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## **THE ROLE AND VALUE OF VARIETY IN THE FORMATION OF THE YIELD OF THE EARLY RIPEN POTATO IN THE RIGHT-BANK FOREST-STEPPE AREA OF UKRAINE**

*The results of the investigation on studying of the varieties of the early ripen potato in the conditions of the right-bank Forest-Steppe area of Ukraine are presented in the article. The correlation between the peculiarities of the passage by the plants of phenological phases of growth and development, biometric indicators and yield-capacity of potato depending on the variety.*

**Key words:** *early ripen potato, variety, phenological phase, the height of plants, stalk forming ability, productivity*

**Introduction.** The sown areas used for growing potatoes in Ukraine are more than 1,6 million hectares. Most of the farms of the country receive relatively low yield-capacity of 10-14 tons/ha, while the potential yield-capacity for this crop is 100 – 130 tons/ha. In Ukraine in recent years, the yield-capacity fluctuated at the level 16 – 20 tons/ha, that is also partly due to the use of old varieties and the degeneration of the planting material and other. According to the FAO STAT data during the last years in the world the tendency of the reduction of areas under potatoes with a simultaneous increase in yield-capacity up to 35 – 45 tons/ha was observed and mainly this process occurs by the use of new high-yielding varieties.

To obtain a good yield-capacity of potato, one must first of all correctly select the type, that can not only increase the yield-capacity, but also improve the product quality and to increase the overall output of tubers per unit area. The selection of the high-yielding varieties plays a decisive role in potato production and is an important factor of increase of gross yield in the certain soil-climatic conditions.

*The analysis of the publications.* In Ukraine a wide range of potato varieties with quite a significant biological potential of productivity traits is presented. The qualitative characteristics of new varieties of potatoes have also significantly increased. Only having the information about the potential productivity, adaptability and stability of the variety, its ability to respond to improved growing conditions, one can effectively use the variety in different conditions [1, 2].

The value of the variety is evaluated by numerous scientific papers. Scientists around the world expressed the unanimous opinion that the variety plays a major positive role in increasing of the yield-capacity of potato, but the percentage of increase is different and depends on various factors [3].

The new varieties, regardless of the purpose of use, should be suitable for the growing technology, provide high economic efficiency of potato production, be adapted to a certain level of farming, and be more resistant to various biotic and abiotic stress factors. It is the variety that plays a decisive role in the use of plants for specific purposes. The knowledge of the variety, as academician V.M. Remeslo claimed, is 90% of success [4, 5].

The use of the varietal plant resources is one of the most important links of agriculture – the basis of economic and social development of the country. The wide introduction of new varieties and hybrids with genetically certain level of adaptation to the conditions of soil-climatic zones of their cultivation is the most effective and economically profitable [6, 7].

According to the foregoing data the need to develop the means of yield-capacity increase and improve the quality of tubers arises. In our investigations we have set ourselves the task to explore the adaptability and productivity of new varieties of the early ripen potatoes in right-bank Forest-Steppe area.

**Materials and methods.** Experiments were made in the vegetable crop rotation of NNVU Uman NUH on heavy loameblack soil in 2011–2013. In researches there were used those kinds of

potatoes that were included to the State Register of kinds of plants: Serpanok (control), Red Scarlet, Latona, Bellarosa, Carrera, Zabava, Tyras.

During the vegetation period the phenological observations and biometric measurements of the plants were conducted according to the methodology of the Institute of potato growing UAAS. The statistical methods and analysis of variance for the analysis of the data were applied. The technological techniques conformed to the common recommendations.

**Results and discussion.** The investigations have shown that the varieties of the early ripen potatoes differed in their biological characteristics. So, the progress of some phenological phases of growth and development of potato depending on the variety occurred with some divergences in time. So, earlier than in other varieties, the beginning and the duration of some phenological phases was observed in the variety Red Scarlet and at the latest in the variety Zabava (*Table 1*).

*Table 1*

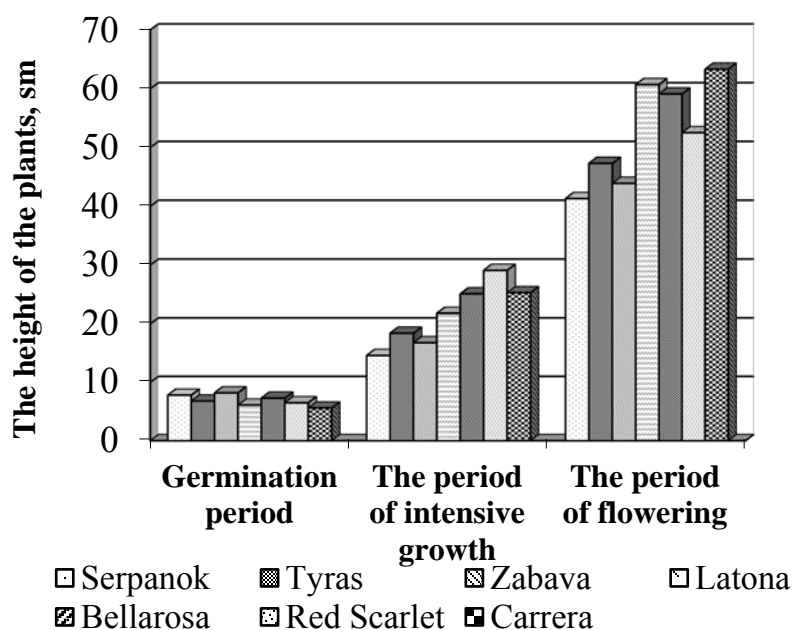
**The duration of phenological phases of growth and development of the plants depending on the variety (the average for the period of 2011-2013), days**

| Variety          | Planting – emergence of seedlings | Emergence of seedlings – buds appearing | Buds appearing – flowering | Flowering – dying of the tops | The duration of the vegetation period |
|------------------|-----------------------------------|---|----------------------------|-------------------------------|---------------------------------------|
| Serpanok control | 18                                | 25                                      | 4                          | 39                            | 86                                    |
| Latona           | 24                                | 26                                      | 6                          | 40                            | 96                                    |
| Bellarosa        | 22                                | 24                                      | 7                          | 41                            | 94                                    |
| Red Scarlet      | 16                                | 23                                      | 5                          | 29                            | 73                                    |
| Carrera          | 23                                | 26                                      | 6                          | 33                            | 88                                    |
| Zabava           | 24                                | 28                                      | 7                          | 39                            | 98                                    |
| Tyras            | 17                                | 24                                      | 5                          | 38                            | 84                                    |

The overall growth and development of the plants affected the beginning of the formation of the tubers. The varieties Red Scarlet and Tyras passed the corresponding phase in the beginning of the first decade of June, and other varieties – in the middle of the first decade of June. To determine the influence of the conditions of cultivation on the growth and development of the plants of potato varieties biometric measurements were held.

It was established that in the phase of intensive seedlings the plants of varieties Bellarosa, Serpanok, Zabava were higher, their height amounted to 7,3 – 8,2 sm (*pict.*). However, in the period of flowering the plants of the varieties Latona and Carrera were higher, this indicator was within 60,7 – 63,3 sm.

It is established that with the increase of the height of the plants the quality of the leaves also increased. The quality of the leaves on the plants of potato varieties in the period of flowering on average for the period of 2011 – 2013 reached the value 37,5 – 67,9 pcs./plants (*Table 2*). The variety Red Scarlet had the highest quantity – 67,9 pcs./plants and the variety Zabava had the lowest quantity. The plants of the variety Carrera in the period of flowering had larger area of the leaves – 31,4 thousand m<sup>2</sup>/ha, that compared with the control has allowed to receive an increase 7,6 thousand m<sup>2</sup>/ha. The varieties Latona and Bellarosa had lower indicator – 31,1 – 30,9 thousand m<sup>2</sup>/ha, accordingly.



**Pict. The dynamics of increase of the height of the plants of the potato varieties depending on the variety (the average for the period of 2011-2013), sm**

*Table 2*

**Biometrical index of early harvestin potatoes at the period of flowering**

| Variety           | Number of leaves for a plant |      |      |         | Area of leaves, thousands m <sup>2</sup> /ha |      |      |         | ± before control, thousands m <sup>2</sup> /ha |
|-------------------|------------------------------|------|------|---------|--|------|------|---------|--|
|                   | 2011                         | 2012 | 2013 | average | 2011   | 2012 | 2013 | average |  |
| Serpanok control  | 45,3                         | 27,9 | 41,3 | 38,2    | 29,4   | 15,3 | 26,8 | 23,8    | –  |
| Latona            | 59,9                         | 36,0 | 48,8 | 48,2    | 38,9   | 22,7 | 31,7 | 31,1    | +7,3   |
| Bellarosa         | 82,5                         | 40,8 | 63,4 | 62,2    | 37,7   | 26,1 | 28,9 | 30,9    | +7,1   |
| Red Scarlet       | 76,0                         | 58,2 | 69,4 | 67,9    | 33,7   | 23,4 | 30,7 | 29,3    | +5,5   |
| Carrera           | 51,5                         | 35,6 | 40,2 | 42,4    | 38,0   | 24,7 | 31,6 | 31,4    | +7,6   |
| Zabava            | 47,6                         | 29,2 | 35,7 | 37,5    | 29,8   | 19,4 | 25,2 | 24,8    | +1,0   |
| Tyras             | 49,5                         | 30,8 | 41,2 | 40,5    | 32,1   | 19,7 | 26,7 | 26,2    | +2,4   |
| HIP <sub>05</sub> | 2,9                          | 1,8  | 2,4  |         | 1,7  | 1,1  | 1,4  |         |  |

Plants on the area consist of potato bushes and stems in each of them (*Table 3*). The data in the table show that the quality of stalks amounted to 3,4 – 5,5 pcs./bush. This indicator was higher in the varieties Carrera and Latona, that in comparison with the control was 2,1 pcs./bush more.

While considering the indicator of the quantity of stalks per 1 ha, it should be mentioned that it was lower in the controlled variety Serpanok – 138,7 thousand pieces. The quantity of stalks at the level of the control was formed by the plants of the variety Zabava – 146,9 thousand pcs./ha. The varieties of the early ripen potato Carrera and Latona had the highest indicators – 224,5 thousand pcs./ha. But the quantity of the stalks per hectare appeared to be insufficient, according to the recommendations of the Ministry of agrarian policy of Ukraine for the early and mid-early varieties the optimal (the number of potato bushes and stalks in each of them) is 250 thousand pcs./ha.

Table 3

**Stalk forming ability of the potato varieties**

| Variety           | The quantity of the stalks in the bush, pcs. |      |      |         | The quantity of the stalks per 1 ha, thousand pcs. |       |       |         | ± before control, thousands pcs./ha |
|-------------------|--|------|------|---------|--|-------|-------|---------|-------------------------------------|
|                   | 2011   | 2012 | 2013 | average | 2011   | 2012  | 2013  | average |                                     |
| Serpanok control  | 3,0  | 3,8  | 3,4  | 3,4     | 122,4  | 155,1 | 138,7 | 138,7   | –                                   |
| Latona            | 6,2  | 4,8  | 5,4  | 5,5     | 253,1  | 195,9 | 220,4 | 224,5   | +85,8                               |
| Bellarosa         | 6,5  | 3,8  | 5,0  | 5,1     | 265,3  | 155,1 | 204,1 | 208,2   | +69,5                               |
| Red Scarlet       | 5,3  | 4,7  | 5,1  | 5,0     | 216,3  | 191,8 | 208,2 | 204,1   | 65,4                                |
| Carrera           | 6,2  | 4,9  | 5,5  | 5,5     | 253,1  | 200,0 | 224,5 | 224,5   | +85,8                               |
| Zabava            | 4,0  | 3,1  | 3,7  | 3,6     | 163,3  | 126,5 | 151,0 | 146,9   | +8,2                                |
| Tyras             | 4,9  | 3,7  | 4,1  | 4,2     | 200,0  | 151,0 | 167,3 | 171,4   | +32,7                               |
| HIP <sub>05</sub> | 0,3  | 0,2  | 0,2  |         | 10,5   | 8,4   | 9,4   |         |                                     |

The productivity of the plants and yield-capacity per unit area are important indicators in determining the effectiveness of potato varieties. The conducted investigations have shown that the weather conditions of the year of research and biological characteristics of the varieties have a significant influence on the value of the yield-capacity of potatoes in the Forest-Steppe area of Ukraine (Table 4).

Table 4

**The productivity of the early ripen potato depending on the variety, tons/ha**

| Variety           | Year of study |      |      |         | ± before control, thousands t/ha |
|-------------------|---------------|------|------|---------|----------------------------------|
|                   | 2011          | 2012 | 2013 | average |                                  |
| Serpanok control  | 18,7          | 16,6 | 17,1 | 17,5    | –                                |
| Latona            | 38,1          | 25,5 | 31,2 | 31,6    | +14,1                            |
| Bellarosa         | 34,1          | 23,2 | 26,2 | 27,8    | +10,3                            |
| Red Scarlet       | 28,2          | 19,8 | 24,8 | 24,3    | +6,8                             |
| Carrera           | 37,3          | 22,8 | 29,6 | 29,9    | +12,4                            |
| Zabava            | 19,6          | 17,1 | 18,2 | 18,3    | +0,8                             |
| Tyras             | 19,8          | 17,4 | 18,9 | 18,7    | +1,2                             |
| HIP <sub>05</sub> | 1,5           | 1,0  | 1,2  |         |                                  |

Thus, according to the data of the table the year of 2011 had the highest level of yield-capacity of potatoes. In this year the potato plants depending on the variety formed from 18,7 to 38,1 tons/ha, when sufficient precipitation and high humidity of the soil and air were observed. In this year the variety Latona distinguished the yield-capacity, which showed the results in the level of 38,1 tons/ha, which prevailed the control on 19.4 tons/ha. Favorable conditions for growing plants contributed to the formation of the higher quality of the tubers, and, accordingly, the higher quality of them from the bush and higher yield-capacity.

In 2012, the yield-capacity of potatoes had low indicators. It is established that air drought in July and August 2012 adversely affected the yield-capacity of the crop, since potatoes do not withstand high temperatures. Thus, the variety Latona also had higher yield-capacity in this year – 25,5 tons/ha. Low yield-capacity in dry conditions of the year 2012 was shown by the varieties Serpanok, Zabava and Tyras – 16,6 – 17,4 tons/ha. Intermediate indicators were observed in the varieties Bellarosa, Red Scarlet and Carrera – 22,8 – 23,2 tons/ha.

In 2013 the yield-capacity of potatoes has distinguished the intermediate indicators. A high level of yield-capacity of potatoes is caused by previous indicators and the data of table 4 shows that the best level of yield-capacity was observed in the variety Latona 31,2 tons/ha, that, in comparison with the controlled variety Serpanok the yield-capacity of which amounted to 17,1 tons/ha, has allowed to receive bonuses of the yield 14,1 tons/ha. The varieties of potato Carrera and Bellarosa also had quite high indicators of the yield-capacity – 29,9 and 27,8 tons/ha, accordingly. The varieties Zabava and Tyras had lower indicators of the yield-capacity – 18,2 – 18,9 tons/ha.

**Conclusions.** It is established that the best varieties for the Forest-Steppe area of Ukraine are the varieties of the early ripen potatoes Latona, Carrera, Bellarosa, which additionally allow to get 10,3 – 14,1 tons/ha. According to the qualitative indicators, the best varieties of the early ripen potatoes are Latona and Red Scarlet, where the quantity of starch reached the level of 16 – 16,5% and vitamin C – 19,0-19,1 mg/100 g of raw substance.

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### Анотація

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**Роль і значення сорту у формуванні урожаю картоплі ранньостиглої в Правобережному Лісостепу України**

У статті наведено результати досліджень з вивчення сортів картоплі ранньостиглої в умовах Правобережного Лісостепу України. Встановлено взаємозв'язок між особливостями проходження рослинами фенологічних фаз росту і розвитку, біометричними показниками та врожайністю картоплі залежно від сорту в Правобережному Лісостепу.

**Ключові слова:** картопля ранньостигла, сорт, фенологічна фаза, висота рослин, стеблостій, урожайність

### Аннотация

**Воробьева Н.В.**

**Роль и значение сорта в формировании урожая картофеля раннеспелого в Правобережной Лесостепи Украины.**

В статье отражены результаты исследований по изучению сортов картофеля раннеспелого в условиях Правобережной Лесостепи Украины. Установлена взаимосвязь между особенностями прохождения растениями фенологических фаз роста и развития, биометрическими показателями и урожайностью картофеля.

**Ключевые слова:** картофель раннеспелый, сорт, фенологические фазы, высота растений, стеблестой, урожайность