CHARACTERISTICS OF POTATO VARIETIES ACCORDING TO ADAPTABILITY PARAMETERS RESEARCHED IN THE FOREST ZONE OF UKRAINE

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Abstract

The article presents the results of research on potato varieties in the Polissia zone of Ukraine. According to them, the adaptive potential, phenotypic stability and resistance to stressful environmental conditions were calculated based on the "yield" feature. According to the results of a comprehensive assessment, it was established that the general adaptive capacity according to the absolute coefficient of adaptability is characteristic of the following varieties: Prada, Sanibel, Riviera, Vzirets, Bellarosa, Zhytnytsia, Rodynna, Lilly, Yavir, Knyazha, Sluch, Toscana, Challenger. High stress resistance was found in potato varieties: Prada Predslava, Challenger. Genetic plasticity, which has a high degree of compatibility of the "genotype-environment" factors, was established in the varieties: Prada, Sluch, Bellarosa, Rodinna. According to the coefficient of variation, a high degree of variation (variability) was established in the varieties: Sluch, Vzirets. Varieties: Prada, Challenger, Predslava had slight variability. This assessment will contribute to the selection of potato varieties for profitable and economically profitable potato farming.

Key words: potatoes, adaptability, plasticity, stress resistance, homeostatic.

INTRODUCTION

Breeders of the leading institutions of Ukraine in the field of potato growing and foreign scientists have created some potato varieties of different groups of maturity and economic purpose, which can satisfy all potato producers. In particular, in 2022, 86 varieties of potatoes of Ukrainian selection and 108 varieties of foreign selection were entered into the State Register of plant varieties suitable for distribution in Ukraine (State Register of Plant Varieties Suitable for Dissemination in Ukraine (2022). URL:https://minagro.gov.ua/storage/app/uploads/public/62b/f32/401/62bf324018d33872424806.pdf).

Maintaining the productive qualities of potato varieties as a crop that reproduces vegetatively requires constant variety renewal using high-yielding seed material, the share of which is estimated at 20-40% relative to the yield level (Kirichenko, 2010; Kononuchenko, 2003; Bondarchuk, 2010; Podgaetsky, Kovalenko, 2011; Melnyk et al., 2017).

One of the urgent tasks of realizing the potential capacity of a variety is to determine its adaptive capacity when grown in certain soil and climatic conditions. Using seed material of high categories of the researched varieties in the production will make it possible to realize the genetic potential and stabilize the yield of potatoes to a large extent. Along with this, it is necessary to determine the criteria that would allow to identify varieties with a high potential of adaptive capacity by qualitative and quantitative characteristics (Osypchuk, 2002; Zhuchenko, 1990).

Research of the presented potato varieties was carried out in the conditions of the Polissia zone.

The soil and climatic conditions of the Polissia zone of Ukraine are diverse. According to its structural structure, the soil cover of Polissia has a large number of soil variations, and their alternation is very frequent on relatively small land plots. The largest areas are occupied by sod-podzolic and sandy light loamy soils, their clayey varieties.

The general characteristic features of the soil cover of the Polissia zone are:
- high mosaicity and complexity of the soil cover;
- the dominance of acidic, surface-glazed, waterlogged and marshy soils in the soil cover;
- low content of humus and organo-mineral, calcium-saturated colloids;
- low ability to provide plants with nutrients;
- high level of environmental vulnerability, susceptibility to degradation processes and depletion.

The climate of the Polissia zone is moderately continental, which favors the cultivation of agricultural crops, in particular potatoes. From west to east, the continentality of the climate increases. In Western Polissia, 580-600 mm of precipitation falls on average per year, in Eastern Polissia up to 550-590 mm per year. However, the soil cover of the Polissya zone is determined by the low deposition coefficient of atmospheric precipitation, which is 0.2-0.25. The hydrothermal coefficient according to Selyaninov, as a comprehensive indicator of the assessment of climatic potential, is 1.23-1.40. The average air temperature of the warmest month (July) varies between 18-20^{0}C. In recent decades, there has been a general warming of the climate with a simultaneous increase in its contrast. The duration of periods of both excessive moisture and dry days, which are not typical for the Polissia zone, became more frequent. Such trends in the patterns of changes in climatic conditions require the introduction of appropriate corrections in the technological operations of growing agricultural crops, increasing the mobility of their implementation (Zubets et al., 2010).

According to the definition of Zhuchenko A.A. an important factor of such agricultural technologies, in particular in potato growing, is the use of varieties with increased adaptive capacity to sudden changes in weather and meteorological conditions during the growing season.

Fundamental developments in the field of the strategy of adaptive intensification of agriculture gave A.A. Zhuchenko the opportunity to claim that a variety is not only resistant to diseases and pests, but also to stress factors associated with meteorological phenomena (high air temperature, lack of moisture etc.). It is also a significant factor that reduces the use of pesticides, as the main component of environmental degradation. (Zhuchenko, 2008).

Each variety has its own specific response to weather conditions. Varieties of different maturity respond differently to temperature conditions. The optimal day and night air temperatures for the growth and development of potatoes shift downward from early- and mid-ripening to late-ripening varieties during the period of planting - sprouting and budding - the end of the growing season. After the emergence of seedlings, varietal requirements are more clearly identified in relation to daytime air temperatures, less so - to night temperatures. Early maturing varieties are more adapted to cool soils or low spring temperatures than medium maturing varieties (Zhuchenko, 2008; Podgaetskyi, 2014).

It is the strategy of adaptive intensification that sets itself the task of transforming plant cultivation from an industry based on the use of an ever-increasing amount of irreplaceable energy and environmental pollution into an industry of life that satisfies ever-increasing human needs at the expense of inexhaustible resources and the application of scientific achievements (Zhuchenko, 2012).

In particular, the use of potato varieties, as the most available centralized economically effective means, with a high level of adaptability, combining high productivity with resistance to biotic and abiotic factors of the environment ensure the conduct of profitable potato farming in the direction of its biologization and environmentalization. The use of such varieties makes it possible to increase the yield of potatoes by 20-70% (Malyavko et al., 2012).

The concepts of plasticity and stability are also used when studying various parameters of plant adaptability. Plastic varieties have the ability to instantly respond to changes in the environment in which they are located, adjusting their functioning to such changes. The concept of stability is used to determine that a given variety has the same phenotype under different developmental conditions (Piskun, 2006; Vlasenko, 2017).

Therefore, the research was aimed at studying varieties with increased adaptive capacity in the

changing conditions of the years in the Polissia zone of Ukraine in terms of yield, as well as determining stability, plasticity, breeding and economic value. These researches are relevant for the field of potato growing, both in scientific and production terms.

MATERIALS AND METHODS

Field research was conducted in 2018-2020 on the basis of the Volyn branch of the Ukrainian Institute of Plant Varieties Examination, located in the soil and climate zone of Polissia of Ukraine.

Four maturity groups of potato varieties were studied. Very early group: Riviera, Prada, SANIBEL, Duma, Vzirets; early ripening group: Svitanok kyivs'kyi, Bellarosa, Paroli, Opillia, Zhytnytsia; medium-ripe group: Yavir, ESMEE, Constance, Solokha, PREDSLAVA, Granada, Rodynna, Lilly, Kniazha; middle-late group: Picasso, Sluch, Toscana, Challenger, Belmonda. All varieties are registrated in the State Register of Plant Varieties Suitable for Dissemination in Ukraine.

The soils of the region, where the research was carried out, are sod-podzolic clayey sandy loam on sandy sediments. The content of humus in the soil is 1.86%, the pH of the soil is 4.61, the mobile compounds of phosphorus are 98.31 mg/kg of soil, potassium is 67.10 mg/kg of soil. Predecessor - winter triticale, winter rye. The average amount of precipitation within the growing season for 2018 was 342.7 mm, 2019 - 336.5 mm, 2020 - 431.5 mm. The average daily temperature during the growing season was - 18.2°C in 2018, 18.4 °C in 2019, and 17.1°C in 2020.

Varieties were characterized according to adaptability parameters: general and specific adaptability, stability, plasticity according to the yield indicator.

Field studies were carried out in accordance with the Methodology for the qualification examination of plant varieties for suitability for distribution in Ukraine. General part, Methods of examination of potato plant varieties and groups of vegetable, melon, spicy-flavored plants for suitability for distribution in Ukraine, Methods of research work of the potato growing institute, Methods of determining indicators of the tolerance level of weediness of crops for effective control (15, Tkachyk, 2016; Tkachyk, 2016; Bondarchuk et al., 2019; Man`ko et al., 2014).

The adaptive capacity of potato varieties was evaluated in accordance with scientific and methodological recommendations for the use of the coefficient of adaptability (CA) (Zhuchenko, 1990; Bondarchuk et al., 2013).

RESULTS AND DISCUSSIONS

One of the conditions for obtaining steady, stable potato crops in years with different meteorological conditions is a high absolute and general adaptive capacity, which the variety should possess. For this purpose, an analysis of 24 varieties of potatoes of four groups of ripeness was carried out for the period 2018-2020, according to the "yield" feature.

The adaptive capacity of potato varieties was evaluated in accordance with scientific and methodological recommendations for the use of the adaptability coefficient (CA).

The reaction of each of the varieties was determined by comparing its yield for a specific year to the average yield of the same year. The main criterion of a variety that is characterized by high adaptability in a certain agro-climatic zone is the adaptability coefficient with an indicator of 1 or higher (Table 1).

Using this method, the studied varieties were located in relation to the obtained adaptability coefficient as follows:

Very early - Prada (1.24), Sanibel (1.10), Riviera (1.02), Vzirets (1.02);

Early ripening - Bellarosa (1.16), Zhytnytsia (1.01);

Medium ripe - Rodynna (1.11), Lilly (1.04), Yavir (1.02), Kniazha (1.00);

Mid-late - Sluch (1.37), Toscana (1.05), Challenger (1.04).

The following varieties are less adapted to the conditions of the Polissia zone:

Very early - Duma (0.84);

Early ripening - Svitanok kyivs'kyi (0.72), Paroli (0.98), Opillia (0.99);

Medium ripe - Predslava (0.74), Solokha (0.81), Constance (0.90), Granada (0.93), Esmee (0.99);

Mid-late - Picasso (0.91), Belmonda (0.99).

Table 1. The yield of potato varieties in the Polissia zone and their adaptability coefficient

Variety	Yield by year, t/ha			Adaptability coefficient by year (CA)			Average coefficient of adaptability
	2018	2019	2020	2018	2019	2020	
Very early							
Riviera	22.8	16.0	25.4	1.0	0.9	1.1	1.02
Prada	24.8	26.6	25.4	1.1	1.4	1.1	1.24
Sanibel	27.6	18.2	23.4	1.3	1.0	1.1	1.10
Duma	19.2	13.8	20.1	0.9	0.7	0.9	0.84
Vzirets	26.4	12.4	26.2	1.2	0.7	1.2	1.02
Early ripening							
Svitanok kyivs'kyi	16.6	11.4	17.6	0.8	0.6	0.8	0.72
Bellarosa	22.6	21.6	28.2	1.0	1.2	1.3	1.16
Paroli	23.9	15.8	22.4	1.1	0.9	1.0	0.98
Opillia	21.7	15.2	25.8	1.0	0.8	1.2	0.99
Zhytnytsia	23.6	18.2	21.8	1.1	1.0	1,0	1.01
Medium ripe							
Yavir	18.6	20.6	24.2	0.8	1.1	1.1	1.02
Esmee	20.2	25.0	15.4	0.9	1.4	0.7	0.99
Constance	19.6	22.0	14.0	0.9	1.2	0.6	0.90
Solokha	17.8	13.9	19.2	0.8	0.8	0.9	0.81
Predslava	14.4	16.4	15.2	0.7	0.9	0.7	0.74
Granada	19.6	21.6	162	0.9	1.2	0.7	0.93
Rodynna	27.2	22.0	19.8	1.2	1.2	0.9	1.11
Lilly	22.0	24.2	18.0	1.0	1.3	0.8	1.04
Kniazha	17.8	22.2	22.0	0.8	1.2	1.0	1.00
Mid-late							
Picasso	16.4	15.8	25.2	0.7	0.9	1.1	0.91
Sluch	36.0	15.8	36.0	1.6	0.9	1.6	1.37
Toscana	21.2	19.2	25.6	1.0	1.0	1.2	1.05
Challenger	22.0	20.1	22.8	1.0	1.1	1.0	1.04
Belmonda	23.5	17.0	22.0	1.1	0.9	1.0	0.99
Average yield, t/ha	21.9	18.5	22.2				

Taking into account average yield indicators, as a criterion for determining favorable and unfavorable for the growth and development of potatoes, it was established that 2020 is a favorable year, and 2019 is an unfavorable year (Table 2).

Table 2. Yield of potato varieties and adaptability parameters in the Polissia zone

Variety	Yield by year, (X) t/ha			Deviation from average yield, t/ha			Adaptability parameters	
	2018	2019	2020	2018	2019	2020	$(X_{min} - X_{max})$	FS (X_{max} / X_{min})
Very early								
Riviera	22.8	16.0	25.4	0.9	-2.5	3.2	-9.4	1.6
Prada	24.8	26.6	25.4	2.9	8.1	3.2	-1.8	1.1
Sanibel	27.6	18.2	23.4	5.7	-0.3	1.2	-9.4	1.5
Duma	19.2	13.8	20.1	-2.7	-4.7	-2.1	-6.3	1.5
Vzirets	26.4	12.4	26.2	4.5	-6.1	4.0	-14.0	2.1
Early ripening								
Svitanok kyivs'kyi	16.6	11.4	17.6	-5.3	-7.1	-4.6	-6.2	1.5
Bellarosa	22.6	21.6	28.2	0.7	3.1	6.0	-6.6	1.3
Paroli	23.9	15.8	22.4	2.0	-2.7	0.2	-8.1	1.5
Opillia	21.7	15.2	25.8	-0.2	-3.3	3.6	-10.6	1.7
Zhytnytsia	23.6	18.2	21.8	1.7	-0.3	-0.4	-5.4	1.3
Medium ripe								
Yavir	18.6	20.6	24.2	-3.3	2.1	2.0	-5.6	1.3
Esmee	20.2	25.0	15.4	-1.7	6.5	-6.8	-9.6	1.6

Variety	Yield by year, (X) t/ha			Deviation from average yield, t/ha			Adaptability parameters	
	2018	2019	2020	2018	2019	2020	$(X_{min} - X_{max})$	FS (X_{max} / X_{min})
Constance	19.6	22.0	14.0	-2.3	3.5	-8.2	-8.0	1.6
Solokha	17.8	13.9	19.2	-4.1	-4.6	-3.0	-5.3	1.4
Predslava	14.4	16.4	15.2	-7.5	-2.1	-7.0	-2.0	1.1
Granada	19.6	21.6	16.2	-2.3	3.1	-6.0	-5.4	1.3
Rodynna	27.2	22.0	19.8	5.3	3.5	-2.4	-7.4	1.4
Lilly	22.0	24.2	18.0	0.1	5.7	-4.2	-6.2	1.3
Kniazha	17.8	22.2	22.0	-4.1	3.7	-0.2	-4.4	1.2
Mid-late								
Picasso	16.4	15.8	25.2	-5.5	-2.7	3.0	-9.4	1.6
Sluch	36.0	15.8	36.0	14.1	-2.7	13.8	-20.2	2.3
Toscana	21.2	19.2	25.6	-0.7	0.7	3.4	-6.4	1.3
Challenger	22.0	20.1	22.8	0.1	1.6	0.6	-2.7	1.1
Belmonda	23.5	17.0	22.0	1.6	-1.5	-0.2	-6.5	1.4
Average yield, t/ha	21.9	18.5	22.2					

It should be noted that some potato varieties react specifically to the same conditions of growth and development under adverse conditions. For example, in 2019, unfavorable due to weather conditions, the following varieties showed an increasing difference in relation to the average varietal index of the year: Prada (8.1 t/ha), Esmee (6.5 t/ha), Lilly (5.7 t/ha), Kniazha (3.7 t/ha), Rodynna (3.5 t/ha), Constance (3.5 t/ha), Bellarosa (3.1 t/ha), Granada (3.1 t/ha), Yavir (2.1 t/ha), Challenger (1.6 t/ha) Toscana (0.7 t/ha).

Therefore, 11 varieties are characterized by adaptability, the reaction to adverse weather conditions is less pronounced than in other varieties. This is especially true of the Prada variety (8.1 t/ha), which has significant adaptability of the variety both in terms of the adaptability coefficient and in deviation from the average yield.

The most sensitive to weather conditions during the years of research, taking into account favorable and unfavorable years, were the varieties with a deviation from the average yield in the direction of decrease: Predslava (-7.0 t/ha, 2020 year), Solokha (-3.0 t/ha), Duma (-2.1 t/ha).

The realized productivity potential of the variety Prada is higher than that of Predslava, Solokha, Duma.

Varieties Prada, Bellarosa, Challenger were distinguished by a positive reaction to the favorable conditions of a particular year of cultivation by the realization of their genetic potential, namely increased productivity, which should be classified as varieties with specific adaptability.

One of the important indicators of the variety is their resistance to stress - the difference between the minimum and maximum productivity.

This indicator has a negative sign. The smaller the value of the indicator is, the higher the stress resistance of the variety. Varieties Prada (-1.8), as well as Predslava (-2.0), Challenger (-2.7) have high resistance to stress.

Kniazha (-4.4), Solokha (-5.3), Zhytnytsia i (-5.4), Granada (-5.4), Yavir (-5.6) varieties can be considered relatively resistant.

In order to avoid shortcomings in establishing the absolute range of variations, that is, the absolute increase between the maximum and minimum value of the levels, the model of D. Levis was used. According to the coefficient of phenotypic stability (SF), as the ratio of high (Xmax) and low (Xmin) values, it was established that Prada (1.1), Predslava (1.1), Challenger (1.1) varieties are highly stable in terms of yield; variety Kniazha (1.2) is moderately stable. All other varieties are low-stable. However, there are varieties that can be considered relatively stable, that is, close to the value of the indicator 1.1, 1.2. Such varieties are: Bellarosa (1.3), Yavir, Granada (1.3), Lilly (1.3), Toscana (1.3), Solokha (1.4), Rodynna (1.4), Belmonda (1.4).

The criterion of high general adaptability in relation to the variety is the absolute coefficient of adaptability (hereinafter - ACA) (Table 3).

Table 3. The yield of potato varieties in the years of research and their absolute coefficient of adaptability

Variety	Yield by year, t/ha			Average yield, t/ha	Absolute coefficient of adaptability (ACA)
	2018	2019	2020	2018-2020	
Very early					
Riviera	22.8	16.0	25.4	21.4	1.02
Prada	24.8	26.6	25.4	25.6	1.22
Sanibel	27.6	18.2	23.4	23.1	1.10
Duma	19.2	13.8	20.1	17.7	0.85
Vzirets	26.4	12.4	26.2	21.7	1.04
Early ripening					
Svitanok kyivs'kyi	16.6	11.4	17.6	15.2	0.73
Bellarosa	22.6	21.6	28.2	24.1	1.15
Paroli	23.9	15.8	22.4	20.7	0.99
Opillia	21.7	15.2	25.8	20.9	1.00
Zhytnytsia	23.6	18.2	21.8	21.2	1.01
Medium ripe					
Yavir	18.6	20.6	24.2	21.1	1.01
Esmee	20.2	25.0	15.4	20.2	0.97
Constance	19.6	22.0	14.0	18.5	0.89
Solokha	17.8	13.9	19.2	17.0	0.81
Predslava	14.4	16.4	15.2	15.3	0.73
Granada	19.6	21.6	16.2	19.1	0.92
Rodynna	27.2	22.0	19.8	23.0	1.10
Lilly	22.0	24.2	18.0	21.4	1.02
Kniazha	17.8	22.2	22.0	20.7	0.99
Mid-late					
Picasso	16.4	15.8	25.2	19.1	0.92
Sluch	36.0	15.8	36.0	29.3	1.40
Toscana	21.2	19.2	25.6	22.0	1.05
Challenger	22.0	20.1	22.8	21.6	1.04
Belmonda	23.5	17.0	22.0	20.8	1.00
Perennial average yield, t/ha	20.9				

According to the absolute coefficient of adaptability, the studied potato varieties were placed as follows:
- very early - Prada (1.22), Sanibel (1.10), Vzirets (1.04), Riviera (1.02);
- early ripening - Bellarosa (1.15), Zhytnytsia (1.01), Opillia (1.00);
- medium ripe - Rodynna (1.10), Lilly (1.02), Yavir (1.01);
- mid-late - Sluch (1.40), Toscana (1.05), Challenger (1.04), Belmonda (1.00).

All other varieties had ACA less than 1.
The specified varieties that corresponded to ACA 1 and above are characterized by high adaptability to agroclimatic growing conditions of a certain zone with changing weather conditions during the years of research. Varieties with ACA less than 1 had a low adaptive capacity to critical phases of the vegetation period and the effect of certain environmental factors on them.

In the process of selection work on productivity, scientists pay attention to the evaluation of the variety by the amplitude of variation of quantitative indicators depending on the growing conditions.

Among the researched varieties, the most valuable for production will be those that have the highest average level of yield and tuber quality. At the same time, they will have a smaller range of character fluctuations under growing conditions, that is, they will be more plastic.

As a measure of the relative stability of varieties, such an indicator of variation as the coefficient of variation (V) can be used (Table 4).

Table 4. Variability of yield of potato varieties of the Polissia zone, 2018-2020

Variety	Yield by year, t/ha (X)			Average yield, t/ha (χ)	V, %
	2018	2019	2020	2018-2020	
Very early					
Riviera	22.8	16.0	25.4	21.4	22.68
Prada	24.8	26.6	25.4	25.6	3.58
Sanibel	27.6	18.2	23.4	23.1	20.41
Duma	19.2	13.8	20.1	17.7	19.25
Vzirets	26.4	12.4	26.2	21.7	37.04
Early ripening					
Svitanok kyivs'kyi	16.6	11.4	17.6	15.2	21.90
Bellarosa	22.6	21.6	28.2	24.1	14.74
Paroli	23.9	15.8	22.4	20.7	20.82
Opillia	21.7	15.2	25.8	20.9	25.82
Zhytnytsia	23.6	18.2	21.8	21.2	12.97
Medium ripe					
Yavir	18.6	20.6	24.2	21.1	13.43
Esmee	20.2	25.0	15.4	20.2	23.76
Constance	19.6	22,0	14.0	18.5	22.15
Solokha	17.8	13.9	19.2	17.0	16.19
Predslava	14.4	16.4	15.2	15.3	6.57
Granada	19.6	21.6	16.2	19.1	15.03
Rodynna	27.2	22.0	19.8	23.0	16.52
Lilly	22.0	24.2	18.0	21.4	14.69
Kniazha	17.8	22.2	22.0	20.7	12.02
Mid-late					
Picasso	16.4	15.8	25.2	19.1	27.50
Sluch	36.0	15.8	36.0	29.3	39.85
Toscana	21.2	19.2	25.6	22.0	14.88
Challenger	22.0	20.1	22.8	21.6	6.41
Belmonda	23.5	17.0	22.0	20.8	16.34
Average yield, t/ha	21,9	18.5	22.2	20.9	18.52
V, %	20.8	22.0	22.2		

When studying the yield of the researched varieties, it was established that it was 20.9 t/ha on average for 2018-2020, varying from 18.5 t/ha to 22.2 t/ha over the years. The maximum productivity was obtained by the Sluch variety (36.0 t/ha) in 2018 and 2020, and the minimum by Svitanok kyivs'kyi (11.4 t/ha) in 2019.

The coefficient of variation on average over the years of research was low and amounted to 18.52%.

During 2018-2020, a high (more than 33%) degree of yield variation (variability) was established in the varieties Sluch (V = 39.85%), Vzirets (V = 37.04%), their yield within the years was 15.8-36.0 t/ha and 12.4 -36.4 t/ha, respectively. Varieties Prada (V = 3.58%), Challenger (V = 6.41%), Predslava (V = 6.57%) had insignificant variability with yields

of 24.8-26.6 t/ha, 20.1-22.8 t/ha, 14.4-16.4 t/ha, respectively.

In general, the studied array of varieties reacts to a small extent to changes in weather conditions determined by the year. However, the dynamics of the average yield by year is synchronous with the weather conditions during the growing season. That is, the varieties are characterized by approximately the same corresponding reaction to the growing conditions of a certain year. Thus, it is not enough to increase the yield of varieties only by changing weather conditions.

One of the main tasks of breeding is to increase the adaptive potential of varieties, which includes plasticity, stability, homeostatic (Table 5).

Table 5. Stress resistance, genetic plasticity and homeostaticity of potato varieties of the Polissia zone, 2018-2020

Variety	Adaptability parameters					
	Y_{max}	Y_{min}	$Y_{min}-Y_{max}$	$(Y_{max}+Y_{min})/2$	V, %	Hom
Very early						
Riviera	25.4	16.0	-9.4	20.7	22.68	0.94
Prada	26.6	24.8	-1.8	25.7	3.58	7.15
Sanibel	27.6	18.2	-9.4	22.9	20.41	1.13
Duma	20.1	13.8	-6.3	17.0	19.25	0.92
Vzirets	26.4	12.4	-14.0	19.4	37.4	0.58
Early ripening						
Svitanok kyivs'kyi	17.6	11.4	-6.2	14.5	21.90	0.69
Bellarosa	28.2	21.6	-6.6	24.9	14.74	1.64
Paroli	23.9	15.8	-8.1	19.9	20.82	0.99
Opillia	25.8	15.2	-10.6	20.5	25.82	0.80
Zhytnytsia	23.6	18.2	-5.4	20.9	12.97	1.63
Medium ripe						
Yavir	24.2	18.6	-5.6	21.4	13.43	1.57
Esmee	25.0	15.4	-9.6	20.2	23.76	0.85
Constance	22.0	14.0	-8.0	18.0	22.15	0.84
Solokha	19.2	13.9	-5.3	16.6	16.19	1.05
Predslava	16.4	14.4	-2.0	15.4	6.57	2.34
Granada	21.6	16.2	-5.4	18.9	15.03	1.27
Rodynna	27.2	19.8	-7.4	23.5	16.52	1.39
Lilly	24.2	18.0	-6.2	21.1	14.69	1.46
Kniazha	22.2	17.8	-4.4	20.0	12.02	1.72
Mid-late						
Picasso	25.2	15.8	-9.4	20.5	27.50	0.70
Sluch	36.0	15.8	-20.2	25.9	39.85	0.73
Toscana	25.6	19.2	-6.4	22.4	14.88	1.48
Challenger	22.8	20.1	-2.7	21.5	6.41	3.37
Belmonda	23.5	17.0	-6.5	20.3	16.34	1.28

Plasticity is the ability of a variety to adapt to environmental conditions.

Phenotypic stability is manifested in the preservation of the phenotype when environmental conditions change, it is due to the norm of the reaction of the genotype, the ability to preserve the relative constancy of features.

Homeostaticity is the ability of plants to respond positively to the improvement of growing conditions and to react little or not at all to their deterioration. The higher this indicator is, the higher the variety is rated for suitability for involvement in further selection work.

For a more objective assessment of the studied potato varieties, we calculated a number of statistical indicators that determined their adaptive properties, namely, stress resistance $(Y_{min}-Y_{max})$, genetic plasticity $((Y_{max}+Y_{min})/2)$ and homeostaticity (Hom).

Prada (-1.8) and Predslava (-2.0) and Challenger (-2.7) potato varieties showed the highest stress resistance.

Greater variability and low homeostaticity were found in varieties Vzirets (Hom = 0.58; V = 37.04%), Sluch (Hom = 0.73; V = 39.85%), which indicates unstable behavior of varieties when growing conditions change.

Lower variability and higher homeostaticity were found in varieties Prada (Hom = 7.15; V = 3.58%), Challenger (Hom = 3.37; V = 6.41%), Predslava (Hom = 2.34; V = 6.57%)

Compared to other varieties, a high value of the genetic plasticity indicator was found in Prada (25.7), Sluch (25.9), Bellarosa (24.9), Rodynna (23.5), which indicates a high degree of compatibility of the "genotype-environment" factors.

Thus, according to the evaluation of the studied potato varieties, varieties with both wide and insignificant variability of this characteristic were selected.

CONCLUSIONS

Based on the results of research, we made the following conclusions. The adaptive potential,

phenotypic stability, and stability of potato varieties based on the "yield" feature were calculated. The best productive varieties in terms of overall adaptability, stability and resistance to stressful conditions during the growing season were identified.

The general adaptive capacity with an absolute coefficient of adaptability of 1 and higher and, accordingly, the yield value exceeding the multi-year average varietal is characteristic of the varieties Prada (1.24), Sanibel (1.10), Riviera (1.02), Vzyrets (1.02), Bellarosa (1.16), Zhytnytsia (1.01), Rodynna (1.11), Lilly (1.04), Yavir (1.02), Knyazha (1.00), Sluch (1.37), Toscana (1.05), Challenger (1.04).

The general adaptive capacity with an absolute coefficient of adaptability of 1 and higher and, accordingly, the yield value exceeding the multi-year average varietal is characteristic of the varieties Prada (1.24), Sanibel (1.10), Riviera (1.02), Vzyrets (1.02), Bellarosa (1.16), Zhytnytsia (1.01), Rodynna (1.11), Lilly (1.04), Yavir (1.02), Knyazha (1.00), Sluch (1.37), Toscana (1.05), Challenger (1.04).

According to the coefficient of phenotypic stability (SF), as the ratio of high (X_{max}) and low (X_{min}) values, it was established that the varieties Prada (1.1), Predslava (1.1), Challenger (1.1) are highly stable in terms of yield; variety Knyazha (1.2) is moderately stable. All other varieties are low-stable.

REFERENCES

Bondarchuk, A. A., Vermenko, Yu. Ya, Chernokhatov, L. V. (2013). Assessment of the adaptive capacity of potato varieties for irrigation in the Southern Steppe zone of Ukraine. Kyiv, RO: KVITS, 14-16 (in Ukrainian).

Bondarchuk, A. A., Koltunov, V. A., Oliynyk, T. M. et al. (2019). Potato growing: Methods of research. Vinnytsia: LLC "TVORY", 652 pp. (in Ukrainian)

Bondarchuk, A. A. (2010). Scientific basis of potato seed production in Ukraine. Monograph. Bila Tserkva, 400 pp. (in Ukrainian).

Kirichenko, V. V. (2010). Special selection and seed production of field crops. Kharkiv, 462 pp. (in Ukrainian).

Kononuchenko, V. V. (2003). State and main directions of development of potato seed production in Ukraine. *Kartoplyarstvo*, Kiev, 32, 3-14 (in Ukrainian).

Malyavko, A. A., Marukhlenko, A. V., Borisova, N. P. (2012). The coefficient of adaptability of the potato variety determines its productivity. *Potatoes and vegetables*, 3, 10-11 (in Russian).

Melnyk, S. I., Kovchi, A. L., Stefkivska, Yu. L. et al. (2017). Functioning of the potato market in Ukraine. *Varietal study and protection of rights to plant varieties*. 13, 2, 206-210 (in Ukrainian).

Man`ko, Yu. P., Babenko, Ye. O. (2014). Methodic for determining indicators access of weediness level crops for its effective control. *Naukovi praci Insty`tutu bioenergety`chny`x kul`tur i czukrovy`x buryakiv - Scientific works of the Institute of Bioenergy Crops and Sugar Beets*, 20, 67-72. URL: http://nbuv.gov.ua/UJRN/znpicb_2014_20_14.

Osypchuk, A. A. (2002). Genetic potential of potatoes. *Potato*, 1, 203-204 (in Ukrainian).

Piskun, G. I. (2006). Adaptive ability and ecological stability of genotypes and the role of these factors in increasing the yield of potatoes. *Potato issues. Actual problems of science and practice: Scientific works of the All-Russian Research Institute of Potato Economy*. Moscov, 355-361 (in Russian).

Podgaetskyi, A. A. (2014). Adaptation and its significance for selection and production of agricultural crops, including potatoes. *Potatoes of Ukraine*. 1-2 (34-35), 10-16 (in Ukrainian).

Podgaetsky, A. A., Kovalenko, V. M. (2011). Adaptability of potato varieties of Belarusian selection. *Herald of the Sumy National Agrarian. University. Agronomy and biology*, 4, 143-146 (in Ukrainian).

Tkachyk, S. O. (Ed.) (2016). Methods of conducting qualification tests of plant varieties for suitability for distribution in Ukraine. General part. (4th ed., rev. and enl.). Vinnytsia: Nilan-LTD, 120 pp. (in Ukrainian).

Tkachyk, S. O. (2016). Methodology for carrying out the examination of varieties of potato and groups of vegetable, melon, spiced and flavored plants on the suitability for distribution in Ukraine. Vinnytsia: Nilan-LTD, 95 pp.

Vlasenko, G. P. (2017). Ecological plasticity and stability of new potato varieties. *Far Eastern Agrarian Bulletin*. 2 (42), 11-15 (in Russian).

Zhuchenko, A. A. (1990). Adaptive crop production. Chisinau: Shtiintsa, 431 pp.

Zhuchenko, A. A. (2008). Adaptive plant breeding (ecological and genetic foundations). *Theory and practice*. AGRORUS. Moscow, 1, 814 pp.

Zhuchenko, A. A. (2012). According to the adaptive system of selection and seed breeding - the future. *Potatoes and vegetables*, 8, 5 (in Russian).

Zubets, M. V. et al. (2010). Scientific basis of agro-industrial production in the Polissia zone and the Western region of Ukraine. Kiev. Urozhai, 980 (in Ukrainian).

***State Register of Plant Varieties Suitable for Dissemination in Ukraine (2022). URL:https://minagro.gov.ua/storage/app/uploads/public/62b/f32/401/62bf324018d33872424806.pdf.