

CHASE NEWS

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Controlling Fusarium Wilt

Mineral Nutrition and pH Management

Over the past 100 years many researchers have been trying to control losses due to Fusarium wilt on many crops from bananas to cotton and tomatoes and even ornamentals like gladiolus and chrysanthemum. I was recently asked to evaluate some methods for controlling a Fusarium wilt disease and thought I would start with a web search.

Fusarium wilt is caused by *Fusarium oxysporum* form species. These slightly different forms are able to infect the vascular system of specific crops (often only a single genus) and cause the typical yellowing, wilting and collapse due to clogging of the xylem and production of toxic compounds that damage the plant. The specificity would appear to be something helpful in designing control strategies. Unfortunately, research has shown that even in the absence of its

host crop the pathogen can persist for years and even reproduce on roots of a wide range of crops and weeds. So although the wilt disease won't occur you won't be able to eliminate the pathogen from the soil simply by avoiding the host crop.

The most interesting result of the research over the past 100 years is that using certain forms of nitrogen and maintaining soil/medium pH are still effective means of reducing Fusarium wilt. Research on Fusarium wilt on lettuce showed very similar results to that performed in 1900 on cotton and tomato. The methods for control in the first half of the 20th century showed consistent and good control when crops were fertilized with lower levels of nitrogen and when the nitrogen was derived from nitrate and not ammonium sources. Fusarium wilt

Using certain forms of nitrogen and maintaining soil/medium pH are still effective

was increased when phosphorous was high and potassium low. Work has been performed on mums, carnations and Hebe in containers as well as tomatoes, cotton and bananas in the field. Additional experiments have shown that liming to increase pH to 6.5-7.5 can reduce severity of Fusarium wilt as well. Some studies suggest that when pH is higher; many minor elements are less available. These are required by *Fusarium oxysporum* to make spores.

While soil fumigation is helpful in field crops and systemic fungicides may help somewhat in containers, using nutrition and pH control must remain an integral part of managing Fusarium wilt.

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Fusarium wilt control on Lisianthus

We have been testing fungicides for control of Fusarium wilt on Lisianthus a lot over the past few years. The test reported here was completed late in 2011. We primarily were evaluating a new (unregistered on ornamentals as yet) fungicide in the sterol inhibitor class called Trinity. It contains the active ingredient triticonazole. For comparison we included Heritage and as a point of interest included a growth promoter called AEM (Activated Effective Microorganisms) from TeraGanix. The products were applied weekly starting on 7 November and ending 19 December 2011. They were applied as sprays (about 1 oz/3.5 inch pot). Pots contained Fafard Mix 2 and top-dressed with Osmocote Plus 15-9-12.

Plants were inoculated with a spores suspension of *Fusarium oxysporum* on 10 November. We rated top grade, height and disease periodically. The first disease symptoms appeared about 4 weeks after inoculation. The table to the right shows the final data.

Optimal disease prevention occurred with all rates of Trinity as well as Heritage. The AEM treatments did not give any control in this trial. Previous trials on *Pythium* and *Phytophthora* have shown good control with AEM.

Effect of fungicides on severity of Fusarium wilt on Lisianthus.

Disease was rated from 1 = none to 5 = dead. Numbers in the same column followed by the same letter are not statistically different.



Treatment	Rate/100 gal.	Disease 12-30-11	Height (cm) 12-30-11	Top Grade 12-30-11
Water Noninoculated	-----	1.0 a	27.7 b	3.5 d
Water Inoculated	-----	3.5 b	12.3 a	2.1 a
Trinity	4 oz	1.1 a	18.2 a	3.1 c
Trinity	8 oz	1.5 a	15.8 a	2.9 bc
Trinity	12 oz	1.4 a	13.9 a	2.8 bc
Trinity	24 oz	1.0 a	12.7 a	2.9 bc
AEM	1:500	3.6 b	11.6 a	2.0 a
AEM	1:250	2.9 b	13.6 a	2.3 ab
Heritage	4 oz	2.0 a	17.9 a	2.8 bc

Height was significantly lower for all treatments that were inoculated even when the fungicide provided prevention of Fusarium wilt symptoms. Plants were adversely affected by all rates of the Trinity which is not surprising for a sterol inhibitor. There was some stunting with the Heritage but this 4 oz rate was over four times the highest labeled rate for a drench application (0.45-0.9 oz/100 gal). Top grade was affected by both the fungicides and the pathogen. Best quality plants were found in the non-inoculated control followed by the lowest rate of Trinity. When stunting it may be hard to tell if the fungicides are causing the stunting or the disease is not being controlled. Be sure to make your decisions carefully when evaluating any new products.



Appearance of cold damage on succulents can be delayed many months. When it finally appears it can be confused with phytotoxicity or a disease.

Cold Damage

Now is the time to watch out for signs of cold damage. This is more a serious problem for diagnosis in warmer environments that usually do not grow as many cold tolerant plants. It is also a problem since what constitutes cold to a succulent is not the same as cold to a conifer.

Problems often appear on warm weather crops being grown at times when cold temperatures can occur (vinca plugs to right, below).

Symptoms may appear almost overnight or take months to develop. The basil seedlings above, right showed the damage to their upper cuticle within a few days of the cold event. In contrast, the aloe to the left did not show the collapse and necrosis on lower leaves for a couple of months.



Micora IR-4 Comparison

I was recently asked to compare Micora (currently in the registration process by Syngenta) to current products for Phytophthora. I went to the IR-4 website and checked their summary.

On an unidentified species of *Phytophthora* on marigold, Micora at 8 oz was better than at 2 oz and about the same as FenStop, Adorn, Segway and Vital. All were as good as the noninoculated controls.

In a trial on *Ph. cactorum*, 8 oz/100 gal appeared to cause phytotoxicity on the roots on 1 of 3 rhododendron cultivars. Micora was better than Adorn or Heritage in this trial.

Many trials on *Ph. cinnamomi* (conifers, rhododendron) showed Micora was excellent at 2-8 oz. It was better than Adorn, Alude, FenStop, Aliette, Segway, Stature, Terrazole and Subdue MAXX in the trials.

Gerber daisy trials with *Ph. cryptogea* showed variable results but Micora was mainly excellent and about equal to FenStop.

On *Ph. drechsleri* on gerber daisy, Micora was excellent and about the same as Stature, Adorn, FenStop, Subdue MAXX and Terrazole.

Control of *Ph. nicotianae* was excellent and about the same or a little better than Segway and Stature, Adorn, FenStop, Subdue MAXX.

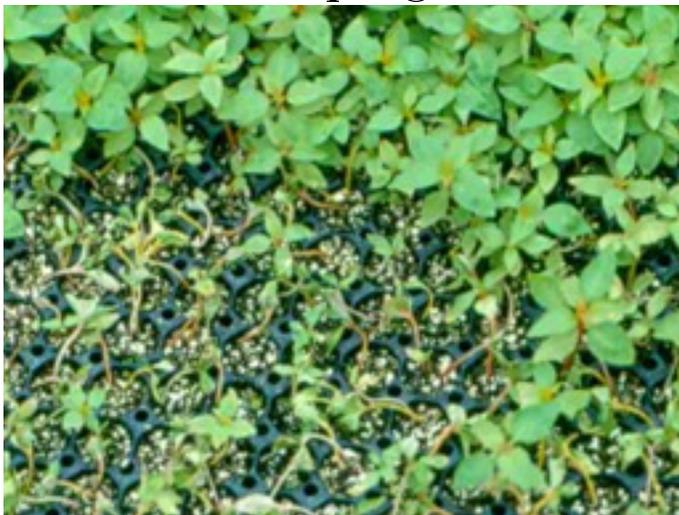
Micora was excellent on *Ph. palmivora* on Hedera. It was better than Segway and Adorn and about the same as Subdue MAXX. It provided no control on the same species on liriopse.

Control of *Ph. ramorum* was excellent at 8 oz and better than Adorn. Micora was excellent in most trials but only good-poor on some plants - the host affected the level of control.

Micora was excellent on *Ph. tropicalis* and about the same as Adorn, FenStop, Segway and Subdue MAXX.

Micora will be a great addition to Phytophthora control in many cases.

Fungicides for damping-off on Celosia



Damping-off on celosia seedlings can be caused by Rhizoctonia solani and several species of Pythium.

We have been using celosia as a test system for both *Rhizoctonia* and *Pythium* damping-off for several years. The test is fast and the plants unfortunately are susceptible to *R. solani*, *Pythium irregulare* and *Pythium ultimum* at least. In 2010 and 2011, we checked a variety of fungicides for efficacy against different species of *Pythium*.

This final test from 2011 evaluated products for control of *P. irregulare* (resistant to mfenoxam) and *P. ultimum* (sensitive to mfenoxam).

The trial started when seeds were sown (10 November) in 3.5 inch pots containing Sunshine No. 4 and top-dressed with Osmocote Plus 15-9-12. They were drenched 2 weeks later (about 2/3 oz per pot) and then inoculated 2 days after that. Pots were drenched again twice for a total of three applications on a 14 day interval.

The first signs of damping-off occurred 3 weeks after inoculation. The number of standing seedlings was recorded twice on a 7 day interval. Subdue MAXX (mefenoxam) was not effective on the resistant *P. irregulare* but did work better on the *P. ultimum*. Heritage also failed on *P. irregulare* but was pretty good on the *P. ultimum*. Hurricane (a combination of mfenoxam and fludioxonil) had more or less the same results as Subdue MAXX which would be expected since fludioxonil (Medallion) does not work on *Pythium*. Finally, the experimental product reacted similarly to Subdue MAXX.

The need for accurate diagnosis is the only way to use the most effective product for the disease. You could also use rotation or tank-mixing for a broader approach.

TREATMENT	RATE/ 100 GAL	# SEEDLINGS P. IRREGULARE	# SEEDLINGS P. ULTIMUM
Noninoculated	-----	7.0 b	7.0 a
Inoculated	-----	0.5 a	1.5 a
Subdue MAXX	0.25 oz	0.3 a	4.8 a
Heritage	0.45 oz	2.5 a	5.7 a
Hurricane	0.75 oz	0.8 a	1.2 a
Experimental	0.5 oz	2.5 a	5.3 a

Bactericides

Xanthomonas blight

I have been reading some older papers on bacterial disease control on crops other than ornamentals and ran across an interesting one on Xanthomonas blight on onions. The researchers evaluated calendar-based copper sprays compared to use of acibenzolar-S-methyl. This systemic acquired resistance product is being researched by Syngenta for its potential on ornamentals. It acts by triggering the plant's defenses to fight off diseases and has been quite effective in some of our trials on bacterial diseases.

Acibenzolar-S-methyl

The trials showed that using 4 weekly sprays of acibenzolar was as effective as 9-12 sprays of copper. It did not improve bulb yield but actually ended up reducing bulb yield if it was used 10 times on a weekly interval (presumably due to phytotoxicity). The research also showed that timing the copper sprays to coincide with bulb formation (1-2 weeks before) was as effective as starting 4 weeks before. It is critical to use products in a targeted way and not simply based on a calendar.

Iron increases copper sensitivity

I also found a paper on using iron (Fe) salts to increase ability of copper (Cu) to work on Cu-resistant bacteria. Trials were done on Xanthomonas blight on walnut. The addition of Fe salts to the spray solution lowered the pH of the solution and made more Cu ions available. This was not simply due to pH being lowered since it was far more effective than simply lowering the pH with an acid. The researchers suggested that the bacteria themselves were actually more sensitive to copper when Fe was present. Solution pH of 5-5.5 was much more effective than pH of 6-6.5. The rate of iron as Fe chloride was 50 ug/ml.

You might consider adding Fe if you have a copper resistance situation. Of course, you must test this addition for safety on your crops. The researchers also noted that wetting agents and other adjuvants could be very important in combating disease caused by Cu-resistant bacteria..

Cylindrocladium on Boxwood!!!



This is the result of Cylindrocladium leaf spot and cutting rot on myrtle which is grown as a cut foliage crop.

The last time the whole country reacted so violently to a new disease was daylily rust over 10 years ago. Now it is Boxwood blight. Bad news travels very and boxwood is an important and widely produced crop. The disease has now been reported in Rhode Island, Maryland, Massachusetts, Oregon and New York in addition to original finds and I am sure we can look forward to many more reports in the next few months. I have received so many requests for control strategies that I finally decided to see what I could do to help.

No research has been done on boxwood blight in US due to the simple fact that we did not have until quite recently. I realized, however, that I had done 10 trials on *Cylindrocladium* spp. on woody crops over the past eight years including two on azaleas and eight on *Myrtus communis*. I am struck by how similar the myrtle disease is to boxwood blight with propagation being especially problematic.

I have summarized our trials on azalea and myrtle. I opted to only list the BEST products and left out a few that performed well in a trial but are less likely to be effective. The single ai

strobilurins, Heritage and Insignia sometimes only provided some control but at other times provided very good control. In contrast, the combination of strobilurin and boscalid in Pageant resulted in more consistent control and was good to excellent. Terraguard (triflumizole) was very good in our trials. Medallion (fludioxonil) provided consistently the best control with Palladium (fludioxonil and cyrodinil) slightly less effective. Based on these trials, the best fungicides to try on boxwood blight should be Medallion alternated with Pageant or Terraguard.

FUNGI-CIDE	RATE/100 GAL	EFFI-CACY
Heritage	2-4 oz	some to very good
Insignia	8-16 oz	some to very good
Medallion	2 oz	excellent
Pageant	12-16 oz	good to excellent
Palladium	4-6 oz	very good
Terraguard	8 oz	very good

Mozart TR - Efficacy

We have worked on various total release (TR) products for the past 14 years. Our first efforts were for Whitmire Micro-Gen (BASF Corporation now). The product we tested was a TR formulation of fludioxonil (the active ingredient in Medallion). I was skeptical at first but early trials proved that the TR form was able to deliver the same level of control as the Medallion wet spray which has been included for comparison in each trial. The table to the right shows the summary of our trials starting in 1997 through the end of 2011. Several were performed more than once.

The trials rarely showed any phytotoxicity. If there was any, both Medallion and Mozart TR treatments were affected making sensitivity to fludioxonil the likely case and not the delivery method.

If you are growing plants in an enclosed structure you might consider trying Mozart TR. It has a wide range of efficacy similar to Medallion and the added benefit of not adding more water to the winter growing environment.

Disease (plant)	Medallion	Mozart
Alternaria (impatiens)	Excellent	Excellent
Alternaria (pittosporum)	Good	Good
Botrytis (geranium)	Very good to excellent	Some to excellent
Botrytis (gerbera)	Very good	Very good
Botrytis (pansy)	Excellent	Excellent
Botrytis (lisianthus)	Good	Good
Colletotrichum (cyclamen)	Good	Good
Cylindrocladium (myrtle)	Excellent	Excellent
Downy mildew (snapdragon)	None	None
Powdery mildew (rose)	Very good	Very good
Rhizoctonia (poinsettia)	Some	None



There are many hosts of Botrytis cinerea including pansy, geranium, gerber daisy, poinsettia, primrose, chrysanthemum, lisianthus and rose. In the winter months, most plants can be attacked due high humidities, free water on leaves and ideal temperatures. This is especially a problem in propagation (peony cuttings below).



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Customer Service?

Ah yes...we've all been on the receiving end. We are either put on hold forever or given a voice prompt directing us to push buttons. Basically they want you to hang up and not deal with you at all. A few weeks ago I watched an episode on CNBC on this topic. As you know, everyone is fed up with most companies' "Customer Service" phone help. Usually when you call a company you are transferred to overseas somewhere often with someone speaking very little English - at least that I can understand easily. It's gotten to the point to where these people are taught to "Lie" and say they are located in the US somewhere...just to keep our anger down.

This will be changing with some companies as they are trying to figure out how (cost effectively) to bring their customer service back to the US. Thanks to YOUTUBE, several very unhappy people have displayed their anger at certain companies with videos of them demolishing new products after they've gotten off the phone with customer service. They vow to never purchase anything else from that company. This has finally gotten the company's attention as it gives them a bad rap.

I can tell you, when you call us you **will** get a a rapid, personal reply and not a "Run-around". We are too small to outsource!

Mike