

UDC 664.71–11.001.32

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## **PROTEIN CONTENT AND ITS EXIT WITH THE YIELD OF WINTER WHEAT GRAIN DEPENDING ON THE VARIETY**

*Formation of yield, protein content and its exit from the harvest of winter wheat and flour yield, as well as flour yield depending on the variety and peculiarities of weather conditions during the years of research have been investigated. It was determined that the highest protein content and flour yield provides cultivation of the varieties Donetsk 48, Harus and Bilotserkivska semidwarf.*

**Keywords:** *protein, flour yield, protein yield*

**Introduction.** Obtaining of high-quality grain is largely dependent on the varietal characteristics, fertility of soil and weather conditions. These varietal characteristics are determinative in the formation of protein content, although environmental and agronomic factors strengthen or weaken this property. Modern production is provided with high-yielding wheat varieties capable under optimal growing conditions form a high-quality grain. However, the quality of commodity grain coming from the fields is still low and, according to many researchers, continues year after year to drop off [1–3]. Many people think that this situation is caused by negative relationship between the quantity of yield and protein content. [2, 4, 5]. Others argue that there is no inverse relationship between the quantity of yield and protein content. [6].

According to many researchers the main reason for the decrease of grain quality in production environment is the insufficient involvement of wheat plants with nutrients, especially nitrogen [7]. Genetic program of the variety is only basis for obtaining high-quality grain. According to A.A. Sozinov and V.G. Kozlov [8], grain protein content to 70% depends on growing conditions and to 30% on the varietal characteristics, but the quality of protein complex, vice versa. In order to know how is it possible to overcome the well known negative correlation between crop yield and protein content, it is necessary to know the genetic nature of these figures and the real possibility of increasing its content. [9]

**Materials and methods.** Experimental work was carried out under conditions of teaching and research and production department of Uman National University of Horticulture during the 2011–2012.

Farming culture of winter wheat is common for Right-Bank Forest-Steppe of Ukraine [11]. In our experiment we cultivated winter wheat, which precursor was vetch and oat mix for green fodder.

Total area of land plot 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 [12, 13].

For qualitative assessment of yield the protein content winter was determined in accordance with GOST 4117:2007, the harvest was gathered on every land plot, mathematical and statistic treatment of experimental materials was performed using standard software package "Microsoft Excel 2003".

**Results and discussion.** Our studies revealed that protein content in grain was significantly affected by weather conditions. Thus, lack of moisture and high air temperature during the ripening of winter wheat grain in 2012 contributed to the increase of protein content (Table 1). Therefore its content compared to 2011 was higher and the largest content was by the variety Bilotserkivska semidwarf – 18,4%.

On the average over the two years of research the highest protein content was by the varieties Donetska 48 and Bilotserkivska semidwarf that exceed standard on 0,7–2 points or by 4–13%. The lowest figures were by the varieties Zolotokolosa – 7,7%, Artemida – 9,7% and Favorytka – 9,9%.

As a result of the research it was determined that the highest yield capacity had the varieties of Artemida, Harus, Vdala, Zolotokolosa and Tronka that exceed standard on 0,7–2,6 t/ha or 8–30%, which was also significant, compared to  $NIR_{05} = 0,4$  for the years of research. Yield capacity of other varieties ranged between 3,7–8,7 t/ha.

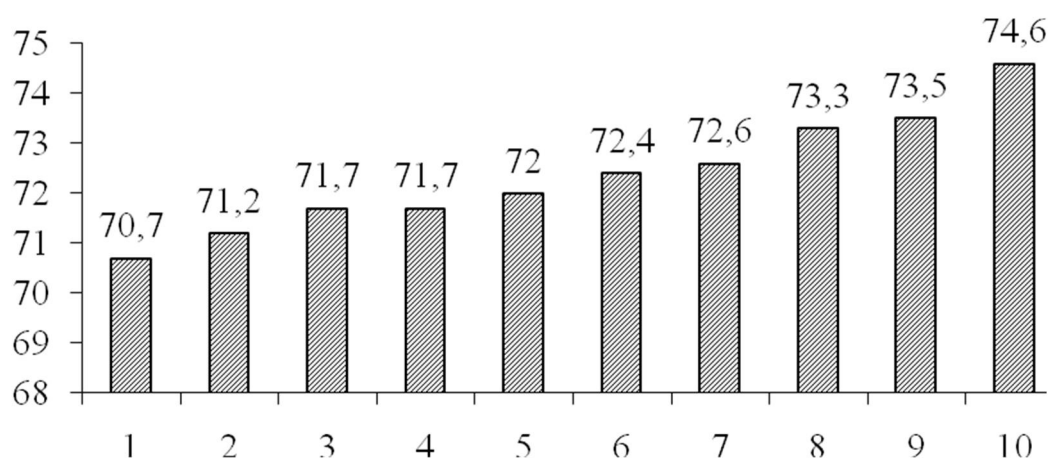
Table 1

**Protein content in winter wheat grain, depending on the variety, %**

| Variety                  | Research year |      | Average for two years of the research |
|--------------------------|---------------|------|---------------------------------------|
|                          | 2011          | 2012 |                                       |
| Podolyanka (standard)    | 15,3          | 16,4 | 15,9                                  |
| Zolotokolosa             | 7,1           | 8,2  | 7,7                                   |
| Artemida                 | 9,1           | 10,2 | 9,7                                   |
| Favorytka                | 9,3           | 10,4 | 9,9                                   |
| Tronka                   | 12,6          | 13,6 | 13,1                                  |
| Kniagynia Olga           | 13,3          | 14,4 | 13,9                                  |
| Vdala                    | 13,5          | 14,6 | 14,0                                  |
| Harus                    | 15,1          | 16,2 | 15,7                                  |
| Donetska 48              | 16,0          | 17,1 | 16,6                                  |
| Bilotserkivska semidwarf | 17,3          | 18,4 | 17,9                                  |
| $HIP_{05}$               | 0,6           | 0,7  |                                       |

The highest nominal flour yield per grain unit was obtained from grain of the varieties Zolotokolosa – 73,3%, Vdala – 73,5% and Donetska 48 – 74,6%, in other varieties, this index ranged from 70,7–72,6% (Fig. 1).

Favorable temperature and water regime in 2011 contributed to the formation of higher yield capacity of winter wheat, which ranged between 4,1–11,7 t/ha (Table 2). High air temperature during the growing season of wheat and lack of moisture in the phase of caryopsides formation determined the obtain of lower yield capacity (4,12–11,72 t/ha).



1 – Bilotserkivska semidwarf; 2 – Harus; 3 – Favorytka; 4 – Knyagynia Olga; 5 – Podolianka; 6 – Tronka; 7 – Artemida; 8 – Zolotokolosa; 9 – Vdala; 10 – Donetska 48.

**Fig. 1. Nominal flour yield per unit of winter wheat grain depending on the variety (2011–2012), %**

Table 2

## Yield capacity of winter wheat grain depending on the variety, t/ha

| Variety                  | Research year |       | Average for two years of the research |
|--------------------------|---------------|-------|---------------------------------------|
|                          | 2011          | 2012  |                                       |
| Podolyanka (standard)    | 9,12          | 8,42  | 8,77                                  |
| Knyagynia Olga           | 4,12          | 3,40  | 3,76                                  |
| Bilotserkivska semidwarf | 7,43          | 6,73  | 7,08                                  |
| Favorytka                | 8,10          | 7,53  | 7,80                                  |
| Donetska 48              | 9,10          | 8,42  | 8,76                                  |
| Artemida                 | 9,85          | 9,11  | 9,48                                  |
| Harus                    | 9,82          | 9,22  | 9,52                                  |
| Vdala                    | 10,51         | 9,93  | 10,22                                 |
| Zolotokosa               | 11,23         | 10,53 | 10,88                                 |
| Tronka                   | 11,72         | 11,00 | 11,36                                 |
| <i>HIP</i> <sub>05</sub> | 0,42          | 0,40  |                                       |

Using correlation analysis, we found a strong correlation dependence ( $r = 0,94$ ) between protein content in winter wheat grain and crop capacity, which is described by the following regression equation:

$$y = 0,5995x + 0,6527, \text{ where}$$

$y$  – the protein content, %;

$x$  – crop capacity, t/ha (Fig. 2).

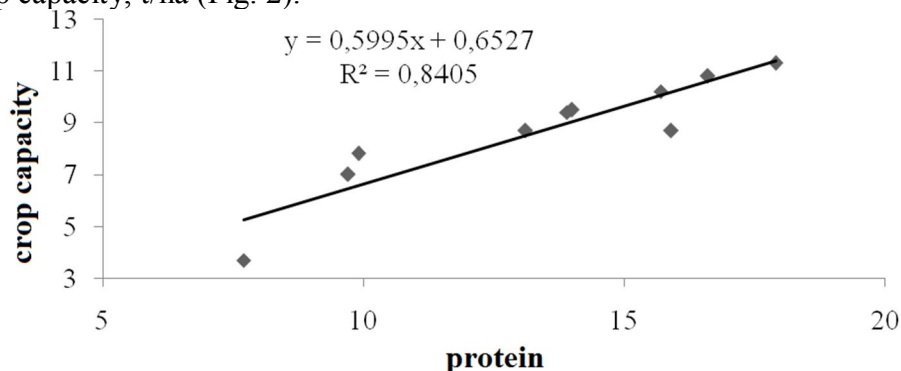
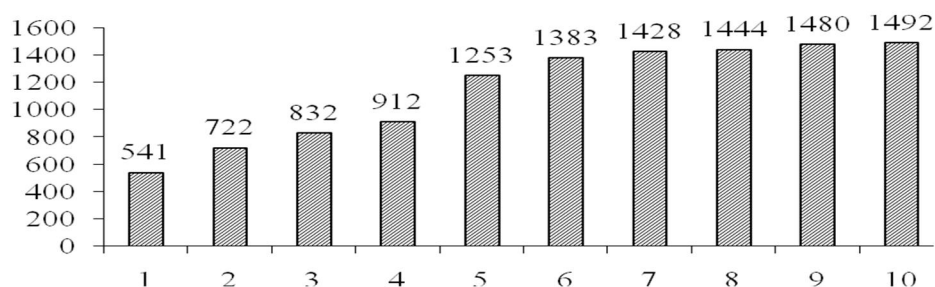


Fig. 2. Correlation dependence between protein content grain and crop capacity of winter wheat in 2011–2012

Exit protein also varied depending on the variety. Thus, the smallest protein exit was by the varieties Kniagynia Olga – 541 kg/ha, Favorytka – 722 kg/ha and Zolotokolosa – 832 kg/ha, and such varieties as Vdala, Harus, Donetska 48 and Tronka exceeded control at 45–109 kg/ha or to 3–8% (Fig. 3).



1 – Kniagynia Olga; 2 – Favorytka; 3 – Zolotokosa; 4 – Atemida; 5 – Bilotserkivska semidwarf; 6– Podolianka; 7 – Vdala; 8 – Donetska 48, 9 – Tronka; 10 – Harus

Fig. 3. Protein exit by the yields of soft winter wheat grain depending on the variety, (2011–2012pp.), kg/ha

**Conclusion.** Thus, the crop capacity and protein content of winter wheat grain depends on the weather of growing season, temperature and variety. High air temperature and lack of moisture in the soil contributes to the formation of higher protein content in grain.

The high protein content in grain form such varieties as Bilotserkivska semidwarf – 17.9%, Donetska 48 – 16.6 and Harus – 15.7%. However, the highest protein exit is provided by such varieties as Vdala, Donetska 48, Tronka and Harus in which this figure ranged from 1428-1492 kg/ha.

The highest nominal yield flour (73,3–74,6%) provided such varieties as Zolotokosa, Vdala and Donetska 48.

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### Анотація

**Полянецька І.О., Любич В.В., Сухомуд О.Г.**

**Вміст білка і його вихід з урожаю зерна пшениці озимої залежно від сорту.**

*Досліджено формування врожайності, вмісту білка і його виходу з урожаю озимої пшениці, а також вихід борошна залежно від сорту і особливостей погодних умов років досліджень. Встановлено, що високий вміст білка і вихід борошна забезпечує вирощування сортів Донецька 48, Харус і Білоцерківська напівкарликова.*

**Ключові слова:** білок, вихід борошна, вихід білка

*Аннотация*

*Полянецкая И.О., Любич В.В., Сухомуд О.Г.*

*Содержание белка и его выход из урожая зерна пшеницы озимой зависимости от сорта*

*Исследовано формирование урожайности, содержания белка и его выхода с урожаем озимой пшеницы, а также выход муки в зависимости от сорта и особенностей погодных условий лет исследований. Установлено, что высокое содержание белка и выход муки обеспечивает выращивание сортов Донецкая 48, Харус и Белоцерковская полукарликовая.*

***Ключевые слова:** белок, выход муки, выход белка*