2023

# On-farm growth and application of mycorrhizae

Using fungal roots to boost production, fight climate change and reduce chemical inputs.

## EAFRD-funded projects

**Location:** La Rioja, Spain

**Programming period:** 2014-2020

**Priority:** P4 – Ecosystems management
P5 – Resource efficiency and climate

**Focus Area:** Soil erosion & soil management, Carbon conservation & sequestration

**Measures:** M16 – Cooperation

**Funding:**

| | |
|---|---|
| Total budget | 234 670.00 (EUR) |
| EAFRD | 187 736.00 (EUR) |
| National/Regional | 0 (EUR) |
| Private/Own funds | 46 934.00 (EUR) |

**Timeframe:** 2017 to 2021

**Project promoter**: El Colletero (NGO)

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## Summary

There is an increasing loss of fertility and biological functionality in agricultural soils, mainly due to intensive cultivation and the abuse of chemicals. The demand for innovative tools that reverse this situation in a more sustainable way prompted the formation of the 'Mycorrhizae Innovation Team'. They hoped to eradicate the main problems that soil faces today; by improving the quality of agricultural soils naturally and the health status of plants, increasing crop productivity, lowering economic costs by reducing and/or eliminating agricultural inputs and producing food more sustainably. The team involved tested the effect on crops and soil quality of incorporating native laboratory-grown mycorrhizae (fungal roots) into the soil. The benefits included increased horticultural production and improved soil composition. The use of mycorrhizae is also a sustainable way to provide plants with a nutritional balance, increasing resistance to stresses such as drought and pests and providing a better soil structure.

## Project results

- Increase in carbon sequestration in soil from 2.8% to 8.5%.
- Increase in biodiversity (tenfold increase in soil from treated plants).
- Lower greenhouse gas (GHG) emissions via reductions in chemical inputs and labour.
- Increased yields (+20% for lettuce, +40% for peas).
- Improved plant growth and disease resistance.
- Labour and costs were reduced thanks to the reduction in pesticide, fertiliser and fuel use.
- One extra job created – a researcher hired by an SME to further develop the mycorrhiza application and marketing.
- Over 6 000 people reached via workshops, conferences, talks, school visits, fairs and web page visits.
- 15 people have attended mycorrhiza courses since 2018.
- Clear improvements in the quality, structure, organic matter, organic carbon content, nutrient absorption, water uptake, and abiotic and biotic stress tolerance have been seen in the soil.
- This leads to healthier food being produced.

## Key lessons and recommendations

- Teaching people to steer away from chemicals in agriculture is very difficult – attitudes are deeply rooted.
- Chemicals are difficult to remove from the mindsets of farmers, who are constantly bombarded with information from chemical companies – many prefer the simpler path of purchasing chemicals rather than growing mycorrhizae.
- The smell and flavour of plants used as examples are important tools to persuade farmers to avoid unnecessary chemicals.
- Concrete examples and proof of the new farming tools need to be shared with farmers so that they can see the results.
- Young people should be the target of agriculture transformation as they have fewer ingrained ideas.

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## Context

There is widespread awareness of the degradation of soils in Europe and around the world due to intensive agriculture. There is an increasing loss of fertility and biological functionality in agricultural soils, mainly due to intensive cultivation and the abuse of chemicals. This project aimed to create hope and stimulate collaboration, helping society-led innovation and fostering sustainability. It also aimed to empower soils and farmers so that they do not need chemicals, paving the way towards a more circular economy.

To fulfil this objective, the project promoters felt the need for a tool that improved yields while complementing both farmers' activities and the soil, and that was easy to implement and replicate. They chose mycorrhizae (fungal roots), as they are at the origin of soil symbiosis, and created the 'Mycorrhizae Innovation Team', which is composed of three different entities: coordination, technical dissemination and farmers.

The team involved tested the effect on crops and soil quality of incorporating native laboratory-grown mycorrhizae into the soil. The benefits included increased horticultural production and improved soil composition. The use of mycorrhizae is also a sustainable way to provide plants with a nutritional balance, increasing resistance to stresses such as drought and pests and providing a better soil structure.

## Objectives

The team had a number of highly quantifiable goals. They were looking to reduce the use of fertilisers and chemicals, and in particular N2O GHG (nitrous oxide greenhouse gas), which is more dangerous than CO2. As mycorrhizae are responsible for fixing one third of total carbon emissions fixed in soils, the project also aimed to increase carbon sequestration, yields and soil biodiversity, all by giving farmers a tool that is easy to replicate, grow and apply in the field. To achieve genuine results, the team wanted to involve at least 100 farmers.

## Activities

In practical terms, the project focused on the on-farm growth of mycorrhizae and the application of mycorrhizae in the field by various means, always looking for what would be the most useful way for farmers to implement this. The team then checked the success of the initiative by collecting data on increases in yields.

On a more hands-on level, the team collaborated with local farmers by constantly exchanging knowledge. By involving farmers from the beginning, the project tapped into their expertise, needs and concerns, ensuring that the solutions offered were practical and relevant to the local agricultural context.

Likewise, the benefits of the project were shared with the local community, in schools (in urban and rural areas) and via workshops with experts, researchers and scientists. The project was presented at national and international conferences, as well as sustainable development fairs and horticultural contests, and received good levels of acceptance.

This was part of the dissemination of information about this new tool that was also a feature of the initiative. Courses were run and

information made available on the internet and through scientific and dissemination papers. Connections with farmers and experts have been maintained through courses and the development of other research and dissemination projects along similar lines.

The project also had practical implications in local contexts, with growers from the region who use mycorrhizae receiving the training course every year free of charge. There is growing interest in the use of mycorrhizae in agriculture in the local area. Promotion, awareness-raising and education is key in this regard, particularly as big companies sell mycorrhizae as a biofertilizer commonly mixed with non-local species, with the result that they are far less effective.

## Main results

In quantifiable terms, the project has led to an increase in carbon sequestration (with the carbon content in the soil rising from 2.8% to 8.5%) and in biodiversity (a tenfold increase in soil from treated plants) while reducing greenhouse gas emissions (not strictly measured in the project, but a logical consequence with the reduction in chemicals used, labour and increased carbon sequestration).

Crucially for the farmers involved, yields have risen (from a 20% increase for lettuce to a 40% increase for peas), plant growth and disease resistance have improved, while labour and costs have gone down due to reductions in the use of pesticide, fertiliser and fuel. An extra job was also created, with a researcher being taken on board by a small / medium-sized business to further develop mycorrhiza application and marketing.

The project reached more than 6 000 people via workshops, conferences, talks, school visits, fairs and web page visits, while 15 people have also attended mycorrhiza courses since 2018. It has also helped to foster gender equality, actively promoting the participation of women and men in its activities, including workshops, training sessions, coordination and decision-making processes, with a focus on using gender-sensitive training materials and approaches.

As for the soil itself, there have been clear improvements in quality, structure, organic matter, organic carbon content, nutrient absorption, water uptake, and abiotic and biotic stress tolerance. While this was not measured per se in the project, improved soil arguably leads to healthier food being produced.

## Key lessons and recommendations

The project's early stages were difficult as many actors with different interests were involved. Furthermore, teaching people to move away from the use of chemicals in agriculture is problematic as attitudes are deeply rooted. New farming tools need to be explained with the use of concrete examples and proof, allowing farmers to see the results.

Chemicals are also very difficult to remove from the mindsets of farmers, who are constantly bombarded with information from chemical companies, with many of them preferring to follow the simpler path of purchasing chemicals rather than growing their own mycorrhizae. As such, young people have to be the main target of agriculture transformation in that they will have fewer ingrained ideas.

This could be seen in the way that people reacted when taught and shown directly what mycorrhizae do. The smell and flavour of the lettuce, tomatoes and other plants used to demonstrate the process were important tools in persuading farmers to avoid the use of unnecessary chemicals.

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### Additional information:

Mycorrhiza website: http://micorrizas.elcolletero.org/

Funded by the European Union