# Plantpro45™: A Potential Low Risk Alternative for Control of Soil-borne Plant Pathogens

**P.D. Adams[1], N. Kokalis-Burelle[1], P. Fuentes-Bórquez[2,3], and W. Basinger[2]**
[1]USDA-ARS, United States Horticultural Research Laboratory, Ft. Pierce, FL
[2]Ajay North America, LLC, Powder Springs, GA
[3]SQM Chemicals, Chile

The ban on methyl bromide production and use has prompted the study of new alternatives for the control of soil-borne pests. Plantpro45™ (Ajay North America, LLC, Powder Springs, GA), a new low risk iodine-based compound, has significantly reduced root-knot nematode (*Meloidogyne incognita*) damage on tomato under field conditions in Florida (Kokalis-Burelle and Fuentes, 2000). Also, use of Plantpro45 as seed-treatment on corn has significantly reduced *Fusarium moniliforme* infestation and its ensuing aflotoxin production (Yates et al., 2000). Research on Fusarium wilt of basil (*Fusarium oxysporum* f.sp. *basilici*) has shown efficacy of this product *in vitro* and as a seed and soil treatment (Adams and Kokalis-Burelle, 2000). Additional data from field trials on tomato has indicated efficacy against bacterial wilt caused by *Ralstonia solanacearum* and Fusarium crown rot caused by *Fusarium oxysporum* f.sp. *radicis-lycopersici* (FORL).

**Effect of Plantpro45 on growth of fungal pathogens *in vitro*.** Four mm plugs of 7-14 day old isolates of FORL*, Fusarium oxysporum* f.sp. *basilici* (FOB)*, Pythium aphanidernatum, Phytophthora capsici,* and *Sclerotium rolfsii* (hyphae and sclerotia) were placed on 80% potato dextrose agar plates amended with varying concentrations of Plantpro45 (0, 30, 60, 120, 240 and 300 ppm a.i.). Inhibition was determined by measuring the diameter of each colony, after 3 to 14 days, from the edge of the plug to the edge of the growing colony.

Although significant reductions in growth occurred at 30 ppm when compared to the control, total inhibition varied according to the pathogen and, with respect to *S. rolfsii*, spore type (Table 1). For example, while total inhibition for *P. capsici* and *P. aphanidernatum* occurred between 60 and 120 ppm, total inhibition for *F. oxysporum* f.sp. *basilici* and sclerotia of *S. rolfsii* did not occur until Plantpro45 concentrations reached 300 ppm.

**Effect of Plantpro45 seed and soil treatment for control of FOB on basil.** Plantpro45 concentrations varying from 0 to 100 ppm were applied to basil seed 24 hrs prior to placing on water agar and Komada plates for germination and selective growth of FOB, respectively. At 3-4 days after planting (DAP), Komada plates were assessed for *Fusarium* growth while water agar plates were assessed for total fungal growth and germination percentage. Final germination counts were recorded at 14 DAP.

Seed treated with 400, 800, and 1000 ppm were planted in Speedling trays containing a soilless mix to determine growth (i.e. height weight, and leaf area) at the transplant stage (21 DAP). Prior to transplanting into naturally FOB infested field soil, the soil was pretreated with varying rates of Plantpro45 (0 to 300 ppm). Pots were watered for 7 days prior to transplanting and wilt ratings (1 = 0 to 1% to 5 = 75 to 100% wilt) were recorded at 19 DAP.

Germination and viability was increased by 27% and fungal contamination was reduced by 100 % as Plantpro45 concentrations reached 1000 ppm (Figures 1 and 2). Transplants (originally seed treated with Plantpro45 concentrations of 400, 800, and 1000 ppm) were taller, weighed more, and had more leaf area than controls; however, those treated at 400 ppm had plant height comparable to the control (Figure 3). Fusarium wilt severity was significantly reduced by 19, 42, and 51% after preplant soil treatment with Plantpro45 concentrations of 80, 120, and 300 ppm, respectively (Figure 4).

**Effect of Plantpro45 on bacterial wilt and Fusarium crown rot of tomato under field condtions.** Two tomato field trials were conducted in the Spring 2000 growing season. The first trial, at the Uniroyal Chemical Co., Florida Research Farm in Sanford, FL, consisted of four rates (60, 80, 100, and 120 ppm) Plantpro45 applied through two drip irrigation lines (emitters spaced at 4 in., tapes spaced 12 in. apart) in 3 ft wide beds, methyl bromide 67:33 (400 lbs/acre), and an untreated control. Five days before planting, an additional 1" of irrigation water was applied to Plantpro45 treated rows. At 35 DAP, a post-plant application of Plantpro45 at 80 ppm was applied through drip irrigation with 1" of water.

The second trial was performed in collaboration with the IR-4 Methyl Bromide Alternatives Research Project. Plantpro45 was applied at a 1X and 2X rates. Plantpro45 applications were compared with 16 products including methyl bromide 67:33 (400 lbs/acre) and untreated plots as controls. All plots were managed according to Florida tomato industry standards. Plots were fertilized with 2,000 lbs. of an 8-2-12 fertilizer pre-plant, fertirrigated at 7-0-7 once a week post-plant, and watered twice a week. All plots were rated for disease incidence and phytotoxicity until harvest.

A high incidence of Fusarium crown rot was detected at the Sanford, FL site while bacterial wilt was detected at the Lake Jem, FL site. Soil samples indicated that Plantpro45 did not significantly reduce populations of *Fusarium oxysporum, Pythium* spp., *Phytophthora* spp., and *Rhizoctonia* spp. However, final disease incidence ratings revealed that plots pretreated with Plantpro45 concentrations of 80 and 120 ppm were comparable to methyl bromide for control of Fusarium crown rot in Sanford. Plots treated with Plantpro45 1X and 2X rates also reduced bacterial wilt incidence and were comparable to methyl bromide and eight other products tested in the IR-4 trial at Lake Jem, FL. Yields for Plantpro45 were comparable to methyl bromide.

In conclusion, Plantpro45 has potential as an alternative to methyl bromide for control of root-knot nematode, Fusarium wilt/crown rot, and bacterial wilt on tomatoes and basil. This product also has the potential to be used as a seed treatment to reduce seed transmitted fungal pathogens.

**References**


- Adams, P.D. and N. Kokalis-Burelle. 2000. Efficacy of PLANTPRO45$^{TM}$ as a seed treatment for the control of Fusarium wilt of basil. Phytopathol. 90(6): S2.
- Kokalis-Burelle, N. and P. Fuentes-Borquez. 2000. Efficacy of PLANTPRO45$^{TM}$ as an Alternative to Methyl Bromide for Control of Root-Knot Nematode on Tomato. J. Nematol. 32: Abstract.
- Yates, I.E., J.W. Arnold, D. Hinton, and W. Basinger. Anovel fungicide controls *Fusarium moniliforme* growth. Phytopathol. 90(6): S102.

**Table 1. Effect of Plantpro 45B on fungal inhibition *in vitro*.**

| Plantpro Treatment | *Fusarium oxysporum* f.sp. *basilici* | *Fusarium oxysporum* f.sp. *radicis-lycopersici* | *Pythium aphanidernatum* | *Phytophthora capsici* | *Sclerotium rolfsii* Hyphae | *Sclerotium rolfsii* Sclerotia |
|---|---|---|---|---|---|---|
| (ppm of a.i.) | diameter (cm) | | | | | |
| 0 | 2.40a | 2.70a | 4.20a | 2.50a | 3.25a | 4.20a |
| 30 | 1.30b | 1.30b | 2.60b | 1.70b | 1.27b | 2.47b |
| 60 | 1.07c | 1.10c | 1.00c | 0.70c | 0.65c | 2.47b |
| 120 | 0.81d | 0.92d | 0.00d | 0.00d | 0.42c | 2.20b |
| 240 | 0.20e | 0.00e | 0.00d | 0.00d | 0.00d | 1.30b |
| 300 | 0.00f | 0.00e | 0.00d | 0.00d | 0.00d | 0.00c |
| LSD (0.05) | 0.10 | 0.06 | 0.00 | 0.00 | 0.41 | 1.19 |

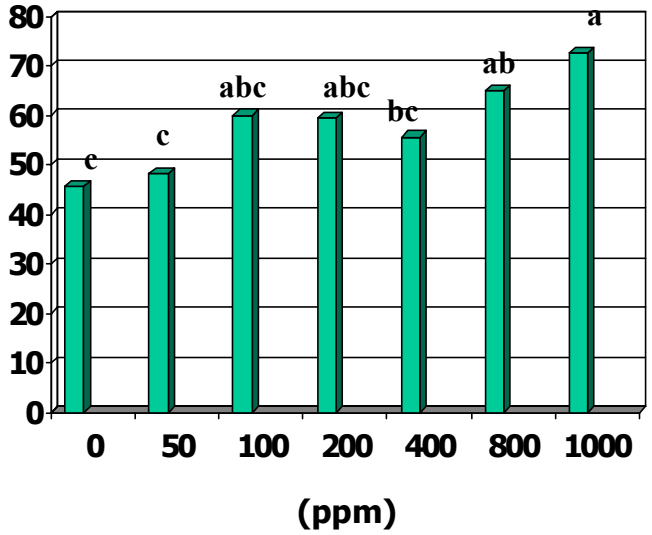



**Figure 1. Effect of various concentrations of Plantpro45 on % germination of basil seed.**

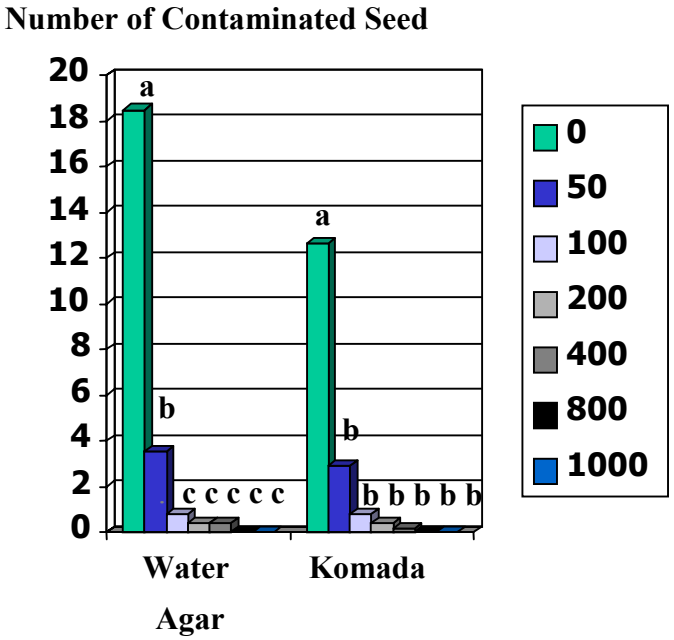
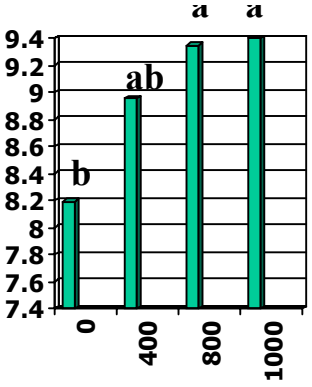
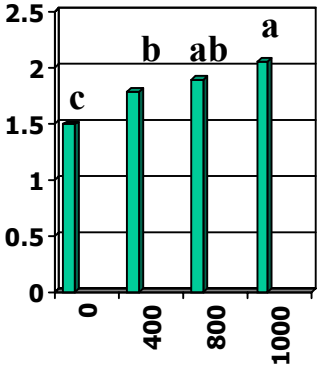
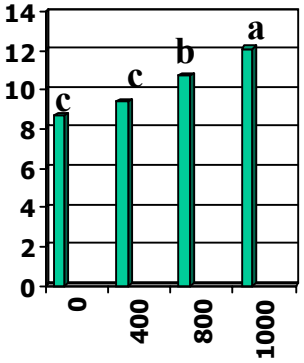



**Figure 2. Effect of various concentrations of Plantpro45 on total fungal growth (water agar) and *Fusarium* spp. infestation (Komada) of basil seed.**




**Wilt Rating**
**(0-5)**