Grades and quality indicators of wheat grain grown in the Karaulbazar district and baking properties of wheat flour of the Tanya grade

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Abstract. The Republic of Uzbekistan occupies a special place in the world in terms of agriculture and the cultivation of grain crops. The daily increase in the cultivation of grain crops (wheat, rice, barley, rye, etc.) leads to the creation of economical and effective ways of processing agricultural crops. Saving and proper use of all cultivated crops is one of the main tasks facing the national economy today. Quality factors and technological properties of some wheat grades grown in 2020-2021 in Qaraulbazar district of Bukhara region have been studied. Their flour property and baking property values have been determined. In laboratory conditions, bread have been baked and compared with bread baked from flour of 1st grade.

1 Introduction

Harvesting, storing, processing and delivering quality finished products to consumers without destroying the cultivated crop requires the rational use of modern science and technology achievements, the ability to use modern methods and technologies in their place and correctly.

The Republic of Uzbekistan occupies a special place in the world in terms of agriculture and the cultivation of grain crops. The daily increase in the cultivation of grain crops (wheat, rice, barley, rye, etc.) leads to the creation of economical and effective ways of processing agricultural crops. Saving and proper use of all cultivated crops is one of the main tasks facing the national economy today.

In order to provide the population with wheat and flour products in 2022, wheat was planted on 1 million 27 thousand hectares of land in the Republic. This indicator is 1 million tons more than last year.

Besides, in the wheat harvest of 2021, 6 million 656 thousand tons of wheat were grown, of which 2 million 533 thousand tons were stored in regional enterprises of JSC “O’zdonmahsulot” for the republic's grain reserves, 4 million 123 thousand tons were collected by farmers and remained at the discretion of the population.

By the end of last year, 2 million 771 thousand tons of wheat grain and 357.7 thousand tons of flour were imported by the private sector mainly from Kazakhstan, and 26.8 thousand tons of wheat grain (94% to Tajikistan and 6% to Kyrgyzstan) %) and 949.1 thousand tons

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of flour (including 1 million 265 thousand tons of wheat) were sent to Afghanistan for export [1-3].

Product quality improvement is one of the urgent problems. Improving the efficiency of grain use and improving product quality is also important for the flour milling industry. Technology of production of wheat flour has a long history and is continuously developing. Especially significant changes have occurred in recent years. New flour weighing equipment ensures high efficiency of technological processes and modes. The modern principles of organizing and managing the processes of the grain cleaning and threshing department of mills have their scientific evidence.

When we consume flour products, our body meets the daily energy needs of its organs from 17% to 45%, depending on the nutrition. Due to its wide distribution, universality and daily consumption, flour is considered the most effective tool for providing humanity with iron, folic acid and vitamins.

All this ensures the high efficiency of using the technological potential of grain in the production of flour. At present, the demand of the population of our country for high-quality flour is increasing.

The following winter wheat grades with high yield, grain and flour quality are grown in different soil and climate conditions of our republic. In particular, wheat grains of Krasnodar-99, Tanya, Moskvich, Kuma, Pamyat, Asr, Vassa grades are being planted in the Bukhara region. Below is a description of the grades obtained for research [4-5].

ASR grade. Autumn soft wheat is medium ripe, 85-90 cm tall. The length of the ear is 8-10 cm, without a stalk. According to the composition of the grain, it belongs to the type of "Precious" wheat. The grain is red, the weight of 1000 grains is 44-45 g. The amount of gluten in the grain is 32.2%, the transparency is 80%, the volume weight of the grain is 785 g/l. It is resistant to rust diseases and requires mineral fertilizers. It was created at the Krasnodar Agricultural Institute [6].

VASSA grade. Medium fast grade. It is medium-sized, resistant to lodging, has a large head, cylindrical shape, large grains, white color, weight of 1000 grains is 52-53 g, flour quality belongs to the group of valuable grades. Resistant to brown and stem rust, resistant to fusarium head blight and black moth, drought tolerant, moderately winter hardy. The standard of planting is 4.0-4.5 million pieces of fertile seeds [7].

TANYA grade. It was created at the Krasnodar Agricultural Scientific Research Institute named after P.P. Lukyanenko. A medium-ripe, semi-fine, high-yielding grade that is resistant to dormancy. It is resistant to brown rust, septoria and fusarium diseases and drought, winter hardiness is above average. The grain is large, egg-shaped. The weight of 1000 grains is 45.4-46.5 g, the quality is 795-810 g/l, and the quality of flour belongs to the group of expensive grades. Sowing rate is 5.0 million fertile seeds.

Krasnodar 99 grade. It was created at the Krasnodar Agricultural Scientific Research Institute named after P.P. Lukyanenko. Semi-small, lodging-resistant, medium-sized grade. The head is cylindrical, white in color, the grain is egg-shaped, it is high yielding, and the quality of flour belongs to the group of valuable grades. It is resistant to black moth and yellow rust, resistant to brown rust and spike fusarium, drought resistant, winter hardiness is above average, planting rate is 5.0 million fertile seeds [8].

2 Methods

Quality indicators of wheat grain (moisture, amount of grainy mixture, amount of impurities, ash content, and volumetric weight) were determined based on standards. Moisture determination was conducted according to GOST 82041-82. Grain moisture is determined as the ratio of water content to its total mass.

Ash content. Conducted according to GOST 10847-64.

Ash content of grain is determined by burning in muffle furnaces at high temperatures with and without accelerators. The method of determining the ash content without accelerators is considered the main one and is used in arbitration cases.

Tanya, Asr, Vassa, Krasnodar 99 grades were taken from the 2020 crop grown in Karulbazar district for research, and the quality indicators of these grains and the baking properties of Tanya wheat flour were studied. The obtained results are shown in Tables 1,2 and 3.

Table 1. Quality indicators of wheat grains taken for research.

No.	**Indicators**	**Unit**	**Wheat properties**			
			Tanya	**Asr**	**Vassa**	**Krasnodar 99**
1.	Moisture	%	10.3	9.2	8.8	11.2
2.	Transparence	%	72	65	54	74
3.	Full-size mass	g/l	780	770	765	785
4.	Mass of 1000 grain	g	42.5	41.8	38	42,3
5.	Foreign impurities	%	2.2	1.5	1.8	1.2
6.	Grain impurities	%	3.0	2.6	2.3	3.2
7.	Ash content	%	1.93	1.90	1.98	1.92
8.	Moist gluten content	%	33.2	30.4	32.8	29.4
9.	IDC index	Standard unit	80	70	75	72
10.	Quality group		I	I	I	I
11.	Size and flatness, sieve content:					
12.	2.5 x 20	mm	75.3	78.2	76.0	74.8
13.	2.2 x 20	mm	4.5	4.8	4.0	6.0
14.	2.0 x 20	mm	10	8.6	10.6	11.4
15.	1.7 x 20	mm	6.6	5.2	5.8	4.2
16.	1.7 x 20 sieve residue	mm	3.6	3.2	3.6	3.6
17.	Organoleptic indicators: color		red	red	red	Red
18.	Smell		Characteristic for grain	Characteristic for grain	Characteristic for grain	Characteristic for grain
19.	Taste		Characteristic for grain	Characteristic for grain	Characteristic for grain	Characteristic for grain

Table 1 shows that the wheat grades taken for research are dry grain in terms of moisture content, that is, the moisture content ranges from 8.8% to 11.2%.

All grades, except Vassa, have high transparency, which allows using it in processing without forming a mixture batch.

Volumetric weight of grain is one of the indicators of its specific weight and completeness. A large grain is highly valued, because it usually contains a large portion of the kernel, which increases the yield during processing. If we take into account that the volume weight of the average quality grain is 745-775 g/l, the volume weight of the grains taken for the analysis indicates that they are full and at a high level.

Absolute weight means the expression of the amount of dry matter in 1000 grains in grams. Fruits and seeds of many crops are very small in weight, so first the mass of 1000 grains is determined and from this amount, the average weight of each grain is derived.

If we take into account that the weight of 1000 grains of wheat fluctuates around 20-60 g, it can be seen that the grains taken for analysis are higher than the average value in all grades except Vassa. The mass of 1000 grains of each crop can vary for various reasons. Examples of these reasons can be the type of crop, grade, region of cultivation, natural and climatic conditions.

The ash content of one or another grain crop may change depending on the region where the grain is grown, the methods of growing, the type of soil and fertilizer used, the method of irrigation, as well as the type of grain. For example, the ash content of wheat grain can be from 1.6% to 2.5% (in huskless wheat). In our study, the grayness of grains has an average value. In the parts of the grain with high ash content, the main part of cellulose and hemicellulose is located, which deteriorates the quality of flour as they pass into it. Depending on the degree of ash content of the flour, it can be determined from which part of the grain it is obtained. If the ash content of the grain is low (for a particular crop), this indicates that the kernel is well developed in the grain. Grains with low ash content are valuable raw materials in the milling industry. Because of processing such grain, it is possible to get good quality flour. Ash content is also an indirect indicator of the ratio of grain parts.

Strong wheat grain must have the quality higher than group I, and the amount of wet gluten should be at least 28%. The grains we are researching respond to this requirement.

2.1 Determining whether the seed is suitable for planting

We studied the quality indicators of dough made from Tanya wheat flour. Bread production consists of five interrelated technological stages: preparation of raw materials, preparation of dough, baking, cooling and storage of bread.

The unleavened method is one-phase method: flour, water, salt and yeast are all added and the dough is kneaded. The duration of leavening is 2-4 hours, punching is one - 46 or several.

Due to its ability to generate gas and physical properties, the dough exhibits properties that are good for baking.

The sum of physical-chemical processes that take place in this process is called dough ripening.

In recent years, new methods of accelerated and continuous flow dough preparation have been developed and used: increasing the mechanical processing of the dough, increasing the amount of pressed and liquid yeasts, and increasing the temperature of the dough.

Chemical methods that accelerate the ripening of dough are also known. Addition of cytein, whey and potassium bromate ($KBrO_3$) to the dough accelerates its ripening and, therefore, significantly reduces the energy of mechanical processing of the dough. The effectiveness of such additives increases with the addition of a small amount of oil with a high melting point.

In order to accelerate the formation and ripening of dough, as well as to improve the quality of bread, surfactants - nutritious emulsifiers: phosphatides and their preparations - phosphatide concentrates, lecithin, etc., sorbitol esters, propylene glycol are added to it. Mixing emulsifier and oils together in the form of finely dispersed oil-water emulsion gives a high result.

Some enzyme preparations are used in baking bread: α and β - amylase, β - fructofuranosidase, glycoamylase, glycoproteinase, lactase, and others with moderate success [9-10].

Orizin and avamorin PK enzyme complex preparations obtained from Asp.oryzal and Asp.awamori fungi are used with high efficiency when working with flour with low sugar and gas-forming ability, as well as short-term and easily digestible gluten.

Table 2. Quality indicators of dough made from Tanya wheat flour.

Indicators	Unit	1st grade wheat flour (control)	Flour obtained from Tanya wheat grain in laboratory conditions
Acidity	grad		
Initial		2.22	2.26
Final		3.42	3.54
pH	N°	5.20	5.28
Rising power	min	8.4	9.0
Gas-forming ability	cm^3	1350	1334
Gas-retaining ability	cm^3	40	38
Rolling ability of the dough ball	cm	0.40	0.42

The quality parameters of the flour of the 1st grade and the dough made from flour of the Tanya grade wheat taken for the experiment are almost the same. As we concluded earlier, this makes the property of "medium" bakery invisible. We baked bread from the dough. We determined the main informative indicators of baked bread after 16 hours and included the obtained results in Table 2.

The property of wheat flour to give bread of this or that quality is called the baking property of the flour. For wheat bread, parameters such as flour quality, size, color of crust, and properties of core - elasticity, porosity, color, taste and smell are also important.

Wheat's baking properties are mainly evaluated by its gas-forming ability, its ability to form dough with certain structural and mechanical properties – "flour strength", color and darkening properties during dough preparation, particle size.

The baking properties of wheat flour are determined by experimental baking. In order to compare the baking properties of flour made from wheat of the Tanya grade, bread made from wheat flour of the 1st grade was also baked in laboratory conditions. According to the first option, 500 g of wheat flour, 2.5 g of dry yeast, and 7.5 g of salt were added to the dough, and in the second option, 1st grade flour (500 g) was used [11].

The dough was kneaded without kneading and baked for 170-180 minutes in a thermostat at 80-85% relative humidity and 32°C. The dough was kneaded every hour of baking. The weight of the matured dough is measured, 400 g of dough is placed in the mold, and 200 g of dough is placed on the tray. These pieces of dough are left to rest for 50-60 minutes. The finished dough was baked at a temperature of 225 °C. Baked in the hearth bread was baked for 20-25 minutes, and mold bread for 40-45 minutes. The weight of hot loaves was measured and cooled (for 1 day).

The results of experimental baking are given in Table 3 below.

Table 3. Quality indicators of experimental bread baked from wheat flour of Tanya grade.

Indicators	1st option	2nd option
	Bread baked from wheat flour of Tanya grade	Bread baked from wheat flour of 1st grade
Weight of ripen dough, g	778	788
Weight of baked bread, g		
baked in the hearth	184	180
molded	346	342

Volume of mold bread, cm^3	516	520
Specific volume of bread, cm^3/100 g of bread	1,45	1,53
N:D of grain bread, mm	46:82	45:85
Shell surface	with cracks	with cracks
Shell color	orange, brown color	orange, brown color
Porosity	less developed	less developed
The appearance of the crumb	specific for dry food product	specific for dry food product
The taste of bread	without foreign tastes	without foreign tastes
The smell of bread	product specific	product specific

Well-baked wheat bread should have the right size, the right shape, a uniformly colored crust without cracks and tears, and a uniformly distributed, soft, porous, elastic crumb.

Bread should be fragrant and tasty. The lighter the crumb of a certain type of wheat bread, the more it is appreciated by consumers.

The baking properties of wheat bread are mainly determined by its following properties:

- gas-forming ability;
- the ability to create dough with specific structural and mechanical properties - the strength of flour;
- the color of flour and the characteristic of darkening when making bread from it;
- The size of the flour particles is also significant.

Research results show that the quality indicators of bread made from wheat flour of Tanya grade do not differ much from the quality of bread made from wheat flour of the 1st grade. If the technological process is properly organized, it has been proven that it allows obtaining flour and bread that fully meets the standard norms.

During the storage process of grinded flour, its titer and active acidity increases. During the first 15-20 days after weighing, a rapid increase in titer acidity of flour is observed. The higher the output of the flour, the faster the acidity increases.

Increase in acidity because of the accumulation of free fatty acids is observed.

Hydrolytic decomposition of fats and formation of free fatty acids is observed during storage of flour. The higher the humidity and air temperature, the faster the fats are deformed.

Free fatty acids have an oxidizing activity and are easily subjected to oxidation, which results in the formation of pyroxide compounds. They help to lighten the color of the flour. Aldehydes and ketones formed during oxidation processes can give it a unique unpleasant smell and taste. The amount of sugar in it remains unchanged. The ability to produce sugar and gas remains unchanged, or slightly decreases.

The change in the color, moisture and acidity of the flour does not change the quality of the flour by itself. A decrease in the ability to form sugar and gas does not improve the quality of flour.

The essence of the ripening process is based on processes that change the structural-mechanical properties of gluten and dough, that is, the protein-proteinase complex of flour and make the flour stronger.

Lately, in order to meet the needs of the population and protect the environment, the issue of increasing the shelf life of food products is of great importance.

Extending the shelf life of food by irradiation with small doses of radiation is a relatively new technology. It is used for processing potatoes, corn and meat.

Even with weak irradiation of grains and grain products, radiation kills bacteria, pests, insects and other impurities contained in them. Even if it doesn't eliminate, it decrease its cohort. This reduces the risk of transmission of various diseases through food. Nevertheless, in irradiated products, the nutritional properties of the product are reduced and, perhaps, it has harmful effects on the human body that are not yet known to us.

3 Conclusions

Lately, the demand of the population of our republic for high-quality flour products has been increasing. This can be explained by the increase of the volume of high-quality flour products imported from the neighboring countries, e.g. Kazakhstan and Russia. The production of local finished products that are competitive with mentioned imported products, as well as the improvement of the quality of flour is an urgent problem. The conducted research shows that this can be achieved by studying the qualitative and technological properties of wheat grain grown in the regions of our republic, by choosing the right technological modes of their processing, as well as their analysis.

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