



WHAT'S WRONG WITH THIS PLANT?

One of the hardest things to teach a new employee is how to spot trouble before it gets out of hand. Any successful grower has mastered the technique of walking through a greenhouse range and pinpointing a diseased or insect infested plant in a seemingly uniform group of plants. What do we see that tells us that plant is different than all of the rest on the bench?

Recognize a healthy plant

The most important thing for anyone to learn is what a healthy plant looks like. Each plant species or cultivar has special growth habits, colors and rates of growth. If you don't know what to expect of the plant you cannot tell when something is wrong. So the first step is to recognize healthy plants. With all of the new colors available for plant foliage and flower color it is sometimes difficult to determine that the cultivar has naturally yellow leaves (for instance some of the *Coleus* cultivars) or it is under fertilized. One way to check this out is to review seed catalogues for photos of the ideally grown plant. If this is not available, you can check some other characteristics of the plant. A fertilizer deficiency is a real possibility if the new leaves are smaller than they should be or if they are different intensities of green from the base of the plant to the tips. In addition, the root system can give you a clue on the level of nutrients. If the roots are more developed than you would have guessed for the amount of top growth then it is possible that the available nutrients are low. Excessive root growth on under fertilized plants is the plants way of trying to reach more potting medium or soil to absorb more nutrients.

Signs of root problems

The most obvious sign of root problems is wilting. In addition, if the color of the plant is dull instead of bright and clear it may indicate water stress. Many things can cause water stress including lack of water, root rot, exposure to bright light or heated air. The entire root system may be stunted and underdeveloped due to root fungi or nematodes. If the roots appear gray or brown and fall apart when you gently pull at them it is likely they are infected by a root fungus.

Stunting

It is relatively easy to teach someone to spot a small plant in the midst of normal sized ones. It is harder to recognize stunting when all of the plants on the bench are uniformly small. This type of condition is usually due to a cultural problem such as lack of fertilizer and is not common for a disease. Most stunting caused by plant pathogens is spotty since it is rare for all of the plants to be infected by the pathogen to the same degree. A bench with plants of all sizes (when they were all planted at the same time) can be a good indicator of a disease problem.

What to look for up close

Once you spot a problem of wilting, off color or stunting it is necessary to examine the plants closely for additional signs and symptoms. We spoke above about examining roots but what about the leaves? Look for distortion, mosaic (color breaks), yellow or dead spots, and wet or mushy areas. Each of these symptoms is characteristic of at least one disease type. Distortions and mosaics are typical of virus infection while wet and mushy spots are most often caused by bacteria. Yellow or dead spots can be caused by bacteria, some viruses (like Tomato spotted wilt virus), fungi and even phytotoxicity.

If you find this symptom type, it is a good idea to consult with an expert before deciding the course of action. Most experts prefer to culture from these symptoms before making a diagnosis and recommendation for control. Be prepared to send in a sample. It may seem that you cannot afford either the cost of this service or the time to receive the diagnosis. The costs of applying inappropriate treatments due to an inaccurate or incomplete diagnosis is usually even higher. The best way to give yourself the time needed is to catch the problem early. Don't assume that if only a few plants are damaged that the problem won't get worse. The best way to treat disease is to get that diagnosis as early as you notice symptoms. We wouldn't consider ignoring an infected cut until it was necessary to amputate the arm. Scout your plants regularly and don't wait until the problem reaches epidemic proportions. To coin a phrase: "An ounce of prevention is worth a pound of cure."

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WATCH OUT FOR THESE DISEASES

Over the past three months, I have been making rounds of many growers on the West Coast. During that time I have started to see some trends in new and/or uncommon diseases. They fall into two broad categories: bacterial diseases and rust diseases. We collected samples from these plants and confirmed the field diagnoses.

One of the most unfortunate things about these diseases is that the growers had no idea what was causing their problems and were resorting to ineffective treatments. Diagnosis is always the first step!

XANTHOMONAS BLIGHT ON CRUCIFERS

Xanthomonas leaf spot and blight is really gaining ground in our perennials nurseries. We have introduced many new cultivars of wallflower, candytuft and other crucifers that have unfortunately been infected with Xanthomonas. These bacteria are probably the same as the one that infects stock (*Matthiola*) via seed contamination.



Stock

Nobody has proven how the *Erysimum* and *Iberis* are infected but bacteria from all three plants infected alyssum and stock in a recent trial. Leaf spots look a lot like copper toxicity, making diagnosis a challenge. They are small black, water-soaked specks with yellow margins. On stock they sometimes are systemic and cause stems to crack and reveal mushy centers. Wallflowers and candytuft also have these leaf spots but on candytuft the stems can also show long black spots.



Wallflower

This disease was first found on cabbage and has the common name black rot. I think it is safe to consider other members of the crucifer family to be susceptible to this disease. It would be a good time to bone up on your plant taxonomy.

Control may be difficult. Plants such as stock that are propagated from seed are routinely infected through contaminated seed. Surface treatment with 10% bleach for 5-10 minutes seems very effective in cleaning this seed. One nursery had inadvertently spread the infection in wallflower using electric pruning shears.

Copper products and a new biological control (Rhapsody) have been somewhat effective in controlling Xanthomonas leaf spots in our trials. I would not expect much benefit if the infection is systemic but leaf spot can be controlled in a weekly rotation as well as limiting exposure to overhead irrigation and rainfall when possible. Make sure new cuttings are symptom-free and never propagate from diseased plants.



Candytuft

ARGYRANTHEMUM RUST

In September, I saw rust on *Argyranthemum* (used to be *Chrysanthemum fruticosum* or marguerite daisy) for the first time at two Southern California nurseries on the same day. It is orange-brown and was found throughout the propagation and production areas. This rust was easy to see on the undersides of leaves but occurred all over the plant. The disease was more severe on some cultivars than others. The host-pathogen listing for the US fails to record any rust diseases on marguerites but does list *Puccinia* on related members in the Asteraceae family.

Of course, we also have brown rust (*Puccinia*) and white rust (*P. horiana*) on Florist's chrysanthemum but this one was clearly different. Next time I see it, I suppose I will have to resort to the microscope and see if I can at least figure out the genus of this apparently new rust disease.



A FEW MORE XANTHOMONADS

Over the years I have seen my share of bacterial problems on rosemary and lavender. I isolated *Pseudomonas cichorii* from these plants previously but most recently have started to isolate *Xanthomonas* instead. From the standpoint of control, this is not relevant since copper products (and Rhapsody) work reasonably well on both types of leaf spots.



All of the lavender types I have found can be infected with one or the other of these bacteria. The picture above shows Xanthomonas on Spanish lavender while that on the left shows the same disease on rosemary. Use of these plants as perennials has resulted in production systems that supply more water and fertilizer than is ideal for these crops. These two conditions weaken the plants and promote disease. While copper sprays are effective, changing the cultural practices is more effective in reducing bacterial diseases.



The most recent isolation of Xanthomonas was from *Bellis* (English daisy). Unfortunately copper damage looked the same and diagnosis through culturing was necessary to confirm the actual cause.



Xanthomonas leaf spot on Bellis

PAST, PRESENT AND FUTURE RESEARCH

ERWINIA CUTTING ROT CONTROL WITH BACTERICIDE DIPS

In 1988, I performed a series of trials for Erwinia soft rot control on pothos (*Epipremnum aureum*) cuttings. Although this may seem like a long way to go for information, the products are still available and the lessons learned still pertinent. The products tested included Kocide 101 (alone and combined with mancozeb), Aliette, Agri-Strep and Captan.

Best overall control was seen with Kocide used at 1 lb/100 gal when used as a 15 minute dip (90-100% control on the average). Tests to evaluate dip times from 5 to 30 minutes showed that 5 minutes was sufficient. Under warm conditions favoring Erwinia, efficacy was reduced to 50%. In this case, the addition of mancozeb at 1 lb/100 gal significantly improved the control (almost as high as under cool conditions).

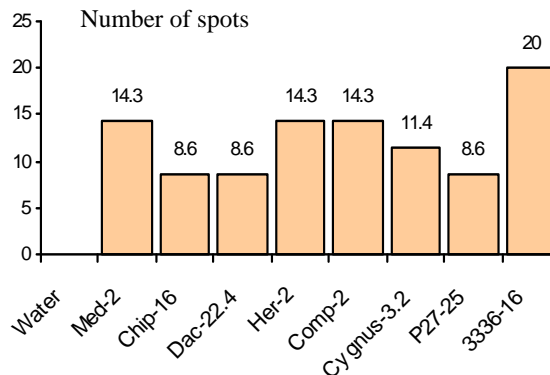
Aliette did not give acceptable control used at 8-32 oz/100 gal. Captan was also ineffective when used at 8 oz/100 gal. Agri-Strep at 8 oz/100 gal usually gave control equal to Kocide at 16 oz/100 gal in a 5 minute dip. Finally, Kocide (1 lb/100 gal) solution temperatures between 60 and 85F gave equal control of Erwinia cutting rot on pothos.

While many of you may not be growing pothos, or other foliage plants, poinsettia cuttings and calla lily bulbs also have serious problems with Erwinia. I do not recommend dipping in general since it is one of the best ways I know to spread a bacterial disease like Erwinia soft rot. If you do insist on dipping at least this research on pothos should give you a starting point for determining your best dipping method.

PHYLLOSTICTA LEAF SPOT ON *DICKSONIA* FERNS

Phyllosticta leaf spot on *Dicksonia* ferns has been a serious problem for the past 4-5 years. The disease appears to be difficult to control with the products available once it has become established in the young plants.

We collected a flat of infected *Dicksonia* a few months ago and started treating with a variety of the most effective leaf spot fungicides available. We applied the products weekly and continued to mist the plants from overhead. Disease severity was recorded on 27 October after four fungicide applications. The percentage of control given by each treatment is shown in the graph above.

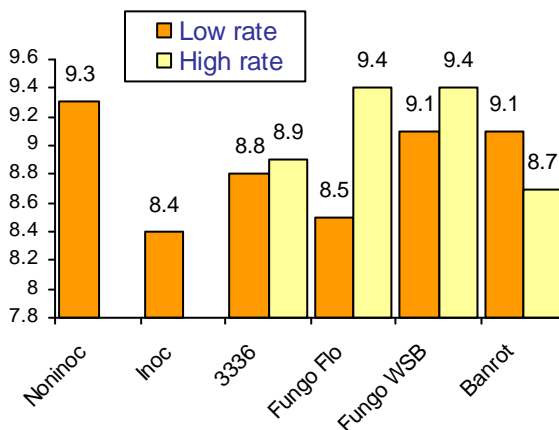


None of the treatments gave satisfactory control although 3336 (16 oz/100 gal) resulted in most disease reduction. Least effective products were Chipco 26109 (16 oz), Daconil Ultrex (22.4 oz) and Phyton 27 (25 oz). We continued the test for another five weeks with even less inspiring results. It appears that prevention of Phyllosticta leaf spot on *Dicksonia* is the only way to control this problem.

BLACK ROOT ROT CONTROL

One of the most common questions in disease control is whether the same active ingredient in different products gives the same degree of control. We decided to check several formulations of thiophanate methyl for control of black root rot (*Thielaviopsis*) on pansy. We tried 3336, Fungo Flo, Fungo WSB and Banrot at a low and high rate. We applied the products once before inoculation and thereafter every 2 weeks for a total of four applications.

At the end of the test, we rated height (shown in the graph below in cm), top grade, root grade and top weights. The lower rate of each fungicide failed to give adequate control while the higher rates tested usually provided growth equal to the noninoculated control. Differences between the fungicides were minimal but both Fungo WSB rates were slightly better than the other products we tested.



WINTER TRIALS ON THE HORIZON

Here is your chance to have some input into the treatments we include in a few upcoming trials. If you have a product you would like to see tested, please e-mail me before 15 January with the trial and product and we will try to include as many as possible. The following are some of the trials we will try to complete by the end of winter:

- Xanthomonas leaf spot - Stock**
- Downy mildew - Rose**
- Downy mildew - Stock**
- Powdery mildew - Gerbera**
- Alternaria leaf spot - Poinsettia**
- Botrytis blight - Geranium**
- Alternaria leaf spot - Impatiens**
- Xanthomonas blight - Lavender or Rosemary**

PRODUCTS IN REVIEW-CHIPCO 26GT

After years of using Chipco 26019 50WP with excellent results I finally had to switch over to Chipco 26GT. The results of our tests over the past few years with this new flowable formulation are given in the table below.

We have tried 24 and 48 oz/100 gal against *Alternaria* leaf spot on impatiens and dusty miller (right) and the closely related *Heterosporium* leaf spot on Dianthus with very good to excellent results.



Alternaria leaf spot

Botrytis blight is a common target for Chipco 26GT. We had less satisfying results with rates of 32 and 48 oz/100 gal. In some cases we saw 75% control (cyclamen flower blight). In others, disease was more severe than on the water sprayed controls. This may have been due to phytotoxicity since this commonly results in an increase in severity of Botrytis blight. *Rhizoctonia* stem canker on vinca and cutting rot control on poinsettia was in contrast very good to excellent.

Finally, we had excellent results preventing *Sclerotinia* leaf spot on petunia. Unfortunately, some petunia cultivars are very sensitive to iprodione (active ingredient of Chipco 26GT). Multiple applications resulted in severe interveinal whitening.



Rhizoctonia cutting rot



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Disease	Plant	Rate/100 gal	% Control
Alternaria leaf spot	Dusty Miller	48 oz	100%
Alternaria leaf spot	Impatiens	48 oz	100%
Alternaria leaf spot	Impatiens	24 oz	92%
Botrytis flower spot	Cyclamen	48 oz	75%
Botrytis leaf spot	Geranium	32 oz	73%
Botrytis leaf spot	Geranium	48 oz	0
Botrytis leaf spot	Pansy	32 oz	60%
Botrytis leaf spot	Ranunculus	48 oz	0
Heterosporium leaf spot	Dianthus	48 oz	87%
Rhizoctonia cutting rot	Poinsettia	26 oz	80%
Rhizoctonia stem canker	Vinca	24 oz	100%
Sclerotinia blight	Petunia	48 oz	100%

UPCOMING MEETINGS AND TRADESHOWS

WESTERN PLANT GROWTH
REGULATOR SOCIETY MEETING-
JANUARY 14-15, SACRAMENTO, CA.

TROPICAL PLANT INDUSTRY
EXPOSITION (TPIE)-JANUARY 15-17,
FT. LAUDERDALE, FL.

NEW ENGLAND GREENHOUSE
CONFERENCE- FEBRUARY 5-7,
BOSTON, MA.

SOCIETY OF AMERICAN FLORISTS'
PEST MANAGEMENT CONFERENCE—
FEBRUARY 20-22—SAN JOSE, CA.

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