

## Conference Paper

# Technological Properties of Grain Varieties of Strong and Valuable Wheat in the Northern Forest-steppe of the Tyumen Region

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## Abstract

The article presents the results of the technological properties of grain of strong wheat varieties Novosibirskaya 15, Novosibirskaya 29, SKENT-1 and valuable Iren, Krasnoufimskaya 100, Lutescens 70, Tyumenskaya 25. The results of the evaluation of the mixing ability of flour of varieties of strong wheat are presented. The varieties of spring soft wheat were grown in 2010–2012 on the experimental field of Agrotechnological Institute of the SAU of the Northern Trans-Urals (the zone of the northern forest-steppe of the Tyumen region). The soil of the experimental field is leached chernozem, heavy loam in granulometric composition. The predecessor is annual herbs. The fertilizers were applied in the amount of 4 t/ha per grain yield. Soil cultivation is generally accepted for the culture in the zone. Laboratory studies were performed in the laboratories of the Agrobiotechnological Center of State Agrarian University of Northern Trans-Urals and Kurgan Research Institute of Agriculture. The results showed that by type of grain Tyumenskaya 25 showed the best results: high rates in 2010 and 2011 (781 and 787 g/l) and higher rates compared to the other varieties in arid period in 2012 (723 g/l). By the number of gluten, strong wheat varieties Novosibirskaya 15 and Novosibirskaya 29, valuable wheat varieties Iren and Tyumen 25 corresponded to the standards of the first class of GOST (at least 32 %). The same varieties were distinguished by the highest physical properties of the test when evaluated on a pharynograph and alveograph. The standards for strong wheat corresponded to the volume of bread from flour varieties Novosibirskaya 15 (1355 cm<sup>3</sup>) and Novosibirskaya 29 (1207 cm<sup>3</sup>). The mixing ability of flour of a strong wheat variety of Novosibirskaya 15 was manifested to a greater extent in the variant with a share of 50 % in a mixture with weak wheat. The improvement effect was 20–24 %. Under the conditions of production experience, the mixing ability of flour of strong wheat variety Novosibirskaya 29 when added to flour from grain of Ikar grade was also the highest in the variant with a ratio of 50: 50 %. The improvement effect was 29 %.

**Keywords:** varieties of strong and valuable wheat, technological properties of grain, mixing ability of flour.

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## 1. Introduction

In order to ensure stable production of high-quality food grain of wheat, it is necessary that cultivated varieties steadily form indicators specified by the requirements of the current national standard: vitreous nature, nature, content and quality of gluten, etc., as well as signs characterizing the baking power of wheat: indicators of the alveograph, farinograph, volume bread and its overall assessment.

The indicators of grain quality are among a set of indicators of the economic efficiency of the variety, i.e. the criterion for the duration of regionalization of a variety and its contribution to all components of grain economy [1].

A special place in the varietal structure is occupied by the varieties of strong and valuable wheat. Economic evaluation of strong wheat is that grain gives an increased yield of flour and bread. Grain of strong wheat, as an improving element, is used in our country and in most countries exporting high-quality grain, such as Canada and the USA [2].

Along with strong wheat varieties, a significant role is played in the production of high-quality grain of valuable wheat varieties. For example, in Western and Eastern Siberia, as well as in other regions, large varieties of Iren valuable wheat are cultivated on large areas. This variety is approved for use in seven regions of the Russian Federation. Such a wide distribution is associated to a large extent with the ability of the variety to stably form the quality of grain that meets the standards for valuable wheat [3].

The importance of the variety, its stability in the formation of grain that meets the requirements of high classes for food in specific agro-climatic conditions, was noted by Yu.P. Loginov [4, 5] and A.A. Cossack [6, 7].

The quality criterion for new varieties, according to S.S. Sinitsyna [8], the relative frequency of formation of a strong grain by all indicators should be considered. It is noted that the varieties cultivated in Siberia do not always stably form grain that meets the requirements of the standard [9, 10].

In the conditions of the northern forest-steppe of the Tyumen Region, a quality index was used to assess the technological properties of wheat grain and meet their standard requirements, which made it possible to rank varieties by the level of quality of their grain [11, 12]. As a result, the varieties were identified that most steadily form high technological properties of grain.

Thus, studies showed the significant role of the variety in the production of high-quality wheat grain. First of all, these are strong and valuable varieties with a high potential of technological properties of grain.

The purpose of our research is to identify the grain quality potential of strong and valuable wheat varieties in the conditions of the Northern Trans-Urals.

## 2. Methods and Equipment

The studies were conducted on wheat varieties from the harvest of 2010--2012 grown on the experimental field of the Agrotechnological Institute of the SAU of the Northern Trans-Urals (the zone of the northern forest-steppe of the Tyumen region). The soil of the experimental field is leached chernozem, heavy loam in granulometric composition. The predecessor is annual herbs. The fertilizers were applied in the amount of 4 tons/ha per grain yield. Soil cultivation is generally accepted for the culture in the zone. Laboratory studies were performed in the laboratories of the Agrobiotechnological Center of State Agrarian University of Northern Trans-Urals and Kurgan Research Institute of Agriculture.

The technological properties of grains of strong wheat varieties --- Novosibirskaya 15, Novosibirskaya 29, SKENT -- 1 and valuable --- Iren, Krasnoufimskaya 100, Lutescens 70, Tyumenskaya 25, were studied.

The observations and calculations in field experiments were carried out according to the methodology of the State Commission for Variety Testing (1985).

Grain quality indicators were evaluated in accordance with the methods set forth in state standards. The following are determined: the nature of the grain, the quantity and quality of raw gluten, the number of drops, the physical properties of the test on alveograph and farinograph instruments.

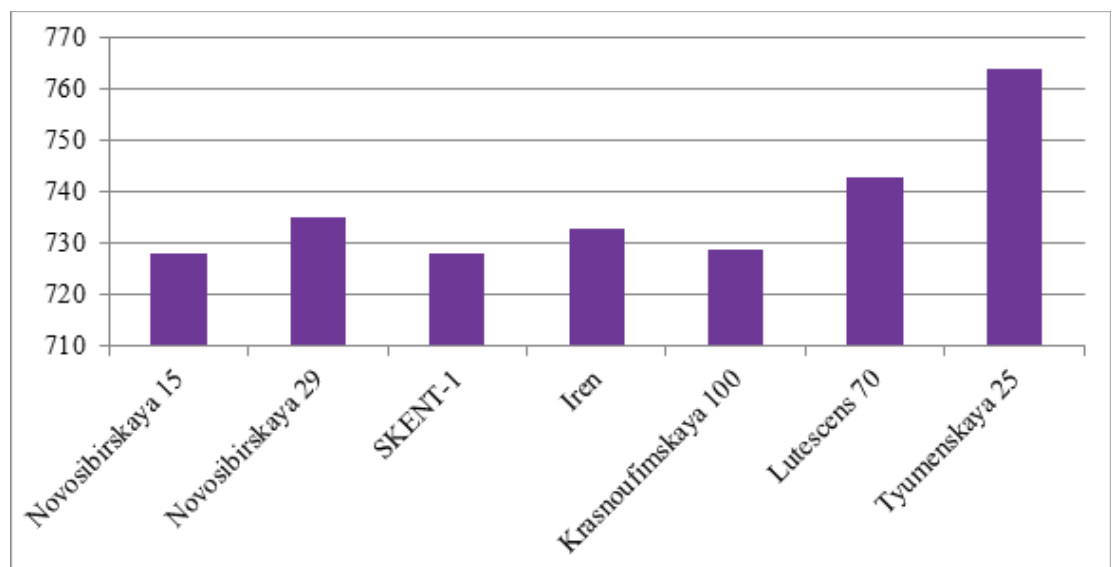
The bakery evaluation of wheat varieties was carried out by laboratory baking from 100 g of flour with improvers and intensive kneading, recommended by the State Commission for Variety Testing. The mixing ability of strong wheat flour was evaluated by laboratory baking from 100 g of flour without improvers and intensive kneading. In the production conditions, the mixing ability of strong wheat flour was determined by baking from 500 g of flour at Kolos LLC (Tyumen Region).

The improvement effect (E), as an indicator of mixing ability, was evaluated by the ratio of the difference between the volume of bread from a mixture of flour and the volume of bread from weak wheat flour to the volume of bread from weak wheat flour, expressed as a percentage [13].

### 3. Results

Mandatory indicators in the grading system include nature -- the mass of a unit volume, which serves as an indirect criterion for the flour milling qualities of grain. The standards of current GOST 9353-2016 provide the value of this trait for wheat of the first and second classes of at least 750 g/l, for the third -- at least 730 g/l.

The grain nature of the studied wheat varieties was in the range of 661--790 g/l. The arid conditions of the growing season of 2012, when insufficiently formed grain was negatively affected this indicator. Tyumen 25 variety showed best results by grain nature: high rates in 2010 and 2011 (781 and 787 g/l) and higher than in other varieties -- in 2012 (723 g/l). The average value of the trait over the years of research in this variety is 764 g/l (Fig. 1).



**Figure 1:** Grain nature of wheat varieties, (g/l), 2010--2012.

The variation of grain nature by years of research was insignificant. Stronger than in other varieties, the trait varied in Krasnoufimskaya 100 ( $V = 7.6\%$ ) and Lutescens 70 ( $V = 7.2\%$ ).

Factor analysis established the prevailing influence on the variability of grain nature of the conditions of the year of cultivation (68%), the proportion of influence of the variety was 12%, the interaction of these factors -- 18%.

Wheat gluten is characterized by high nutritional value and plays an important role in baking, as it is the mechanical basis of the dough and retains the carbon dioxide released by yeast during fermentation and baking of bread.

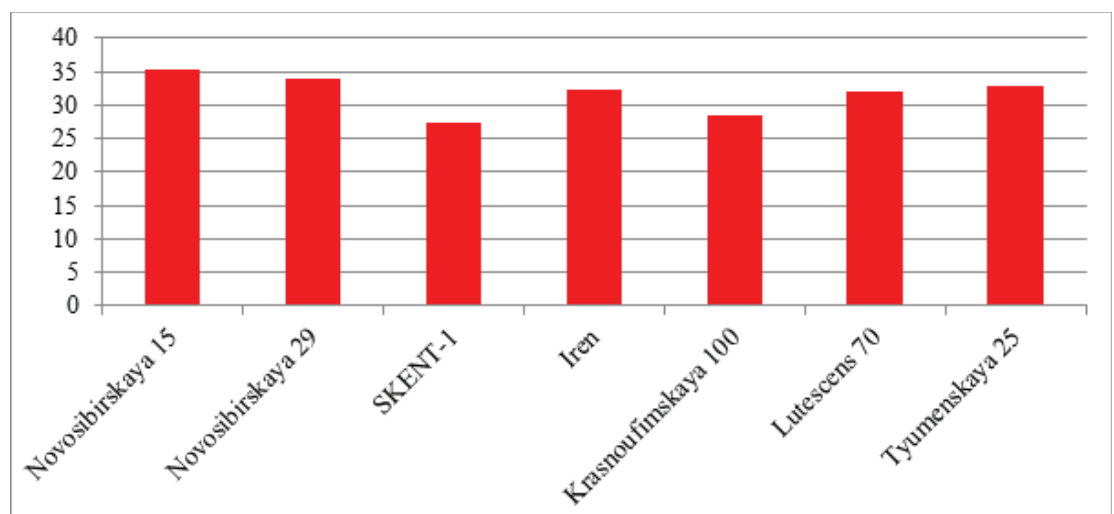
The gluten content in the grain of wheat varieties varied during the years of research in a wide range of 21.8 – 40.8 %. A high potential in the formation of the amount of gluten was manifested in the strong wheat variety Novosibirskaya 15 (40.5 %), as well as the varieties Novosibirskaya 29 (39.0 %) and Tyumen 25 (38.0 %).

As a negative property, a significant decrease in the amount of gluten in the grain was manifested in the SCANT-1 variety (22.0 % in 2011). Given the average values of the trait, it should be noted that strong wheat varieties Novosibirskaya 15 and Novosibirskaya 29, valuable wheat varieties Iren and Tyumen 25 in terms of gluten content met the standards of the first class of GOST (at least 32 %) (Fig. 2).

The remaining varieties on this basis, with the exception of SCANT-1, corresponded to the second class (at least 28 %), SCANT-1 with an indicator of 27.3 % -- to the third class.

An important feature of wheat varieties is a slight variation in the magnitude of the trait under study during the years of research: this was the difference between the varieties Iren (1.4 %) and Krasnoufimskaya 100 (4.6 %). At the same time, in the variety SKENT-1, the variation in gluten content was much stronger: 17.9 %. Comparing the average values of the trait for the selected groups, it is necessary to note a certain advantage of the varieties of the strong wheat group (32.1%) compared to the varieties of valuable wheat (31.3 %).

According to the results of factor analysis, it was found that the share of the influence of the variety and the year of cultivation on the variability of this trait was approximately at the same level: 36 and 30 %, respectively. The interaction of these factors was 23 %.

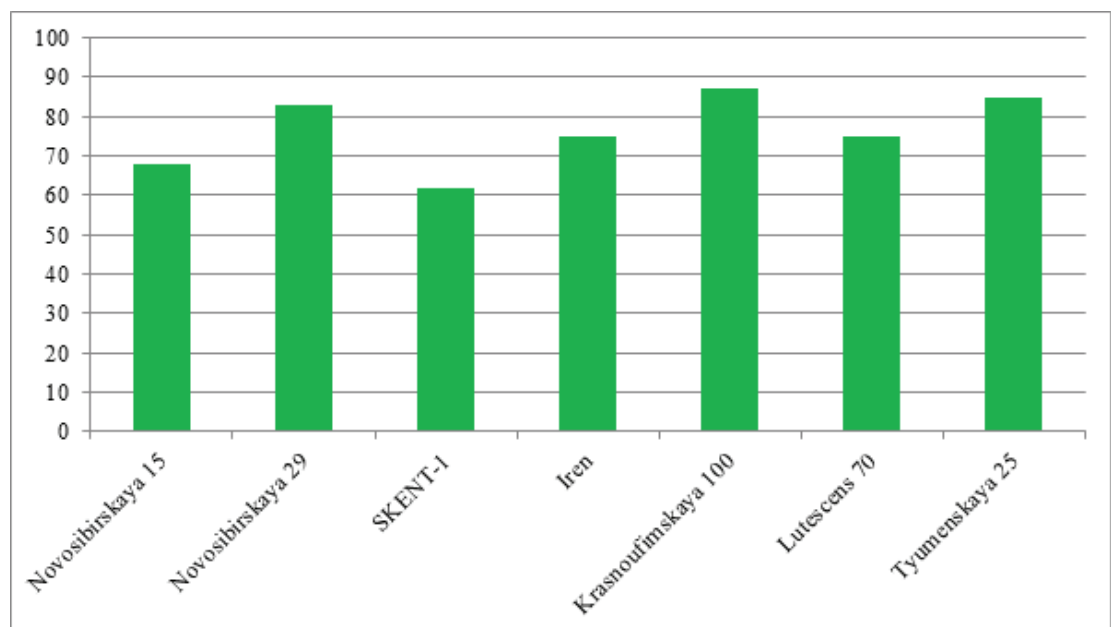


**Figure 2:** Content of crude gluten in the grain of wheat varieties, (%), 2010--2012.

The quality of gluten varied in the studied varieties during the years of research from 50 to 95 units. In all years of research, gluten of the second quality group was noted in the variety of strong wheat Novosibirskaya 29 (80–85 units of IDK), valuable wheat Krasnoufinskaya 100 (80–95 units of IDK) and Tyumen 25 (80–90 units of IDK). Wheat varieties Iren and Lutescens 70 during the years of research formed the gluten of the first and second quality groups.

Strong wheat varieties formed more elastic gluten than valuable wheat varieties (Fig. 3). The most stable level of gluten quality was observed in the variety Novosibirskaya 29 ( $V = 3.5\%$ ). Significant variation of the trait in the variety SCANT-1 ( $V = 20.3\%$ ). The coefficient of variation in the quality of gluten in varieties Iren and Lutescens 70 was 13.3%, which indicates an average degree of variability. In other varieties, the coefficient of variation was at the level of 5.9–8.8%. This is a slight variation.

According to the results of factor analysis, a significant influence of the variety (54%) on the variability of gluten quality was revealed. The share of influence of the factor "year" was 11%, the interaction of factors "grade x year" -- 23%.



**Figure 3:** Quality of raw gluten.

Gluten of only the first quality group was formed by strong wheat varieties Novosibirskaya 15 (65–75 units of IDK) and SKENT-1 (50–75 units of IDK).

The most valuable for baking are wheat varieties with a high content of gluten in grain and its good quality. Among the varieties studied by us, Novosibirskaya 15, Iren, Lutescens 70 were distinguished by a complex of such characters.

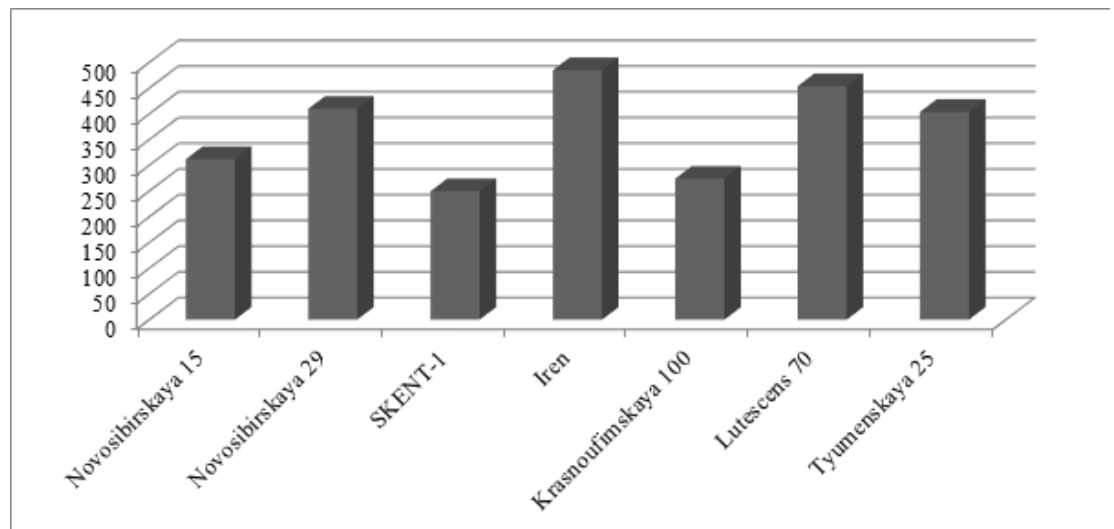
The state of starch in the grain and the activity of the enzyme alpha-amylase characterize the indicator "number of falls". Secondary hydration of the grain after maturation contributes to the activation of metabolic processes in it and causes intensive work of amylolytic enzymes, primarily alpha-amylase. This enzyme decomposes starch with the formation of water-soluble substances -- sugars and dextrans. The drop number (in the second) indirectly characterizes the activity of the alpha-amylase enzyme, taking into account the state of starch paste according to the time the stem with the disk (plunger) travels to the bottom of the tube with a flour-water suspension. This indicator is especially important for the conditions of Siberia, since in the region in the autumn-summer period quite often warm rainy weather is observed, which causes the activation of enzymes in the grain and its germination during the year. The requirements of the current standard provide the fall number for strong wheat is at least 200 s, for valuable is at least 150 s.

The number of drops in the grains of the studied varieties varied during the years of research from 229 to 537 s, these indicators were within the requirements of the 1<sup>st</sup> class of GOST and indicated the high quality of the grain and low alpha-amylase activity in it. At the same time, bakery specialists noted that a too high drop number (more than 350 s) was undesirable for dough processes, since the sugar-forming ability of flour was reduced due to insufficient activity of enzymes acting on starch.

A high fall number was observed in the varieties: Iren (485 s), Lutescens 70 (454 s) and Novosibirskaya 29 (410 s) (Fig. 4). Values of the coefficient of variation of this indicator were: from 4.7 to 44.4 %. The trait was characterized by the best stability in the variety SCANT-1 (7.6 %), a significant variation -- in the varieties Novosibirskaya 15 (44.4 %) and Tyumen 25 (21.7 %). In other varieties, there was the average degree of variability of the value of the fall number (11.1--17.1 %).

According to the data of factor analysis, a high proportion of the contribution of the variety (59 %) to the variability of the trait under consideration was established. The contribution of the growing year was 15 %, the interaction of these factors -- 18 %.

Comprehensive characteristic -- the baking power of flour includes the parameters of the physical (rheological) properties of the dough and the baking qualities of the flour. The properties of the test are evaluated on the devices of the farinograph (indicators -- the time of formation and stability of the test, its dilution, valorimetric assessment) and the alveograph (indicators -- the elasticity of the test, the ratio of elasticity to extensibility, flour strength). The main indicators for assessing the quality of bread -- its volume (cm<sup>3</sup>) and overall assessment (score).



**Figure 4:** Number of falls in the grain of wheat varieties, (s), 2010--2012.

The total test score on a pharynograph is a valorimetric score. The requirements for the value of this trait for strong wheat were at least 70 %, for valuable were at least 55 %. The valorimetric score for wheat varieties varied during the years of research from 42 % (SKENT-1) to 80 % (Novosibirskaya 15 and Novosibirskaya 29).

Given the standards for strong and valuable wheat, it can be argued that the level of this trait in all varieties corresponded to the standards. A high value of the valorimetric assessment for the strong wheat varieties Novosibirskaya 15 (79 %) and Novosibirskaya 29 (80 %), as well as the varieties Iren (76 %) and Tyumen 25 (77 %) (table 1). The varieties of strong wheat Novosibirskaya 15 and Novosibirskaya 29 were most stable in the formation of a high value of this trait. A low coefficient of variation was also noted in the variety Lutescens 70 ( $V = 2.0$  %).

The value of the indicator in varieties Iren ( $V = 22.0$  %) and SKENT-1 ( $V = 21.6$  %) significantly varied.

**TABLE 1:** Characterization of the physical properties of the test of wheat varieties, 2010--2011.

Varieties	Classification of varieties by baking power	Calorimetrically based on the farinograph, %
Novosibirskaya 15	Strong wheat	79
Novosibirskaya 29		80
SKENT-1		56
Iren	Valuable wheat	76
Omskaya 36		68
Krasnoufimskaya 100		59
Lutescens 70		77



The average value of calorimetric assessment for varieties of strong wheat was 72 %, valuable -- 66 %. Thus, the value of the indicator decreased in accordance with a decrease in the baking power of wheat.

The contribution of the variety to the variability of the trait under consideration was 30 %, the contribution of the factor "year" was slightly lower --- 26 %, and the influence of the interaction of these factors --- 26 %.

The assessment of the physical properties of the test on an alveograph involves determining the strength of the flour from the resistance to air pressure provided by the test with the simultaneous recording of a curve -- an alveogram. The area of the alveogram is proportional to  $W$  -- the specific work of the deformation of the test (the main indicator on this device). Strong wheat requirements require a  $W$  value of at least 280 ea. (units of alveograph), for valuable wheat -- not less than 260 e.a.

The specific deformation of the dough, or the strength of the flour according to the alveograph in the studied varieties, varied during the years of research from 148 to 447 e.a.

In 2011 the value of this indicator in the variety SCANT-1 significantly reduced. The maximum value of the strength of flour was recorded in the Novosibirskaya strong wheat variety 15 (447 e.a.) and the valuable variety -- Lutescens 70 (441 e.a.).

On average, over the years of research, the standards for strong wheat (not less than 280 e.a.) were met by the indicators for varieties Novosibirskaya 15 (347 EA), Novosibirskaya 29 (324 e.a.), Iren (339 e.a.), Lutescens 70 (324 e.a.) and Tyumen 25 (285 e.a.) (Table 1). In wheat Krasnoufimskaya 100, the indicator corresponded to the requirements for valuable wheat (270 e.a.). The comparative assessment of the average values of flour strength in the varieties of different quality groups indicate that the highest value of the indicator in the group of strong wheat (308 e.a.), the value of the varieties of valuable wheat at 21 EA below.

A high value of the coefficient of variation indicates that a number of varieties do not sufficiently sustain the strength of the flour: SKENT-1 ( $V = 36.0$  %), Lutescens 70 ( $V = 32.9$  %), Krasnoufimskaya 100 ( $V = 26.9$  %), Novosibirskaya 15 ( $V = 25.3$  %). A slight variation of this trait was observed in the variety Novosibirskaya 29 ( $V = 3.9$  %).

In the variability of the strength of flour, a significant share of the "year" factor is 40 %, the influence of the variety is 25 %, and the interaction of these factors is 32 %.

Based to the results of laboratory baking, the standardized indicators according to the classification of the State Commission for variety testing are the volume of bread and the overall assessment of bread. The requirements for strong wheat require a bread

volume of at least 1200 ml, a total bread score of at least 4.5 points, valuable wheat -- at least 1100 ml and at least 4 points, respectively.

The volume of bread in the studied wheat varieties during the years of research varied widely: from 480 cm<sup>3</sup> (SKENT-1) to 1550 cm<sup>3</sup> (Novosibirskaya 15).

Considering the standards, we can distinguish the varieties the indicators of which are within the requirements for strong wheat -- Novosibirskaya 15 (1355 cm<sup>3</sup>) and Novosibirskaya 29 (1207 cm<sup>3</sup>), as well as a variety that meets the standard for valuable wheat by volume of bread -- Krasnoufimskaya 100 (1052 cm<sup>3</sup>). It is also worth highlighting the varieties the indicators of which are closest to the standard for valuable wheat: Tyumen 25 (988 cm<sup>3</sup>) and Iren (927 cm<sup>3</sup>) (table 2).

TABLE 2: Characterization of the baking qualities of the flour of wheat varieties, 2010--2011.

Varieties	Classification of varieties by baking power	Bread volume, cm <sup>3</sup>	An overall assessment of the bread, score
Novosibirskaya 15	Strong wheat	79	347
Novosibirskaya 29		80	324
SKENT-1		56	252
Iren	Valuable wheat	76	340
Omskaya 36		68	270
Krasnoufimskaya 100		59	324
Lutescens 70		77	286

The degree of variation in the volume of bread is quite high in most varieties, which indicates their lack of stability in the formation of this trait. The largest coefficient of variation in the volume of bread in the varieties was observed in SKENT-1 (39.9 %) and Krasnoufimskaya 100 (31.3 %).

On average, over the years of research, the bread volume indicator for strong wheat varieties was --1126 cm<sup>3</sup>, which is 257 cm cm<sup>3</sup> higher than for valuable wheat varieties.

The variability of the volume of bread is largely due to the influence of the variety (40 %) and the influence of the "year" factor (47 %).

The total bakery score for the studied wheat varieties varied over the years of research from 2.7 (SKENT-1) to 4.5 points (Novosibirskaya 15 and Novosibirskaya 29). The best indicators on average over the years of research were in varieties of strong wheat Novosibirskaya 15 (4.3 points) and Novosibirskaya 29 (4.0 points) (table 2). This is at the level of the requirements for valuable wheat (at least 4.0 points). The closest indicators to this level are the varieties of Krasnoufimskaya 100 (3.8 points), Iren (3.6 points) and Tyumen 25 (3.6 points).

For strong wheat varieties, the average bread rating was 3.9 points, for valuable varieties -- 3.5 points. The coefficient of variation of the trait in wheat varieties was 2.8-22.2 %, which indicated the degree of variation from weak to significant. The highest grade of bread (4.3 points) and its slight variation ( $V = 8.0$  %) was characterized by the Novosibirskaya variety 15, as well as the Krasnoufimskaya 100 variety with a bread rating of 3.8 points and a slight variation of the trait ( $V = 9.3$  %). An average degree of variation in the assessment of bread was noted in the variety Novosibirskaya 29 ( $V = 15.6$  %) with a rather high value (4.0 points). The indicator significantly varied in the variety SCANT-1 ( $V = 22.2$  %).

The variability of the bread estimation value was significantly influenced by the "year" factor (47 %), the proportion of the variety influence (34 %) is also significant and the influence of the interaction of these factors was 12 %.

Particular value is presented by strong wheat as a raw material for baking, the flour of which is able to improve the flour of low-quality wheat when baking in mixtures. The varieties of strong wheat can be characterized by different mixing ability. It was revealed that grain of strong wheat with only high technological properties has good mixing ability [14]. In order to effectively use strong wheat as an improving element, it is necessary to identify the optimal quantitative ratio of the components of the mixture [15].

In laboratory conditions, we studied the mixing ability of flour of a strong wheat variety of Novosibirskaya 15. For the preparation of mixtures, we used Kazakhstan flour with low rheological properties and baking qualities as a weak one. The following percentages of the strong and weak varieties were studied: 15:85, 30:70, 50:50 %. Each mixture was tested in six replicates.

When evaluating wheat flour grown in 2010, the volume of bread in the Novosibirskaya 15 variety was  $572 \text{ cm}^3$ , and in the early Kazakhstan variety  $460 \text{ cm}^3$ . In mixtures, as the proportion of strong wheat flour increased, the volume of bread also increased: with the addition of 15 % -- by  $61 \text{ cm}^3$ , 30 % -- by  $81 \text{ cm}^3$ , 50 % -- by  $102 \text{ cm}^3$ . Overall assessment of bread from flour grade Novosibirskaya 15 amounted to 4.55 points, from early grade flour -- 3.22 points. Evaluation of bread with an increase in the proportion of strong wheat flour in the mixes increased: with the addition of 15 % -- by 0.58 points, 30 % -- by 0.81 points, 50 % -- by 1.35 points.

The greatest improvement effect was obtained from mixing flour from grain of strong and weak wheat in a ratio of 50:50 (22 %).

The volume of bread from flour of the Novosibirskaya 15 variety grown in 2011 was  $547 \text{ cm}^3$ , from dairy wheat flour --  $435 \text{ cm}^3$ . In mixtures, the volume increased: with

the addition of 15 % -- by 41 cm<sup>3</sup>, 30 % -- by 90 cm<sup>3</sup>, 50 % -- by 87 cm<sup>3</sup>. The total baking evaluation of bread made from strong wheat flour was 4.38 points, from bread made from weak wheat flour -- 3.22 points. Evaluation of bread in variants with mixtures increased with an increase in the proportion of flour from strong wheat: with the addition of 15 % -- by 0.35 points, 30 % -- by 0.61 points, 50 % -- by 0.98 points. When using wheat flour from the harvest of this year, the improvement effect in mixtures 30:70 and 50:50 was almost at the same level: 21 % and 20 %, respectively.

From the Novosibirskaya wheat flour 15 harvest of 2012, the volume of bread obtained was 640 cm<sup>3</sup>, from early Kazakhstan flour -- 480 cm<sup>3</sup>. In the variant with a ratio of 15:85 %, the volume of bread increased by 43 cm<sup>3</sup>, with a ratio of 30:70 % -- by 80 cm<sup>3</sup>, with a ratio of 50:50 % -- by 74 cm<sup>3</sup>. The assessment of bread from flour of strong wheat Novosibirskaya 15 was at the level of 4.67 points. For weak wheat, Kazakhstan's early overall bread score was 3.6 points. The value of this indicator increased: with the addition of 15 % flour from strong wheat -- by 0.27 points, 30 % -- by 0.7 points, 50 % -- by 1.33 points. The greatest improvement effect was obtained in the variant with a ratio of flour from grain of strong and weak wheat 50:50 (E = 24 %).

The production experience in assessing the mixing ability of strong wheat flour Novosibirskaya 29 was carried out in 2014 at the LLC Kolos enterprise in the Nizhnetavdinsky district of the Tyumen region. Company LLC Kolos, along with grain production, has processing complexes: a mini-mill and a mini-bakery.

In mixtures with flour of strong wheat, Novosibirskaya 29 used Ikar flour, characterized by average rheological properties of the dough and baking qualities. Baking was carried out from 500 g of flour. The mixtures were made in the following proportions of flour of sorts Novosibirskaya 29 and Icarus: 15:85, 30:70, 50:50 %. Each mixture was tested in triplicate.

The data in table 3 shows that the volume of bread from flour of strong wheat of Novosibirskaya 29 was 520 cm<sup>3</sup>, from flour of Ikar variety -- 450 cm<sup>3</sup>. In mixtures, as the amount of strong wheat flour increased, the volume of bread increased: with the addition of 15 % -- by 58 cm<sup>3</sup>, 30 % -- by 108 cm<sup>3</sup>, 50 % -- by 129 cm<sup>3</sup>.

The total baking assessment of bread from wheat flour of Novosibirskaya 29 amounted to 4.3 points, from flour of Ikar variety -- 3.0 points. The evaluation of bread in the mixture also increased: with the addition of 15 % -- by 1.1 points, 30 % -- by 2 points, 50 % -- by 2 points.

The greatest improvement effect (E) was obtained from mixing flour from wheat grain of Novosibirskaya 29 and Ikar wheat in the ratio of 50:50 (E = 29 %).

TABLE 3: Mixing ability of strong wheat flour Novosibirskaya 29 (based on the results of production experience at the LLC Kolos enterprise), 2014.

Option	Bread volume, cm <sup>3</sup>	An overall assessment of the bread, score	The effect of improving, %
Flour from wheat varieties Novosibirskaya 29	520±16	4,3±0,3	--
Flour from varieties of Ikar	450±7	3,0±0,07	--
Relation 15:85 %*	508±7	4,1±0,2	13
Relation 30:70 %	558±3	5,0±0,04	24
Relation 50:50 %	579±5	5,0±0,04	29

\* Ratio -- Novosibirskaya 29 wheat flour: Ikar wheat flour.

## 4. Conclusion

1. The studies showed that, the technological properties of grain are most steadily formed within the established standards of Novosibirskaya 15 and Novosibirskaya 29, of varieties of valuable wheat -- Iren and Tyumen 25.

2. The mixing ability of flour of a strong wheat variety Novosibirskaya 15 was manifested to a greater extent in the variant with the share of 50 % in a mixture with weak wheat. The improvement effect was 20--24 %.

3. Under the conditions of production experience, the mixing ability of flour of strong wheat variety Novosibirskaya 29 when adding it to flour from Ikar grain was also highest in the variant with the ratio of 50: 50 %. The improvement effect is 29 %.

4. According to factor analysis, the prevalence of the influence of the variety in the variability of the quantity and quality of gluten, fall number, and calorimetric assessment was established. A significant share of the influence of the "year" factor was characteristic of the size of grain nature and the overall assessment of bread.

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## Conflict of Interest

The authors have no conflict of interest to declare.

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