Symptoms

Above ground symptoms include death of leaves, starting at the outer leaves and continuing inward. It eventually leads to premature plant death. Diseased areas can be seen as patches of dead leaves or plants, usually any time from mid-season to harvest. Below ground symptoms include a semi-watery rot of bulbs and roots. There may be fuzzy white material present in the rotted area, which is the fungal mycelium. You may also see sclerotia (the overwintering structure of the fungus), which are tiny round structures that resemble poppy seeds, around the size of the head of a pin. Infected bulbs are not marketable.

Disease Cycle

White rot is caused by the soil-borne fungus Sclerotium cepivorum. It can infect all plants in the Allium family (including leeks and chives,) but garlic and onions are the most susceptible. Currently, there are no available resistant varieties. White rot spreads and overwinters as sclerotia, which are small round, black fruiting structures similar in appearance to poppy seeds. The sclerotia are highly resistant to adverse temperatures and conditions, and can remain alive in the soil for thirty or more years, even in the absence of a host. A very small number of sclerotia can cause significant disease, and it is very difficult to control. Multiple controls are needed to produce a sufficient yield in infected fields. Ideally, the disease needs to be controlled both by reducing the number of sclerotia in the soil, and slowing fungal growth (i.e. with both a sclerotia germination stimulant and fungicides.)

Controls

Sanitation

Only use clean seed or transplant stock. Infected planting stock is responsible for spreading the disease over large areas. Any time infected soil is moved, sclerotia will be moved as well. They can move in water, on equipment, on shoes, and in the wind. It is very important to reduce the spread of the fungus by practicing good sanitation. Wash tractors, spray rigs, harvesting equipment, etc. when moving between infected and uninfected fields. Wash equipment with water only, and make sure all soil is washed off. If muddy, wash off boots between fields.

Cultural Controls

White rot grows the best under the same conditions that are good for onions and garlic (cool weather and moist soil), so it is difficult to avoid the pathogen by changing planting dates. In areas with hot summers, planting in the Spring and harvesting in the Fall will reduce potential disease. This strategy is not effective in areas with cool summers. If you see white rot infections in the field, reducing irrigation may slow spread of the disease.

Sclerotia Germination Stimulants

Sclerotia germination stimulants are extremely effective in reducing the numbers (and initial inoculum) of sclerotia in the soil. They can reduce numbers of sclerotia in the soil by over 90%. The active ingredient is the chemical diallyl disulfide (DADS,) which is the same chemical that is naturally exuded by Allium roots. This chemical triggers sclerotia to germinate. When DADS is applied artificially in the field in the absence of Alliums, sclerotia germinate and cannot find an Allium host. This causes them to germinate and die, rather than lying dormant. DADS is available as a commercial product, called Alli-up. Garlic oil/extract (which also contains DADS) is also equally effective.

DADS (in the form of either Alli-up or garlic oil) is applied at the rate of 1 gallon per acre in a fallow field. It is essential to shank-apply DADS during cool weather in moist soil. Otherwise, the sulfur compounds will volatilize and the application will be ineffective. There can be no Alliums planted in the treated area for at least a year after application. However, it’s fine to grow other crops, such as wheat, corn, etc. during the one year Allium-free period. After this period, Allium crops can be grown again. It is however, still very important to apply a fungicide at planting, even after DADS treatment.

Chemical Controls

Currently, three fungicides are registered for white rot control: tebuconazole, fluazinonil and boscalid. Regardless of which fungicide is used, they need to be applied in a 4-6” bandwidth, at planting, and in the seed furrow. Later fungicide applications are ineffective in controlling disease. Multiple applications are not significantly more effective than a single application to control disease. Tebuconazole is the most effective fungicide for white rot control. Please note that tebuconazole is phytotoxic on onions if it is applied at a higher concentration than the recommended 20.5 fl oz/acre. Phytotoxicity can also occur if the bandwidth is narrowed, even at the recommended rate per acre. If a narrower bandwidth is applied, then the tebuconazole concentration per acre must also be reduced. Fluazinonil and boscalid are also effective in reducing white rot.

Organically Acceptable Practices

Organic growers should follow sanitation and cultural control practices. Sclerotia germination stimulants from natural sources (such as garlic oil/extract and powder) are acceptable for organic use. Currently, there are no other organically acceptable controls which have proven to be effective.
SUMMARY—CONTROLLING WHITE ROT OF ONION AND GARLIC

To Prevent New Infected Fields:
• Use clean, disease free garlic seeds and onion transplants
• Clean tractor equipment, shoes, etc. between infected and uninfected fields
• Don’t let irrigation water in infected fields to spread to clean fields

When You Find a New Infected Field:
• Reduce further spread of the disease to new areas
  o Wash equipment between healthy and infected fields
  o If possible, prevent the spread of irrigation water between healthy and infected fields
  o After harvest, do not compost or till under infected bulbs; dispose of them
• Reduce irrigation, which may slow disease progress
• Once infected plants are found, there are NO chemical controls which will stop or reduce disease during the current season.
• Note the field location and disease severity, and report it to Bob Ehn. This is very important for providing funding and justification for new control research.

When You Want to Plant Alliums in a Field that is Known to have White Rot:
• Apply a sclerotia germination stimulant (such as garlic oil), 1 year before planting any Allium crop. Shank apply 1 gallon of product per acre in moist soil under moderate temperature conditions (50-70°F). There cannot be any garlic or onion plant debris in the field during application, or the fungus can complete another life cycle and produce more sclerotia. After application, other crops can be grown in the treated area (but not Allium crops). After at least 1 year, Alliums can be planted in the treated area.
• At planting, apply a fungicide in furrow. Apply chemical in a 4-6” bandwidth. Options include:
  o tebuconazole (Folicur, Orius, Tebuzole)-20.5 fl oz/A
  o fludioxonil (Cannonball)- 8 oz/A
  o boscalid (Endura)-6.8 oz/A
• Tebuconazole is the most effective fungicide for white rot control. Please note that tebuconazole is phytotoxic on onions if it is applied at a higher concentration than the recommended 20.5 fl oz/acre. Phytotoxicity can also occur if the bandwidth is narrowed, even at the recommended rate per acre. If a narrower bandwidth is applied, then the tebuconazole concentration per acre must also be reduced.
• Fludioxonil and boscalid are also effective in reducing white rot.
• It is not effective to apply fungicides multiple times throughout the season, and once white rot symptoms are visible, no controls are available

Want to Know More? Check out these Resources:
UC IPM White Rot Management Guidelines
http://www.ipm.ucdavis.edu/PMG/r584100511.html
California Onion and Garlic Research Advisory Board Resources
http://cagarlicandonion.com/page/1003/resources.html