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ECOLOGICAL PLASTICITY OF NEW WINTER WHEAT VARIETIES UNDER DIFFERENT SOIL AND CLIMATIC CONDITIONS

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The results of the research on new varieties of soft winter wheat on ecological plasticity for 2010-2012 are presented. Varieties that due to inherited high plasticity and stability, are able to successfully adapt to limitative factors of life support and stressful phenomena, and to positively modify in different soil and climatic zones, subzones and micro zones, which are significantly dominated by the yield and grain quality, are revealed.

Keywords: *winter wheat, varieties, ecological plasticity, stability, soil and climatic zones, limitative factors, extreme phenomena, adaptability, yield, product quality.*

The fundamental direction and determinative powerful biological basis of yield increase is the development of genetics and breeding concerning the genetic potential of varieties. Therefore, in the world increment of grain croppage for last 70 years by 50-60 %, as denotes an academician of NAS and Hero of Ukraine V.V. Morhun, the major part is caused by the introduction of new varieties [1].

Breeding, unlike other agronomic sciences, does not affect soil, agrotechnical and phytosanitary conditions and during solving the problem of increasing the yield and grain quality indices, improves the plant, its genotype, morphotype, ecological plasticity, stability, adaptability, viability, immunity, tolerance to negative factors and stressful hydrothermal phenomena and the genetic potential of productivity and product quality [2,3]. Therefore, due to the achievements of

geneticists-selectionists, genetic potential of yield of varieties of new generations significantly increases. Choice of the best varieties for farms of different soil-climatic zones, subzones and micro zones with unstable weather conditions is of decisive importance for increasing yield and improving product quality. It must be scientifically grounded, *taking into account the characteristics of ecological plasticity, stability and potential of adaptability of new varieties.*

Thus, studying of *agroecological plasticity and stability, by which is evaluated the potential of adaptability* of new wheat varieties, is actual for food security and economic independence of Ukraine.

Methods of researches that were conducted in the institutions of state expertise and grade testing, were carried out according to the methods of examination and the state strain testing [4], and results of analysis of ecological plasticity and stability of productivity features and protein content in grains of winter wheat varieties were evaluated by generally accepted methods of Eberhard-Russell [5].

The results of researches of ecological plasticity and stability of winter wheat indicate the reaction of genotype to the combined action and degree of influence of abiotic and biotic environmental factors, which causes the ability of *phenotype* to adapt to the limitative factors and stressful phenomena, tolerance and stability of the negative factors, the variability of some quantitative features of its plants structure, formation of positive morphophysiological features of productivity and product quality increase.

According to Eberhard-Russell regression coefficient of varietal yield on indexes of the environment is called *the coefficient of ecological plasticity*, the variance relatively regression – *stability*, and eco-ductile variety, in which the regression coefficient is equal to 1 and the deviation from the regression line is minimum – *stable*. By the combining of these parameters with high yield such stable variety is considered quite valuable or unique, genotypes with coefficient b > 1 belongs to highly-ductile (relatively the avarage group), with 1 > b = 0 – belongs to relatively low ductile. If index of the variety plasticity doesn’t

significantly differ from 1, then this variety by the reaction to changing environmental conditions is equivalent to the avarage group ecological plasticity.

By the degree of deviation from the regression W low ductile varieties with low value of W are considered widely adapted genotypes but are unprofitable so they refer to extensive, and highly ductile varieties with low value of W – to intensive.

The results of investigations showed that in some agro-climatic zones, yield is formed by varieties in most cases unstable and it is sometimes unpredictable because it is difficult to find highly ductile, versatile variety that would be suitable for any environment conditions. The priority task is to identify varieties suitable for specific soil-climatic zone. But its realization is complicated by the fact that for last 50 years weather conditions, within the agro-climatic zones of Ukraine, acquire considerable diversity and extremality [6], which cause changes of the norm of reaction of plant varieties to growing conditions. Therefore the research of varieties within only the one zone (Steppe, Forest-Steppe or Polissya) is not sufficient to identify highly ductile variety that can provide good results in other zones during years with significant deviations of hydrothermal conditions from the optimal values. Therefore, lets consider the obtained indices of ecological plasticity and stability of yield and grain protein content in different zones of Ukraine, starting from the Steppe zone (Table 1).

Table 1

Ecological plasticity and stability of yield features and protein content in grains of soft winter wheat in Steppe zone (2010-2012)

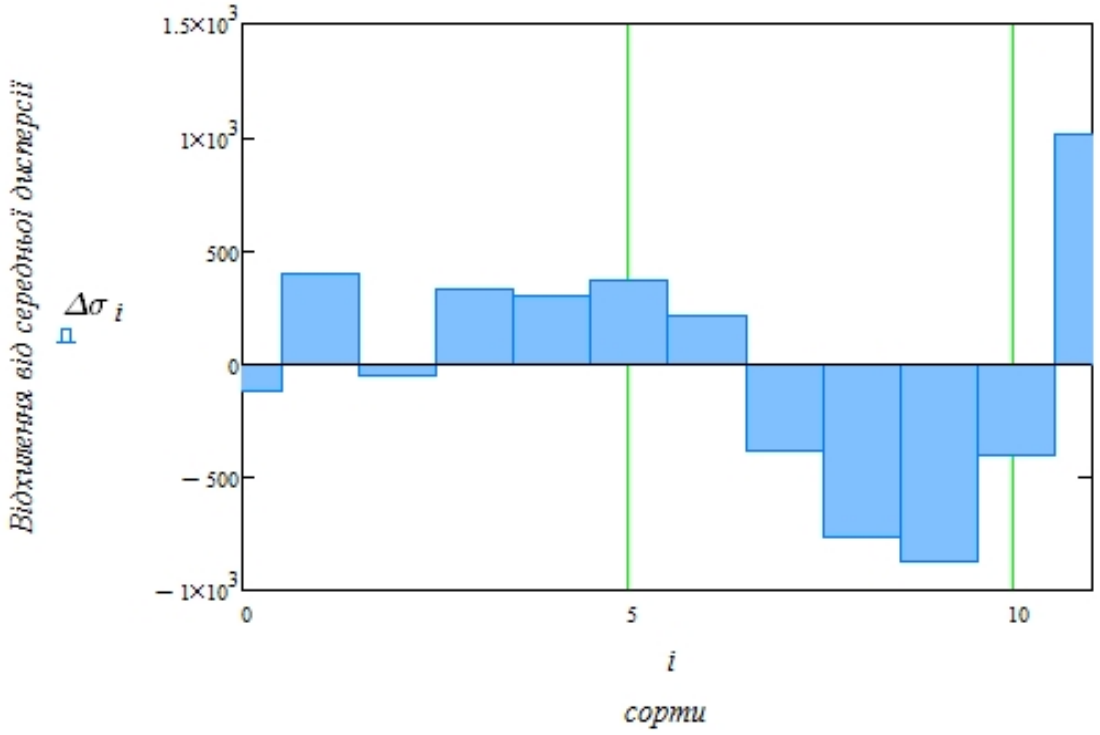
№	Variety	Yield		Protein content	
		plasticity (b)	stability (W)	plasticity (b)	stability (W)
1	Podolyanka st.	1,158	$8{,}927 \times 10^7$	0,739	$1{,}857 \times 10^6$
2	Yednist’ st.	0,969	$8{,}790 \times 10^7$	1,319	$1{,}879 \times 10^6$
3	Kraevyd	0,728	$8{,}844 \times 10^7$	1,081	$1{,}862 \times 10^6$
4	Lira odeska	1,094	$8{,}824 \times 10^7$	1,322	$1{,}870 \times 10^6$

5	Mariya	1,137	$8,838 \times 10^7$	0,665	$1,878 \times 10^6$
6	Oriyka	1,043	$8,808 \times 10^7$	0,994	$1,888 \times 10^6$
7	Sotnytsya	0,998	$8,833 \times 10^7$	1,379	$1,878 \times 10^6$
8	Arktis	1,021	$8,958 \times 10^7$	1,129	$1,833 \times 10^6$
9	Etela	0,706	$8,988 \times 10^7$	0,912	$1,857 \times 10^6$
10	Matrix	0,625	$9,008 \times 10^7$	0,367	$1,859 \times 10^6$
11	Sailor	1,137	$8,978 \times 10^7$	0,672	$1,853 \times 10^6$
12	Tonatsiya	1,384	$8,751 \times 10^7$	1,420	$1,867 \times 10^6$

As we can see, the indices of ecological plasticity and stability of majority of winter wheat varieties by the index of plasticity of yield feature in conditions of Steppe, including varieties – standards, are within 1, or very close to 1 and differ little from the avarage group ecological plasticity. Highly ductile turned out varieties Lira odeska, Mariya, Oriyka and Tonatsiya, which are confirmed also graphically by analysis of deviations from the average group dispersion, since their dispersions are located at the top of the scale (Fig.).

Graphical analysis of surfaces indicates that these highly ductile varieties have been forming for three years the consistently high yields, while the remaining varieties concede by stability.

Analysis of results of feature deviation of stability is also interesting in terms of determining the average-group constant, as index of stability is more conditional than that of ecological plasticity and only comparison by the norm of reaction of other genotypes allows to select by this indicator the best and worst varieties in group. Thus, by the results of research on the stability of yield index, highly ductile are varieties Lira odeska, Mariya, Oriyka and Tonatsiya and they can be attributed to the varieties of intensive type with positive reaction to changing environmental conditions.



* Відхилення від середньої дисперсії - Deviation from average dispersion

** сорти - varieties

Fig. **Deviation of yield in conditions of Steppe from average dispersion (varieties 1-12 according to numeration in Table 1)**

By the protein content in grain, highly ductile varieties are Yednist', Lira odeska, Sotnytsya, Arktis, but varieties Yednist' and Arktis are significantly higher than the average group dispersion. Graphical analysis of the surfaces indicates that these two varieties by protein content for three years are highly stable, especially Arktis variety refers to the intensive type with positive reaction to the accumulation of protein, the content of which reached in all grade testing institutions of Steppe on the average 15,2 %.

The variety of intensive type Lira odeska deserves particular attention, which combines high ecological plasticity by yield with high ecological plasticity by protein content in grain with no significant excess of average group dispersion. However, it has an advantage over varieties with higher than his ecological plasticity by protein content, but with lower environmental plasticity by the yield,

taking into consideration the harvest of protein per hectare. Also *positive and unique feature of this variety, unlike other varieties could be significantly lower negative correlative connection between the level of yield and protein content in grain.* [7]

With the help of investigations of ecological plasticity of winter wheat varieties in Forest-Steppe (Table 2) by deviations of feature of yield stability from the average group value, were found varieties of intensive type such as: Lira odeska and Tonatsiya and low ductile varieties with low stability value. Variety Krayevyd can be attributed to the widely adapted, but extensive genotype with the lowest in the group value ecological plasticity index of yield. By protein content highly ductile are varieties Lira odeska, Sotnytsya, Etela and especially Arktis that, as in the Steppe zone, essentially predominates over other varieties, but by the yield is low ductile.

Table 2

Ecological plasticity and stability of yield and protein content of soft winter wheat varieties in Forest-Steppe zone (2010-2012)

№	Variety	Yield		Protein content	
		plasticity (b)	stability (W)	plasticity (b)	stability (W)
1	Podolyanka st.	0,858	$8{,}226 \times 10^7$	-0,08	$1{,}634 \times 10^6$
2	Yednist’ st.	1,085	$8{,}438 \times 10^7$	0,178	$1{,}649 \times 10^6$
3	Kraevyd	0,809	$8{,}326 \times 10^7$	2,738	$1{,}658 \times 10^6$
4	Lira odeska	1,041	$8{,}300 \times 10^7$	1,795	$1{,}652 \times 10^6$
5	Mariya	1,105	$8{,}398 \times 10^7$	1,146	$1{,}652 \times 10^6$
6	Oriyka	0,923	$8{,}285 \times 10^7$	0,736	$1{,}662 \times 10^6$
7	Sotnytsya	1,041	$8{,}356 \times 10^7$	2,682	$1{,}655 \times 10^6$
8	Arktis	0,825	$8{,}348 \times 10^7$	1,330	$1{,}639 \times 10^6$
9	Etela	0,987	$8{,}372 \times 10^7$	1,420	$1{,}641 \times 10^6$
10	Matrix	1,162	$8{,}457 \times 10^7$	0,034	$1{,}649 \times 10^6$

11	Sailor	1,037	$8,352 \times 10^7$	-1,684	$1,651 \times 10^6$
12	Tonatsiya	1,126	$8,329 \times 10^7$	1,705	$1,657 \times 10^6$

In soil and climatic conditions of Polissya (Table 3) highly ductile and highly stable by yield and intensive turned out varieties Kraevyd, Sotnytsya, Arktis, Etela, Matrix, Sailor and Tonatsiya, which by the intensive production technologies are able to significantly increase their productivity. And by the protein content varieties Podolyanka, Yednist', Lira odeska, Oriyka, Arktis, Etela and Matrix have indicators of plasticity with coefficient b > 1, they are highly ductile, Lira odeska and Arktis are highly stable varieties of highly intensive type with positive reaction to environmental conditions changing.

As a result researches on the stability and plasticity of new varieties of winter wheat, were allocated genotypes of intensive type with positive reaction to improving the growing conditions, that are most suitable for intensive technologies, and resumptive recommendations of their usage in different zones were made.

Table 3

Ecological plasticity and stability of yield and protein content of soft winter wheat varieties in Polissya zone (2010-2012)

№	Variety	Yield		Protein content	
		plasticity (b)	stability (W)	plasticity (b)	stability (W)
1	Podolyanka st.	0,484	$1,831 \times 10^7$	2,829	$2,182 \times 10^5$
2	Yednist' st.	0,835	$1,861 \times 10^7$	1,543	$2,174 \times 10^5$
3	Kraevyd	1,062	$1,830 \times 10^7$	0,596	$2,176 \times 10^5$
4	Lira odeska	0,869	$1,857 \times 10^7$	1,675	$2,146 \times 10^5$
5	Mariya	0,609	$1,885 \times 10^7$	0,342	$2,141 \times 10^5$
6	Oriyka	0,909	$1,841 \times 10^7$	1,393	$2,175 \times 10^5$
7	Sotnytsya	1,280	$1,833 \times 10^7$	-0,263	$2,163 \times 10^5$

8	Arktis	1,329	$1,828 \times 10^7$	2,017	$2,154 \times 10^5$
9	Etela	1,071	$1,824 \times 10^7$	2,604	$2,159 \times 10^5$
10	Matrix	1,065	$1,828 \times 10^7$	1,534	$2,175 \times 10^5$
11	Sailor	1,396	$1,813 \times 10^7$	-1,534	$2,178 \times 10^5$
12	Tonatsiya	1,092	$1,847 \times 10^7$	-0,737	$2,158 \times 10^5$

Conclusions. According to the research results of new varieties of soft winter wheat on ecological plasticity were identified varieties that due to the high plasticity and stability can successfully adapt to the limitative factors of life support and stressful events in different soil-climatic zones, subzones and microzones significantly predominate by the yield and grain quality.

For the usage are proposed highly ductile varieties by yield indices, particularly in the Steppe zone Lira odeska, Mariya, Oriyka and Tonatsiya; in the Forest-Steppe – Lira odeska, Tonatsiya, Yednist', Mariya, Sotnytsya, Matrix and Sailor; and in Polissya – Krayevyd, Sotnytsya, Arktis, Etela, Matrix, Sailor and Tonatsiya. For some subzones, microzones, territories and geographic points of soil-climatic zones these and other registered varieties are proposed.

In the Steppe zone varieties Lira odeska, Arktis and Tsarychanka, in the Forest-Steppe – Lira odeska, Artis, Sotnytsya, Tsarychanka and Esperiya, and in Polissya - Arktis, Lira odeska, Esperiya and Genesi deserve attention by protein content.

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Аннотация

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Экологическая пластичность новых сортов озимой пшеницы в разных почвенно-климатических условиях

В результате исследований по экспертизе новых сортов пшеницы мягкой озимой на агроэкологическую пластичность и стабильность за 2010-2012 гг.. выделены значительно лучшие сорта. Они имеют высокую экологическую пластичность и стабильность, лучше адаптируются в разных почвенно-климатических условиях зон, подзон и микрозон, отличаются существенным превосходством по урожайности и содержанию белка в зерне.

Ключевые слова: *сорт, пшеница озимая, экспертиза сортов, экологическая пластичность, стабильность, почвенно-климатические условия, лимитирующие факторы, адаптивность, урожайность, качество продукции.*

Annotation

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