Evaluation of PCC1210 for control of *Phytophthora capsici* on pepper

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Phytophthora blight and root and crown rot of bell pepper, caused by *Phytophthora capsici* is a major concern of producers of this crop. This pathogen is favored by wet, warm weather and can be devastating when conditions are favorable for disease development and spread. Symptoms include the formation of stem lesions that are dark brown to purple, which begin at the soil line and progress upward. A sudden wilt of the entire plant follows, without yellowing of the foliage. The pathogen produces motile zoospores that are carried through fields by wind and rain. Even when methyl bromide is used, the pathogen can move into a field and eliminate the crop. The use of multiple sprays of Ridomil has been reported as a management tool. Avoiding plantings in poorly drained soil can reduce the incidence of disease. The use of raised beds and deeply buried drip tape can also serve to reduce the occurrence of standing water coming in contact with the root systems. Several biologically based products have been labeled for management of this disease and show some efficacy against various soil-borne plant pathogenic fungi. These include: Mycostop®, a strain of *Streptomyces griseoviridis*; Kodiak®, a strain of *Bacillus subtillis*; and RootShield® or PlantShield®, a strain T-22 of *Trichoderma harzianum*. While there are many other biologically based products available, few control *Phytophthora* spp.

In continuing greenhouse trials conducted with a variety of biologically based products and biorational compounds, one product, PCC 1210 (previously called BIOPHOS) gave excellent results against this pathogen. PCC1210, a mixture of phosphates, is patented by Foliar Nutrients, LLC and is licensed by United Agricultural Products. Although the effects of most of the biologically based products were somewhat variable between inoculum concentrations and from trial-to-trial, PCC1210 reduced bell pepper mortality at every zoospore concentration tested and in every trial. Results of one of the initial trials are summarized in Figure 1.

In order to determine optimal rates and methods of application for PCC1210 use in bell pepper, greenhouse trials were conducted using multiple rates and either foliar or soil drench applications. Foliar rates were 1, 2, and 3% (v:v) applied at 15 ml per plant. Soil drenches were applied at 0.5, 1.5, and 2% (v:v) using 100 ml per 9.6-cm pot containing 200g potting mix. These treatments were applied either as a single application 7 days prior to inoculation with the fungus or three times on a 10-day spray schedule. All treatments were also applied in the absence of the fungus to determine the levels of phytotoxicity to bell pepper (*Capsicum annum* cv. Capistrano). Foliar applications of the material resulted in high levels of phytotoxicity, particularly with the triple application and did not provide any disease control (Figures 2 and 3). Phytotoxicity ratings with foliar applications ranged from 1-2 with single applications and from 2.5 to 5 with triple applications. Three soil applications caused only minimal phytotoxicity, with a maximum of 2.0 with triple applications of the high rate. Soil drenches provided significant disease control, although disease in control plants was less severe than in previous tests (Figures 4 and 5). Additional studies are currently underway.

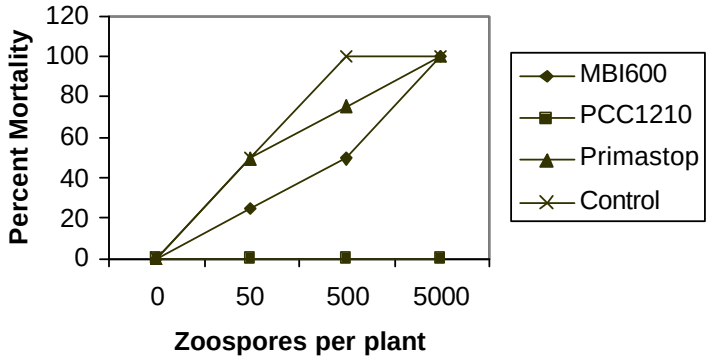

Figure 1. Bell pepper mortality resulting from inoculation with *Phytophthora capsici* and treatment with MBI600 (*Bacillus subtilus*), Primastop (*Gliocladium catenulatum*), and PCC1210. Control plants were treated with *Phytophthora capsici* only.

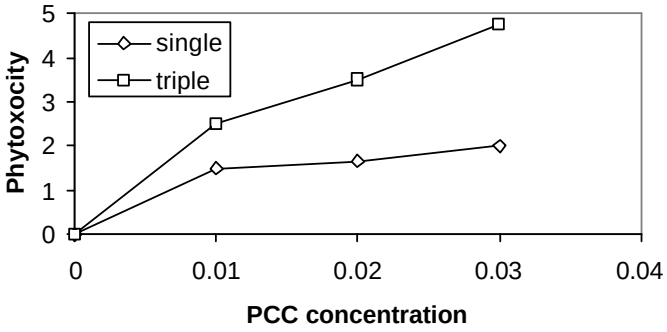

Figure 2. Phytotoxicity rating as a result of treatment with PCC1210 applied as a foliar spray. Rating scale of 0-5 with 0 being healthy and 5 being dead. Single application y=82.5x-0.05, R^2=0.67, triple application y=162.5x-2E(-15), R^2=0.83.

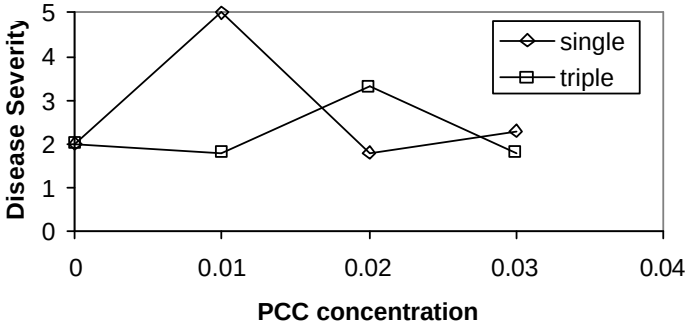

Figure 3. Disease severity resulting from inoculation of plants with *Phytophthora capsici* and treatment with PCC1210 applied as a foliar treatment. Rating scale of 0-5 with 0 being healthy and 5 being dead. Single application y=-25x+3.125, R^2=0.02, triple application y=7.5x+2.075, R^2=0.002.

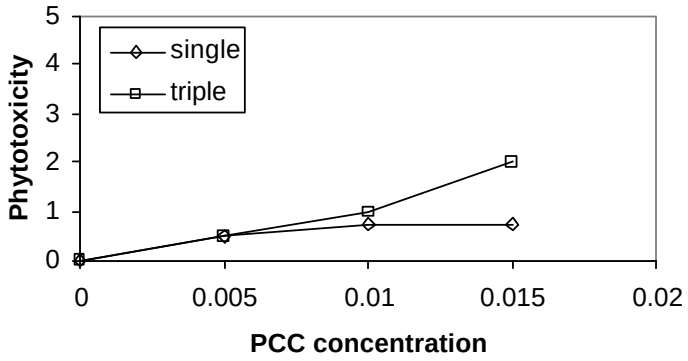

Figure 4. Phytotoxicity rating as a result of treatment with PCC1210 applied as a soil drench. Rating scale of 0-5 with 0 being healthy and 5 being dead. Single application y=50x+0.125, R^2=0.13, triple application y=130x-0.1, R^2=0.54.

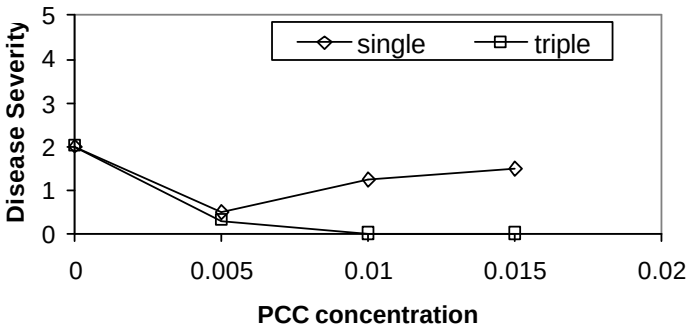

Figure 5. Disease severity resulting from inoculation of plants with *Phytophthora capsici* and treatment with PCC1210 applied as a soil drench. Rating scale of 0-5 with 0 being healthy and 5 being dead. Single application y=30x-0.1, R^2=0.26, triple application y=75x-0.125, R^2=0.72.