UDC 633.1: “324”:631.524.85 https://doi.org/10.31867/2523-4544/0255

ADAPTIVE POTENTIAL OF WINTER TRITICALE BREEDING LINES (×*TRITICOSECALE WITTMACK*) IN FOREST-STEPPE OF UKRAINE

A. V. Pirych, M. V. Fedorenko, I. V. Fedorenko, Ye. A. Kuzmenko, R. M. Blyzniuk
The V. M. Remeslo Myronivka Institute of Wheat NAAS, Tsentralne village, Obukhiv district, Kyiv region, 08853, Ukraine

Topicality. *The requirements for modern winter triticale varieties include high grain yield and quality, as well as resistance to adverse environmental factors, i.e. high adaptability. Therefore, it remains important to develop varieties that combine the highest yield potential with genetic resistance to limiting factors.* ***Purpose****. To identify winter triticale breeding lines with high adaptability for use in breeding practice.* ***Materials and Methods****. The studies were carried out at the V. M. Remeslo Myronivka Institute of Wheat NAAS of Ukraine. As a standard, the Amur variety was used. We have examined 20 breeding lines. Accounting plot area was 10 m^2, trial was repeated four times. In experiment, laboratory-field and mathematical-statistical methods were used.* ***Results.*** *In 2019/20–2021/22, contrasting meteorological conditions helped to evaluate and select the breeding lines of winter triticale for their adaptive potential. It was found that the yield, which actually characterises the genotype response to environmental growing conditions, was the highest (5.36 t/ha) in 2020/21 and the lowest (3.81 t/ha) in 2019/20. It was established that the breeding lines 22002 ($\bar{x}$ = 4.97 t/ha), 22008 ($\bar{x}$ = 4.88 t/ha), 22016 ($\bar{x}$ = 4.79 t /ha) had the best general adaptability in comparison with the Amur variety-standard, and they were included in the group with the highest indicators of maximum yield (ranks of 1–3). The coefficient of variation was characterized by an insignificant (7.24–7.66 %) and medium level of variability (12.54–16.65 %), which confirms a fairly high and stable genotypic component in the formation of plant productivity. Calculations of ecological plasticity made it possible to identify the lines 22015, 22004 (b_i = 0.63), which significantly reduced the yield under limited growing conditions. It is explained by high resistance of these lines to adverse environmental factors. In terms of yield, the highest homeostaticity and breeding value were shown by lines 22004, 22015, and 22008.* ***Conclusions.*** *During the research, we have identified the breeding lines 22004, 22015, 22008, and 22002 with high adaptive potential, which can used as a source material for developing highly productive varieties in the Forest-Steppe of Ukraine.*

Key words*: winter triticale, breeding lines, adaptability, yield, meteorological conditions*

Introduction. Alongside conventionally grown cereals, the cultivation of winter triticale (×*Triticosecale Wittmack*) is gradually expanding in many countries around the world. Triticale is a wheat-rye amphidiploid artificially created crops that differs from other cereals in its large grain, with a unique combination of the best economic and biological traits of wheat and rye. High potential for grain and green mass yield, enhanced adaptive properties to adverse weather conditions (winter hardiness, drought resistance, undemanding to soil conditions, resistance to fungal diseases) and high grain quality have resulted in the crop being recognised globally as a food and fodder crop [1, 2].

Crop cultivation technologies require from the new modern varieties offered for production to be not only high-yielding with high grain quality, but also resistant to adverse environmental factors, i.e. highly adapted, highly homeostatic [3].

Adaptive breeding is a major area of agricultural science, and research centres around the world devote significant attention to it in their breeding programs.

Achieving an increase and stability of grain

Author information:

Alina V. Pirych, *Candidate of Agricultural Sciences, Head of the Spring Wheat Breeding Laboratory,* e-mail: alina22pirych@gmail.com, https://orcid.org/0000-0003-2312-9774

Maryna V. Fedorenko, *Candidate of Agricultural Sciences, Senior Researcher of the Spring Wheat Breeding Laboratory,* e-mail: ira_mip@ukr.net, https://orcid.org/0000-0002-3021-3643

Iryna V. Fedorenko, *Candidate of Agricultural Sciences, Scientific Secretary,* e-mail: ira_mip@ukr.net, https://orcid.org/0000-0001-5471-6475

Yevhenii A. Kuzmenko, *Candidate of Agricultural Sciences, Senior Researcher of the Spring Wheat Breeding Laboratory,* e-mail: evgeniy.anatoliyovich@gmail.com, https://orcid.org/0000-0002-6256-1482

Ruslan M. Blyzniuk, *Candidate of Agricultural Sciences, Senior Researcher of the Spring Wheat Breeding Laboratory,* e-mail: bliznyuk359@gmail.com, https://orcid.org/000-0002-8645-2539

yield and quality in time and space is possible through the creation and introduction of new varieties that combine maximum productivity with an increased level of homeostasis [4]. However, given the trend towards narrowing the areas of introduction of varieties and shortening the cycle of variety replacement, the development of highly specialised varieties that can provide maximum yields is also necessary. Obviously, the problem of developing high-yielding and ecologically plastic varieties with high adaptive potential and resistance to stress factors, as well as finding ways to evaluate them, is relevant. Today, the most common way to comprehensively evaluate plasticity is to analyse the grain yield of varieties and lines under contrasting hydrothermal conditions of years. Despite the notable success of domestic breeders in developing triticale varieties, they are still not widely disseminated, primarily due to the lack of zonal cultivation technologies that would ensure high and sustainable harvests. Therefore, the development of varieties that combine the highest yield potential with genetic resistance to limiting environmental factors remains relevant. [5].

The research was aimed at selecting winter triticale breeding lines with high adaptive parameters for further breeding practice.

Materials and Methods. The research was conducted in 2019/20–2021/22 at the V. M. Remeslo Myronivka Institute of Wheat of NAAS. Breeding lines of winter triticale were sown with a SN-10Ts seeder. The predecessor was soybean. Amur variety was used as a standard. There were 20 breeding lines studied. Phenological observations were carried out according to the methodology of the State Variety Testing [6]. The registered area of the plot was 10 m^2, and the experiment was repeated four times. The harvesting was carried out with a Sampo-130 combine harvester. For the qualitative assessment of favourable environmental conditions and the winter triticale productivity, the hydrothermal coefficient (HTC) was calculated by the method of G. T. Selyanynov [7]. The calculation of statistical parameters such as arithmetic averages ($\bar{x}$), minimum values (x_{min}); maximum values (x_{max}); range of variation ($R = x_{max} - x_{min}$); coefficient of variation (V, %) was performed according to the method of breeding experiment in crop production [8]. Indicators of stability (b_i regression coefficient) and plasticity (S^2_{di} – variance of deviations from the regression line) [9]; the index of homeostasis (Hom) and breeding value (Sc) were determined by the formulas of V. V. Khangildin et al. [10].

Results and Discussion. During the study period of 2019/20–2021/22, weather conditions differed from long-term averages in terms of temperature, precipitation and their distribution in certain stages of winter triticale plant growth and development (Fig. 1, 2). At the time of sowing of winter triticale in autumn 2019, soil drought was observed. In September, the rainfall amounted to 15.2 mm, which is 41.4 mm less than the long-term average. During almost the entire winter, the temperature at the tillering node depth ranged from -2.0 to +2.5 ºC (the indicator was recorded during the period of changes in the snow cover height). Temporary growth resumption of winter crops was observed on 26 February 2020, and the final one was observed on 1 March. In April, the average air temperature was at the level of the long-term average, and in May, it was 2.6 ºC below the long-term average against the background of excessive moisture supply. During the period from the growth resumption to the end of July, precipitation amounted to 341.9 mm or 106.3 % of the long-term average. The maximum air temperature for the spring and summer period was recorded in August (26.4 °C).

The amount of precipitation for the year was 588.1 mm, which is 56.8 mm less than the long-term average. The maximum amount of precipitation (122.3 mm) was in May 2020, and the minimum (10.5 mm) was in October 2019. The average monthly rainfall was 43.8 mm. The hydrothermal coefficient for the 2019/20 growing season was 0.60, which corresponds to very dry conditions. In summary, the weather conditions were not favourable for a high yield due to a lack of moisture during sowing and grain ripening.

Winter triticale was sown in autumn 2020 under insufficient moisture conditions. From August to October, the air temperature exceeded the long-term average by 1.1–4.9 °C. At the same time, the moisture deficit was 22.8–49.6 mm. In 2020, the growth cessation was regis- tered on 11 November. The lowest air temperature (-21.4 °C) for 2021 was recorded on 17 Janu-

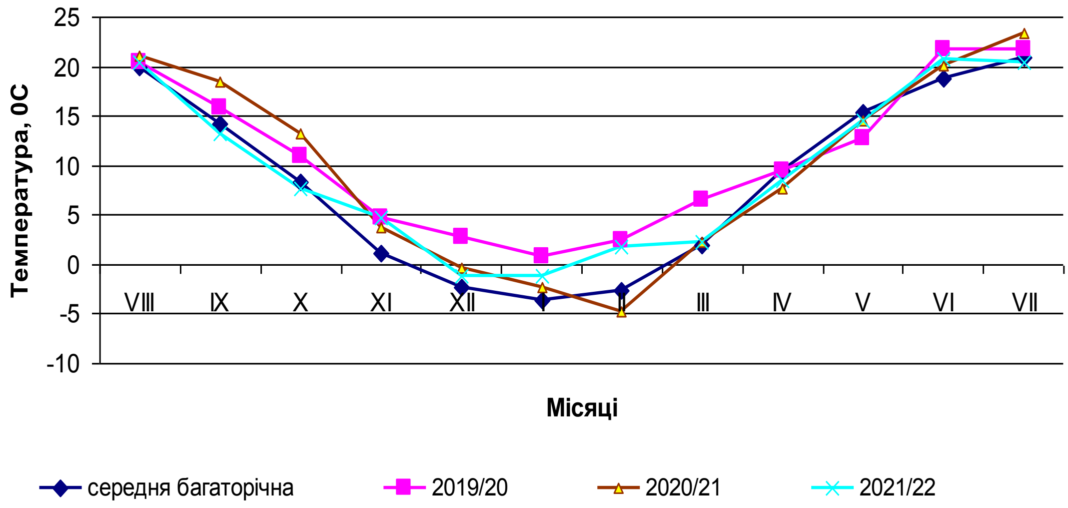

Fig. 1 Average monthly air temperature during the growing seasons 2019/20–2021/22

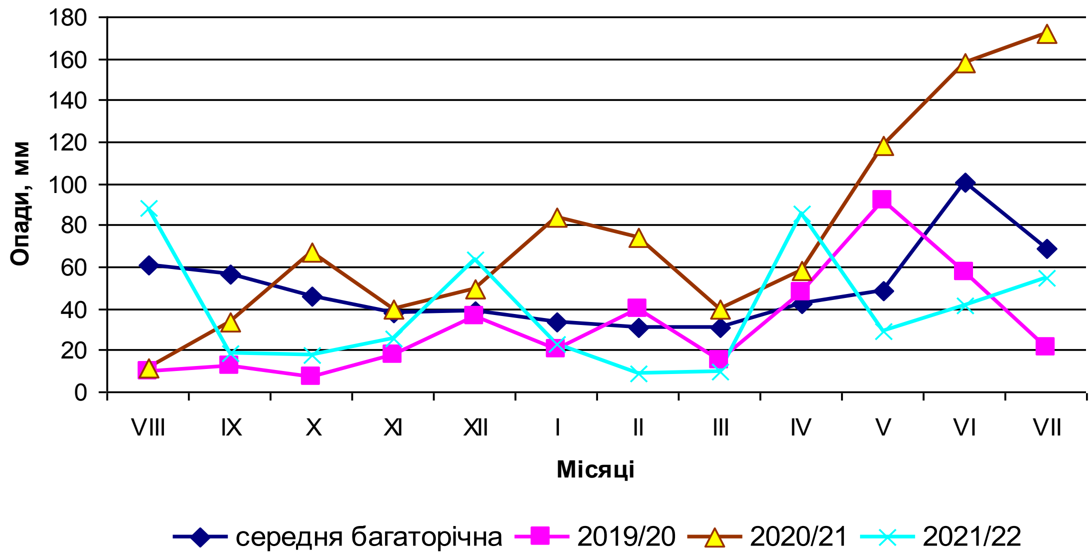

Fig. 2 Average monthly rainfall during the growing seasons 2019/20–2021/22

ary. In general, the winter was quite mild, with air temperature of -0.3 °C in December 2020, which was +2.0 °C above the long-term average; in January 2021, the average monthly air temperature was -2.3 °C, which was also +1.4 °C above the long-term average; in February 2021, the air temperature was -4.7 °C, which was +2.1 °C below the long-term average. During the winter 2020/21, the maximum snow cover reached 30–45 cm, and the temperature at the tillering node depth ranged from 0 to -2 °C. The growth resumption of winter crops in 2021 was noted on 14 March, and the final one on 26 March. In April and May 2021, the average air temperature was -0.9 and -1.8 ºC below the long-term average, respectively, on the background of excessive moisture supply. During the period from the growth resumption to the end of July, rainfall was 506.5 mm, which is 246.8 mm above the long-term average. Total precipitation for the year reached 905.0 mm, which is 309.7 mm higher than the long-term average. The hydrothermal coefficient for the 2020/2021 growing season was characterised by an insufficient moisture content and amounted to (HTC = 1.03).

September and October 2021 were characterised by a severe precipitation deficit compared to the long-term average (35.0 and 23.5 mm, respectively), resulting in a loss of soil moisture. During the pre-sowing and sowing periods, the average air temperature was close to the long-term average. The growth cessation of winter triticale was observed in mid-November. Like in most recent years, overwintering took place in conditions of unstable snow cover or its absence, short-term sharp cold snaps and thaws. In November and December, the air temperature was slightly higher than the long-term average by 2.9 and 0.6 °C, respectively. The spring vegetation of winter triticale took place under very dry conditions (HTC = 0.28; 0.65). In the spring and summer period, the maximum air temperature was 20.7 °C in June, with a moisture deficit of 43.6 mm. The total annual precipitation was 467.6 mm, which is 114.2 mm less than the long-term average (581.8 mm). In summary, the hydrothermal coefficient for the growing season 2021/22 of winter triticale was 0.80, which corresponds to dry conditions, which negatively affected the formation of a high productivity level. So, the meteorological conditions of 2019/20–2021/22 were contrasting, that allowed to evaluate and select breeding lines of winter triticale by adaptive potential.

Crop yield is the result of a complex interaction between plants and a range of environmental conditions. In recent decades, global grain yields have increased significantly. The crop yield increase was mainly due to breeding and genetic improvement of the varietal composition, increased potential of genotype productivity, adaptability to variability of agro-ecological factors, and tolerance to stress factors of biotic and abiotic origin [11]. Therefore, the yield per unit area is the final indicator that characterises the economic and breeding value of the studied material [12]. We used data on the winter triticale yield for 2019/2020–2021/2022 to determine the adaptive potential of breeding lines and the Amur variety-standard (Table 1). The yield actually characterises the response of genotypes to external weather conditions. It was found that the highest yield was 5.36 t/ha in 2020/21 with a variation from 3.98 (min) to 8.48 t/ha (max) and the lowest yield was 3.81 t/ha in 2019/20 with a variation from 2.94 (min) to 4.59 t/ha (max).

During the research in 2019/20–2021/22, breeding lines of winter triticale 22002, 22008, 22016, 22004, 22015, 22011 were identified that exceeded the standard variety yield (4.18 t/ha) and can be used as a source material for the development of high-yielding varieties in the Forest-Steppe of Ukraine. It was found that the breeding lines 22002 ($\bar{x}$ = 4.97 t/ha), 22008 ($\bar{x}$ = 4.88 t/ha), 22016 ($\bar{x}$ = 4.79 t/ha), which were included in the group with the highest yield level (ranks 1-3), had the best overall adaptive capacity compared to the Amur variety-standard. The analysis of adaptability parameters allowed us to identify lines that combined high productivity with resistance to environmental changes. The difference (R) between the maximum and minimum values of a trait characterises its stability in a particular genotype. The range of variation characterises the ability of the genotype to form high grain yield with a slight difference in the limits under stressful environmental conditions. The maximum limits of this trait (R = 1.20–1.51 t/ha) were revealed in the breeding lines – 22008 (R = 1.20 t/ha), 22002 (R = 1.34 t/ha), 22011 (R = 1.51 t/ha) and the variety-standard (R = 1.22 t/ha), which indicates their high genetic potential under more favourable growing conditions. Lines 22004 (R = 0.68 t/ha), 22015 (R = 0.69 t/ha), 22016 (R = 1.08 t/ha) with a minimum variation range were identified, which indicates their high stress resistance. The coefficient of variation (V, %) was used to characterise the adaptability of each particular line to different agroecological conditions, which was characterised by a low (7.24–7.66 %) and medium (12.54–16.65 %) level of variability, which confirms a rather high and stable genotypic component in the formation of plant productivity over the years of research.

The regression coefficient (b_i) characterises the average response of a genotype to environmental changes, shows its plasticity and allows predicting the variability of the studied trait within certain conditions. A higher regression coefficient (bi) indicates a higher susceptibility of the variety to changes in growing conditions. The value of (b_i) equal to zero or close to zero indicates that the genotype does not respond to environmental changes. Increased plasticity of a variety often leads to a decrease in its stability [13]. The calculations of ecological plasticity of these genotypes in the Forest-Steppe zone of Ukraine showed that breeding lines 22011 (bi = 1.39), 22002 (bi = 1.34), 22008 (bi = 1.12) are highly plastic in yield, since their regression coefficient is greater than 1. Line 22016 (bi = 0.98) is characterised by an average level of plasticity, since its index is close to 1. The genotypes studied for yield are low plastic (bi < 1) – 22015, 22004 (bi = 0.63)

Grain Crops. Vol. 7. No. 1. 2023. P. 28–35

https://doi.org/10.31867/2523-4544/0255

Table 1. Parameters of the best breeding lines of winter triticale in terms of yield (t/ha) and its stability (average for 2019/2020–2021/2022)

Variety-standard, line	$\bar{x}$ – Z	x_{max}, – Z	x_{min} – Z	R (max-min) – Z	V, % – Z	b_i–Z	S^2_{di}–Z	Hom–Z	Sc–Z	Average sum of ranks , Y
Amur – standard	**4.18–7**	**3.48–7**	**4.70–7**	**1.22–5**	**15.02–6**	**0.79**	**0.43–7**	**22.92–6**	**3.10–7**	**6.50–7**
22016	4.79–3	4.10–5	5.17–4	1.08–3	12.54–3	0.98	0.16–6	35.42–3	3.79–5	4.00–5
22015	4.63–5	4.24–4	4.93–6	0.69–2	7.66–2	0.63	0.02–2	87.50–2	3.98–2	3.13–2
22002	4.97–1	4.43–1	5.77–1	1.34–6	14.21–5	1.34	0.06–4	26.06–5	3.82–4	3.38–4
22011	4.58–6	3.76–6	5.27–3	1.51–7	16.65–7	1.39	0.04–3	18.25–7	3.27–6	5.63–6
22004	4.69–4	4.35–3	5.03–5	0.68–1	7.24–1	0.63	0.00–1	95.27–1	4.06–1	2.12–1
22008	4.88–2	4.42–2	5.61–2	1.20–4	13.08–	1.12	0.08–5	31.24–4	3.84–3	3.33–3
Average on experiment	**4.41**	**3.82**	**4.98**	**1.16**	**13.56**	**1.00**	**0.11**	**87.30**	**3.41**	–

Notes: $\bar{x}$ – average yield, t/ha; x_{max}, x_{min} – maximum and minimum yields, t/ha; R (max-min) – range of variation; V – coefficient of variation, %; b_i – linear regression coefficient; S^2_{di} – variances of deviations from the regression line; Hom – homeostaticity; Sc – breeding value of the genotype; Z – rank; Y – average sum of ranks.

and the variety-standard (b_i = 0.79), which insignificantly reduced the yield under limited growing conditions, due to their high resistance to adverse environmental factors. The stability variance of the trait (S^2_{di}) shows how the line reliably corresponds to the plasticity estimated by the regression coefficient. The closer (S^2_{di}) is to zero, the less the empirical values of the trait differ from the theoretical values located on the regression line. Smaller standard deviation means that the breeding line forms a more stable yield in different environmental conditions [14]. Breeding lines – 22004 (S^2_{di} = 0.00), 22015 (S^2_{di} = 0.02), 22011 (S^2_{di} = 0.04), 22002 (S^2_{di}= 0.06) were found to be more stable with a lower numerical value (S^2_{di}). Homeostaticity is an indicator that combines the average yield and the adaptive rate of response of varieties (genotypes) to limiting environmental factors. This statistical indicator is widely used in research on grain crops [15]. Plant adaptation is associated with the specific impact of environmental factors, which is determined, on the one hand, by their type, dose, duration of exposure, and, on the other hand, by the biological characteristics of the species and its functional state. In addition, during the implementation of breeding programmes, the breeding value of genotypes used for crossing is usually determined. It has been determined that the higher the level of homeostaticity and breeding value means the more stable and breeding valuable variety, sample, line in changing weather conditions of the growing season [16]. For a particular line, high homeostaticity is associated with its ability to keep yield variability low. Among the breeding lines, the highest indicators of homeostasis in terms of yield were shown by lines – 22004 (Hom = 95.27) and 22015 (Hom = 87.50), a rather low value was noted in line – 22011 (Hom = 18.25), and the rest were almost at the same level (26.06–35.42). The index of genotype breeding value (Sc) evaluates the resistance of a variety (line) and shows the transformed actual average yield of the genotype into the conditional one with correction for homeostaticity. Breeding lines 22004 (Sc = 4.06), 22015 (Sc = 3.98), 22008 (Sc = 3.84), 22002 (Sc = 3.82), exceeding the Amur variety-standard (Sc = 3.10), were identified. For generalised characterisation of the evaluation of the adaptability and its differentiation, we used an indicator that would integrate as many parameters as possible. For this purpose, we calculated the sum of the ranks, then the average indicator, and finally ranked the last one. Lines with low values of this indicator and ranked first should be classified as having high adaptive capacity. The lines with the highest values of the indicators were ranked higher, see Table 1.

Conclusions. For the period of research in 2019/20–2021/22, the meteorological conditions demonstrated contrasting differences from long-term indicators in terms of temperature, precipitation and their distribution by months. The hydrothermal coefficient for 2019/20 was characterised by very dry moisture conditions (HTC = 0.60), and 2020/21, 2021/22 – by dry conditions (HTC = 1.03; 0.80, respectively), which negatively affected the formation of a high yield level and allowed to evaluate and select breeding lines of winter triticale by adaptive potential. The evaluation of genotype adaptability in terms of yield based on a combination of plasticity and stability parameters allowed us to identify the best lines according to the integrated indicator – line adaptability rating, for selection of future varieties. The group with high adaptive potential included breeding lines 22004, 22015, 22008, 22002, as evidenced by their high rankings, which can serve as source material for the development of high-yielding varieties in the Forest-Steppe of Ukraine.

References

1. Levchenko, O. S., Starychenko, V. M. (2020). Identification of the source breeding material of winter triticale using indices of distance from the adaptive norm. *Naukovi dopovidi NUBiP Ukrainy*. [Scientific reports of NUBNS of Ukraine], *84 (2)*. doi: 10.31548/dopovidi 2020.02.009 [in Ukrainian].
2. Levchenko, O., Starychenko, V. (2021). Evaluation of winter triticale collection on the stability of the manifestation of the grain yield trait. *American Journal of Agriculture and Forestry, 9 (2).* 49–52. doi: 10.11648/ j.ajaf.20210902.11.
3. Yehupova, T. V., Romaniuk, P. V. (2020). Mo-dern technologies of cultivation of winter triticale in the Right-Bank Forest-Steppe. *Visnyk ahrarnoi nauky.* [Bulletin of Agricultural Science], *98 (7).* 31–37. doi: 10.31073/agrovisnyk202007-04 [in Ukrainian].
4. Kuzmenko, Ye. A., Fedorenko, M. V., Pirych, A. V., Blyzniuk, R. M. (2022). Ecological plasticity and sta-

bility of promising lines of spring wheat (*Triticum aestivum* L.) in terms of yield. *Plant Varieties Studying and Protection*, *18 (4)*. 242–250. doi: 10.21498/2518-1017.18.4.2022.273985 [in Ukrainian].
5. Buniak, N. N., Moskalets, V. V., Moskalets, T. Z., Moskalets, V. I. (2012). Reaction of winter triticale varieties on presowing seed bacterization. *Silskohospodarska mikrobiolohiia*. [Agriciltural Microbiology], *14.* 32–40. doi: 10.35868/1997-3004.14.32-40.
6. Tkachyk, S. O. (Ed.) (2016). *Metodyka provedennia ekspertyzy sortiv roslyn hrupy zernovykh, krupianykh ta zernobobovykh na prydatnist do poshyrennia v Ukraini* [Methodology for the examination of plant varieties of the group of grain, cereal crops and legumes for suitability for distribution in Ukraine] (3rd ed., red. and suppl.). Vinnytsia: FOP Korzun D. Yu. [in Ukrainian].
7. Selyaninov, G. T. (1937). *Metodika selskokhozyaystvennoy kharakteristiki klimata* [Method of agricultural characteristics of climate]. In World Agroclimatic Reference Book (pp. 5−29). I. A. Goltsberg & S. A. Sapozhnikova (Eds.). Leningrad, Moscow: Gidrometeoizdat. [in Russian].
8. Ermantraut, E. R., Hoptsii, T. I., Kalenska, S. M., Kryvoruchenko, R. V., Turchynova, N. P., Prysiazhniuk, O. I. (2014). *Metodyka selektsiinoho eksperymentu (u roslynnytstvi)* [Methods of selection experiment (in crop production)]. Kharkiv: N. p. [in Ukrainian].
9. Eberhart, S. A., Russell, W. A. (1966). Stability Parameters for Comparing Varieties. *Crop Science*, *6 (1)*, 36–40. doi: 10.2135/cropsci1966.0011183X000600010011x.
10. Khangildin, V. V., Litvinenko, N. A. (1981). Stability and adaptability of winter wheat varieties. *Nauchno-tekhnicheskiy byulleten VSGI* [Scientific and technical bulletin of AAI], *1*. 8–14. [in Russian].
11. Gyrka, A. D., Pedash, O. O., Kulyk, I. O., Viniukov, O. O., Ishchenko, V. A. (2016). Productivity of winter wheat after winter rape regards sowing time and seeding rate in Ukrainian Step conditions. *Ukrainian Journal of Ecology*, *7 (1)*. 30–36.
12. Krivenko, A. I., Pochkolina, S. V., Bezede, N. G. (2019). Productivity and quality of grain of promising varieties of winter wheat at different sowing periods in the conditions of the Southern Steppe of Ukraine. *Tavriiskyi naukovyi visnyk* [Taurida Scientific Herald], *107*. 78−85. doi: 10.32851/2226-0099.2019.107.10 [in Ukrainian].
13. Khomenko, S. O., Fedorenko, I. V., Fedorenko, M. V. (2016). Homeostasis and selective value of collection accessions of bread spring wheat for conditions of Forest-Steppe of Ukraine. *Myronivskyi visnyk* [Myronivka Bulletin], *3*. 85–93. [in Ukrainian].
14. Yarosh, A. V., Riabchun, V. K. (2021). Adaptability of winter bread wheat by homeostaticity and breeding value. *Henetychni resursy roslyn* [Plant Genetic Resource], *28*. 36−47. doi: 10.36814/pgr.2021.28.03 [in Ukrainian].
15. Solonechnyi, P. M., Kozachenko, M. R., Vasko, N. I., Naumov, O. G., Dmitrenko, P. P., Kovalenko, A. L. (2014). Stability of productivity elements in spring barley varieties under ecological testing. *Selektsiia i nasinnytstvo* [Plant Breeding and Seed Production], *105*. 194−203. doi :10.30835/2413-7510.2014.42075
16. Sharma, R. C., Morgounov, A. I., Braun, H. J., Akin, B., Keser, M., Kaya, Y., Khalikulov, Z., van Ginkel, M., Yahyaoui, A., Rajaram, S. (2012). Yield stability analysis of winter wheat genotypes targeted to semiarid environments in the international winter wheat improvement program. *International Journal of Plant Breeding*, *6 (1)*. 7–13.

УДК 633.1.“324”:631.524.85

Пірич А. В., Федоренко М. В., Федоренко І. В., Кузьменко Є. А., Близнюк Р. М. Адаптивний потенціал селекційних ліній тритикале озимого (×Triticosecale Wittmack) в умовах Лісостепу України.

Зернові культури. 2023. 7 (1). 28–35.

Миронівський інститут пшениці імені В. М. Ремесла НААН, с. Центральне, Обухівський р-н, Київська обл., 08853, Україна

Актуальність. Сучасні сорти тритикале озимого повинні бути не тільки високоврожайними та давати зерно високої якості, а й стійкими до несприятливих факторів середовища, тобто високоадаптованими. Тому, і надалі актуальним залишається створення сортів, що поєднують найвищий потенціал врожайності з генетичною резистентністю до лімітуючих чинників. **Мета роботи** передбачала виділити селекційні лінії тритикале озимого з високими адаптивними показниками для використання в селекційній практиці. **Матеріали і методи.** Дослідження проводили в Миронівському інституті пшениці імені В. М. Ремесла НААН України. За стандарт обрали сорт Амур. Досліджували 20 селекційних ліній. Облікова площа ділянки становила 10 м^2, повторність досліду – чотириразова. Використовували лабораторно-польовий та математично-статистичні методи. **Результати.** Метеорологічні умови 2019/20–2021/22 рр. виявились контрастними, що дало можливість оцінити та виділити селекційні лінії тритикале озимого за адаптивним потенціалом. Виявлено, що врожайність, яка фактично характеризує реакцію генотипів на зовнішні погодні умови вирощування, була найвищою у 2020/21 р. – 5,36 т/га і найнижчою у 2019/20 р. – 3,81 т/га. Встановлено, що кращою загальною адаптивною здатністю, порівняно із сортом-стандартом Амур, характеризувалися селекційні лінії – 22002 ($\bar{x}$ =

4,97 т/га), 22008 ($\bar{x}$ = 4,88 т/га), 22016 ($\bar{x}$ = 4,79 т/га), які увійшли до групи з найвищими показниками максимальної врожайності (ранги 1–3). Коефіцієнт варіації відзначався незначним (7,24–7,66 %) та середнім рівнем мінливості (12,54–16,65 %), що підтверджує досить високу і стабільну генотипову складову у формуванні продуктивності рослин. Розрахунки екологічної плас-тичності дозволили виявити лінії – 22015, 22004 (bi = 0,63), які неістотно знижували врожайність за лімітованих умов вирощування, що пояснюється їх високою стійкістю проти несприятливих чинників навколишнього середовища. За рівнем урожайності найвищі показники гомеостатичності та селекційної цінності проявили лінії – 22004, 22015, 22008. **Висновки.** За період проведення досліджень виділено селекційні лінії – 22004, 22015, 22008, 22002 з високим адаптивним потенціалом, які можуть слугувати вихідним матеріалом при створенні високопродуктивних сортів в умовах Лісостепу України.

Ключові слова: *тритикале озиме, селекційні лінії, адаптивність, урожайність, метереологічні умови*