

YIELD OF EARLY POTATOES IN THE CONDITIONS OF WESTERN SERBIA

PRINOS MLADOG KROMPIRA U USLOVIMA ZAPADNE SRBIJE

Dobrivoj POŠTIĆ¹, Ratibor ŠTRBANOVIĆ¹, Nenad ĐURIĆ², Nikola KOKOVIĆ³
Nenad PAVLOVIĆ⁴, Ivana ŽIVKOVIĆ², Rade STANISAVLJEVIĆ¹

¹Institute for Plant Protection and Environment, Teodora Dražera 9, Belgrade, Serbia

²Institute for Vegetable Crops, Smederevska Palanka, Karadordeva 71, Serbia

³Institute of Soil Science, Teodora Dražera 7, Belgrade, Serbia

⁴Faculty of Agronomy, Cara Dušana 34, Čačak, Serbia

*Correspondence: pdobrivoj@yahoo.com

ABSTRACT

The goal of the research was to determine the variation in the yield of early potatoes in the conditions of western Serbia. During 2021 and 2022, the experiment was carried out at the site of KO Bogatić, the area of the village of Belotić (65 m above sea level, chernozem), 44° 49' N, 19° 32' E. The research was set up with three potato varieties: one early (Colomba) and two medium early (Esmee and Memphis).

The analysis of productive traits showed very significant differences ($r < 0.01$) and ($r < 0.05$) under the influence of the variety (factor G). The influence of the year (factor E) and the interaction of factors ($E \times G$) on the examined productive traits of early potatoes were absent. The mid-early varieties Esmee and Memphis showed a significantly lower yield of early potatoes, compared to the early variety Colomba. A significant positive correlation was found between the yield of new potatoes and the number of tubers per plant ($r = 0.78447, p < 0.05$). We can conclude that the Colomba variety, due to its early maturity and genetic predisposition, formed and bulking the tubers the fastest, which directly influenced the achievement of the highest yield of early potatoes.

Keywords: variety, number of tubers.

REZIME

Cilj istraživanja bio je da se utvrdi variranje prinosa mladog krompira u uslovima zapadne Srbije. Tokom 2021. i 2022. godine, ogled je izveden na lokalitetu KO Bogatić, područje sela Belotić (65 m nv., černozem), 44° 49' N, 19° 32' E. Istraživanja je izvedeno sa tri sorte krompira: jedne rane (Colomba) i dve srednje rane (Esmee i Memphis). Sadnja je izvedena (15. marta), dok je vađenje krtola mladog krompira i ocena produktivnosti izvršena 30.06. u obe godine istraživanja.

Analiza produktivnih osobina pokazala je vrlo značajne razlike ($p < 0,01$) i ($p < 0,05$) pod uticajem sorte (factor G). Uticaj godine (factor E) i interakcije faktora ($E \times G$) na ispitivane produktivne osobine mladog krompira je izostao. Kod sorte Colomba u obe godine ispitivanja zabeležen je značajno veći broj krtola po biljci, u odnosu na sorte Esmee i Memphis, što je imalo rezultat obrnutu situaciju kada je u pitanju osobina prosečna masa krtola po biljci. U dvogodišnjem proseku najkupnije krtole od 88,00 g zabeležene su kod sorte Memphis, zatim 68,50 g kod sorte Esmee, dok su najsitnije krtole u proseku od 65,0 g zabeležene kod sorte Colomba. Kod srednje ranih sorti Esmee i Memphis konstatovan je značajno manji prinos mladog krompira, u poređenju sa ranom sortom Colomba. Utvrđena je značajna pozitivna korelacija između prinosa mladog krompira i broja krtola po biljci ($r = 0,78447, p < 0,05$). Možemo zaključiti da je sorta Colomba zbog svoje ranostasnosti i genetske predispozicije najbrže formirala i nalivala krtole, što je direktno uticalo da ostvari i najveći prinos mladog krompira.

Ključne reči: sorta, broj krtola.

INTRODUCTION

The production of early potatoes represents the production of physiologically immature and incompletely formed potato tubers, which are used in human nutrition (Broćić and Stefanović, 2012). Early potatoes production represents a good opportunity for making a profit, because it arrives early in the spring when there is not a large selection of fresh vegetables on the market and, as a rule, have a good price (Buono *et al.*, 2009). In the conditions Western Serbia, there are very favorable conditions for the production of early potatoes, which agricultural producers do not use. With relatively low investments, early maturity of early potatoes can be achieved by applying the following agrotechnical measures: selection variety, sprouting of planting material, early planting, improvement of thermal conditions (selection location, use of agrorotextiles and mulch foils). Early potatoes are harvested very early (mid-May) and allow two harvests a year, leaving behind a well-structured soil with a high level of nutrients (Broćić and Stefanović, 2012). Due to the early harvesting, early potatoes have great agrotechnical importance, because many other plant species can

be grown after them (cabbage, sweet corn, etc.), which contributes to better land utilization (Lazić *et al.*, 1998). Early varieties are mainly used for the production of new potatoes. Young potato tubers contain a higher amount of sugar, compared to physiologically ripe potatoes, less dry matter and less starch.

In the Serbia, in certain regions where the climatic and soil conditions are more favorable, the production of early potatoes is traditionally represented: Leskovac, Trstenik, Opovo, Subotica, the area of Mačva. In these areas, earlier planting is possible and there are slightly lighter types of soil, which are more suitable for the production of early potatoes (Broćić and Stefanović, 2012).

The application of protective agents can be completely omitted or reduced to a minimum, so that a product that is safe for health is obtained. The great agrotechnical importance of new potatoes is also reflected in the fact that they are grown in crop rotation. It should be borne in mind that an earlier planting time plays a very important role, because it enables higher early yields, especially considering global warming and that winters are very mild, especially compared to 30-40 years ago (Poštić *et al.*, 2021). The aim of the research was to determine the influence of year

and variety on yield components and early yield of potato tubers in the conditions of western Serbia.

MATERIAL AND METHOD

During 2021 and 2022, the experiment was carried out at the site of KO Bogatić, the area of the village of Belotić (65 m above sea level, chernozem), 44° 49' N, 19° 32' E. The research was set up with three potato varieties: one early (Colomba) and two medium early (Esmee and Memphis). Planting material belonged to the category of original (certified seeds), fractions 35-55 mm. In early February, tubers for planting previously sprouting by the methodology given by (Poštić et al., 2016). Soil properties are shown in Table 1.

Table 1. Properties of soil at the experimental plot

Depth (cm)	Type of soil	CaCO ₃ %	pH		Humus %	mg/100g soil	
			H ₂ O	nKCl		P ₂ O ₅	K ₂ O
0-30	Chernozem	2.50	7.95	6.92	2.72	95.1	108.9

The field experiment was carried out as a two-factorial method split-plot, with four replications. Planting dates were 15 March in both years, the distance between the rows was 0.70 m, and the distance in the row was 0.30 m. Standard cropping practices in production were applied in both years during growing season. Harvesting of early potato tubers and assessment of productivity performed on June 30 in both years. The data of meteorological conditions are shown in Table 2.

Table 2. Meteorological conditions during the potato growing season 2021 and 2022 year and longtherm data (1975-2019) for the area western Serbia (<https://www.hidmet.gov.rs/>)

Month	2017		2018		1975-2019	
	°C	mm	°C	mm	°C	mm
March	5.5	38.0	5.1	6.9	11.3	40.5
April	9.3	38.2	10.8	65.5	16.8	65.4
May	16.2	49.0	18.9	11.8	20.1	71.1
June	22.7	7.2	22.9	43.3	21.2	69.3
Average-sum	13.4	132.4	14.7	127.5	17.4	246.3

The experimental data obtained were processed using the statistical package STATISTICA 8.0 for Windows. Differences between the treatments were determined using the analysis of variance (ANOVA), whereas the least significant difference (LSD) test was used for individual comparisons. Grouping information using Tukey method and 95.0% confidence. Correlations between the parameters observed were determined using the Pearson correlation coefficient (r).

RESULTS AND DISCUSSION

Analysis of the productive traits (Table 3) early potato yield showed highly significant ($r < 0.01$) and ($r < 0.05$) differences under influenced genotype (factor G). This results coincides with the results gained by other authors (Poštić et al., 2017; Poštić et al., 2021). The influence of the year (factor E) and the interaction of factors ($E \times G$) on the examined productive traits of early potatoes were absent. The influence of the year (E) was absent because the meteorological conditions between the years did not differ significantly (Table 2).

Table 3. F-values for observed factors

Factors	Number of tubers per plant	Mean tuber weight	Early yield of tubers
Year (E)	0.297ns	0.169ns	0.029ns
Genotype (G)	16.055**	3.298*	7.707**
$E \times G$	0.099ns	0.109ns	0.016ns

** - significant at 0.01; * - significant at 0.05; ns - not significant

The highest number of tubers per plant in the two-year average was produced by Colomba (8.38), followed by Esmee (5.75), and the lowest by Memphis (5.50). A significantly higher number of tubers per plant was recorded in the Colomba variety in both years of testing, compared to Esmee and Memphis. No significant differences in the number of tubers per plant were established between the cultivars Esmee and Memphis (Table 4).

Table 4. Effect of year and genotype on the number of tuber per plant

Genotype (G)	Year (E)		Average (G)
	2021	2022	
Colomba	8.50 aA	8.25 aA	8.38
Esmee	6.00 bA	5.50 bA	5.75
Memphis	5.50 bA	5.50 bA	5.50
Average (E)	6,67	6,42	6,54

*Small letters show the difference a, b, for the column, capital letters show the difference A, B, for the line; Grouping Information Using Tukey Method and 95.00% confidence;

The mean tuber weight of 75.30 g recorded in 2022 (Table 5) was slightly higher compared to the established average tuber mass of 72.30 g in 2021. In the two-year average, the largest tuber was produced by Memphis (88.00 g), followed by Esmee (68.50 g), and the lowest by Colomba (65.0 g), due to ability formation of larger number of tubers per plant (Table 4). The mean tuber weight decreases with the increase in the number of tubers per plant, similar results were reached (Poštić et al., 2017; Poštić et al., 2021). The Memphis variety had a significantly higher mean tuber weight than the other two potato varieties, this is a consequence of the smallest number of tubers per plant (Table 4). No significant difference in tuber size was observed between Esmee and Colomba.

Table 5. Effect of year and genotype on mean tuber weight (g)

Genotype (G)	Year (E)		Average (G)
	2021	2022	
Colomba	66 bA	64 bA	65.0
Esmee	65 bA	72 bA	68.5
Memphis	86 aA	90 aA	88.0
Average (E)	72.3	75.3	73.8

*Small letters show the difference a, b, for the column, capital letters show the difference A, B, for the line; Grouping Information Using Tukey Method and 95.00% confidence;

The highest average early potato yield (Table 6) was determined in the Colomba (25.68 t ha⁻¹), followed by Memphis (22.03 t ha⁻¹), while the lowest (17.35 t ha⁻¹) in Esmee. As expected the early variety will achieve a higher yield of early potatoes compared to the medium early variety, these results are in agreement with the results of other authors (Bošković-Rakočević and

Pavlović 2009; Poštić et al., 2021). The mid-early varieties Esmee and Memphis showed a significantly lower yield of early potatoes, compared to the early variety Colombia. A significantly higher yield of early potatoes at variety Memphis, compared to the Esmee.

Table 6. Effect of year and genotype on early yield potato tuber (t ha⁻¹)

Genotype (G)	Year (E)		Average (G)
	2021	2022	
Colombia	25.97 aA	25.38 aA	25.68
Esmee	18.12 cA	16.57 cB	17.35
Memphis	21.97 bA	22.09 bA	22.03
Average (E)	22.02	21.35	21.69

*Small letters show the difference a, b, for the column, capital letters show the difference A, B, for the line;

Grouping Information Using Tukey Method and 95.00% confidence;

A significant positive correlation was found between the yield of early potatoes and the number of tubers per plant ($r = 0.78447$, $p < 0.05$) Table 7. A low negative correlation was found between the number of tubers per plant and the mean tuber weight. No significant correlation was found between the mean tuber weight and the yield of early potatoes, which contradicts the results Poštić et al. (2021) in their trials early potato yield.

Table 7. The correlation coefficients between the observed traits (n=6)

Traits	Number of tubers per plant	Mean tuber weight	Early yield of tubers
Number of tubers per plant	-	- 0.67221	0.78477*
Mean tuber weight		-	- 0.08852
Early yield of tubers			-

Pearson correlation coefficient: *** $P \leq 0.001$, ** $P \leq 0.01$, * $P \leq 0.05$, respectively

CONCLUSION

According to the two-year research results effect of year and genotype on productivity early potato in Western Serbia, the following can be concluded:

The genotype (factor G) had a significant effect on all productive traits of early potatoes. The year factor, i.e. environmental conditions (factor E) and the interaction of the examined factors (E × G) did not significantly affect the observed productive traits early potatoes. All three grown potato varieties achieved a high yield of early potatoes and we can state that the producers would achieve a high price on the market and a large income. We can conclude that the early variety Colombia, due to its early maturity and genetic predisposition, formed and bulking the tubers the fastest, which directly influenced the achievement of the highest yield of early potatoes.

The production of early potatoes represents a great opportunity for producers to achieve higher incomes in rural areas and increase living standard, especially considering the cultivation of a second crop during one season.

ACKNOWLEDGMENT: Ministry of education, science and technological development of Republic of Serbia, Contract No. 451-03-136/2025-03/200010.

REFERENCES

Bošković-Rakočević, L., Pavlović, R. (2009). Uticaj azota na prinos i sadržaj nitrata kod mladog krompira u plasteničkoj proizvodnji. *Acta agriculturae Serbica*, 14(27), 93-99. <https://scindeks.ceon.rs/article.aspx?artid=0354-95420927093B>

Broćić, Z. and Stefanović, R. (2012). Potato production, economy and market. Monograph, University of Belgrade, Faculty of Agriculture, Zemun, 1-403.

Buono, V., Paradiso, Annalisa, Serio, F., Gonnella, Maria, De Gara, Laura, Pietro Santamaria, P. (2009): Tuber quality and nutritional components of "early" potato subjected to chemical haulm desiccation, *Journal of Food Composition and Analysis*, Vol. 22, Issue 6, Pages 556-562. <https://www.semanticscholar.org/paper/>

Lazić, B., Đurovka, M., Marković, V., Ilin, Ž. (1998). Povrtarstvo, Univerzitet u Novom Sadu, Poljoprivredni Fakultet, Novi Sad.

Poštić, D., Momirović, N., Broćić, Z., Stanisavljević, R., Šrbanović, R., Đokić, D., Jovović, Z. (2016). Effects of the Origin of Potato Planting Material on Morphological Characteristics of Seed Tuber. *Journal on Processing and Energy in Agriculture*, vol. 20, 3, p. 125-127. <https://scindeks.ceon.rs/article.aspx?artid=1821-44871603125P>

Poštić, D., Momirović, N., Broćić, Z., Đukanović, L., Šrbanović, R., Terzić, D., Stanisavljević, R. (2017). The effect of genotype and ecological conditions on yield components of potato, *Journal on Processing and Energy in Agriculture*, vol. 21(4), p. 207-210. <https://scindeks.ceon.rs/article.aspx?artid=1821-44871704207P>

Poštić, D., Stanisavljević, R., Šrbanović, R. (2021). The effect of mechanized planting on early potato yield in organic system production. *Seventh international Conference INOPTEP 2021, Sustainable postharvest and food technologies. Book of proceedings. April 18th – 23th, 2021, Vršac, Serbia, pp. 103.* <https://www.ptep.org.rs.PTEP 2021. book of proceedings.>

Republički hidrometeorološki zavod Srbije (<https://www.hidmet.gov.rs/>)

STATISTICA (Data Analysis Software System), v.8.0 (2006). StatSoft, Inc, USA (www.statsoft.com). <https://doi.org/10.1016/B978-0-323-03707-5.50024-3>

Received: 24. 02. 2025.

Accepted: 26. 03. 2025.