and between the environmental factors separately during the first (April-June) and second (July-September) halves of the soybean growing period and the economic features.

Conclusions. We demonstrated a leading role of relative air humidity for soybean yield (r = 0.723). The dependence of yield on precipitation amount during the growing period was moderate (r = 0.605). The role of precipitation increased in the first half of the growing period (r = 0.525) compared to the second half (r = 0.342). There was a moderate negative correlation between yield and average air temperature (r= -0.666) as well as between yield and the sum of effective temperatures during the growing period (r = -0.373). There was a moderate negative correlation (r = -0.403) between the contents of protein and oil. The total content of protein and oil in seeds was determined by protein content (r = 0.948) and did not depend on oil content (r = -0.091). The protein content was moderately negatively correlated with relative air humidity (r = -0.582) and average air temperature (r = -0.437) and weakly correlated with precipitation amount (r = -0.213). The oil content in seeds was positively correlated with the average temperature during the growing period (r = 0.435) and relative air humidity (r = 0.376). The output of protein and oil did not depend on protein content (insignificant r = -0.006) and was negatively correlated with oil content (r = -0.223). The total content of protein and oil in seeds was negatively affected by relative humidity (r = -0.502), average air temperature (r = -0.325), and precipitation amount (r = -0.175). The output of protein and oil was positively correlated with relative air humidity (r = 0.686) and precipitation amount (r = 0.603) and negatively correlated with the average air temperature (r = -0.706) and effective temperature sum (r = -0.362). A mathematical model of the dependence of soybean yield on the hydrothermal factors was constructed.

***Key words**: soybean, yield, mathematical model, seed quality, correlation, variety trial, environmental factors.*

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ADAPTABILITY OF WINTER BREAD WHEAT BY ENVIRONMENTAL PLASTICITY AND STABILITY

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The results of studying the adaptability of winter bread wheat in terms of environmental plasticity and stability are presented. It was determined that the highest genetic potential of adaptability (sum of ranks 2) in combination with high yields was intrinsic to mid-tall domestic genotypes − Haiok (ε_i = 2.24; R_i = 0.97) and MIP Lada (ε_i = 0.90; R_i = 0.92) (UKR).

***Key words:** adaptability, winter bread wheat, genotypic effect, stability, plasticity, freeze tolerance, yield, source*

Introduction. To successfully intensify winter cereal production, creation of high-yielding and adapted to certain growing conditions plant varieties is a very important step. The introduction of such accessions in combination with high quality grain is a key to their effective implementation. Increased adaptability of winter bread wheat varieties giving stable yields under stressful growing conditions is a major objective of current breeding, which boosts gross yields and stabilizes grain production and, consequently, food security [1, 2]. Preliminary selection of sources of desirable traits and appropriate levels of their expressions under environmental stressors is of great importance for the creation of such varieties, and the availability of such sources is provided by pre-conducted introduction [3].

Literature review and problem articulation. Many researchers pointed out that for successful introduction of plant varieties recommended for certain agroecological growing areas into production, it is important to know their adaptability, which is assessed by environmental plasticity and stability, from which the genotypic effect, adaptability to changing environmental conditions and effectiveness of manifestation of required levels of performance and yield determined by genetic systems are calculated [4, 5, 6]. The genotypic effect characterizes the genotype potential for a specific trait under optimal weather conditions [7].

Varieties that were properly selected in terms of environmental plasticity and stability in different regions of their cultivation minimize unwanted yield losses because of different abiotic [8] and biotic factors [9] environmental stressors, including recent various epiphytoties [10].

During the long-term breeding aimed at increased yields of winter bread wheat varieties, their adaptive potentials were often reduced or lost. As a result, varieties with potentially high but unstable yields were significantly inferior in their breeding value to genotypes with low but stable yields during study periods, which included stressful years significantly limiting the harvest of high yields [9, 11]. Highly-plastic plant varieties are able to give high yields under improved growing conditions, but they considerably reduce yields under worse conditions or on poor nutrition. Lowly-plastic accessions are less responsive to changes in growing conditions, showing greater stability of yields, which are often not very high, however, such varieties reduce their yields to a lesser extent even under harsh and stressful conditions during their development, i.e. conditions that can limit their yields. Thus, environmental plasticity is determined by ability of the genotype to effectively use favorable environments, while environmental stability – by its ability to withstand environmental stressors [12, 13].

Thus, high adaptability of genotypes, without significantly reducing their yields, remains a major and urgent objective of breeding. Pre-selection of adaptable sources with high yields is a key to effective breeding.

Purpose and objectives. The work was aimed to determine the winter bread wheat adaptability by environmental plasticity and stability via assessing yields and to identify high-yielding sources adapted to the Eastern Forest-Steppe of Ukraine.

Materials and methods. Twenty-nine winter bread wheat (*Triticum aestivum* L.) accessions from nine countries were studied: 13 accessions from Ukraine, 7 from Germany, 2 from Hungary, 2 from Austria, 1 from Russia, 1 from Belarus, 1 from Poland, and 1 from the Netherlands. Fourteen accessions were mid-tall and 15 - short-stemmed. The study was conducted in the Laboratory of Genetic Resources of Cereals of the National Center for Plant Genetic Resources of Ukraine (NCPGRU) on the experimental basis of the Plant Production Institute named after VYa Yuriev of NAAS, which is located in the Kharkivskyi District of Kharkivska Oblast in the Northeastern Left-Bank Forest-Steppe of Ukraine, in 2017−2020. The experiments were carried iut in accordance with the requirements for breeding field experiments [14]. Seeds were sown with a breeding planter SSFK-7 on plots of 5m^2 in three replications after fallow within the optimal timeframe at a sowing rate of 4.5 million seeds/ha. In the spring, the plots were fertilized with ammonium nitrate (N_{40}). Podolianka was a check variety the mid-tall group; Bunchuk – for the for short-stemmed accessions. The check varieties were sown every 20 accessions. The accessions were investigated by appropriate methods [15, 16]. The adaptability by environmental plasticity and stability was determined as BP Huriev, PP Litun, and IA Hurieva [17] described; this method is based on determination of the genotypic effect (ε_i) as a degree of general adaptability and of the regression coefficient (R_i) as a degree of plasticity with ranking. According to the method, the higher the genotypic effect is and the lower the regression coefficient is, the higher the rank is (1 − high, 2 − medium, 3 − low). Genotypes with a total number of ranks of 2−3 are of the greatest breeding value, as they combine a high potential of the trait of interest and its stable expression during the study period. Freeze tolerance was determined in accordance with DSTU 4749: 2007 [18]. Data were statistically processed, as BA Dospekhov recommended [14].

Results and discussion. Analyzing the weather during the 2017–2020 vegetation periods, we can conclude that that various values of the hydrothermal coefficient (HTC) contributed to the differentiation of winter bread wheat accessions in terms of yield and adaptability. The 2017 autumn weather was warm and dry. Water deficit suppressed the plant growth and development. The average daily temperature in September 2017 was 17.7°C. The monthly precipitation amount was 25.7 mm, while the average long-term amount of precipitation is 39.2 mm. The 2018 autumn was quite dry. In September-November, the total amount of precipitation was 70 mm, which is by 63 mm less than the long-term average. The precipitation amount in September was 35.5 mm. The 2019 autumn weather was, on the contrary, warm and quite humid. In September, the air temperature was 16.2°C (the long-term average is 14.5°C). The precipitation amount in September was 30.2 mm, in October –73.4 mm.

The meteorological conditions during the spring-summer vegetation study periods differed significantly in wetting and temperature: very arid - 2018 (HTC = 0.42), sufficiently wet - 2019 (HTC = 0.98) and excessively wet - 2020. (HTC = 1.66) (Fig. 1).

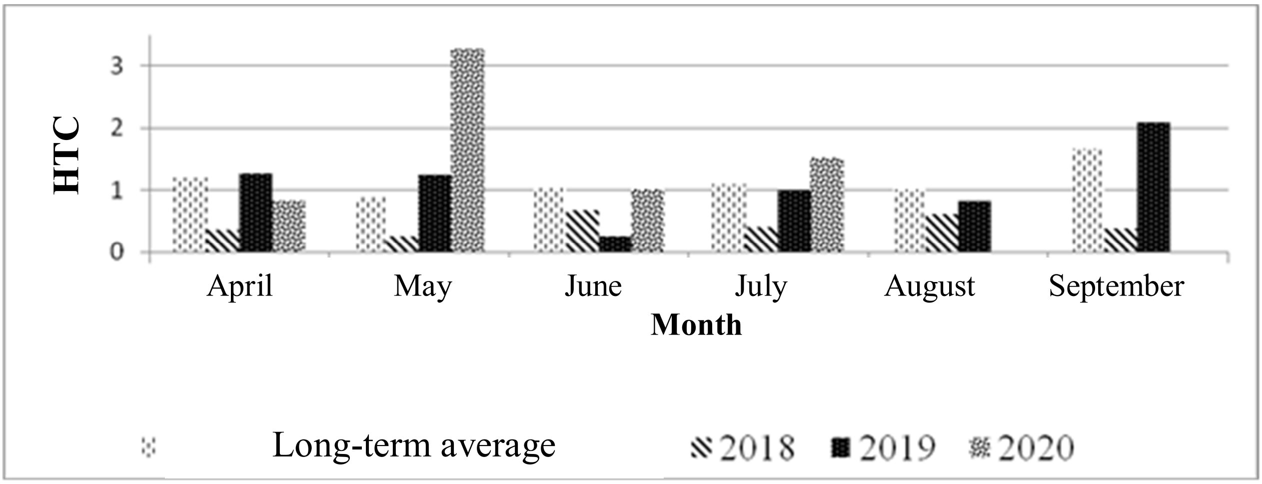

Fig. 1. Hydrothermal coefficient during the vegetation period (2018−2020)

Thus, the weather during the 2017 - 2020 vegetation periods allowed for differentiation of winter bread wheat accessions by adaptability, for determination of environmental plasticity and stability via assessing yields and for identification of high-yielding genotypes adapted to the Eastern Forest-Steppe of Ukraine.

2020 was the most favorable year for yielding. In 2018, the yields were mostly lower than those in the previous years.

For effective breeding to create new high-yielding and adaptable varieties, we had comprehensively studied the NCPGRU’s winter bread wheat collection accessions of different eco-geographical origins. Basing on the obtained results, we selected 29 accessions that bested the others in terms of yield and investigated them for environmental plasticity and stability.

In 2017−2020, we identified winter bread wheat sources of high yields (+ 16% to the yield from the check variety) in the mid-tall group (Haiok, MIP Lada (UKR); Apertus (DEU) and Faunus (AUT) (Table 1) and in the short-stemmed group (MIP Valensiia, Sotnytsia, Sicheslava, Homin (UKR); Gordian, Patras, Desamo, KWS Ronin (DEU) and Balitus (AUT) (Table 2). The check varieties, Podolianka and Bunchuk (UKR), produced 6.53 and 5.77 t/ha, respectively.

Twelve mid-tall varieties had high values of the genotypic effect (up to 85.7%; rank 1) for yield. They were Serpanok Kyivskyi, MIP Lada, Haiok, Optima Odeska, Dyvo, Amina (UKR); Karavan (RUS), Avgustina (BLR), Figure (POL), Apertus (DEU), Faunus (AUT), and Manella (NLD). The moderate genotypic effect (14.3%; rank 2) was determined for Kyivska 17 and MIP Rokslana (UKR).

Table 1

Environmental plasticity and stability of the best mid-tall winter bread wheat varieties by yield, 2017–2020

Accession	Country of origin	Yield, t/ha			Genotypic effect		Plasticity		Sum of ranks
		max	*min*	$\overline{X}$	ε_i	Rank	R_i	Rank	
Podolianka[1)]	UKR	7.65	6.25	6.53	0.46	1	0.89	1	2
Haiok	UKR	9.25	7.10	8.60	2.24	1	0.97	1	2
MIP lada	UKR	8.75	6.49	7.65	0.90	1	0.92	1	2
Serpanok Kyivskyi	UKR	8.95	6.20	7.35	0.71	1	1.29	3	4
Dyvo	UKR	8.95	7.45	7.28	3.33	1	1.20	2	3
Optyma Odeska	UKR	8.25	6.15	7.20	1.01	1	0.78	1	2
Kyivska 17	UKR	7.85	6.65	7.18	0.21	2	0.52	1	3
MIP Roksolana	UKR	6.45	7.50	7.00	0.08	2	0.49	1	3
Amina	UKR	7.70	5.90	6.80	0.74	1	0.67	1	2
Karavan	RUS	8.05	5.75	7.18	2.06	1	0.73	1	2
Avgustina	BLR	7.30	5.60	6.65	0.69	1	0.71	1	2
Figura	POL	8.95	5.75	7.32	0.36	1	1.55	3	4
Apertus	DEU	8.80	5.80	7.68	1.13	1	1.34	3	4
Faunus	AUT	8.65	5.45	7.78	3.71	1	1.25	3	4
Manella	NLD	8.85	4.80	7.30	3.88	1	1.69	3	4
$LSD_{0.05}$		–	–	0.29	0.29	–	0.22	–	–
Variability range (min – max)		6.45–9.25	4.80–7.50	6.53–8.60	0.08–3.88	1–2	0.49–1.69	1–3	2–4

Note: 1) – check variety for the mid-tall accessions.

The short-stemmed accessions were inferior to the mid-tall ones in terms of the share of the strongest genotypic effect (rank 1); they numbered ten genotypes, i.e. 66.7% of the total sample. These were the following varieties: Sicheslava, Korysna, Homin (UKR); MV Nemere, MV Menrot (HUN); Gordian, Patras, Alauda, KWS Ronin, and Atlon (DEU) (Table 2).

Moderate values of the genotypic effect (rank 2) in the short-stemmed group were found for five accessions, i.e. 33.3%. They were MIP Valensiia, Sotnytsia (UKR); Desamo (DEU), Balitus (AUT), and Bodycek (FRA). Low values (rank 3) were not detected in any of the studied samples. The check varieties, Podolianka and Bunchuk (UKR), showed strong genotypic effects for yield (rank 1).

We found that the genotypic effect (ε_i) for yield in the mid-tall group ranged 0.08 to 3.88; the variability range in this group varied significantly less compared to the short-stemmed genotypes (0.11−5.64). It established that the number of mid-tall homeostatic accessions with high and stable yields (rank 1) was eight varieties or 57.1%. They were MIP Lada, Haiok, Optima Odeska, Kyivska 17, Amina, MIP Roksolana (UKR); Karavan (RUS), and Avgustina (BLR). Dyvo (UKR) (7.1%) was considered a moderately plastic genotype in terms of yield under changing growing conditions (rank 2). As to the plasticity (R_i), the number of intensive, i.e. susceptible to improved or worsened cultivation conditions genotypes (rank 3) in the mid-tall group was five varieties, or 35.7%. They were Serpanok Kyivskyi (UKR), Figura (POL), Apertus (DEU), Faunus (AUT), and Manella (NLD).

Analyzing the yield plasticity in the short-stemmed group, we found that the share of homeostatic accessions (rank 1) was 33.3%, which was less than 23.8% (the share of homeostatic accessions of the mid-tall group). In fact, there were five such genotypes in the short-stemmed group: MIP Valensiia, Korysna (UKR); MV Menrot (HUN), Atlon (DEU), and Balitus (AUT). The number of moderately plastic varieties in the short-stemmed group was four: Sicheslava (UKR), MV Nemere (HUN), Patras, and Alauda (DEU), which accounted for 26.7%. The number of intensive varieties in the short-stemmed sample was six or 40% of the total number. They were Sotnytsia, Homin (UKR); Gordian, Desamo, KWS Ronin (DEU); and Bodycek (FRA). The check varieties, Podolianka and Bunchuk (UKR), had plasticity ranks 1 and 2, respectively.

Table 2

Environmental plasticity and stability of the best short-stemmed winter bread wheat varieties by yield, 2017–2020

Accession	Country of origin	Yield, t/ha			Genotypic effect		Plasticity		Sum of ranks
		max	*min*	$\overline{X}$	ε_i	Rank	R_i	Rank	
Bunchuk[1)]	UKR	7.20	5.35	5.77	0.79	1	1.12	2	3
MIP Valensiia	UKR	8.25	5.90	7.30	0.11	2	0.67	1	3
Sotnytsia	UKR	8.75	4.30	6.93	0.33	2	1.26	3	5
Sicheslava	UKR	8.25	4.25	6.75	0.70	1	1.15	2	3
Homin	UKR	8.45	4.00	6.73	0.66	1	1.27	3	4
Korysna	UKR	7.95	4.75	6.40	4.58	1	0.29	1	2
MVMenrot	HUN	7.80	4.50	6.38	5.64	1	0.14	1	2
MV Nemere	HUN	8.65	4.25	5.80	3.97	1	1.11	2	3
Gordian	DEU	9.00	4.50	7.48	1.84	1	1.32	3	4
Patras	DEU	8.85	4.80	7.47	1.38	1	1.18	2	3
Desamo	DEU	8.75	4.05	6.73	0.13	2	1.32	3	5
KWS Ronin	DEU	8.30	4.00	6.70	0.87	1	1.24	3	4
Alauda	DEU	7.95	4.10	6.63	1.24	1	1.12	2	3
Atlon	DEU	7.95	4.00	5.38	4.13	1	0.93	1	2
Balitus	AUT	7.90	5.95	7.22	0.28	2	0.57	1	3
Bodycek	FRA	8.80	4.00	6.48	0.14	2	1.31	3	5
$LSD_{0.05}$		–	–	0.33	0.33	–	0.20	–	–
Variability range (min – max)		–	–	0.33	0.33	–	0.20	–	–
		7.20–9.00	4.00–5.95	5.38–7.48	0.11–5.64	1–2	0.14–1.32	1–3	2–5

Note: 1) – check variety for the short-stemmed accessions.

We detected six accessions (42.9%) with the strongest genotypic effect (ε_i) and highest plasticity (R_i) as measures of relative practical value of varieties for production (sum of ranks 2) in the mid-tall group. They were both domestic and foreign varieties: Haiok (ε_i = 2.24; R_i = 0.97), MIP Lada (ε_i = 0.90; R_i = 0.92), Optima Odeska (ε_i = 1.01; R_i = 0.78), Amina (ε_i = 0.74; R_i = 0.67) (UKR); Karavan (ε_i = 2.06; R_i = 0.73) (RUS), and Avgustina (ε_i = 0.69; R_i = 0.71) (BLR). In the mid-tall group, Dyvo (ε_i = 3.33; R_i = 1.20), Kyivska 17 (ε_i = 0.21; R_i = 0.52), and MIP Roksolana (ε_i = 0.08; R_i = 0.49) (UKR) were slightly inferior to the above-listed accessions in terms of the total sum of their ranks (sum of ranks 3). The lowest sums of ranks across the studied winter bread wheat varieties were recorded for foreign varieties: Figura (ε_i = 0.36; R_i = 1.55) (POL), Apertus (ε_i = 1.13; R_i = 1.34) (DEU), Faunus (ε_i = 3.71; R_i = 1.25) (AUT), and Manella (ε_i = 3.88; R_i = 1.69) (NLD) (sum of ranks 4).

Investigating the genetic potential of adaptability of the short-stemmed genotypes for environmental plasticity and stability, we noted that the share of the most adapted to the Eastern Forest-Steppe of Ukraine accessions (sum of ranks 2) was 13.3%. Such varieties included Korysna (ε_i = 4.58; R_i = 0.29) (UKR) and MV Menrot (ε_i = 5.64; R_i = 0.14) (HUN). The second group in terms of adaptability and relative practical value (sum of ranks 3) includes six varieties (40%): MIP Valensiia (ε_i = 0.11; R_i = 0.67), Sicheslava (ε_i = 0.70; R_i = 1.15) (UKR); MV Nemere (ε_i = 3.97; R_i = 1.11) (HUN), Patras (ε_i = 1.38; R_i = 1.18), Alauda (ε_i = 1.24; R_i = 1.12) (DEU), and Balitus (ε_i = 0.28; R_i = 0.57) (AUT). The sum of ranks 4 in the short-stemmed group was found in three accessions (20%): Homin (ε_i = 0.66; R_i = 1.27) (UKR), Gordian (ε_i = 1.84; R_i

= 1.32), and KWS Ronin ($ε_i$ = 0.87; R_i = 1.24) (DEU). The following accessions had the lowest adaptability by genotypic effect and plasticity (sum of ranks 5): Sotnytsia ($ε_i$ = 0.33; R_i = 1.26) (UKR), Desamo ($ε_i$ = 0.13; R_i = 1.32) (DEU), and Bodycek ($ε_i$ = 0.14; R_i = 1.31) (FRA), their percentage in the short-stemmed group was also 20%. The check varieties had the following parameters of adaptability and relative practical value: Podolianka ($ε_i$ = 0.46; R_i = 0.89) (sum of ranks 2) and Bunchuk ($ε_i$ = 0.79; R_i = 1.12) (sum of ranks 3) (UKR).

We found that domestic genotypes of Haiok ($ε_i$ = 2.24; R_i = 0.97) and MIP Lada (εi = 0.90; Ri = 0.92) (UKR) had the highest genetic potentials of adaptability (sum of ranks 2) in terms of environmental plasticity and stability in combination with high yields (+ 16% to the yield from the check variety) across the mid-tall varieties. The best short-stemmed genotypes, which were somewhat inferior by adaptability (sum of ranks 3), but also produced high yields, were MIP Valensiia ($ε_i$ = 0.11; Ri = 0.67), Sicheslava ($ε_i$ = 0.70; R_i = 1.15) (UKR); Patras ($ε_i$ = 1.38; R_i = 1.18) (DEU), and Balitus ($ε_i$ = 0.28; R_i = 0.57) (AUT).

The value of starting material in breeding for adaptability is complemented by information on resistance to environmental stressors. Hence, the accessions under investigation were evaluated for and differentiated by freeze tolerance. The critical freezing temperature ranged from high (-12.5°C) to low (-17.0°C). Mid-tall domestic varieties, Dyvo and Optima Odeska (UKR), were noticeable for their high freeze tolerance (7 points), with a critical freezing point of -17.0°C. Haiok, Serpanok Kyivkyi, Amina (UKR), and Manella (NLD) with a critical freezing temperature of -16.5°C had above-average freeze tolerance (6.5 points). Of the short-stemmed genotypes, the best freeze tolerance was recorded for moderately freeze-tolerant accessions (5 points), with a critical freezing point of -15.0°C: Homin (UKR), KWS Ronin (DEU), and Bodycek (FRA). Several accessions in this group showed low freeze tolerance (3 points), in particular Gordian, Desamo, and Atlon (DEU), at a critical freezing point of -13.0°C – - 13.5°C. The check varieties, Podolianka and Bunchuk, had 7 and 6 points, respectively.

The high-yielding and highly adaptable genotypes selected in the study are valuable starting material to breed new, promising winter bread wheat varieties that could adapt to stressful growing conditions in the Eastern Forest-Steppe of Ukraine.

Conclusions. The results demonstrated that in the Eastern Forest-Steppe of Ukraine the highest adaptability (sum of ranks 2) in terms of environmental plasticity and stability in combination with high yield (+ 16% to the yield from the check variety) was recorded for mid-tall domestic genotypes, Haiok ($ε_i$ = 2.24; R_i = 0.97) and MIP Lada ($ε_i$ = 0.90; R_i = 0.92) (UKR). The most adaptable best short-stemmed accessions, which were slightly inferior to the mid-tall varieties (sum of ranks 3), but also gave high yields, were MIP Valensiia ($ε_i$ = 0.11; R_i = 0.67), Sicheslava ($ε_i$ = 0.70, R_i = 1.15) (UKR); Patras ($ε_i$ = 1.38; R_i = 1.18) (DEU), and Balitus ($ε_i$ = 0.28; R_i = 0.57) (AUT). We selected sources of high (7 points; Dyvo, Optima Odeska (UKR)) and medium (6.5 points; Haiok, Serpanok Kyivskyi, Amina (UKR), and Manella (NLD)) freeze tolerance, which complement the importance of the starting material for breeding for adaptability.

The high-yielding and highly adaptable genotypes selected in the study are valuable starting material to breed new, promising winter bread wheat varieties that could adapt to stressful growing conditions in the Eastern Forest-Steppe of Ukraine.

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АДАПТИВНІСТЬ ОЗИМОЇ М'ЯКОЇ ПШЕНИЦІ ЗА ПАРАМЕТРАМИ ЕКОЛОГІЧНОЇ ПЛАСТИЧНОСТІ ТА СТАБІЛЬНОСТІ

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Мета і задачі дослідження. Мета полягала у визначенні адаптивності озимої м'якої пшениці за параметрами екологічної пластичності та стабільності за оцінкою врожайності, виділення високоврожайних джерел, адаптованих до умов східної частини лісостепу України.

Матеріали та методи дослідження. Матеріалом дослідження були 29 зразків озимої м'якої пшениці (*Triticum aestivum* L.) походженням з дев'яти країн, у т. ч. 14 середньорослих зразків та 15 короткостеблих. Вивчення зразків та визначення їхньої адаптивної здатності проводили за відповідними методиками.

Обговорення результатів. У результаті дослідження визначено, що генотиповий ефект (ε_i) за врожайністю у групі середньорослих зразків був у межах від 0,08 до 3,88, а короткостеблих – від 0,11 до 5,64. Кращі показники адаптивності (сума рангів 2) серед середньорослих сортів за параметрами екологічної пластичності та стабільності у поєднанні з високою врожайністю мають вітчизняні генотипи Гайок (ε_i = 2,24; R_i = 0,97) та МІП Лада (ε_i = 0,90; R_i = 0,92) (UKR), а серед короткостеблих (сума рангів 3) – МІП Валенсія

(ε_i = 0,11; R_i = 0,67) (UKR) та Patras (ε_i = 1,38; R_i = 1,18) (DEU). Високим рівнем морозостійкості (7 балів) відзначилися Диво та Оптима одеська (UKR).

Висновки. У результаті проведених досліджень визначено, що найвищий генетичний потенціал адаптивності у поєднанні з високою врожайністю мають середньорослі вітчизняні генотипи Гайок та МІП Лада (UKR), які є цінним вихідним матеріалом для створення високоадаптивних та перспективних сортів озимої м'якої пшениці до умов східної частини Лісостепу України.

Ключові слова: *адаптивність, озима м'яка пшениця, генотиповий ефект, стабільність, пластичність, морозостійкість, урожайність*

ADAPTABILITY OF WINTER BREAD WHEAT BY ENVIRONMENTAL PLASTICITY AND STABILITY

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Purpose and objectives. The work was aimed to determine the winter bread wheat adaptability by environmental plasticity and stability via assessing yields and to identify high-yielding sources adapted to the Eastern Forest-Steppe of Ukraine.

Material and methods. Twenty-nine winter bread wheat (*Triticum aestivum* L.) accessions from nine countries were studied: 14 mid-tall accessions and 15 short-stemmed ones. The accessions were studied and their adaptability was determined by appropriate methods using general-scientific, special and genetic-statistical approaches.

Results and discussion. It was determined that the genotypic effect (ε_i) for yield ranged from 0.08 to 3.88 in the mid-tall group and from 0.11 to 5.64 in the short-stemmed group. The best adaptability (sum of ranks 2) in terms of environmental plasticity and stability was recorded for two mid-tall high-yielding domestic varieties (Haiok (εi = 2.24; Ri = 0.97) and MIP Lada (εi = 0.90; Ri = 0.92) (UKR)) and for two short-stemmed ones (sum of ranks 3) (MIP Valensiia (εi = 0.11; Ri = 0.67) (UKR) and Patras (εi = 1.38; Ri = 1.18) (DEU)). Dyvo and Optima Odeska (UKR) were noticeable for high freeze tolerance (7 points).

Conclusions. The study demonstrated that the highest genetic potential of adaptability in combination with high yields was intrinsic to the mid-tall domestic genotypes, Haiok and MIP Lada (UKR), which are valuable starting material for creating highly adaptable and promising winter bread wheat varieties for the Eastern Forest-Steppe of Ukraine.

Keywords: *adaptability, winter bread wheat, genotypic effect, stability, plasticity, freeze tolerance, yield, source*