, resistant to lodging. High frost resistance,

drought-resistant, not susceptible to yellow rust, dusty and hard smut. Average yield is 65-70 c/ha. In terms of grain quality, it belongs to the "valuable" varieties. Protein content is 14.1%, gluten content is 29.28%. In addition to the technological properties of grain, its food safety indicators are also of decisive importance. Therefore, an assessment of the sanitary and hygienic state of the grain of the studied wheat varieties was also carried out according to the safety criteria established by the requirements of SanPiN No. 0283-10.

The average experimental data are presented in Table 3.

Table 3. Characteristics of the sanitary and hygienic condition of wheat grain

Indicator	Grain sample level indicators of varieties, mg/kg		
	MPC	Zimnitsa	Khisorak
Toxic elements:			
- lead	0,500	0,210	0,308
- cadmium	0,100	0,047	0,037
- mercury	0,030	H/o*	H/o
- arsenic	0,200	H/o	H/o
Pesticides:			
- hexachlorocyclohexane (α-, β- and γ- isomers)	0,50	Traces	Traces
- DDT and its metabolites	0,02	H/o	H/o
GHB	0,01	H/o	H/o
organomercury compounds	Not add.	H/o	H/o
Mycotoxins:			
aflatoxin B	0,005	H/o	H/o
deoxynivalenol	0,700	0,032	0,044
zearalenone	1,000	H/o	H/o
T-2 toxin	0,100	H/o	H/o

Note: N/A* - not detected

From the data in Table 3 it follows that the content of toxic elements in the grain samples studied did not exceed the MAC, while pesticides and mycotoxins were not detected in them, which confirms the assumptions about the environmental "cleanliness" and food safety of this strategically important raw material. Factors influencing the efficiency of post-harvest grain processing can be divided, with some degree of conventionality, into three groups: agro-technological, technical and organizational (Figure 1).

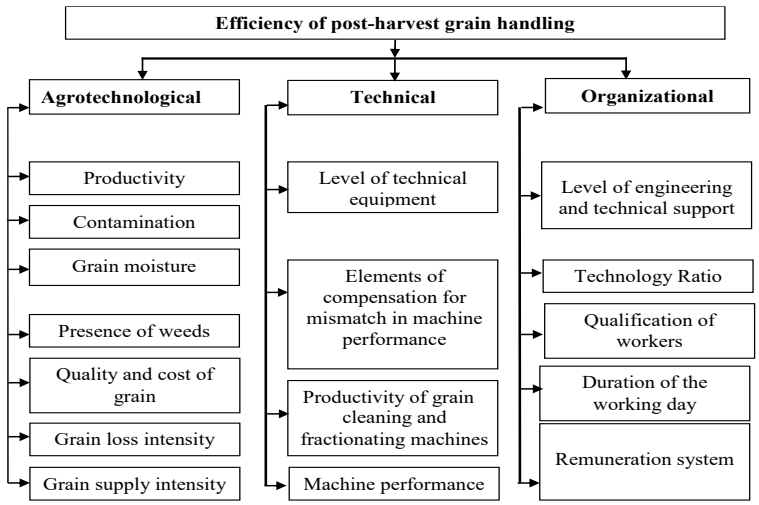

Fig. 1. Factors Affecting the Efficiency of Post-Harvest Grain Handling

The first two groups of factors are determined by production conditions, the adopted farming system, the timeliness and quality of technological operations for the cultivation of grain crops. These factors for post-harvest grain processing are the external environment and are considered given when choosing promising machines and methods for their rational use. The process of food production as a system can be divided into four subsystems (Figure 2).

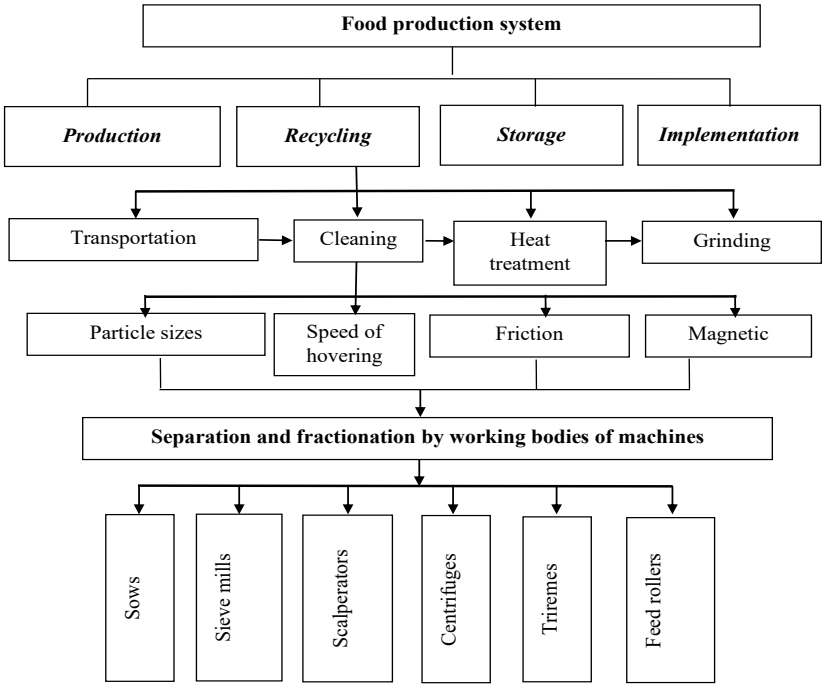

Fig. 2. Multi-level system of the process of production of food products from grain

In food production, agricultural products are subject to the following operations: transportation, grinding, dosing, separation and others, which can be represented as third-level subsystems. Further, cleaning is represented by a system of a higher level in relation to the properties of the components by which the grain mixture is separated. The separation processes in the working bodies listed at the fifth level are represented as elements of a multi-level system that are not subject to further dissection.

The external environment parameters include: grain mixture moisture, particle size and density. Internal connections take into account the effect of the sieve on the grain mixture particles and the interaction between the particles. The input control parameters are the design and kinematic parameters of the sieve mill: the size and shape of the holes, the angle of inclination, the frequency and amplitude of the sieve oscillations. The output parameters are: specific sifting capacity for the sieve, specific sifting capacity and separation completeness for the undersieve, characterizing the efficiency of the separation process.

4 Conclusion

One of the main features of the system is the presence of a common goal for the entire system - determining rational parameters of the sieve mill with minimal grain losses and operating costs.

Thus, the most important condition for obtaining high-quality grain is the fulfillment of technological requirements for each individual operation of its post-harvest processing. Compliance with these requirements is possible only with the organization of internal control over compliance with the conditions for growing wheat and post-harvest grain processing. Increasing the production of high-quality grain that meets international standards contributes to increasing the productivity of all industries, as well as entering international markets.

The results obtained in the course of research will contribute to the expansion of the production of high-quality wheat varieties and the rational use of grain with various technological properties. The study of the technological properties and food safety of wheat grain of various varieties grown in Uzbekistan is of great practical and scientific interest.

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