

# Management of Wilt Diseases on Tomato by Organically Acceptable Methods

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## SUMMARY

Soilborne wilt disease caused by fungal pathogen *Verticillium* spp, *Fusarium* spp and bacterial pathogen *Ralstonia solanacearum* often cause serious losses to tomato growers either by stunting or totally killing the plants prematurely. Rotation and chemical fumigation of soil is not feasible to many growers either due to limited farm size or organic growing conditions. Biofumigation and/or biologically based options for managing these pathogens are critical needs to these growers. On-farm trials were conducted at grower cooperators' fields with heirloom tomato 'Mortgage lifter' to investigate the efficacy of bio-fumigants, biological antagonists, and resistant rootstock in managing wilt disease, and demonstrate results to tomato growers. Thirty five days after planting in contaminated soil, grafted (on resistant rootstock "Maxifort") tomato plants showed significantly higher plant vigor compared with non-treated check. All treatments had significantly lower symptomatic leaves than that of non-treated check at 35 days after planting. Cumulative harvests for six weeks showed that yield from all treatments except mustard cover crop were significantly ( $P < 0.001$ ) higher compared with non-treated check in the 1<sup>st</sup> year. However, in the 2<sup>nd</sup> year all treatments had higher yield compared to non-treated check. Grafted plants produced ~20 lb tomatoes/plant compared with only 11 lbs by non-treated check. Results suggest that organically acceptable methods can provide significant yield advantage to heirloom tomatoes in soilborne pathogen infested soil. A total of 120 farmers reported changes in knowledge, attitudes, skills and/or awareness from which 35 adopted grafted tomato and bio-fumigation for managing soilborne tomato diseases as a result of outreach activities.

## MATERIALS AND METHODS

**Variety: Heirloom tomato 'Mortgage Lifter'**

**Trt 1** - Non-treated 'Mortgage Lifter'

**Trt 2** - Mustard was seeded on April 28 and allowed to grow until flowering (Fig. 1). The mustard was then incorporated into the soil (Fig. 2) and covered with plastic in order to trap the gas (isothiocyanate) released during breakdown of tissues.

**Trt 3** - Mustard meal incorporated as pre-plant soil treatment and watered to activate the release of gas similar to treatment 1.

**Trt (4+5)** - Serenade & Prestop soil bio-fungicide was used for seed treatment, mixed with seedling growing medium and also used in the seedling planting holes as suspension (Table 1).

**Trt 6** - Grafted plants - 'Mortgage Lifter' grafted onto the Maxifort (F1) rootstock three weeks prior to transplanting. Treatments were replicated four times in a RCBD. Each plot had three plants in a 12' bed in each replicate. Plots were sprayed with *Verticillium inoculum* @  $2.49 \times 10^5$  cfu/ml followed by laying plastic mulch. Tomatoes were harvested weekly until frost for cumulative yield/plot.

# of symptomatic leaves/plant were counted and averaged for individual plot\*\*



## RESULTS

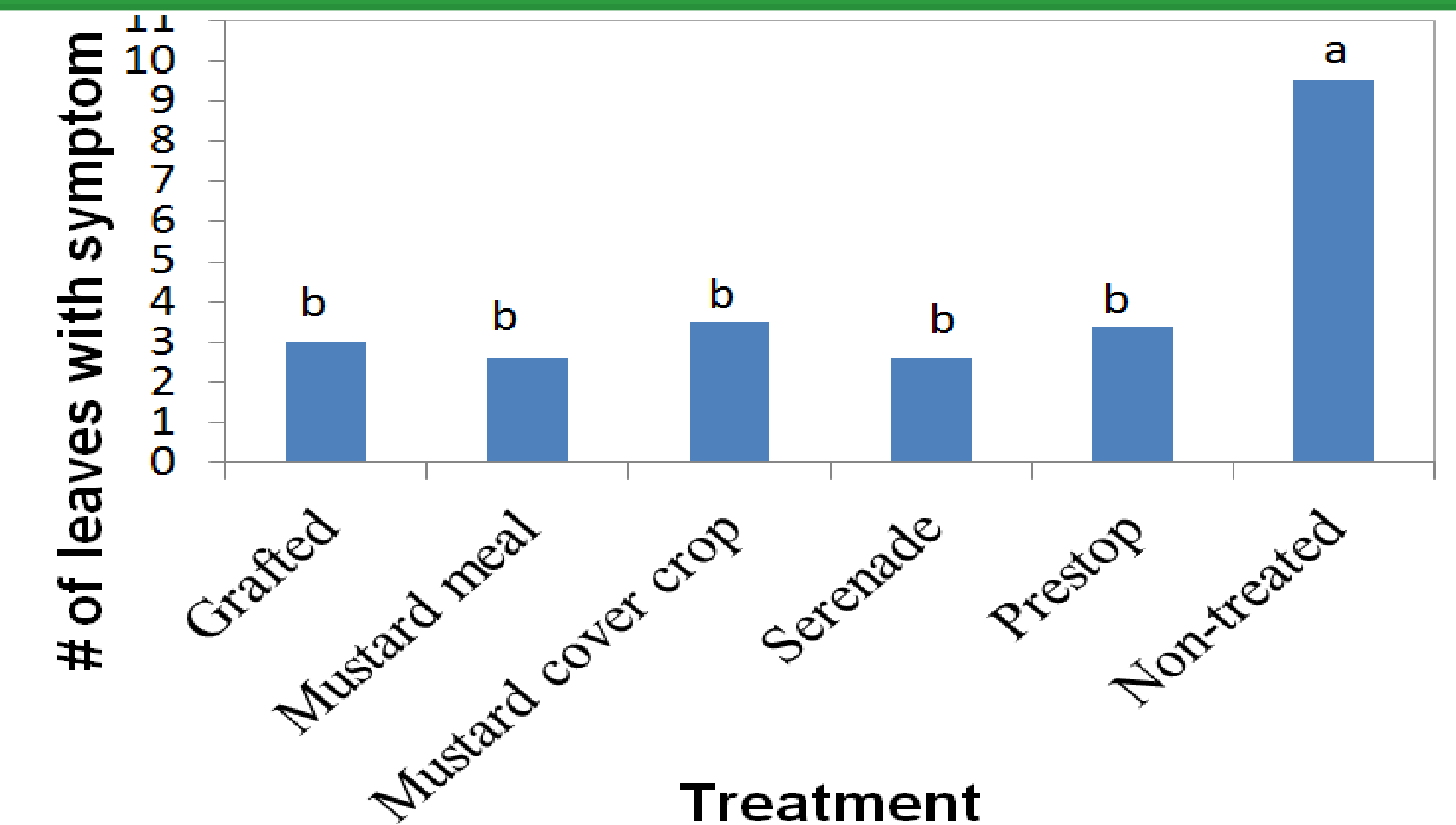


Fig. 3. Suppression of *Verticillium* wilt by different treatments compared with non-treated

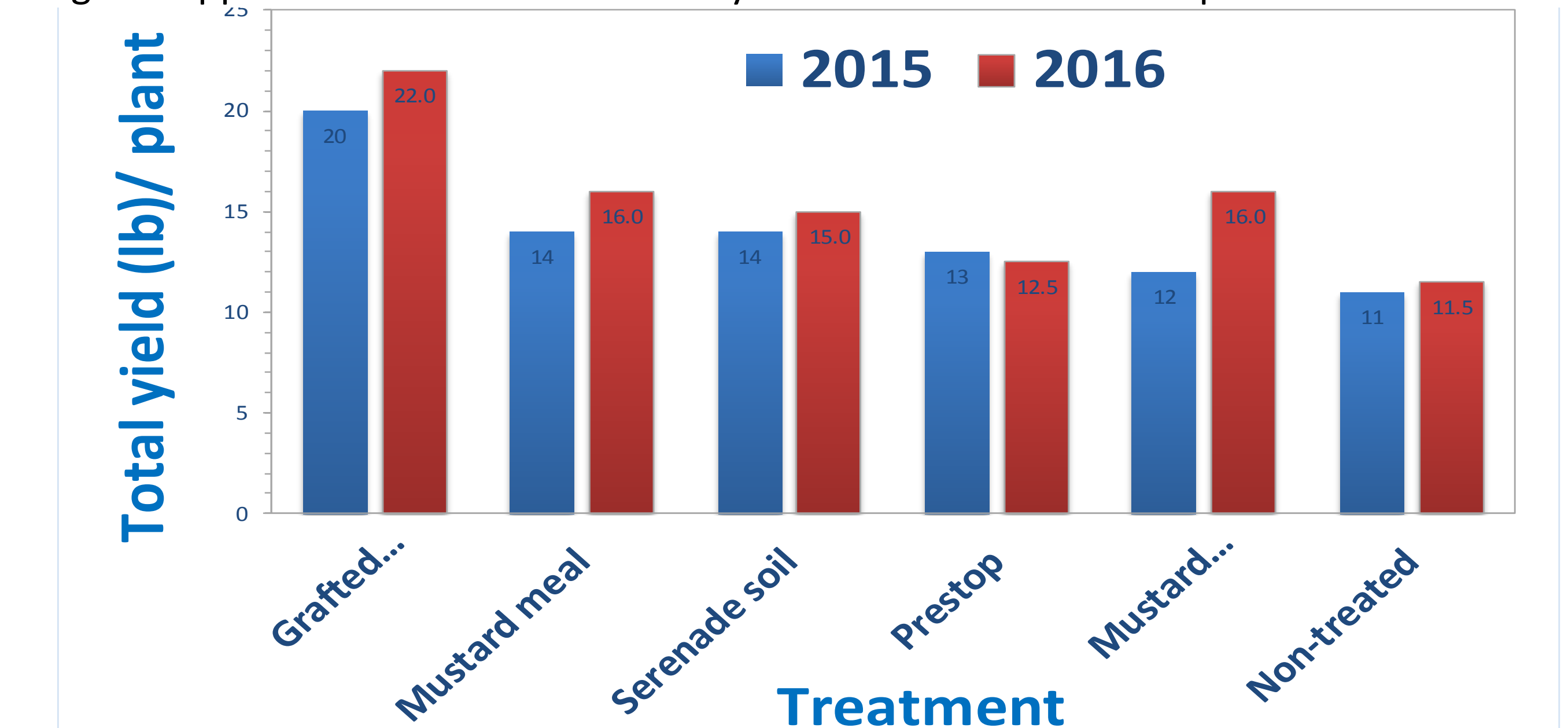


Fig. 4. Tomato yield improvement by different organically acceptable treatments in 2015 and 2016

Table I. Application rate, active ingredient, method of organic treatment application and effect on tomato yield.

Treatment and rate	How applied	Active ingredient	Total yield (lb/3 plants)	%Yield increase over non-treated
Non-treated check	N/A	N/A	32.1 c	-
Mustard cover crop "Caliente" 10 lb/A	Incorporated	Isothiocyanate (ITC)	36.9 bc	15
Mustard seed meal 4000 lb/A	Incorporated	Isothiocyanate (ITC)	42.9 b	36
Serenade Soil 1.34ASO 0.25 fl oz/oz	On seeds	<i>Bacillus Subtilis</i> strain QST 713	42.0 b	36
1 fl oz/gal	Potting mix			
1.5% (v/v)	Transplant water			
Prestop 32WPO 0.25 oz/oz	On seeds	<i>Gliocladium catenulatum</i>	39.9 b	26
1 oz/gal	Potting mix			
0.5% (w/v)	Transplant water			
Grafted plant, 'Maxifort' rootstock	N/A	Resistant 'Maxifort' rootstock	59.1 a	84

## OUTREACH ACTIVITIES

20 consultations; 2 curricula, factsheets or educational tools; 4 on-farm demonstrations; 2 published press articles, newsletters; 3 tours; 2 webinars / talks / presentations; 3 workshop field days; 2 farmers 123 ag professionals participated; 120 farmers reported changes in knowledge, attitudes, skills and/or awareness as a result of their participation

**Key areas :**

Soil-borne diseases on tomatoes; Bio-fumigation with "Caliente mustard"; Grafting tomatoes and bio-control.