



Pythium diseases are among the most common in ornamental plants. They occasionally kill bedding plant plugs but usually cause stunting through root loss on larger crops (greenhouse and nursery potted crops). Since they may escape notice for much of the crop cycle we have come to depend on preventative fungicide treatments.

Despite what you may have heard you cannot tell Pythium from other root disease simply by testing whether or not the outer covering of the root (cortex) is easy to slip off of the core. While this can be a good sign of Pythium it can occur with other soil-borne pathogens including Rhizoctonia and Fusarium. What is even more to the point is that root rot fungi are not always selfish—they like to share the roots. Mixed infections with Pythium, Phytophthora, Fusarium or Rhizoctonia are more common than we recognize. That makes use of mixtures of preventative fungicides necessary in many cases. There are a variety of fungicides used for Pythium control throughout the US. One of the oldest Pythium products is etri-

diazole, currently sold as either Terrazole or Truban (and as Banrot when mixed with thiophanate methyl). Fungicides with etridiazole can be drenched or mixed as a granular into the potting medium before planting. Subdue and Subdue Maxx (metalaxyl and mfenoxam) have been used for nearly 20 years. Subdue Maxx can be applied as a soil drench (or as a preplant granular) but is not labeled for foliar applications. Aliette was developed a little after Subdue. It is the first and only fungicide we can spray and obtain good control of soil-borne Pythium diseases. Propamocarb (Banol and Previcur N) is used in some parts of the country.

Finally, some growers are very happy with biological control products. These include RootShield (*Trichoderma harzianum*) and SoilGard (*Gliocladium virens*). The products must be used preventatively. Both work best on Rhizoctonia and Pythium.

The occurrence of widespread mfenoxam resistance, development of alternatives to Aliette, and use of some unusual new products are each covered in the following articles.



Pythium damping-off on Alyssum and other bedding plants starts at germination.



Pythium root rot on Snapdragons frequently appears as stunting only. Healthy plants are on the right.



Pythium blight on pansy can occur anytime the plants are too wet and stressed.

Signs of Pythium Root Rot

1. Root balls are smaller than they should be.
2. Roots are mushy and fall apart when handled (especially the outer sheath).
3. Roots are dark-colored and watery appearing.
4. Lower leaves are yellowish or off-color.
5. Plants wilt even when the potting medium is wet.
6. Plant tops are stunted.
7. Plant growth is uneven (some plants are small and others large).

CONTROLLING PYTHIUM AND PHYTOPHTHORA WITH PHOS-ACID ALTERNATIVES (SEE PAGE 2)

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Alternatives to Aliette 80WDG — The Phos Acids

I have been giving talks on the West Coast for the past 8 or 9 years and am often asked about the alternatives to Aliette. As usual, money is the driving force here with some of the alternatives priced lower than Aliette. Additionally, these other products are sometimes labeled as fertilizers or growth promoters and therefore not subject to the usual pesticide regulations (no REI). Since they are not labeled to control diseases the manufacturers make no claims (at least on paper) with respect to Pythium and Phytophthora control.

These alternative products contain ingredients such as potassium salts of phosphorous acid (phosphates) and phosphonic acid (phosphonates). Over the past few years, we finally did some testing on a few of these including Nutri-Phite PK, Bio-Phos, Agri-Fos and Vital. In general, we have found them to be effective but occasionally phytotoxic on the small bedding plants we often use for our trials. Some of the newest products are being developed as fungicides so we will have full labels for control of Pythium and Phytophthora. In addition, we have tested a few of these products for downy mildew control. Last season, we saw excellent control of downy mildew on pansy with Nutri-Phite PK (1%) and Bio-Phos (1%). Compared to Aliette at 1 lb/100 gal they worked slightly better but the Aliette was safer on the pansies.

One of the selling points of the newer products is their pH. They are all more basic than Aliette and as such do not increase availability of copper that leads to copper toxicity. They are, however, capable of causing phytotoxicity in their own right. We have seen certain products safe at 0.5-1% and severely phytotoxic at 2%. Care should always be taken to check safety of each new product before wide scale use.

Summary of efficacy of Aliette alternatives on a few Pythium and Phytophthora diseases on ornamentals.

Product	Pathogen	Plant	Degree of Control
Agri-Fos	<i>Phytophthora parasitica</i>	Vinca	0.5% excellent
Agri-Fos	<i>Pythium irregulare</i>	Snapdragon	0.5% some
Bio-Phos	<i>Phytophthora parasitica</i>	Spathiphyllum	1% very good
Bio-Phos	<i>Phytophthora parasitica</i>	Vinca	1 or 2% none
Nutri-Grow PK	<i>Phytophthora parasitica</i>	Vinca	0.5% excellent
Nutri-Grow PK	<i>Pythium irregulare</i>	Lisianthus	1% very good
Vital	<i>Phytophthora parasitica</i>	Vinca	0.75% excellent
Vital	<i>Pythium irregulare</i>	Snapdragon	0.75% none

Effect of concentration on solution pH

Product	0.5%	1%	2%
Aliette 80WDG	4.6	4.5	4.3
Agri-Fos	6.7	6.8	6.9
Bio-Phos	8.3	8.4	8.4
Vital	7.7	7.8	7.8

Aliette was tested at 0.5, 1 and 2 lbs/100 gal. These laboratory tests indicate the magnitude of the pH difference between Aliette and the phos-acid alternatives. I do not think they should be treated as exact substitutes for Aliette although they may work on many of the same diseases.

Subdue Maxx Resistance

Over the past couple of years resistance to Subdue Maxx has become a more common problem. We do a little diagnosis for our consulting clients and have started to find some Pythium isolates that are resistant to Subdue Maxx. In 2000, we found several of the most virulent Pythium isolates from lisianthus cut flower production were resistant to Subdue Maxx. We found this out accidentally when we performed some trials and the Subdue Maxx (our standard for Pythium control) failed to give any control. Since that time I have noted reports of Subdue Maxx resistance in lisianthus pot production in California as well. We also found an isolate of Pythium from snapdragons that gives us good disease that has also been found resistant to Subdue Maxx.

I attended a meeting of many ornamental pathologists across the US a few weeks ago. I have to admit I was surprised at how many

people reported Subdue Maxx resistance throughout the country. It is more common in ebb and flood systems than in other production systems. In addition we heard reports of Subdue Maxx resistance in Phytophthora. This was the first report showing quite a few isolates from different plants showing substantial resistance to this fungicide.

The only way to really handle this problem is to make sure you are rotating from one chemical class to another. That means using etridiazole (Terrazole, Truban and Banrot), propamocarb (Banol and Previcur N), fosetyl aluminum (Aliette) and biological like *Trichoderma* (RootShield). Please do not use products in ways inconsistent with their labels. That means do not spray Subdue Maxx or Terrazole. As always, if you don't know what you are preventing or treating you will be wasting your money.

PRODUCTS IN REVIEW - AGRI-50

One of the most interesting new products we have been working with is called AGRI-50. The manufacturer is Cal Agri Products in Davis, CA. I heard about AGRI-50 a few years ago when attending an IR-4 meeting. The product comes in a variety of formulations designed to control insects like white fly and aphids and one directed more to fungal diseases.

We started working on a formulation in 2000 (the results of

our early trials are shown in the table below). At the time I was surprised by the excellent control of both downy mildew and Pythium. We did not see control of Botrytis or black root rot in the first round of trials. At that time, phytotoxicity was also a concern. Cal Agri Products went back to the lab bench and fine-tuned the product. In the fall of 2001 we started another set of trials with the new

lution and found to be safe on all of the plants tested. The effective rate had also been decreased on downy mildew and powdery mildew. We still have not identified how many soil-borne diseases that AGRI-50 controls. It does appear to be a very good choice for Pythium root rot (at least on lisianthus). In one of our downy mildew trials last spring we failed at downy mildew but did see good aphid control on

pansy. AGRI-50 lists potassium phosphate as its active ingredient. It is reduced risk and carries no residue tolerances. It may be a good tool for the herb industry with its broad-spectrum control of insects, Pythium root rot and some foliar diseases. In the next year, we will be trialing AGRI-50 on long list of other diseases. I am looking forward to seeing what else it works on.

Efficacy of AGRI-50 on a few ornamental diseases—2000 and 2001 trials

Pathogen	Plant Host	Rate	Control
<i>Thielaviopsis basicola</i>	Viola	0.33%, 0.66%	None
<i>Botrytis cinerea</i>	Geranium	0.33%, 0.66%	None
<i>Pythium irregulare</i>	Lisianthus	0.33%, 1%	0.33% none, 1% good
<i>Peronospora parasitica</i>	Matthiola	0.33%, 0.66%	Excellent
<i>Rhizoctonia solani</i>	Impatiens	0.16%, 0.33%	None
<i>Sphaerotheca</i> sp.	Gerbera	0.16%, 0.33%	Very good to excellent
<i>Thielaviopsis basicola</i>	Pansy	0.33%, 1%	None
<i>Peronospora violae</i>	Pansy	0.25%, 0.5%	Both rates very good

Cylindrocladium cutting rot on azalea



CYLINDROCLADIUM CUTTING ROT CONTROL ON AZALEAS

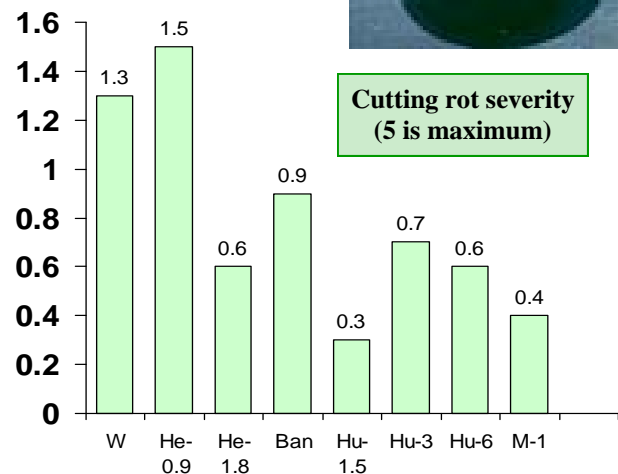
Cylindrocladium cutting rot on azaleas (see photo at right) occurs when the fungus contaminates the cutting, the potting medium, recycled pots and even bench surfaces.

We have been testing fungicide efficacy for this disease for many years with Medallion acting the most effectively against losses. Careless use of Medallion can result in poor or nonexistent rooting at times. This summer we tested products from Syngenta at a variety of rates to determine efficacy in controlling the disease and potential for root inhibition.

Cuttings were gathered, stuck into 5-inch pots with a peat-based medium and treated a single time with one of the

fungicides. The lower rate of Heritage (He-0.9 oz/100 gal) was obviously too low in this case. Heritage at 1.8 oz/100 gal gave good control. Banrot gave moderate control (Ban) while Hurricane (Hu—a mixture of Medallion and Subdue Maxx) gave good control at all rates tested (1.5, 3 and 6 oz/100 gal). Finally, the Medallion used at 1 oz/100 gal gave good control. None of these treatments hurt root formation in any way.

A similar trial evaluated Heritage at different rates and application methods. Medallion at 2 oz as a spray (14 day interval) gave excellent control. Heritage gave better control as drenches than sprays and was good at 0.9 to 1.8 oz/100 gal (14-day interval).



It is clear that Medallion remains the best fungicide for controlling Cylindrocladium cutting rot on azalea. It can be applied as a single drench or repeated spray. Heritage can be effective at the higher end of the labeled rates only.

NEW FORMULATIONS/EXPERIMENTALS

KEITH HUNDERFUND

FROM THE TRADESHOW FLOOR

MIKE ZEMKE

We get new formulations of old standards every year such as Chipco 26GT to replace Chipco 26019. We also test many experimental products. One of the key questions (after efficacy and safety) is how do the products handle. We summarized some of this information in the table to the right.

Product	Comments
BAS500 (Insignia)	Easy to measure but does not mix as easily as Heritage
Chipco 26GT	Measures and mixes easily
Fungo Flo (new to us)	Measuring is a little difficult but mixes well
QRD131AS (Serenade)	Measures and mixes easily
Terraguard 4SC	Measuring is a little difficult but

Next month we will present a summary of residue severity for the most common foliar fungicides. We have noticed that some of the products for powdery mildew actually leave so much white residue you are hard pressed to see whether or not they control powdery mildew.

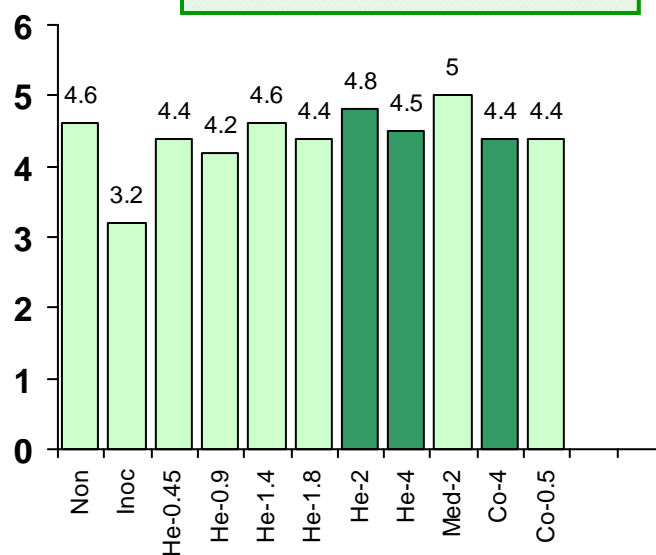
Fusarium root rot Control on Lisianthus

Lisianthus have been attacked by several species of Fusarium over the past 8 years or so. The most common species has been *F. avenaceum*. We performed a single trial this past summer hoping for good disease expression. We watched all summer for crown rot, stunting or wilting to no avail. Finally, we gave up and checked the roots as a last resort. The plants showed no aboveground signs of Fusarium but actually had developed some root rot.

Our trial was designed to check application method (drench or heavy spray) with

Heritage and also Compass. Medallion was our chemical standard. The light green bars were products applied as drenches and the dark green ones were heavy sprays. All of the Heritage rates and application methods gave excellent control of Fusarium root rot. Compass was also excellent when used as a spray at 4 oz/100 gal or a drench at 0.5 oz/100 gal. The best product, however, was Medallion used as a 2 oz drench. The roots on all of the Medallion plants were excellent.

We will be doing another trial over the winter (hopefully with crown rot symptoms this time).



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