Increasing the efficiency and competitiveness of organic crop breeding (ECOBREED)

Potato

Partner institutions:

- Kmetijski inštitut Slovenije (KIS)
- Newcastle University (UNEW)
- Plant Breeding and Acclimatization Institute (IHAR)
- University of Pannonia (UNIPAN)

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ECOBREED – potato

a) Managing and conserving the genetic resources to facilitate further use of the genetic material (WP1): identification and multiplication of variety collection.

b) Increasing the availability of organic seeds and varieties for the organic sector (WP3).

c) Genotyping and phenotyping of core collections to identify genetic variation available in agro-morphological and quality traits (WP3).

d) Identifying relevant (combinations of) traits suited to organic farming conditions (WP3)

e) Developing improved genotyping and/or phenotyping capabilities (WP3).

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ECOBREED – potato activities across the project

f) Transfer of identified genes/traits into breeding programmes for improved pest resistance, agronomic performance and nutritional quality (WP3).

g) Establishing an efficient system for farmer-participatory-selection of new varieties suited to organic production in selected countries representing different pedoclimatic zones/regions (WP6).

h) Delivering a training programme to facilitate rapid technology transfer from the project (improved genotyping and phenotyping, together with PPB and farmer participatory trial management) into commercial practice (WP7).

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TASK1.1 Identification of wheat, potato, soybean and buckwheat genetic material (months 1-6)

The collections will include ~ 200 accessions for each species from which the core collections will be identified.

A set of standardised descriptors including passport and characterisation information will be selected.

Responsible partner: NPPC; Partners involved: KIS, UNEW, IHAR, UP

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TASK1.2 Multiplication of genetic resources for further evaluation (months 1-36)

In this crucial task of ECOBREED the materials to be studied in other WPs will be prepared and distributed.

Seed multiplication of each species will occur to form core collections: for potato (60 accessions).

The core collections will be initially multiplied to have sufficient quantity of good quality seed for
a)morpho-physiological, genetic and quality characterisation to be carried out in WP 3,
b)farmer participatory trials to be carried out in WP6,
c)pre-breeding and participatory plant breeding activities (WPs 3 and 6)
Responsible partner: BOKU; Partners involved: KIS, IHAR

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ECOBREED – potato

The objectives of WP3 are:
a)Perform a detailed phenotypic analysis of the potato core collection identifying traits suited to organic potato production systems.

b) Improve the quality of organic ware and seed potato production.

c) Production of new potato cultivars and breeding materials suitable for organic production.

d) Produce superior elite breeding line (s) with durable field resistance to multiple *P. infestans* races.

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TASK 3.1 Screening of genetic resources and breeding material (months 13-36)

A collection of potato genotypes will form the basis of a core collection. Phenotyping of the collection will take place across a range of environments in 4 countries i.e. SI, PO, HU and the UK (set of 60 accessions, 30 plants per accession).

The characteristics which will be assessed in the field trials:
i)morphological and phenological traits (e.g. growth stages, shoot habit, plant height, leaf colour, canopy cover, number of days to flowering/maturity etc.),
ii)tolerance/resistance to naturally occurring biotic/abiotic stresses according to locality/country e.g. fungi such as *P. infestans*, *Alternaria*, *Rhizoctonia, Colletotrichum, Fusarium* the viruses PVY, PLRV, insect pathogens such as Colorado beetle, wireworms,
iii)yield and yield component parameters (tuber number, tuber size, skin finish etc.),
iv)market quality of tubers for fresh and processing e.g. silver scurf, common scab, skin finish etc..
v) DM%, cooking/baking quality, taste etc.

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TASK 3.1 Screening of genetic resources and breeding material (months 13-36)

In addition **high throughput phenotyping** will be used (years 3 and 4) on a subset of selected genotypes (20) in the UK and Slovenia.

To evaluate and validate the potential to get a fast and more accurate method of screening and selection for
a)crop vigour to increase competitiveness against weeds
b) disease resistance for *P. infestans*, Alternaria, *Rhizoctonia*
c) post-harvest traits. Using this approach it would be possible to determine the relationship between imaging and ground truthing for different diseases and post-harvest traits.

Responsible partner: KIS; Partners involved: UNEW, UP, IHAR

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WP3.2 AMF compatibility screening

- 20 potato varieties
- Inoculant either from INOQ (Germany) but also comparison with a native trap crop inoculant being developed from Nafferton Farm, UK
- Partners: UNEW

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WP3.3 Cover crops for improving seed quality and vigour in potato

6 species/mixtures of cover crops selected for ability to reduce potato pest and disease pressure but comprising brassica, legume and cereal species e.g. *Brassica juncea*, *Raphanus sativus*, *Medicago sativa*, *Solanum sisymbriifolium*, *Avena strigosa*, *Vicia sativa*

Established in early September in UK and Slovenia, (10 x 20 m) replicated 4 times. Cover crops to be flailed and ploughed in prior to planting 2 varieties of potato.
Monitor yield, disease, quality etc

Partners: UNEW, KIS

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TASK 3.4 Colorado potato beetle and wireworm control strategies (months 25-48)

Test plots for ware organic crops with selected potato genotypes **(3 genotypes)** together with a range of **Colorado beetle control** strategies:
- trenches around plots
- beetle suction methods of adults and larvae,
- different fungal or bacterial sprays will be evaluated.

Sustainable wireworm control will be evaluated by using different strategies of microcapsules of CO2 and pathogenic fungi. The technology of microcapsules that attracts wireworms and kill them is already available, but strategies how to apply it are still under development. Field treatments with entomopathogenic fungi applied in artificial CO2 capsules to increase wireworm control will be evaluated.

Responsible partner: KIS; Partners involved: UP, IHAR

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TASK 3.5 Marker assisted selection in organic breeding (months 13-48)

Late blight and PVY resistant potato varieties will be combined with high performance commercial varieties. The aim will be to maintain the high resistance level and improve the agronomy quality traits in the progeny, which will be the basis for selection of new potato varieties suitable for organic agriculture in the near future.

Molecular markers for PVY and late blight resistant genes (*Rysto*, *Rychc*, *R1-R9*, *Rpi-Blb1*, *Rpi-Blb2*, *Rpi-Smira1*, *Rpi-Smira2*) will be used for exploiting the established progeny populations and advanced clones derived from ‘Sarpo Mira’ and other PVY and late blight resistant germplasm at KIS, IHAR and UP for selection of advanced clones.

Responsible partner: KIS; Partners involved: UP, IHAR

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TASK 3.6 Production of elite varieties and advanced breeding lines (months 19-60)

Pyramiding of *R* genes for late blight resistance and PVY extreme resistance to achieve long term resistance against new more virulent pathotypes of *P. infestans* and strains of PVY. In the medium term the pyramiding can be therefore obtained by crossing resistant potato varieties and advanced clones of different breeding programmes.

Progeny populations will be analysed using existing molecular markers for PVY and late blight resistant genes for selection of quantitative resistance particularly to late blight (*Rpi-Smira2…*) and other pathogens to develop elite lines suitable for breeding for organic production.

Responsible partner: IHAR; Partners involved: KIS, UP

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Deliverables (brief description and month of delivery)

D3.1 Phenotypic data management system for potato produced for partners (M 12)
D3.2 Final report on AM-compatibility evaluation (M 48)
D3.3 Final report on phenotypic characterisation of potato (M 48)
D3.4 Final report on Colorado potato beetle and wireworm control strategies (M 48)
D3.5 Final report on improving seed tuber quality and vigour via the use of cover crops (M 54)
D3.6 Statistical analyses of phenotyping results (M 54)
D3.7 Final report on MAS in potato (M 54)
D3.8 Final publishable report on WP3 (M 60)

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TASK 6.2 Farmer participatory field trials (months 25-48)

3 countries:

4 farmers per country

8 -12 genotypes in non replicated trial
(4 rows of 100 meters per genotype)

Possible different treatments.

Responsible partner: NATUR; Partners involved: KIS, IHAR, UP

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TASK 6.3 Participatory plant breeding (months 25-48)

3 countries:

3 farmers across the participating countries

Small number of progenies/lines

Responsible partner: WSU; Partners involved: KIS, IHAR, UP

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