Evaluating the efficacy of ethaboxam (V-10208) for control of *Phytophthora capsici* crown and root rot on fresh market peppers

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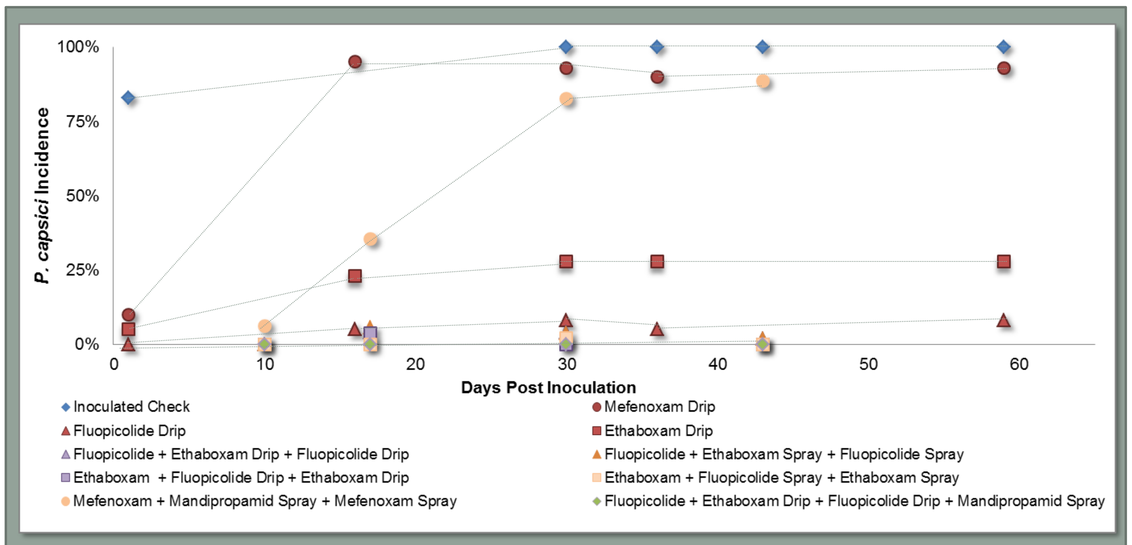
Abstract Fungicides active against *Phytophthora capsici,* which causes crown and root rot in bell peppers, have been effective as soil treatments either applied as a transplant drench or drip irrigation, two methods currently being utilized by growers for fresh market. A new fungicide being developed by Valent U.S.A. Corp. containing the active ingredient ethaboxam (V-10208 4 SC) has shown significant control of a virulent strain of *P. capsici* applied alone or in rotation with fluopicolide. Ethaboxam was tested in 2014 and 2015 in replicated field trials of bell pepper grown using raised beds, plastic mulch, drip irrigation, and inoculated with *P. capsici*. In 2015, *P. capsici* infestation was severe on untreated plots with a disease incidence of 30% on plants treated with mefenoxam one week post-inoculation. Among ethaboxam treatments, there were no significant differences in severity ratings or incidence for the application types and timings, with greater than 80% control of SAUDPC and only 20% for the mefenoxam treatment. Plots treated with ethaboxam and fluopicolide applied by drip yielded significantly more peppers than a spray treatment using fluopicolide first in the rotation. Ethaboxam, with both fluopicolide and mandipropamid did better than fluopicolide and ethaboxam alone for improving marketable yields.

Photos taken 20 days after inoculation show significant losses in inoculated check plots, and severe stunting and foliage loss in plots treated with mefenoxam. In the plots treated with ethaboxam, pepper plants are vigorous and robust despite severity of infestation.

Methodology

Red Knight variety bell pepper were treated with fungicide drench after transplanting into raised beds covered in plastic mulch with drip irrigation. Within three weeks of planting, plots were inoculated with 5 ml of zoospore suspension of a virulent *Phytophthora capsici* culture collected from infected cucumber by soaking infected fruit in water and collecting zoospores from the filtrate. Ethaboxam, fluopicolide, mefenoxam and mandipropamid were applied either through drip irrigation or sprays to inoculated plants for the remainder of the study.

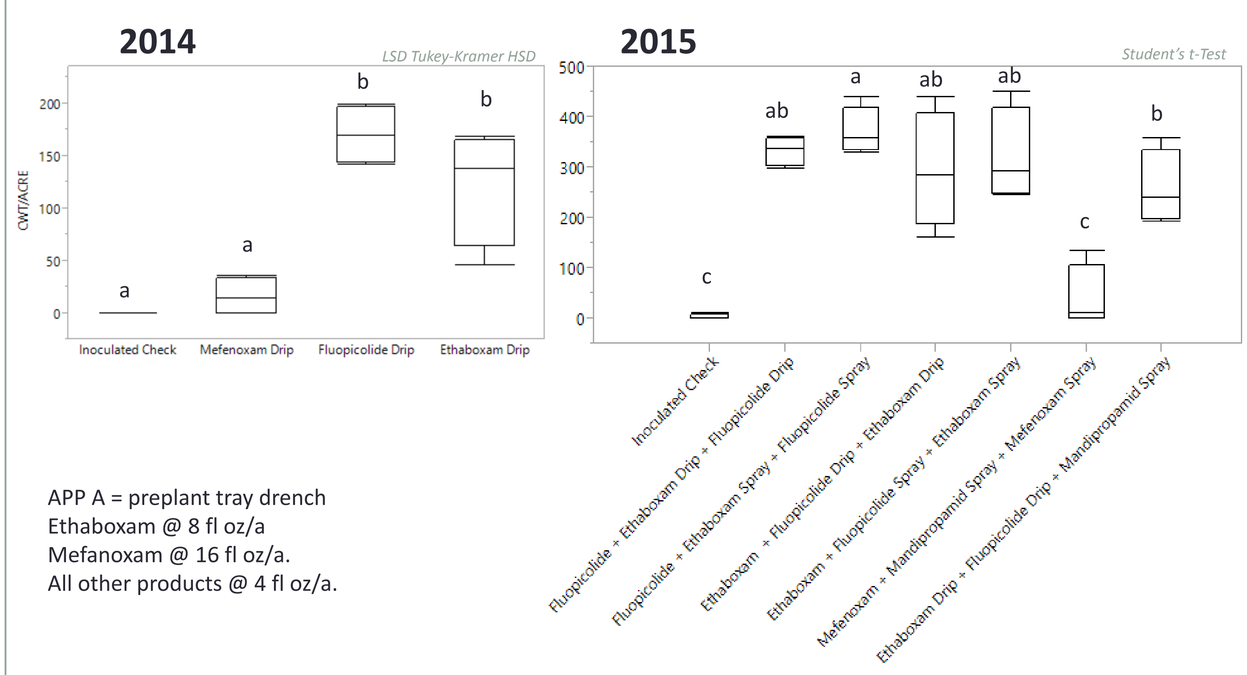


Disease Incidence

Pest incidence on pepper plants quickly reached high levels in the inoculated check plots (blue diamond) as well as those treated with drip applied mefenoxam (red circle). Mefenoxam rotated with manipropamid also had disease incidence near 75% at 30 days post inoculation. Plots treated with the fluopicolide-ethaboxam rotations (purple and orange triangles and squares) or fluopicolide drip (red triangle) alone remained relatively resistant to the pest.

Yield

Under moderate to severe *Phytophthora* pressure, Red Knight variety bell pepper yields in hundred-weight per acre were statistically superior in plots treated with a fluopicolide drench, followed by a rotation of ethaboxam and fluopicolide applied to crown as a directed spray. Drip applications in the same frequency and rotation were equally productive, followed statistically by the same treatments in reverse order.



APP A = preplant tray drench
Ethaboxam @ 8 fl oz/a
Mefanoxam @ 16 fl oz/a.
All other products @ 4 fl oz/a.

Treatment Name	*P. capsici* % CONTROL	
Inoculated Check	0.0%	b
Mefenoxam Drip	16.3%	b
Fluopicolide Drip	95.6%	a
Ethaboxam Drip	76.0%	a
Fluopicolide + Ethaboxam Drip + Fluopicolide Drip	83.0%	a
Fluopicolide + Ethaboxam Spray + Fluopicolide Spray	92.8%	a
Ethaboxam + Fluopicolide Drip + Ethaboxam Drip	85.2%	a
Ethaboxam + Fluopicolide Spray + Ethaboxam Spray	84.4%	a
Mefenoxam + Mandipropamid Spray + Mefenoxam Spray	23.0%	b
Fluopicolide + Ethaboxam Drip + Fluopicolide Drip + Mandipropamid Spray	85.5%	a

APP A = preplant tray drench
Ethaboxam @ 8 fl oz/a and Mefanoxam @ 16 fl oz/a. All other products @ 4 fl oz/a
LSD Tukey-Kramer HSD. % Control tabulated from AUDPC using Abbott's formula

Disease Control

Ethaboxam provides control of *P. capsici* on vegetable crops as a soil applied treatment while having a different mode of action to currently registered products. Ethaboxam can be used in rotation with other products such as fluopicolide, mandipropamid and possibly mefenoxam to reduce resistance development within these class of fungicides. The solubility of ethaboxam in water makes it effective for both drench and drip applications currently being used by growers to treat for *P. capisici*.

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