INTEGRATED MANAGEMENT OF PHYTOPHTHORA ON STRAWBERRY WITHOUT METHYL BROMIDE

G. Browne*[1], H. Becherer[1], S. McLaughlin[1], S. Fennimore[2], J. Duniway[3], F. Martin[4], H. Ajwa[2], C. Winterbottom[5], and L. Guererro[6].

[1]USDA-ARS, Dept. of Plant Pathology, UC Davis; [2]Dept. of Veg. Crops, UC Davis, [3]Dept. of Plant Pathology, UC Davis; [4]USDA-ARS, Salinas, CA; [5]Sunrise Growers, Watsonville, CA; and [6]California Strawberry Commission, Watsonville, CA

Introduction

Phytophthora cactorum causes crown and root rot and plant collapse on strawberries in California and in most other areas where strawberries are grown commercially. Pre-plant soil fumigation with methyl bromide-chloropicrin (MB:Pic) mixtures helps prevent disease caused by *P. cactorum* and other soilborne pathogens by reducing pre-plant inoculum densities. The phase-out of methyl bromide is necessitating development of alternative control measures for soilborne strawberry diseases. We determined potential contributions of genetic resistance, systemic fungicides, and alternative fumigants for managing Phytophthora crown rot on strawberries without methyl bromide.

Materials and Methods

Efficacy of cultivar resistance and systemic fungicides for controlling Phytophthora crown rot was determined in trials conducted from 1998 to 2003 near Watsonville, CA at the Monterey Bay Academy. Land used for the experiments was flat fumigated with approximately 400 lb of MB:Pic mixture per acre to minimize contributions from pathogens other than *P. cactorum.* Artificially infested and non-infested plots were prepared by adding a vermiculite-oat substrate (colonized by mixtures of *P. cactorum* isolates or sterile for non-infested controls) into or on top of strawberry planting holes. Additional treatments, including current and historical UC and private strawberry cultivars and systemic fungicides were imposed over the infested and non-infested plots. All experiments occurred on 52-inch 2-row plant beds, and there were 3 to 4 replicate plots of 8 to 10 plants per plot per treatment, depending on the experiment. Effects of the treatments were assessed according to disease severity ratings and marketable fruit yields.

Effects of alternative fumigants on survival of *P. cactorum* in soil were determined in 2000-2002 team trials conducted at commercial nurseries located near Ballico, Macdoel, and Susanville, CA and fruiting fields located near Oxnard and Watsonville, CA. Inoculum density of the pathogen was typically low at the experimental sites, so a bioassay using inoculum of *P. cactorum* in 40-ml bags of soil buried at 6 to 36" (nurseries) or 6 to 24" (fruiting fields) was used assess efficacy of the fumigants for control of the pathogen.

Results and Discussion

Among cultivars tested for resistance to *P. cactorum*, selections ranged from resistant (Camino Real, Pacific, Parker, Cal Giant [CG] 2, CG 3, and CG4) to highly susceptible (Catalina, Diamante, Gaviota, Pajaro, and Ventana). Cultivars with intermediate

susceptibility included Aromas and Camarosa. Assessments of susceptibility generally have been repeatable over successive years of testing using the field method. Apparently, there is potential to select cultivars that combine general horticultural acceptability with moderate to high resistance to *P. cactorum*.

Both Aliette WDG (applied as labeled as a plant dip plus 5 monthly foliar sprays) and Ridomil Gold (applied as a soil drench to mimic chemigation at planting and at two additional intervals during the fruiting season) prevented most of the yield loss caused by *P. cactorum* on cultivars Aromas and Diamante. Our trials indicate that these fungicides can minimize impact of *P. cactorum* in cultivars that are moderately to highly susceptible to the pathogen. Limited testing has not detected significant levels of resistance to Ridomil among California strawberry isolates of *P. cactorum.*

Among the fumigants tested for control of *P. cactorum* in soil, propargyl bromide (non-registered, experimental; ca 180 lb/A) was the most effective, typically eradicating the pathogen and exceeding the performance of MB:Pic, which generally killed most inoculum of *P. cactorum*, except for occasional inoculum survival at the deepest soil depths (24 to 36"). Iodomethane:chlropicrin (50:50, 350 to 400 lb/A, drip or shank) was similar in effectiveness to MB:Pic. Telone C35 (shank, 250 to 390 lb/A, followed by dazomet, 250 lb/A), and Inline (drip, 400 lb/A), and chloropicrin applied by shank (300 lbs/A) approached or matched the performance of MB:Pic when conditions were optimal, but were less effective under suboptimal conditions. Chloropicrin applied by drip consistently was less effective than MB:Pic for control of *P. cactorum*. Agrizide and Plant Pro were not effective in either of two trials for control of the pathogen. Results of recent experiments indicate virtually impermeable film mulch can be used to improve fumigation efficacy.

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