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CHASE NEWS
CHASE RESEARCH GARDENS, INC.

Overview of Fungicide/Nematicide Reports for Powdery Mildew

In August, I summarized some of the reports (*Phytophthora* and *Pythium*) on ornamental disease control published in Fungicide and Nematicide Reports for the past five years. Ornamental researchers including Margery Daughtrey (Cornell University), Mike Benson (North Carolina State University) and Mary Hausbeck (Michigan State University) each contributed as well as many others. Since I am reporting on three powdery mildew trials we recently completed I have only summarized results for powdery mildew in the table to the right.

You can see that a wide range of products have been under evaluation including industry standards as well as some experimental products and the lesser known biological controls. I tried to average the results and found it nearly impossible, thus the range of reactions given in the table.

One of the most unfortunate events is overuse of a single product resulting in resistance to that product. Powdery mildew fungi make huge numbers of spores and the ease with which they become resistant to a fungicide is demonstrated in the reactions reported to thiophanate methyl products (in green shading) At times the products fail to give control while at other times they give excellent control. This is a reflection of resistance.

It is often difficult to determine what chemical class a product falls into even if you read the list of active ingredients. I decided to shade the products in the same chemical class with the same color background. Be sure to use products in different chemical classes in an alternating fashion. The codes for the most common chemical classes are given below the table. A few of the products are mixtures of two chemical classes and thus have two colors. Use of these would aide in resistance management without rotating. Tank-mixing has been found as effective (or more effective) as rotating or alternating for resistance management. Finally, there are quite a few products that are not color coded since they only have one representative of their chemical class in the table. They are each in separate chemical classes from each other and they are separate from all of the color coded groups as well. It is obvious, at least to me, that rotating fungicides used for powdery mildew control is not a problem due to lack of choices.

Product	Efficacy
Banner MAXX	Very good to excellent
BAS500	Very good to excellent
Biophos	Very good
Camelot	Some
Compass O	Very good to excellent
Cygnus	Very good to excellent
Daconil Ultrex	Very good to excellent
Decree	Good
Domain	Poor or excellent
Fungo	Excellent
Heritage	Very good to excellent
Immunox	Very good
Kaligreen	Very good
Milsana	Some to good
Milstop	Some to good
Phyton 27	Very good
Pipron	Very good to excellent
Rhapsody	Very good
Rubigan	Very good
Spectro	Poor to some
Strike	Very good
Systhane (Eagle)	Very good to excellent
Terraguard	Very good to excellent
Triact	Good
Zerotol	Some
Zyban	Poor or excellent
3336	Poor or good

Color code for Chemical Class

Benzimidazoles	Nitriles
Bicarbonates	Sterol Inhibitors
Coppers	Strobilurins

Inside this issue:

What's New for Phytophthora Root Rot?

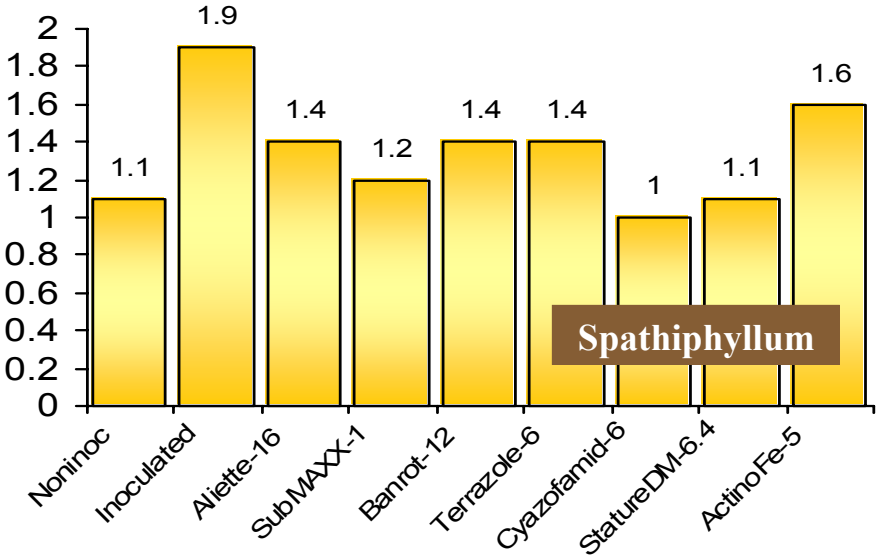
Phytophthora root rot can be a very difficult to control. We performed several trials over the summer on different crops with various degrees of success with both labeled and experimental fungicides.

The first trial was performed on vinca with Phytophthora aerial blight. The level of disease was too low to really decide anything except that a couple of the biological control products we tested actually made the disease worse than the inoculated controls (data not presented). The difficulty of obtaining a good aerial blight trial in the past few years may indicate changes in the resistance of vinca cultivars to this serious disease. Unfortunately, finding a resistant cultivar when we are trying to test fungicides is hardly satisfying. Next summer, we will start with testing currently available vinca cultivars for susceptibility to *P. parasitica* before doing additional fungicide trials.

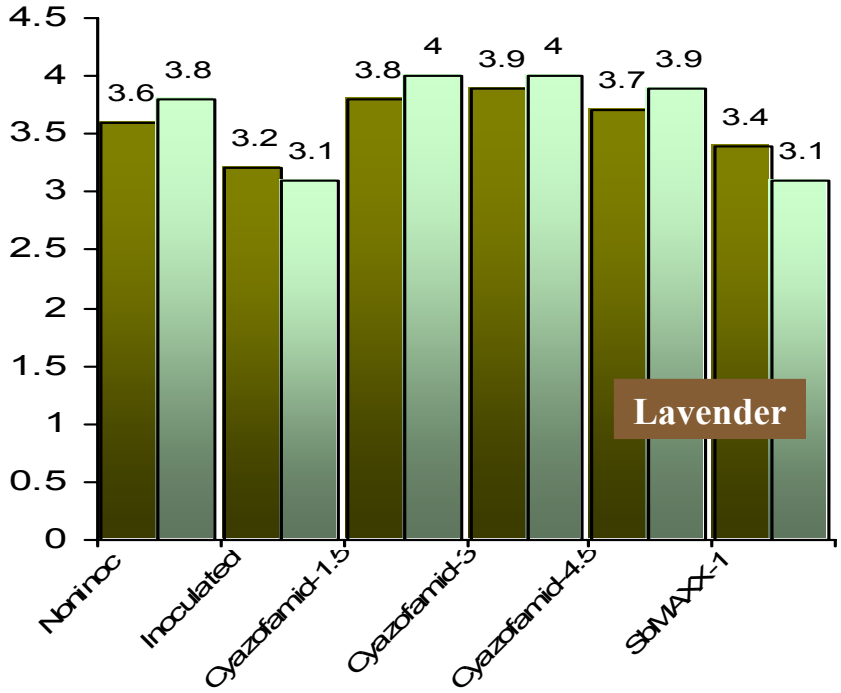
The second trial was Phytophthora root rot on *Spathiphyllum*. This disease is also caused by *P. parasitica* and can result in aerial blight in wet-hot climates (like Florida) but only root rot or crown rot in our trials here in California. The trial was performed on 'Stephanie' plugs planted in 5 inch post containing Sunshine Mix No. 1. Plants were treated once with a fungicide and then inoculated with the pathogen. We applied fungicides as soil drenches at the rate of 1 pint per square foot surface area (75 ml/5 inch pot) on a 14-day interval for a total of five applications. Results are shown in the graph to the upper right.

Disease development was low in this trial. There were no symptoms on the leaves or petioles but once we checked the roots we did find slight root rot on some treatments. In this trial, best control was obtained with Subdue MAXX (1 oz/100 gal), cyazofamid (6 oz/100gal) and Stature DM (6.4 oz/100 gal).

The final trial was performed on lavender with Phytophthora root rot. This disease is a serious problem on nearly all species of lavender, perennial salvias and rosemary. We planted rooted cuttings of *Lavandula* 'Province' into 3.5 inch pots containing Sunshine Mix No. 1 on 10 September. Plants were treated once with various rates of cyazofamid (1.5, 3 and 4.5 oz/100 gal) compared to Subdue MAXX (1 oz/100 gal). We rated disease about a month after inoculation. Top grade and fresh weights of leaves/petioles and roots were also recorded. Results are shown in the lower graph.



Root rot severity was rated from 1 (none, healthy) to 5 (severe, dead).



Top grade was rated from 1 (dead) to 5 (excellent).
Top weight (g)

All rates of cyazofamid provided excellent control of Phytophthora root rot as shown in top grade and top weight. Subdue MAXX actually had the same top weight as the inoculated controls but all cyazofamid rates were slightly better than the noninoculated controls. None of the treatments resulted in the same root weight as the noninoculated control indicating no benefit to roots.

Powdery Mildew Control-Old and New Fungicides

In the past few months we have been trying to do several powdery mildew trials using both experimental and labeled fungicides. The data I am presenting in the two graphs is for products that will likely come to market soon as well as those available now. The truly experimental products were left out of the graphs.

BAS500 was tested in the Gerber daisy trial at both 8 and 16 oz/100 gal. This product is being developed by BASF and is the newest strobilurin that will eventually be registered for ornamental use.

Milsana is a product we have been looking at for about 10 years in one form or another. It is currently registered for use in California by Western Farm Service (Agrium). Milsana is a botanical extract from giant knotweed.

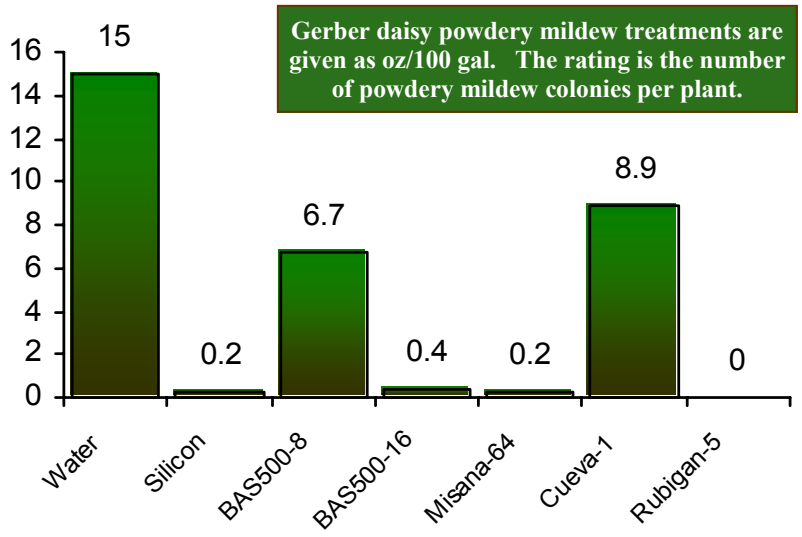
The silicon product we tested is a nutrient source that has been shown to reduce diseases on some agronomic crops. It was applied with No-Foam A (8 oz/100 gal). I have not included a rate since it is not currently available for this use.

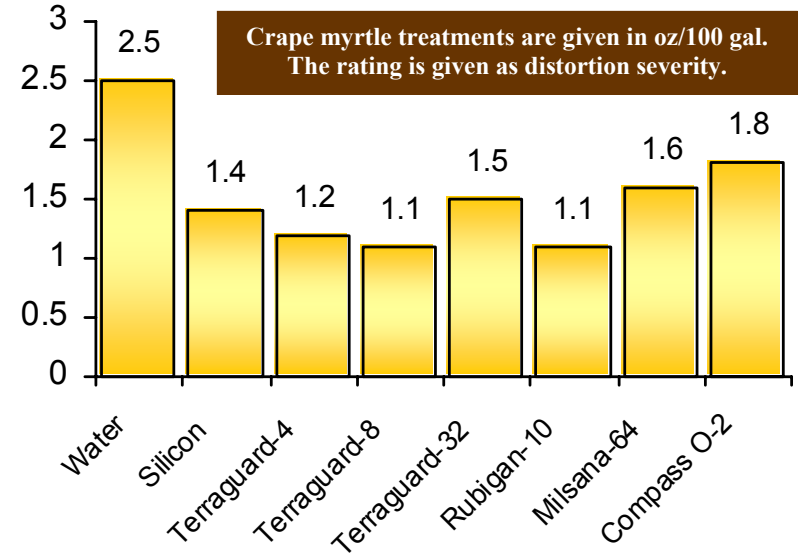
The Trials-

Gerber daisy plants were sprayed every 14 days (except for Milsana) from 11 August through 6 October. Milsana plants were sprayed weekly. Crape myrtle plants were also sprayed on a 14 day interval from 10 August through 21 September. On crape myrtle, Milsana was sprayed weekly.

These tests ran unusually long due to very low relative humidity. By the end, I was pretty sure I had forgotten how to do powdery mildew trials. The Gerber daisies finally developed some powdery mildew sporulation (*Oidium* sp.) while the crape myrtle never showed any sporulation (*Erysiphe lagerstroemia*). In the case of crape myrtle we rated the degree of distortion of new growth which is also a symptom of powdery mildew infection. Distortion of crape myrtle tips was rated as follows:1 (none, no infection), 2 (slight) to 3 (moderate).

The trials show that both Milsana and the silicon product were effective in preventing powdery mildew on crape myrtle and Gerber daisy. Rubigan (a sterol inhibitor from Gowan) has given excellent prevention of powdery mildew for years and continued to do so in these trials. Terraguard (a sterol inhibitor from Crompton-UniRoyal) remains an excellent choice for powdery mildew prevention as seen in the crape myrtle trial. Finally, strobilurins (like Compass O, Cygnus and Heritage) are also very good when used at appropriate rates (the 2 oz rate of Compass O used in the crape myrtle trial was apparently too low). BAS500 showed excellent control in the Gerber daisy trial at the 16 oz rate but was less effective at 8 oz.





The final powdery mildew trial was performed on zinnias planted directly into ground beds. In this case we tested rates of Banner MAXX and Heritage applied three times on a 21 day interval. The test started in early August and we rated it for disease on 15 October. The plants showed a good dosage response to the rates of Banner MAXX with the 3 oz rate very good but not as effective as the 6 and 9 oz rates (Table below). Heritage was somewhat effective but not as good as Banner MAXX in this trial.

Product	Rate/ 100 gal	No. PM colonies
Water	—	50.6 c
Banner	3 oz	9.0 a
Banner	6 oz	0.8 a
Banner	9 oz	0.2 a
Heritage	2 oz	23.3 b

We have new active ingredients as well as new formulations under development for powdery mildew control on ornamentals. Sterol inhibitors (like Banner MAXX, Terraguard, Rubigan and Systhane) are among the most effective products for powdery mildew. Remember you should rotate between chemical classes to avoid resistance development. You should use a strobilurin, a copper or one of several other chemical groups to rotate with a sterol inhibitor for maximum benefits.

Griffin Products (Camelot, Kocide and Junction) Find New Home

Griffin LLC sold its agricultural products to DuPont recently. DuPont in turn made a marketing agreement for the ornamental labels of these products with SePRO Corporation. The products in question are Kocide, Junction, Camelot and Vital. Camelot is being marketed by Whitmire Micro-Gen in an earlier agreement between Griffin and Whitmire.

The table to the right summarizes the trials we performed for Griffin and Whitmire over the past five years on Kocide, Junction and Camelot. All three products have a copper compound as one active ingredient. In addition, Junction contains a relatively small amount of mancozeb which does broaden its efficacy somewhat compared to that of copper alone.

We tested many different plant-pathogen combinations in some cases such as for the bacterial diseases caused by *Pseudomonas* and *Xanthomonas* and downy mildew disease. Various levels of efficacy or control were obtained. The boxes highlighted with pink show good to excellent control while blank boxes represent combinations that were not tested.

We performed relatively few tests with Kocide. The residue left by Kocide has been a drawback to its widespread use in some crops. In one recent test, however, we evaluated phytotoxicity on vinca (*Catharanthus*) flowers and found that Kocide and Camelot were each safe when used at 16 oz/100 gal (data not shown) while another copper product caused flower damage.

Both Junction and Camelot have been effective on a wide range of diseases from leaf spots (*Alternaria, Colletotrichum*, scab and *Heterosporium*) to powdery mildew and rust (*Puccinia* and *Uromyces*). And of course they give good to very good control of bacterial leaf spots caused by *Pseudomonas* and *Xanthomonas*.

Be sure to read labels on these products if you are not familiar with them. The 16 oz rate for Camelot is lower than currently labeled but has been very good in some of our trials.

Disease (plants)	Kocide	Junction	Camelot
Alternaria leaf spot (Impatiens)		Good at 24 oz	Good at 5 pints
Botrytis blight (Gerber daisy, poinsettia, cyclamen, geranium, Ranunculus)	None at 32 oz	Generally none at 24-48 oz	Generally none
Colletotrichum leaf spot (Cordyline)			Good at 1 pints
Cylindrocladium cutting rot (Azalea)	Some at 32 oz		Some at 3- 5 pints
Downy mildew (Pansy, stock, snapdragon)	None at 32 oz	Variable at 24-48 oz	Variable at all rates
Heterosporium leaf spot (Dianthus)			Very good at 1 pint
Myrothecium leaf spot (New Guinea Impatiens)		None at 16-32 oz	
Phytophthora root rot (Spathiphyllum)			None at 1 or 3 pints
Powdery mildew (miniature rose, hydrangea)		Very good at 24-48 oz	Very good at 3-5 pints
Pseudomonas leaf spot (verbena, impatiens, delphinium)	Some at 32 oz	Very good at 24 oz	Very good at 3 pints
Puccinia rust (snapdragon)	None at 32 oz	None at 24-48 oz	Good at 5 pints
Pythium root rot (Easter lily, lisianthus, dieffenbachia)	Some at 32 oz	Some at 24 oz	Some to good at 3-5 pints
Rhizoctonia canker (vinca)	Poor at 32 oz	Excellent at 24-48 oz	Poor at all rates
Sphaceloma scab (poinsettia)		Very good at 24 oz	
Uromyces rust (hypericum)		Very good at 24-48 oz	
Xanthomonas leaf spot and blight (stock, geranium, Ranunculus)	Good at 32 oz	Good at 24-48 oz	Good at 1-3 pints

CHASE RESEARCH GARDENS, INC.

8031 MT. AUKUM RD., BOX 529

MT. AUKUM, CA 95656-0529

PHONE/FAX (530)620-1624

MTAUKUM@DIRECTCON.NET