

DETERMINATIONS REGARDING THE PRODUCTION OBTAINED IN SOME EARLY POTATO VARIETIES CULTIVATED ON THE SANDY SOILS OF SOUTHERN OLTENIA

Gheorghe COTEȚ^{1,*}, Aurelia DIACONU¹, Alina PARASCHIV¹, Cristina BÎRSOGHE¹

¹Research and Development Station for Plant Culture on Sands Dabuleni, 217 Petre Banita street, Dolj, Romania



Abstract

In the 2023-2024 agricultural years, research was carried out on the behavior of four potato varieties for early consumption, in the conditions of the sandy soils at SCDCPN Dabuleni. The potato varieties studied showed different results in the years of study, depending on their biological potential and pedoclimatic conditions. After harvesting at 75 days, in 2023 the varieties Prada (which achieved a production of 46.30 t/ha) and Riviera, which achieved an average production of 46.23 t/ha, stood out, and in 2024, the Carrera and Riviera varieties stood out with an estimated production of 46.98 t/ha and 45.19 t/ha, respectively. From a qualitative point of view, in terms of the starch content of the tubers, the Riviera variety stood out with 15.16%, the average being 14.08%, and the total dry matter was between 17.61% for the Natalia variety and 22.84% for the Carrera variety, with an average of 18.94%. The vitamin C content varied according to the analyzed variety, the Prada variety standing out with 16.72 mg. f.s., the average for the five varieties being 12.49 mg.f.s.

Keywords: early potato, quality, production, total dry matter

1. INTRODUCTION

Among the cultivated plants that the "new world" discovered by Columbus offered to Europe, the potato can be considered among the most valuable, its tubers becoming the staple food of many millions of Europeans and largely replacing bread. Potato cultivation following advantages: high yield potential, excellent nutrient source, high proportion of edible biomass, easiness to prepare for consumption, wide acceptance as an adaptability for intensive cultivation, range cultivars, security of production under stress conditions, short crop season, positive development in the last 10 years and represents a staple food for the 3rd millenium (Draica and Caciuc, 1997; Draica et al., 2004). In the top EU potato producers is France, with 8.73 million tons, followed by the Netherlands - 7.09 million tons, Poland - 6.48 million tons and Belgium, with 4.1 million tons. Regarding the cultivated area, Romania occupied the fourth place with 166,000 hectares, after Poland (359,000 hectares), Germany (275,000 hectares) and France (206,000 hectares). The provisional data of the RNSI show that in 2020 the local potato harvest was slightly higher than in 2019, an increase of 56,000 tons, although the drought caused serious damage in 2020, while the cultivated area decreased by about 3,000 hectares (<https://www.agerpres.ro/economic-intern/2021/04/07/>). Potato cultivation is widespread in all agricultural areas of the country, creating specialized basins through zoning and microzoning, so that potatoes in Romania meet conditions for all destinations, from the

production of extra-early potatoes to the cultivation of potatoes for autumn-winter consumption and in the south of the country it tends to become a real business of the farmers here, being one of the most profitable culture in the area (Diaconu et al., 2019). However, by cultivating the same potato varieties year after year, they depreciate in quality and lose their initial production potential (Diaconu, 2009). As a means of combating degeneration, the continuous creation of new varieties from seeds and the removal of old, degenerate varieties from cultivation is required. In potato cultivation, the size and quality of the harvest is determined by the quality of the planting material, while the technology applied ensures favorable conditions for production (Berindei et al., 1979). Drought during the period of simultaneous growth of the bushes and the tubers (24-25 days, after tuberization, depending on the variety) greatly reduces production, this being the critical period for water for the plant and the irrigation rate applied to potatoes for early consumption in the southern part of the country is, on average, 2400-2800 m³/ha (Diaconu et al., 2009, cited by Burzo, 2014). Climatic conditions influence plant growth, the formation of stolons, the formation and growth of tubers, and the formation of stolons and their transformation into tubers occurs in very different times from one variety to another

(https://potato.ro/publicatii_files/cartoful_in_ro/cartoful%20in%20RO%20vol18nr1.2.pdf).

The growth, development and productivity of potato plants are strongly influenced by the climatic conditions of the crop year (Diaconu et al., 2024), climate change and drought represent a significant challenge for agriculture in Romania, including potato cultivation. Research conducted on sandy soils in southern Oltenia highlighted the role of variety, fertilization and irrigation in obtaining economically efficient and high-quality potato production (Croitoru Mihaela et al., 2016; Dima Milica et al., 2014). The development of early potato varieties resistant to variable environmental conditions and adapted to market requirements can contribute to more stable and sustainable production.

2. MATERIALS AND METHODS

In the years 2023 and 2024, four varieties of early potato with yellowish-white skin (*Prada*, *Carrera*, *Natalia* and *Riviera*) were studied. The monofactorial experiment was carried out according to the randomized block method and located on sandy soil, under sprinkler irrigation conditions. The planting of tubers was carried out on March 9 in 2023 and February 22 in 2024, by opening the trenches mechanically, planting the sprouted tubers manually and then hilling the land. The planting density was achieved at approximately 57,000 nests/ha. *Carrera* is an early ripening variety (77 days), with an attractive appearance, large tubers, yellow-white skin. The variety has medium resistance to foliar diseases. *Carrera* is susceptible to *Alternaria solani*. The content in dry matter is 17% and in starch 11.2%. Productions obtained: between 30-40 t/ha. *Prada* is an early maturing variety with an attractive appearance, large tubers, oval shape, yellowish-white skin, with a large number of tubers per nest and high yields. The variety has medium resistance to foliar diseases. Productions obtained: between 40-50 t/ha. *Natalia* is an extra-early variety, with early development of the leaf apparatus. The tubers are large, oval in shape and with light yellow skin and bright yellow flesh. Productions obtained: between 30-40 t/ha. *Riviera* is an early maturing variety with attractive appearance, tolerance to excessive heat and good virus resistance. It was obtained by hybridization (*MINERVA* x *ALCMARIA*). The tubers are large, oval-round in shape, with light yellow skin and yellow flesh. Productions obtained: between 40-50 t/ha.

Observations and experimental determinations were made regarding early potato production and the state of soil fertility. Soil samples were collected at a depth of 0-50 cm, and in the laboratory,

determinations were made regarding the physico-chemical composition of the soil, as well as its fertility status, determinations made using specific methods. To determine the quality of production, laboratory analyses aimed to determine the percentage of:

1. water and total dry matter (TDM) (%) – gravimetric method;
2. soluble dry matter (SDM) (%) – refractometric method;
3. starch (%) - gravimetric method;
4. vitamin C (mg/100g f.s.) – iodometric method.

3. RESULTS AND DISCUSSIONS

From a climatic point of view, the year 2023 can be characterized as a dry year, but with an amount of precipitation of 256.8 mm during the vegetation period of the plant (March-June) (Table 1). In the March-June period, there were 53 days with rain, spread over each month and totaling 256.8 mm, the precipitation in May and June totaling 81.6 mm and 81.4 mm, respectively, the amount of precipitation being 36.34 mm above the multi-year monthly average (1956-2023). The average air temperature from March to June was 14.28 °C, being + 0.23 °C higher than the multiannual average for this period.

Table 1. Analysis of the climatic conditions at SCDCPN Dabuleni during the period March - June 2023

<i>Climatic element/Month</i>	<i>III</i>	<i>IV</i>	<i>V</i>	<i>VI</i>	<i>Average</i>
Average temperature (°C)	8	11.1	16.8	21.2	14.28+0.23
The absolute maximum temperature (°C)	21.6	23.5	29	37.6	27.93
The absolute minimum temperature (°C)	-5.9	0	7.4	11.4	3.23
Rainfall (mm)	36	57.8	81.6	81.4	256.80+36.34
Rainy days	12	12	16	13	53
Relative air humidity (%)	67.2	67.1	66.9	70.6	67.95
Multiannual average temperature (1956-2023); (°C)	5.87	11.8	16.9	21.5	14.05
Rainfall (mm) Multi-year monthly average (1956-2023)	40.6	47.1	62.6	70.0	220.46

Table 2. Analysis of the climatic conditions at SCDCPN Dăbuleni during the period January - May 2024

<i>Climatic element/Month</i>	<i>I</i>	<i>II</i>	<i>III</i>	<i>IV</i>	<i>V</i>	<i>Average</i>
Average temperature (°C)	0.5	8.5	9.25	15.2	16.7	10.03
The absolute maximum temperature (°C)	16.1	22	29	34.1	28.6	25.96
The absolute minimum temperature (°C)	-12.9	-7.1	-3.1	2.7	7.4	-2.6
Rainfall (mm)	39	11.2	36.6	36	114	47.3
Rainy days	19	8	11	7	15	60
Relative air humidity (%)	100	100	100	99.6	100	99.9
Multiannual average temperature (1956-2024); (°C)	-1.303	1.299	5.919	11.916	16.943	5.754
Rainfall (mm) Multi-year monthly average (1956-2023)	36.297	32.104	40.611	46.967	63.415	43.777

The climatic data recorded at the SCDCPN Dăbuleni Weather Station in the period January-May 2024 showed an average temperature of 8.5 °C and an absolute maximum of 22 °C in February, which allowed the planting of the genotypes on February 22. In May 2024, the amount of precipitation exceeded the multiannual monthly average (1956-2024) by 50.59 mm. (Table 2). Also, in the first six months of the year, 60 days of precipitation were recorded.

In the experimental years, the percentage of total nitrogen showed values between 0.05 - 0.07% - low supply (Table 3), while extractable phosphorus (79.66 - 97.36 ppm) showed a very good supply, positively influencing plant growth. Exchangeable potassium (96 - 102.4 ppm), indicated an average supply, as did organic carbon (0.65 - 0.79%), and the pH of the soil solution (7.12 - 7.32) indicated a neutral to alkaline reaction.

Table 3. Soil fertility status in 2023 and 2024

Depth (cm)	Total nitrogen (%)	Extractable phosphorus (ppm)	Exchangeable potassium (ppm)	Organic carbon (%)	pH
0-25	0.07	79.66	96	0.79	7.32
25-50	0.05	97.36	102.4	0.65	7.12
Supply status (by Davidescu and Davidescu, 1981)					
Low	<0,10	8,1 - 18	<66	<0,58	
Medium	0.11 - 0.15	18.1 - 36	66.1 - 132	0.59 - 1.16	
Normal	0.16 - 0.20	36.1 - 72	132.1 - 200	1.17 - 2.32	
Very good	0.21 - 0.30	72.1 - 144	200.1 - 400	2.33 - 4.64	
Very high	>0.30	>144	>400	-	

The emergence of potato varieties took place starting from April 15 in 2023 and April 1 in 2024. In order to highlight the ability of potato varieties to accumulate substances in the tubers as early as possible, harvests were made at 45 days from at emergence and physiological maturity of potato plants. The best growth rate of the plant in the two years, calculated from the emergence of the potato varieties, was registered with the Prada variety (0.915 cm/day in 2023 and 0.958 cm/day in 2024 year). The other varieties registered a growth rate close to that of the Prada variety (Figure 1). Biometric determinations carried out 75 days after the mass emergence of the potato varieties in 2023 showed the productive potential of each individual variety. The number of buds per plant was between 2.56 (at *Carrera*) and 3.33 (at *Natalia*), the weight of buds was between 284.4 g/plant (at *Natalia*) and 483.3 g/plant (at *Prada*), and the height of the bush had values between 42.44 cm and 43.67 cm.

As for the marketable tubers harvested 75 days after emergence, they had an average weight of over 90 grams/tuber (94.7 g for *Natalia* and 137.8 g/tuber for the *Prada* variety) and their number per plant was varied between 4.56 (at *Carrera*) and 6.78 at *Riviera*. The weight of the tubers per plant was between 442.2 g/plant in *Natalia* and 750.0 g/plant in the variety *Riviera* (Table 4).

As for the small tubers harvested 75 days after emergence, they weighed more than 27.2 grams/tuber in *Natalia* and 44.6 g/tuber in the *Prada* variety) and their number per plant varied between 2.22 (at *Riviera*) and 6.56 at *Natalia*.

The weight of the tubers per plant was between 61.11 g/plant in *Riviera* and 178.33 g/plant in the *Natalia* variety.

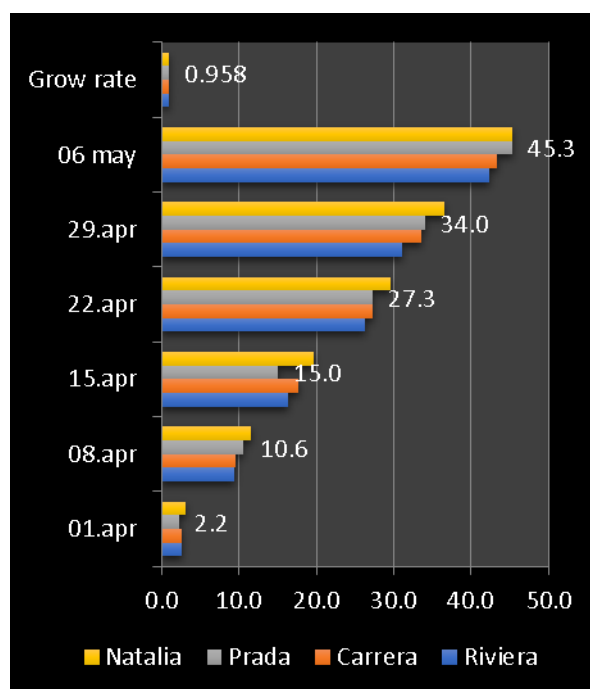


Figure 1. Grow rate at the four varieties

As for the marketable tubers harvested 75 days after emergence in 2024, they had an average weight of over 70 grams/tuber (73,4 g for *Natalia* and 98.7 g/tuber for the *Carrera* variety) and their number per plant was varied between 3.80 (at *Carrera*) and 5.90 at *Riviera*.

The weight of the tubers per plant was between 286.7 g/plant in *Prada* and 532.3 g/plant in the variety *Riviera* (Table 5).

Table 4. Biometric determinations made 75 days after emergence, in the year 2023

Variety	Large tubers (Weight>50g)			Small tubers (Weight<50g)		
	No.	Weight (g/plant)	Weight (g/tuber)	No.	Weight (g/plant)	Weight (g/tuber)
<i>Carrera</i>	4.56	572.22	125.61	2.89	89.44	30.96
<i>Prada</i>	4.89	673.33	137.73	3.11	138.89	44.64
<i>Natalia</i>	4.67	442.22	94..6	6.56	178.33	27.20
<i>Riviera</i>	6.78	750.00	110.66	2.22	61.11	27.50

Table 5. Biometric determinations made 75 days after emergence, in the year 2024

Variety	Large tubers (Weight>50g)			Small tubers (Weight <50 g)		
	No.	Weight (g/plant)	Weight (g/tuber)	No.	Weight(g/plant)	Weight (g/tuber)
<i>Carrera</i>	3.8	373.0	98.7	4.7	201.4	42.9
<i>Prada</i>	3.8	286.7	75.9	4.3	171.7	39.9
<i>Natalia</i>	4.1	301.8	73.4	4.5	159.2	35.4
<i>Riviera</i>	5.9	532.3	90.4	6.7	224.2	33.5

Regarding the average production of tubers harvested 75 days after emergence, the best results were obtained with the varieties cultivated with the *Prada* variety, where a production of 46.30 t/ha was achieved and a production increase of 4.85 t/ha compared to the average production of the four varieties, and for the *Riviera* variety, where a production of 46.27 t/ha was achieved and a production increase of 4.79 t/ha compared to the average of the varieties, insignificant from a statistical point of view (Table 6). The percentage of tubers weighing more than 50 grams, recorded when harvested 75 days after emergence, had values between 71.3% for the *Natalia* variety and 92.5% for the *Riviera* variety.

Table 6. The influence of the variety on the production recorded 75 days after emergence, in the year 2023

Variety	Production of marketable tubers	Production of unmarketable tubers	Total production of tubers	Difference from average	Percentage of large tubers
	t/ha	t/ha	t/ha	t/ha	%
<i>Carrera</i>	32.63	5.09	37.72	-3.68	86.5
<i>Prada</i>	38.40	7.90	46.30	4.90	82.9
<i>Natalia</i>	25.20	10.17	35.37	-6.03	71.3
<i>Riviera</i>	42.75	3.48	46.23	4.83	92.5
Variety average	34.75	6.66	41.40	-	
DL 5%=15.38 t/ha; DL 1%=22.37 t/ha; DL 0.01 %=33.56 t/ha					

In 2024, the best results were obtained with the variants cultivated with the *Carrera* variety, with a production of 46.98 t/ha and a production increase of 2.92 t/ha compared to the average production of the five varieties, and in the *Riviera* variety, where a production of 45.19 t/ha was achieved and a production increase of 1.79 t/ha compared to the average of the varieties, insignificant from a statistical point of view (Table 7).

Table 7. The influence of the variety on the production recorded 75 days after emergence, in the year 2024

Variety	Total production of tubers (t/ha)	Difference from average (t/ha)	Percentage of large tubers (%)
<i>Riviera</i>	45.19	1,13	85.5
<i>Carrera</i>	46.98	2,92	83.1
<i>Prada</i>	40.11	-3,95	81.3
<i>Natalia</i>	43.96	-0,10	92.5
Variety average	44.06	-	
DL 5%=15,38 t/ha; DL 1%=22,37 t/ha; DL 0,01 %=33,56 t/ha			

Total dry matter ranged from 17.61% in the *Natalia* variety to 22.84% in the *Carrera* variety, with an average of 18.94%. Varieties with a total dry matter content of more than 20% are also recommended for industrialization. Soluble dry matter varied between 3.8% in the *Natalia* cultivar and 5% in the *Carrera* and *Riviera* cultivars, with an average of 4.64%. Starch is the most important reserve substance in the plant, being deposited in the tubers, from where, through enzymatic hydrolysis, glucose is available to the plant organs. The starch content of the tubers varied between 13.74 % in *Carrera* and *Prada* and 15.16 % in the *Riviera* variety. The vitamin C content varied according to the variety analyzed and showed values between 7.92 mg in the *Carerra* variety and 16.72 mg in the *Prada* variety, with an average of 12.49 mg. (Table 8).

Table 8. Biochemical composition of potato tubers according to the variety under study

Variety	Water (%)	Total dry matter (%)	Soluble dry matter (%)	Starch (%)	C Vitamin (mg/100g s.p)
<i>Carrera</i>	77.16	22.84	5	13.74	7,92
<i>Natalia</i>	82.39	17.61	3.8	14.14	12,32
<i>Prada</i>	81.11	18.89	4.8	13.74	16,72
<i>Riviera</i>	81.75	18.25	5	15.16	12,32
Average	81.05	18.94	4.64	14.08	12,49

4. CONCLUSIONS

The potato varieties studied performed differently in the two years, depending on their biological potential. Following harvesting at physiological maturity, in 2023 the *Prada* varieties stood out (which achieved a production of 46.30 t/ha and a production increase of 4.85 t/ha compared to the average production of the five varieties) and *Riviera*, which achieved an average production of 46.23 t/ha and a production increase of 4.79 t/ha, and in 2024 the *Carrera* and *Riviera* varieties stood out, with an average production of 46.98 t /ha, respectively 45.19 t/ha. From a qualitative point of view, in terms of the starch content of the tubers, the *Riviera* variety stood out with 15.16%, the average being 14.08%, and the total dry matter was between 17.61% for the *Natalia* variety and 22.84% in the *Carrera* variety, with an average of 18.94%. The vitamin C content varied according to the analyzed variety, the *Prada* variety standing out with 16.72 mg. s.p., the average for the five varieties being 12.49 mg.s.p.

5. ACKNOWLEDGEMENTS

This work was supported by a grant from the Romanian Ministry of Agriculture under the Project no: 563/1.1.5/15.03.2023 "Improving the assortment of early potato varieties by selecting the most adapted varieties to the pedoclimatic conditions in the area of sandy soils and to market requirements".

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