

## PHYSICAL CHARACTERISTICS OF WINTER WHEAT GRAIN QUALITY DEPENDING ON THE VARIETY

*It was determined that the grain of investigated winter wheat varieties has good physical characteristics of quality. Big kernel size have such varieties as Afina, Artia, Lastivka Odeska, Tronka and Plutos, which is 2.8-3.0 mm, but such varieties as Zolotokolosa, Donetska 48 and Lupus have higher grain unit – 756-782 g/l. Big weight per 100 kernels have the varieties Podolianka, Afina, Artia, Zolotokolosa, Myronivska 808, Lastivka Odeska, Tronka, Donetska 48, Lupus.*

**Keywords:** winter wheat, linear dimensions, kernel size, weight per 100 kernels, grain unit

**Introduction.** Improvement of wheat quality is one of the main ways to improve agricultural production. The value of wheat protein consist in the fact that the gliadin and glutenin in the water forming protein complex - gluten. The higher gluten content in grain and the better its physical properties balanced the better are baking properties of flour [1].

Also important is the grinding capacity of wheat which is affected by kernel size and leveling, the shape of grains, weight per 100 kernels and glassiness, depending on the protein content. That's why, the increase in protein content helps to increase the weight per 100 kernels and glassiness, which in turn contributes to greater output flour and improves its structure [1, 2].

M.I. Vavylov, and then also I.M. Eremeev on the example of the world known variety Ukrainka 0246, proved that one, even the best variety is not able to satisfy all the needs of the production [3].

Role of the variety in ensuring the stability of crop area is well known. It provides up to a 50% surcharge gross grain production. The innovative potential of new varieties and hybrids increases the efficiency of modern agricultural technologies, payback of technological factors through greater productivity, better grain quality and higher resistance to biotic and abiotic factors of the environment [4].

**Materials and methods.** Experimental work was carried out in the short experiment of Uman National University of Horticulture during the 2011-2012.

The agricultural technique of winter wheat growing is common for Right-Bank Forest-Steppe of Ukraine. During the experiment winter wheat was grown, which the precursor was oats for green fodder.

The total area of the plot in the short experiment was 5 m<sup>2</sup>, repetition of the experiment - four times, placement of the plots was consecutive. Establishment of field investigations, making observations and research was carried out in accordance with the recommendations, guidelines and manuals of recent years.

For qualitative assessment of yield in grain winter wheat the grain unit was determined in accordance with GOST 10840-64, weight per 100 kernels in accordance with GOST 10842-76, kernel size - according to the method of state variety testing.

Mathematical treatment of experimental materials was performed by method of dispersive analysis of one-way field experience using standard software package "Microsoft Excel 2003".

Weather conditions during the investigation period were unstable compared with average year indices.

Weather conditions in 2011 were characterized by sufficient rainfall. Thus, for the period April - July 294.3 mm of rain fell that is 1.1 times more in comparison with average year index.

Weather conditions in 2012 were also characterized by sufficient rainfall. Thus, for the period April - July 373.6 mm of rain fell, which is 1.3 times more in comparison with average year index. But this year was characterized by lower temperatures and higher relative humidity, which adversely affected the quality formation of winter wheat.

**Results and discussion.** Linear dimensions of winter wheat grain varied depending upon the place of variety creation and weather conditions during the years of research. Thus, on the average in

two years of the research the length of winter wheat varieties ranged from 6,1-7,3 mm, thickness – 2,9-3,5 , width – 3,1-4,2 (Table 1).

Table 1

**Linear dimensions of winter wheat grain depending on the variety, mm**

Variety	Research year						Average for two years of the research		
	2011			2012					
	length	thickness	width	length	thickness	width	length	thickness	width
<b>Varieties, created under conditions of the Right Bank Forest Steppe</b>									
Podolianka (control)	7,3	3,3	4,2	7,1	3,1	4,0	7,2	3,2	4,1
Afina	7,1	3,3	4,1	7,1	3,7	4,3	7,1	3,5	4,2
Afrodita	6,4	3,1	3,3	6,2	3,1	3,1	6,3	3,1	3,2
Artia	6,1	3,2	3,1	6,1	3,2	3,5	6,1	3,2	3,3
Favorytka	6,1	3,1	3,0	6,3	3,1	3,2	6,2	3,1	3,1
Zolotokosa	7,3	3,2	4,1	7,3	3,0	4,3	7,3	3,1	4,2
Kniagynia Olga	7,3	3,2	3,1	7,1	3,2	3,1	7,2	3,2	3,1
Myronivska 808	7,0	3,0	4,3	7,2	3,2	4,1	7,1	3,1	4,2
<b>Varieties, created under conditions of Steppe</b>									
Lastivka Odeska	7,5	3,3	3,2	7,1	3,1	3,2	7,3	3,2	3,2
Tronka	6,2	2,8	3,3	6,4	3,0	3,1	6,3	2,9	3,2
Donetska 48	6,2	2,9	4,2	6,6	3,3	4,0	6,4	3,1	4,1
<b>Varieties of foreign selection</b>									
Plutos	7,1	3,0	4,1	7,1	3,2	4,1	7,1	3,1	4,1
Lupus	6,2	3,3	3,4	6,0	3,1	3,0	6,1	3,2	3,2
Torrild	6,4	2,7	3,3	6,2	2,9	3,1	6,3	2,8	3,2
<i>HIP<sub>05</sub></i>	0,3	0,2	0,2	0,3	0,2	0,2			

Among the varieties cultivated in the conditions of Right-Bank Forest Steppe the greatest length was by the variety Zolotokolosa - 7.3 mm, what is 0.1 mm more compared with the variety Podolianka. Minimum length was by the variety Artia - 6.1 mm. Length of the rest of the varieties ranged from 6.2-7.2 mm. However, the maximum thickness was by the variety Afina - 3.5 mm that exceeds the control at 0.3 mm or 9.3%. The thickness of the remaining grain of other varieties ranged from 3.1-3.2 mm. Maximum width was by the varieties Afina, Zolotokolosa and Myronivska 808 - 4.2 mm, which was 0.1 mm higher than the control. Width of the other grain varieties ranged from 3.1 to 3.3 mm.

Among the varieties that were created in the conditions of Steppe the length of grain of the only variety Lastivka Odeska exceeded the control at 0.1 mm and was 7.3 mm, the rest of the varieties varied from 6.3 to 6.4 mm. The greatest thickness of the grain was by the variety Lastivka Odeska - 3.2 mm, as well as the control. The thickness of the rest of the varieties ranged from 2.9 to 3.2 mm. The greatest width of the grain was by the variety Donetska 48 - 4.1 mm, as well as control. Width of the other grain varieties was 3.2 mm.

Among the varieties of foreign selection concerning the grain length none of the varieties exceed the control. The maximum length was sort by the variety Plutos - 7.1 mm, other varieties ranged from 6.1 to 6.3 mm. Grain thickness of the variety Lupus was 3.2 mm, as well as the control. And thickness of other varieties ranged from 2.8 to 3.1 mm. Grain width by the variety Plutus was 4.1 mm, the other varieties showed lesser width – 3.2 mm.

Kernel size of winter wheat also changed depending on the place of variety creation and weather conditions during the years of research. Thus, on the average, during two years of research the

kernel size of winter wheat varieties ranged between 2,6-2,8 – 2,8-3,0 (*Table 2*). Among the varieties cultivated under the conditions of the Right-Bank Forest Steppe by the varieties Afina and Artia the kernel size was 2,8-3,0. By other varieties the kernel size was 2,6-2,8 that was at grade Podolianka.

Among the varieties that are created under the conditions of steppe only by the varieties Lastivka Odeska and Tronka the kernel size was 2,8-3,0, and the by the variety Donetska 48 – 2,6-2,8.

Varieties of foreign selection had the following kernel size: variety Torrild – 2,4-2,6 , Lupus – 2,6-2,8, Plutos – 2,6-3,0.

Our research determined that weight per 1000 kernels was significantly affected by weather conditions. Thus, lack of moisture and high air temperature during the ripening of winter wheat in 2012 helped to reduce weight per 1000 kernels. Therefore, weight per 1000 kernels was higher in 2011 and the largest weight was observed by the variety Afina – 53 g.

*Table 2*

**Kernel size of winter wheat grain depending on the variety, mm**

Variety	Research year		Average for two years of the research
	2011	2012	
<b>Varieties, created under conditions of the Right Bank Forest Steppe</b>			
Podolianka (control)	2,6-2,8	2,6-2,8	2,6-2,8
Afina	2,8-3,0	2,8-3,0	2,8-3,0
Afrodita	2,6-2,8	2,6-2,8	2,6-2,8
Artia	2,8-3,0	2,8-3,0	2,8-3,0
Favorytka	2,6-2,8	2,6-2,8	2,6-2,8
Zolotokosa	2,6-2,8	2,6-2,8	2,6-2,8
Kniagynia Olga	2,6-2,8	2,6-2,8	2,6-2,8
Myronivska 808	2,6-2,8	2,6-2,8	2,6-2,8
<b>Varieties, created under conditions of Steppe</b>			
Lastivka Odeska	2,8-3,0	2,8-3,0	2,8-3,0
Tronka	2,8-3,0	2,8-3,0	2,8-3,0
Donetska 48	2,6-2,8	2,6-2,8	2,6-2,8
<b>Varieties of foreign selection</b>			
Plutos	2,6-3,0	2,6-3,0	2,6-2,8
Lupus	2,6-2,8	2,6-2,8	2,6-2,8
Torrild	2,4-2,6	2,4-2,6	2,4-2,6

In general over the two years of research weight per 1000 kernels of winter wheat ranged from 34,6 to 52,5 g (*Table 3*). Of the varieties created under the conditions of Right-Bank Forest Steppe, the variety Afina showed the biggest weight per 1000 kernels – 52,5 g, exceeding the control at 7 g or 15 %. By other varieties weight per 1000 kernels ranged from 38,7 to 43,6 g.

Among the varieties created under the conditions of northern Forest Steppe none of the varieties exceed weight per 1000 kernels of Podolianka variety. The smallest weight per 1000 kernels had the variety Favorytka – 40.5 g, weight per 1000 kernels of other varieties ranged from 41,7 to 44,8 g or 1,5-8 % lower than by the variety Podolianka.

Of the varieties that were created under the conditions of steppe the weight per 1000 kernels had the variety Tronka – 46.8 g, exceeding the control by 1.3 g or 3 %. By the variety Donetska 48 weight per 1000 kernels was 45.5 g, which was comparable to Podolianka variety and variety Lastivka Odeska had weight per 1000 kernels 44.6 g or 2% less, compared with the control.

By the varieties of foreign selection the weight per 1000 kernels ranged from 34,6 to 44,8 g that was 1,9-23,9% less compared with the control.

Table 3

**Weight per 1000 kernels of winter wheat, depending on the variety, g**

Variety	Research year		Average for two years of the research
	2011	2012	
<b>Varieties, created under conditions of the Right Bank Forest Steppe</b>			
Podolianka (control)	46,0	45,0	45,5
Afina	53,0	52,0	52,5
Afrodita	39,4	38,0	38,7
Artia	44,1	43,0	43,6
Favorytka	41,0	40,0	40,5
Zolotokosa	45,0	44,0	44,5
Kniagynia Olga	43,0	42,0	42,5
Myronivska 808	45,5	44,0	44,8
<b>Varieties, created under conditions of Steppe</b>			
Lastivka Odeska	45,1	44,0	44,6
Tronka	47,6	46,0	46,8
Donetska 48	46,0	45,0	45,5
<b>Varieties of foreign selection</b>			
Plutos	37,1	36,0	36,6
Lupus	45,5	44,0	44,8
Torrild	35,2	34,0	34,6
<i>HIP<sub>05</sub></i>	2,2	2,1	

On the average over the two years of research the grain unit of winter wheat ranged from 662 to 782 g/l (Table 4). Among the varieties created under the conditions of the Right-Bank Forest Steppe only Zolotokolosa variety exceeded control, its grain unit was 756 g/l. The grain unit of other varieties ranged from 662 to 728 g/l.

Table 4

**Grain unit of winter wheat, depending on the variety, g/l**

Variety	Research year		Average for two years of the research
	2011	2012	
<b>Varieties, created under conditions of the Right Bank Forest Steppe</b>			
Podolianka (control)	750	705	728
Afina	672	652	662
Afrodita	710	699	705
Artia	682	649	666
Favorytka	745	703	724
Zolotokosa	765	747	756
Kniagynia Olga	732	718	725
Myronivska 808	721	707	714
<b>Varieties, created under conditions of Steppe</b>			
Lastivka Odeska	742	718	730
Tronka	750	727	739
Donetska 48	790	773	782
<b>Varieties of foreign selection</b>			
Plutos	735	711	723
Lupus	790	766	778
Torrild	724	697	711
<i>HIP<sub>05</sub></i>	36	35	

Among the varieties created under the conditions steppe all the varieties had high grain unit. The largest grain unit was by the variety Donetska 48 – 782 g/l, the grain unit of other varieties ranged from 730 to 739 g/l.

By the varieties of foreign selection variety Lupus exceeded control, hits grain unit was - 778 g/l, which was more than 6.8% compared with the control. Grain unit of other varieties ranged from 711 to 723 g/l.

Favorable temperature and water regime in 2011 contributed to the formation of a larger grain unit of winter wheat, which ranged from 672 to 790 g/l. High air temperatures during the growing season of wheat and lack of moisture in the stage of grain formation caused the smaller grain units.

**Conclusions.** It was determined by the research that winter wheat is characterized by high technological properties that vary considerably depending on the variety. Big kernel size (2,8-3,0 mm) have the varieties Afina, Artia, Lastivka Odeska, Tronka and Plutos, but the highest grain unit have the varieties Zolotokolosa, Donetska 48 and Lupus, which ranged from 756 to 782 g/l. Big weight per 1000 kernels have the varieties Podolianka, Afina, Artia, Zolotokolosa, Myronivska 808, Lastivka Odeska, Tronka, Donetsk a48, Lupus.

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### Анотація

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#### **Фізичні показники якості зерна пшениці озимої залежно від сорту**

*Встановлено, що зерно досліджуваних сортів пшениці озимої має хороші фізичні показники якості. Велику крупність зерна мають сорти Афіна, Артія, Ластівка одеська, Тронка і Плутос, яка становить 2,8–3,0 мм, однак вищу натуру зерна мають сорти Золотоколоса, Донецька 48 і Лупус – 756–782 г/л. Велику масу 1000 зерен – сорти Подолянка, Афіна, Артія, Золотоколоса, Миронівська 808, Ластівка одеська, Тронка, Донецька 48, Лупус.*

**Ключові слова:** пшениця озима, лінійні розміри, крупність, маса 1000 зерен, натура

### Аннотация

**Любич В.В.**

#### **Физические показатели качества зерна пшеницы озимой в зависимости от сорта**

*Зерно исследуемых сортов озимой пшеницы характеризуется высокими технологическими свойствами. Большую крупность зерна имеют сорта Афина, Арттия, Ласточка одесская, Тронка и Плутос, которая составляла 2,8-3,0 мм, однако высшую натуру зерна имеют сорта Золотоколосая, Донецкая 48 и Лупус, которая колебалась в пределах 756-782 г/л. Большую массу 1000 зерен имеют сорта Подолянка, Афина, Арттия, Золотоколосая, Миронивская 808, Ласточка одесская, Тронка, Донецкая 48, Лупус.*

**Ключевые слова:** пшеница озимая, линейные размеры, крупность, масса 1000 зерен, натура