

## Evaluation of the adaptive properties of potato varieties (*Solanum tuberosum* L.) according to the main economic and valuable characteristics

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**Purpose.** To carry out an analysis of the ecological plasticity and stability of the characteristics of productivity, starch content, dry matter and to determine the parameters of ecological adaptability of potato varieties based on the characteristic "yield" in the soil-climatic zones of the Forest-Steppe and Polissia. **Methods.** The following methods were used in the research: laboratory, computational and statistical; to draw conclusions – analysis and synthesis. **Results.** The results of the analysis of potato varieties grown in different soil and climatic zones of Ukraine in terms of yield, starch and dry matter content are given. Promising varieties for selection and practical use with high indicators of adaptability, stability and plasticity were identified. It was found that the highest productivity results were obtained for the variety 'RANOMI' in the Forest-Steppe and Polissia zones – 34.6; 28.2 t/ha and high adaptability potential – 1.28; 1.27. The varieties 'RANOMI', 'Cherie' performed best in the Forest-Steppe zone with yields of 34.6 and 31.4 t/ha, in Polissia conditions – the varieties 'RANOMI', 'PARADISO' – 28.2 and 27.4 t/ha. The varieties with high plasticity were distinguished by starch and dry matter content ('7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE'), productivity ('7 FOUR 7', 'Rodriga', 'ALOUETTE', 'PARADISO', 'LAUDINE'). The varieties 'Mysteriia', '7 FOUR 7', 'LAUDINE', 'FONTANE' and 'LAUDINE' proved to be very stable in terms of productivity and the varieties 'Mysteriia', '7 FOUR 7', 'Rodriga', 'PARADISO', 'RANOMI' in terms of dry matter and starch content. The varieties with the highest productivity were 'Rodriga', 'PARADISO', and for dry matter and starch content – 'FONTANE', 'LAUDINE'. **Conclusions.** In different soil and climatic zones, highly plastic varieties were selected according to yield index – '7 FOUR 7', 'Rodriga', 'ALOUETTE', 'PARADISO', 'LAUDINE', according to starch and dry matter content – varieties '7 FOR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE'. It was found that on average for 2019–2020 the highest productivity and high adaptive potential in the Forest-Steppe and Polissia zones had the variety 'RANOMI' – 34.6; 28.2 t/ha, respectively, CA – 1.28; 1.27. In the Forest-Steppe zone it is worth mentioning the varieties 'Cherie', 'Rodriga' with average CA index 1.15; 1.12 and productivity – 31.4; 30.62 t/ha, in the Polissia zone – 'PARADISO', 'Rodriga' with CA value – 1.20; 1.11 and productivity – 27.4; 25.5 t/ha.

**Keywords:** potato; starch content; dry matter content; stability; plasticity; adaptability.

### Introduction

Today, the potato is one of the most important food, fodder and industrial crops [1]. Its

value as a foodstuff is determined by the high taste quality of the tubers and their chemical composition, which is favourable for human health. They contain 14–22% starch, 1.5–3% protein, 0.8–1% minerals and up to 1% fibre. Potato starch is easily absorbed and the biological value of its proteins is higher than that of other crops. Potatoes are rich in B group vitamins, PP and carotenoids. In winter, potatoes are the main source of vitamin C for humans [2].

The potatoes is a valuable raw material for the production of alcohol, starch, glucose, dextrin and many other products [3]. It is one of the best predecessors for winter and spring cereals, flax. It is grown in all soil and climatic zones of Ukraine. The annual produc-

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tion of potatoes is 20–23 million tonnes [4–6]. In terms of gross potato production, Ukraine ranks among the top five commodity producers in the world [7]. An important condition for achieving high potato yields is the use of high quality seed of varieties adapted to the external conditions of a specific soil and climatic zone. Under the same climatic and technological conditions, this ensures an increase in yield of up to 25%, and if newly created varieties are also used, this indicator increases by 20–40% [5, 8].

One of the most important ways to increase the yield and improve the quality of potatoes is to develop and introduce varieties that ensure high and stable yields and are suitable for cultivation in different soil and climatic zones. The realisation of the genetic potential of potato varieties and species takes place within the limits of adaptive capacity, i.e. within the limits of a reaction norm. Therefore, an urgent task is to determine the realization of the genetic potential of potato varieties in specific conditions, in particular, in the conditions of Polissia and Forest-Steppe of Ukraine.

The influence of environmental factors on plants is characterised by an indicator of plant response such as adaptability [9]. The adaptive potential of plants is their ability to survive, reproduce and produce crops under constantly changing environmental conditions. Terms such as plasticity and stability are used when studying different aspects of plant adaptation [9–13]. Plastic varieties are characterised by a “monitoring” type of response that corrects their functioning following a change in environmental conditions. The concept of stability is used to indicate that this variety has the same phenotype under different conditions of plant development [14].

In the publication [15] it is stated that an adaptive variety is an ecologically plastic genotype that is adapted to both optimal and minimal or maximal manifestation of environmental factors. The concept of “ecological stability” is closely related to plasticity, which reflects the ability of plant populations to resist stress factors, and plasticity is the ability of plants to combine economical consumption and efficient use of natural resources and nutrients under certain growing conditions [16, 17].

The new generation of potato varieties should have a wide reaction norm to changes in growing conditions, high plasticity and stability of quantitative and qualitative characteristics. Cultivation of such varieties can ensure conservation of limited resources and

nutrients in different natural and climatic conditions.

*The purpose of the research* is to analyze the ecological plasticity and stability of productivity, starch content, dry matter and to determine the parameters of ecological adaptability of potato varieties based on the quantitative trait “yield” in the soil-climatic zones of Forest-Steppe and Polissia.

### Materials and methods

In 2019–2020, experimental research was carried out in experimental fields at the branches of the Ukrainian Institute for Plant Varieties Examination (UIPVE) (Forest-Steppe zone – Poltava, Sumy; Polissia zone – Chernihiv, Volyn) in accordance with the Methodology for conducting qualification examination of plant varieties for suitability for distribution in Ukraine [18].

The starch and dry matter contents were determined according to the method [19] based on the UIPVE Laboratory of Quality Indicators of Plant Varieties. Nine potato varieties of different ecological and geographical origin served as material for the research (‘Mysteriia’ – Ukraine, ‘Rodriga’ – Germany, ‘7 FOUR 7’, ‘ALOUETTE’, ‘PARADISO’, ‘FONTANE’, ‘RANOMI’, ‘LAUDINE’ – Holland, ‘Cherie’ – France), included in the State Register of varieties suitable for distribution in Ukraine.

The results of the analysis of the ecological plasticity and stability of the productivity traits, starch content and dry matter content in potato varieties were evaluated according to the generally accepted Ebergard-Russell method [20] using PTC Mathcad Prime 3.1 software (trial version).

This technique makes it possible to evaluate varieties not only on the basis of average indicators, but also on the basis of plasticity (b), which reflects the regression of the variety to changes in environmental conditions, and the stability (W) of this response. The authors proposed to divide the sum of squares of the interaction of each variety with environmental conditions into two parts – the linear regression component (b) and the non-linear part determined by the mean square deviation from the regression line (W) [20].

When using regression models to assess the response of the variety to changes in environmental factors, the regression coefficient (b) acts as an indicator of the plasticity of the variety. Assuming a linear relationship between genotypic and environmental effects, it is possible to use the regression of this trait on the environmental indices of the environ-

ment, estimated by the average of all the varieties grown under these conditions. When comparing the plasticity indicators of the varieties studied, genotypes with a coefficient  $b > 1$  are classified as highly plastic (relative to the group average). If  $1 > b = 0$ , the variety is classified as relatively low plastic. The variety does not differ from the group average in response to changes in environmental conditions if the plasticity index of the variety does not reliably differ from unity [9, 20–22].

In addition to assessing the direction and magnitude of the response of the variety to the change in environmental conditions, the stability of this response is calculated by the degree of deviation from the regression of  $W$ . Low-plastic varieties with a low value of  $W$  are widely adapted genotypes, as they do not reduce the value of the trait in the conditions of the limit of environmental factors and an unlimited environment, but they are unprofitable to grow and belong to extensive varieties. Highly plastic varieties with a low  $W$  value belong to the intensive type varieties, with a positive stable response to the improvement of growing conditions.

The adaptability of potato varieties was determined by the coefficient of variety adaptability in the form of the ratio of the yield in the year of cultivation to the average yield of the variety in that year [14, 15, 23].

The criterion of the adaptability of the variety characterised by high adaptability in the test area is the coefficient of adaptability (CA) with a value of 1.0 and above.

The coefficient of adaptability (CA) of the variety is calculated according to the formula:

$$KA = (X_{ij} : X)$$

where  $X_{ij}$  is the yield of a given variety in the year of the study;  $X$  is the average yield of the year.

Assessing the adaptability of varieties [24] allows breeders to find out the nature of the adaptive properties of the source and selection material, and producers to decide which varieties are best adapted to the ecological conditions of a particular region.

## Results and discussion

During the research period (2019–2020), the weather conditions differed from the long-term averages in terms of temperature, rainfall and their distribution over the months, but this did not prevent high yields. The hydrothermal coefficient (HTC) was calculated to determine the effect of environmental conditions on productivity, starch content and dry potato. The potato growing season in the

Forest-Steppe and Polissia zones is characterised by dry conditions (HTC = 0.6; 0.75) in 2019 and optimal moisture conditions (HTC = 1.2; 1.5) in 2020, which positively influenced the formation of potato productivity this year. This made it possible to evaluate the potato varieties in terms of adaptability and to identify the best among them.

In 2019, the average annual air temperature was 11.1 °C for the Forest-Steppe zone and 11.4 °C for Polissia. In 2020 the average annual air temperature was 10.3 °C for the Forest-Steppe zone, 10.6 °C for Polissia. The transition of the average daily air temperature over 10 °C in spring falls in the third decade of April in the Forest-Steppe zone and in the first decade of May in the Polissia zone in 2019, and in the first decade of May in the Forest-Steppe and Polissia zones in 2020. The end of the transition of the average daily air temperature by 10 °C is observed in the first decade of October for the Forest-Steppe and Polissia zones in 2019–2020. The period with the average daily temperature above 10 °C lasts on average 163–173 days. The sum of active temperatures during the growing season for the Forest-Steppe and Polissia zones is 2458.8 °C; 2438.6 °C in 2019 and 2357.4 °C; 2324.1 °C in 2020.

In general, warm and dry weather leads to a shortening of the growing season and a maximum accumulation of dry matter in potato tubers at harvest. If the soil has been overwatered during the growing season, this indicator will be lower at harvest than under normal conditions for a given soil and climate zone [25].

The main component of dry matter is starch. It is the main product used to evaluate the nutritional value of potato tubers. It accumulates in the form of grains of different sizes. In tubers, the starch content depends on varietal characteristics and can range from 9 to 25% [26].

According to the results of the studies, the degree of accumulation of dry matter and starch in the tubers was determined by the weather conditions and the growing area. Thus, in relation to soil-climatic zones, slightly higher values of starch and dry matter content in potato samples were found in the Forest-Steppe zone (Table 1).

The highest starch and dry matter contents were found in tubers of the 'FONTANE' variety in the Forest-Steppe and Polissia zones. The starch content is 18.5% in 2019 and 18.9% in 2020 in the Forest-Steppe zone and 16.6% in 2019 and 17.6% in 2020 in the Polissia zone. The dry matter content is 27.5% and 28.2%

**Table 1**  
**Content of starch and dry matter in tubers of different plant varieties grown in the conditions of Forest-Steppe and Polissia of Ukraine**

| Variety             | Starch content, % |      |          |      | Dry matter content, % |      |          |      |
|---------------------|-------------------|------|----------|------|-----------------------|------|----------|------|
|                     | Forest-Steppe     |      | Polissia |      | Forest-Steppe         |      | Polissia |      |
|                     | 2019              | 2020 | 2019     | 2020 | 2019                  | 2020 | 2019     | 2020 |
| 'Misteriia'         | 14.2              | 13.8 | 13.8     | 14.0 | 22.0                  | 21.5 | 22.3     | 22.0 |
| '7 FOUR 7'          | 15.1              | 14.1 | 14.0     | 13.0 | 22.7                  | 21.3 | 21.1     | 19.5 |
| 'Rodriga'           | 13.9              | 13.4 | 13.0     | 12.4 | 21.8                  | 21.1 | 20.8     | 20.3 |
| 'ALOUETTE'          | 15.4              | 15.2 | 15.4     | 16.3 | 23.3                  | 23.7 | 22.5     | 24.8 |
| 'PARADISO'          | 13.0              | 12.7 | 11.5     | 12.9 | 20.3                  | 19.5 | 18.8     | 19.6 |
| 'FONTANE'           | 18.5              | 18.9 | 16.6     | 17.6 | 27.5                  | 28.2 | 24.8     | 25.7 |
| 'RANOMI'            | 14.2              | 14.3 | 13.3     | 12.6 | 22.1                  | 22.0 | 20.1     | 20.4 |
| 'LAUDINE'           | 15.6              | 15.8 | 13.9     | 13.9 | 22.7                  | 24.3 | 21.2     | 20.8 |
| 'Cherie'            | 16.8              | 16.4 | 15.2     | 16.0 | 24.9                  | 24.4 | 22.2     | 23.7 |
| LSD <sub>0.05</sub> | 1.81              | 2.05 | 1.63     | 2.04 | 2.27                  | 2.80 | 1.85     | 2.53 |

in the Forest-Steppe zone and 24.8% and 25.7% in the Polissia zone. The variety 'Cherie' in the Forest-Steppe zone in both 2019 and 2020 reached a level of 16.8; 16.4% – starch content and 24.9%; 24.4% – dry mat-

ter content. It is worth noting that the variety 'ALOUETTE' obtained higher starch and dry matter indicators in 2020 in Polissia conditions (16.3 and 24.8%).

It should also be noted that the varieties 'FONTANE' and 'Cherie' in the Forest-Steppe zone, according to the Classifier of Quality Indicators of Botanical Taxa, whose varieties are tested for suitability for marketing [27], had a higher content of starch (16.1–21.0%) and dry matter (24.1–30.0%).

In certain agro-climatic zones, the productivity of varieties is in most cases unstable and rather unpredictable, since it is difficult to find a highly plastic universal variety that would be suitable for different soil and climatic zones. Therefore, the main task is to identify a variety that would be suitable for cultivation in different soil and climatic zones (Forest-Steppe, Polissia).

According to the results of the conducted studies on potato varieties, indicators of stability and plasticity were obtained (Table 2).

**Table 2**  
**Indicators of plasticity and stability of the main economic and quality traits of yield, starch content and dry matter of potatoes in different soil and climatic zones**

| Variety     | Yield, t/ha |                     | Starch content, % |                     | Dry matter content, % |                     |
|-------------|-------------|---------------------|-------------------|---------------------|-----------------------|---------------------|
|             | b           | W                   | b                 | W                   | b                     | W                   |
| 'Misteriia' | 0.809       | $1.676 \times 10^7$ | -0.137            | $5.414 \times 10^6$ | -0.065                | $1.253 \times 10^7$ |
| '7 FOUR 7'  | 1.003       | $1.63 \times 10^7$  | 1.193             | $5.404 \times 10^6$ | 1.407                 | $1.264 \times 10^7$ |
| 'Rodriga'   | 1.055       | $1.553 \times 10^7$ | 0.879             | $5.485 \times 10^6$ | 0.434                 | $1.267 \times 10^7$ |
| 'ALOUETTE'  | 1.181       | $1.626 \times 10^7$ | 0.567             | $5.261 \times 10^6$ | 0.347                 | $1.231 \times 10^7$ |
| 'PARADISO'  | 1.229       | $1.568 \times 10^7$ | 1.599             | $5.542 \times 10^6$ | 1.483                 | $1.287 \times 10^7$ |
| 'FONTANE'   | 0.839       | $1.633 \times 10^7$ | 1.521             | $5.052 \times 10^6$ | 1.656                 | $1.189 \times 10^7$ |
| 'RANOMI'    | 0.706       | $1.502 \times 10^7$ | 1.009             | $5.445 \times 10^6$ | 1.09                  | $1.264 \times 10^7$ |
| 'LAUDINE'   | 1.453       | $1.621 \times 10^7$ | 1.479             | $5.332 \times 10^6$ | 1.677                 | $1.249 \times 10^7$ |
| 'Cherie'    | 0.725       | $1.573 \times 10^7$ | 0.889             | $5.215 \times 10^6$ | 0.972                 | $1.228 \times 10^7$ |

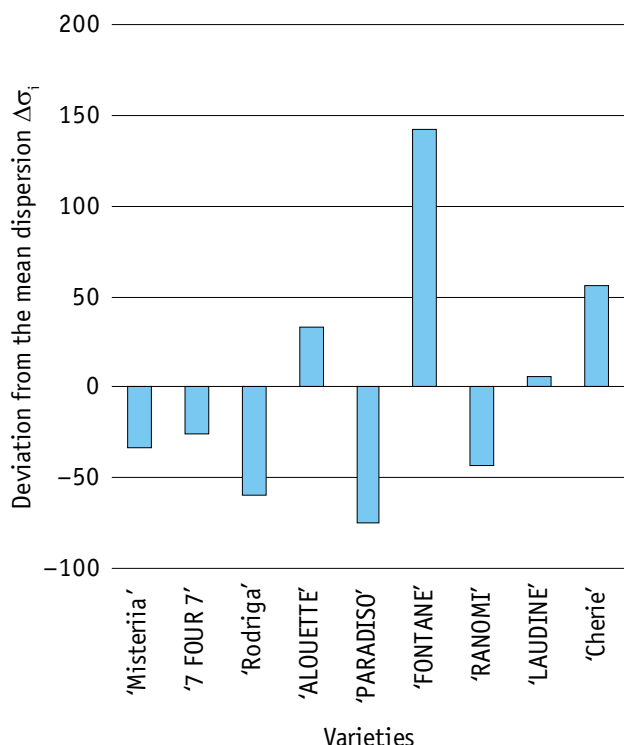
**Note.** b – plasticity index; W – stability index.

Some of the potato varieties do not differ from the group standard in the value of yield plasticity, starch content and dry matter content, and this indicator is within unity or very close to unity. The investigated variety 'Mysteriia' is characterised by negative values of the plasticity coefficient. However, it is possible to identify varieties with high plasticity on the basis of starch content ('7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE'), productivity ('7 FOUR 7', 'Rodriga', 'ALOUETTE', 'PARADISO', 'LAUDINE') and dry matter content ('7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE'). The varieties '7 FOUR 7', 'PARADISO', 'LAUDINE' are therefore highly plastic in all respects.

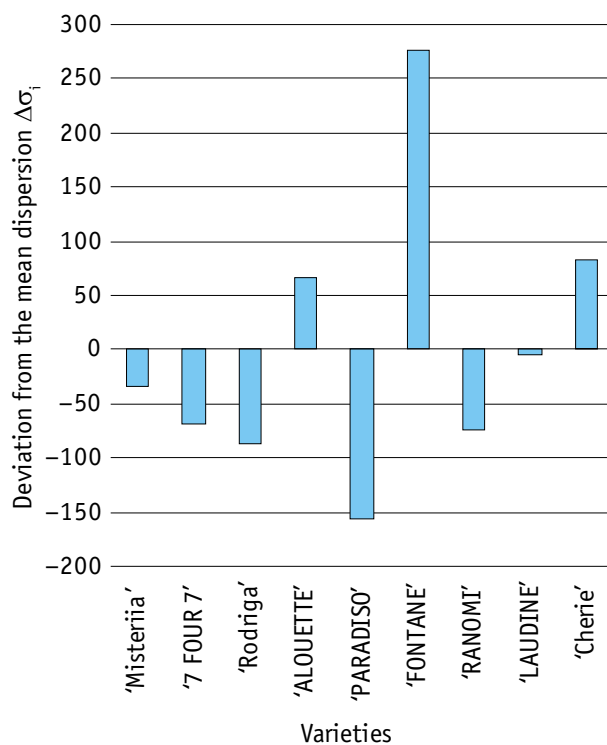
It should be noted that, among the varieties studied, the average group dispersion in terms

of starch content is exceeded by the varieties 'ALOUETTE', 'FONTANE', 'LAUDINE' and 'Cherie' (Fig. 1). On the other hand, the varieties 'Rodriga', 'Paradiso', 'Ranomi' and 'Laudine' dominate in terms of yield (Fig. 2). For dry matter content, the varieties 'ALOUETTE', 'FONTANE' and 'Cherie' are above the average dispersion (Fig. 3).

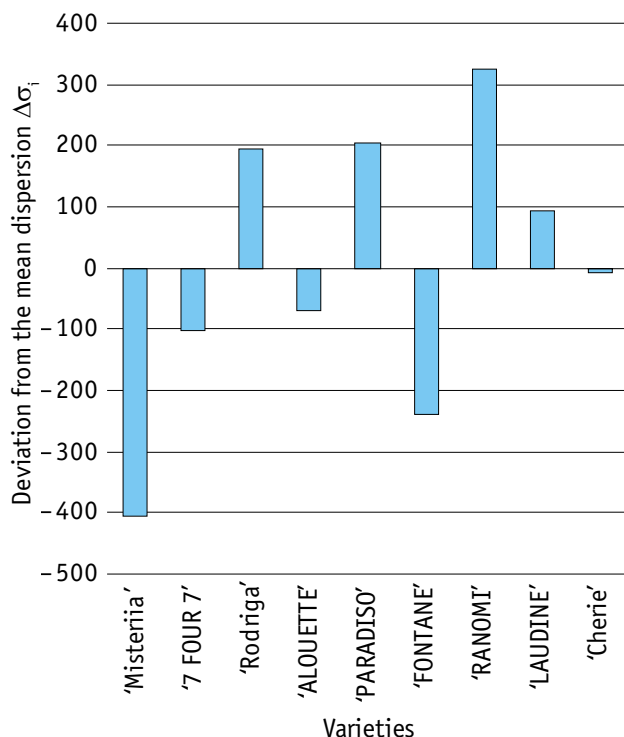
Thus, as a result of the analysis of the regression coefficient and the deviation from the average variance of the characteristics of starch content and dry matter of the studied potato varieties, it was determined that the variety 'FONTANE' belonged to the highly plastic ones by all indicators, the variety 'LAUDINE' – by the signs of starch content and productivity. The varieties 'Rodriga' and 'PARADISO' were also highly plastic according



**Fig. 1. Deviation from the mean dispersion of starch content in potatoes grown in different soil and climatic zones of Ukraine**



**Fig. 3. Deviation from the mean dispersion of dry matter content in potatoes grown in different soil and climatic zones of Ukraine**



**Fig. 2. Deviation from the mean dispersion of yield characteristics of potatoes grown in different soil and climatic zones of Ukraine**

to the yield, but the varieties 'ALOUETTE', 'Cherie' and 'RANOMI' were characterised by high plasticity only within the group studied.

On the basis of the studied indicators, the varieties 'Mysteria', '7 FOUR 7', 'ALOUETTE', 'FONTANE' and 'LAUDINE' were found to be very stable in terms of yield in different soil and climatic zones. The varieties 'Mysteria', '7 FOUR 7', 'Rodriga', 'PARADISO' and 'RANOMI' were characterised by stability of dry matter and starch content. The variety 'LAUDINE' was characterised by the stability of the sign of the dry matter content throughout the years studied. This indicates the ability of these varieties to maintain the potential of the productivity traits, dry matter content and starch under limited environmental factors (Figs. 4–6).

Based on the analysis of the stability and plasticity of the studied potato varieties, recommendations can be made for the use of high-intensity varieties in different soil and climatic zones of Ukraine: in particular, it is recommended to use the varieties 'Rodriga', 'PARADISO' according to the yield, and – according to the content of dry matter and starch – the varieties 'FONTANE', 'LAUDINE'.

Varieties with a regression coefficient significantly lower than 1 belong to the neutral type (with low ecological plasticity). They react weakly to changes in environmental factors, they cannot achieve high results under intensive farming conditions, but under poor

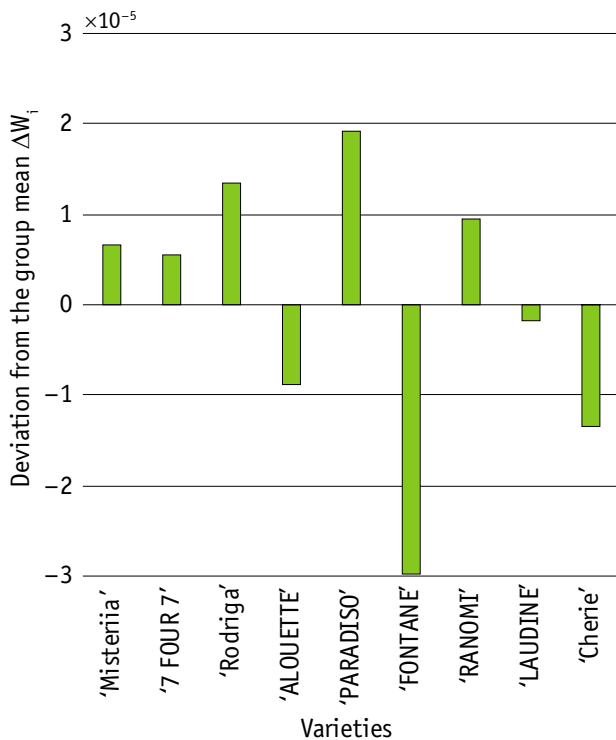


Fig. 4. Deviation of the sign of stability of starch content in different potato varieties from the group mean

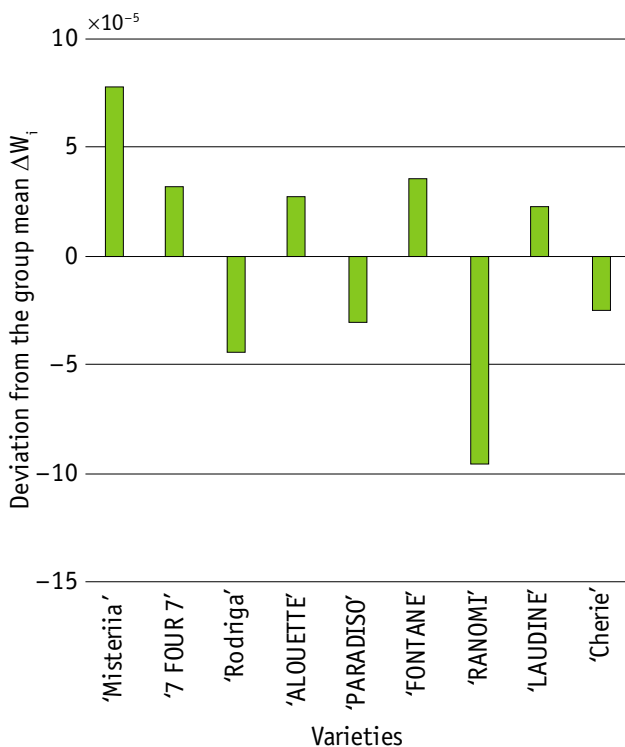


Fig. 5. Deviation of the yield stability sign of different potato varieties from the group mean

conditions their indicators decrease less than those of varieties of the intensive type.

Extensive varieties are those which produce a certain level of productivity in spite of adverse growing conditions or agronomic defi-

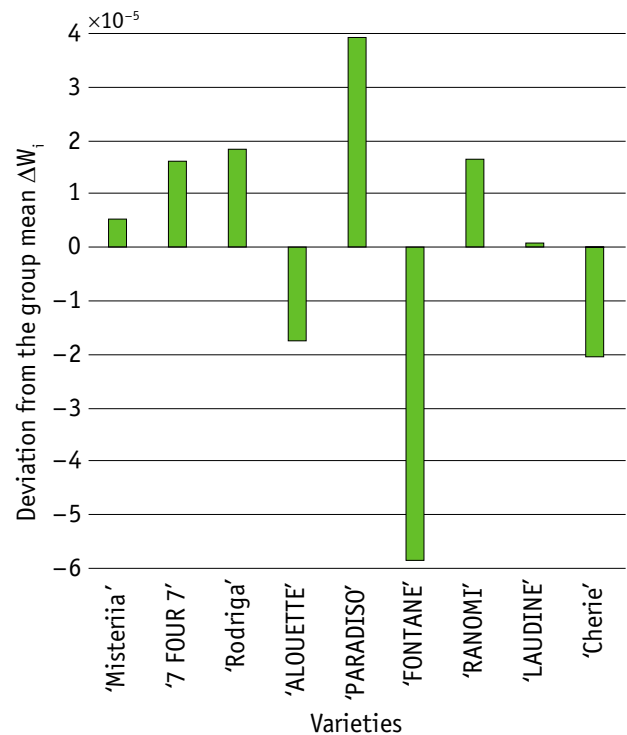


Fig. 6. Deviation of the sign of the stability of the dry matter content in different potato varieties from the group mean

ciencies [10, 28, 29]. These varieties include 'ALOUETTE' for starch and dry matter content and 'RANOMI' for productivity.

On the basis of the studied indicators, a three-dimensional graph of the dependence of yield, starch content and dry matter content of the studied potato varieties on growing conditions and varietal characteristics in different soil and climatic zones was constructed. Graphical analysis of the surfaces showed that the above-mentioned highly plastic varieties had consistently higher yields, starch content and dry matter content throughout the years studied. Instead, some of the varieties are characterised by instability according to these indicators (Figures 7–9).

According to the results of studies of potato varieties that have passed the State Variety Testing and have been entered into the Register of Plant Varieties Suitable for Distribution in Ukraine, it was found that each variety reacts differently to the weather conditions of the year under equivalent growing conditions. In the group of varieties grown in the Forest-Steppe zone, the highest coefficient of annual adaptability in relation to the yield indicator was observed: in 2019 – the varieties 'RANOMI' (1.44), 'Cherie' (1.26) with yields of 31.9 and 28.1 t/ha, respectively; in 2020 – the variety 'LAUDINE' (1.15), the yield was 38.3 t/ha; in the conditions

of Polissia, highly adaptable varieties were selected according to the average indicator of adaptability coefficient in 2019 – ‘RANOMI’ (1.40) and ‘PARADISO’ (1.17) with yields of

26.2 and 21.9 t/ha, respectively; in 2020 – ‘Rodriga’ (1.20) and ‘PARADISO’ (1.23), productivity was 32.1 and 32.9 t/ha, respectively (Table 3).

Table 3

**Yield of potato varieties and their coefficients of adaptation to the conditions of Forest-Steppe and Polissia of Ukraine**

| Variety                            | 2019            |      | 2020            |      | Mean            |      | 2019            |      | 2020            |      | Mean            |      |
|------------------------------------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|-----------------|------|
|                                    | Forest-Steppe   |      |                 |      |                 |      | Polissia        |      |                 |      |                 |      |
|                                    | X <sub>ij</sub> | CA   | X <sub>ij</sub> | CA   | X <sub>ij</sub> | CA   | X <sub>ij</sub> | CA   | X <sub>ij</sub> | CA   | X <sub>ij</sub> | CA   |
| ‘Misternia’                        | 17.1            | 0.77 | 24.4            | 0.73 | 20.8            | 0.75 | 14.2            | 0.76 | 25.5            | 0.96 | 19.9            | 0.86 |
| ‘7 FOUR 7’                         | 22.4            | 1.00 | 31.0            | 0.93 | 26.7            | 0.97 | 16.5            | 0.88 | 22.8            | 0.85 | 19.7            | 0.87 |
| ‘Rodriga’                          | 26.4            | 1.19 | 34.8            | 1.05 | 30.6            | 1.12 | 18.9            | 1.01 | 32.1            | 1.20 | 25.5            | 1.11 |
| ‘ALOUETTE’                         | 17.1            | 0.77 | 32.4            | 0.97 | 24.8            | 0.87 | 16.8            | 0.90 | 27.5            | 1.03 | 22.2            | 0.97 |
| ‘PARADISO’                         | 17.0            | 0.77 | 36.7            | 1.10 | 26.8            | 0.94 | 21.9            | 1.17 | 32.9            | 1.23 | 27.4            | 1.20 |
| ‘FONTANE’                          | 16.8            | 0.76 | 29.9            | 0.90 | 23.4            | 0.83 | 20.6            | 1.10 | 24.6            | 0.92 | 22.6            | 1.01 |
| ‘RANOMI’                           | 31.9            | 1.44 | 37.2            | 1.12 | 34.6            | 1.28 | 26.2            | 1.40 | 30.2            | 1.13 | 28.2            | 1.27 |
| ‘LAUDINE’                          | 23.3            | 1.05 | 38.3            | 1.15 | 30.8            | 1.10 | 12.1            | 0.65 | 21.2            | 0.79 | 16.7            | 0.72 |
| ‘Cherie’                           | 28.1            | 1.26 | 34.6            | 1.04 | 31.4            | 1.15 | 21.1            | 1.13 | 23.4            | 0.88 | 22.3            | 1.01 |
| X varietal yield of the year, t/ha | 22.2            | –    | 33.3            | –    | 27.7            | –    | 18.7            | –    | 26.7            | –    | 22.7            | –    |
| LSD <sub>0.05</sub> t/ha           | 6.16            | –    | 4.76            | –    | 4.80            | –    | 4.69            | –    | 4.60            | –    | 4.10            | –    |

Note. X<sub>ij</sub> – yield of a certain variety in the year of the study, t/ha; CA – the coefficient of adaptability.

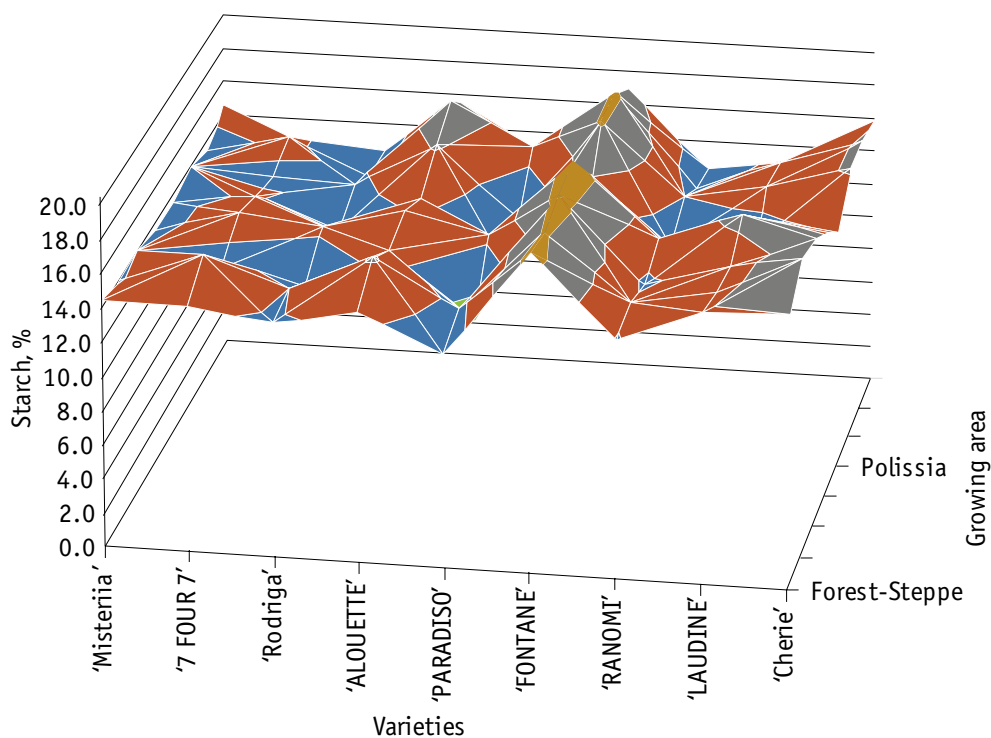


Fig. 7. Dependence of starch content of studied potato varieties on growing conditions and varietal characteristics

According to the results of the analysis of the yield of potato varieties grown in the Forest-Steppe and Polissia zones, it was found that the highest average productivity was demonstrated by the variety ‘RANOMI’ – 34.6 and 28.2 t/ha, respectively. The varieties ‘RANOMI’, ‘Cherie’ were the best in the

Forest-Steppe zone with yields of 34.6 and 31.4 t/ha, respectively, in the Polissia conditions the highest yields were obtained by the varieties ‘RANOMI’, ‘PARADISO’ – 28.2 and 27.4 t/ha.

In the Forest-Steppe zone, the annual coefficient of adaptability was higher than 1



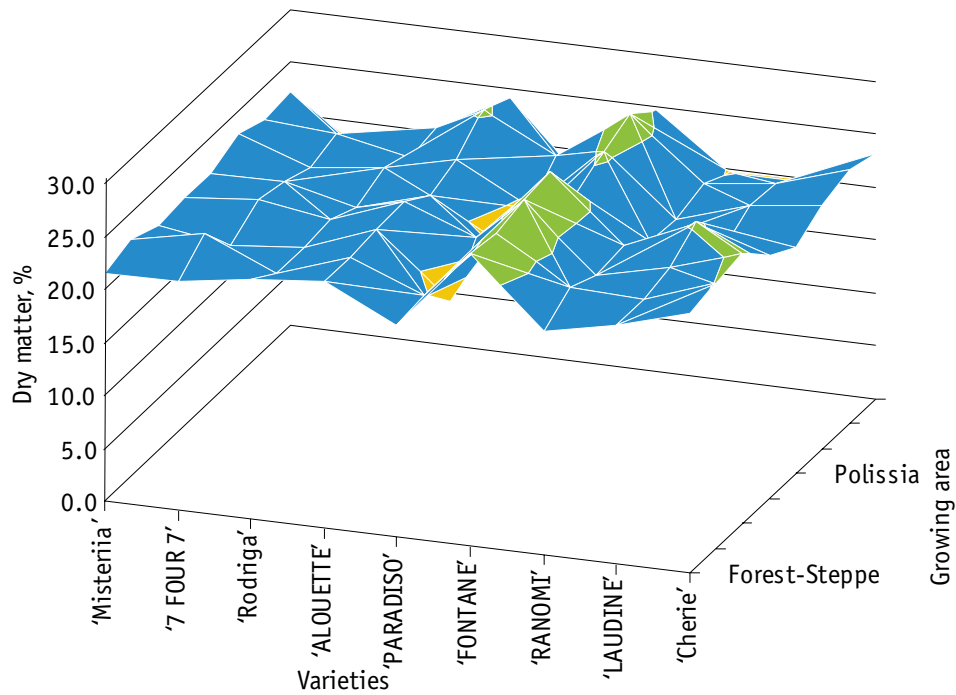


Fig. 8. Dependence of yield of studied potato varieties on growing conditions and varietal characteristics

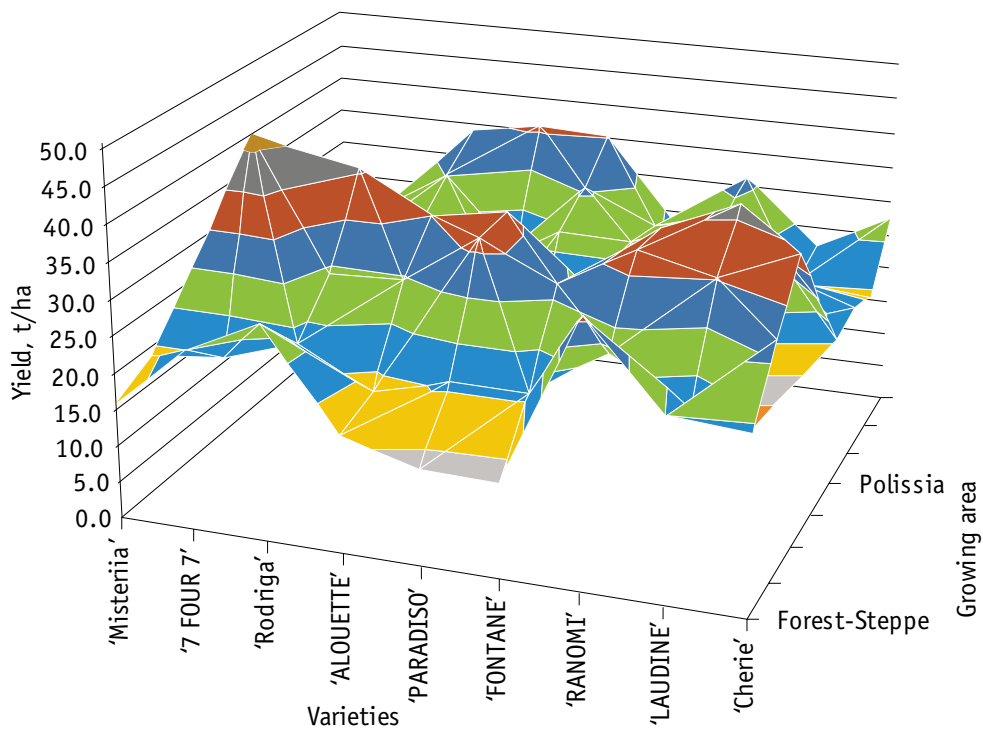


Fig. 9. Dependence of dry matter content of studied potato varieties on growing conditions and varietal characteristics

for the varieties 'Rodriga', 'RANOMI', 'LAUDINE' and 'Cherie' in both 2019 and 2020. So for the varieties 'Rodriga' CA – 1.19 in 2019, 1.05 in 2020, 'RANOMI' – 1.44–1.12, 'LAUDINE' – 1.05–1.15, 'Cherie' – 1.26–1.04. This corresponds to the productivity of these varieties: 26.4–34.8 – 'Rodriga'; 31.9–37.2 – 'RANOMI';

23.3–38.3 – 'LAUDINE'; 28.1–34.6 t/ha – 'Cherie'.

In the conditions of Polissia, the highest value of the annual coefficient of adaptability was shown by the varieties 'Rodriga' (1.01–1.20), 'PARADISO' (1.17–1.23), 'RANOMI' (1.40–1.13) in terms of productivity 18.9–32.1; 21.9–32.9; 26.2–30.2 t/ha, respectively.



According to the average indicator of the coefficient of adaptability, the variety 'RANOMI' was selected, which obtained the highest results in the Forest-Steppe and Polissia zones – 1.28; 1.27, respectively. In the Forest-Steppe zone the varieties 'Cheri', 'Rodriga' with an average coefficient of adaptability of 1.15; 1.12 and in the Polissia zone – 'PARADISO', 'Rodriga' with a value of 1.20; 1.11 are worth mentioning.

### Conclusions

According to the results of the investigation of potato varieties for ecological plasticity, varieties were found which, thanks to their high plasticity and stability, are able to adapt successfully to the limiting factors of life-support and stress phenomena in different soil and climatic zones.

For use in different soil and climatic zones, the highly plastic varieties '7 FOUR 7', 'Rodriga', 'ALOUETTE', 'PARADISO', 'LAUDINE' and the varieties '7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE' based on starch content, based on dry matter content – '7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE'. Varieties '7 FOUR 7', 'PARADISO', 'LAUDINE' were among the most plastic in all characteristics.

The most stable varieties in terms of yield are 'Mysteriia', '7 FOUR 7', 'ALOUETTE', 'FONTANE' and 'LAUDINE', in terms of dry matter and starch content are 'Mysteriia', '7 FOUR 7', 'Rodriga', 'PARADISO' and 'RANOMI'. The variety 'LAUDINE' was characterised by the stability of the sign of the dry matter content throughout the years studied.

High-intensity varieties grown in different soil and climatic zones of Ukraine include 'Rodriga', 'PARADISO' for productivity and 'FONTANE' and 'LAUDINE' for dry matter and starch content.

According to the results of the analysis of the yield of potato varieties grown in the Forest-Steppe and Polissia zone, it was found that, on average over the two years of research, the highest average productivity was demonstrated by the 'RANOMI' variety – 34.6 t/ha in 2019 and 28.2 t/ha in 2020.

According to the average indicator of the coefficient of adaptability, the variety 'RANOMI' was selected, which obtained the highest results in the Forest-Steppe and Polissia zones – 1.28; 1.27, respectively. In the Forest-Steppe zone the varieties 'Cheri', 'Rodriga' with an average coefficient of adaptability of 1.15; 1.12 and in the Polissia zone – 'PARADISO', 'Rodriga' with a value of 1.20; 1.11 are worth mentioning.

An important factor in increasing the production of high-yielding potato varieties is growing varieties with increased adaptability.

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**Король Л. В.\***, **Топчій О. В.**, **Іваницька А. П.**, **Безпрозвана І. В.**, **Піскова О. В.**, **Костенко А. В.** Оцінювання адаптивних властивостей сортів картоплі (*Solanum tuberosum* L.) за основними господарсько-цінними ознаками. *Plant Varieties Studying and Protection*. 2023. Т. 19, № 1. С. 4–14. <https://doi.org/10.21498/2518-1017.19.1.2023.277766>

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**Мета.** Проаналізувати екологічну пластичність і стабільність ознак продуктивності, вмісту крохмалю й сухої речовини та визначити параметри екологічної адаптивності сортів картоплі за врожайністю в ґрунтово-кліматичних зонах Лісостепу й Полісся. **Методи.** У процесі досліджень використовували лабораторний, розрахунковий і статистичний методи, для підготовки висновків – аналізу та синтезу. **Результати.** Вирощувані в різних ґрунтово-кліматичних зонах України сорти картоплі проаналізовано за врожайністю, вмістом крохмалю та сухої речовини. Сорти з високими показниками адаптивності, стабільності та пластичності виділено як перспективні для селекційного і практичного застосування. У зонах Лісостепу та Полісся найвищі показники продуктивності одержано для сорту 'RANOMI' – 34,6 і 28,2 т/га відповідно (адаптивний потенціал – 1,28; 1,27). Найбільшу врожайність сорти 'RANOMI' та 'Cherie' продемонстрували в зоні Лісостепу – 34,6 і 31,4 т/га. В умовах Полісся 'RANOMI' і 'PARADISO' відзначилися продуктивністю 28,2 і 27,4 т/га. За показниками вмісту крохмалю та сухої речовини виділено високопластичні сорти '7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI', 'LAUDINE';

врожайності – '7 FOUR 7', 'Rodrigo', 'ALOUETTE', 'PARADISO', 'LAUDINE'. Високостабільними за ознакою врожайності виявилися 'Містерія', '7 FOUR 7', 'LAUDINE' та 'FONTANE'; за вмістом сухої речовини та крохмалю – 'Містерія', '7 FOUR 7', 'Rodrigo', 'PARADISO' й 'RANOMI'. До високоінтенсивних за ознакою врожайності належать сорти 'Rodrigo', 'PARADISO', за вмістом сухої речовини та крохмалю – 'FONTANE', 'LAUDINE'. **Висновки.** У різних ґрунтово-кліматичних зонах за показниками врожайності виділено високопластичні сорти '7 FOUR 7', 'Rodrigo', 'ALOUETTE', 'PARADISO' та 'LAUDINE', за вмістом крохмалю та сухої речовини – '7 FOUR 7', 'PARADISO', 'FONTANE', 'RANOMI' та 'LAUDINE'. У середньому за 2019–2020 рр. найбільшу продуктивність та високий адаптивний потенціал у зонах Лісостепу й Полісся продемонстрував сорт 'RANOMI' – 34,6 і 28,2 т/га відповідно, КА – 1,28; 1,27. У Лісостепу варто відзначити сорти 'Cherie' та 'Rodrigo' (середній показник КА – 1,15 та 1,12; урожайність – 31,4 і 30,62 т/га відповідно); у зоні Полісся – 'PARADISO' та 'Rodrigo' (значення КА – 1,20 та 1,11; урожайність – 27,4 і 25,5 т/га відповідно).

**Ключові слова:** картопля; вміст крохмалю; вміст сухої речовини; стабільність; пластичність; адаптивність.

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