CHASE NEWS

Volume 7—Issue 8
August 2008

CHASE HORTICULTURAL RESEARCH, INC.

The State of Fungicide Development

This month I am reviewing a series of fungicides that have not been covered in the past few years. Most of these products have been used in our industry for a number of years and we have performed many trials on most of them. There is also a large body of information on these products from other researchers but I have included only those we have tested. I will be covering a few more products next month as well as our newest efficacy trials with EcoGuard (a biological product from Novozymes).

Good News for Ornamental Disease Control

We have seen an influx of interest in registering new products for the ornamental industry. The products include adjuvants, media amendments that improve root health, biological agents and standard fungicides. This year we also see a few bactericides being researched and will be doing a couple of trials with IR-4 as well as the interested companies. Some efforts are being made along the lines of new products with familiar active ingredients and in other cases new active ingredients are being researched. We are still seeing new active ingredients in chemical classes including strobilurins and sterol inhibitors.

Recently, we heave seen registration of Pageant (a combination of pyraclostrobin and boscalid from BASF Corporation), Fungaflor TR (a total release product with imazalil from Whitmire Micro-Gen), and Xeroton-3 (a peroxide product from Phyton Corporation). All have been reviewed in recent issues of Chase News or GMPro.

I have listed a few of the products and associated companies in the table to the right. They run the gambit from organic sourced products and biological agents to strobilurins and sterol inhibitors. For the first time in years, we are testing some bactericides too. Finally, there will be more products for the water molds (Pythium, Phytophthora and downy mildew) and more for Botrytis too.

The interest in registering new products in a very wide range of categories for ornamental disease control is exciting and bodes well for the future. We will of course report results of these trials when available.

Company	Products being developed
Marrone Organic Innovations	Several experimentals of organic origins
Stoller Enterprises	ReZist and BioForge
Syngenta Professional Products	Mandipropamid, Palladium and others
BASF Corporation	Trinity and several experimentals
Novozymes	EcoGuard GN and Taegro
Cleary Chemical	Endorse (label expansion) and others
OHP	Various products including a bactericide
Phyton Corporation	Experimental copper
Valent USA Corporation	Various experimentals including products for Phytophthora and downy mildew as well as one for Botrytis

Inside this issue:

Anthracnose Trial Summary

We have been working on the broad grouping of diseases known as anthracnose. There are quite a number of different fungi that are sometimes relegated to this group including: *Colletotrichum, Coniothyrium, Diplodia, Discula, Gloeosporium, Glomerella, Macrophoma, Phoma, Phomopsis, Phyllosticta* and *Phyllostictina*.

Anthracnose diseases are usually characterized by leaf spots and blight but also can cause stem rot and fruit rot on some crops. Diagnosing anthracnose can be challenging since many people do not recognize that the leaf spots and cutting rot found in propagation are due to the same pathogen as shoot dieback later in the production cycle. If you do not achieve control of the propagation phase, you will be fighting a generally losing battle a year or more later when the dieback phase becomes obvious. These diseases spread by spores that are easy to splash with irrigation water or rainfall but since they are somewhat sticky they do not easily spread by simple air movement from wind or fans. Wounding can increase disease severity but it is not necessary. Since the dieback phase often looks like mechanical damage the question of whether the disease or the damage is first is hard to answer.

Many plants can be attacked by anthracnose fungi especially those grown outside of greenhouses like woody ornamentals and tropical foliage plants. There are far fewer examples in greenhouse potted crops and the bedding plants. Some of the most commonly affected are *Camellia*, cyclamen, *Euonymus*, *Ficus* (many species), *Hydrangea*, *Hosta*, *Vinca minor*, lupine, azalea, *Aglaonema*, *Cordyline*, *Dieffenbachia*, palms, yucca, cacti and succulents.

Over the past 10 years, Chase Horticultural Research has completed about a dozen trials. The work was sometimes conducted as curative (Cordyline, vinca, Mandevilla and euonymus) trials and sometimes as preventative (cyclamen, camellia and hydrangea) trials. The table summarizes the results of most of these trials.

Our experience with these pathogens indicates that diseases caused by *Colletotrichum* spp. are somewhat faster to develop than those caused by *Phyllosticta* spp. They can look very similar, unfortunately, and knowing which one you have can be critical for optimal disease control. Control was nearly always better when fungicides were applied on a 7 or 10 day interval compared to a 14 day interval. This was especially apparent with the Colletotrichum anthracnose. For this pathogen, spraying weekly in a preventative manner is necessary to obtain the optimal results. In contrast, we did most trials on Phyllosticta using a 14 day interval and control was very good to excellent with some products. In a case where control was none-good the shorter interval provided the better control.

The best products for both Colletotrichum and Phyllosticta were Daconil Ultrex (chlorothalonil), Pageant (pyraclostrobin and boscalid) and Spectro 90WDG (chlorothalonil and thiophanate methyl). Get a diagnosis before choosing which product suits your situation to obtain the best results. If you guess about the cause and are wrong you may choose the wrong product and the result will be poor. For instance if you have Colletotrichum leaf spot and dieback on hydrangea and choose to control it with Insignia on a 14 day interval your results may be poor. If however, you choose to use Pageant on a 14 day interval you can control both Colletotrichum and Phyllosticta. The first step in solving any disease problem is a good diagnosis. Please take the time to send in a sample to a diagnostic lab to make sure your control strategy is the best one available for your situation. Guessing costs time and money.

Chemical	Rates/ 100 gal	interval	Efficacy Colletotrichum	Efficacy Phyllosticta
Banner MAXX	6 oz	14 days		good
Camelot	16 oz	14 days	good	
Chipco 26019	16 oz	7-14 days	none-some	
Cleary 26/36	64 oz	7 days	good	
Cleary 3336	16 oz	14 days		none
Clevis	16-32 oz	7-14 days	very good	some
Compass O	4 oz	14 days		none
Daconil Ultrex	22 oz	7-10 days	some-excellent	good
Dithane	24 oz	14 days	very good	
Eagle	2-4 oz	10-14 days	none-good	very good
Heritage	2-4 oz	7-10 days	none-very good	good
Insignia	8-10 oz	10-14 days	none-some	good-excellent
Medallion	4 oz	7-10 days	none-good	very good
Pageant	12.5-18 oz	7-14 days	very good-excellent	excellent
Pentathlon	24 oz	7-14 days	very good	
Phyton 27	15-25 oz	7-10 days	very good-excellent	
Protect T&O	16 oz	14 days	some	
Rhapsody	128 oz	7-14 days	good	
Spectro	24 oz	7-14 days	excellent	very good-excellent
Terraguard	8 oz	7-14 days	none-excellent	none

Myclobutanil—Hoist and Clevis Trial Summaries

We started working on Systhane (most recently sold as Hoist through Prokoz) and a new combination fungicide called Clevis in 1998 and continued for several years. Early trial reports labeled the fungicide RH-0611 and Manhandle. Clevis is a pre-mix of myclobutanil (Hoist) and mancozeb (Dithane). We had some very good results with it on quite a variety of diseases as one might expect from a combination of these two active ingredients. Myclobutanil (Hoist) trials are summarized in the table to the right. It is clear that there are many excellent uses for Hoist in foliar diseases like powdery mildew, rust, Cercospora and Alternaria leaf spots and even anthracnose and scab. We often use Hoist as our fungicide standard in powdery mildew trials especially.

Hoist Summary Table (previously called Systhane and Eagle)

Disease (pathogen)	Plant	Rate/100 gal	Result
Alternaria leaf spot	Dusty miller, pittosporum	2-3 oz	good to excellent
Colletotrichum anthracnose	Ti plant, mandevilla	2-4 oz	very good
Cercospora leaf spot	Moluccella, myrtle	4 oz	excellent
Colesporium rust	Bellis	2-3 oz	excellent
Phyllosticta anthracnose	Euonymus	4 oz	good
Puccinia rust	Geranium, snapdragon	2-3 oz	excellent
Sphaceloma scab	Poinsettia	2 oz	excellent
Uromyces rust	Hypericum	3-4 oz	very good
Oidium, *Sphaerotheca*, *Erysiphe* – powdery mildews	Gerber daisy, rose, scabiosa, pansy, euonymus, coreopsis, salvia, hydrangea	2-4 oz	excellent

In 2006, we started working on the product again when it was finally brought to the ornamental market by a company called Prokoz. We started with a few standard trials and have most recently been testing the longevity of Clevis on foliar diseases. The most recent trial was on 'Nearly Wild Pink' rose infected with a low level of powdery mildew (*Sphaerotheca pannosa*). Treatments were applied three times in November and the final rating was made almost 2 months later. The best long term prevention of powdery mildew in this trial was achieved with Clevis at 32 oz/100 gal (98% control) and Hoist at 4 oz/100 gal (86% control).

Clevis has provided very good to excellent results were seen on most diseases (Table below) when used at 1-2 lbs/100 gal. Clevis is especially effective on rust, downy mildew and powdery mildew diseases. It is also very good to excellent on Alternaria leaf spot and anthracnose caused by *Colletotrichum* spp. One of the most interesting results has been a very high degree of downy mildew control. When Clevis is used, results appear to be better than one would expect from simply adding the two active ingredients (ai) . The combination is also an excellent solution to fungicide resistance since both ai's target the same pathogen using unrelated modes of action. Thus there is a reduced chance of resistance developing. This holds true for powdery mildew, rust and downy mildew. Check the label for specific use information.

Clevis Summary Table

Disease	Plants tested	Interval	Result
Alternaria leaf spot	Impatiens, pittosporum	7-14 days	Good to excellent
Botrytis blight	Exacum, geranium, poinsettia	7 days	Some to excellent
Coleosporium rust	Bellis	7 days	Excellent
Colletotrichum anthracnose	Cordyline, cyclamen	7-10 days	Some to very good
Erysiphe (powdery mildew)	Scabiosa	14 days	Excellent
Myrothecium leaf spot	New Guinea Impatiens	7 days	None
Peronospora (downy mildew)	Alyssum, snapdragon, stock	7-14 days	Very good to excellent
Puccinia rust	Geranium, snapdragon	7 days	Excellent
Sphaerotheca (powdery mildew)	Rose	7-10 days	Excellent
Uromyces rust	Hypericum	7 day	Excellent

Fludioxinil—Medallion and Palladium Trial Summaries

Fludioxinil is the active ingredient in Medallion and one of the active ingredients in Palladium. Both fungicides are products of Syngenta Professional Products. We have been working with Palladium to a limited degree since the late 1990's and with Medallion since it was a numbered compound in the late 1980's. Both products have been very safe in our trials and we have also seen little visible residue to be of concern with either one. Fludioxinil has been very effective against *Alternaria*, anthracnose *(Colletotrichum) Botrytis, Cercospora, Cylindrocladium, Fusarium, Rhizoctonia* and *Sclerotinia*.

Palladium is a 62.5% WG active ingredient combination of fludioxinil and cyprodinil. Cyprodinil is currently is labeled for fruit trees and used to control *Alternaria, Botrytis, Monilinia* (related to *Sclerotinia*), powdery mildew (suppression) and *Venturia*. You can see that combining fludioxinil and cyprodinil creates a broad range fungicide as well as provides for resistance management in the overlapping pathogen groups (especially *Botrytis* and *Sclerotinia*).

Palladium has shown very high efficacy on Alternaria leaf spot, Botrytis blight, Colletotrichum leaf spot, Fusarium leaf spot, Rhizoctonia cutting rot and Sclerotinia blight. We have also seen good control of Cylindrocladium cutting rot on myrtle and Myrothecium petiole rot on pansy.

Medallion Trial Summary

Disease	Plant	Rate/ 100 gal	Degree of control
Alternaria leaf spot	Impatiens, zinnia, pittosporum	1-2 oz	Very good to excellent
Anthracnose	Many crops	2-4 oz	Good
Botrytis blight	Many crops	2-4 oz	Very good to excellent
Cercospora leaf spot	Pansy, moluccella	1 oz	Excellent
Coniothyrium cane rot	Rose	4 oz	Good
Cylindrocladium cutting rot	Azalea, myrtle, spathiphyllum	2-4 oz	Very good to excellent
Fusarium crown rot and wilt	Phormium, cacti, mandevilla, lisianthus	2-4 oz	Very good to excellent
Gliocladium (pink rot)	King palm	4 oz	None
Myrothecium petiole rot	Pansy	1-2 oz	Very good
Phyllosticta leaf spot	Ficus, vinca	4 oz	None
Rhizoctonia damping-off	Many crops	0.5-1 oz	Excellent
Sclerotinia blight	Petunia, primrose	2 oz	Very good to excellent

Palladium Trial Summary

Disease	Plants tested	Results
Alternaria leaf spot	Impatiens, pittosporum, zinnia	Very good to excellent at 2, 4 or 8 oz on a 7-14 day interval
Botrytis blight	Impatiens	Very good at 6 oz on a 10-14 day interval
Colletotrichum leaf spot	Cyclamen	Very good at 6 oz on a 7 day interval
Cylindrocladium cutting rot	Myrtle	Good at 6 oz on a 14 day interval
Fusarium wilt	Cyclamen	None at 3 oz on a 14 day interval
Fusarium leaf spot	Dracaena	Very good at 3 oz on a 7 day interval
Myrothecium petiole rot	Pansy	Good at 2, 4 or 6 on a 14 day interval
Rhizoctonia cutting rot and stem rot	Hydrangea, impatiens, poinsettia	Good to excellent at 2-8 on a 7-14 day interval
Rust	Hypericum	None at 4 oz on a 7 day interval
Sclerotinia blight	Petunia, primrose	Good to excellent at 2 or 4 on a 7 day interval

Terrazole 35WP Trial Summary

I started working on Terrazole in the 1980's when I was a Professor of Plant Pathology at the University of Florida Central Florida Research and Education Center. I worked primarily on foliage plant diseases at that time and found good to excellent control of Pythium root rot on pothos, schefflera and begonias. In 1994, I returned to California and found to my surprise that Terrazole was not registered for use at that time.

After more than 35 years of use, there are no documented cases of resistance to etridiazole. In contrast, some of the other products used for Pythium control have documented resistance. Terrazole was registered in California a few years ago to aid in control of Pythium populations that are resistant to mefenoxam (the active ingredient in Subdue MAXX). This has been a great boon for the California growers but differences in the legal uses are significant. The most critical difference is that the product cannot be used outside a greenhouse and cannot be used on pot sizes greater than 6 inches. A PCA must write a prescription stating that Subdue MAXX resistance is present at the nursery. Further limitations on the re-treatment are the use rates are 4-6 oz/100 gal. instead of the national label that includes 3.5 to 10 oz/100 gal. Finally, Terrazole CA can only be used twice on a 30 day interval on a crop unlike the Terrazole label that states reuse is legal on a 4 to 12 week interval.

The table to the right shows a summary of the Terrazole trials we have conducted in California in the past ten years. The 28 day treatment interval is too long in some cases if less then 10 oz/100 gal is used. You should consider alternating with another chemical class like mefenoxam, phosphonates (like fosetyl aluminum) or azoxystrobin under higher disease pressure. The 3.5-6 oz rate is viable under low disease pressure and preventative conditions. If you produce plants outside California you should use the 6 oz/100 gal rate as a good starting point. When disease pressure is high, 10 oz/100 gal will probably result in better control. It is especially important to use Terrazole 35WP when resistance is a concern.

Plant	Rate/100 gal	Interval	Degree of Control
Calla lily-test 1	6 oz	28 days	None
Calla lily-test 2	10 oz	28 days	Excellent
Calla lily-test 3	3.5, 6 oz	14 days	Excellent
Geranium-test 1	6 oz	14 days	Very good
Geranium-test 2	3.4, 5.1 oz	28 days	Poor
Geranium-test 3	6 oz	14 days	Excellent
Geranium-test 4	10 oz	14 days	Very good
Geranium-test 5	2.5, 5, 10 oz	30 days	Very good
Lily	3.5, 6 oz	28 days	Some
Lisianthus-test 1	5 oz	21 days	None
Lisianthus-test 2	6 oz	Once	Very good
Lisianthus-test 3	5 oz	28 days	Very good
Pansy-test 1	6 oz	Once	Very good
Pansy-test 2	6 oz	28 days	None
Ranunculus	6 oz	14 days	Good
Snapdragon-test 1	6, 10 oz	21 days	Very good
Snapdragon-test 2	6 oz	Once	Very good
Snapdragon-test 3	3.5, 6 oz	28 days	Poor

Pythium root rot on Calla lily

We have also performed a few trials on Phytophthora root rot with very good results and even tested Terrazole 35WP for downy mildew control, also with good results. Terrazole has been safe in the majority of our trials with a single trial on vinca (*Catharanthus roseus*) showing possible root damage. Terrazole was used on a 14 day interval at 10 oz/100 gal and this was perhaps simply too much for the small bedding plants we used.

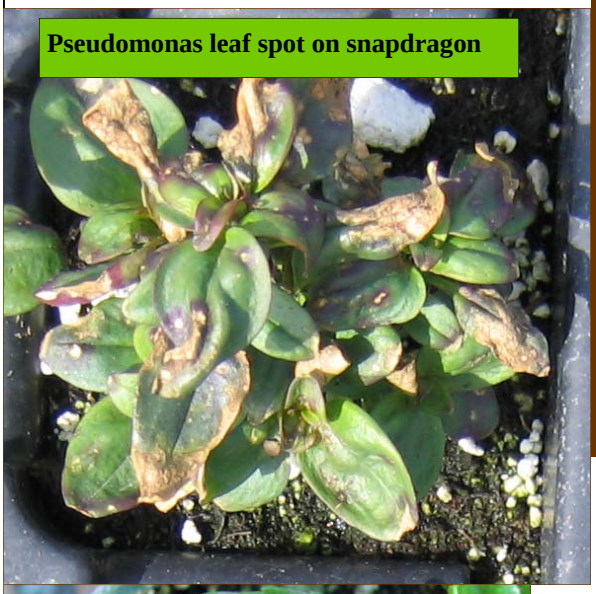
Pythium root rot on Hedera

Cease(Rhapsody) Trial Summary

We have been working on biological control agents over the years including those that are bacterial and fungal in nature. Rhapsody (*Bacillus subtilis*) was developed by AgraQuest and is now marketed by Bio-Works as Cease. This bacterial product works on a wide variety of diseases with the best results on foliar diseases. The summary to the right shows results of many of our trials over the past 8-10 years.

Good control is possible on downy mildew, powdery mildew, bacterial leaf spots (like *Pseudomonas* and *Xanthomonas*), Botrytis, Cercospora leaf spot and Colletotrichum leaf spot. We have not seen control of Erwinia soft rot (*E. carotovora*), fire blight (*E. amylovora*) or crown gall (*Agrobacterium*). Control of soil-borne diseases is less sure but we have had good trials with Pythium root rot and Rhizoctonia root rot at times.

Disease-pathogen	Plant	Rate	Results
Anthracnose (*Colletotrichum*)	Cyclamen, hydrangea	1%	Some-good
Botrytis	Liatris, salvia	1-2%	None-good
Cercospora leaf spot	Moluccella	1%	Good
Crown gall	Aster, solidago	1%	None
Cylindrocladium root rot	Spathiphyllum	1%	None
Downy mildew	Stock	1-1.5%	Some-good
Fire blight	Cotoneaster	1%	None
Fusarium wilt	Cyclamen	1%	None
Fusarium crown rot	Phormium	1-2%	None
Powdery mildew	Rose, rosemary	1%	Some-good
Pythium root rot	Geranium, snapdragon	1%	None-some
Rhizoctonia stem rot	Impatiens, poinsettia	1-1.5%	None-some
Xanthomonas leaf spot	Ranunculus, stock	1-1.5%	Some-good



Pseudomonas leaf spot on snapdragon

Powdery mildew on hydrangea

Cease is compatible with the following fungicides: Banner MAXX, Camelot, Chipco 26GT, Daconil, Dithane, Eagle (now called Hoist), 3336, Heritage, Kocide 101, Maneb, Oxidate and Phyton 27. The only fungicide combination that was not compatible was Aliette. It is especially interesting that Cease is compatible with copper products although we have not seen any benefits to combining the two in overall efficacy against bacterial leaf spots.

Anthracnose on cyclamen

Contact Us:

www.chasehorticulturalresearch.com or archase@chaseresearch.net.

Chase Horticultural Research, Inc.
Education for Horticulture