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Drought resistance of soft spring wheat varieties of different ecological and geographical origins in the Forest Steppe of Ukraine

Abstract. Wheat is one of the most important crops and the basis of human food and food security. Significant climate changes in recent years directly affect the formation of the level of wheat productivity. Therefore, the creation of varieties with increased resistance to drought at the initial stages of organogenesis, as well as the ability to form a high level of productivity in arid

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conditions is an urgent task in the modern selection of crops. The research aims to evaluate the level of drought tolerance wheat varieties different methods and to identify sources for involvement in crossbreeding during the selection of drought tolerance. Laboratory and field methods were used to study the researched varieties in response to drought: germination of seeds in a sucrose solution and determination of drought resistance indices by yield level. Varieties of spring wheat of different ecological and geographical origins have an increased productive potential in the conditions of the central part of the Forest Steppe of Ukraine. A wide range of variability in the degree of drought sensitivity of spring wheat was established. Varieties that have increased resistance to drought and can form a sufficient level of productivity under stress factors have been identified: Leguan (Czech Republic) and Koksa (Poland). The obtained results prove the possibility of combining in one variety an increased level of drought resistance and yield by classical breeding methods. According to the correlation coefficient between the productivity index and other studied indices of drought resistance, the effectiveness of using the Geometric Mean (proportional average) Productivity (GMP), Stress Tolerance Index (STI) and Yield Stability Index (YSI) indices in further breeding practice was noted. The practical research significance is determined by the combination of different methods for determining drought tolerance in crop breeding allowing for an objective assessment of resistance to stress factors and determination of viability at the initial stage of plant growth and development under the influence of the limiting factor – moisture

Keywords: *Triticum aestivum* L.; productivity; crops; productivity index; dryness

INTRODUCTION

Wheat holds significant importance in agriculture as a staple crop and a fundamental component of human nutrition and food stability. Among the complex factor groups that determine all life processes of plants, climatic factors occupy a special place, since they directly determine the conditions and limits of the life of organisms, their distribution, and reproduction. The influence of agroclimatic conditions on the yield level reaches 60-70% (Hladii & Luzan, 2020; Butenko *et al.*, 2020). V.V. Hamayunova *et al.* (2018) noted that the impact of climate change on agricultural production will only increase in the future. Due to the arid conditions that occur during the growth season of wheat, there is a need to determine the level of drought tolerance of varieties at different stages of their growth and development. Dry conditions during seed germination led to thinning of crops, and their insufficient amount during the growing seasons reduces productivity.

Air temperature will continue to rise, and dry periods will alternate with periods of normal moisture. The basis for the formation of the appropriate level of productivity is favourable weather conditions during the growing season (Sobko & Vozniuk., 2018). An important role in the life of all living things is played by water, an insufficient amount of which causes water stress, which leads to a violation of the life processes of the plant organism. M. Hou *et al.* (2022) considered water scarcity a serious challenge for wheat productivity in changing climates, especially in arid and semi-arid regions. Plants develop best with optimal provision of the necessary life factors and high-quality performance of all agrotechnical measures (Yurchenko *et al.*, 2020). Different approaches are used to overcome the problem of wheat drought resistance: agronomic, physiological, and molecular. It is noted that one of the most effective options for solving the problem of drought resistance is the creation of new varieties of wheat adapted to drought (Itam *et al.*, 2020; Chowdhury *et al.*, 2021; Ahmad *et al.*, 2022). Considering climate changes (Blyzniuk *et al.*, 2019), breeding for increased resistance to drought and heat is a promising direction for further increasing wheat productivity (Collins & Chenu, 2021).

Considering the aforementioned, the determination of the features of modern spring wheat genotypes by the level of drought resistance is an important and urgent task in breeding for adaptability. In H.U. Rehman *et al.* (2021) characterization of genotypes for adaptive traits can increase their selection for higher yield under drought conditions, and phenotypic and genetic study of drought-related traits will aid future gene discovery efforts and provide the basis for breeding drought-resistant wheat varieties (Lin *et al.*, 2019).

The study and research of the economic characteristics of the modern assortment of soft spring wheat allows to identify sources of valuable characteristics for their further involvement in breeding programs as valuable starting material (Lozinska *et al.*, 2018; Langridge & Reynolds, 2021). The research aims to evaluate the level of drought tolerance wheat varieties different methods and to identify sources for involvement in crossbreeding during the selection of drought tolerance.

MATERIALS AND METHODS

The research was conducted in 2016-2018 at the V.M. Remesla Myroniv Wheat Institute of the National Academy of Sciences. Fourteen varieties of soft spring wheat of different ecological and geographical origins were used: Elegia Myronivska, Struna Myronivska, Kharkivska 26, MIP Zlata, Panyanka, SimkodaMyronivska, Etud, Suite, Heroinya (Ukraine), Koksa, Yasna (Poland), Granny (Austria), Leguan (Czech Republic), Venera (Syria). Sowing was carried out on the experimental field with a CH-10C seeder in four repetitions. The registered area of the site is 10 m².

The variety Elehiia Myronivskawas used as a control sample. Laboratory and field methods were used to study the researched varieties in response to drought: germination of seeds in a sucrose solution and determination of drought resistance indices by yield level. Seed germination on a sucrose solution was carried out using a solution with a molar concentration corresponding to 14 atm of osmotic pressure (Dorofeyev *et al.*, 1974).

The seeds were disinfected with sodium hypochlorite (NaClO) solution. Seed germination was carried out on filter paper in Petri dishes for 7 days at a temperature of +20...21°C (Fig. 1a). The control sample seeds germinated under similar conditions in distilled water (Fig. 1b). Seed germination was determined as the percentage of germinated seeds compared to the control. The number of germinal roots was determined on the 7th day of germination in the control sample group.

Figure 1. Determination of drought resistance by seed germination on sucrose solution
Note: a) seed germination in a thermostat; b) wheat seeds for germination on distilled water (with sprouts) and in sucrose solution (without sprouts)

Indices of drought resistance are calculated according to the formulas:

➤ the yield index (YI) characterizes the percentage of the yield of a specific sample in dry conditions to the average yield of the studied varieties during the drought period (Gavuzzi *et al.*, 1997):

$$YI = \frac{Y_s}{\bar{Y}_s} \times 100, \qquad (1)$$

where *Ys* is the yield in drought conditions, $\bar{Y}s$ is the average yield of all studied samples in drought conditions;

➤ the average yield index (MP) characterizes the yield of the variety in dry and optimal years. (Ribaut & Poland, 1999):

$$MP = \frac{Y_p + Y_s}{2}; \qquad (2)$$

➢ the geometric mean (proportional mean) of yield (Griffing, 1950):

$$GMP = \sqrt{Y_P \times Y_S}\,; \tag{3}$$

➢ the yield stability index (YSI) characterizes the ratio of yield under stress to yield under optimal conditions (Bouslama & Schapaugh, 1984):

$$YSI = \frac{Y_S}{Y_p}\,; \tag{4}$$

➢ the drought susceptibility index (DSI) characterizes how sensitive the variety is to the effects of drought, therefore, the lower its index, the greater the level of drought resistance of the sample (Fischer & Maurer, 1978):

$$DSI = \frac{Y_p - Y_s}{Y_p \times D}\,, \tag{5}$$

where: D (intensity of the stress factor) = 1-(HŶs/Ŷp); *Ys* – yield of a variety in drought conditions, *Yp* – yield of a variety in favourable conditions, HŶs – average yield level for all varieties in drought conditions, *Ŷp* – average yield level for all varieties in favourable conditions;

➢ the stress tolerance index (STI) characterizes the ability of a sample to maintain a stable yield level regardless of stress factors (Fernandez, 1992):

$$STI = \frac{Y_p \times Y_s}{(\bar{Y}_p)^2}\,, \tag{6}$$

where $\bar{Y}p$ is the average yield under optimal conditions;

➢ the drought tolerance index (TOL) determines the yield reduction under the influence of drought in absolute units. The optimal yield level of varieties with low indicators of this index was noted. (Hossain *et al.*, 1990):

$$TOL = Y_p - Y_s\,, \tag{7}$$

where *Yp* is yield in optimal conditions, Ys is yield in drought conditions;

➢ to characterize the hydrothermal conditions, the hydrothermal coefficient of Selyaninov (HCS) (Selyaninov, 1937) was calculated:

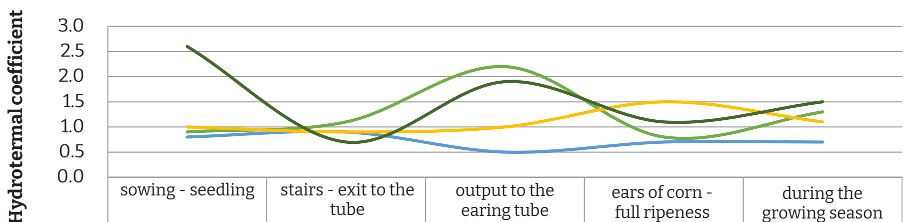
$$HCS = \frac{\sum r}{0{,}1 \times \sum t^{\circ}C}\,, \tag{8}$$

where $\sum r$ is the sum of precipitation (in mm) for the period with an average daily air temperature above 10°C; $\sum t$ is the sum of active temperatures for the same period; 0.1 – constant coefficient.

Statistical analysis was performed using the Statistica 12.0 program (StatSoft, TIBCO, USA). The research was conducted following the requirements of the International Convention on Biological Diversity (1992).

RESULTS AND DISCUSSION

The sum of temperatures during the growing season of 2016-2018 was 1666.7-1771.6°C, while the long-term indicator was 1550.7°C. The hydrothermal coefficient in 2016 (Fig. 2) was generally optimal (HCS=1.3), but in the interphase period "exiting the tube–earing" there was overwetting of the territory (HCS=2.2), and the period "earing–full ripeness", during which 70.60 mm of precipitation fell, was marked as dry (HCS=0.8). The total HCS for 2017 was 0.7 with a critical value (HCS=0.5) in the period "exit to the tube–earing", during which 14.74 mm of precipitation fell, and the average daily temperature was higher by 1.3°C. In 2018, the total value of HCS was noted at the level of 1.1, its decrease occurred in the interphase period "stairs – exit into the tube" (HCS=0.9).



	sowing - seedling	stairs - exit to the tube	output to the earing tube	ears of corn - full ripeness	during the growing season
2016	0.9	1.1	2.2	0.8	1.3
2017	0.8	0.9	0.5	0.7	0.7
2018	1	0.9	1	1.5	1.1
average multi-year indicator	2.6	0.7	1.9	1.1	1.5

Figure 2. Hydrothermal conditions of soft spring wheat vegetation in the Forest-Steppe Zone of Ukraine (MIP, 2016-2018)

Source: compiled by the authors

Considering climate changes, breeders are constantly increasing the level of drought resistance of crop genotypes by both traditional breeding methods and genetic engineering (Chebotar *et al.*, 2020; Motsnyi *et al.*, 2022). As scientists note, the use of laboratory methods for assessing drought resistance requires testing genotypes under natural growth conditions (Yurchenko *et al.*, 2020). The variation of the average yield level of the varieties over the years of research was noted from 2.94 to 4.00 t/ha (Table 1). The highest level of spring wheat yield was recorded in 2016, and the lowest in 2017, which proves optimal and unsatisfactory climatic conditions during the growing season. In selection for drought resistance, varieties that can form a sufficiently high level of productivity in unfavourable growing conditions should be prioritised. Thus, under dry vegetation conditions, the highest level of productivity was noted in wheat varieties: Suita (3.16 t/ha), Leguan (3.06 t/ha), Koksa (2.99 t/ha) and MIP Zlata (2.95 t/ha).

Table 1. Yield parameters of soft spring wheat varieties (± SE) for (2016-2018)

Variety, standard	Country of Origin	Productivity, t/ha			
		2016	2017	2018	
Elehiia myronivska- St	UKR	4.60±0.08	2.74±0.17	3.11±0.08	3.48±0.98
MIP Zlata	UKR	5.45±0.13	2.95±0.06	3.61±0.11	4.00±1.30
Struna myronivska	UKR	4.89±0.18	2.59±0.14	4.22±0.05	3.90±1.18
Koksa	POL	4.64±0.07	2.99±0.14	3.69±0.11	3.77±0.83
Leguan	CZE	4.60±0.08	3.06±0.14	3.64±0.15	3.77 ± 0.78
Simkoda myronivska	UKR	5.01±0.16	2.61±0.09	3.64±0.15	3.75±1.20
Yasna	POL	4.01±0.13	2.59±0.07	4.53±0.09	3.71±1.00
Paniyanka	UKR	5.00±0.14	2.62±0.05	3.53±0.11	3.72±1.20
Kharkivska 26	UKR	4.74±0.08	2.74±0.09	3.39±0.10	3.62±1.02
Granny	AUT	4.31±0.07	2.66±0.09	2.99±0.17	3.32±0.87
Heroinia	UKR	4.20±0.14	2.47±0.14	2.80±0.09	3.18±0.91
Venera	SYR	4.34±0.12	2.86±0.11	2.11±0.15	3.10±1.13
Siuita	UKR	3.86±0.30	3.16±0.06	2.14±0.11	3.05±0.87
Etiud	UKR	3.49±0.19	2.79±0.15	2.53±0.09	2.94±0.50

Note: St – standard, – three-year average
Source: developed by the authors based on their research (2016-2018)

Following the research methodology, to calculate the corresponding indices of drought resistance, the yield formed by varieties in two years with contrasting weather conditions was chosen. These were 2017 and 2016 when the minimum and maximum yield levels were obtained, respectively. The fluctuation range of the productivity index (YI) was 85-109 (Table 2). A high value of the productivity index was noted in the varieties Suita (YI=109), Leguan (YI=105), Koksa (YI=103), MIP Zlata (YI=101), Venera (YI=98), Etyud (YI=96). The obtained data testify to a higher level of yield in the indicated varieties in drought conditions.

Table 2. Characteristics of soft spring wheat varieties according to drought resistance indices

Variety, standard	YI	MP	GMP	YSI	SSI	STI	TOL
Elehiiamyronivska- St	94	3.60	3.49	0.60	1.00	0.60	1.71
MIP Zlata	101	4.20	4.01	0.54	1.19	0.79	2.50
Strunamyronivska	89	3.74	3.56	0.53	1.23	0.63	2.30
Koksa	103	3.82	3.72	0.64	0.93	0.69	1.65
Leguan	105	3.83	3.75	0.67	0.87	0.69	1.54
Simkodamyronivska	90	3.81	3.62	0.52	1.25	0.65	2.40
Yasna	89	3.30	3.22	0.65	0.93	0.51	1.42
Paniyanka	90	3.81	3.62	0.52	1.24	0.65	2.38
Kharkivska 26	94	3.74	3.60	0.58	1.10	0.65	2.00
Granny	91	3.49	3.39	0.62	0.99	0.57	1.65
Heroinia	85	3.34	3.22	0.59	1.07	0.51	1.73
Venera	98	3.60	3.52	0.66	0.89	0.61	1.48
Siuita	109	3.51	3.49	0.82	0.47	0.6	0.70
Etiud	96	3.14	3.12	0.80	0.52	0.48	0.70

Note: YI – productivity index, MP – average productivity index, GMP – geometric mean (proportional average) productivity, YSI – yield stability index, DSI – susceptibility index, STI – stress tolerance index, TOL – tolerance index. For TOL and DSI, lower values are desirable; For YI, MP, GMP, YSI and STI, higher values are desirable
Source: compiled by the authors

The MP index varied from 3.14 to 4.20. According to this indicator, the varieties MIP Zlata, Panyanka, Kharkivska 26 (UKR), Leguan (CZE), and Koksa (POL) were selected, which are capable of forming high yields under different weather conditions. Variations in the values of the yield stability index (YSI) were noted in the range of 0.52-0.82. Among the studied varieties, the lowest level of susceptibility to drought was found in the following varieties: Suite (DSI=0.47), Etude (DSI=0.52), Leguan (DSI=0.87), Venera (DSI=0.89). The range of variation according to the stress tolerance index (STI) was 0.48-0.79. A consistently high level of productivity was found in the following varieties: Simkoda Myronivska, Panyanka, MIP Zlata (UKR), Koksa (POL), and Leguan (CZE). The index of tolerance to stress in the specified varieties was from 0.65 to 0.79. The stress tolerance index (TOL) variation ranged from 0.70 to 2.50. As a result of the analysis, the optimal yield level under conditions of water deficit was found in the following varieties: Suite (TOL=0.70), Etude (TOL=0.70) and Yasna (TOL=1.42). According to most indices of drought resistance, the following varieties were selected: Koksa, Leguan, MIP Zlata and Etyud.

One of the determining factors of spring wheat yield level is moisture supply during the interphase periods of growth and development. In the studied years, dry conditions were observed during the germination period (Fig. 2). One of the methods that allow you to identify genotypes that can avoid the effect of drought in the early stages of development is the diagnosis of wheat varieties based on the indicator of seed germination on sucrose solution and the number of roots (Pour-Aboughadareh *et al.*, 2019; Khomenko, 2020).

During seed germination in a sucrose solution corresponding to 14 atm of osmotic pressure, differentiation of the investigated varieties was revealed by the percentage of germinated seeds (Fig. 3). Drought resistance at the level of the standard variety Elehiia Myronivska (according to Fisher's criterion) was noted in the following varieties: Koksa (91±2.9), Venera (91±2.9), Leguan (80±4.0), Simkoda Myronivska (75±4.3), Yasna (87±3.4) and Granny (87±3.4).

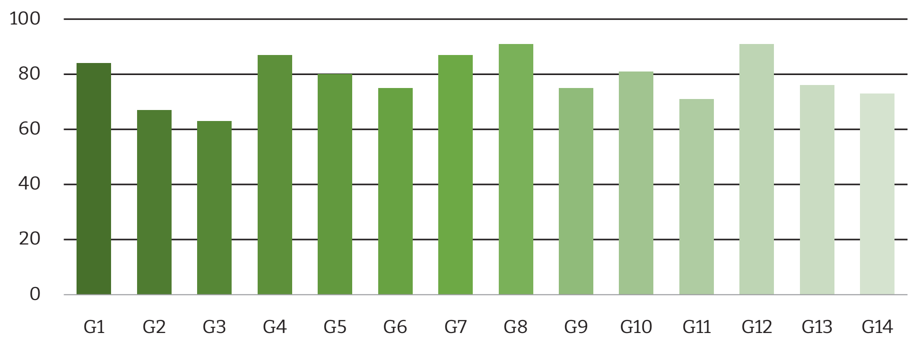


Figure 3. Distribution of spring wheat varieties by the percentage of germinated seeds on a 14 atm sucrose solution, 2016-2018

Note: G1 – Elehiia Myronivska, G2 – MIP Zlata, G3 – Struna Myronivska, G4 – Koksa, G5 – Leguan, G6 – Simkoda Myronivska, G7 – Paniyanka, G8 – Yasna, G9 – Kharkivska 26, G10 – Granny, G11 – Heroinia, G12 – Venera, G13 – Siuita, G14 – Etiud

Source: compiled by the authors based on their research (2016-2018)

The root plays an important role in providing water for the viability of plants at the germination stage (Khakwani *et al*, 2011; Wasaya *et al*, 2018; Terletskaya *et al.*, 2020), namely the number of germinating roots during seed germination since it is the root system that is responsible for providing plants with nutrients for their growth and development. Counting the number of germinal roots in spring wheat varieties showed a significant variation of this indicator depending on the genotype (Fig. 4). Within the studied set of varieties, from one to six germinal roots were noted, as well as a small percentage of seeds in the ringing phase.

In varieties (Koksa (91±2.9), Venera (91±2.9), Yasna (87±3.4), Granny (87±3.4), Leguan (80±4.0), Simkoda Myronivska (75±4.3), in which a high percentage of germinated seeds on sucrose solution was noted, the highest number of germinal roots was determined. The obtained data are consistent with the results of studies where it is noted that genotypes with a greater root biomass, and accordingly a greater number of roots, have a higher level of drought resistance (Mia *et al.*, 2020).

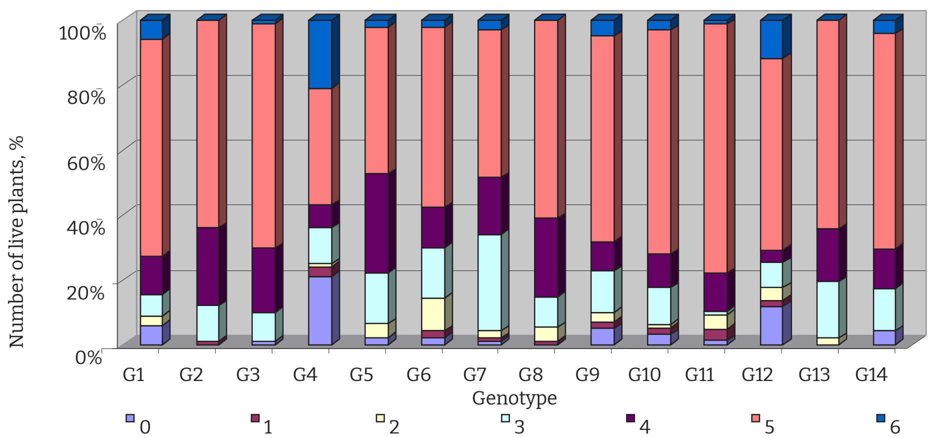


Figure 4. Distribution of spring wheat varieties by the number of germinal roots

Notes: G1 – Elehiia Myronivska, G2 – MIP Zlata, G3 – Strunam Myronivska, G4 – Koksa, G5 – Leguan, G6 – Simkoda Myronivska, G7 – Paniyanka, G8 – Yasna, G9 – Kharkivska 26, G10 – Granny, G11 – Heroinia, G12 – Venera, G13 – Siuita, G14 – Etiud

Source: developed by the authors based on their research (2016-2018)

The spring wheat varieties used in the study demonstrate a relatively wide range of drought resistance using the index approach and the laboratory method, which is also noted by other scientists (Grzesiak *et al.*, 2019). The obtained results prove the difficulty of combining high productivity and drought resistance in one genotype (Moskalets & Rybalchenko, 2015).

The correlation coefficient between productivity in optimal and drought conditions and drought resistance indices was determined. Variability of the strength and direction of the relationship between the indices of drought resistance and productivity in contrasting years in terms of vegetation conditions was revealed (Table 3). A strong relationship was established between the productivity of spring wheat varieties in the optimal growing season (2016) and drought resistance indices – MP (0.92±0.11). GMP (0.84±0.16), DSI (0.84±0.15), STI (0.85±0.15), TOL (0.93±0.10). A significant relationship between wheat yield in a dry year and drought resistance indices was noted only in the calculations: YI (1.00±0.00), YSI (0.58±0.24).

Table 3. Correlation coefficients of productivity with stability and drought resistance indices

Index, parameter	YI	MP	GMP	YSI	SSI	STI	TOL
$\overline{Y_p}$	-0.07±0.29	0.92±0.11**	0.84±0.16**	-0.85±0.15**	0.84±0.15**	0.85±0.15**	0.93±0.10**
Y_s	1.00± 0.00	0.31±0.10	0.48±0.25	0.58±0.24*	-0.58±0.24*	0.47±0.26	-0.42±0.26
YI	-	0.30±0.27	0.50±0.25	0.60±0.24**	-0.60±0.24**	0.50±0.26	-0.40±0.26

Notes: $\overline{Y_p}$ – optimal conditions; Ys – arid conditions; * – marked correlations are probable at p<0.05; ** – marked correlations are probable at p<0.01

Source: compiled by the authors

Correlations were also established between the yield index (YI) and the rest of the drought resistance indices: MP (r=0.30±0.27); with indices: GMP (r=0.50±0.25), YSI (r=0.60±0.24), SSI (r=-0.60±0.24), STI (r=0.50±0.26) and TOL (r=-0.40±0.26). Statistically significant correlations were determined between the yield index (YI) and the yield stability index (YSI) and the drought susceptibility index (DSI). When determining the correlations between the yield index (YI) and other calculated indices of drought resistance, a positive correlation (r=0.50±0.26) was noted between the yield index and the stress tolerance index (STI) and a negative correlation (r=-0.6±0.24) with the index of susceptibility to drought (DSI).

The obtained results of the correlation analysis coincide with the results of the research of other scientists, who also found a positive correlation between the yield and the stress tolerance index and a negative correlation between the yield and the drought susceptibility index (Pireivatlou *et al.*, 2010). Considering the research results, it should be noted that in selection for drought resistance, it is worth paying attention to the correlation between the yield index (YI) and the indexes of GMP, STI, and YSI, since there is a moderate and medium correlation, which may indicate the effectiveness of their use in further selection practice. S. Grzesiak *et al.* (2019) also note the effectiveness of using the stress tolerance index to determine resistant genotypes. At that time, other scientists note that the index approach characterizes genotypes by yield level and is considered an important addition to the classical methods of selection of agricultural plants (Peña-Gallardo *et al.*, 2019; Pykalo *et al.*, 2020).

Therefore, to determine the level of drought resistance of wheat varieties, it is advisable to use different methods of evaluating the specified trait, which provides a comprehensive approach and makes it possible to identify genotypes resistant to the influence of the limiting factor in different phases of growth and development.

CONCLUSIONS

The study showed that soft spring wheat varieties with different ecological and geographical origins demonstrate increased productivity potential in the central part of the Forest-Steppe of Ukraine. Among these varieties are those with increased resistance to drought and the ability to form a sufficient level of productivity under stress factors: Leguan (Czech Republic) and

Koksa (Poland). In varieties Koksa (91±2.9), Venera (91±2.9), Yasna (87±3.4), Granny (87±3.4), Leguan (80±4.0), Simkoda Myronivska (75±4.3) in which a high percentage of germinated seeds on sucrose solution was noted, the highest number of germinal roots was determined. The assessment of germination rates on sucrose solution and the number of germinal roots further supported this finding for varieties Koksa, Venera, Yasna, Granny, Leguan, and Simkoda Myronivska.

The results also show that it is possible to combine increased drought tolerance and favourable yields in one variety using traditional breeding methods. The correlation coefficients between the productivity index and the other drought tolerance indices studied (GMP, STI and YSI) underline the effectiveness of incorporating these indices into future breeding practices. The combination of different methods for assessing drought tolerance in crop breeding allows for an objective assessment of stress tolerance and viability at the initial stages of plant growth and development, especially under conditions of limiting factors such as moisture availability.

Determining the level of drought resistance of spring wheat makes it possible to identify the sources of this trait, which makes it possible to involve highly drought-resistant genotypes in the selection process and create drought-resistant varieties A promising direction of the research is the involvement of varieties of different ecological and geographical origin, in particular, Koksa, Venera, Yasna, Granny, Leguan and Simkoda Myronivska in crossbreeding, which will increase the level of drought resistance of new varieties of spring wheat and expand the range of their cultivation.

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CONFLICT OF INTEREST

None.

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Посухостійкість сортів м'якої ярої пшениці різного еколого-географічного походження в Лісостепу України

Анотація. Пшениця є однією з найважливіших сільськогосподарських культур і основою продовольства та продовольчої безпеки людства. В останні роки відмічаються значні зміни кліматичних умов, які безпосередньо впливають на формування рівня продуктивності пшениці. Тому створення сортів з підвищеною стійкістю до посухи на початкових етапах органогенезу, а також здатністю формувати високий рівень продуктивності в посушливих умовах є актуальним завданням сучасної селекції сільськогосподарських культур. Метою роботи було оцінити рівень посухостійкості сортів пшениці м'якої різними методами та виявити джерела для залучення в схрещування при селекції на посухостійкість. Для вивчення реакції досліджуваних сортів на посуху використовували лабораторні та польові методи: пророщування насіння в розчині сахарози та визначення індексів посухостійкості за рівнем урожайності. Встановлено, що сорти пшениці м'якої ярої різного еколого-географічного походження мають підвищений продуктивний потенціал в умовах центральної частини Лісостепу України. Встановлено широкий діапазон мінливості за ступенем посухостійкості пшениці м'якої ярої. Виділено сорти, які мають підвищену стійкість до посухи та здатність формувати достатній рівень продуктивності в умовах дії стресових факторів: Легуан (Чехія) та Кокса (Польща). Отримані результати доводять можливість поєднання в одному сорті підвищеного рівня посухостійкості та врожайності класичними методами селекції. За коефіцієнтом кореляції між індексом продуктивності та іншими досліджуваними показниками посухостійкості відзначено ефективність використання індексів Geometric Mean (proportional average) Productivity (GMP), Stress Tolerance Index (STI) та Yield Stability Index (YSI) у подальшій селекційній практиці. Практичне значення роботи полягаэ в тому, що поєднання різних методів визначення посухостійкості в селекції сільськогосподарських культур дозволяє проводити об'єктивну оцінку стійкості до стресових факторів та визначати життєздатність на початковому етапі росту і розвитку рослин в умовах дії лімітуючого фактора – вологи

Ключові слова: *Triticum aestivum* L.; продуктивність; сільськогосподарські культури; індекс продуктивності; сухість