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CHASE NEWS
CHASE RESEARCH GARDENS, INC.

Development of Biopesticides

Last month, I had the opportunity to attend a meeting conducted by Agraquest in Davis California. This company is responsible for discovery and development of biological control agents including one I am getting more familiar with—Rhapsody. The meeting was designed to educate some of the researchers across the US (and one from Chile) about both the company and their products. We also had the charge of reporting our own experiences with their biological control products and indeed any others we had evaluated. I was one of the two researchers in the room who work on ornamentals so I was able to gain a much broader perspective listening to research on potatoes, tomatoes, apples and grapes. The day we spent was one of the most interesting I have had a chance to participate in during recent months. It is not often that I come away form a meeting with such a positive response.

The global pesticide market was about 30 billion dollars in 2004. The table below shows the breakdown between crops. In 1956, it cost $1 million to develop a product while in 2003 it cost $65 million. In 1990, approximately 20,000 new chemicals were screened annually but by 2000 this number had increased tenfold.

Crop	Dollars
Small grains	$4.4
Maize (corn)	$2.8
Rice	$2.7
Cotton	$2.4
Oil seeds	$2.7
Sugar beets	$0.6
Fruits, nuts and vegetables	$8
Turf and ornamentals,	$4.4

Biopesticide sales have been increasing about 20% annually in California alone. In the US , the biopesticide market was 2 billon in 1992 and had reached 12 billion by the end of 2003.

Finally, most, if not all, biopesticide are classified as biorationals and are handled differently by the EPA during the registration process. The time to complete a registration is about half that of conventional products and the fees paid are reduced as well. These facts make development of a new product, biopesticide or not, a daunting task.

How does Rhapsody work?

The main activity of this biopesticide is afforded by the lipopeptides produced by *Bacillus subtilis.* These lipopeptides directly disrupt or breakdown the membranes of the pathogens they contact. The secondary mode of action is as an SAR (systemic acquired resistance). This is the type of action that the phosphonates like Aliette afford. The plant actually is stimulated to fight off the pathogen through its own means. If the bacterium is not actively present then the only action will be that of the lipopeptide.

What does Rhapsody work on?

We have reported on our trials with Rhapsody recently but I can add a few new wrinkles based on research by other scientists. Trials on Sclerotinia on lettuce and downy mildew on spinach showed good control with a similar product. Margery Daughtrey reported moderate control of Botrytis on geranium. David Norman reported on powdery mildew control on Gerber daisy with moderate results again. Finally, Jean Williams-Woodward reported some control in trials on daylily rust.

The results appear to be consistent although none of them show excellent control of the target pathogen. One of the things that Agraquest suggests is to alternate Rhapsody with another fungicide. In some crops, they have seen this results in what they term a synergistic effect with higher control. We are in the process of evaluating tank-mixes and rotation with Rhapsody for a couple of ornamental disease right now. Look for results in upcoming issues of ***Chase News***.

Inside this issue:

Strobilurins vs. Phosphonates-Powdery Mildew

Over the past few years we have been exploring the efficacy of phosphonates (phos acids) against diseases like Pythium root rot, Phytophthora aerial blight and root rot and downy mildew diseases. Our results have shown comparable control with some phosphonates to Aliette 80WP for all of these diseases. Unfortunately, their safety on some tender ornamentals is lower than that of Aliette. Further, you must check the use rate since they cannot be substituted across the board. Some have effective rates 4 times that of Aliette while others should be used at only slightly higher rates or even the same rate. Finally, keep in mind that the pH of the phosphonates (6.5 to 8.2 usually) is not like Aliette (3.5 to 4 usually).

I recently started reading the literature on this interesting group of fungicides and found that there are a number of reports on efficacy against other fungal and bacterial targets including, rust, Fusarium, powdery mildew and Phomopsis. A couple of trials on powdery mildew and bacterial leaf spot later and I was a believer.

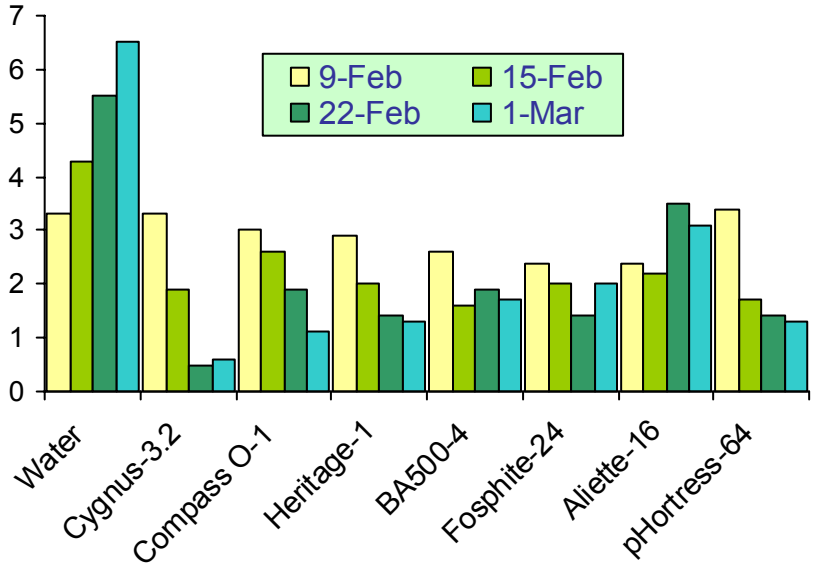
This winter we took advantage of a batch of rooted rosemary cuttings that we were saving for some root disease studies when it warmed up. These cuttings started showing powdery mildew infections and we leapt into action and set up a powder mildew eradication/prevention trial. Each eradication trial can become a prevention trial if you can stop the disease from progressing further. We rated the severity of disease before the first fungicide application and then every week thereafter until a month after we started. The sprays were made on a weekly interval three times. These cuttings were about 4 inches tall and disease we recorded was the number of powdery mildew colonies per plant.

When we started the trial all of the plants had an average of 3 colonies. After a single week, the control plants (water) had a little over 4 colonies and after four weeks there were 6.5 colonies per plant. The fungicides all reduced the number of colonies to one degree or another and all prevented disease from increasing significantly.

It was not surprising to see the strobilurins perform well with Cygnus doing overall the best. Overall, this product was used at 3.2 oz/100 gal and perhaps would have been better to compare at 1.6 oz to the 1 oz rates of Compass O and Heritage that we included. BAS500 was used at 4 oz/100 gal. Statistically, each of the strobilurins provided the same level of control.

The phosphonates we included were Fosphite (24 oz/100 gal), Aliette (16 oz/100 gal) and pHortress (64 oz/100 gal). We have occasionally seen phytotoxicity but these products were safely used in this trial. As you can see from the graph above, the phosphonates worked as well as the strobilurins. Although the Aliette treatment appeared to be losing control part way through the trial the average disease was statistically the same as the other fungicide treatments. We included two other phosphonate products with similar results (data not shown).

Clearly, Fosphite and pHortress were able to give suppression (control) of this powdery mildew on rosemary equivalent to strobilurins.



GRAPH

The severity of rosemary powdery mildew was recorded by counting the number of colonies per plant each week. Fungicides were applied as sprays. Fungicide The rates are oz/100 gal.

Powdery mildew spores form in chains and are easily dislodged by the wind, fans or handling. They do not need free water on the leaves to germinate and infect. Both powdery mildews and rusts are serious problems in the spring and fall. Watch for them now. You can check our website for listings of plants attacked by rust and powdery mildew.

Research Highlights

Shade and Irrigation Affect Euonymus Anthracnose- Ningen et al. completed a series of trials on Euonymus anthracnose caused by *Colletotrichum gloeosporioides*. They tested severity of disease on several cultivars grown under different shade levels and irrigated in the morning or in the afternoon. The effect of time of day when the plants were watered was slight with the results dependent on how long the leaves stayed wet. In some sites, afternoon irrigations dried more quickly than morning irrigations while in other sites the reverse was true.

The shade level was by far more important in reducing anthracnose severity. Plants in higher shade had significantly less disease with plants in 80% shade having 60 to 90% less disease than those in full sun. The authors attributed this to the cooler conditions which in turn reduced pant stress and susceptibility to disease. The greatest benefit was in adding 63% shade compared to full sun. For a complete report see HortScience 40(1):111-113.

Resistance to Subdue MAXX in Phytophthoras—Hwang and Benson reported on some extensive work they performed to determine the species of *Phytophthora* infecting greenhouse ornamentals as well as the sensitivity of these pathogens to Subdue MAXX (mefenoxam). The table below summarizes their results. Hwang and Benson attempted to isolate Phytophthora from ornamentals from 3831 samples from 41 species of plants. Their results showed that only seven species (hosts) were found with three species of *Phytophthora*. Many of the isolates were found to be resistant (insensitive) to one of the most commonly used soil fungicides for this key pathogen. All of the *P. cryptogea* were resistant while only 21% of the *P. nicotianae* were resistant. In contrast, none of the *P. palmivora* (all from English ivy) were resistant. For a full report see Plant Disease 89:185-190 (2005).

Species	No. isolates	Hosts	Fungicide characterization
Phytophthora cryptogea	184/483	Dusty miller, Gerber daisy	Insensitive to Subdue
Phytophthora nicotianae	273/483	African violet, lavender, pansy, petunia	21% insensitive to Subdue MAXX
Phytophthora palmivora	26/483	English ivy	Sensitive to Subdue MAXX

Stock downy mildew

Can you Stop Downy Mildew with a Drench?—We performed a trial on pansy downy mildew several years ago with a new fungicide. The most interesting thing about the trial was that we were able to reduce disease severity with a soil drench. The pansy leaves did not have any direct contact with the fungicide.

So we decided to try some of the most effective fungicides for downy mildew in a drench trial. The products were all systemic to some degree. We chose stock (*Matthiola*). The trial was performed in 3.5 inch pots that were drenched every 14 days, four times. The drench rate was equivalent to 1 pint/square foot of surface area. After the third spray we inoculated the plants with a spore suspension of *Peronospora parasitica*.

Treatment	Rate/ 100 gal	Percent sporulation
Water	——	70
Fenstar	14 oz	50
Aliette	16 oz	0
Stature DM	9.6 z	0
Heritage	2 oz	58
Subdue MAXX	1 oz	74

Plant top grade was not affected by the treatments. However, when we rated downy mildew severity (% sporulation), it was obvious that some of the fungicides were very effective in preventing downy mildew. The best control was achieved with Aliette and Stature DM. An experimental phosphonate and it was 100% effective as well. Fenstar gave slight control but Heritage and Subdue MAXX were the same as using water in this trial. This information is important since it means that 100% coverage of the leaves is probably not critical with phosphonates (like Aliette) and Stature DM for control of

Chase Research Gardens
Education for Horticulture

What's New at Chase Research Gardens?

On February 28, 2005, Marianne Waindle joined Chase Research Gardens, Inc. as our technical sales representative. Marianne has a Master's degree in Plant Pathology from the University of Georgia and a diverse background in field and laboratory diagnosis and sales in the horticultural industry. She most recently worked for Olympic Horticultural Products in northern California, Oregon and Washington.

Marianne has launched a new program for Chase Research Gardens called **Health Check**. We are offering this service to provide a routine consultation designed to identify problems before they cause serious losses. Marianne will also be doing training sessions on scouting, nutrition, wetting agents, insect and mites control as well as diagnosis o problems. The program is flexible with **Health Check 4, 6 or 12** depending on the number of visits annually. Our **Health Check** service is backed by diagnostic laboratory analyses (see below).

We are looking forward to working with Marianne and expanding our ability to serve the educational needs of the horticultural industry. **Welcome to the family Marianne!**

Watch out for These Diseases

We started doing diagnosis and control strategies officially a little over a year ago. It turned out to be a lot more interesting than I anticipated as I was able to meet many new people (t least over the phone). It is fun to be able to design personal control strategies for each situation. This has occasionally included web image diagnosis and control for our clients outside the state of California.

The samples have started to build in volume making my little slice of the disease-ridden world very interesting. We perennials, bedding plants, landscape ornamentals, woody container crops and cut foliage crops. The examples below came in for diagnosis in the past six weeks.

Leaf spots caused by less common fungi include *Pestalotiopsis* on a seed crop of Lupine and *Ulocladium* on a bulb crop of Oxalis. I used to see *Pestalotiopsis* on some palms in Florida causing severe spotting and rachis blight and we do see *Pestalotia* sp. (closely related to *Pestalotiopsis* as the name suggests) causing spots on some woody crops once in a while. *Ulocladium* is very similar to *Alternaria* and another less common fungus, *Stemphylium*.

Botrytis on lavender and rose is still common as is Phyllosticta dieback on Gardenia. The dark purple (almost black) *Liriope* I saw a few weeks ago was showing crown rot and I was a little surprised to see Fusarium recovered since this is the only problem I saw on the more common selections of *Liriope* in Florida nearly 15 years ago. We are also seeing Xanthomonas on wallflower (especially Bowles Mauve) and some new leaf spots on *Hydrangea*. Watch for pictures next month.

Pestalotiopsis leaf spot on Lupine

Ulocladium leaf spot on Oxalis

Phyllosticta dieback on Gardenia

Botrytis blight on Lavender

Botrytis cane rot on Rose

Fusarium crown rot on Liriope