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The effects of plant essential oils and particle films on tomato spotted wilt and thrips in tomatoes

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Because the thrips-vectored *Tomato spotted wilt virus* is a limiting factor in tomato production in the southern USA, we are investigating novel control methods that would be effective and environmentally non-disruptive. In laboratory choice tests, we found that three plant essential oils, geraniol, lemongrass oil and tea tree oil were repellent to western flower thrips and repellency increased with the addition of kaolin. In two field trials we compared the effects of these essential oils (250 ppm per application, twice per week) and kaolin (28kg/ha) with a grower standard insecticide treatment (spintor rotated with baythroid and endosulfan) and a control on the population dynamics of thrips and incidence of tomato spotted wilt, in a 5x2 factorial design. Insect and disease pressure was much greater in the second year trial (mean tomato spotted wilt: 34% year 1 versus 82% year 2). The plant essential oils were more effective when combined with kaolin, because kaolin may reduce the volatility of the oils, thus increasing their effective time. Tea tree oil was the most effective essential oil. In each year, the tea trial + kaolin treatment was as effective as the standard synthetic insecticide treatments in terms of insect and disease control and yield. These findings indicate that naturally occurring products, such as plant essential oils and particle films, could be used successfully to reduce insecticide use on tomatoes.

Investigation of inoculum sources for *Pseudomonas syringae* pv. *alisalensis*

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Pseudomonas syringae pv. *alisalensis* causes bacterial blight on crucifers in the U.S. Hold-over inoculum from residue of previously diseased crops is known to be an important source of inoculum. Seed and farm equipment may also serve as inoculum sources. The distribution of the pathogen on seed was evaluated using seed collected from diseased plants generated using a rifampicin resistant isolate, BS106. After seed processing, bacterial suspensions and dilutions were spread on KBBC amended with rifampicin. Colonies were counted after incubation for four to six days at room temperature. Although high levels of bacteria were associated with the seed after harvest (5.0 – 6.0 Log (CFU/gm seed)), no bacteria were detected from seed following surface-disinfestation. At least 1 seed in 15 was infested at the time of harvest and one month later. Additionally, survival of the pathogen on work clothing was evaluated. 10-µl aliquots of BS106 (4.0 –7.0 Log (CFU/ml)) were applied to PVC field overalls. The overalls were incubated at room temperature and populations were measured by dilution plating on selective media for up to 21 days after inoculation. Populations dropped significantly to a level below detection by day 14.

Phenotypic characterization of roots responding to *Heterodera glycines* CLE peptides

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Parasitism genes coding for secreted CLAVATA3/ESR(CLE)-like peptides are expressed in the dorsal esophageal gland cell of the soybean cyst nematode (SCN), *Heterodera glycines*, during syncytium induction and maintenance. Recent data indicate that there are two predominant forms of SCN CLEs, HgCLEA and HgCLEB, that only differ in a variable domain immediately upstream of the conserved CLE domain. When overexpressed in Arabidopsis, *HgCLEA* not *HgCLEB* results in shoot and floral meristem defects, the severity of which correlates with expression level of the transgene. Roots of *HgCLEA* overexpression lines exhibit premature termination of the primary root meristem. Similarly, overexpression in soybean roots results in a range of growth rate phenotypes. Exogenous application of a synthetic peptide corresponding to the conserved CLE motif of HgCLEs to Arabidopsis and soybean roots induces a short root phenotype similar to synthetic plant CLE peptide treatment and overexpression lines. To assess affects on a cellular level, cell identity marker lines treated with nematode CLE peptides are being monitored using confocal microscopy. These studies provide evidence of a role for HgCLEs in ligand mimicry of plant signaling peptides to developmentally reprogram the fate of selected plant cells for syncytium development.

Comparison of Deoxynivalenol effects on the cells of two cultivars susceptible and tolerant to Fusarium head blight of wheat in suspension cultures

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Deoxynivalenol (DON) is an important virulence factor in *fusarium* head blight (FHB) disease of wheat. The effects of DON on the cells obtained from embryos calli of two susceptible (Falat) and tolerant (Sumai#3) wheat cultivars were compared in suspension cultures. The number and percent of vitality of the cells in the liquid MS media were counted immediately and 2, 4, 6 and 8 hours after addition of 10^{-6} M DON using Ivan's blue stain on a heamocytometer slide. After two hours of toxin addition no significant changes were observed in the number and percent of vitality of the cells in both susceptible and tolerant cultivars. By the 8th hour these two indexes in the Falat susceptible cultivar were reduced respectively 13% and 17%, while in the Sumai#3 tolerant cultivar the reductions were 3% and 5%. It seems that the responses of the cells to this concentration of DON are not urgent and there should be no differences between the responses of the susceptible and tolerant cultivars cells in the first two hours, but at the 4th hour there would be significant. However, the changes in the number and percent of vitality in the tolerant cultivar were not significant during the test period.

Microbiological profiling of cultural systems for *Phytophthora* control in Fraser fir

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Phytophthora root rot of Fraser fir caused by several *Phytophthora* spp. is a severe problem in Christmas tree production. Since fungicides and host resistance are ineffective in disease control, mulches and compost were tested on field planted trees at five sites. Treatments included wood chips (WC), wood chips plus compost (WCC), or pine bark (PB) as raised beds, and compost or sulfur (S) tilled into soil. Microbial populations were characterized by dilution plating and calculation of a log series diversity index, and by enzyme analyses. After 22 weeks, bacterial counts (CFU) were highest in WCC at 3 of 3 sampled sites, and were lowest in S-treated soil at the single site which included this treatment. Bacterial and fungal counts were higher in mulch than in soil at all sites, while diversity was higher in soil than in mulch. Fungal counts were highest in WCC and WC, except at the site which included sulfur, where counts were higher in S-amended soil. Counts were higher in compost amended soil than control soil at 2 of 3 sites. Data from enzyme analyses for total activity and cellulase activity will also be presented. There were no significant treatment effects (alpha = 0.05) on transplant survival at the end of the first season; however one site showed a trend (P = 0.06) indicating highest survival in WC and WCC treatments and lowest in compost amended soil.

A plant picorna-like virus causes severe damage to tomato in the states of Sinaloa and Sonora, Mexico

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A previously unrecognized virus, tentatively named *tomato apex necrosis virus* (ToANV), produces significant economic loss of tomatoes grown in the Mexican states of Sinaloa and Sonora. Symptoms include plant stunting, flagging of shoot apices (twisting, necrosis, death), necrotic flecking on leaves, and concentric ring-spotting of green fruit. Plants collected from tomato growing regions in Sinaloa and Sonora were tested extensively throughout 2005 and 2006 for many pepper and tomato viruses using serological and molecular methods. Although some were found, they occurred infrequently (except for tomato yellow leaf curl virus), and none seemed associated with the unidentified disease. Isometric viral particles circa 30 nm diameter were observed in symptomatic tissue with an electron microscope, purified in a sucrose gradient, and transmitted mechanically to *Chenopodium quinoa*. After three cycles of inoculation and isolation from single lesions, tomato plants were mechanically inoculated with this isolate. The plants subsequently produced symptoms characteristic of the Mexican disease and