

Quality and Phenolic Acid Content in Tubers of Different Potato Varieties

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ABSTRACT

Potato is a very popular food that is consumed all over the world. Climatic conditions, genotype, and cultivation technology determine quality production. The aim of the study was to determine the quality and content of phenolic acids in different potato varieties grown over three years in conditions western Serbia. The research material included three potato varieties of different maturity periods: Esmee (red skin, early), Arizona (white skin, middle early) and Kuroda (red skin, middle late). The analysis of variance showed a significant effect ($p < 0.01$) of the year (Y), genotype (G) and interaction $Y \times G$ on dry matter content and starch content in tubers. On a three-year average, the highest DMC in tubers (21.90%) was recorded in the mid-late variety Kuroda, followed by the middle-early variety Arizona (20.83%), while the lowest DMC in tubers (17.68 %) was determined in the early variety Esmee. In all tested varieties, significantly higher starch content in tubers was recorded in 2020, compared to the other two years, which is the result of a more favorable distribution of precipitation during 2020, compared to the other two years. The concentration of individual phenolic acids (chlorogenic, p-coumaric, caffeic, trans-cinnamic, and trans-ferulic) varied and depended on ecological conditions and variety genotype: chlorogenic acid (36.09 $\mu\text{g/g}$ FW), p-coumaric acid (30.47 $\mu\text{g/g}$ FW), caffeic acid (28.09 $\mu\text{g/g}$ FW), trans-cinnamic acid (12.81 $\mu\text{g/g}$ FW) and trans-ferulic acid (2.60 $\mu\text{g/g}$ FW). The presence of gallic acid in the tuber core of the tested varieties in all three years of the study was not recorded. Year and genotype significantly influence the quality and content of biologically active substances (phenolic acids) in the flesh of potato tubers.

Keywords: *Solanum tuberosum* L., dry matter, starch content, phenolic acids.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most popular foods consumed around the globe, following rice and wheat (Bvenura et al., 2022). Potato is cultivated in about 160 countries in the world and consumed every day by over a billion people (Bishwoyong and Swarnima, 2016). Potatoes are grown on over 16 mill. ha worldwide, with an average yield of around 22 t ha⁻¹ (FAO, 2023), but with a wide yield range from 2 t ha⁻¹ (in underdeveloped countries) to 50 t ha⁻¹ (developed countries - USA, Netherlands, Belgium, Germany, France). In total food production in Serbia, potatoes occupy a significant place. The great economic

importance of potatoes and over 24,000 ha of land on which they are grown in our country, with an average yield (in the period 2020-2024) of 23.2 t ha⁻¹ (Republic Institute for Statistics, 2024) significantly lags behind potato yields in Europe and the world (FAO, 2024). Such modest yields are the result of low yields on small farms that prevail in Serbia. At the same time, intensive commercial potato production takes place on 10,000-15,000 ha on larger farms with significantly higher average yields of 30-40 t ha⁻¹ (Bročić et al., 2016).

Fresh tubers, depending on the variety and growing conditions, contain 13.1-36.8% of dry matter (on average 22.2%), while the rest is water, with about 63.2-86.9% (on average

77.8%). The largest part of the dry matter is starch, about 66-80% (Li et al., 2006). The content of starch in the total chemical composition of tubers is 8.0-29.4% (on average 14.1%) depending on the variety, protein 0.4-4.7% (on average 2.4%), ash 0.44-1.9%, etc. Starch content in the tuber is an indicator of quality, i.e. its purpose, whether it is for cooking or processing (Singh and Lovedeep, 2009).

Its nutritional value is based on the high content of carbohydrates, mainly starch and high quality protein, macro and micro-elements, and bioactive ingredients (Oertel et al., 2017; De Masi et al., 2020). In the tested genetic materials of potatoes, chemical compounds were found that protect human cells from damage caused by free radicals, prevent oxidized low-density lipoprotein cholesterol, and contribute to a lower incidence of some types of cancer, neurodegenerative diseases, osteoporosis, and diabetes (Lachman et al., 2009; Silveira et al., 2017). The health benefits of coloured-fleshed and -skinned potatoes were corroborated by (Kazimierczak et al., 2019; Liao et al., 2019), who identified polyphenols in potato. Most of those polyphenols were phenolic acids mainly chlorogenic acid and, to a lesser extent, caffeic, cinnamic, p-coumaric, ferulic, and sinapinic acid as well as flavonoids. The presence of polyphenols in the human diet is crucial in the prevention of a number of lifestyle diseases (Vaitkevičienė et al., 2020; Franková et al., 2022; Zhang et al., 2022). According to those authors, polyphenolic compounds in the diet can help maintain good body condition, prevent many diseases, and facilitate the treatment of existing disorders. According to Koszowska et al. (2013) and Zhang et al. (2022), a diet rich in antioxidants is beneficial to health as it decreases the incidence of cardiovascular diseases, diabetes, cancers, and osteoporosis.

Climatic conditions, genotype, phenophases of development and cultivation technology determine dry matter production (Poštić et al., 2015; Bročić et al., 2016; Arslanović-Lukač et al., 2021; Poštić et al., 2022). The content of starch depends on the content of dry matter. Starch content is

particularly important in potato industry and processing, but it is also interesting in potatoes for fresh consumption, as it affects the texture. Late varieties have a higher content of dry matter than early ones, because they are longer on the plot and the accumulation period of photosynthetic substances is longer (Singh and Lovedeep, 2009). Drought stress affects the relative reduction (53.96%; $P < 0.001$) of starch yield (Rudack et al., 2014). Compared to other plant species, potatoes are sensitive to drought due to their shallow root system. Drought stress negatively affects all phenophases of potato development, resulting in reduced yield and quality of potato tubers (Momirović et al., 2016; Arslanović-Lukač et al., 2021; Poštić et al., 2022). The mineral nutrition of plants depends on the type of soil, climatic factors of the region, and other agroecological factors (Popović et al., 2015; 2022; Lakić et al., 2022; Milunović et al., 2022; Ljubičić et al., 2023; Bojović et al., 2024). The aim of the study was to determine the quality and biological value of tubers of different potato varieties grown in the conditions of western Serbia in three production years, as well as to raise consumer awareness of the health benefits of using potatoes in the diet.

MATERIAL AND METHODS

Chemicals and reagents

Polyphenolic acid standards (gallic (97.5%), caffeic ($\geq 98\%$), chlorogenic (99%), trans-ferulic (99%), p-coumaric (98%), and trans-cinnamic acid (97%)) were purchased from Sigma-Aldrich Chemie GmbH (Merck KGaA, Darmstadt, Germany), iodine and starch reagents were purchased from Fisher Scientific (Bishop Meadow Road, Loughborough, Leicestershire). HPLC grade methanol ($\geq 99.9\%$) and ultrapure water were purchased from Riedel-de Haën (Honeywell, Charlotte, NC, USA).

Field location and tested cultivars

The field experiment was carried out during three-year period (2020-2022) in the Badovinci village located in Western Serbia

(75 m a.s.l., recent alluvium) (44°47'05"N - 19°32'10"E). Potato crops were grown in crop rotation, every year the pre-crop was wheat. The following cultivars were tested: Esmee (red, early), Arizona (white, middle early) and Kuroda (red, middle late). Planting material seed tubers category of original (certified seeds 35-45 mm, approx 70 g each). The basic soil properties are presented in Table 1. The soil on which the experimental research was carried out belongs to the type of recent alluvium. The humus horizon is very strong (ranging from 40-60 cm), while the groundwater level oscillates from 3 to 6 m deep. According to its textural composition, it belongs to the class of sandy loams. The sandy-clay mechanical composition contributes to good permeability of this soil, but poor water retention, which in years with a rainfall deficit can be a limiting factor in potato production.

Weather Conditions

Climatic conditions at the experimental field are mild continental, with hot and dry

summers and cold winters (www.stat.gov.rs). Meteorological conditions data in Table 2 indicate significantly higher air temperatures than optimal and very different between years.

Analyzing the data on meteorological conditions on the sample plot, it can be concluded that all three years were dry and warm. Lower air temperatures in the phenophase of flowering and tuber formation, as well as a more even distribution of precipitation contributed to the year 2020 being more favorable for potato production, compared to the other two years characterized by longer dry periods followed by extremely high air temperatures.

Field trials were performed as a two-factorial split-plot method in four replications. Spacing between rows was 0.70 m and spacing between plants in row was 0.30 m. Planting of tubers was carried out manually in the first decade of April in all three years of the study. Standard cropping practices were applied in all locations during growing season.

Table 1. Soil chemical analysis over the three years in the experimental plot

Year	Depth (cm)	pH (KCl)	CaCO ₃ (%)	N (%)	Organic matter (%)	mg/100g soil	
						P ₂ O ₅	K ₂ O
2020	0-30	6.43	0.00	0.16	2.49	19.34	16.31
2021		6.18	0.00	0.18	2.56	20.11	15.86
2022		6.27	0.00	0.20	2.42	19.23	16.30

Table 2. Meteorological conditions during the potato growing season, 2020, 2021 and 2022, and long-term data (1975-2019) for the area of western Serbia

Month	2020		2021		2022		1975-2019	
	°C	mm	°C	mm	°C	mm	°C	mm
IV	12.5	5.9	9.3	38.2	10.8	65.5	11.3	40.5
V	15.9	66.3	16.2	49.0	18.9	11.8	16.8	65.4
VI	20.1	70.5	22.7	7.2	22.9	43.3	20.1	71.1
VII	21.8	44.1	24.5	105.9	23.5	12.4	21.2	69.3
VIII	22.9	104.1	21.4	30.1	23.0	129.0	20.9	43.5
IX	18.7	33.4	17.5	7.8	16.3	129.4	16.7	53.2
Average/Sum	18.7	324.3	18.6	238.2	19.2	391.4	17.8	343.0

Data Collected

To determine the quality and biological value of potato tubers from each repetition, 5 tubers of commercial tubers were sampled for examination of dry matter, starch content and polyphenolic acid content.

The dry matter content (DMC) was determined at harvest, and samples were prepared by mixing tubers of different sizes for each variety. DMC was determined by drying the tubers at 105°C in the laboratory oven (Digitheat-TFT J.P. Selecta, Spain) to constant mass (Bročić et al., 2016).

Starch content was determined spectrophotometrically, according method to the Vračar (2001). Fresh potato samples were cut and 0,5 g of each variety was weighed with an accuracy of 0.0001 g on an analytical balance (Mettler Toledo, AE-240). In a mortar with a pestle, with the addition of 5 ml of cold water, the weighed potato samples were ground. Then the contents were transferred to a 50 ml centrifuge tube, filled to the mark with cold water and shaken for 30 min. at room temperature. The samples were centrifuged at 5000 rpm for 15 minutes and the supernatant was carefully decanted. The precipitate was quantitatively transferred to a 100 ml Erlenmeyer flask with approximately 30 ml of cold water, and heated to 100°C with constant stirring. The contents were then filtered into a 50 mL beaker. The filter paper was washed with warm water, and immediately before determining the starch content, the solutions were diluted 10 times. The starch content was determined on a Shimadzu UV-VIS 2100 spectrophotometer (Shimadzu, Japan) at 600 nm. A calibration curve of starch was constructed in the concentration range from 0.05 mg/ml to 1 mg/ml from a starch standard solution by serial dilutions. For each standard and sample solution, 150 µl of iodine reagent was mixed with 5 mL of solution, and the absorbance was measured at 600 nm.

Extraction of polyphenolic acids was performed from fresh samples. From each crushed sample, 1g was weighed and extracted with 10 mL of 80% methanol in an ultrasonic bath for 1 hour. After the extraction was completed, the supernatant was filtered through

a PTFE filter with a 0.45 µm pore diameter, and the samples were subjected to the HPLC analysis.

Quantification of polyphenolic acids was performed on a liquid chromatograph Shimadzu Nexera XR (Shimadzu, Japan), with autosampler, using a Zorbax SB C18 4.6×250 mm column, thermostatically maintained at 25°C. The two-component mobile phase consisted of A: 0.1% HCHOOH in water and B: 0.1% HCHOOH in methanol was used in a gradient mode as follows: 0 min 5% B, 25 min 30% B, 35 min 40% B, 40 min 48% B, 50 min 70% B, 55 min 100% B, 75 min 5% B. Flow rate was 1 ml/min. Dual wavelengths of $\lambda=280$ nm (for gallic and trans-cinnamic acid) and 325 nm (for caffeic, p-coumaric, chlorogenic and trans-ferulic acid) were used to detect the eluted polyphenolics. Quantification of polyphenolic acids was performed using the external standard method by comparing retention times and peak areas.

Calibration curves of polyphenolic acids were constructed in the concentration range of 25 to 250 µg/mL (Supplementary File S1). The concentration of polyphenolic acids in potato samples was determined using Shimadzu's LabSolution software and expressed in µg/g fresh weight.

All analyses were performed in triplicate, and the results are expressed as the mean value.

Data Analyses

The obtained experimental data were processed by a mathematical statistical procedure using the statistical package STATISTICA 8.0 for Windows (Analytical software, Faculty of Agriculture, Novi Sad, Serbia).

The differences between the treatments were determined by analysis of the variance (ANOVA - model random) and the least significant difference test (LSD) was used for the individual comparisons. Grouping information using Turkey method and 95.0% confidence.

RESULTS AND DISCUSSION

According to the analysis of variance (ANOVA), our results showed a significant effect ($p<0.01$) of the year on the dry matter,

starch content, trans-cinnamic and trans-ferulic acid, while it had an effect on chlorogenic acid at ($p < 0.05$) level. A significant effect ($p < 0.01$) of the genotype only on dry matter and starch content.

Interaction of studied factors $Y \times G$ was significant effect ($p < 0.01$) for dry matter,

starch content, trans-cinnamic and trans-ferulic acid, while caffeic acid was affected at the level on ($p < 0.05$). The tested factors and their interaction did not significantly affect the content of p-coumaric and gallic acids in the tubers.

Table 3. The significance level of tested factors - from the analysis of variance

Factors	Dry matter	Starch content	Chlorogenic acid	p-Coumaric acid	Caffeic acid	trans-Cinnamic acid	trans-Ferulic acid	Gallic acid
Year (Y)	**	**	*	ns	ns	**	**	ns
Genotype (G)	**	**	ns	ns	ns	ns	ns	ns
$Y \times G$	**	**	ns	ns	*	**	**	ns

Y - Year; G - Genotype; ns = $P > 0.05$, * = $P < 0.05$, ** = $P < 0.01$.

The average number of seeds in 1 gram depending on the year of the test, the sowing distance and the method of fertilization with nitrogen fertilizer is shown in Table 3. During the three-year tests, the average number of seeds/g, depending on the year, the sowing distance and the method of fertilization, was from 661.8 seeds/year in 2018 to 882.3 seeds/year in 2019. The highest average number of seeds/g seeds was determined in 2019 at the inter-row spacing B2 and C1-a of the fertilization treatment.

Dry Matter Content (%)

In 2022, the highest of dry matter content (DMC) in tubers was recorded (20.66%), then in 2021 (20.44%), while the lowest DMC was noted in 2020 (19.31%), Table 4. A very significantly lower DMC in tubers was noted in 2020, compared to the recorded DMC in the other two examined years.

As expected, on a three-year average, the highest DMC in tubers (21.90 %) was recorded in the mid-late variety Kuroda, followed by the middle-early variety Arizona

(20.83%), while the lowest DMC in tubers (17.68%) was determined in the early variety Esmee. The lowest DMC in tubers was found in early varieties, and DMC grew by increasing the length of the vegetation period. Our results are in agreement with the results of other authors (Bročić et al., 2016; Arslanović-Lukač et al., 2021) who state in their research that of dry matter content in tubers depends on the genotype and agroecological conditions and their interaction.

The DMC in the tubers of the mid-late variety Kuroda was very significantly higher compared to the recorded DMC in the tubers of the other two tested varieties. Tuber dry matter content is a varietal characteristic and it depends on the conditions in the growing season, and its lower in early varieties compared to late cultivars. These results agree with other studies reporting decreased tuber DMC under drought (Muthuni and Shimelis, 2020; Arslanović-Lukač et al., 2021; Poštic et al., 2022).

Table 4. Effect of year and genotype on dry matter content (%) and starch content (%) in potato tubers during 2020, 2021 and 2022 year

Genotype	Year			
	2020	2021	2022	Average
Dry matter				
Esmee	17.19bB	18.51bA	17.34bB	17.68
Arizona	20.17aB	21.43aA	20.90bA	20.83
Kuroda	20.58aB	21.37aA	23.74aA	21.90
Average	19.31	20.44	20.66	20.14
Starch content				
Esmee	15.18cA	15.18cA	14.62cB	14.88
Arizona	19.29aA	19.29aA	18.70aB	18.97
Kuroda	17.42bA	17.42bA	16.64bB	16.94
Average	17.30	17.30	16.65	16.93

* Small letters show the difference a, b, for the column, capital letters show the difference A, B, for the line; Grouping Information Using Turkey Method and 95.0% Confidence.

Starch content (%)

The highest starch content in tubers (17.30%) was recorded in 2020, then in 2021 (16.84%), while the lowest starch content in tubers was recorded in 2022 (16.65%) Table 4.

Significantly higher starch content in tubers was recorded in 2020, compared to the other two years. This can be explained by a more favorable precipitation distribution in 2020 compared to the other two years, these results are in accordance with the results (Bročić et al., 2016; Arslanović-Lukač et al., 2021). Between 2021 and 2022, no statistically significant differences were found regarding the content of starch in the tubers. The content of dry matter and starch also depends on the size of tubers, but also on the climatic conditions. Larger tubers generally have a lower dry matter and starch content, but the smallest tubers usually have a higher dry matter and starch content (Gvozden, 2016). The starch content in tubers is a varietal trait and, like all genetic characteristics, is a function of hereditary factors and environmental conditions acting together (Singh et al., 2008; Bročić et al., 2016; Arslanović-Lukač et al., 2021).

Phenolic Acid Content ($\mu\text{g/g}$ FW)

Our research showed that environmental conditions and genetic traits of the studied varieties have a significant impact on the content of phenolic acids in potato tubers (Table 5). These results are in agreement with

the results of other authors (Vaitkevičienė et al., 2020; Cebulak et al., 2023).

The study identified five phenolic acids (chlorogenic, p-coumaric, caffeic, trans-cinnamic and trans-ferulic) in edible potato tubers. The presence of gallic acid in the tuber core of the tested varieties in all three years of the study was not recorded. Their concentration in descending order was as follows: chlorogenic acid > p-coumaric acid > caffeic acid > trans-cinnamic acid > trans-ferulic acid > gallic acid. These results are in agreement with the research of other authors (Vaitkevičienė et al., 2020; Franková et al., 2022; Cebulak et al., 2023), who determined that chlorogenic acid was the most abundant in all tested potato varieties included in their study.

According to other authors (Ezekiel et al., 2013; Rytel et al., 2014), who tested potato varieties with different flesh colors (white-red and red-purple), chlorogenic acid is dominant among the phenolic acids of potatoes, and its concentration is at a level of up to 90% of the total phenolic content in the tubers. Other phenolic acids (caffeic, p-coumaric, ferulic and sinapic) make up only 10% of the total phenolic acids.

Several authors (Gvozden, 2016; Liao et al., 2019; Vaitkevičienė et al., 2020; Franková et al., 2022; Cebulak et al., 2023) who studied potatoes with different skin and flesh colors reported that varieties with white and yellow flesh contain fewer phenolic acids than varieties with white-red and red-purple

flesh, which is in agreement with our obtained phenolic acid values.

Observed by year, all tested phenolic acids had the highest content in 2022, then in 2020,

while the lowest concentration in tubers was achieved in 2021, which was the most unfavorable year for potato production.

Table 5. Effect of year and genotype on phenolic acid content ($\mu\text{g/g}$ FW) in flesh tubers, 2020, 2021 and 2022

Genotype	Year			
	2020	2021	2022	Average
Chlorogenic acid				
Esmee	36.28aA	35.93aA	37.65aA	36.62
Arizona	35.74aA	34.48aA	36.40aA	35.54
Kuroda	36.13aA	35.81aA	36.42aA	36.12
Average	36.05	35.41	36.82	36.09
p-Coimmaric acid				
Esmee	29.85aA	29.31aA	30.64aA	29.94
Arizona	30.28aA	29.41aA	31.69aA	30.46
Kuroda	29.43aA	29.10aA	30.66aA	31.00
Average	29.52	29.27	30.99	30.09
Caffeic acid				
Esmee	27.83abA	27.37aA	28.10aA	27.77
Arizona	28.81aA	28.15aA	29.07aA	28.68
Kuroda	27.71bA	27.63aA	28.12aA	27.82
Average	28.12	27.72	28.43	28.09
Trans-Cinnamic acid				
Esmee	13.18abA	12.10bA	13.55aA	12.94
Arizona	12.85aA	12.13aA	13.10aA	12.69
Kuroda	12.86aA	12.42aA	13.11aA	12.80
Average	12.96	12.22	13.25	12.81
Trans-Ferulic acid				
Esmee	2.49aB	2.38aB	2.75aA	2.54
Arizona	2.63aAB	2.51aB	2.85aA	2.66
Kuroda	2.73aA	2.30aB	2.76aA	2.60
Average	2.61	2.40	2.79	2.60
Galic acid				
Esmee	0	0	0	0
Arizona	0	0	0	0
Kuroda	0	0	0	0
Average	0	0	0	0

* Means that columns followed by the same letter are not significantly different according to Turkey Method confidence ($P=0.05$); Small letters show the difference a, b, for the column, capital letters show the difference A, B, for the line; Grouping information using Turkey method and 95.0% Confidence.

Tests conducted on these acids showed significant differences in their content in tubers depending on environmental conditions and variety, with chlorogenic acid being the most abundant in all varieties, ranging from $34.48 \mu\text{g/g}$ FW to $37.65 \mu\text{g/g}$ FW in the tested samples. The highest three-

year average content of chlorogenic acid in the tuber core ($36.62 \mu\text{g/g}$ FW) was found in the Esmee variety, followed by the Kuroda ($36.12 \mu\text{g/g}$ FW), while the lowest content of chlorogenic acid in the tuber core ($35.54 \mu\text{g/g}$ FW) was recorded in the Arizona.

The content of p-coumaric acid in the tested samples ranged from 29.10 $\mu\text{g/g}$ FW in the Kuroda variety (red skin) to 31.69 $\mu\text{g/g}$ FW in the Arizona variety (white skin). The Kuroda variety recorded the highest three-year average content of p-coumaric acid in the tuber core (31.00 $\mu\text{g/g}$ FW), followed by the Arizona (30.46 $\mu\text{g/g}$ FW), while the lowest p-coumaric acid content in the tuber core (29.94 $\mu\text{g/g}$ FW) was recorded in the early variety Esmee.

Starch content (%)

The highest caffeic acid content was found in the Arizona variety (29.07 $\mu\text{g/g}$ FW, white skin), while the lowest was found in the Esmee variety with red skin (27.37 $\mu\text{g/g}$ FW). The highest content of caffeic acid in the three-year average was found in the core of the tuber (28.68 $\mu\text{g/g}$ FW) in the mid-early variety Arizona, followed by the late-early variety Kuroda (27.82 $\mu\text{g/g}$ FW), while the lowest content of caffeic acid in the core of the tuber (27.77 $\mu\text{g/g}$ FW) was found in the early variety Esmee.

The content of trans-cinnamic acid ranged from 12.10 $\mu\text{g/g}$ FW (in the Esmee variety with red skin color) to 13.55 $\mu\text{g/g}$ FW also in the Esmee variety. In the three-year average, the highest trans-cinnamic acid content in the tuber core (12.94 $\mu\text{g/g}$ FW) was found in the Esmee variety, followed by the Kuroda (12.80 $\mu\text{g/g}$ FW), while the lowest trans-cinnamic acid content in the tuber core (12.69 $\mu\text{g/g}$ FW) was recorded in the Arizona variety.

The least abundant in all tested varieties was trans-ferulic acid, ranging from 2.30 $\mu\text{g/g}$ FW to 2.85 $\mu\text{g/g}$ FW in the tested samples. The highest content of trans-ferulic acid in the tuber core (2.66 $\mu\text{g/g}$ FW) in a three-year average was found in the Arizona variety, followed by the Kuroda (2.60 $\mu\text{g/g}$ FW), while the lowest content of trans-ferulic acid in the tuber core (2.54 $\mu\text{g/g}$ FW) was recorded in the Esmee variety.

CONCLUSIONS

Our study of the flesh tubers evaluation of three potato varieties showed that the quality

(DMC and starch content) and content of individual phenolic acids (chlorogenic, p-coumaric, caffeic, trans-cinnamic, trans-ferulic and gallic) varied and depended on ecological conditions and variety genotype. For all tested varieties, the lowest content of phenolic acids was recorded in 2021, which was the most unfavorable year for potato production.

As expected, on a three-year average, the highest DMC in tubers (21.90%) was recorded in the mid-late variety Kuroda, followed by the middle-early variety Arizona (20.83%), while the lowest DMC in tubers (17.68%) was determined in the early variety Esmee.

In all tested varieties, significantly higher starch content in tubers was recorded in 2020, compared to the other two years, which is the result of a more favorable distribution of precipitation during 2020, compared to the other two years.

The highest content of trans-cinnamic and chlorogenic acid and the lowest content of caffeic, p-coumaric and trans-ferulic acids were recorded in the early variety Esmee (red skin color). The highest content of caffeic and trans-ferulic acids in the tubers was found in the mid-early variety Arizona (white color of the skin) and the lowest content of trans-cinnamic and chlorogenic acids. The highest content of p-coumaric acid was found in the mid-late Kuroda variety (red skin color).

Summarizing our research, we can conclude that the studied potato varieties contain significant biologically active substances, including phenolic acids. Consumption of these potato varieties may provide multiple health benefits. In addition, the research results provide a basis for raising awareness about the need to increase the presence of potatoes in the human diet. It is expected that the results of this research will raise consumer awareness about the health benefits of potatoes in general.

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