Effective Utilization of Biofungicides for Disease Control

In the Agricultural and Ornamental Environments[1/]

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Introduction

AgraQuest discovers, develops and markets safe & effective microbial pesticides. These products can be used in both organic and conventional systems in agricultural and ornamental production. Serenade® (*Bacillus subtilis*, strain 713) is a broad spectrum product that controls or suppresses a wide array of fungal and bacterial pathogens. Sonata® (*Bacillus pumilis*, strain 2808) has a narrower spectrum than Serenade, but can be used at lower rates and has longer residual activity. Rhapsody® and QRD 288 are product extensions of *B. subtilis* and *B. pumilis*, respectively. Rhapsody is used in greenhouse production of ornamentals, while QRD 288 has been shown to be effective against Asian Soybean Rust (ASR). Extensive in-house and collaborative research with University researchers continues to define the role of these products in integrated disease management programs. The efficacy of the products, along with their safety to crops, humans and the environment provide growers with tools to address many production and food export issues. All of the aforementioned products comply with the NOP standards.

This poster will discuss those areas where AgraQuest products have been used successfully in both organic and integrated pest management programs in a wide variety of agricultural and ornamental production settings.

Sonata for Control of Powdery Mildew in Wine Grapes in California

Powdery mildew (*Uncinula necator*) is a serious, recurrent problem in grapes grown for wine in California. Sonata – registered for use in 2004 - can be used in organic production or integrated with synthetic fungicides. Organic programs will generally require 7-10 days spray intervals. Depending upon disease pressure, Sonata may provide powdery mildew control for up to 14 days. Below are some examples of effective programs for powdery mildew control in wine grapes.

Figure 1 – Sonata and Rally for powdery mildew control in wine grapes in California.. 2004. P. Walgenbach. Agraquest

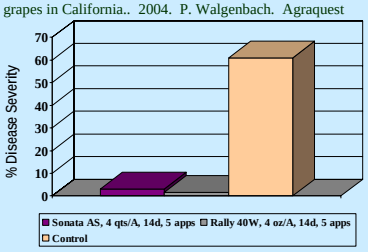


Figure 2 – Sonata rates and intervals for control of powdery Mildew in wine grapes. 2004. W. D. Gubler. UC-Davis

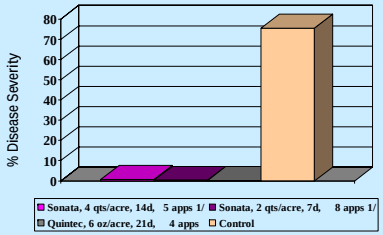
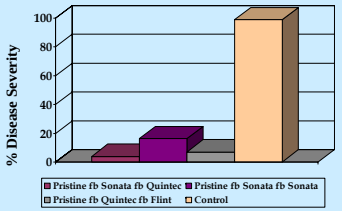


Figure 3 – Sonata utilized in integrated programs for Powdery mildew control in wine grapes. 2005. W. D. Gubler. UC-Davis.



Figures 1 and 2 display the activity of Sonata when used alone under conditions when powdery mildew disease pressure built slowly through the season and ultimately resulted in severe damage to the controls. Sonata provided good control when used on either a 7-day schedule at 2 qts/acre or a 14-day schedule at 4 qts/acre. In 2005 (Figure 3) disease pressure built to high levels early in the season and persisted, stressing even the best synthetic chemistry. Even under these conditions Sonata performed well in integrated programs. Disease control is enhanced in organic production with the addition of NuFilm-P® surfactant and in integrated programs with the addition of an organo-silicone surfactant.

Serenade for Control of Bacterial Leaf Spot in Tomatoes in Florida

Bacterial spot of tomatoes, caused by *Xanthomonas campestris*, pv *vesicatoria* is one of the most widespread and damaging pathogens in Florida. Growers routinely apply from 11 – 22 bacteriocide applications per season to control this pest. Its effect on yield and quality can be dramatic. Serenade is the only mircrobial pesticide registered for control of this pest. In addition to bacterial spot, late blight (*Phytophthora infestans*), early blight (*Alternaria solani*) and target spot (*Corynespora cassicola*) can also be serious diseases of tomatoes. Serenade has been shown to be effective on these pests, thus adding to its value to Florida fresh market tomato producers.

Serenade is most effectively used for the control of these diseases when used in a tank-mix with a copper fungicide and rotated with mancozeb or chlorthalonil. Below, field trials show typical results of such programs.

Figure 4 – Serenade for control of bacterial spot in tomatoes. 2005. R. Roberts. U FL. Immokalee, FL.

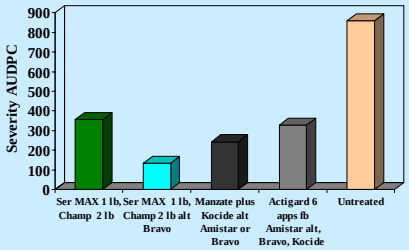
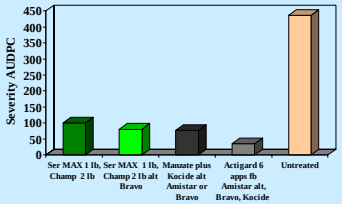


Figure 5 – Serenade for control of late blight in Tomatoes. R. Roberts. U of FL. Immokalee, FL.



Serenade for Control of Fire Blight in Pome Fruits in the PNW and NE

Fire Blight (*Erwinia amylovora*) is a serious pest of pome fruits. It often shows up sporadically, but can be devastating to apples and pears. Extensive field trials have shown Serenade to be an effective tool when used in conjunction with disease models and in integrated programs. Although not as inherently active on E. amylovora as the antibiotics streptomycin and terramycin, it provides fine control when used in conjunction with these materials in a resistance management program. There is widespread resistance to streptomycin in major apple and pear growing areas.

By employing the Cougar blight model, Serenade applications can be targeted to the upward curve of the model prior to the point where high potential for and outbreak exists, then switching to an antibiotic to address the most severe outbreaks. Results from 3 years of testing in artificially inoculated plots display the efficacy of Serenade on fire blight (Figure 6).

Figure 7 displays the efficacy of Serenade when used in an integrated control program in the state of New York. In this system the integrated program works as well a straight antibiotic use and provides resistance management.

Figure 6 – Control of Fire Blight in applies, artificially inoculated with E. amylovora, with pre and post applications of control agents. 2003 -2005. T. Smith WSU. Wenatchee, WA.

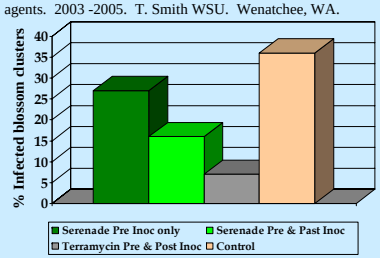
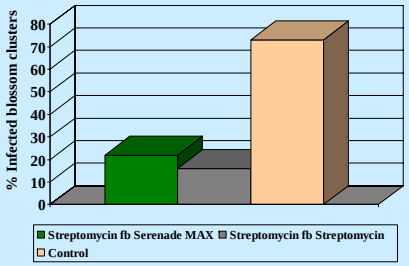


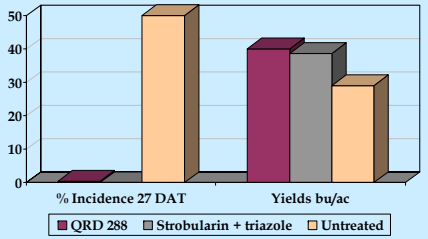
Figure 7 – Control of Fire Blight with an integrated program. 2003. Aldwinkle. Cornell Univ. Ithica, NY.



QRD 288 for Control of Asian Soybean Rust

QRD 288 is *Bacillus pumilis* (Strain 2808). It has been developed for the control of Asian Soybean Rust (ASR) in South America for use in the U. S. when the disease takes hold. Figure 8 is a representative trial of work done there. Under the moderate disease conditions encountered in 2004, QRD 288 compared favorably with the Strobilurin/DMI tank-mix for both disease control and yield

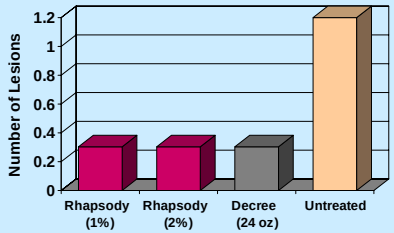
Figure 8 – QRD for control of ASR. 2004 M. Colombo. AgraQuest. Argentina.



Rhapsody: A Unique Microbial Pesticide for Control of Fungal and Bacterial Diseases In Ornamentals

Rhapsody had proven itself to be efficacious on an array of common green-house diseases such as Powdery Mildew, Botrytis and bacterial diseases (*Xanthomonas* and *Pseudomonas*). It is the only alternative to copper for control of bacterial diseases. It is also used to control downy mildew, rust, anthracnose and some leaf spots. Rhapsody provides a high level of plant, worker and environmental safety. It is compatible with a wide array of pesticides and fertilizers. It is safe to beneficial insects and mites. It has multiple modes of action. Finally, Rhapsody can be used as soil drench to aid in the control of soil borne diseases. The aforementioned properties provide Rhapsody with the flexibility to fit into many disease management programs.

Figure 9 – Rhapsody for control of *Botrytis cinerea* in Poinsettias. 2002. M. Daughtrey. Cornell University. NY.



Summary

AgraQuest's current products, based on unique strains of *Bacillus spp.*, have utility well beyond organic production. When used in conjunction with synthetic fungicides and bacteriocides, whether in tank-mixes or in rotations, they provide growers with effective tools for disease management, with the added benefit of high levels of crop, human and environmental safety.

Innovative natural product solutions for pest management

[1/] A portion of this research was supported by the USDA SBIR program