



# EU CAP Network Seminar 'Smart circular farming to address high energy and fertiliser prices'

6-7 December 2022  
Porto| Portugal



Funded by  
the European Union

# FERTIBIO

Elisa Pellegrino

EU CAP  
NETWORK



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**CROP SCIENCE  
RESEARCH CENTER**



**Sant'Anna**  
School of Advanced Studies – Pisa

# Microorganisms in Support of Agriculture: The FERTIBIO Project

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Web Site: <https://fertibio.ciatoscana.eu>

Socials: <https://www.facebook.com/Fertibio-102171111133459>

[https://www.instagram.com/fertibio\\_project/](https://www.instagram.com/fertibio_project/)



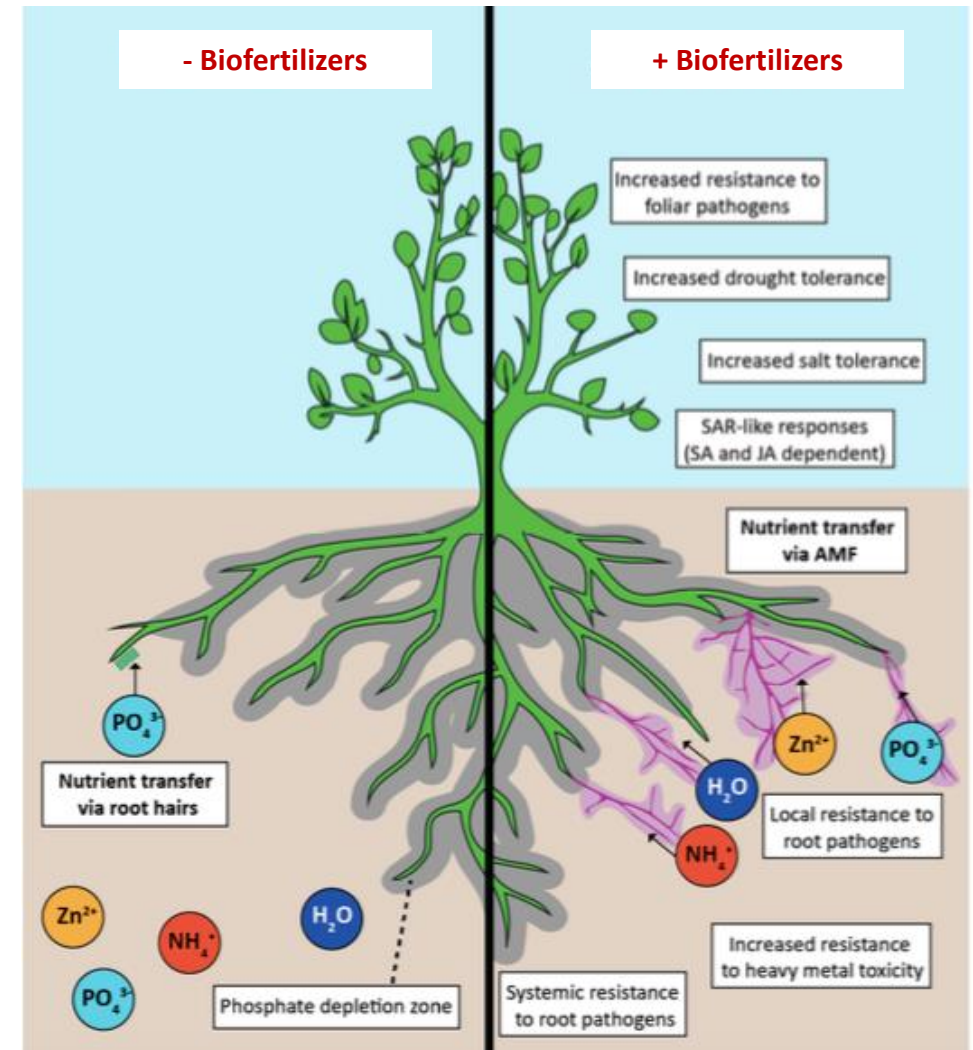
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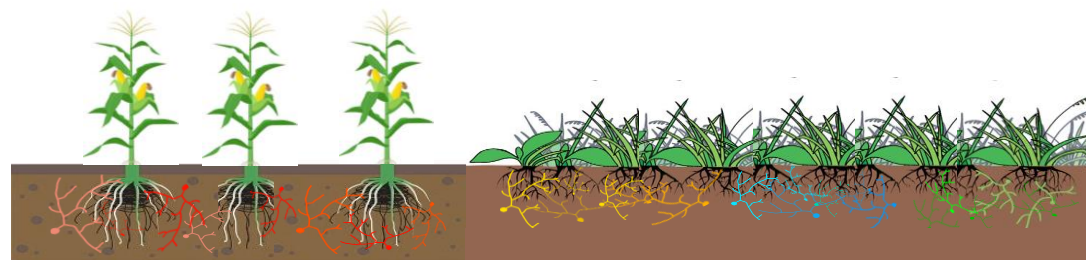


## Innovative biofertilizers

Development of the production process of biofertilizers and their application to different crops in Tuscany

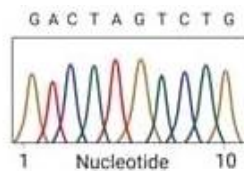
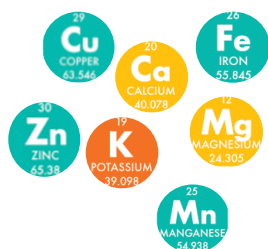


# Isolation of new strains of symbiotic fungi

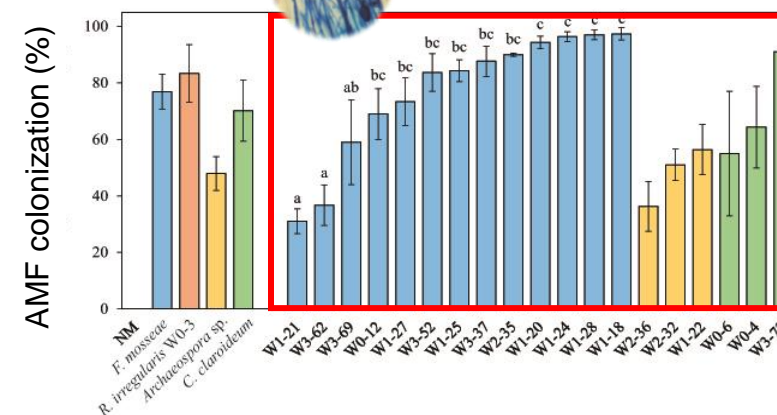
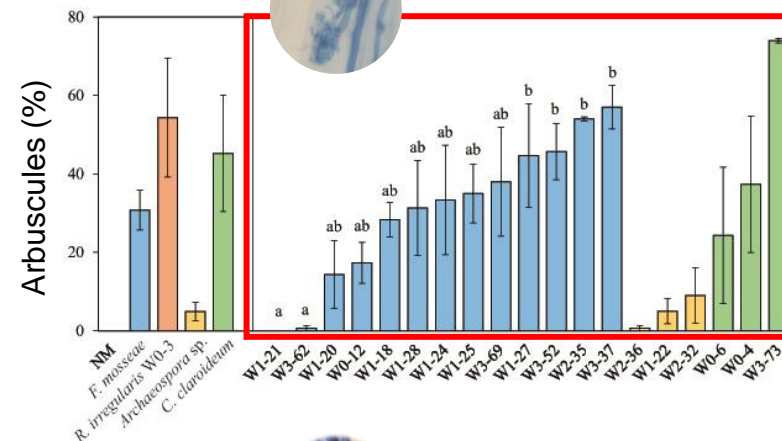


- *Funneliformis mosseae*
- *Rhizophagus irregularis*
- *Archaeospora* spp.
- *Claroideoglomus claroideum*

Fertility gradient

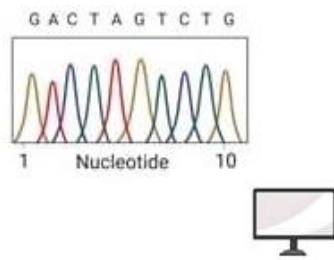
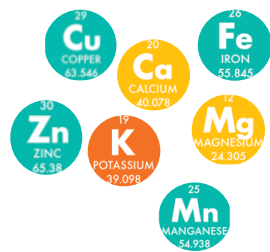
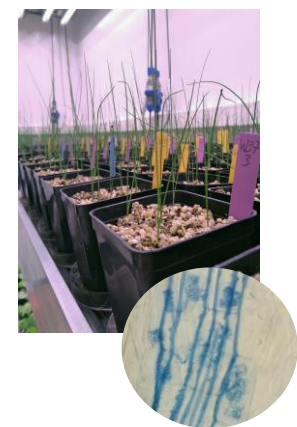
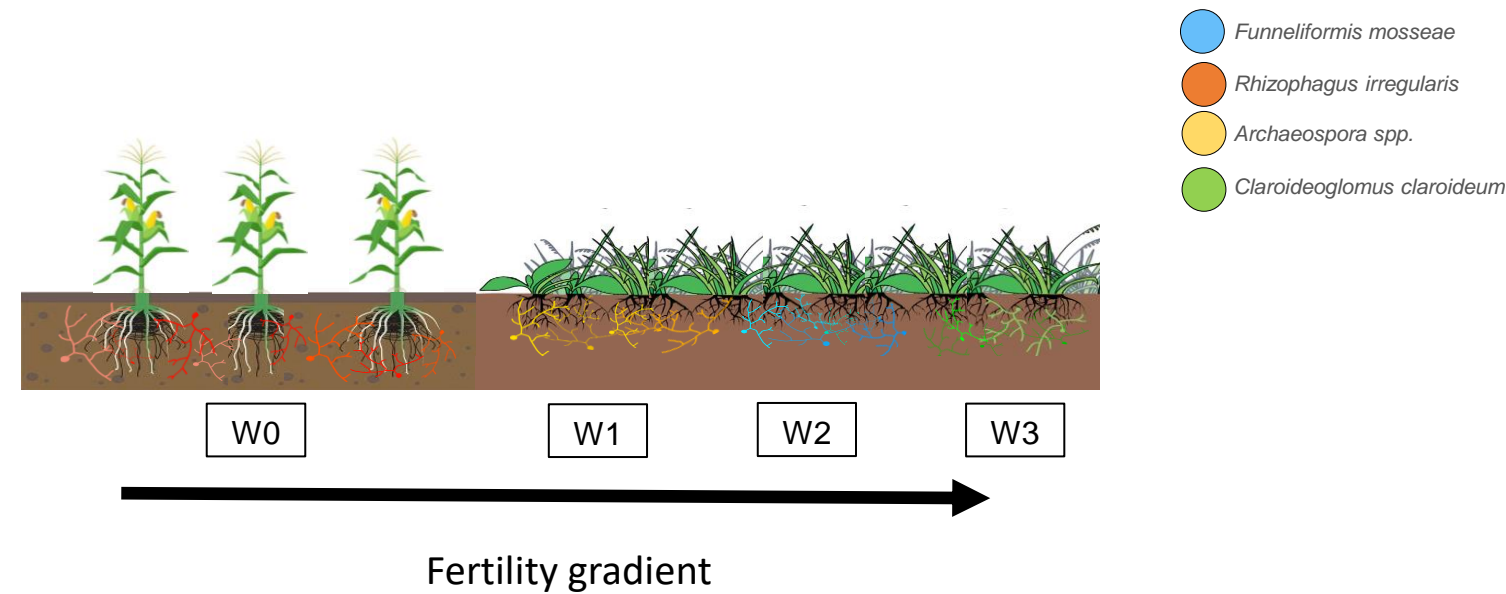


## Infectivity

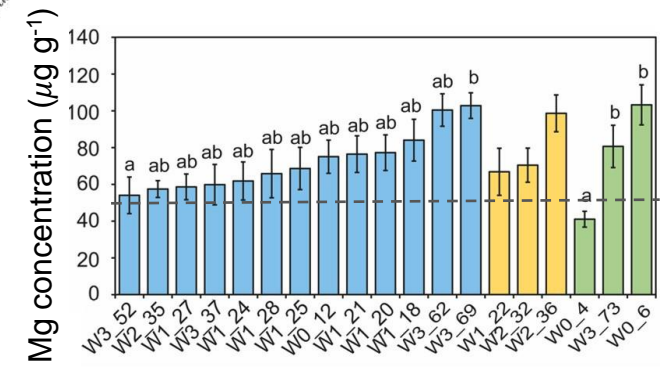
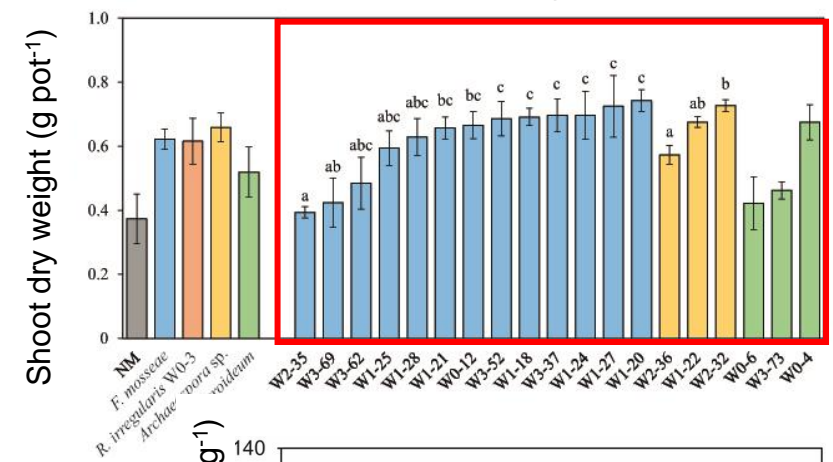


72 isolates from single spore molecularly characterized and analysed for infectivity and efficacy

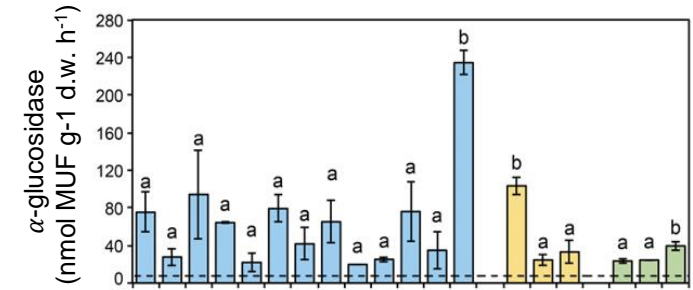
# Isolation of new strains of symbiotic fungi



## Efficacy



## C cycle



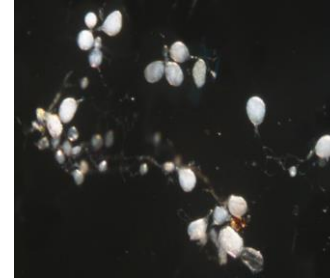
# Microbial bank



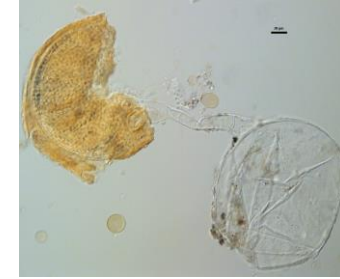
*Funneliformis mosseae* MD118, IT201



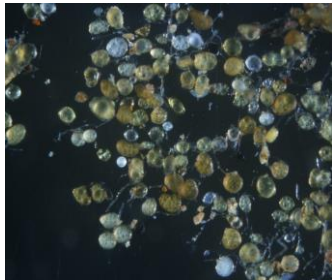
*Glomus versiforme* BR11A



*Acaulospora trappei* CR401



*Acaulospora leptoticha* NC171



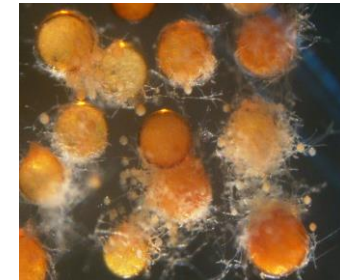
*Rhizophagus irregularis* DN201



*Glomus infrequens* CA203



*Redeckera* spp.



*Glomus globiferum* NM105

**100 isolates of Arbuscular Mycorrhizal Fungi (AMF)**



# Microbial bank



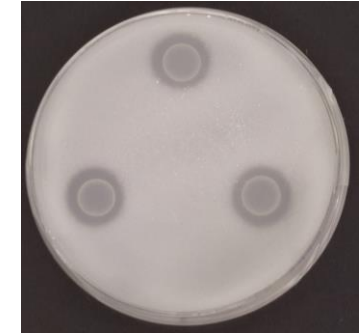
*Serendipita indica*



*Streptomyces rochei*



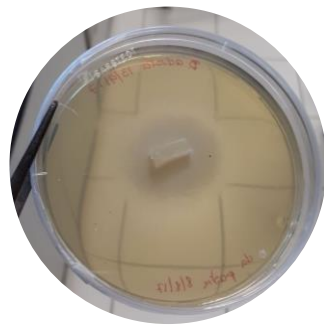
*Streptomyces chromofuscus*



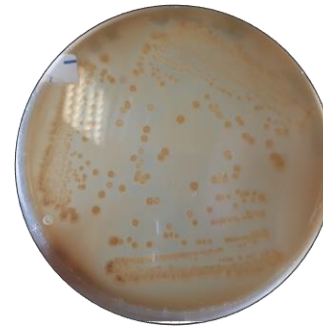
*Pseudomonas graminis* - PSB



*Trametes versicolor*



*Bjerkandera adusta*



*Amycolatopsis orientalis*



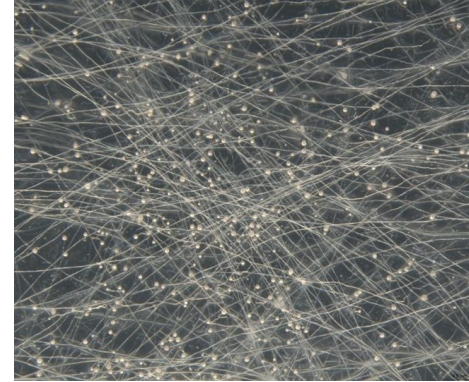
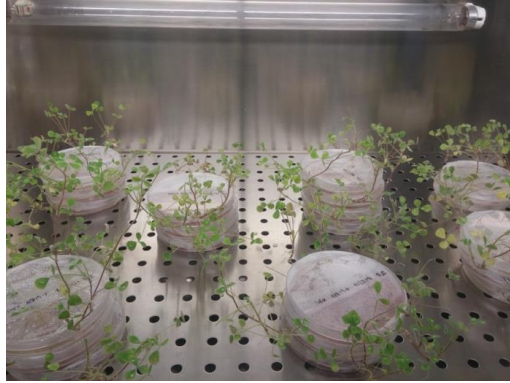
*Phanerochaete chrysosporium*

**50 strains of bacteria and other fungi**

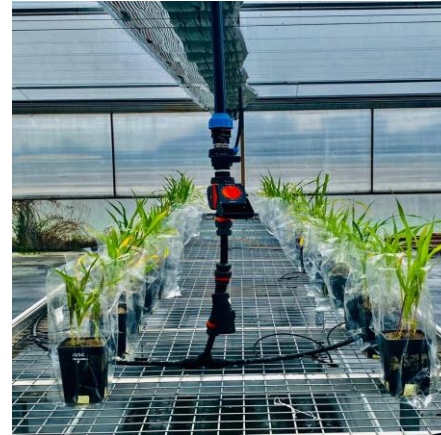


# Multiplication of microorganisms

## *In vitro*



## *In vivo*

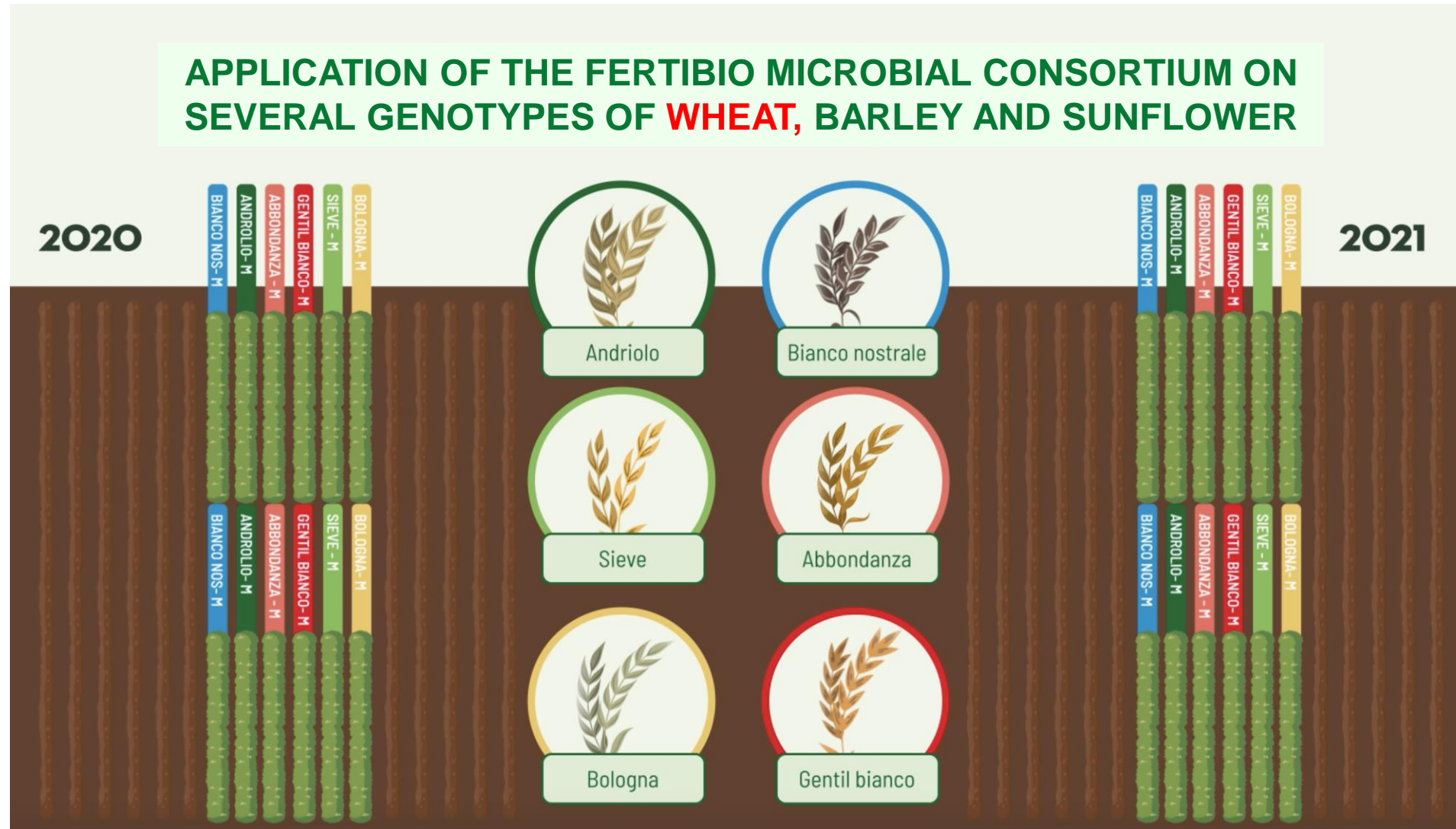


# Development of the **FERTIBIO** microbial consortium





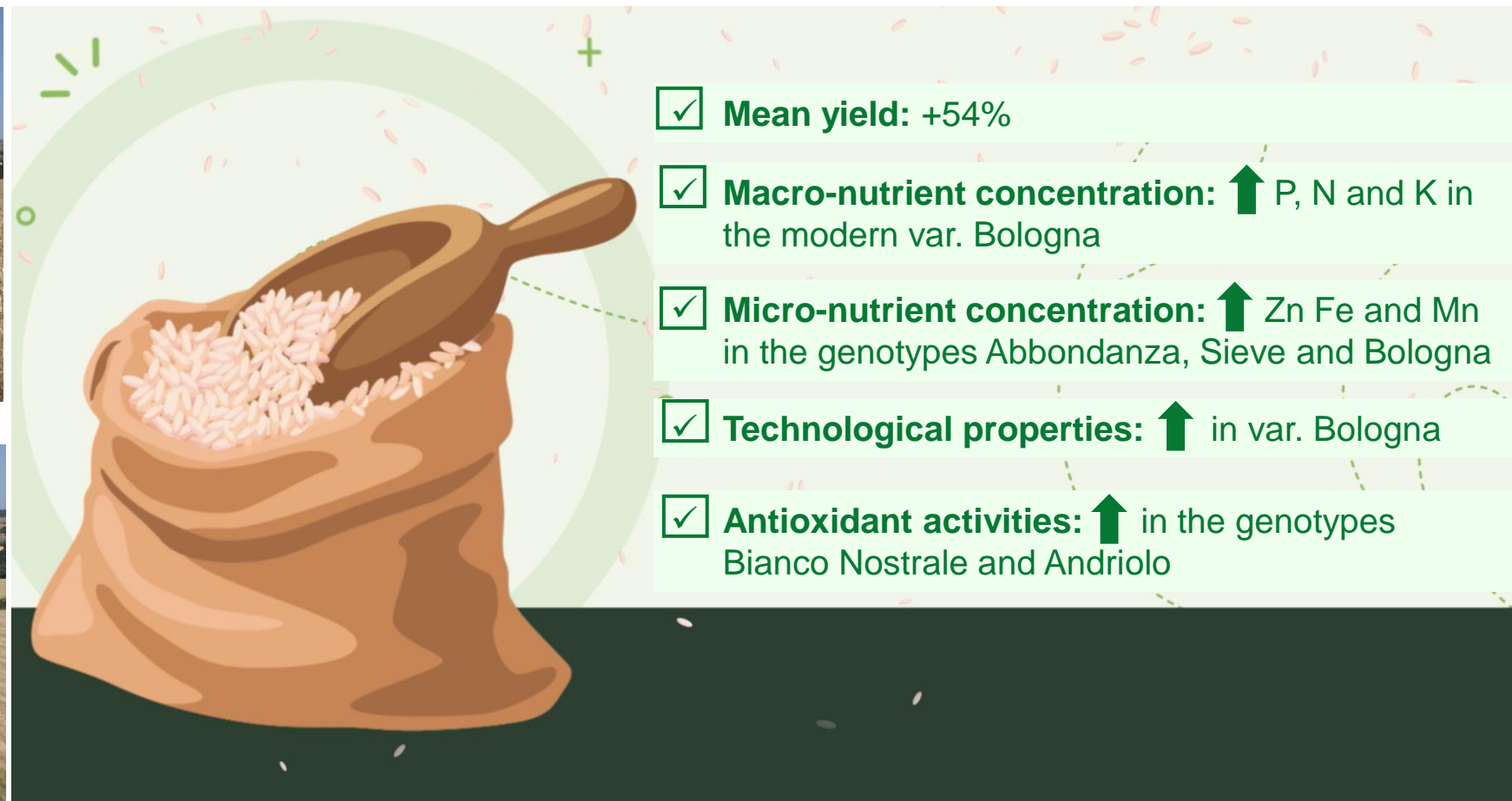
# Application of the FERTIBIO microbial consortium



Soil: silty clay. Rate of application of the AM fungal inoculum:  $0.24 \text{ g m}^2$  ( $2.4 \text{ kg ha}^{-1}$ )

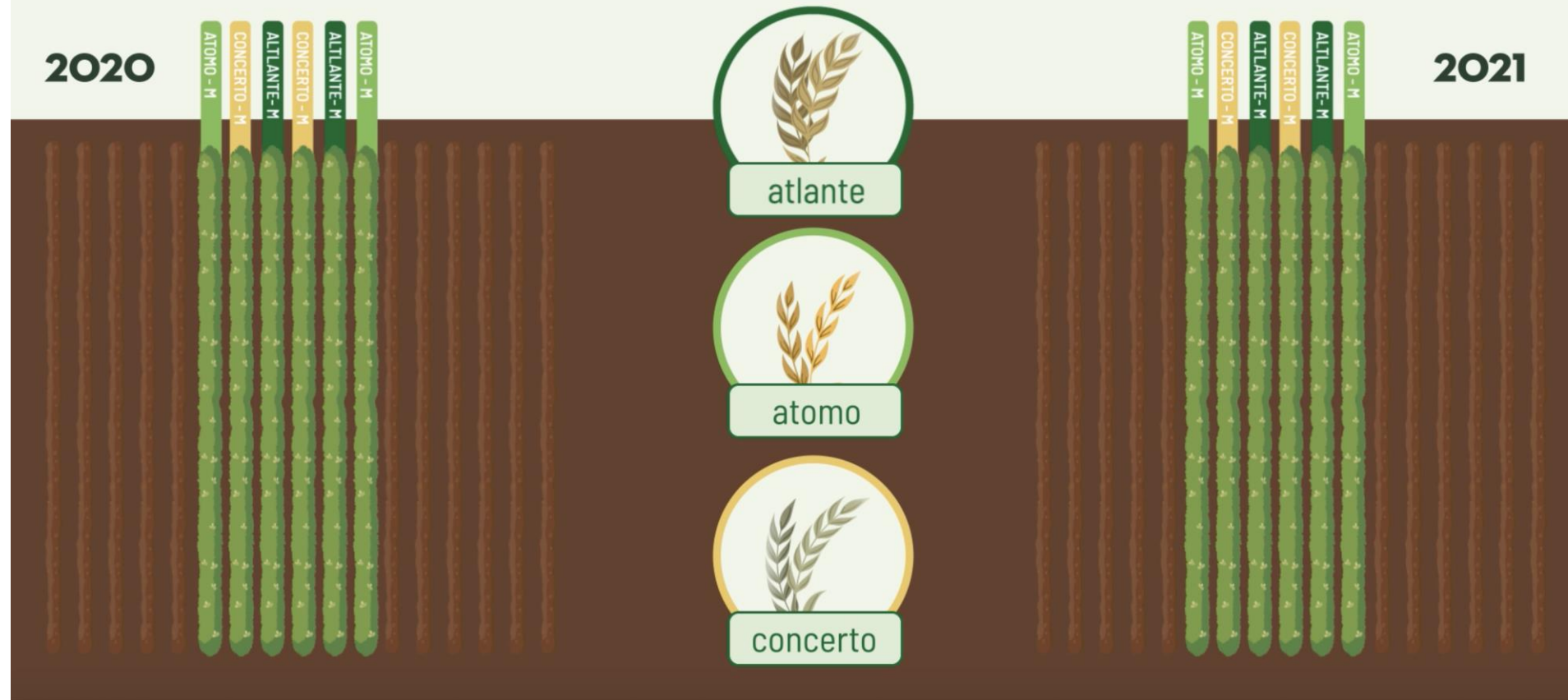


# Bread wheat - Results



# Application of the **FERTIBIO** microbial consortium

## APPLICATION OF THE FERTIBIO MICROBIAL CONSORTIUM ON SEVERAL GENOTYPES OF WHEAT, **BARLEY** AND SUNFLOWER

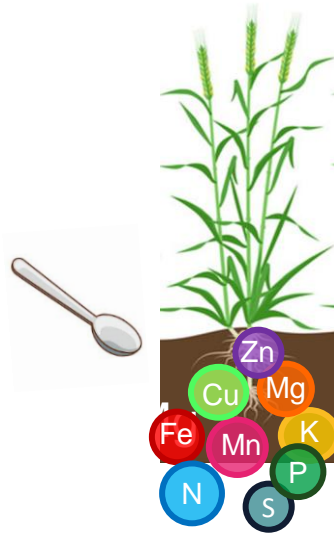


Soil: clay loam

Rate of application of AMF inoculum  
 $0.8 \text{ g m}^{-2}$  ( $8 \text{ kg ha}^{-1}$ )

Soil: silty clay loam

# Barley - Results



✓ **Mean yield:** +32%, +58% and +71% in Atomo, **Concerto** and Atlante

✓ **Nutrient concentration:** ↑ P, N, Zn, Fe, Ca, Mg, K, and Cu



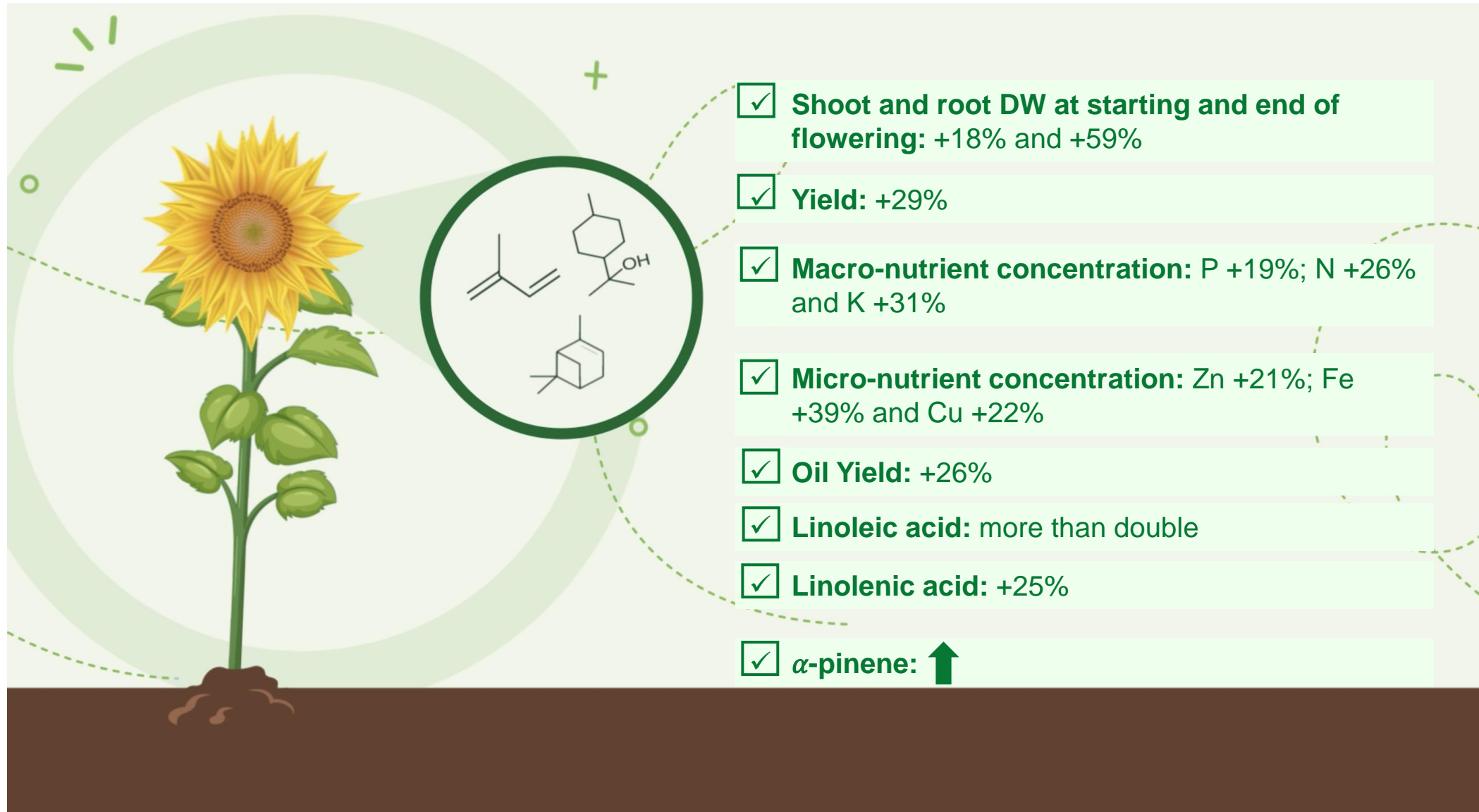
# Application of the **FERTIBIO** microbial consortium

## APPLICATION OF THE FERTIBIO MICROBIAL CONSORTIUM ON SEVERAL GENOTYPES OF WHEAT, BARLEY AND **SUNFLOWER**



- High-Oleic hybrid: Talento
- Distribution at the sowing of AM fungal mycorrhizal roots, spores and hyphal fragments ( $45000 \text{ spores ha}^{-1}$ )

# Sunflower - Results



# Recommendations for the application of microbial biostimulants

**Cropping system:** rotation, host crops, tillage and fertilization  
**Preliminary evaluations:** soil biological parameters

**Crop genotype/microorganism**  
**Functional complementarity**  
**within the microbial consortia**

Inoculation or  
not?

Soil fertility  
Soil microbial activity  
Mycorrhizal Infection Potential

How much?  
Rate

Type of microbial consortia  
Quality of carrier material  
Liquid or solid formulation

When?  
Time

Preseeding  
Seeding  
Topdressing

What?  
Formulation

Powder, Liquid or Pellet  
Carrier (e.g. lignite, zeolite)  
Shelf life of the formulate

How?  
Method of  
application

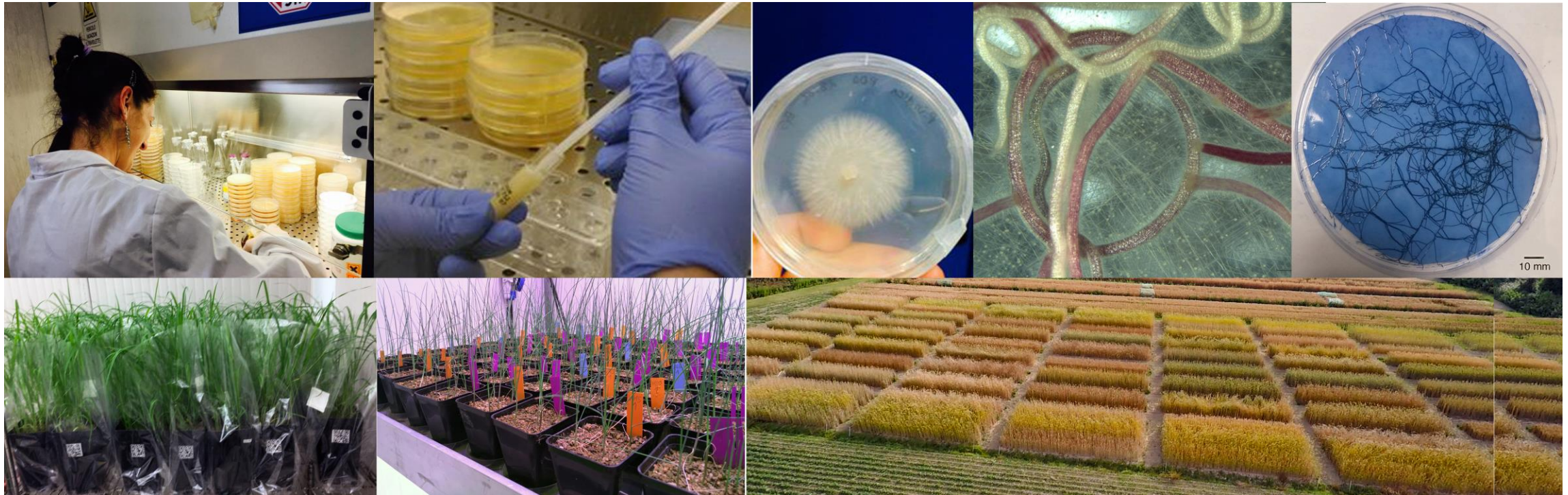
Soil: Broadcasting or Band placement  
Foliar  
Seed inoculation  
Seedling root dip



# Thanks for the attention



<http://www.santannapisa.it/it/personale/elisa-pellegrino>



<https://www.youtube.com/watch?v=mPq9Y19mzp4>  
Web Site: <https://fertibio.ciatoscana.eu>