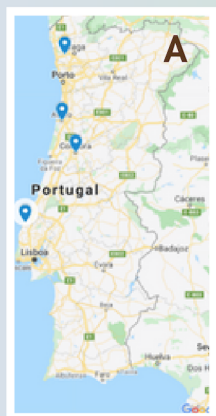


# Case Study 8: North, Center, and Center South of Portugal.

## SURVEILLANCE ON POTATO-GROWING SOILS

### Context and background



Potato (*Solanum tuberosum*) is an important staple crop worldwide and thousands of hectares of potatoes are grown every year. Potato has great social and economic importance in Portugal since it is grown throughout the country. The most representative production regions are the North and West Regions, with a total potato growing area of approximately 20,000 ha and a total production of 430,000 tons. Plant-parasitic nematodes (PPN), such as potato cyst nematodes (PCN), *Globodera* spp., and root knot nematodes (RKN), *Meloidogyne* spp., are a serious problem in potato growing areas. These PPN are among the most economically important nematodes in agriculture, being potato the main host for PCN while RKN can cause significant losses in potato. To control PPN, responsible for low yields and poor quality of crops, new efficient bio-tools are needed, as alternatives to synthetic products.

### Objectives

The main objectives of this case study are to explore the potential benefits of the microbiome of potato fields against PPN. Specifically, the study aims to:

1. identify the core microbiome of healthy soils (without PPN) and diseased soils (with PPN).
2. predict their functionality to a healthy soil.

### Experimental design

The evaluation of microbiomes and the identification of nematodes was carried out before and after potato cultivations. In total, 45 fields from North, Center and South Portugal from the representing areas producing potato were evaluated. Four hundred and fifty soil samples (45 fields x 5 composed samples by 5 independent samples x 2 time points) were collected, before and after potato. The soil was chemically characterized, the microbiome was assessed, and nematodes were identified. Some bacteria were tested against RKN and *Caenorhabditis elegans*, some fungi and on plant (*S. lycopersicum*) germination and growth.

## Key Innovations

The case study focuses on two pillars of regenerative agriculture:

- 1. Beneficial microorganisms:** Development of bio-tools using bacteria for biological nematode control as biological control agents (BCAs).
- 2. Agronomical practices:** The proposed solutions developed will make them potentially suitable to be used for integrated pest management.

The ultimate goal is to develop sustainable tools against PPN that can mitigate environmental impacts by replacing synthetic nematicides while maintaining high potato productivity in the region.

## Preliminary results

Overall, the analysed strains exhibit promising potential as a PGPB (Plant Growth Promoting Bacteria). All strains possess characteristics that are associated with the ability to enhance plant growth, increase nutrient availability, and improve plant resistance to various stresses. Moreover, bacterial consortium has the potential to perform a dual role in agricultural ecosystems by acting as both nematicides and fungicides. The results considering *C. elegans* indicate that the strains choose to have no effect on non-target-organisms.

These results demonstrated the effectiveness of the chosen bacterial consortium against *M. hapla* under *in vitro* conditions. Overall, this consortium exhibited a notable level of nematicidal activity with statistically significant variations against *M. hapla*.

Microorganisms applied are those screened as the best for plant growth promoting properties *in vitro* phenotypic tests (Fig. 1). Their genomes have been published on NCBI, as described in deliverable 3.3.



Fig. 1- *In vitro* assay with the bacteria consortium composed by strains of genera *Bacillus* and *Pseudomonas* to evaluate their effect on *S. lycopersicum* growth. Five replicates per treatment including the control with water.

