Scientific Papers. Series B, Horticulture. Vol. LXX, No. 1, 2026
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

RESEARCH ON THE IDENTIFICATION OF THE NEW IDEOTYPE OF POTATO, COMPETITIVE IN THE AGRICULTURAL SECTOR IN SOUTHERN OLTENIA

Gheorghe COTEȚ[1], Alina-Nicoleta PARASCHIV[1], Aurelia DIACONU[1], Ștefan NANU[1], Milica DIMA[1], Maria-Florentina ȘTEFAN[2]

[1]Research and Development Station for Plant Culture on Sands Dăbuleni, 217 Petre Baniță Str., Dolj County, Romania
[2]National Institute for Research and Development for Potato and Sugar Beet Brașov, 500470, 2 Fundăturii Str., Brașov County, Romania

Corresponding author emails: salina22paraschiv@yahoo.com, nanu.st@scdcpndabuleni.ro

Abstract

The research was carried out at R.D.S.P.C.S. Dabuleni in the agricultural years 2024 and 2025 and aimed at comparing potato lines originating from the National Institute for Research and Development for Potato and Sugar Beet Brașov, at different stages of the improvement process, with the aim of identifying the new potato ideotype, competitive in the agricultural sector of the southern area.
The results obtained highlighted increased tolerance to thermohydric stress in lines 1927/1 and 22-1941/8, in 2024 and in line 1901/6 in 2025, a line differentiated positively, with statistically assured values that were very significant compared to the control. In terms of potato line productivity, in 2024, the 1895/4 line stood out, with an average production of 38.49 t/ha, which was 5.45 t/ha above the average of the varieties. In 2025, the 2008/4 lines stood out, with 48.75 t/ha and 22-1895/4, which achieved 44.05 t/ha.
Also, in the two years of study, environmental factors had a direct influence on the physiological, biochemical, and production processes.

Key words: *potato, sandy soils, abiotic stress, production, quality.*

INTRODUCTION

Potato is one of the most important food crops worldwide, ranking fourth in the hierarchy of staple crops, after rice, wheat and maize, and being cultivated on an area of over 17 million hectares (FAO, 2023). With a global production of over 370 million tons annually, potato contributes significantly to food security, especially in temperate and mountainous regions, being an essential source of food and income for millions of farmers (FAO, 2023). Due to its high nutritional value, ecological adaptability, and high yield per unit area, the potato is considered a strategic crop in the face of the climatic and demographic challenges of the 21st century (FAO, 2023).
In recent decades, climate change has required a profound reassessment of genetic improvement strategies in agriculture, especially for staple crops such as potatoes (CIP, 2024). The creation of new potato varieties is a strategic priority both globally and regionally, especially in areas vulnerable to climate change, such as southern Oltenia. This region frequently faces pedological drought, high temperatures during the growing season, and sandy soils with low fertility, which requires the development of genotypes adapted to these restrictive conditions. The International Potato Center (CIP), based in Peru, conducts research in over 25 countries to develop potato varieties adapted to diverse agroecosystems. Internationally, CIP promotes the use of local varieties and wild relatives of the potato to introduce traits of resistance to drought, disease, and extreme temperatures (Nature, 2019; CIP, 2024). Researchers from the University of Hawaii and the Royal Botanic Gardens, Kew, are exploring the potential of wild potato to expand the genetic base of the cultivated species. These genetic resources provide valuable traits for adaptation to emerging ecological niches, especially in regions affected by rapid climate change (Fumia et al., 2021). In Europe, research is focused on integrating traits of drought resistance, high

temperature tolerance, and nutrient use efficiency into modern ideotypes, with the aim of maintaining the competitiveness of potato cultivation in southern and Mediterranean regions. In the case of potatoes, the agronomic ideotype translates into an ideal plant profile consisting of:

- a deep and branched root system, capable of exploring large volumes of soil for the absorption of water and minerals;
- a moderate leaf surface, with increased efficiency in photosynthesis and controlled transpiration;
- a high capacity for allocating assimilates to tubers;
- physiological resistance to water and thermal stress;
- uniform and compact tubers, with firm skin and high dry matter content, over 20% (Caliskan & Demirkaya, 2019).

The sand region of southern Oltenia is characterized by psamosol and arenosol soils, with a sandy-loamy texture, high permeability, and low humus content (below 0.6%), and because of this texture, the water retention capacity is two times lower than in chernozems, and leaching losses are high (Velu & Popescu, 2022).

Studies conducted in the Dăbuleni region have demonstrated that the application of drip irrigation and manure (30 t/ha) improves water retention and leads to increased production of up to 28-30 t/ha (Velu & Popescu, 2022). The creation and exploitation of an ideotype adapted to the sands of Oltenia presents multiple benefits, both ecologically and economically.

By integrating genetic and physiological approaches into breeding programs, the ideotype becomes a biological target capable of redefining potato cultivation in sandy ecosystems – offering a sustainable agronomic and ecological solution. At the genetic level, contributions from the wild species *Solanum chacoense*, *Solanum commersonii,* and *Solanum berthaultii* represent the basis of modern breeding for traits such as drought tolerance and vascular disease (Machida-Hirano, 2015).

Research conducted on sandy soils in southern Oltenia has highlighted the role of variety, fertilization, and irrigation in obtaining economically efficient and high-quality potato production (Croitoru et al., 2014; Dima et al., 2014). Early potato ideotypes intended for cultivation under stress conditions, such as drought, frost, or attacks by pests and diseases, must present a series of specific characteristics to ensure healthy development and optimal production.

In order to select and develop early potato ideotypes that are resistant to stress conditions, it is essential to integrate these characteristics into the selection and breeding process. The purpose of this paper is to analyze the pedoclimatic context of the southern Oltenia region, the main challenges related to potato cultivation on sandy soils, and the genetic and technological characteristics necessary to define a new potato ideotype adapted to abiotic stress. Understanding the complexity of the relationship between genotype and environment is essential for building a sustainable, productive, and efficient agriculture on the sandy lands of Romania.

MATERIALS AND METHODS

In 2024, technical work was carried out corresponding to the planting of the breeding material for the establishment of the experimental field. For the study of potato lines, four lines subjected to the breeding process by NIRDPSB Brașov were studied, namely 1901/12, 1895/4, 1927/1 and 22-1941/8, and the Ervant variety was taken as the control, while in 2025, five potato lines were studied, respectively 22-1895/4, 1897/2, 1901/6, 1930/3 and 2008/4, the same Ervant variety as the control. The monofactorial experiment was located on a sandy soil with low fertility, under sprinkler irrigation conditions, according to the randomized block method. The planting of the tubers was carried out on February 22, 2024 and March 11, 2025, the works consisted of opening the mechanized trenches, manually planting the sprouted tubers, and then covering the trenches mechanically. The distance between the rows was 70 cm, and between the tubers in a row was 25 cm, achieving a planting density of about 57,000 nests/ha. The basic fertilization was done the day before planting, using mineral-type NPK 15.15.15 fertilizers in a quantity of 400 kg/ha. In vegetation, fertilization was carried out with ammonium nitrate at a dose of 200 kg/ha. In order to ensure an early harvest, the tuber-

germination work was carried out one month before planting in the field. Thus, by planting the sprouted tubers, conditions were ensured for harvesting the tubers in June, thus avoiding the crop being subjected to the drought and heat periods in July-August characteristic of the southern area of the country. Optimal light and temperature conditions were ensured for the germination of the seed tubers. Vigorous tubers were obtained at a temperature of 16-18°C for 12-14 days (pre-germination), after which the temperature was reduced to 12-15°C and maintained for 20-25 days (germination itself). Maintenance work was carried out during vegetation to prevent the occurrence of, and to manage, fungal diseases or harmful insects that appeared in the crop. Observations and experimental determinations were carried out regarding:

- early potato production;
- sensory evaluation of vegetation parameters.

In order to evaluate the sensory parameters of vegetation, photosynthesis processes were analyzed using modern study methods. To determine the physiological activity of potato plants, the portable LC Pro SD system was used, with the help of which the gas exchange between plants and the environment was analyzed using the broad leaf chamber.

RESULTS AND DISCUSSIONS

Year 2024 can be characterized as a dry year. Climatic data recorded at the RDSPCS Dăbuleni Weather Station during February-May 2024 showed an average temperature of 8.5°C in February, which allowed potato planting in this month (Table 1).

The average temperature recorded in the four months exceeded the multiannual average (1956-2023) by +3.4°C, and the amount of precipitation was higher by 14.7 mm, but these were unevenly distributed.

Potato plants were influenced by these climatic conditions both during the emergence period and during the initiation and development of tubers.

In 2025, tuber planting was done in the second decade of March because the average monthly temperature was between 9.37°C in March and 24.7°C in June, and the months of March and April were colder compared with previous years, with minimums of -6.0°C in March, -3.97°C in April, and 1.53°C in May (Table 2).

During April 07-11, 2025, the air temperature dropped significantly, with average values ranging between 3.73-6.83°C. The minimum temperatures during this period ranged between +0.94 and -3.97°C.

Table 1. Analysis of the climatic conditions at RDSPCS Dăbuleni during February - May 2024

Climatic conditions	II	III	IV	V	Average/ Sum
Average temperature ^{0}C	8.5	9.25	15.2	16.7	12.41 +3.4
The absolute maximum ^{0}C	22	29	34.1	28.6	28.6
The absolute minimum^{0}C	-7.1	-3.1	2.7	7.4	-7.1
Rainfall, mm	11.2	36.6	36	114	197.8 +14.7
Moisture, %	100	100	99.6	100	99.92
Multiannual average temperature (1956-2023), °C	1.299	5.919	11.916	16.943	9.01
Rainfall Multi-year monthly average (1956-2023), mm	32.104	40.611	46.967	63.415	183.09

Table 2. Analysis of the climatic conditions at RDSPCS Dăbuleni during March 10-June 10, 2025

Climatic conditions	III	IV	V	VI	Average/ Sum
Average temperature, ^{0}C	9.37	12.54	16.07	24.05	15.5
The absolute maximum, ^{0}C	24.1	28.97	29.87	32.9	29.0
The absolute minimum, ^{0}C	-5.99	-3.97	1.53	15.86	1.9
Rainfall, mm	28.8	21.0	55.4	7.6	112.8
Multiannual average temperature (1956-2023), ^{0}C	5.91	11.91	16.95	21.53	16.79
Rainfall Multi-year monthly average (1956-2023), mm	40.61	46.96	63.41	10.43	161.41

The precipitation recorded during these months amounted to 112.8 mm, lower than the multiannual amount for the respective months (between 1956-2024), the accumulation of water in the soil being very important for the normal development of the plant throughout the vegetation period. In 2024, the average production of marketable tubers obtained at the final harvest ranged between 23.99 t/ha for the 22-1941/8 line and 41.97 t/ha for the Ervant

variety, with an average production of 33.05 t/ha (Figure 1).

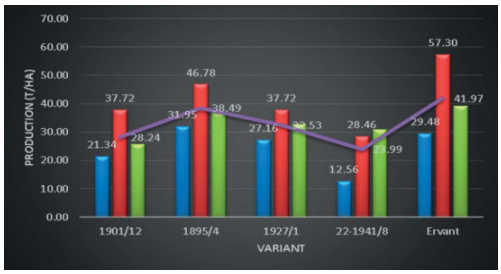

Figure 1. Average production of tubers in 2024

The potato genotypes studied showed different results in terms of their biological potential.
Marketable yields above the average of the five genotypes were achieved by the 1895/4 line (by 5.45 t/ha) and the Ervant variety (by 8.92 t/ha), the marginal differences being statistically insignificant (Table 3).

Table 3. Statistical analysis of average production in 2024

Genotype	Production (t/ha)	Difference (t/ha)	Significance
1901/12	28.24	-4.80	ns
1895/4	38.49	5.45	ns
1927/1	32.53	-0.52	ns
22-1941/8	23.99	-9.05	ns
Ervant	41.97	8.92	ns
Production Average (t/ha)	33.05	Mt	
LSD 5%=9.00; LSD 1%=13.09; LSD 0,1 %=19.63			

Regarding the average production obtained in 2025, it ranged between 29.26 t/ha for the 1901/6 line and 63.12 t/ha for the Ervant variety, with the average production being 42.68 t/ha (Figure 2).

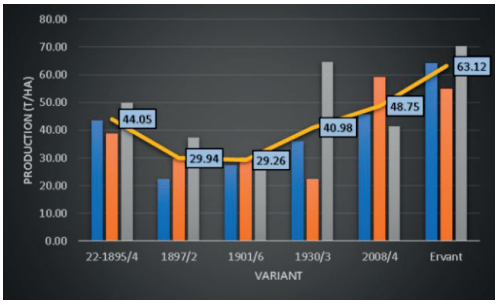

Figure 2. Average production in tubers in 2025

Marketable yields above the average of the six genotypes were achieved in lines 22-1895/4 (by 1.37 t/ha) and 2008/4, where production exceeded the average by 6.06 t/ha, the marginal differences being statistically insignificant. In Ervant variety, production obtained in 2025 exceeded the average production of the genotypes by 20.44 t/ha, this difference being statistically ensured as positively significant (Table 4).

Table 4. Statistical analysis of average production in 2025

Genotype	Production (t/ha)	Difference (t/ha)	Significance
22-1895/4	44.05	1.37	ns
1897/2	29.94	-12.75	ns
1901/6	29.26	-13.42	ns
1930/3	40.98	-1.70	ns
2008/4	48.75	6.06	ns
Ervant	63.12	20.44	*
Production Average (t/ha)	42.68	Mt.	
LSD 5%=18.62; LSD 1%=26.47; LSD 0.1 %=38.33			

The intensity of the photosynthesis process of potato genotypes cultivated on sandy soils from Dăbuleni varied depending on the genotype and their degree of adaptability to severe thermal stress, ranging between 7.57 µmol $CO_2/m^2/s$ at Ervant and 15.46 at 22-1941/8 (Table 5).

Table 5. Photosynthesis rate in potatoes grown on sandy soils in Dăbuleni - 2024

Genotype	Photosynthesis (µmol $CO2/m^2/s$)	Difference	Significance
1901/12	9.34	1.77	ns
1895/4	11.55	3.98	*
1927/1	15.19	7.62	***
22-1941/8	15.46	7.89	***
Ervant	7.57	Mt	
LSD 5%=2.77; LSD 1%=4.03; LSD 0.1 %=6.05			

The genotypes 1927/1 and 22-1941/8 were noted with have increased tolerance to thermal stress, which differed very significantly from a statistical point of view compared to the Ervant variety.
At RDSPCS Dăbuleni, in 2025, research undertaken aimed at monitoring the physiological reactions of the 6 potato genotypes studied, by vegetation phenophases, in order to determine their tolerance to the climate and soil conditions specific to the sandy soil area in southern Romania; the determinations were carried out during the vegetation period between the appearance of the floral bud and the full flowering of the potato.
The intensity of the photosynthesis process of potato genotypes grown on sandy soils from Dăbuleni varied between 11.69 µmol $CO_2/m^2/s$

at line 2008/4 and 23.17 µmol $CO_2/m^2/s$ at line 1901/6 (Table 6).

Table 6. Photosynthesis rate in potatoes grown on sandy soils in Dăbuleni - 2025

Genotype	Photosynthesis (µmol $CO_2/m^2/s$)	Difference	Significance
22-1895/4	18.75	-0.23	ns
1897/2	20.30	1.32	ns
1901/6	23.17	4.19	***
1930/3	20.40	1.42	ns
2008/4	11.69	-7.29	ooo
Ervant	18.98	0.00	Mt
LSD 5%=1.55; LSD 1%=2.21; LSD 0.1 %=3.20			

Comparing the results obtained with the average values of the Ervant variety (control variant) developed at NIRDPSB Brașov, it was found that the 1901/6 line differentiated positively, with values statistically assured as being very significant, and showed an increased tolerance to severe thermal stress.

CONCLUSIONS

Research conducted in 2024 and 2025 monitored the behaviour of potato lines originating from INCDCSZ Brașov at different stages of the improvement process.

Marketable production above average of the five genotypes was achieved in 2024 in the 1895/4 line (by 5.45 t/ha) and in the Ervant variety (by 8.92 t/ha), the marginal differences were statistically insignificant, and in 2025, it was achieved in the 22-1895/4 lines (by 1.37 t/ha) and 2008/4, in which the production exceeded the average by 6.06 t/ha, the marginal differences being statistically insignificant.

In Ervant variety, the production obtained in 2025 exceeded the average production of the genotypes by 20.44 t/ha, this difference being statistically ensured as positively significant.

With an increased withlerance to thermal stress in 2024, the genotypes 1927/1 and 22-1941/8 were noted, which differed very significantly from a statistical point of view compared to the Ervant variety, and in 2025 the line 1901/6 differed positively, with values statistically ensured as being very significant, having an increased tolerance to accentuated thermal stress.

ACKNOWLEDGEMENTS

This work was supported by a grant from ADER project 5.1.1. "Research on the impact of climate change on potato cultivation in traditional areas in order to reconfigure optimal cultivation areas in accordance with the EU "Green Deal" strategy and to identify and model the new potato ideotype with tolerance/resistance to climate change".

REFERENCES

Bonierbale, M. et al. (2020). Potato Breeding and Genetics. In: Campos, H., Ortiz, O. (eds). *The Potato Crop*. Springer. [https://doi.org/10.1007/978-3-030-28683-5_6]. (https://doi.org/10.1007/978-3-030-28683-5_6)

Caliskan, M. E., & Demirkaya, M. (2019). Drought tolerance and yield responses of potato cultivars under Mediterranean conditions. *Scientia Horticulturae*, 251, 73–83. https://doi.org/10.1016/j.scienta.2019.02.022

CIP – International Potato Center (2024). Research Programs and Global Impact. [https://cipotato.org/research] (https://cipotato.org/research)

Croitoru Mihaela; Aurelia Diaconu; Milica Dima; Draghici I.; Draghici Reta (2014). Research on the influence of the variety and the fertilization system on the nutritional quality of potato tubers in sandy soil conditions in southern Oltenia. National Symposium "Use of mineral and organo-mineral fertilizers in agriculture", *Scientific papers ICPA,* CIEC Bucharest, ISBN 10973-8115-47-7, Ed. New Agris.

Devaux, A. et al. (2021). The Potato of the Future: Opportunities and Challenges in Sustainable Agri-food Systems. *Potato Research*, 64, 681–702. [https://doi.org/10.1007/s11540-021-09501-] (https://doi.org/10.1007/s11540-021-09501-4)

Dima Milica, Diaconu Aurelia, Croitoru Mihaela, Constantinescu Emilia (2014) The influence of climatic conditions on the yield and quality of potato varieties cultivated on sandy soils. *Journal of Horticulture, Forestry and Biotechnology*, Vol. 18(1), pp.49-54, 2014, Ed. AGROPRINT Timișoara.

FAO (2023). Potato Facts and Figures. [https://www.fao.org/ potato-2008/en/world/ index.html] (https://www.fao.org/potato-2008/en/ world/ index.html)

Fumia, N. et al. (2021). Wild relatives of potato may bolster its adaptation to new niches under future climate scenarios. Wiley Online Library. (https://onlinelibrary.wiley.com/doi/pdf/10.1002/fes3.360)

Lobell, D.; B., Burke, M.; B., Tebaldi, C.; Mastrandrea, M.; D., Falcon, W.; P., & Naylor, R. L. (2011). Prioritizing climate change adaptation needs for food security in 2030. *Science*, 319(5863), 607–610. https://doi.org/10.1126/science.1152339

Machida-Hirano, R. (2015). Diversity of potato genetic resources. *Breeding Science*, 65(1), 26–40. https://doi.org/10.1270/jsbbs.65.26

Nature (2019). Potato research for a climate-smart food system. https://www.nature.com/articles/d42473-019-00418-8

Velu, S., & Popescu, D. (2022). *Sustainable agricultural technologies on sandy soils*. Craic, Romania: Sitech Publishing House. Retrieved from https://www.editasitech.ro/tehnologii-agricole-nisipuri