UDC 633.16.524

FEATURES OF REALIZATION THE PRODUCTIVITY POTENTIAL OF WINTER AND SPRING BARLEY VARIETIES IN NORTHERN STEPPE OF UKRAINE

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Наведено результати аналізу наявності сортових ресурсів і врожайності зерна різних сортів ячменю озимого та ярого у дослідах з екологічного випробування залежно від мінливих гідротер-мічних умов. Виділено сорти, що характеризуються стабільною реалізацію генетичного потенціалу в широких межах варіювання середньодобових температур повітря і умов вологозабезпечення.

Ключові слова: *ячмінь озимий та ярий, сорт, клімат, зерно, урожайність.*

Every year in Ukraine created and registered a lot of varieties and hybrids of agricultural crops, which can fully provide the production by food and feed grain and raw materials for industry. Modern varieties can generate high crop yields and with adherence of growing technology, the average crop yields of spring small cereals in Ukraine could reach 4,0–6,0 t/ha, as it is in European countries. A characteristic feature the grain production of spring cereals: barley, oat, wheat and triticale in Ukraine have always been varying the levels of crop yields and gross grain yields due to instability of growing conditions [1, 2].

Therefore, the focus of breeding and technological programs for spring small cereals has always prevailed tasks aimed at increasing and stabilizing crop yields. Particularly, in conditions of economic instability the variety value as a factor to increase production efficiency is quite high. Introduction of the newest varieties, which, along with high yield and grain quality, characterized by rational use of nutrients, as well as increased resistance to stressful environmental conditions, makes it possible to significantly reduce the production costs of labor and resources at growing crops and increase the sustainability of grain production. Growing highly well-adapted varieties is one of the cheapest ways to meet the challenges of saving as well as provides an opportunity to increase crop yield and improve its quality with little additional cost. Important in such event an environmental crop variety testing of spring small cereals, which are made annually by institutions and organizations of different ownership forms [3, 4].

The aim of our research was to study the effect of environmental factors on degree of imple-mentation the genetic potential productivity of different varieties of winter and spring barleys from leading national breeding centers (Plant Production Institute nd. a. V. Ya. Yuriev of NAAS, Plant Breeding and Genetics Institute – National center of seed and cultivar investigation, JSC «Selena», Kirovograd and Donets'k State Agricultural Experimental Station, Institute of Agriculture of Steppe zone of NAAS and others).

The study was conducted at the Erastivka Experimental Station of the Institute of Agriculture of Steppe zone of NAAS during 2011–2013, according to generally known methods [5, 6]. Soil of experimental field – ordinary chernozem, low-humic, loamy. The humus content in arable soil layer (0–30 cm) – 4,0–4,5 %, total nitrogen – 0,23–0,26 %, phosphorus – 0,11–0,16 %, potassium – 2,0–2,5 %, pH of water extract – 6,5–7,0.

Field experiments were laid in six-field crop rotation after predecessor winter wheat. Field experiments were laid after winter wheat on a background of $N_{45}P_{45}K_{45}$. Seeding rate of barley and oat was 4,5, million of grains/ha. In experiments seeded varieties of winter and spring barleys of various breeding centers. Soil preparation, sowing, care of crops and harvesting were carried out according to the zonal recommendations. Variants in a field experiment designed systematically, with three replications. Accounting plots area – 50 m^2.

Arid conditions of Ukraine's Steppe zone is quite complex. Two-thirds of land in Ukraine,
according to the FAO, referred to zone of risky agriculture, but even here you can use 30–50 %

and more of varieties capacity, in consideration of importance the local gene pool in creating highly adapted varieties based on local varieties, that are resistant to dry conditions.

Weather conditions during the investigation were different, which made it possible to fully assess its impact on grain productivity potential of spring small cereals.

The adaptive potential of spring cereals varieties as their ability to survive and generate through the constant improvement of adaptation to abiotic and biotic environmental factors was determined on base the relative properties of biological characteristics and agronomic attributes, that are listed in the State Register of plant varieties suitable for dissemination in Ukraine. Varieties choice of spring small cereals wide enough and updated every year by a significant number of promising new products.

Thus, in the State Register of plant varieties suitable for dissemination in Ukraine in 2000 there were 26 varieties of winter barley and 59 – of spring barley, in 2010 – respectively 34 and 101 varieties, and in 2015 to the register were included 49 varieties of winter barley and 133 – of spring barley (Fig. 1).

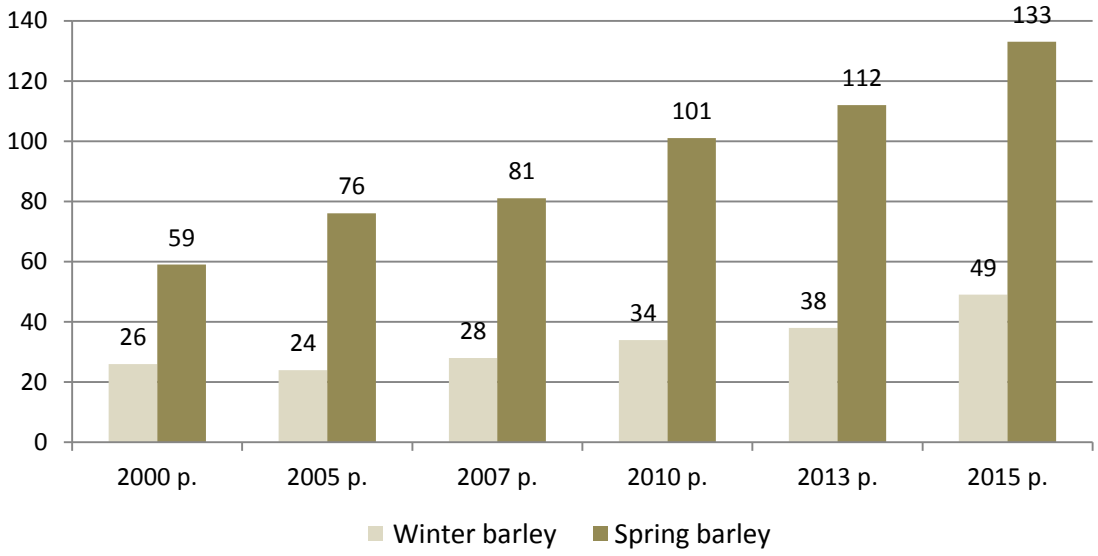

Fig. 1. Number of winter and spring barley varieties, entered to the State Register (2000–2015).

Graphic representation is clearly indicates a steady annual increase in the number of regis-tered varieties of winter barley by 12,6, and of spring barley – by 15,0 %. In general, over the past 15 years the number of barley varieties in the State Register was doubled.

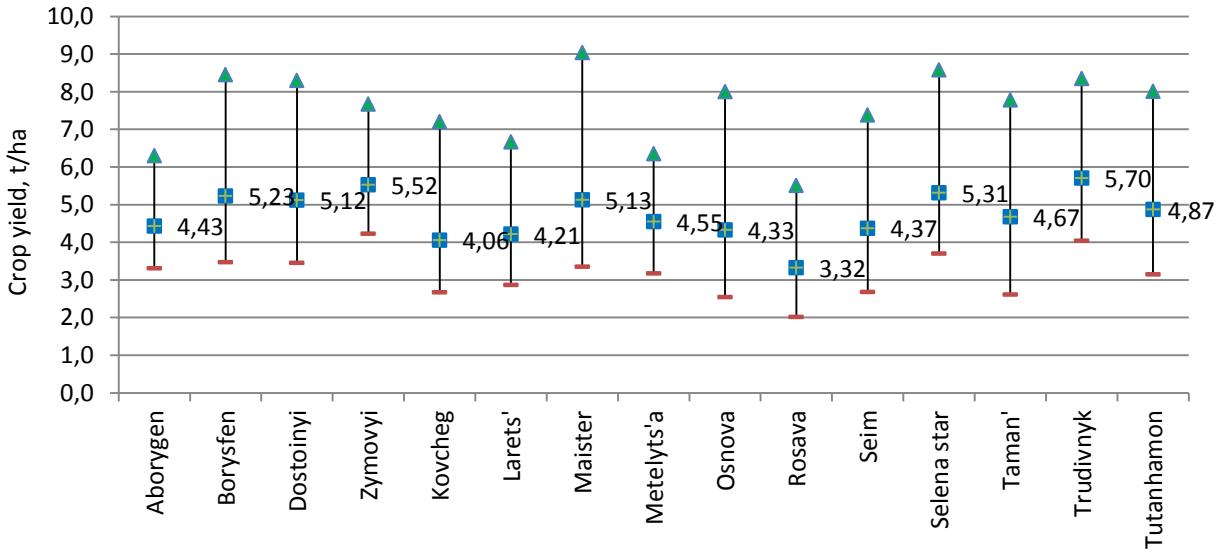

Fig. 2. Range of variation the grain yield of winter barley varieties, t/ha (average for 2007–2010).

In average years of research the highest level of grain productivity (more than 5,0 t/ha) pro-vided by barley varieties of typical winter forms: Borysfen, Zymovyi, Selena star and Trudivnyk, as well as alternate varieties – Dostoinyi, Maister, whose crop yield was 5,12–5,70 t/ha (watch Fig. 2).

Crop yield of spring barley in experiments on environmental crop variety testing t/ha (2010–2015)

Variety	Years					
	2010	2011	2012	2013	2014	2015
Avatar	-	-	-	-	-	3,60
Agrarii	-	-	-	-	-	3,52
Adapt	2,03	3,10	2,84	3,43	4,50	3,09
Alegro	-	-	-	-	-	3,79
Aspekt	1,85	2,92	2,70	2,73	3,51	2,90
Vakula	2,02	3,18	2,94	3,13	3,07	3,20
Vzirets’	2,29	3,51	3,21	3,14	3,20	3,53
Vyklyk	2,06	3,16	2,89	3,49	4,58	3,14
Vodograi	1,82	3,13	3,33	3,37	4,33	3,58
Voievoda	1,80	3,09	3,29	3,33	3,75	3,62
Vsesvit	1,82	3,43	3,45	3,50	4,05	3,74
Galaktyk	2,02	2,95	3,15	3,57	4,29	3,64
Gatunok	1,46	2,67	2,83	2,50	2,77	3,14
Gelios	1,95	3,15	3,24	3,04	3,65	3,10
Get’man	1,63	2,98	3,16	2,79	3,09	3,50
Dzherelo	1,56	3,03	2,57	2,65	2,93	3,03
Dniprovs’kyi 257	1,83	2,76	3,02	3,15	3,44	3,57
Dokaz	2,11	3,17	3,47	3,42	3,97	3,68
Donets’kyi 12	1,77	2,66	2,91	2,87	3,34	3,09
Donets’kyi 14	1,96	2,95	3,23	3,18	3,72	3,52
Donets’kyi 15	2,08	3,12	3,27	3,49	3,63	3,64
Doridnyi	1,79	2,69	2,95	3,04	3,36	3,48
Enei	2,02	3,04	3,33	3,43	3,79	3,93
Etyket	1,50	2,54	2,45	2,75	2,61	2,74
Zorianyi	1,89	2,46	2,60	2,77	2,87	2,91
Ilot	1,87	3,17	3,06	3,26	3,26	3,42
Inkliuzyv	1,90	3,21	3,12	3,21	3,28	3,43
Kazkovyi	1,77	3,33	2,55	3,08	3,85	2,77
Kozvan	1,93	2,97	2,68	3,02	3,44	3,80
Komandor st.	1,85	2,88	2,14	2,58	3,23	2,33
Krok	2,13	3,56	3,20	3,12	4,38	3,85
Luka	-	-	-	-	4,15	3,45
Modern	1,85	2,68	2,89	3,11	3,80	3,34
Parnas	1,54	2,62	2,57	2,47	2,37	2,93
Partner	1,74	2,58	3,12	3,05	3,45	3,16
Pivdennyi	2,02	2,30	3,29	3,41	3,27	3,95
Sviatogor	1,82	3,16	3,25	3,54	3,33	3,43
Sviatomykhailivs’kyi	1,87	2,79	2,86	3,29	3,48	3,84
Selenit	1,63	2,62	2,57	3,45	3,37	3,88
SN-28	1,96	2,23	3,20	3,31	3,17	3,93
Sovira	1,93	3,40	2,95	3,01	3,22	3,41
Sozonivs’kyi	2,08	3,53	3,49	3,34	3,20	3,95
Stalker	2,35	3,45	3,35	3,33	4,36	3,55
Statok	2,37	3,48	3,38	3,47	3,79	3,96
Stepovyk	2,05	3,01	2,92	2,99	3,27	3,42
Shidnyi	2,15	3,16	3,06	3,14	3,62	3,53
Hadar	2,23	3,27	3,18	3,26	3,48	3,25
Charivnyi	1,56	3,29	3,29	3,38	3,69	3,86
Yukatan	2,17	3,19	3,10	3,18	3,35	3,22

LSD_{05}	0,02	0,03	0,03	0,02	0,02	0,04

The reserves of productive moisture before sowing of spring barley during the years of experiment (2010–2015) varied considerably, but still satisfactory to obtain even sprouts. Thus, in seed soil layer (0–10 cm) water content was 15,6–18,8 mm, in 0–30 cm – 49,1–52,2, and in 0–100 cm – 139,3–148,1 mm. If the phases of sprouting grain, tillering and stem elongation of plants in all varieties of spring barley were marked almost simultaneously, the phase of earing – varied in terms of occurrence.

As a general thing, the first ear emergence of plants observed in varieties: Adapt, Sozonivs'kyi, SN-28, Gatunok, Stalker, Krok, Vodograi, Donets'kyi 15 and Voievoda. Others, depending on the varietal biological characteristics – for 3–6 days later.

Before the rest (for 2–5 days), matured the grain in spring barley varieties: Adapt, Stalker, Sozonivs'kyi, SN-28. On the whole the growing season in spring barley varieties lasted 76–87 days.

Plant height varied within 57,8–69,3 cm. The longest ear had varieties: Stalker, Adapt, Statok (6,6–6,7 cm), slightly shorter – in varieties Vodograi, Vsesvit, Sozonivs'kyi, Vzirets' and Yukatan (6,1–6,4 cm).

The most number of grains per ear formed in multi-rowed barley varieties Vakula (33,2 pc.) and Gelios (28,4 pc.). Within a two-rowed barleys the most number of grains per ear had varieties: Sozonivs'kyi, Vsesvit and Galaktyk – 24,6; 22,5 and 22,6 pieces respectively.

The coefficient of productive tillering was the highest in varieties: Donets'kyi 12, Donets'kyi 14, Sozonivs'kyi, SN-28 and Galaktyk and varied from 1,68 to 1,79. Slightly lower indicators of tillering were observed in varieties: Vodograi, Voievoda, Statok, Donets'kyi 15, Vzirets' and Yukatan – 1,56–1,63.

The greatest weight of 1000 grains had grain in varieties: Statok (45,8 g) and Sozonivs'kyi (45,2 g), slightly lower – Stalker and Donets'kyi 15 (over 44,3 g). The smallest weight of 1000 grains formed in multi-rowed barley varieties: Vakula and Gelios – respectively 33,5 and 33,8 grams.

The differences in indicators of ear structure elements of plants accordingly affected the grain yield of spring crops (watch Table).

On a basis of 6-year average of research the highest level of grain yield provided by varieties of spring barley – Vyklyk, Vodograi, Vsesvit, Galaktyk, Dokaz, Donets'kyi 15 Enei, Krok, Sozonivs'kyi, Stalker and Statok, which formed 3,21–3,41 t/ha (Fig. 3).

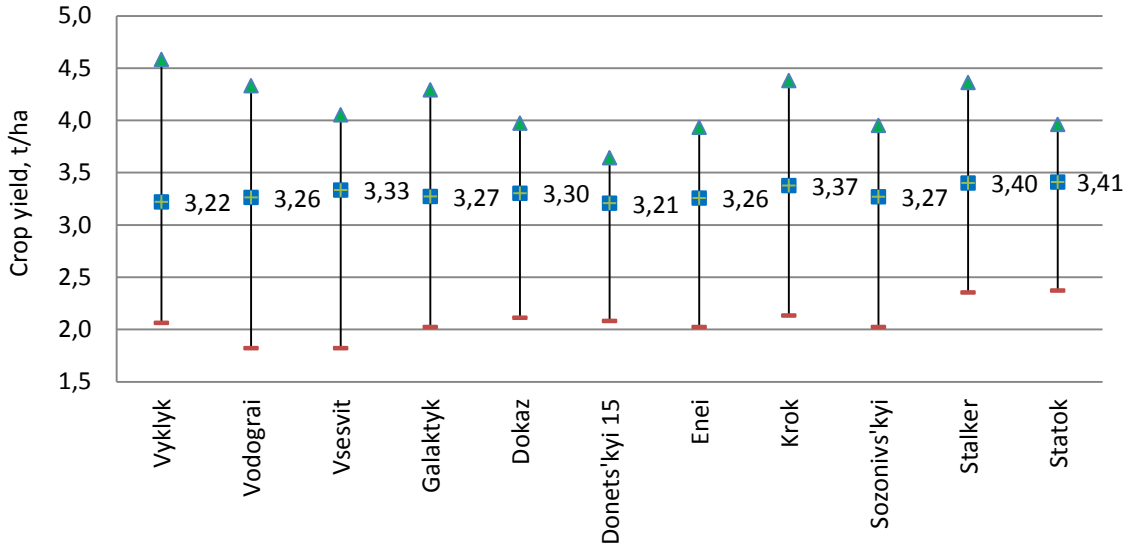

Fig. 3. Range of variation the grain yield of spring barley varieties, t/ha (average for 2010–2015).

According to the obtained data, among the most productive ones, should be highlighted varieties, that demonstrates the minimal variation in crop yield on an annual basis – Donets'kyi

15, Statok, Dokaz, Enei, Sozonivs'kyi, Stalker, which characterized by stable expression of this trait.

The high grain yield also provided by new varieties of spring barley – Avatar, Agrarii, Alegro and Luka (3,45–4,15 t/ha).

Conclusions. For maximal realization the genetic potential of barley that promotes the formation of stable high grain yields it is necessary to accelerate the implementation into production the varieties of new generation, adapted to agroecological conditions of cultivation with valuable commercial properties and characteristics.

In Ukraine there is a steady annual increasing in the number of registered varieties of winter barley by 12,6, and spring – by 15,0 %. In general, over the past 15 years the number of barley varieties in the Register was doubled.

Among the investigated barley varieties the optimal growth, development and combination of yield structural elements that provides formation the largest grain productivity (more than 5,0 t/ha) and complex resistance to arid conditions of Steppe were noted in the barley varieties of typical winter forms: Borysfen, Zymovyi, Selena star and Trudivnyk, as well as alternate varieties –Dostoinyi, Maister, whose crop yield was 5,12–5,70 t/ha. The highest grain yield of spring barley provided by varieties: Vyklyk, Vodograi, Vsesvit, Galaktyk, Dokaz, Donets'kyi 15, Enei, Krok, Sozonivs'kyi, Stalker and Statok – at level of 3,21–3,41 t/ha.

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