Microbial Bio-Effectors improve the Yield of Tomato Production with Organic Fertilization

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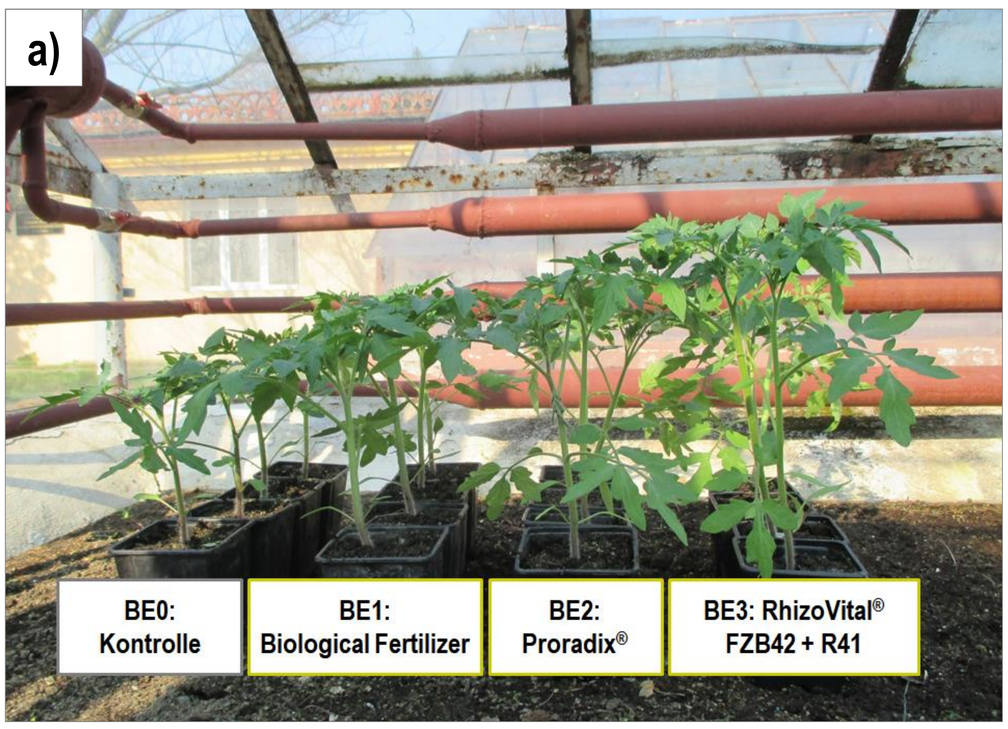
Introduction

- A major challenge in organic vegetable production is the optimized adaptation of nutrient supply from soils or organic fertilizers to the crop demand.
- Plant growth-promoting rhizosphere microorganisms can improve nutrient acquisition and plant growth by numerous interactions, such as: (i) promotion of root growth and mycorrhization, (ii) mobilisation of sparingly soluble mineral nutrients in soils, (iii) increased tolerance against abiotic stress factors, and (iv) pathogen antagonisms.

Therefore, the application potential of microbial inoculants (Bio-Effectors) in combination with organic fertilizers was tested over four years in commercial greenhouse production trials with tomato in Romania.

Nursery Culture of Tomato Plants



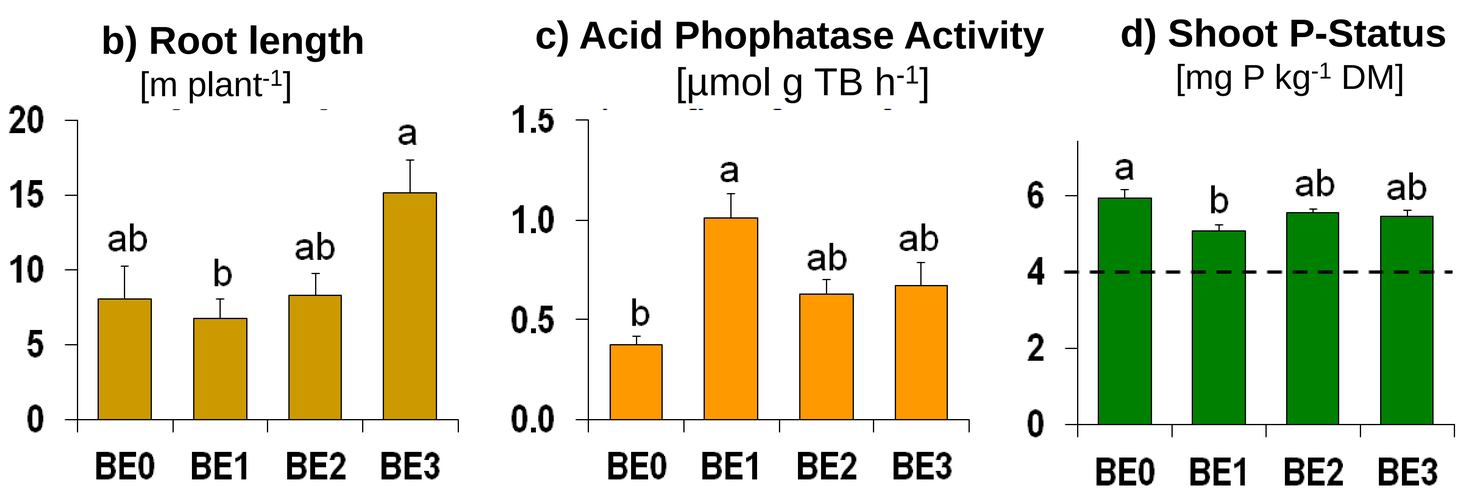


Fig. 1: (a) Shoot growth, (b) Total root length (c) Rhizosphere acid phosphatase-activity (d) Shoot phosphate concentratio (Shoot P-Status) of Tomato plants by the end of the nursery phase (March 2015).
(------ = P deficiency threshold, shoot tissue tomato)

Greenhouse Culture of Tomato Plants – Production phase

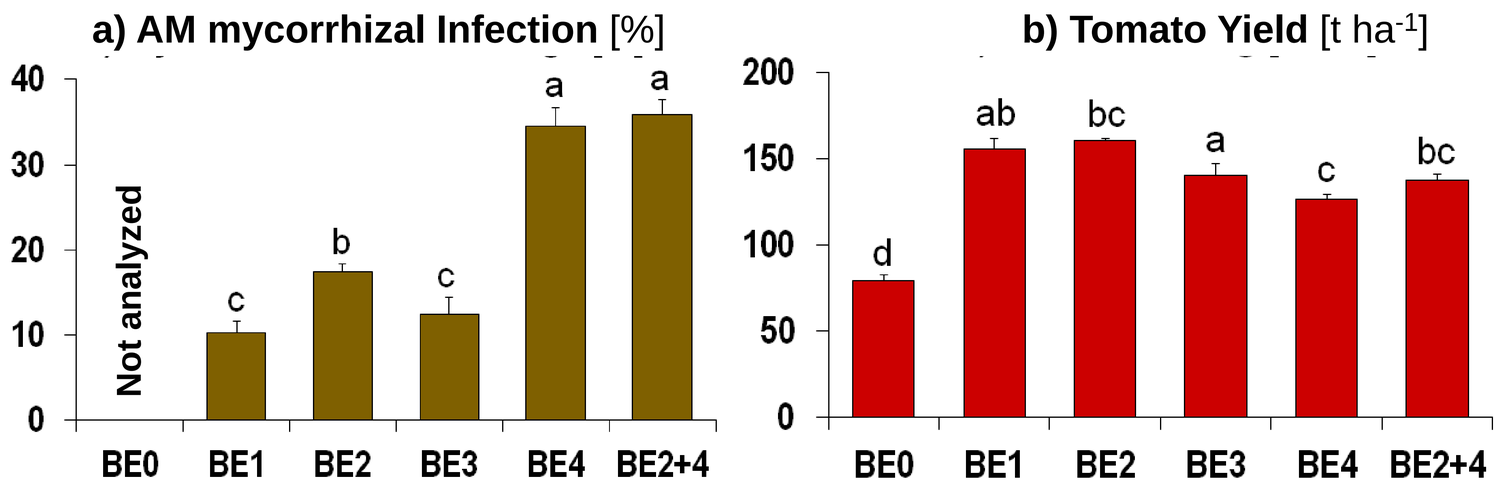


Fig. 2: (a) AM infected root length [%, (b) Total tomato yield (c) Culture system, growth period 2015. (BE0 = untreated control)

Experimental

Crop: Tomato (*Lycopersicum esculentum* Mill.) var. Primadona, Hazera, Israel
Nursery substrate: 45 % composted cow manure, 30 % garden soil 15 % peat, 10 % Ssnd
Greenhouse culture: Vertisol, clay loam, pH 6.7, 55 mg P(CAL) 100 g^{-1} soil (very high)
Fertilization: 100 t fresh cow manure ha^{-1} (70 % of farmer´s practice)

BE application (cfu)		
Product name, Producer And microbial BE strains	1.. Drench application Nursery phase	2. Drench application Transplanting
BE1: Proradix® WP, *Pseudomonas* DSMZ 13134	$2.6*10^8$ cfu $Plant^{-1}$	$3.3*10^9$ cfu $Plant^{-1}$
BE2: RhizoVital® *Bacillus* FZB42 + R41	je $2.0*10^8$ Spores $Plant^{-1}$	je $2.5*10^9$ Spores $Plant^{-1}$
BE3: Biological Fertilizer, *Penicillium bilaii*	$1.0*10^7$ Spores $Plant^{-1}$	$1.3*10^8$ Spores $Plant^{-1}$
BE4: Vitalin AM-Inoculum, *Glomus intraradices*	No application	17 Spores $Plant^{-1}$

Conclusions

- Plant growth promotion by all BE products already during the nursery phase (Fig. 1a).
- BEs selectively influenced root growth (Fig 1b), Rhizosphere acid phosphatase (Fig. 1c) and AM mycorrhizal root colonization (Fig. 2a).
- During the nursery phase BE-induced plant growth promotion could not be related with nutrient availability (e.g. P status Fig. 1d).
- During three years field testing, BE applications induced a reproducible yield increase of 70% on average, with an average economic benefit of 35200 €/ha

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