

**28th International Symposium
of the International Scientific Centre for Fertilizers**

**Colonization with arbuscular mycorrhizal fungi
enhances growth and mineral acquisition by
tomato plants under normal and salinity stress
conditions**

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Papadopoulou K., Ehaliotis C.

This work was supported by General Secretariat for Research and Technology (GSRT) by the single
RTDI state aid action "RESEARCH - CREATE - INNOVATE" – [MIMIN MIS:5029903].



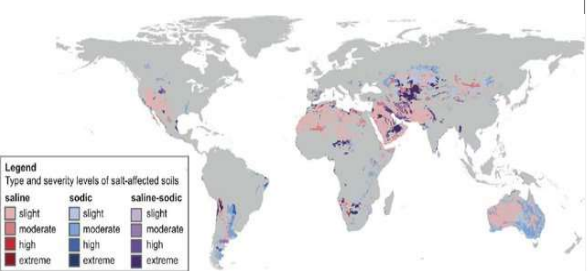
Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης

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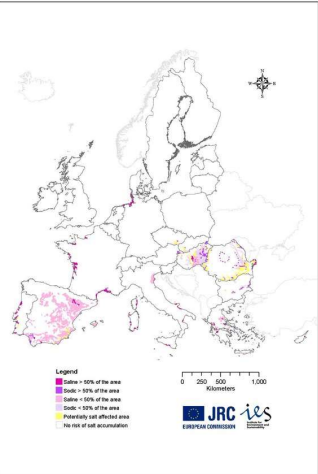
Salt affected land

- > 800 million ha
- 6% - of total land
- 20% - of arable land
- 1-2% per year
- $EC_e > 4 \text{ dS/m}$



Legend
Type and severity levels of salt-affected soils

saline	sodic	saline-sodic
slight	slight	slight
moderate	moderate	moderate
high	high	high
extreme	extreme	extreme



Legend
Saline > 50% of the area
Sodic > 50% of the area
Saline < 50% of the area
Sodic < 50% of the area
Potentially salt affected area
No data of salt accumulation

0 250 500 1,000
Kilometers

JRC EC 

Wicke. DOI: 10.1039/C1EE01029H

JRC. EC. <https://esdac.jrc.ec.europa.eu/>

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Salinity Stress

- Low osmotic potential of soil solution
- Nutritional imbalance
- Specific ion effect

- Leaf expansion ↓
- Leaf burning
- Chlorosis, Senescence
- Growth Rate ↓
- Photosynthesis rate ↓
- ROS Generation ↑↑



Lawrence, <https://www.agric.wa.gov.au/soil-salinity/dryland-salinity-extent-and-impact>

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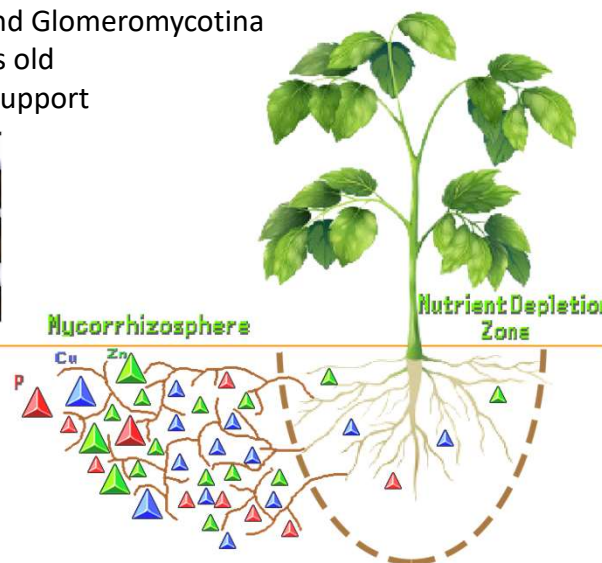
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Arbuscular mycorrhiza

- > 80% of land plants and Glomeromycotina
- 400 – 450 Million years old
- Important ecosystem support



<https://youtu.be/0oyqPZJj-2w>



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Beneficial Services

Plant physiology

- Mineral nutrient uptake from the soluble and insoluble pool (mainly P, Zn, Cu)
- More efficient nutrient and water uptake
- Enhanced resistance against abiotic stresses (drought, salinity, heavy metal toxicity)

Soil Ecological Interactions

- *Rhizobium* (+)
- Phosphate solubilizing bacteria (+)
- Root borne pathogens (–)

Soil Structure Engineering

- C-exudates
- Glycoproteins

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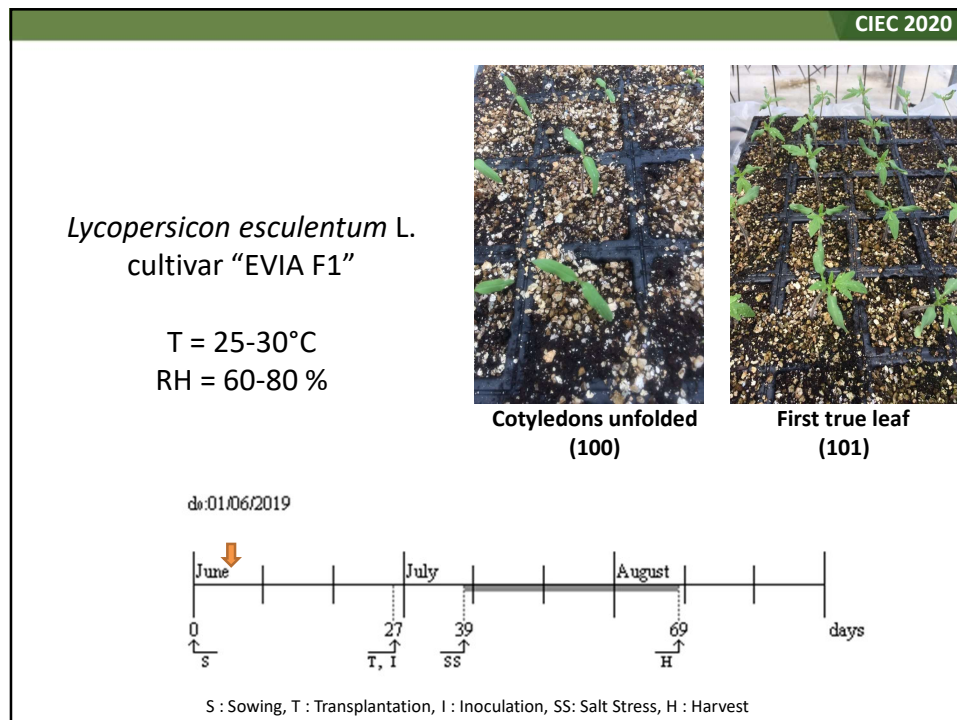
Purpose of Study

**Influence of the symbiosis on tomato plant performance
under normal and salinity stress conditions**

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Materials & Methods

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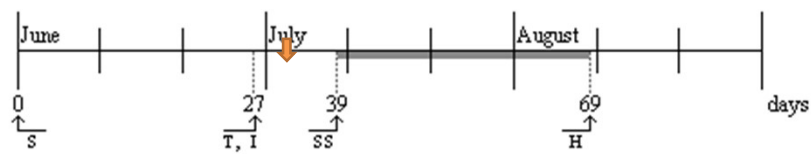


Third true leaf
(103)

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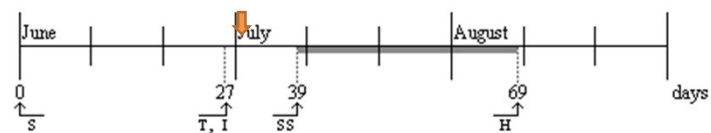
Funneliformis mosseae
Rhizophagus intraradices (DAOM 197198)

10 g of each inoculum
2:1 v/v sand : vermiculite medium (1.4 L pots)



S : Sowing, T : Transplantation, I : Inoculation, SS: Salt Stress, H : Harvest

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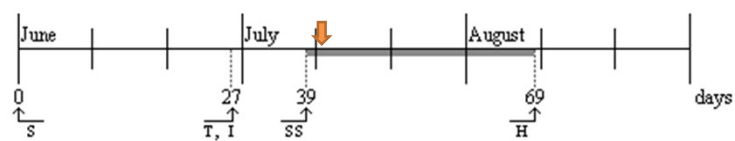


S : Sowing, T : Transplantation, I : Inoculation, SS: Salt Stress, H : Harvest

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Treatments

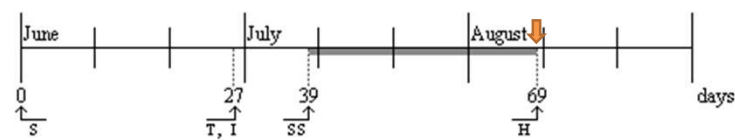
- Fourth true leaf (104)
 - One month of stress application by adding NaCl application to the irrigation water
 - 2 X 3 factorial
- Inoculation levels :* Control, *F. mosseae*, *R. intraradices*
Salinity Levels : 1.3, 6.5 (dS/m)



S : Sowing, T : Transplantation, I : Inoculation, SS: Salt Stress, H : Harvest

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- Plant Growth Variables
- Photosynthesis rate, Transpiration Rate, Stomatal conductance
- Leaf RWC (%)
- Leaf Nutrients
- AMF Colonization (%)

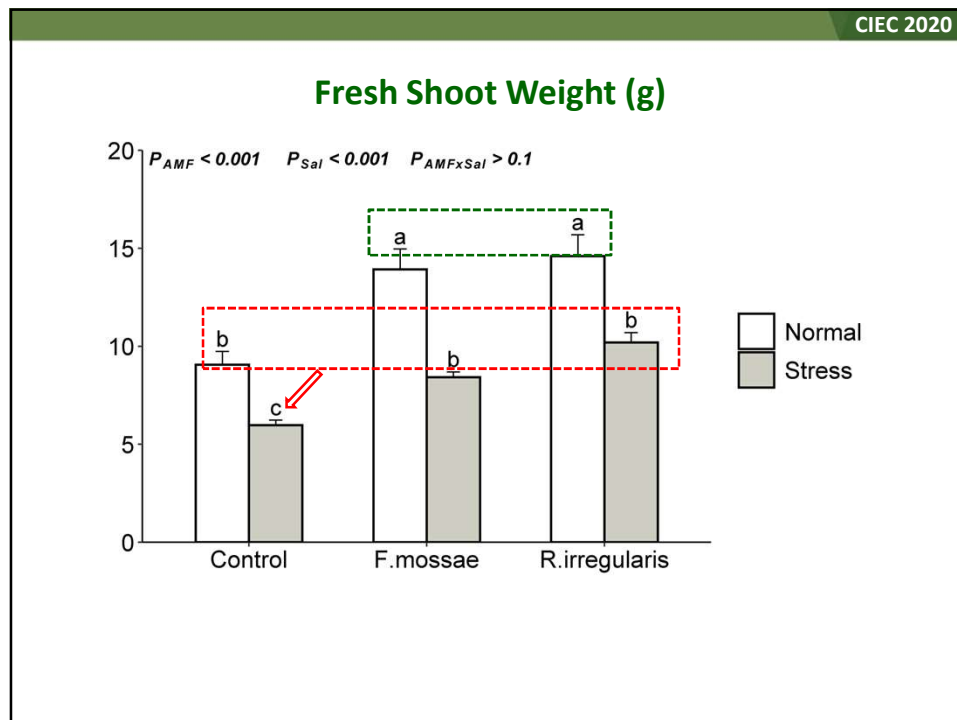


S : Sowing, T : Transplantation, I : Inoculation, SS: Salt Stress, H : Harvest

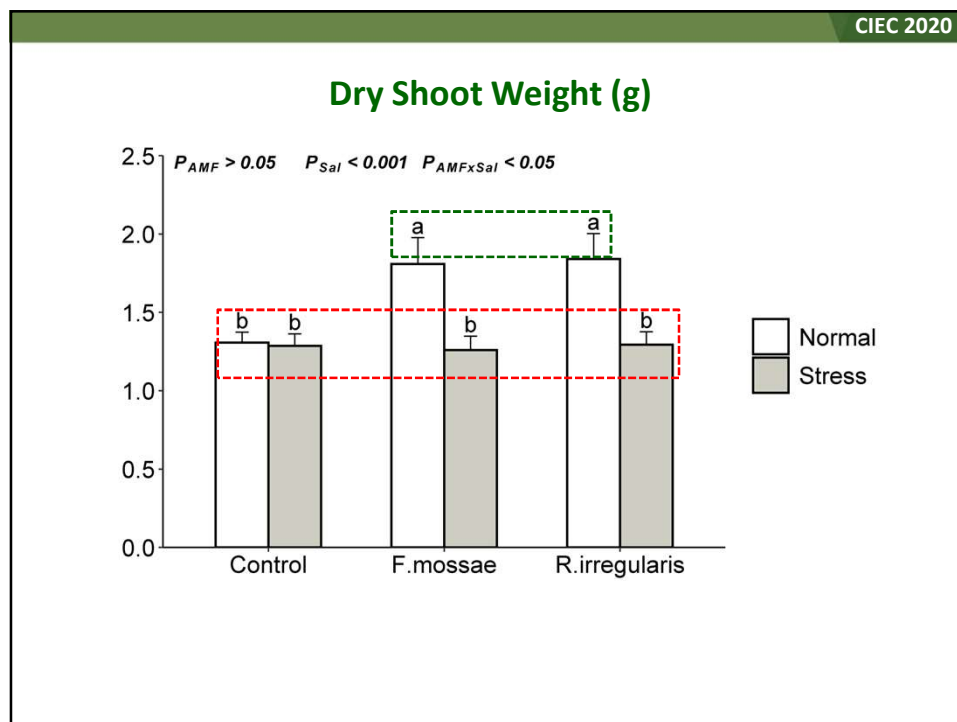
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Results

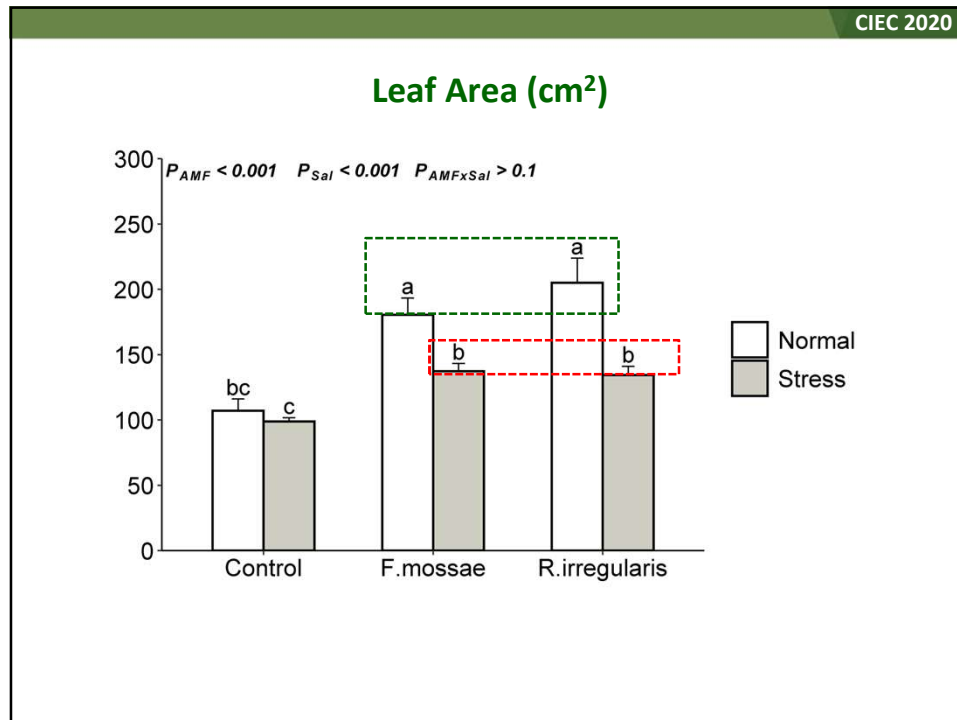
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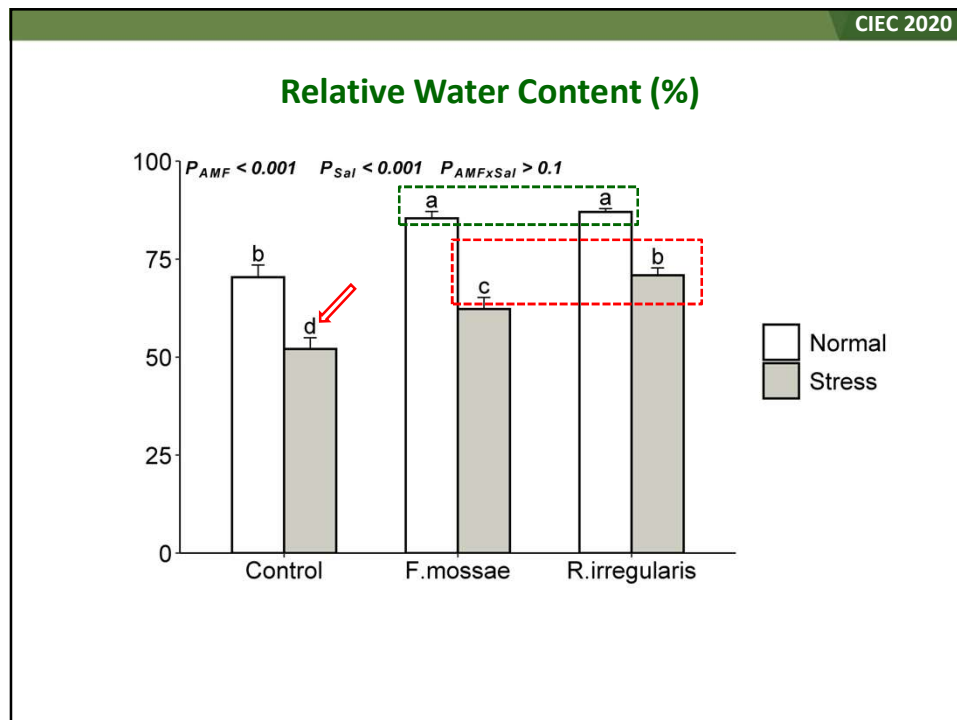
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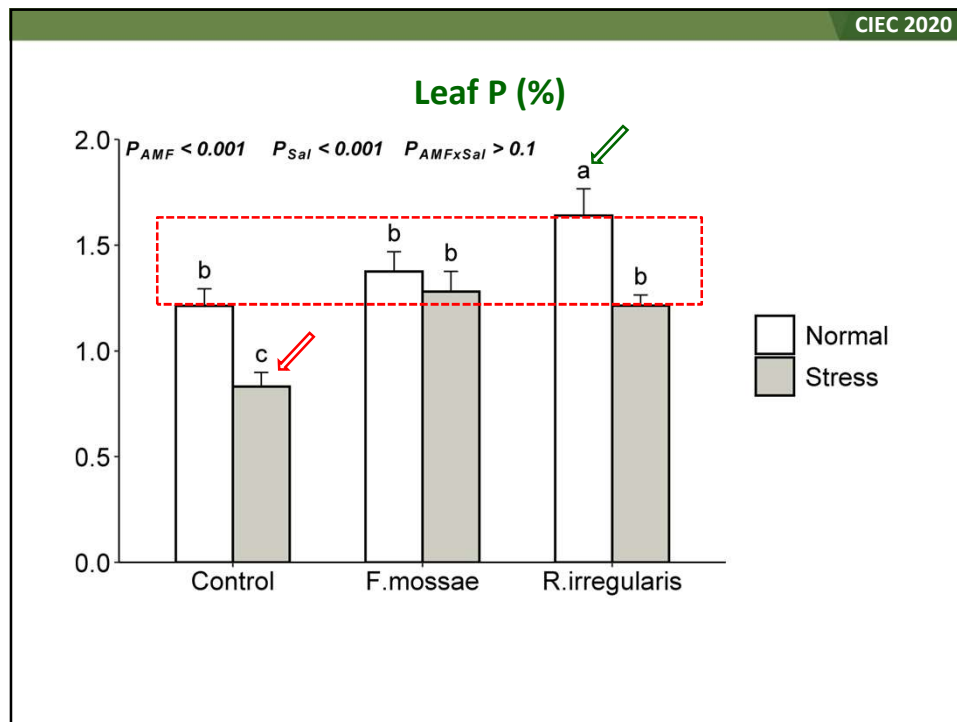
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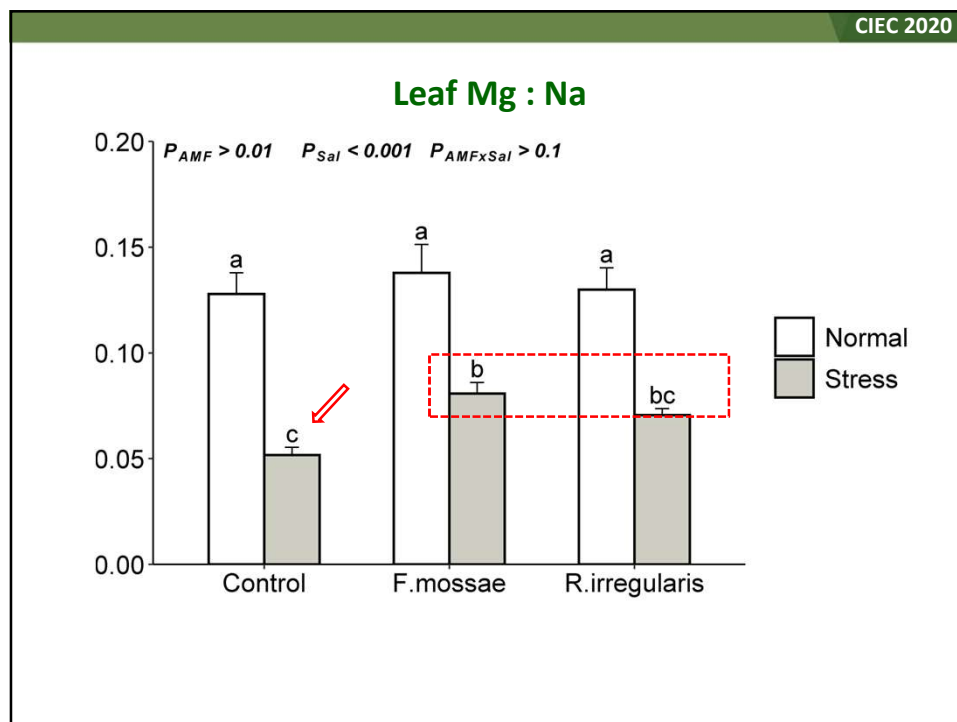
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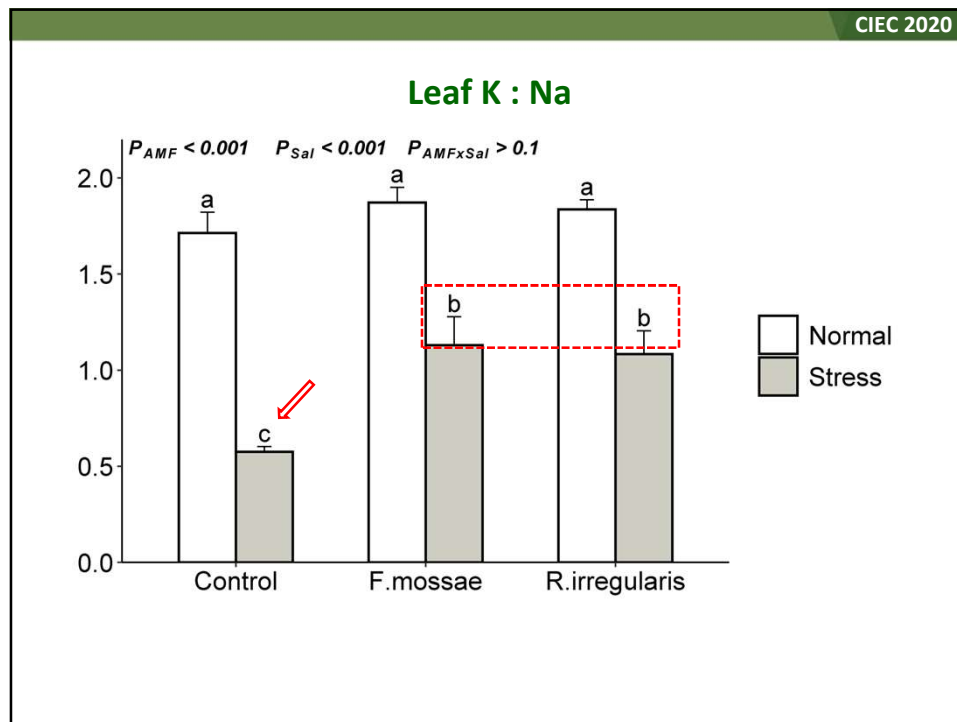
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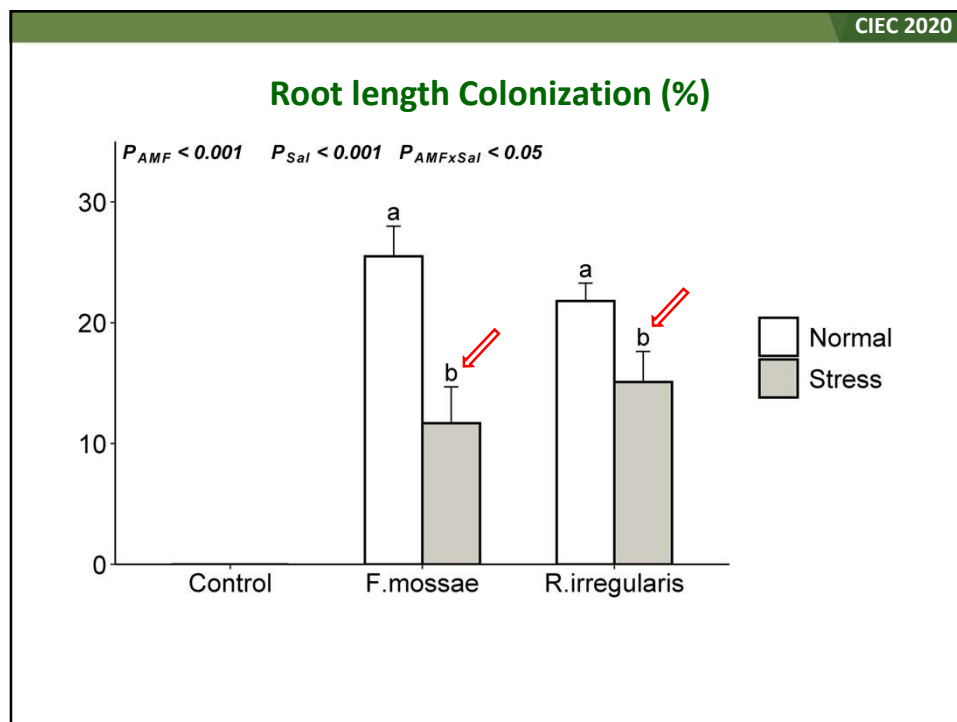
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Discussion

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- Salinity impaired performance in non-mycorrhizal plants
- Inoculated non-stressed plants
 - Shoot fresh weight ↑
 - Leaf Area ↑
 - Leaf P ↑
 - RCW ↑
 - Photosynthesis rate ↑
 - Shoot dry weight ↑
- Inoculated stressed plants
 - Shoot fresh weight ↑
 - Leaf Area ↑
 - Leaf P ↑
 - RWC ↑
 - K:Na ↑
 - Mg:Na ↑
- Salinity reduced AMF Colonization

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¿Premature Flowering?

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Conclusions

- Inoculation with AMF improves plant fitness under normal and salinity stress conditions via combined effects leading to improved:
 - Water Relations ↑
 - Growth ↑
 - Nutrient Uptake, Balance ↑
- Use of AMF as biofertilizers of tomato plants is very promising

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¡Thank you for your attention!

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ΕΛΛΗΝΙΚΗ ΓΡΑΜΜΑΤΕΙΑ ΕΤΠΑ & ΠΕ
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ΕΡΕΥΝΑΣ ΚΑΙ ΤΕΧΝΟΛΟΓΙΑΣ



ΕΥΜ
ΕΛΟΚ



ΕΠΑνΕΚ 2014-2020
ΕΠΙΧΕΙΡΗΣΙΑΚΟ ΠΡΟΓΡΑΜΜΑ
ΑΝΤΑΓΩΝΙΣΤΙΚΟΤΗΤΑ
ΕΠΙΧΕΙΡΗΜΑΤΙΚΟΤΗΤΑ
ΚΑΙΝΟΤΟΜΙΑ



ΕΣΠΑ
2014-2020
ανάπτυξη - εργασία - αλληλεγγύη

Με τη συγχρηματοδότηση της Ελλάδας και της Ευρωπαϊκής Ένωσης