SEED QUALITY INDICATORS OF WINTER BREAD WHEAT ACCESSIONS DEPENDING ON THE GRAIN SIZE

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Scientific/theoretical review of studies of the seed size effect on the seed yield and sowing qualities was conducted. The results of a 2016–2018 study of the grain size influence on the germination energy, laboratory germinability and 1000-grain weight in winter bread wheat are presented. The relationship between the grain size and the sowing qualities of seeds was established. Varieties with a high 1000-grain weight (Doskonala, Pryvablyva, Smuhlianka, and Haiok) and high germination energy and germinability (Yednist, Harmonika and Bunchuk), as well as varieties and lines that showed a high germinability of small seeds (2.2 x 20 mm), were distinguished.

Key words: winter wheat, accession, seed quality, grain size, germination energy, laboratory germinability, 1000-grain weight

Introduction. Improvement of seed production and quality are important to achieve high and stable yields, and the most efficient use of the obtained seeds is the main objective of agriculture [1, 2].

Literature review and problem articulation. Sowing qualities of seeds are a set of biological and economic features and properties that characterize the suitability of a crop for sowing [3]. In Ukraine, they are regulated by the State Standard DSTU–22-40-93 [4]. The following seed quality indicators have been introduced for winter wheat: varietal purity, content of the main crop, laboratory germinability, water content, viability, disease and pest infestation, which vary slightly depending on the seed category. Only seeds that meet these requirements are considered certified and allowed for sowing [5].

Of the sowing qualities of winter wheat seeds, the laboratory germinability, which is the main factor in recognizing seeds as certified or non-certified, is of great importance. This indicator is affected by a large number of natural factors, primarily the air humidity and temperature mode [6].

The output of winter wheat seeds depends primarily on the grain yield and 1000-grain weight [7]. The 1000-grain weight is an important indicator of sowing qualities of seeds, which is determined be a complex of weather and agronomic factors [8].

When preparing seeds for sowing, one should select seeds of the highest quality. M.Ya. Kyrpa [9] noted that the winter wheat top-quality seeds weighing 40–42 g were tailings from sieves 2.5 x 20 mm; the content of such seeds averaged 71.6%, with fluctuations from 68.3% to 76%, depending on varieties.

The seed size effect on the seed yield has been studied by many scientists, but so far there is no consensus on this issue. Analyzing the results of an eight-year study, H.V. Huliaev points to the clear advantage of large seeds over small ones [10]. According to the results of a study conducted at Podillia Experimental Station of Ternopil Institute of Agroindustrial Production confirmed the prospects for using large seeds [11].

I.H. Strona made a significant contribution to solving this problem. He found that the seed size was not a decisive factor in obtaining a high yield, although the plant performance tends to increase with increasing seed weight. Seeds of medium and larger than medium size are considered robust and productive [12].

© O.O. Skrypnyk, O.Yu. Leonov, T.P. Shyianova, K.Yu. Suvorova, Z.V. Usova. 2021.
ISSN 1026-9959. Селекція і насінництво. 2021. Випуск 119
I.A. Lutak and A.V. Shapoval claim that the sowing qualities of the grown seeds do not significantly depend on the size of the sown seeds, and the highest yield of spring wheat seeds is achieved when seeds of 2.2 x 20 mm or larger are sown [13].

**Purpose.** To evaluate the influence of seed sorting by size on their quality indicators: germination energy, laboratory germinability and 1000-grain weight.

**Material and methods.** The study was conducted at the Plant Production Institute named after V.Ya. Yuriev of NAAS in 2016–2018. The technology of growing winter wheat (tillage, sowing time, sowing depth, etc.) is conventional for the eastern Forest-Steppe of Ukraine. The predecessor was black fallow. Sowing was performed by the standard method in four replications. The record area was 10 m$^2$. Twenty six varieties and lines of winter bread wheat were studied.

Winter bread wheat seeds were separated on a laboratory separator RLU-3 by sifting through sieves with rectangular openings of 2.2 x 20, 2.5 x 20 and 2.8 x20 mm in accordance with the technique of qualification examination of plant varieties for suitability for dissemination in Ukraine [14]. The seed quality indicators were determined in accordance with DSTU 4138-2002 [15].

**Results and discussion.** 2017 had the best conditions for growing winter bread wheat seeds of good quality, and 2016 – the worst. Characterizing major grain sizes, first, one should determine the 1000-grain weight for each grain size (Table 1). Over the study years, the 1000-grain weight in winter wheat varieties (LSD BC $0.05 = 0.22$) varied as follows: in 2016, the weight was 44.2–53.0 g for 2.8 x 20 mm seeds, 34.7–42.3 g for 2.5 x 20 mm seeds and 25.2–32.7 g for 2.2 x 20 mm seeds; in 2017, it was 44.5–54.6 g for 2.8 x 20 mm seeds, 36.1–43.8 g for 2.5 x 20 mm seeds and 26.3–33.5 g for 2.2 x 20 mm seeds; in 2018, it was 42.0–50.5 g for 2.8 x 20 mm seeds, 33.9–40.3 g for 2.5 x 20 mm seeds and 25.1–31.0 g for 2.2 x 20 mm seeds.

On average for the three study years, the following varieties were distinguished by the ‘1000-grain weight’ trait: Doskonala (52.2 g) and Pryvablyva (51.3 g) for 2.8 x 20 mm seeds, Smuhlianka (42.1 g) and Doskonala (41.7 g) for 2.5 x 20 mm seeds and Smuhlianka (32.4 g) and Haiok (31.5 g) for 2.2 x 20 mm seeds. It should be noted that seeds of the same size had various weights of 1000 grains in different winter wheat varieties. It was also found that the significant difference in the 1000-grain weight was 9.9 g for seeds separated on sieves of 2.8 x 20 mm and 2.5 x 20 mm seeds and 26.3–33.5 g for 2.2 x 20 mm seeds; in 2018, it was 42.0–50.5 g for 2.8 x 20 mm seeds, 33.9–40.3 g for 2.5 x 20 mm seeds and 25.1–31.0 g for 2.2 x 20 mm seeds.

The germination energy varied as follows: in 2016, it was 73.5–92.5% for 2.8 x 20 mm seeds, 64.0–92.0% for 2.5 x 20 mm seeds and 62.0–89.8% for 2.2 x 20 mm seeds; in 2017, it was 87.5–97.8% for 2.8 x 20 mm seeds, 88.5–98.8% for 2.5 x 20 mm seeds and 91.0–98.0% for 2.2 x 20 mm seeds; in 2018, it was 83.8–98.0% for 2.8 x 20 mm seeds, 81.8–97.8% for 2.5 x 20 mm seeds and 85.3–98.0% for 2.2 x 20 mm seeds. Like the germination energy, the germinability of winter wheat seeds was the lowest in 2016. In 2016, the germinability of 2.2 x 20 mm seeds of all the varieties and lines did not meet the requirements of the Standard (92%) (Table 3).
| Accession (factor A) | 2.8 x 20 мм | 2.5 x 20 мм | 2.2 x 20 мм |
|---------------------|-------------|-------------|-------------|
|                     | 2016 | 2017 | 2018 | Average | 2016 | 2017 | 2018 | Average | 2016 | 2017 | 2018 | Average |
| Podolianka          | 51.1 | 52.3 | 49.2 | 50.8 | 39.3 | 40.5 | 38.7 | 39.5 | 29.0 | 29.7 | 29.1 | 29.3 |
| Smuhlianka          | 50.0 | 53.7 | 48.2 | 50.6 | 42.3 | 43.8 | 40.3 | 42.1 | 32.7 | 33.5 | 31.0 | 32.4 |
| Bunchuk             | 44.7 | 44.5 | 42.5 | 43.9 | 36.4 | 36.1 | 33.9 | 35.5 | 28.1 | 27.4 | 25.7 | 27.1 |
| Yednist             | 48.0 | 45.5 | 42.9 | 45.4 | 38.0 | 37.3 | 35.5 | 36.9 | 28.0 | 27.6 | 26.5 | 27.3 |
| Ferrungineum 1239   | 44.2 | 44.7 | 42.0 | 43.6 | 34.7 | 36.7 | 34.2 | 35.3 | 26.1 | 28.9 | 26.0 | 27.0 |
| Kharkivska 81       | 46.6 | 47.5 | 44.4 | 46.2 | 36.5 | 40.1 | 36.3 | 37.6 | 25.2 | 28.9 | 26.2 | 26.7 |
| Doridna             | 50.0 | 50.3 | 47.5 | 49.3 | 41.0 | 40.4 | 38.3 | 39.9 | 31.4 | 30.9 | 29.3 | 30.5 |
| Statna              | 50.2 | 48.7 | 46.0 | 48.3 | 39.9 | 40.2 | 37.8 | 39.3 | 29.5 | 29.6 | 27.9 | 29.0 |
| Alians              | 50.1 | 49.8 | 45.6 | 48.5 | 37.8 | 37.7 | 35.0 | 36.8 | 27.0 | 26.3 | 25.1 | 26.1 |
| Doskonalna          | 51.6 | 54.6 | 50.5 | 52.2 | 40.9 | 42.7 | 39.9 | 41.2 | 30.0 | 31.2 | 30.2 | 30.5 |
| Rozkishna           | 50.1 | 51.2 | 47.2 | 49.5 | 41.2 | 41.8 | 38.8 | 40.6 | 30.4 | 30.5 | 28.6 | 29.8 |
| Fermerka            | 50.4 | 50.9 | 48.0 | 49.7 | 39.2 | 40.0 | 38.0 | 39.1 | 28.5 | 29.5 | 28.2 | 28.8 |
| Zapashna            | 49.6 | 51.0 | 45.9 | 48.8 | 39.3 | 39.0 | 36.5 | 38.3 | 30.0 | 30.0 | 28.5 | 29.5 |
| Pryvablyva          | 51.4 | 52.3 | 50.1 | 51.3 | 40.2 | 40.8 | 39.8 | 40.3 | 29.5 | 29.9 | 30.2 | 29.9 |
| Pryvinya            | 49.3 | 51.4 | 48.7 | 49.8 | 38.9 | 38.5 | 37.3 | 38.2 | 28.8 | 29.3 | 28.3 | 28.8 |
| Zdobna              | 51.6 | 51.8 | 47.7 | 50.4 | 38.9 | 38.6 | 35.3 | 37.6 | 28.3 | 27.1 | 25.7 | 27.0 |
| Krasa Laniv         | 46.6 | 46.4 | 43.0 | 45.3 | 36.2 | 37.6 | 35.4 | 36.4 | 26.9 | 26.8 | 26.9 | 26.9 |
| Harmonika           | 49.8 | 49.6 | 47.0 | 48.8 | 39.2 | 40.3 | 38.5 | 39.4 | 30.5 | 31.3 | 30.3 | 30.7 |
| Patriotka           | 49.7 | 50.5 | 46.8 | 49.0 | 39.7 | 40.6 | 37.4 | 39.2 | 31.4 | 32.0 | 29.2 | 30.9 |
| Vyhadka             | 49.9 | 49.9 | 46.9 | 48.9 | 40.1 | 41.4 | 37.8 | 39.8 | 29.6 | 30.3 | 28.0 | 29.3 |
| Dyvo                | 49.2 | 47.8 | 46.0 | 47.7 | 39.4 | 38.9 | 37.6 | 38.6 | 30.1 | 30.4 | 28.9 | 29.8 |
| Haiok               | 51.1 | 51.7 | 47.4 | 50.1 | 40.0 | 40.8 | 36.8 | 39.2 | 31.7 | 32.8 | 29.9 | 31.5 |
| Metelytsia Kharkivska | 50.2 | 51.4 | 48.1 | 49.9 | 39.3 | 41.2 | 38.8 | 39.8 | 29.4 | 31.9 | 30.0 | 30.4 |
| Lutescens 217-13    | 53.0 | 52.1 | 47.9 | 51.0 | 41.7 | 41.5 | 38.6 | 40.6 | 29.6 | 29.9 | 28.3 | 29.3 |
| Erythrosperrum 408-13 | 48.6 | 49.6 | 44.4 | 47.5 | 39.4 | 40.2 | 35.5 | 38.4 | 30.1 | 31.3 | 27.1 | 29.5 |
| Erythrosperrum 164-13-3m | 48.4 | 49.5 | 46.5 | 48.1 | 38.8 | 40.1 | 37.8 | 38.9 | 28.1 | 29.2 | 27.7 | 28.3 |
| **Average**         | 49.5 | 50.1 | 46.7 | 48.8 | 39.2 | 39.9 | 37.4 | 38.9 | 29.3 | 29.9 | 28.3 | 29.2 |

Note: LSD A (0.05) = 0.37, LSD B = 0.13, LSD C = 0.13, LSD AB = 0.64, LSD AC = 0.64, LSD BC = 0.22, LSD ABC = 1.11
| Accession (factor A) | 2.8 x 20 мм | 2.5 x 20 мм | 2.2 x 20 мм |
|---------------------|-------------|-------------|-------------|
|                     | 2016       | 2017       | 2018       | 2016       | 2017       | 2018       | 2016       | 2017       | 2018       | Average  |
| Podolianka          | 91.8       | 95.5       | 95.3       | 94.2       | 87.8       | 95.3       | 92.5       | 91.8       | 88.3       | 95.8       | 90.5       | 91.5       |
| Smuhlianka          | 86.3       | 95.8       | 94.5       | 92.2       | 91.0       | 95.5       | 91.5       | 92.7       | 89.8       | 96.3       | 91.8       | 92.6       |
| Bunchuk             | 88.3       | 97.8       | 98.0       | 94.7       | 89.8       | 96.0       | 95.8       | 93.8       | 87.5       | 96.5       | 98.0       | 94.0       |
| Yednist             | 92.0       | 97.3       | 98.0       | 95.8       | 92.0       | 95.3       | 97.8       | 95.0       | 88.8       | 94.0       | 96.3       | 93.0       |
| Ferrugineum 1239    | 73.5       | 94.5       | 90.5       | 86.2       | 64.0       | 95.5       | 92.0       | 83.8       | 62.0       | 91.5       | 89.5       | 81.0       |
| Kharkivska 81       | 79.5       | 87.5       | 94.5       | 87.2       | 77.0       | 88.5       | 93.5       | 86.3       | 78.0       | 91.0       | 94.5       | 87.8       |
| Doridna             | 92.5       | 96.3       | 86.5       | 91.8       | 90.5       | 96.0       | 86.0       | 90.8       | 85.5       | 95.3       | 86.8       | 89.2       |
| Statna              | 84.0       | 96.8       | 93.3       | 91.3       | 83.0       | 93.0       | 91.5       | 89.2       | 82.8       | 91.3       | 93.0       | 89.0       |
| Alians              | 90.0       | 95.3       | 98.0       | 94.4       | 86.8       | 95.5       | 94.8       | 92.3       | 84.5       | 92.3       | 97.0       | 91.3       |
| Doskonal            | 86.8       | 94.8       | 96.5       | 92.7       | 86.3       | 95.3       | 92.3       | 91.3       | 88.8       | 93.8       | 93.8       | 92.1       |
| Rozkishna           | 87.0       | 97.0       | 90.8       | 91.6       | 89.3       | 95.8       | 86.3       | 90.4       | 83.5       | 94.8       | 85.3       | 87.8       |
| Fermerka            | 90.3       | 97.3       | 84.3       | 90.6       | 89.0       | 92.5       | 87.5       | 89.7       | 86.3       | 91.5       | 88.3       | 88.7       |
| Zapashna            | 89.0       | 96.0       | 95.5       | 93.5       | 88.3       | 94.0       | 97.3       | 93.2       | 87.5       | 93.5       | 96.5       | 92.5       |
| Pryvablyva          | 90.5       | 97.3       | 91.8       | 93.2       | 87.5       | 97.0       | 93.3       | 92.6       | 84.8       | 94.3       | 90.5       | 89.8       |
| Pryvitna            | 86.0       | 93.8       | 90.0       | 89.9       | 86.3       | 95.0       | 90.3       | 90.5       | 84.3       | 95.0       | 90.8       | 90.0       |
| Zdobna              | 89.0       | 93.5       | 96.8       | 93.1       | 84.8       | 93.3       | 94.0       | 90.7       | 83.0       | 91.0       | 95.3       | 89.8       |
| Krasa Laniv         | 90.6       | 95.8       | 92.8       | 93.0       | 88.8       | 91.5       | 94.8       | 91.7       | 88.5       | 96.0       | 95.3       | 93.3       |
| Harmonika           | 91.8       | 95.3       | 97.8       | 94.9       | 88.8       | 96.0       | 96.3       | 93.7       | 89.0       | 94.8       | 96.8       | 93.5       |
| Patriotka           | 85.0       | 96.8       | 96.8       | 92.8       | 82.5       | 95.3       | 97.0       | 91.6       | 82.3       | 95.0       | 97.3       | 91.5       |
| Vyhadka             | 88.5       | 96.3       | 85.3       | 90.0       | 87.5       | 94.8       | 86.3       | 89.5       | 84.3       | 92.8       | 91.0       | 89.3       |
| Dyvo                | 87.0       | 97.5       | 95.3       | 93.3       | 86.8       | 98.8       | 96.0       | 93.8       | 84.5       | 98.0       | 95.5       | 92.7       |
| Haidok              | 88.0       | 97.5       | 96.8       | 94.1       | 83.0       | 94.5       | 96.0       | 91.2       | 79.8       | 93.8       | 93.0       | 88.8       |
| Metelytsia Kharkivska | 91.3       | 96.3       | 94.3       | 93.9       | 90.5       | 95.3       | 92.5       | 92.8       | 88.8       | 95.5       | 94.0       | 92.8       |
| Lutescens 217-13    | 87.0       | 91.0       | 83.8       | 87.3       | 86.5       | 92.3       | 81.8       | 86.8       | 87.0       | 91.5       | 86.8       | 88.4       |
| Erythrospermum 408-13 | 90.5       | 94.8       | 95.5       | 93.6       | 87.5       | 95.8       | 91.3       | 91.5       | 87.0       | 96.5       | 94.8       | 92.8       |
| Erythrospermum 164-13-3m | 83.0       | 93.5       | 86.0       | 87.5       | 84.8       | 93.8       | 82.0       | 86.8       | 82.8       | 93.0       | 85.8       | 87.2       |
| Average             | 87.6       | 95.4       | 86.0       | 92.0       | 86.1       | 94.7       | 82.0       | 90.9       | 84.6       | 94.0       | 85.8       | 90.4       |

Note: LSD А (0.05) = 1.27, LSD B = 0.43, LSD C = 0.43, LSD AB = 2.19, LSD AC = 2.19, LSD BC = 0.75, LSD ABC = 3.80
**Germinability in the winter bread wheat accessions, depending on the grain size, %**

| Accession (factor A) | 2.8 x 20 мм | 2.5 x 20 мм | 2.2 x 20 мм |
|----------------------|-------------|-------------|-------------|
|                      | 2016 | 2017 | 2018 | Average | 2016 | 2017 | 2018 | Average | 2016 | 2017 | 2018 | Average |
| Podoliananka         | 92.5 | 95.8 | 96.3 | 94.8 | 88.8 | 95.8 | 94.0 | 92.8 | 88.5 | 96.3 | 92.8 | 92.5 |
| Smuhlianka           | 87.3 | 96.5 | 95.5 | 93.1 | 91.3 | 96.5 | 92.3 | 93.3 | 90.8 | 96.8 | 91.8 | 93.1 |
| Bunchuk              | 88.8 | 98.0 | 99.0 | 95.3 | 90.3 | 96.3 | 96.0 | 94.2 | 88.5 | 97.5 | 98.0 | 94.7 |
| Yednist              | 92.8 | 97.3 | 98.8 | 96.3 | 92.3 | 95.3 | 98.5 | 95.3 | 89.3 | 94.5 | 96.3 | 93.3 |
| Ferrungineum 1239    | 77.5 | 99.5 | 92.5 | 89.8 | 67.0 | 98.0 | 94.0 | 86.3 | 63.0 | 97.0 | 91.5 | 83.8 |
| Kharkivska 81        | 87.0 | 96.0 | 95.0 | 92.7 | 82.5 | 95.0 | 93.5 | 90.3 | 83.0 | 95.0 | 94.5 | 90.8 |
| Doridna              | 92.8 | 96.8 | 88.0 | 92.5 | 91.5 | 96.0 | 86.8 | 91.4 | 86.3 | 96.0 | 87.3 | 89.8 |
| Statna               | 84.3 | 96.8 | 95.0 | 92.0 | 84.5 | 93.5 | 92.5 | 90.2 | 84.5 | 91.5 | 96.0 | 90.7 |
| Alians               | 91.5 | 95.8 | 98.0 | 95.1 | 88.3 | 96.5 | 95.3 | 93.3 | 88.0 | 93.8 | 98.0 | 93.3 |
| Doskonala            | 90.5 | 95.3 | 97.5 | 94.4 | 90.8 | 96.8 | 92.5 | 93.3 | 91.5 | 95.0 | 94.3 | 93.6 |
| Rozkishna            | 88.5 | 97.8 | 90.5 | 92.3 | 90.0 | 96.5 | 87.0 | 91.2 | 85.0 | 95.5 | 86.5 | 89.0 |
| Fermerka             | 91.0 | 97.5 | 84.8 | 91.1 | 90.0 | 94.0 | 87.8 | 90.6 | 88.0 | 92.3 | 89.3 | 89.8 |
| Zapashna             | 90.8 | 97.3 | 96.0 | 94.7 | 89.3 | 94.5 | 97.8 | 93.8 | 88.8 | 94.3 | 97.0 | 93.3 |
| Pryvablyna           | 92.0 | 98.3 | 95.8 | 95.3 | 90.3 | 97.3 | 95.0 | 94.2 | 87.3 | 95.5 | 92.0 | 91.6 |
| Pryvitna             | 89.3 | 94.0 | 91.0 | 91.4 | 89.8 | 95.8 | 91.0 | 92.2 | 88.0 | 96.0 | 91.0 | 91.7 |
| Zdobna               | 90.5 | 96.3 | 98.0 | 94.9 | 85.5 | 96.0 | 94.8 | 92.1 | 84.8 | 93.0 | 96.0 | 91.3 |
| Krasa Laniv          | 91.4 | 96.3 | 94.8 | 94.1 | 89.3 | 92.0 | 95.8 | 92.3 | 88.8 | 96.3 | 97.0 | 94.0 |
| Harmonika            | 92.8 | 96.3 | 98.0 | 95.7 | 89.5 | 96.5 | 96.8 | 94.3 | 89.8 | 96.0 | 97.0 | 94.3 |
| Patriotka            | 90.3 | 97.5 | 96.8 | 94.8 | 86.5 | 95.5 | 97.3 | 93.1 | 87.8 | 95.5 | 97.5 | 93.6 |
| Vyhadka              | 90.5 | 96.5 | 86.0 | 91.0 | 88.0 | 95.0 | 87.0 | 90.0 | 85.5 | 93.5 | 91.3 | 90.1 |
| Dyvo                 | 88.3 | 99.5 | 96.3 | 94.7 | 88.8 | 99.0 | 96.5 | 94.8 | 86.5 | 98.8 | 95.8 | 93.7 |
| Haiok                | 90.3 | 97.8 | 97.5 | 95.2 | 85.3 | 95.3 | 97.5 | 92.7 | 82.5 | 95.0 | 94.3 | 90.6 |
| Metelytsia Kharkivska| 93.5 | 98.0 | 94.8 | 95.4 | 92.5 | 96.5 | 93.0 | 94.0 | 90.8 | 97.3 | 95.5 | 94.5 |
| Lutescens 217-13     | 88.3 | 92.0 | 84.3 | 88.2 | 88.0 | 93.0 | 82.0 | 87.7 | 87.3 | 92.3 | 87.0 | 88.8 |
| Erythrospermum 408-13| 91.0 | 98.3 | 96.8 | 95.3 | 88.3 | 97.0 | 93.8 | 93.0 | 87.8 | 97.8 | 95.5 | 93.7 |
| Erythrospermum 164-13-3m| 84.8 | 94.5 | 86.5 | 88.6 | 88.0 | 94.8 | 82.5 | 88.4 | 85.3 | 94.3 | 86.0 | 88.5 |
| **Average**          | 89.5 | 96.7 | 94.0 | 93.4 | 87.9 | 95.7 | 92.7 | 92.1 | 86.4 | 95.2 | 93.4 | 91.7 |

Note: LSD A (0.05) = 1.22, LSD B = 0.42, LSD C = 0.42, LSD AB = 2.12, LSD AC = 2.12, LSD BC = 0.72, LSD ABC = 3.67
As to the seed germinability, on average all three grain sizes were good in winter wheat varieties Yednist, Harmonika, Metelytsia Kharkivska and Bunchuk over the three study years. The significant difference in the germinability 1.3% between 2.8 x 20 mm seeds and 2.5 x 20 mm seeds and 1.7% between 2.8 x 20 mm seeds and 2.2 x 20 mm seeds. Yednist, Harmonika, Metelytsia Kharkivska, Bunchuk, Alians, Podolianka, Patriotka, Zapashna, Dyvo, Doskonala, Krasa Laniv, Smuhlianka, and Erytrospermum 408-13 had a high germinability of small seeds (2.2 x 20 mm).

The effects of the factors ‘variety’, ‘grain size’, ‘year’ and the variety-year and grain size-year interactions on the germination energy and seed germinability were significant (P <0.05).

**Conclusions.** It was found that the grain size significantly affected the winter bread wheat seed quality: the larger seeds were, the higher the 1000-grain weight, germination energy and germinability were. In particular, the difference in the 000-grain weight was 9.9 g between 2.8 x 20 mm seeds and 2.5 x 20 mm seeds and 19.6 g between 2.8 x 20 mm seeds and 2.2 x 20 mm seeds; the difference in the germination energy was 1.1% and 1.6%, respectively; the difference in the germinability was 1.3% and 1.7%, respectively.

The weather in the study years significantly affected the germination energy, laboratory germinability and 1000-grain weight in winter wheat. Yednist, Harmonika, and Bunchuk had the highest germination energy and seed germinability. In particular, their germination energy was 93.0–95.8%, and the germinability – 93.3–96.3%.

Varieties and lines with high germinability (92.5–94.7%) of small seeds (2.2 x 20 mm) were selected: Yednist, Harmonika, Metelytysia Kharkivska, Bunchuk, Alians, Podolianka, Patriotka, Zapashna, Dyvo, Doskonala, Krasa Laniv, Smuhlianka, and Erythrospermum 408-13. When sorting these varieties, one can use seeds of 2.2-2.5 x 20 mm for sowing, which is important in years with low seed yields.
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ПОКАЗНИКИ ЯКОСТІ НАСІННЯ ЗРАЗКІВ ПШЕНИЦІ М’ЯКОЇ ОЗИМОЇ В ЗАЛЕЖНОСТІ ВІД ФРАКЦІЙНОГО СКЛАДУ

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Мета і задачі дослідження. Встановити вплив сортування насіння за фракціями на показники його якості: енергію проростання, лабораторну схожість та масу 1000 зерен.

Матеріали і методи. Експериментальні дослідження проведено в 2016–2018 рр. на дослідному полі Інституту рослинництва імені В.Я. Юр’єва НААН за методикою польового експерименту, вихідним матеріалом були 26 ліній і сортів пшениці м’якої озимої. Сорти та лінії вирощували в дослідах сортовипробування, площа ділянки 10 м². Проведено ситове сепарування насіння на приладі розсійник лабораторний РЛУ–3, визначено масу 1000 насінин, установлено їх лабораторну схожість та енергію проростання.

Обговорення результатів. При сепаруванні на ситах насіння пшениці м’якої озимої поділяється на фракції з різною масою 1000 насінин. Виділені фракції насіння пшениці озимої характеризуються різними посі вними якостями. Кращою була якість (енергія проростання, схожість) фракцій типорозміру 2,5 х 20 і 2,8 х 20 мм. Установлено, що в 2016–2018 роках значення показників енергії проростання, лабораторної схожості та маси 1000 насінин змінювалися в залежності від погодних умов. Найбільш високими вони були в 2017 р. Виділено сорти з високою масою 1000 насінин: Досконалі, Приваблива, Смуглянка, Гайок та з найбільш високими енергією проростання і схожістю: Єдність, Гармонік, Бунчук. У сортів Єдність (93,3 %), Гармонік (94,3 %), Метелиця харківська (94,5 %), Бунчук (94,7 %), Альянс (93,3 %), Подолянка (92,5 %), Патріотка (93,6 %), Запашна (93,3 %), Диво (93,7 %), Досконалі (93,6 %), Краса ланів (94,0 %), Смуглянка (93,1 %), Еритроспермум 408–13 (93,7 %) були високі показники схожості дрібної фракції 2,2 х 20 мм. Для очистки цих сортів, особливо в роки з невисокою врожайністю насіння, рекомендується використовувати фракції типорозміру 2,2–2,5 х 20 мм.

Висновки. Встановлено залежність між розміром фракції та посі вними показниками якості насіння. Сепарування насінневого матеріалу є ефективним технологічним методом, за допомогою якого можна відібрати фракції кращої якості.

Ключові слова: пшениця озима, зразок, якість насіння, фракція, енергія проростання, лабораторна схожість, masa 1000 насінин.

ПОКАЗАТЕЛИ КАЧЕСТВА СЕМЯН ОБРАЗЦОВ ПШЕНИЦЫ МЯГКОЙ ОЗИМОЙ В ЗАВИСИМОСТИ ОТ ФРАКЦИОННОГО СОСТАВА

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Цель и задачи исследования. Определить влияние сортировки семян по фракциям на показатели его качества: энергию прорастания, лабораторную всхожесть и массу 1000 зерен.

Материалы и методы. Экспериментальные исследования были проведены в 2016–2018 гг. в условиях опытного поля Института растениеводства им. В.Я. Юрьева НААН согласно методике полевого эксперимента. Исходным материалом были 26 линий и сортов пшеницы мягкой озимой. Сорта и линии включали в опытах сортоиспытания, площадь делянки 10 м². Проведено ситовое сепарирование семян на приборе рассевок.
лабораторный РЛУ–3. Определена масса 1000 семян, изучена их лабораторная всхожесть и энергия прорастания.

Обсуждение результатов. При сепарировании на ситах семена пшеницы мягкой озимой разделяется на фракции с разной массой 1000 семян. Выделенные фракции семян пшеницы озимой характеризуются разными посевными качествами. Лучшее качество (энергия прорастания, всхожесть) имеют фракции типоразмера 2,5 х 20 и 2,8 х 20 мм. Установлено, что в погодных условиях 2016–2018 годов значение показателей энергии прорастания, лабораторной всхожести и массы 1000 семян изменялись в зависимости от условий выращивания. Наиболее высокие они были в 2017 году. Выделены сорта, имеющие высокую массу 1000 семян: Досконала, Приваблива, Смуглянка, Гайок; наиболее высокие энергию прорастания и всхожесть: Сдність, Гармоніка, Бунчук.

Сорта Сдність (93,3 %), Гармоніка (94,3 %), Метелица харківська (94,5 %), Бунчук (94,7 %), Альянс (93,3 %), Подолянка (92,5 %), Патріотка (93,6 %), Запашна (93,3 %), Диво (93,7 %), Досконала (93,6 %), Краса ланів (94,0 %), Смуглянка (93,1 %), Еритроспермум 408-13 (93,7 %) имели высокие показатели всхожести мелкой фракции 2,2 х 20 мм. Для очистки этих сортов, особенно в годы с невысокой урожайностью семян, рекомендуется использовать фракции типоразмером 2,2–2,5 х 20 мм.

Выводы. Установлена зависимость между размером фракции и посевными показателями качества семян. Сепарирование семенного материала является эффективным технологическим приемом, с помощью которого можно отобрать фракции с лучшим качеством.

Ключевые слова: пшеница озимая, образец, качество семян, фракция, энергия прорастания, лабораторная всхожесть, масса 1000 семян.

SEED QUALITY INDICATORS OF WINTER BREAD WHEAT ACCESSIONS DEPENDING ON THE GRAIN SIZE

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Purpose and objectives. To evaluate the effect of sorting seeds by size on their quality indicators: germination energy, laboratory germinability and 1000-grain weight.

Materials and methods. The experiments were carried out in the experimental field of the Plant Production Institute named after V.Ya. Yuriev of NAAS in accordance with the field experimentation method in 2016–2018; 26 winter bread wheat lines and varieties were studied. The varieties and lines were grown in variety trial experiments; the plot area was 10 m². Seeds were separated on sieves of a laboratory separator RLU-3; the 1000-grain weight was measured; the laboratory germinability and germination energy were determined.

Results and discussion. When winter bread wheat seeds are sorted on sieves, they are separated into fractions with various 1000-grain weights. The separated fractions of winter wheat seeds have different sowing qualities. The 2.5 x 20 mm seeds and 2.8 x 20 mm seeds are of the best quality (germination energy, germinability). It was found that in 2016–2018, the germination energy, laboratory germinability and 1000-gain weight changed depending on the growing conditions. They were the highest in 2017. The varieties with a high 1000-grain weight have been identified: Doskonala, Pryaniblyva, Smuhlianka, and Haiok. The highest germination energy and germinability were intrinsic to varieties Yednist, Harmonika and Bunchuk.

Yednist (93.3%), Harmonika (94.3%), Metelytsia Kharkivska (94.5%), Bunchuk (94.7%), Alians (93.3%), Podolianka (92.5%), Patriotka (93.6%), Zapashna (93.3%), Dyvo (93.7%), Doskonala (93.6%), Krasa Laniv (94.0%), Smuhlianka (93.1%), and Erythrospernum 408-13 (93.7%) had a high germinability of small seeds (2.2 x 20 mm). To clean these varieties,
especially in years with low seed yields, it is recommended to use seeds of the standard size (2.2–2.5 x 20 mm).

**Conclusions.** The relationships between the grain size and sowing qualities of seeds have been established. Separation of seeds is an effective technological method allowing for selection of top-quality seeds.

**Key words:** winter wheat, accession, seed quality, grain size, germination energy, laboratory germinability, 1000-grain weight