The efficacy of MOLTRO, a new product based on *Bacillus atrophaeus* and plant-derived organic compounds on the mitigation of nutrient shortage effects.

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BACKGROUND

After 50 years of intensive agriculture we are witnessing fast soil depletion in a great part of arable lands in developed countries. According to Lal (2015) globally 33% of earth's land surface is affected by some type of soil degradation (physical, chemical or biological).

For this reason Green Has Italia has recently developed MOLTRO, a new product for the restoration of microbiota diversity of soil and for the improvement of nutrient use efficiency in those soils where the bioavailability of nutrients is limited due to the alteration of chemical, biological and physical equilibrium.

MOLTRO is a product based on *Bacillus atrophaeus* and high-value organic compounds (phenols, fatty acids and peptides) in liquid form. *Bacillus atrophaeus* is a plant growth promoting rhizobacterium that in previous studies (Reva et al, 2013) showed outstanding ability to colonize plant roots and stimulate plant growth.

METHODS

MOLTRO comes from an intensive development process that started in 2016.

- 2016-2017 **screening trials** carried out in **R&D facility of Green Has Italia** (growth chamber and greenhouse)
- 2017-2019 **field trials** in cooperation with **Agroservice R&S s.r.l.**, a C.R.O. specialized in field tests on mediterranean crops.
- 2019 **demo trials** in cooperation with **key-accounts** and **distributors**.

Experimental trials were conducted with a standardized trial design in order to evaluate:

- ✓ Efficacy on **yield and quality**
- ✓ Efficacy on **Nutrient Use Efficiency**
- ✓ Efficacy on **nutrient intake**

The product was tested in:

- ✓ Standard conditions
- ✓ Limited nutrient availability conditions

Nutrient supply	Product
100%	Untreated
	Plant-origin base (without *B. atrophaeus*)
	MOLTRO
25-50 %	Untreated
	Plant-origin base (without *B. atrophaeus*)
	MOLTRO

MOLTRO was applied at **15 l/ha** by **fertirrigation**

- 1 drench application at planting (3 ml/l)
- 4 drip applications with 15-20-day interval

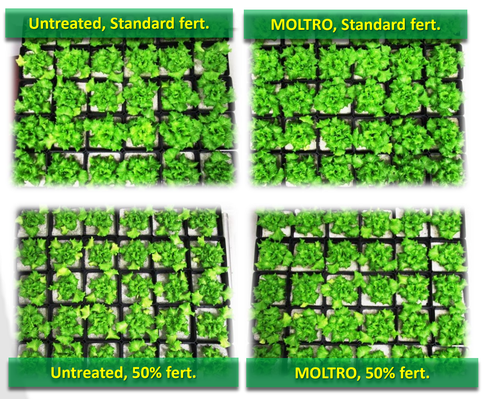
KEY FINDINGS

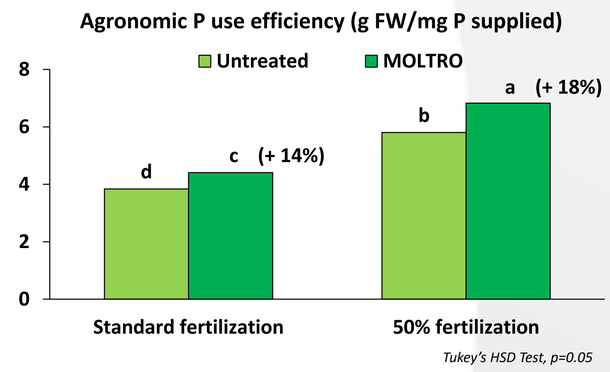
Trial on lettuce, 2017, growth-chamber (Green Has Italia R&D Dept.)

Aerial biomass (g/plant)

	Untreated	MOLTRO
Standard fertilization	89.2 b	**107.8 a**
50% fertilization	68.6 c	**83.3 b**

Tukey's HSD Test, p=0.05





Tukey's HSD Test, p=0.05

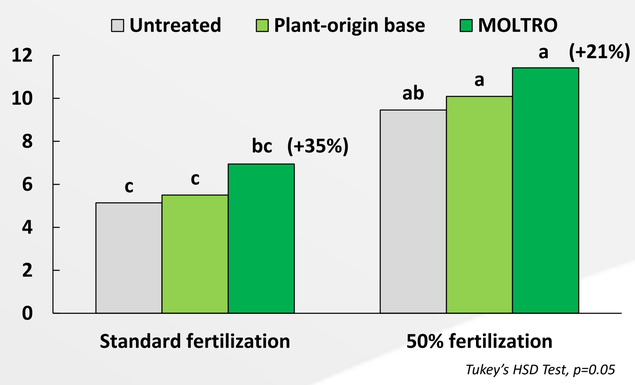
- ✓ **Mitigation of yield loss due to 50% reduction of nutrient supply**
- ✓ **Increase of NUE based on P supply (up to 18%)**

Trial on cucumber, greenhouse, Puglia - Italy 2018 (Agroservice R&S s.r.l.)

14 days cumulative YIELD (kg/m²)

	Untreated	Plant-origin base	MOLTRO
Standard fertilization	3.6 b	3.8 ab	**4.8 a**
50% fertilization	3.3 b	3.5 b	**4.0 ab**

Tukey's HSD Test, p=0.05



Tukey's HSD Test, p=0.05

- ✓ **Full recovery of yield loss due to 50% reduction of nutrient supply**
- ✓ **Increase of NUE based on P supply (up to 35%)**

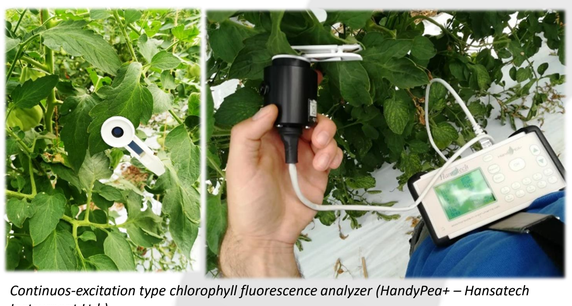
Trial on tomato, greenhouse, Veneto - Italy 2018 (Green Has Italia R&D Dept.)

Photosynthetic parameters - chlorophyll fluorescence

	Fv/Fm	RC/CSm	PI_{abs}
Untreated	0.847 b	1609 a	3.60 b
MOLTRO	**0.851 a**	**1698 a**	**4.39 a**

Tukey's HSD Test, p=0.05

- ✓ **Increase of performance index (PIabs)**
- ✓ **Improvement of plant performance and resilience even in stress conditions**



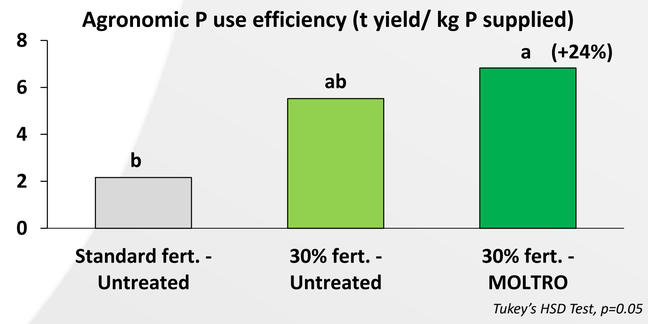
Continuos-excitation type chlorophyll fluorescence analyzer (HandyPea+ – Hansatech Instrument Ltd.)

Trial on eggplant, greenhouse, Puglia - Italy 2019 (Agroservice R&S s.r.l.)

25 days cumulative YIELD (kg/m²)

	Untreated	MOLTRO
Standard fertilization	1.32 a	-
30% fertilization	1.10 a	**1.25 a**

Tukey's HSD Test, p=0.05



Tukey's HSD Test, p=0.05

- ✓ **Mitigation of yield loss due to 30% reduction of nutrient supply**
- ✓ **Increase of NUE based on P supply by 24%**

Agronomic validation trials - Overview

Effects of MOLTRO on the test crops

Crop	# trials	Yield	NUE	Nutrient uptake	Photosynthetic efficiency
Lettuce	4	●	●	●	●
Tomato	3	●	●	●	●
Cucumber	2	●	●	●	●
Pepper	2	●	●		●
Eggplant	1	●	●		
Zucchini	1	●	●	●	
Strawberry	1	●			●
Melon	1	●	●		
Celery	1	●			

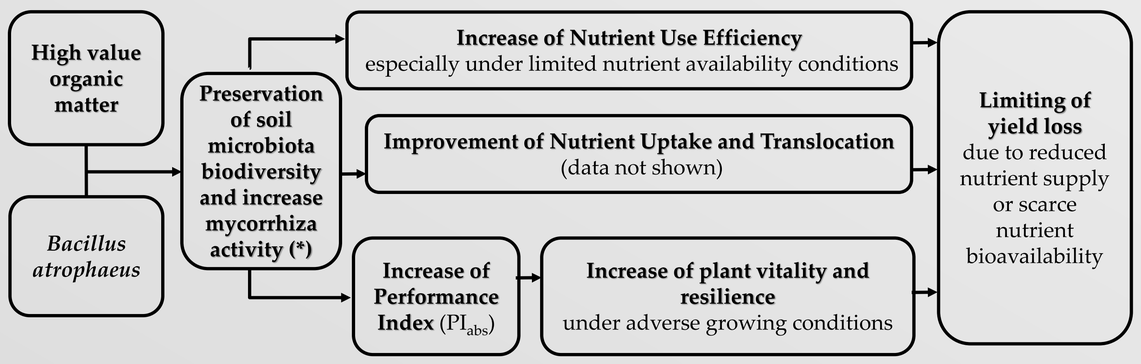
● : *positive effect confirmed*

● : *still under investigation*

Agronomic validation trials took place in 2019 under different growing conditions in Italy and Spain.

CONCLUSIONS

The efficacy of **MOLTRO** was tested for **3 years**, in different **vegetable crops**, under several cropping systems and conditions and the results obtained can be summarized as follows:



The efficacy of MOLTRO in perennial crops is still under investigation. Long-term trials are ongoing.

(*) for more information visit the poster*: The interaction of MOLTRO, a new product based on Bacillus atrophaeus and plant-derived organic compounds, with the microbiota of a natural soil in presence of tomato plants*

References:

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