**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**

**Greenhouse Culture of Tomato Plants – Production phase**

**Experimental**

Crop: Tomato (Lycopersicum esculentum Mill.) var. Primadona, Hazera, Israel

Nursery substrate: 45 % composted cow manure, 30 % garden soil 15 % peat, 10 % Ssand

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)**

<table>
<thead>
<tr>
<th>Product name, Producer And microbial BE strains</th>
<th>1. Drench application Nursery phase</th>
<th>2. Drench application Transplanting</th>
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</thead>
<tbody>
<tr>
<td>BE1: Proradix® WP, Pseudomonas DSMZ 13134</td>
<td>2.6*10⁶ cfu Plant⁻¹</td>
<td>3.3*10⁶ cfu Plant⁻¹</td>
</tr>
<tr>
<td>BE2: Rhizovital® Bacillus FZB42 + R41</td>
<td>je 2.0*10⁶ Spores Plant⁻¹</td>
<td>je 2.5*10⁶ Spores Plant⁻¹</td>
</tr>
<tr>
<td>BE3: Biological Fertilizer, Penicillium bilaii</td>
<td>1.0*10⁹ Spores Plant⁻¹</td>
<td>1.3*10⁹ Spores Plant⁻¹</td>
</tr>
<tr>
<td>BE4: Vitalin AM-Inoculum, Glomus intraradices</td>
<td>No application</td>
<td>17 Spores Plant⁻¹</td>
</tr>
</tbody>
</table>

**Fig. 1:** (a) Shoot growth, (b) Total root length (c) Rhizosphere acid phosphatase-activity (d) Shoot phosphate concentration (Shoot P-Status) of Tomato plants by the end of the nursery phase (March 2015).

--- = P deficiency threshold, shoot tissue tomato

**Fig. 2:** (a) AM infected root length [%], (b) Total tomato yield [t ha⁻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