

# Evaluation of Grain Quality Indicators In Old Varieties of Spring Soft Wheat

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## **Abstract:**

*In the conditions of the steppe zone of the Samarkand region, 5 local ancient varieties of spring soft wheat of various geographical origin were studied. The aim of the research is to evaluate the grain quality indicators of ancient wheat varieties in various meteorological conditions and to identify sources of protein and gluten content for use in practical breeding.*

*The negative effect of abundant moisture (26%) during the filling period and high air temperature (26%) in the phase of grain ripeness on the quantity and quality of gluten was found. It is shown that the studied ancient varieties in typical meteorological conditions of the steppe zone of the Samarkand region stably form first-class grain: the maximum protein content in the grain is 13.1-14.5%, raw gluten-33.2-35.4%, the number of drops-319-340 s, nature-758-779 g/l. At the same time, the potential of rheological properties of the dough in varieties exceeds the norms for strong wheat: dough liquefaction-39 u. f., valor metric assessment-60-72 u. V. calorimeters.*

*The volume of bread-678-773 ml with a total score of 3.0-4.8 points. Studies have shown that the meteorological conditions of the year cause a high phenotypic variability of the rheological properties of the dough (CV=51.4-64.3 %), the average variability of signs: the number of falls (CV=12.2-14.0%), the mass fraction of protein (CV=9.1-12.2 %), the overall score of bread (CV=8.1-11.3 %). On the basis of the conducted research, the source varieties for indicators of technological properties of grain for use in practical breeding programs are identified.*

*Keywords: ancient local varieties, wheat, variety, protein content, gluten, grain nature, rheological properties of dough, bread quality, temperature regime, phenotypic variation.*

**Introduction.** Wheat is one of the main grain crops of Uzbekistan, providing the population's needs for bread and bread products. Its share in the total grain production is gradually increasing, but the structure of production in terms of quality composition is deteriorating, and the production of valuable wheat, which is necessary for the production of high-quality flour, has decreased [1]. Grain quality is a complex attribute that depends on the genetic characteristics of the variety [2,3,4], meteorological conditions of the year [5], soil fertility, growing conditions [7], and the influence of pests and diseases [6].

The quality of wheat grain and flour is an important selection criteria when creating varieties. At the same time, their complex composition, polygenic inheritance, and dependence on environmental conditions make purposeful selection difficult [8].

The problem of grain production of strong and valuable wheat is quite acute. Therefore, the modern world food production imposes various requirements on the technological properties of grain and flour. To meet these requirements, it is necessary to create and introduce universal wheat varieties that are resistant to extreme conditions in zones that stably preserve the genetic potential of grain productivity and quality [9].

To create such varieties, it is important to use local ancient wheat, the genetic potential of which can be used to expand the genetic diversity of soft wheat for various characteristics [10]. Despite the important breeding value of ancient varieties of spring soft wheat, the indicators of grain quality, their maturity, stability, research in hybrid combinations, as well as the identification of forms with high indicators of grain quality and baking properties are not sufficiently studied. In this regard, the formation of grain quality of local old varieties of spring soft wheat, their variability and stability.

The purpose of this study is to assess the grain quality indicators of ancient varieties of spring soft wheat and identify the initial forms for ancestral breeding.

### **Material and methods**

The research was conducted in 2019-2020 on the fields of the «Bekh-DIL-Bekh» farm in the Samarkand region (644 m steppe zone). above sea level 39<sup>0</sup>39' s. s. and 66<sup>0</sup>40' V. d.). as the source material for the study, old varieties were used: Bardosh, Pahlavon, Kairaktosh and collections of the Institute of genetics and experimental plant biology of the Academy of Sciences of Uzbekistan and the variety Khupar from the collection of their own collections.

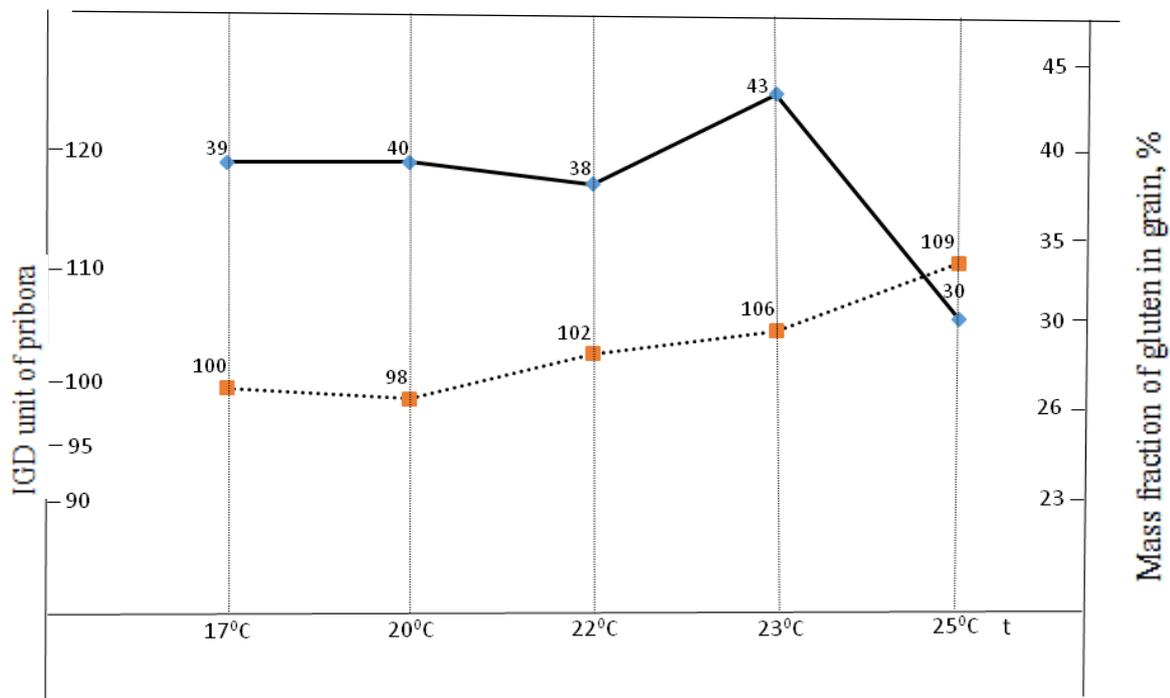
Sowing of seeds of varieties was carried out in the second decade of October at the optimal sowing time for the zone. Varieties were studied in a competitive test on plots of 25 m<sup>2</sup> in four-fold repetition. Grain quality grades were evaluated in accordance with the

methods of national standards of the Russian Federation for the following indicators: grain nature [11], the amount and quality of gluten [12], physical properties of the pharynograph test [13], the mass fraction of protein in the grain [14], the number of drops [15] and the method of state variety testing [16].

**Results and discussion**

Weather conditions during the experiments were contrasting in terms of the temperature regime of the air in winter and the difference in precipitation during the filling of wheat grain. The weather conditions of the year during the growing season had a significant impact on the quantity and quality of gluten in the grain of the studied varieties.

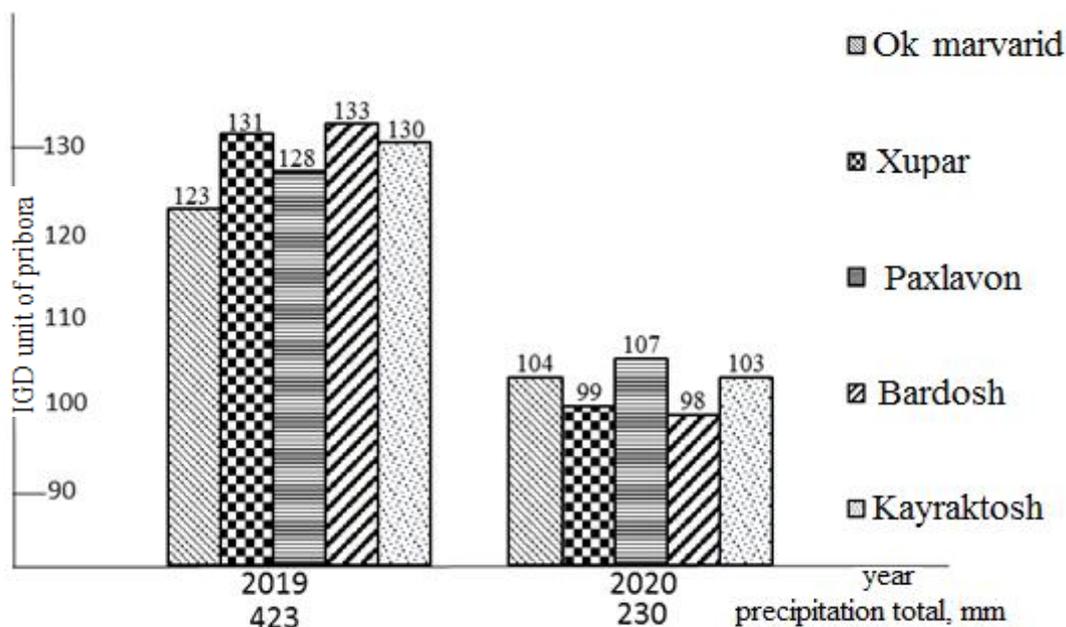
According to the results of a two-year study, it was found that humidity and air temperature during the growth and development of plants have the greatest influence on the formation of grain quality. Analysis of the obtained data showed that the optimal conditions for the formation of grain quality is the average daily temperature-23°C. An increase in temperature from 25°C and higher causes a decrease in the quality of gluten in the grain and its quality (Pic.1).



Pic.1. influence of average daily air temperature on quantity and quality gluten varieties of spring soft wheat Khupar, 2019-2020 yy.

— Mass fraction of gluten in grain, %, ..... Gluten quality, u. p. IGD.

It should be noted, however, that heavy precipitation in may and June 2019 caused a sharp decline in the quality of gluten of old varieties of spring soft wheat. At the same time, moderate moisture during the period of filling and ripening of grain contributes to the realization of the genetic potential of the variety (Pic.2).



Pic 2. The effect of amount of rainfall in June on the quality of gluten-free ancient varieties of spring soft wheat

This is due to a number of reasons, primarily the variability of the grain nature attribute. The nature of grain is a very variable indicator, depending on the genetic characteristics of the variety and its growing conditions, humidity and grain shape. From the data in table 1, it follows that in all the studied varieties, the grain nature on average for two years of study exceeds the norm of the standard for first-class grain. Therefore, in experimental varieties, the minimum value of this trait corresponds to the norm for third-class wheat (Table 1).

It should be noted that in the foothill and mountain grain-growing zones of Uzbekistan, one of the unfavorable environmental factors affecting the germination of grain in the ear is water logging of grain during the spring wheat harvest. It leads first to spry, and then to the appearance of germination of grain in the ear. To confirm our conclusions, a comparative assessment of varieties was carried out by the degree of damage during grain germination in the ear, which was determined by the number of drops that characterize the activity of amylolytic enzymes.

Analysis of the data obtained showed that in the growing season of 2019, due to adverse weather conditions during the grain maturation period, the baklavon and Bardosh varieties had very low drop rates of 75 and 66 C, respectively, which indicates the germination of grain on the bark. As a result, there was a decrease in the technological properties of grain of these varieties by the main quality indicators (Table 1).

Table 1

Indicators of technological quality of long-standing varieties of spring soft wheat (on average for 2019-2020 yy.)

Indicator	Variety				
	Xupar	Bardosh	Paxlavon	Ok marvarid	Kayraktosh
Nature, g/l	779±11,4 728-821	768±11,3 726-818	758±11,6 738-816	781±11,8 730-824	760±11,7 716-820
Number of drops, s	328±13,8 260-410	340±16,2 226-422	320±16,2 240-413	322±16,0 251-418	319±16,4 237-408
Mass fraction of protein in grain, %	14,5±0,61 11,1-16,4	14,7±0,54 11,6-16,8	13,8±0,48 11,1-16,4	14,8±0,56 12,2-17,3	13,1±0,50 10,1-16,2
Mass fraction of raw gluten in grain, %	34,1±1,9 27,1-41,8	35,4±1,97 28,1-42,8	33,3±1,61 24,2-37,7	34,4±1,96 24,4-38,2	33,2±1,64 22,1-35,8
IDK unit of the device	101±1,32 96-107	102±1,54 94-110	101±1,03 100-103	104±1,40 98-109	101±0,04 92-104
The distinction between test units of the farinograph	70±13,8 39-148	73±11,5 41-132	86±19,8 39-178	84±21,1 41-151	80±14,1 38-130
Calorimetrically assessment, u.val	61±6,1 45-94	70±6,3 48-96	64±3,9 40-86	72±6,4 50-98	60±5,8 43-95
Volume of bread from 100 g of flour, ml	758±69,8 448-1118	768±63,8 547-1108	681±38,9 540-830	773±61,9 561-1112	678±39,5 540-828
An overall assessment of the bread, score	3,8±0,17 3,1-4,2	4,4±0,14 3,7-4,28	4,0±0,11 3,3-4,1	4,2±0,12 3,7-4,9	3,9±0,19 3,0-4,1

One of the main indicators of wheat grain quality is the protein content, which is the most important indicator of baking advantages, strength of flour, nutritional value and its intended use. Analysis of the obtained data showed that the amount of protein in the grain of the studied varieties of spring soft wheat, depending on the genetic characteristics of the variety and the conditions of the year, ranged from 12.2% to 17.3 %. As can be seen from table 1 mass fraction of protein in grain of varieties Bardos and Pahlavon the average for the two years are OK for wheat the first grade, and grades OK hotel marvarid, Kiratas and Huper exceed the norm of the second class [17], and conform to the norm for a strong wheat [16].

As a result of our research, it is reliably established that the minimum value of the mass fraction corresponds to the norm for third-class wheat. The quantity and quality of gluten remains one of the most informative features when evaluating the baking properties of wheat grain. It is necessary to pay attention to the fact that the studied ancient varieties of spring soft wheat have a mass fraction of raw gluten in the grain on average for two years exceeds the norm for first-class wheat[17]. At the same time, the minimum value of the mass fraction of raw gluten in grain varieties Bardosh and Kairaktosh corresponds to wheat of the second class, and OK marvarid-of the third class. The quality of gluten has a significant impact on the baking properties of flour. The value of this indicator is also strongly influenced by environmental factors.

The results of a comparative analysis of five varieties for gluten quality showed that during the two years of study, almost all varieties were kept within the first quality group. It should be noted, however, that the old-fashioned variety Khupar, the average value of gluten quality was 67 units. SHK. IDK. For example, during the two years of study, the best gluten quality varieties were: baklavon, Kairaktash and Khupar, which were characterized by high grain quality indicators. As a result of studying the technological properties of the grain of local ancient wheat, the following high-quality varieties were identified: Pahlavon, OK marvarid and Khupar, which met the requirements for valuable wheat. These varieties have the highest flour yields recorded in the 2019 harvest. At the same time, the varieties had a flour strength exceeding the classification norms for strong wheat. Growing conditions in 2020 for the studied varieties, the measure of the strength of the flour ranged from 204 EA at variety Caraccas, 250 EA-Chupar. According to the results of two-year studies of flour strength indicators, the high-quality SOR there is attributed to the Hupar with flour strength of 250 EA (Table 2).

Table 2

Characteristics of long-standing varieties of spring soft wheat in terms of rheological properties of flour dough (on average for 2019-2020 yy)

Variety	indicators					
	power of flour	p/L	upu, %	porosity markisa in the balls	softball color in balls	volume output of bread, cm <sup>3</sup>
Xupar	250	1,6	61,4	4,2	4,3	946
Bardosh	220	1,5	60,3	4,1	4,1	810
Paxlavon	246	1,5	60,5	4,3	4,2	935
Ok marvarid	221	1,6	59,8	4,1	4,0	940
Kayraktosh	204	0,7	60,0	4,1	4,1	840

In the bakery evaluation of wheat, the volume yield of bread is an important indicator of quality. It should be noted that all the studied varieties that showed high physical properties passed the bakery assessment. The results of a comparative assessment of the baking properties of ancient wheat showed that the volume yield of bread varies depending on the genotypic features of the variety, but it is influenced by the weather conditions of the growing season of plants. For example, in 2019, the volume output of bread is higher compared to the same indicators in 2020, which may be due to an increase in the temperature regime during the grain maturation period. Consequently, the volume yield of bread from 100 g of flour for all grades for 2019-2020 was 896 cm<sup>3</sup>. At the same time, the maximum volume yield of bread for two years was in the Khupar variety and amounted to 946 cm<sup>3</sup>, with fluctuations over the years from 894 to 948 cm<sup>3</sup>, the minimum -in the Bardosh variety -810 cm<sup>3</sup>. Varieties of baklavon, Kairaktash, OK marvarid Had a volume yield of bread at the level of 840-935 cm<sup>3</sup>.

As a result of a comprehensive comparative analysis, the nature of variability of indicators of technological properties of grain of old varieties of spring soft wheat was established. It was revealed that some varieties may have high indicators of technological properties of grain, while other varieties may have low indicators of grain turnover. The variability of grain properties of the studied varieties of soft wheat is primarily due to the nature of the interaction of the factors “genotype” and “meteorological conditions of the year”. From the data in table 2, it follows that some varieties (Khupar, pakhlavon) in a year

favorable for the formation of grain quality have indicators exceeding the norm of first-class wheat in terms of natural grain weight, number of drops, mass fraction of protein and raw gluten in the grain.

Table 3

Phenotypic variability of grain quality indicators of old varieties of spring soft wheat, V, % (on average for 2019-2020 yy)

Indicator	Variety				
	Xupar	Bardosh	Paxlavon	Ok marvarid	Kayraktosh
Nature, g/l	4,8	4,8	4,4	4,2	4,1
Number of submissions, s	12,1	13,1	13,2	14,0	12,2
Mass fraction of protein in grain, %	12,2	10,8	9,1	10,8	9,8
Mass fraction of wet gluten in the grain, %	16,1	15,3	13,4	14,8	14,3
IDK unit of the device	3,4	3,8	4,0	4,6	3,6
Dilution of the test units of the farinograph	54,6	47,2	52,4	64,3	51,4
Calorimetrically assessment, u. val	27,4	24,8	21,0	28,1	21,5
Volume of bread from 100 g of flour, ml	28,5	21,9	15,9	27,6	16,1
An overall assessment of the bread, score	11,2	10,6	7,8	11,3	8,1

Analyzing the data obtained, we can note the variability of features that determine the rheological properties of the test. Table 3 shows the average values of phenotypic variability of grain quality indicators of old varieties of spring soft wheat.

As can be seen the parameters of grain quality variability are divided into resistant and moderately variable group: sustainable-nature of the grain, and IDK falling number, medium varying-mass fraction of protein, wet gluten, total score of bread.

### Conclusion

Based on the data obtained, it can be concluded that in typical conditions of the steppe zone of The pastes of the Dargom district of the Samarkand region, the varieties of spring soft wheat-Khupar and pakhlavon are able to form first - class grain, and in unfavorable conditions-third-class wheat. It was revealed that the change in indicators of technological qualities of spring soft wheat grain depends on the genotypic features of the variety and the conditions of the year. The lowest phenotypic variability was determined in terms of grain nature, mass fraction of protein in grain, quantity and quality of gluten, and volume yield of bread. The negative influence of the sum of temperatures during the period from earing to harvesting is established.

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