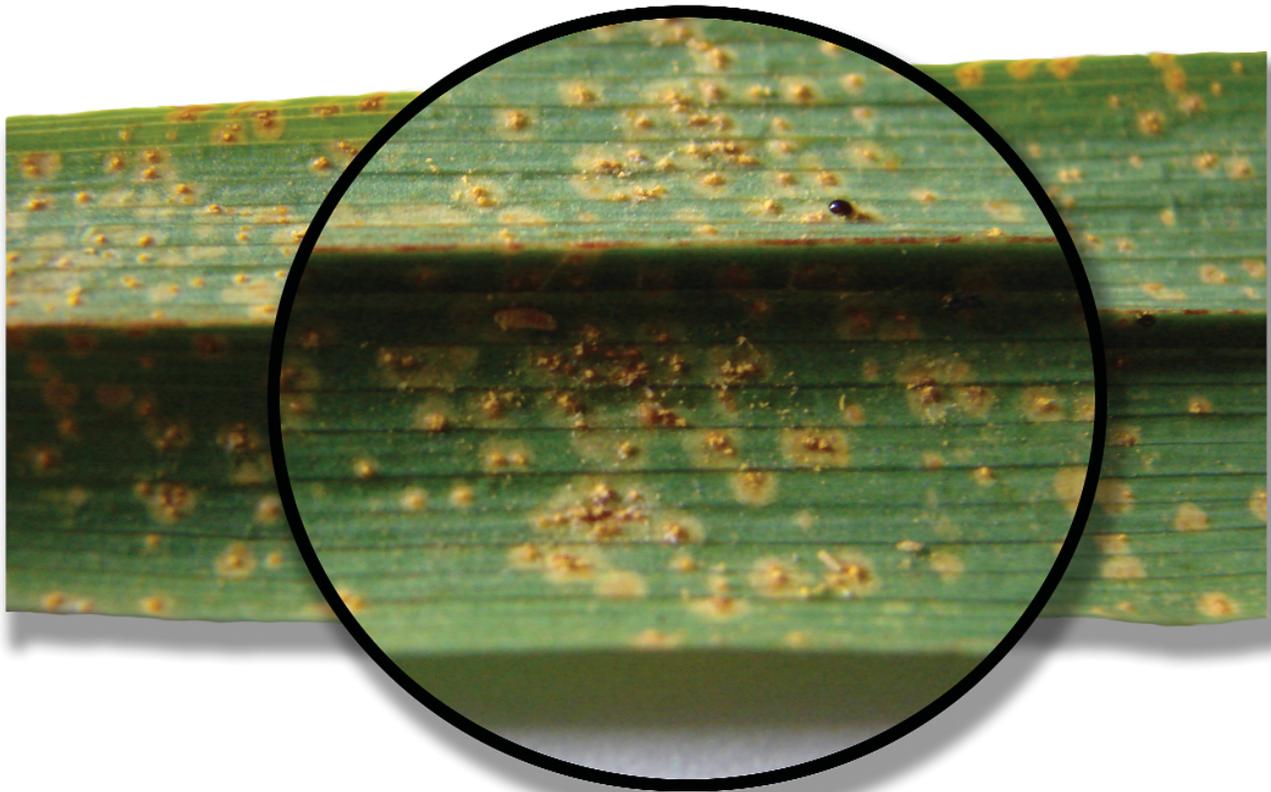


Controlling Daylily **Rust**



**By Patricia Crooks Henley, Ph.D.
Region 2, Ohio**

When daylily rust first appeared in the U.S. in 2000, little was known about its potential spread and impact. Today, we know that it generally is winter-killed in zones as cold as USDA zone 6. In zone 7, rust persists in some areas but not others. In zone 8 and warmer, rust may be present year-round. Anywhere green daylily leaf tissue survives, there is a chance rust can survive with it.

Diseased leaves are unsightly and often die prematurely. Badly diseased plants may dwindle away, but most daylily cultivars are not that badly affected. Although it blemishes the leaves and sometimes the scapes, it does not infect the flowers, consequent-



*Patricia Crooks
Henley*

ly, many gardeners find rust tolerable at low levels. In some states rust is a more pressing issue because growers cannot sell daylilies if rust is found anywhere in the nursery.

Rust severity varies according to weather conditions. Rainy periods and mild temperatures in the 60 to 80 degree Fahrenheit range favor rust, while low temperatures, high heat, or drought hold it at bay. In many areas rust seems to break out most strongly in fall.

Rust control has a single goal: Preventing rust infections by reducing the number of spores being released into the garden. Rust infections damage leaves while growing inside them, then produce pustules filled with spores that are the

cause of new infections. The fewer spores produced, the fewer new infections that will occur, and therefore less damage to the leaves.

The most important weapons you have are “cultural” controls as outlined in the first steps below. Fungicides are not the first line of defense, they are the heavy artillery to use when all else fails. If you have a choice, don’t use them. Many are rated as “bad actors” by the Pesticide Action Network (PAN), having potentially hazardous side-effects on you or the environment.

1. Eliminate the most rust-prone cultivars from your garden. Daylily cultivars do vary in how susceptible they are to rust infection, how badly they are damaged by it, and how many spores are produced if they become infected. In one study, the



Rust is seen outdoors and in a container grown daylily.



Sue Bergeron photos

most susceptible cultivar produced over 36,000 spores per square centimeter of leaf, whereas the most resistant cultivars produced *none* in the same time period! (Li, *et al.*, 2007). Considering that the rust disease can cycle from a single infecting spore to a new pustule producing thousands more spores in as little as 10 days, this makes a huge difference in the amount of disease that is likely to develop over the season. If you want to keep some of the rust-prone ones, try grouping them together in an “intensive care” bed.

See the sidebar for the address of Rebecca Board’s Rust Survey website that lists rust susceptibility ratings of numerous cultivars, and please contribute your own observations!

2. Watch for rust pustules developing. Remove diseased foliage as soon as you can. The pustules are the small, rounded blemishes which are filled with loose orange spores. If you’re in doubt, try wiping the leaves on both sides with a white tissue; a powdery orange deposit indicates rust. Diseased foliage should be collected in plastic bags or heavy-paper yard-waste bags. Try to handle the foliage in a way that minimizes shaking spores loose into the air. If practical, completely removing all the foliage once a year can reduce spore levels substantially. In transition climate zones, growing deciduous daylilies can reduce carryover.

3. Promote leaf dryness by spacing plants well and avoiding sprinkler irriga-

tion. To germinate and infect the plant, rust spores need moisture for about 4 hours. Longer moist periods permit greater numbers of spores to germinate. Moisture trapped inside clumps creates an ideal environment for disease. Leaves will dry faster if daylily clumps are spaced well-apart, and the clumps are divided as needed to prevent crowding. It’s also easier to “scout” for rust and to remove diseased leaves when plants are not crowded. Drip irrigation is recommended rather than sprinklers.

Many non-commercial daylily growers report that cultural practices like the ones above control rust well enough they don’t find it necessary to use fungicides. Rust may still be present, but at levels they find tolerable. Daylily sellers, though, do not always have the option of tolerating rust in their gardens. Some state departments of agriculture require nurseries to be rust-free to be certified. In other states, rust can be present in the nursery, but any plants which are actually sold are supposed to be rust-free.

4. Keep track of the disease cycle in your garden. Keep a log of the dates when rust appears in your garden. Record rain events and temperature cycles in your garden and try to relate them to rust outbreak or quiescent periods. Try to figure out whether there is a pattern of rust occurrence; it tends to be seasonal in most regions. If you decide to use sprays as part of your rust control program, knowing

when the most severe rust episodes are likely to hit will help you target the treatments for best results.

5. If necessary, use fungicides. Fungicides cannot make sick leaves healthy again. The lesions and damage won’t go away. The purpose of fungicides is to protect the leaves from becoming diseased, or from getting worse. To do that, fungicides have to be applied as soon as rust appears, before a lot spores are produced. By spraying early in the disease cycle, you can use a lower rate of fungicide and space the sprays further apart, saving money and time. Remove as much of the diseased foliage as possible before applying fungicides.

Before you buy a fungicide, read the information on the label. Does it say it can be used on daylilies (or at least “ornamentals”)? Does it say it will control *Puccinia* rust diseases? That’s the group daylily rust belongs to. What protective equipment do you need to wear while you are mixing it, and while you are applying it? How often should you apply it? What pH should the water be? Is there a maximum number of times it can be applied per season? The label tells you all this and much more that you need to know. You can find sample labels and Material Safety Data Sheets online at the PAN and other sites. For your safety, fungicides and all other pesticides should only be purchased and stored in their original containers.

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Fungicide names are confusing! A fungicide product might be described by several different terms, such as its chemical class, its mode of action, its active ingredient, and one or more brand names. No wonder we can't keep them straight. Recognizing this problem, manufacturers have started labeling fungicides with a "Group" designation, according to the active ingredient's mode of action. These groupings clarify how to use fungicides in ways that minimize the risk of fungi becoming resistant. When fungi develop resistance to a fungicide, they are no longer controlled by it; you don't want that happening in your garden! The main approach to minimizing resistance is to rotate applications of fungicides from different Groups so that fungi are not exposed to the same kind indefinitely.

The fungicides which have most consistently been shown effective against daylily rust and are labeled for that use in the U.S. fall into three mode of action Groups¹:

Group 3 systemic fungicides (DMI inhibitors). Two which have performed well in most studies are triadimefon (Bayleton, Strike, and other brands) and

propiconazole (Banner Maxx and other brands).

Group 11 systemic fungicides (Stobilurins). Three are currently labeled: azoxystrobin (Heritage), pyraclostrobin (Insignia), and trifloxystrobin (Compass).

Group M contact fungicides, particularly chlorothalonil (M5) and mancozeb (M3). These two are available in several brand names and various concentrations.

There are other products which may be effective against daylily rust, but the ones listed are the basis of most of the successful rust control programs used by experienced growers. The basic strategies of rust control never change, but the products available do, so watch for new information. Be wary of claims that one product is the same as another. Two products can have the same active ingredient and even the same concentration but have different formulations, which greatly affects how they are used.

How do you decide which ones to use? There is not a lot of difference in how well these fungicides have controlled rust on plants in greenhouses in research studies. But there are differences in how well they will control rust outdoors in gardens, in how they should be used, in safety issues, and in cost. One important factor is the frequency that you find it necessary to treat in order to control rust in your garden. If

it's only once or twice a year, rotation is not a critical issue. You could choose just one product. If you need to treat frequently and you plan to use any of the systemics (Groups 3 and 11 here), you need to use at least two products and they must be from two different Groups (3, 11, or M).

The Group M contact fungicides are the least costly, out-of-pocket. They can only protect the leaf surfaces they actually cover (contact). That makes it necessary to spray the undersides of daylily leaves if you are trying to protect them with a contact fungicide alone, because rust can easily infect daylily leaves from the undersides. Researchers have obtained excellent rust control with these contact fungicides

¹Outside the U.S., fungicide Groups may be designated by letters instead of numbers, otherwise they are the same. Brand names may also be different. The common name of the active ingredient, such as chlorothalonil, does not change. Not every fungicide is available in every country, nor even in every state in the U.S.. Sometimes the same product is sold under more than one brand name, but it can be difficult to determine whether they are actually the same. Always use the product that is correctly labeled for the situation in which you are applying it.

alone, but they were treating potted plants with one or a few fans each. Daylily clumps in gardens are much harder to spray thoroughly!

The risk that fungi will become resistant to contact fungicides is very low, so they do not have to be rotated. Chlorothalonil is the most widely available and can be mixed with many other fungicides (check the labels first). Example brands are Bravo, Daconil, and Fung-onil. Mancozeb is a little harder to find; Protect DF and Bonide Mancozeb Flowable are two examples.

Systemics have several advantages compared to contacts. They are absorbed into the leaf, where they protect it from infection by spores that land on the undersides. Contacts can't do this. Systemics may be active against infections that already started a few days before the fungicide was applied. Systemics are generally effective over a longer period than contacts. Systemics do have one important disadvantage, which is that fungi are more likely to become resistant to them; that is why rotation is needed if they are used frequently.

The strobilurins in Group 11 are the



Certain Patrinia species are the only other plants known to be susceptible to daylily rust and in Asia allow the disease to re-develop after winter even where the daylilies are deciduous.

most effective systemics against daylily rust, and also the most expensive. Dr. James Buck reported: "In some of our work (unpublished) we observed that the strobilurins were the only class of fungicide that significantly lowered spore production from active lesions" [personal communication, 2008]. Of the three listed, Compass is the most economic for a small garden. It's available in a 2-ounce size for about \$70 (or 8-ounce for \$230). Heritage is available in a 4-ounce for about \$170 (or 16 ounce \$500). Currently, Insignia (which was tested as BAS500) only seems to be available in a 2.4-pound size for about \$370. Very small amounts of these products are used, about 1/8-1/2 teaspoon per gallon (again, check the labels), so a little goes a long way.

Where rust is a threat year-round, and treatments are ongoing, using more than one product and rotating them properly becomes paramount. Read the label of the product you are using, but in most cases you should never make more than three consecutive applications of any one systemic fungicide nor of any products from the

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same Group of systemics. Remember that to rotate systemics, you need at least one product each from two different Groups. That means, for example, that alternating Bayleton and Banner Maxx would *not* be properly rotating because both are Group 3. Any product from Group 3 rotated with any product from Group 11 or Group M would be acceptable. Group M fungicides can be used in several ways depending on what is allowed by the labels: 1) alone; 2) combined with any systemic or any other contact; 3) in rotation with any systemic; 4) both in combination and rotation.

Many plant pathologists recommend adding a contact fungicide to each application of a systemic to assist in killing spores. Although alternating two different contact fungicides seems to be common practice among daylily nurseries, you could add the same one each time if it can be mixed with the other products you are using.

An example of an intensive rotation program using the above products:

First application: Group 3 DMI (such as Bayleton or Banner Maxx) + mancozeb

Wait 14-28 days (if less than 14 days, repeat this combination once – see below)

Second application: Group 11 strobilurin (Compass, Heritage, or Insignia) + chlorothalonil

Wait 14-28 days (if less than 14 days, repeat this combination once – see below)

Repeat the cycle

The “waits” given reflect the long residual activity of these systemic fungicides. The labels might permit using them as often as every seven days, but if you find it necessary to use any of these systemics at intervals of less than 14 days, use the same one *twice* before switching. The reason being the residual activity of these systemics can extend beyond two weeks. By repeating the same fungicide at close intervals the two applications reinforce each other, building and maintaining an effective level of that fungicide for a longer period. Then, while you make the next two applications using different fungicides, the longer reprieve allows the first combination to dissipate from the plant before it is applied again. This meets the goal of rotation. When rust threat is highest and when daylilies are actively growing, use the highest rate (amount) of the fungicide per application that the product’s manufacturer recommends.

Systemic product labels may have limits stated for the number of times they can be used, or the total amounts per year. For example, Heritage currently states that it should not be used more than 8 times per year. To avoid overusing these systemics, you may need to do some applications using only the contact fungicides. If so, save the systemics for periods when rust threat is highest based on your experience with the disease cycle.

The systemic products listed have given good control of daylily rust for at least a two-week period in research studies (e.g. Mueller *et al.*, 2004, and others). Most daylily growers report that they spray every two weeks when conditions are optimal for rust development. When conditions are less favorable such as during cool winters and hot summers in the subtropics, every month seems to be adequate. In the upper south, some growers report that just one or two treatments in the early fall are enough to give satisfactory control.

The three most important words in spraying fungicides? Coverage, coverage, coverage. Spray until all the leaves are thoroughly wet, all the way inside the clump. Try to cover the undersides of the leaves also. Remember that the young leaves in the

center of each daylily fan are actually growing from the bottom up, so the newest portion of each leaf is at the bottom. New growth has to be treated in order to be protected.

Keep a log of your spray applications and make notes on how successful they were. Realize that it may be 10 or more days before pre-infected leaves show pustules. So, you may see some rust even though your sprays were successful in controlling spores that landed after the treatment.

Reading the labels of the fungicides you’ve chosen, you may find they can also control various other diseases which cause problems for daylilies. Names like *Aureobasidium*, *Colletotrichum*, *Fusarium*, *Pythium*, *Phytophthora*, *Rhizoctonia*, *Sclerotium* may be included. At first this may sound terrific. Think of it, controlling so many diseases with a single product. On the other hand, think of this – if you misuse or abuse that product, resistant pathogens of *all* those diseases could develop in your garden! Also, the fungicide may be affecting beneficial fungi in the soil, directly and indirectly. Many reasons exist to use fungicides thoughtfully and conservatively.

The author welcomes feedback on this article, additional information, or questions relating to it, which may be published later. Please write: daylily@greenapple.com. ◀

References

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Online sources of information on Daylily Rust

The single best source of information about daylily rust is Susan Bergeron’s Daylily Rust Information Page. The site has images, and lots of links, both general and specific.

<http://web.ncf.ca/ah748/rust.html>

Find (and contribute) rust resistance ratings for daylily cultivars on Rebecca Board’s Rust Survey website. Participating requires filling out a garden form, which can be as complete or as brief as you choose.

<http://www.daylilyrust.org/survey.html>

The Pesticide Action Network (PAN) Pesticide Database can be searched by name of product, active ingredient, or manufacturer. Has links to product specimen labels and safety data sheets (MSDS). Gives toxicity to humans & animals, and environmental hazards. Rates some as “bad actors”. Lists products which are simply re-packaged versions of others, allowing you to tell which ones are actually identical.

<http://www.pesticideinfo.org/>