SECTORAL PLAN – ADER 2023-2026

Final Results of the Research Project

ADER 4.1.1./Research on identifying efficient in vitro conservation methods to maintain the biodiversity of potato, sweet potato and medicinal plant germplasm

Contracting Authority

MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

Contractor

NATIONAL INSTITUTE OF RESEARCH AND DEVELOPMENT FOR POTATO AND SUGAR BEET BRAȘOV

OCTOBER
2026

General Project Data

Project title	Research on identifying efficient *in vitro* conservation methods to maintain the biodiversity of potato, sweet potato and medicinal plant germplasm
Project code	ADER 4.1.1 / 21.07.2023
Project director	Dr. eng. Mihaela CIOLOCA
Implementation period	21.07.2023 – 30.10.2026 (4 phases, 40 months)
Total approved budget	1,100,000 lei
Total executed budget	1,099,299 lei

Research Objectives

General Objective

The main objective of the project was to enrich the existing potato germplasm collection conserved "in vitro" by introducing new Romanian and foreign varieties, and to complete the collection with new species: sweet potato and medicinal plants. A further aim was to establish the "in vitro" conservation conditions and to extend the interval between subcultures on fresh medium, while maintaining plantlet viability.
The "in vitro" conservation of the genetic diversity of potato, sweet potato and medicinal plants will provide commercial opportunities in the future, by making the material available to breeders, researchers and growers.

Specific Objectives

SO1	Increasing the number of potato genotypes in the *in vitro* germplasm collection
SO2	Introduction and medium-term *in vitro* conservation of sweet potato and of several medicinal plant species
SO3	*In vitro* conservation of genotypes that can be a valuable genetic resource for breeding varieties tolerant to biotic and abiotic stress
SO4	A brochure on *in vitro* conservation and on the characteristics of the genotypes in the collection

Activities Carried Out

Summary of activities by implementation phase:

Phase 1	*[2023]*	Literature review; selection of the medicinal plant assortment to be introduced into the germplasm collection; initiation of potato *in vitro* cultures from meristem excision (7 new genotypes, 123 meristems).
Phase 2	*[2024]*	Meristem excision for 12 new potato genotypes (684 meristems, 71% viable); development of a method for obtaining a stock of virus-free potato plantlets; initiation of cultures and *in vitro* multiplication of several medicinal plant species.
Phase 3	*[2025]*	Selection of sweet potato genotypes and production of shoots in the greenhouse (2 methods); initiation of cultures and *in vitro* multiplication of sweet potato (sterilisation protocol – 4.76% contamination; testing of 7 multiplication media); immunological analysis of potato plantlets regenerated from meristems (DAS-ELISA testing of 19 potato genotypes) and *in vitro* multiplication of virus-free potato plantlets; dissemination of results.
Phase 4	*[2026]*	Testing of 7 medium variants each for the *in vitro* conservation of potato, sweet potato and medicinal plant germplasm; development of 3 conservation protocols; dissemination of the experimental results through participation in 10 scientific events; publication of a brochure.

Technical and Scientific Results (1)

Establishment of an *in vitro* germplasm collection for potato, sweet potato and medicinal plants

R1

20 new potato genotypes

Introduced into the collection: Neil, Evollete, Nevin (SCDC Târgu Secuiesc); A17b, A20n, Ea23v, P19rs (ISPHTA Chișinău); Amural, Coradia, Postăvaru, Getica (INCDCSZ Brașov); Temerar, Impuls, Event (SCDA Suceava); Red Lady, Prada, Edison, Dior, Rivola (Solana); Solist (Norika).

R2

Virus-free potato material

807 meristems excised in 2023-2024, 590 viable (73.11%); DAS-ELISA testing; virus-free clones obtained from meristem tissue for all 19 potato genotypes; the Solist variety acquired as healthy microplants.

R3

New species in the *in vitro* collection

5 sweet potato genotypes from SCDCPN Dăbuleni (DK 19/1, DK 19/2, Dch 19/3, DK 19/4, DK 19/5) and 6 medicinal and aromatic plant species (*Salvia officinalis* L., *Ocimum basilicum* L. (3 varieties), *Thymus vulgaris* L., *Calendula officinalis* L., *Mentha* spp. (2 species) and *Lavandula angustifolia* Mill.).

Technical and Scientific Results (2)

Design of *in vitro* conservation protocols for potato, sweet potato and medicinal plants, with the main stages: initiation, micropropagation and conservation of plant germplasm

R4

In vitro conservation protocol - potato

MS½ (V0) or MS + mannitol 7.5 g/l + sorbitol 7.5 g/l (V1): 100% survival after 9 months without subculture, compared with subculturing every 3 months at present.

R5

In vitro conservation protocol - medicinal plants

MS medium (basil, mint, pot marigold, thyme) or WPM (sage, lavender).
Sage 100% after 7 months (W0); 100% after 9 months for mint (almost all variants) and thyme (V4, V5, V6); “Grand vert” basil 80% after 9 months (V0), red basil 100% after 8 months (V1), Greek basil 75% after 5 months (V1); lavender 100% after 5 months (W3); pot marigold 75% at 8 months (V2).

R6

In vitro conservation protocol - sweet potato

MS + IAA 0.5 mg/l + PEG 20 g/l + vitamin C 20 mg/l (V6): 7 months for DK 19/4 and DK 19/5, with viable plantlets also at 9 months; for the other 3 genotypes the effective interval was 3–5 months.

Medium variants tested for conservation (phase 4)

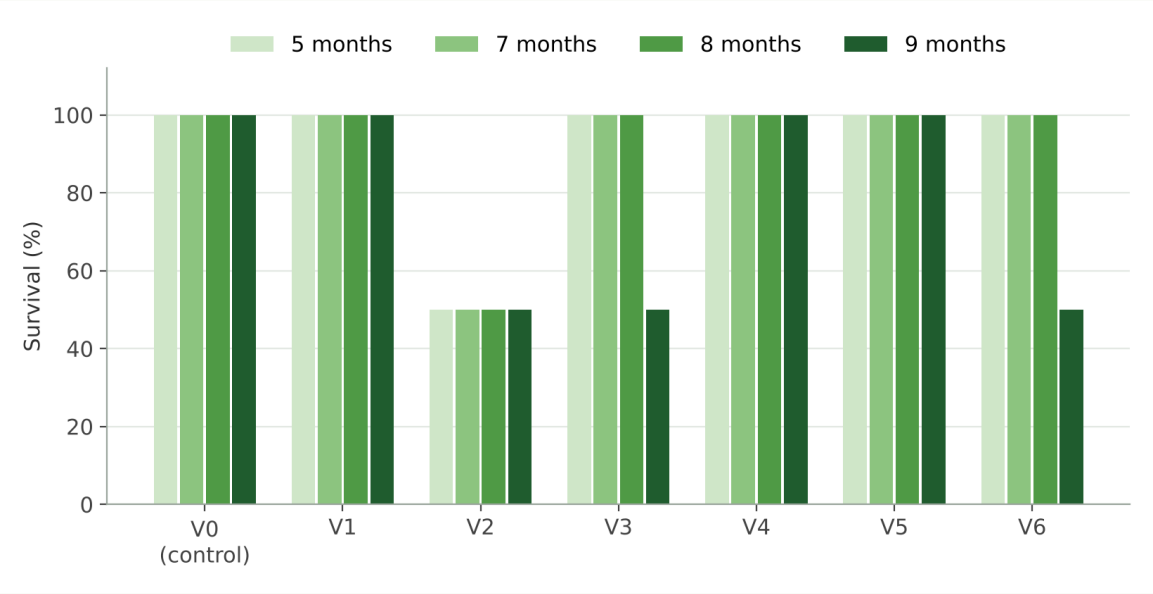
V0 / W0	MS½ / WPM without auxin, vitamin C or osmotic agents (control)
V1 / W1	MS/WPM + auxin 0.5 mg/l + mannitol 7.5 g/l + sorbitol 7.5 g/l
V2 / W2	MS/WPM + auxin + mannitol 7.5 g/l + sorbitol 7.5 g/l + vitamin C 20 mg/l
V3 / W3	MS/WPM + auxin + mannitol 20 g/l
V4 / W4	MS/WPM + auxin + mannitol 20 g/l + vitamin C 20 mg/l
V5 / W5	MS/WPM + auxin + PEG 20 g/l
V6 / W6	MS/WPM + auxin + PEG 20 g/l + vitamin C 20 mg/l

V = MS medium + IAA (potato, sweet potato, basil, mint, pot marigold, thyme); W = WPM medium + IBA (sage, lavender).
MS - Murashige-Skoog; WPM - Woody Plant Medium; IAA/IBA - indoleacetic/indolebutyric acid; PEG - polyethylene glycol.
All variants: sucrose 20 g/l, agar 9 g/l, pH 5.8; 19-20±2 °C, 16 h light/8 h dark.



Growth chamber – the germplasm collection

Potato: plantlet survival during conservation



- V0, V1, V4 and V5: 100% survival after 9 months.
- Vitamin C had a positive effect only together with mannitol 20 g/l (V4 compared with V3).
- Recommended in terms of cost: variants V0 (MS½) and V1.
- Extension of the subculture interval: from 3 months (current practice) to 9 months.

Medicinal plants: survival on different medium variants

Survival after 5 months (%)

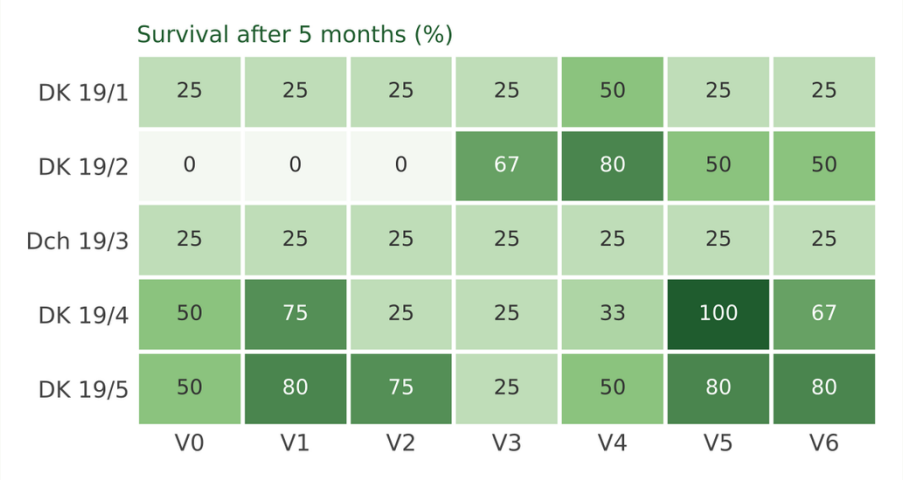
	V0/W0	V1/W1	V2/W2	V3/W3	V4/W4	V5/W5	V6/W6
Basil Grand vert	100	100	100	100	100	100	83
Greek basil	50	75	75	100	50	75	50
Red basil	75	100	100	100	75	100	50
Mentha piperita	100	100	100	100	100	75	100
Mentha spicata	100	100	100	100	100	100	100
Pot marigold	50	80	100	50	50	20	25
Thyme	89	100	50	100	100	100	100
Sage (W)	100	25	50	25	50	75	50
Lavender (W)	62	25	50	100	50	50	33

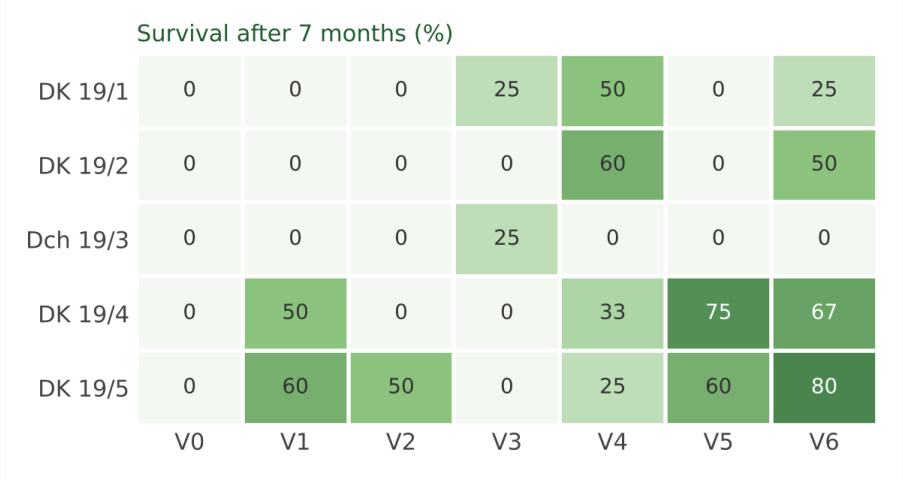
Survival after 9 months (%)

	V0/W0	V1/W1	V2/W2	V3/W3	V4/W4	V5/W5	V6/W6
Basil Grand vert	80	50	33	25	67	0	0
Greek basil	0	50	0	25	0	25	0
Red basil	0	25	0	0	0	0	0
Mentha piperita	100	100	100	100	100	75	100
Mentha spicata	100	100	100	100	100	100	100
Pot marigold	0	0	0	0	0	0	0
Thyme	89	75	50	50	100	100	100
Sage (W)	50	0	0	0	0	25	0
Lavender (W)	38	0	25	50	50	25	0

- Thyme (V4, V5, V6): 100% after 9 months; mint: almost all variants effective, also after 9 months (100%); very good adaptation of these species to *in vitro* conservation conditions.
- Basil: the control (V0) for the “Grand vert” variety (80% after 9 months), V1 for red basil (100% after 8 months) and Greek basil (75% after 5 months); pot marigold - the shortest conservation interval (max. 8 months, 75% survival rate on variant V2).
- Sage - the control (W0), 100% between 5-7 months; lavender - mannitol 20 g/l (W3), 100% after 5 months.

Sweet potato: survival of the genotypes on different medium variants, after 5 and 7 months of conservation





- The genotypes responded differently; after 3 months of conservation, survival ranged from 25 to 100%.
- DK 19/4 and DK 19/5: over 60% after 7 months on V5 (PEG 20 g/l) and V6 (PEG 20 g/l + vitamin C 20 mg/l); viable plantlets also after 9 months on V6.
- DK 19/1, DK 19/2 and Dch 19/3: the effective interval remains 3-5 months. Sweet potato conservation needs further optimisation.

Initiation, multiplication and *in vitro* conservation activities



Initiation of in vitro cultures from meristem tissue and regeneration of potato microplants



In vitro multiplication of sweet potato



Micropropagation of plantlets regenerated from seeds germinated in vitro (Mentha spicata)



Thyme microplants during conservation
(after 5 months – left; after 9 months – right, medium variant V5)

Products and Deliverables

Research reports

4 *in extenso* reports by activity; 4 annual reports; the final report

Protocols

3 *in vitro* conservation protocols: potato, medicinal plants, sweet potato

In vitro collection

In vitro germplasm collection, completed with 20 new potato varieties/genotypes, 5 sweet potato genotypes and 6 medicinal plant species

Brochure

„Conservarea *ex situ* a resurselor genetice vegetale - cartof, cartof dulce și plante medicinale” (*Ex situ* conservation of plant genetic resources - potato, sweet potato and medicinal plants) (2026); ISBN: 978-630-6793-04-4

Published papers

10 published papers (6 indexed BDI/ISI), 2 in press, 1 brochure

Scientific communications

19 scientific communications, 4 of them abroad: 8 oral presentations and 11 posters

Scientific Publications

Selection of representative publications:

Cioloca Mihaela, Andreea Tican, Monica Popa, Aurelia Diaconu, Reta Draghici, Alina Paraschiv, 2026. In vitro evolution of some sweet potato (Ipomoea batatas [L.] Lam.) genotypes under the influence of different plant growth regulators (auxins and cytokinins). Scientific Papers. Series B. Horticulture, Vol. LXX, No. 1, pp. 417-426. https://horticulturejournal.usamv.ro/pdf/2026/issue_1/vol2026_1.pdf

Cioloca Mihaela, Andreea Tican, Monica Popa, Valentina Șerban, Anca Baciu, Petru Iliev, 2023. The importance of "in vitro" plant genetic resources conservation - potato (Solanum tuberosum L.). Studia Universitatis "Vasile Goldis" Life Sciences Series, Vol. 33 (1), pp. 12-16. Studia Univ. VG, SSV, vol. 33, iss. 1, 2023 – Studia Universitatis

Mihaela Cioloca, Andreea Tican, Monica Popa, 2024. Evaluation of virus-free potato minitubers derived from "in vitro" meristem cultures for high-quality seed potato production. Rom J Hortic. 5:15–22.
https://doi.org/10.51258/RJH.2024.02

Ștefan Maria, Chelmea Carmen, Poptelecan Diana, Cioloca Mihaela, 2024. Conservarea resurselor genetice în colecţii de cultură [Conservation of genetic resources in culture collections]. Cartoful în România, Vol. 33, pp. 29-40.
https://potato.ro/_publicatii_files/cartoful_in_ro/2024CartofulInRomania_vol.33%20.pdf

Scientific Publications

Selection of representative publications:

Cioloca Mihaela, Tican Andreea, Popa Monica, 2025. Micropropagation of sage (Salvia officinalis L.) plantlets obtained in vitro from seeds and shoots. International Journal of Engineering Research and Applications (IJERA), Vol. 15, Issue 8, pp. 20-25. https://www.ijera.com/papers/vol15no8/15082025.pdf

Popa Monica, Cioloca Mihaela, Tican Andreea, Nagy Alexandra-Mihaela, Sava Sand Camelia, Petre Diana, Diaconu Aurelia, Drăghici Reta, Paraschiv Alina, 2025. Comparative analysis of sugar content in storage roots of three sweet potato genotypes grown in a greenhouse under different substrate and irrigation conditions. International Journal of Engineering Research and Applications (IJERA), Vol. 15, Issue 9, pp. 187-192. https://www.ijera.com/papers/vol15no9/1509187192.pdf

Cioloca Mihaela, Tican Andreea, Popa Monica, Bădărău Carmen, 2025. Îmbunătățirea calității cartofului pentru sămânță prin utilizarea minituberculilor obținuți în spațiu protejat [Improving seed potato quality by using minitubers produced in protected areas]. Cartoful în România, Vol. 34, pp. 46-49. https://potato.ro/_publicatii_files/cartoful_in_ro/2025CartofulInRomania_vol.34.pdf

Cioloca Mihaela, Andreea Tican, Monica Popa, Nina Bărăscu, 2026. Influence of culture medium composition on the in vitro growth and development of three medicinal and aromatic plants (Ocimum basilicum L., Lavandula angustifolia Mill. and Salvia officinalis L.). AGRICULTURA, USAMV Cluj-Napoca, Vol. 137 No. 1-2. https://doi.org/10.15835/agr.v137i1-2.15339

Dissemination of Results

National conferences

Annual conferences/sessions of scientific papers and communications: INCDCSZ Brașov (2024, 2025); SCDA Secuieni (2024, 2025, 2026); SCDA Turda (2026); INCDBH Ștefănești (2026) - scientific session dedicated to the research results of the ADER Sectoral Research Plan and of the Nucleu Programme 2023-2026.

International conferences

"The European Cooperative Programme for Plant Genetic Resources (ECPGR) - EURO-POTATOES", Poland, 2024; "Life Sciences For Sustainable Development", USAMV Cluj-Napoca, 2025; International Conference Agriculture & Food, Bulgaria, 2025; International Multidisciplinary Conference on Sustainable Development, USV "King Michael I" Timișoara, 2026; "Agriculture for Life, Life for Agriculture", USAMV Bucharest, 2026; "Conservation of plant diversity *in situ* and *ex situ*", "Alexandru Ciubotaru" National Botanical Garden (Institute), Republic of Moldova, 2026.

Symposia/round tables

"Potato Green Day" - 48th edition, Târgu Secuiesc (2025) and 49th edition, Râșnov (2026);

"Green Romania - Land of Medicinal Plants", 1st edition, Foundation for Multidisciplinary Research, Buzău (2025);

Round tables: INCDCSZ Brașov (2023); Romanian Society of Ethnopharmacology - New objectives for saving natural resources and for the valorisation of Medicinal and Aromatic Plants in Romania, Fundata, Brașov county (2026).

Participation in scientific events and publications

19 communications, 4 of them abroad: 8 oral presentations and 11 posters; 10 published papers (6 indexed BDI/ISI) and 2 in press; 1 brochure printed in 2026

Project website: https://potato.ro/proiecte-ader/
Social media: https://www.facebook.com/share/19tEy11454/

Estimated Economic and Social Impact

💰 Direct economic impact

Extension of the subculture interval on fresh medium: for potato from 3 months (current practice) to 9 months; effective interval for medicinal plants: thyme, mint (9 months), pot marigold (8 months) sage (5-7 months), lavender (5 months); basil (5-8 months); effective interval for sweet potato (3-5 months) - lower costs of maintaining the collection (culture medium preparation, labour, energy) through fewer subcultures per year.

🌍 Environmental impact

Conservation of potato, sweet potato and medicinal plant germplasm through *in vitro* cultures, avoiding contamination with the main pathogens and other risks associated with field cultivation; availability of the conserved material throughout the year.

👥 Social impact

Virus-free (potato) material, available for breeding, research and seed potato production.

🏭 Technology transfer

Plant germplasm conservation protocols applicable in *in vitro* culture laboratories; a brochure for researchers, growers and students.

Beneficiaries

Research institutes and stations

INCDCSZ Brașov, SCDC Târgu Secuiesc, SCDA Suceava, SCDCPN Dăbuleni; breeding programmes

Private sector

Seed potato producers; growers of medicinal plants and sweet potato

Academia

Agricultural universities interested in fields such as plant biotechnology and the conservation of genetic resources

Public authorities

MADR, ASAS - strategies for the conservation of plant genetic resources

Conclusions 1

Main conclusions of the ADER 4.1.1 research project

1. The project fully achieved the technical and scientific objectives set out in financing contract ADER 4.1.1./21.07.2023.

2. The *in vitro* collection for potato, sweet potato and medicinal plants was established using the medium variants that gave the best results, both for plantlet survival rate and for the *in vitro* conservation interval (20 new potato varieties/genotypes; 5 sweet potato genotypes; 6 medicinal plant species).

3. Virus-free clones (DAS-ELISA testing) were obtained for all 19 new potato genotypes started from meristem culture. The MS½ and MS + mannitol 7.5 g/l + sorbitol 7.5 g/l media preserved 100% of the plantlets after 9 months of *in vitro* conservation.

4. Mint and thyme adapted very well to *in vitro* conservation (100% after 9 months); pot marigold had the shortest interval. Each medicinal plant species needs its own conservation recipe: MS½ for “Grand vert” basil, WPM for sage, mannitol 20 g/l for lavender.

5. In sweet potato, plantlet viability of genotypes DK 19/4 and DK 19/5 was maintained after 7 months of conservation; for DK 19/1, DK 19/2 and Dch 19/3 the effective interval was 3-5 months.

Conclusions 2

6 *In vitro* tissue culture protocols can be used in the future to conserve plant species, to preserve the genetic pool of a crop and to avoid the loss of heritage due to biotic or abiotic stress factors.

7 *In vitro* conservation made it possible to keep plant material in a small space, with a lower risk of losing genotypes and with the possibility of rapid multiplication and regeneration when needed.

8 Availability of the *in vitro* conserved biological material for use as a germplasm source in research, breeding or for introduction into cultivation.

4

9 The results were disseminated through 10 published papers, 19 communications and a brochure with ISBN.

Recommendations

In vitro culture laboratories

Use of the *in vitro* conservation protocols for potato, sweet potato and medicinal plant germplasm in plant tissue culture laboratories.

Research

Further research on identifying favourable variants for *in vitro* initiation/multiplication/conservation; extending the studies to endangered species (*Arnica montana L.*) and to cryopreservation.

Breeding and seed production

Use of the collection as a source of virus-free (potato) material for breeding programmes and seed potato production.

Public authorities

Support for maintaining *in vitro* collections as part of the national strategy for the conservation of plant genetic resources.

Contact Details

CONTRACTOR
National Institute of Research and Development for Potato and Sugar Beet Brașov
2 Fundăturii St., postal code 500470, Brașov county, Romania
Project director: Dr. eng. Mihaela Cioloca

E-mail

icpc@potato.ro

Website

https://potato.ro/proiecte-ader/

Phone

0268 476795