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Pesticide Environmental Stewardship Program

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Biopesticide Demonstration Project

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In its second year, the Biopesticide Demonstration Project is jointly funded and administered by EPA and USDA's Interregional Project No. 4 (IR-4). The goal of the project is to reduce the barriers to increased adoption of biopesticides nationally by funding field demonstrations of effective biopesticides within IPM systems. In 2005, 16 projects totaling \$200,000 were funded.

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Biopesticide-Based, Area-Wide Approach to Managing Codling Moth in Michigan Apple (Michigan State University)

In 2004, an area-wide approach to manage codling moth was implemented on eight farms over 800 acres in the fruit-growing region north of Grand Rapids, Michigan. Nine additional growers on 1,300 acres joined the project in 2005, bringing the total number of acres included in the study to over 2,000. The IPM system employed pheromone-based mating disruption, codling moth granulosis virus, and some reduced risk insecticides.

The initial two years was considered highly successful by participating growers, with additional acreage added to the project in 2006. Codling moth injury to fruit was 87% lower in area-wide orchards at harvest compared to non-pheromone-treated (non-disrupted) orchards outside the project. Area-wide orchards incorporating codling moth virus sustained 4.2% fruit injury compared to 77.9% injury in non-disrupted orchards

outside the project. Use of mating disruption in Michigan increased 4 to 5-fold from 2003 to 2005, in part due to the high visibility of the biopesticide demonstration project.

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Control of Septoria Blueberry Leaf Spot Diseases Through Foliar-Applied Phosphite-Containing Biopesticides (University of Georgia)

ProPhyt (potassium phosphate) alternated with the conventional strobilurin fungicide, Cabrio, yielded disease suppression similar to that of the chemical standard, Cabrio. As a stand-alone product, Agri-Fos (mono- and dipotassium salts of phosphorous acid) yielded similar results to the chemical standard. Thus, these biofungicides can provide options for use in reduced-risk and resistance management programs.

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Effectiveness of Contans and Serenade Within a Biologically Intensive IPM System for Sclerotinia Drop on Lettuce (University of Arizona)

This is the second year of funding to confirm the results reported in 2004. Excellent control of lettuce drop caused by *S. sclerotiorum* was achieved by the biopesticide Contans (*Coniothyrium minitans*) as a stand-alone treatment, outperforming the conventional fungicide Endura. Similarly, Contans at seeding followed by the biopesticide Serenade (*Bacillus subtilis*) at thinning also provided excellent control. Two applications of Serenade controlled *Sclerotinia* drop as well as two applications of the conventional fungicide Endura.

The results of this study indicate that the biopesticides Contans and Serenade, used either alone, or combined with each other or the conventional fungicide Endura, can provide effective levels of control of lettuce drop caused by *S. sclerotiorum* and aid in resistance management programs for conventional fungicides.

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Evaluating Biopesticides for Control of Powdery Mildew in Pumpkin (Cornell University)

One of the objectives of this study was to evaluate six plant oil biopesticide products used alone for powdery mildew in pumpkin. The focus was on plant oils because good control was achieved in previous studies with mineral oil (JMS Stylet-oil), which is not considered a biopesticide. Of all the oils, Organocide (sesame oil), and Eco E-Rase (jojoba oil) were as effective as Microthiol Disperss 80W (sulfur) and the conventional fungicide Bravo Ultrex.

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Demonstration of Effectiveness of Sonata (*Bacillus pumilis*) in a Wine Grape IPM Program to Control Powdery Mildew (University of California – Davis)

Sonata in rotation with conventional fungicide treatments of Pristine, Quintec, along with sulfur and mineral oil (JMS Stylet oil) was as effective as rotating only conventional fungicides and sulfur in controlling the incidence and severity of powdery mildew in grapes.

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Demonstrating the Role of Phostrol for Phytophthora Management in Ginseng (Michigan State University)

The efficacy of the biopesticide Phostrol (phosphorous acid) for control of *Phytophthora cactorum* was compared to conventional fungicides Captan, Aliette, Acrobat and Gavel. Because Phostrol-induced phytotoxicity (leaf burn) interfered with observations of plant death caused by the plant disease *Phytophthora*, differences among treatments were not detected in this study.

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Efficacy of Oxidate for Control of Sour Rot and Powdery Mildew on Vinifera Grapevines (Cornell University)

Oxidate used in addition to late season sulfur sprays did not offer additional control of powdery mildew. Oxidate used as a replacement for the final sulfur spray provided control equivalent to standard treatments; however, it must be determined if sulfur applied on the second to the last timing provided that control.

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Demonstration of Biopesticides for Greenhouse Tomato (Cornell University)

Diseases common to soil-based tomato greenhouses include white mold, gray mold, leaf mold, powdery mildew, early blight, leaf spot, and others. Tomatoes are often grown in association with spring floral crops, and frequently do not share registration of the same chemical fungicides. In addition, the legality of using field chemicals in greenhouses is ambiguous in New York State.

The focus of this project is to demonstrate the effective use of several biopesticides including Companion (*Bacillus subtilis*), Mycostop (*Streptomyces griseoviridis*), and PlantShield (*Trichoderma harzianum*) within greenhouse IPM systems. Weather conditions present during the trial, however, did not favor the growth of disease organisms, so no treatment-related effects could be observed.

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Demonstration of Effectiveness of Serenade (*Bacillus subtilis*) for Control of Fire Blight in Apples and its Utilization within an Apple IPM Program in Washington (Washington State University)

Fire blight is currently controlled by conventional growers through the use of antibiotics, including streptomycin and oxytetracycline. Agricultural use of these antibiotics raise concerns regarding the resistance development and subsequent impacts on medical uses of these same antibiotics.

This project investigated Serenade (*Bacillus subtilis*) as an alternative. Serenade ASO, while not performing at a level of the various antibiotics, appeared to control fire blight infection to a greater degree than in similar tests carried out in 2003 and 2004. The use of Serenade during the three or four day period prior to infection, during which bacterial levels are building to dangerous levels, appears to disrupt the development of large colonies of disease organisms (*Erwinia amylovora*). Thus, pre-infection use of Serenade could reduce the numbers of antibiotic sprays and enhance their effectiveness.

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Results of the following projects will be available in late 2006.

Reduced-Risk Management of Peach Rusty Spot (Rutgers University)

The goal of this project is to demonstrate a 67 - 75% reduction in use of conventional fungicides by taking advantage of the fruit's natural resistance to peach rusty spot that develops as the fruit matures, and by the use of the biopesticides Serenade (*B. subtilis*) and Kaligreen (potassium bicarbonate). Final results are expected in June 2006.

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Field Demonstration of Reduced Conventional Pesticide Use in Snap Beans by the Effective Utilization of Biopesticides (Cornell University)

Nationwide, production of snap beans is limited by the presence of two pathogens: *Sclerotinia sclerotiorum* (cause of white mold), and *Botrytis cinerea* (cause of grey mold). These pathogens are becoming increasingly more resistant to conventional benzimidazole fungicides. This study will demonstrate the use of low rates of the conventional products Endura and Topsin M in combination with the biopesticides Kaligreen (potassium bicarbonate) or Trilogy (neem oil) in order to increase efficacy and reduce risk.

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Effectiveness of Serenade and Sonata Within a Biologically Intensive IPM System for Downy Mildew on Broccoli (University of Arizona)

Biopesticides Serenade (*Bacillus subtilis*) and Sonata (*Bacillus pumilus*) reduced downy mildew severity by an average amount of 23 and 32% respectively, while the conventional fungicide Maneb reduced disease severity by an average of 36%. Several other tested fungicides, such as Acrobat, Aliette, and Cabrio also had results comparable to the two biopesticides. The relatively equivalent efficacy of Serenade and Sonata when compared to conventional fungicides was achieved with fairly long application intervals (13-20 days). If the seven-day spray interval recommended on the Serenade and Sonata labels had been used, then the performance of these products might have been enhanced.

The similar performance of Serenade and Sonata compared to some conventional fungicides suggests that these products have high potential for widespread adoption as stand-alone treatments, in addition to being included in biologically-intensive IPM systems for crops such as broccoli, cabbage, and cauliflower.

This study demonstrates the efficacy of the two biopesticides applied alone, or in rotation with each other or the conventional fungicides Aliette and Maneb, using a shorter spray interval for the biopesticides.

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Effectiveness of *Metarhizium Anisopliae* as a Biopesticide Against Oriental and Japanese Beetles (University of Connecticut)

Management of the turf insect pests, such as Japanese and Oriental beetles, is typically accomplished by the conventional insecticide imidacloprid (Merit). However, recent detections of this insecticide in Long Island groundwater have put the future of that active ingredient in question. The objective of this project is to evaluate application rates of a biopesticide, *Metarhizium anisopliae* (Tick-Ex), when used as an alternative, as well as how different application procedures influence the effectiveness of this biopesticide.

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Application of Biopesticides for the Control of Mummyberry and Powdery Mildew in Blueberry (Rutgers University)

Blueberry is a high value crop that is grown in environmentally sensitive areas such as the New Jersey Pine Barrens. Fungicide applications with moderate benefit are generally justified economically and there are limited options for using biopesticides or other reduced risk products. This project plans to test the effectiveness of the biopesticides Serenade (*Bacillus subtilis*), Armicarb (potassium bicarbonate), and BioCure (mixture of *Candida saitoana* and lysozyme), in combination with the conventional fungicides Abound, Indar, and Quintec.

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Improving the Field Performance of Codling Moth Granulovirus in Organic and Conventional Orchards (USDA/ARS, Yakima Agricultural Research Laboratory)

The majority of conventional growers in the Pacific Northwest rely on chemical insecticides such as Guthion (azinphos-methyl) to control codling moth in apples, pears, and walnuts. However, pest resistance to conventional products is on the rise, and in addition, broad spectrum insecticides, including organophosphates, synthetic pyrethroids, and even newer reduced risk products, such as spinosad, the neonicotinoids, and insect growth regulators have an adverse impact on beneficial insect populations.

Codling moth granulovirus is a promising alternative which does not negatively impact beneficials, such as parasitoids. However, the range of dosage and number of applications that provides the most effective control for orchard conditions and codling moth pressures in the Pacific Northwest is unknown.

The focus of this project is to define and demonstrate these application parameters which provide the most effective control by the virus, and to evaluate its utility in conventional resistance management programs. The final report for this project will be available in June 2006.

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Demonstration of the Effectiveness of Serenade (*Bacillus subtilis*) for Control of Silver Scurf in Stored Potatoes (Oregon State University)

Silver Scurf is a very common and destructive pest of stored potatoes, primarily those used in the fresh market. The primary source of the fungal disease is infected seed, which occurs in the field, and spreads during storage. Currently, pest resistance exists to all current conventional controls for this disease, including Mertect, the chemical standard. This project will evaluate the effectiveness of the biopesticide Serenade (*Bacillus subtilis*) at different application rates. Final results are expected in June 2006.

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Last updated on Tuesday, May 22nd, 2007.

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