Southern Blight Cliff Notes- 2017

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This was a big year for southern blight. Out of over forty crown rot samples received in the UC Davis Vegetable and Agronomic Crop Pathology program (Swett lab) in summer 2017, 50% were southern blight, 40% were Fusarium root and crown rot, and 10% were attributed to other causes. This disease was commonly reported to cause over 50% mortality in affected fields.

Southern blight is a very destructive, fast acting crown rot disease that rapidly kills the plant. Over 500 different plants are southern blight hosts. Affected crops in 2017 included pepper, potato, tomato, cucumber, canary bean, chard, and sunflower. Most unusually, this disease caused major losses in many northern counties in the San Joaquin and Sacramento valley, where it is not typically an issue, including Colusa, Yolo, Contra Costa, San Joaquin, and Merced.

Southern blight is not typically considered to be a widespread problem in California--major impacts are usually restricted to the Kern County area. The widespread distribution we saw this year is NOT likely due to pathogen spread to new fields. Southern blight is favored by high temperatures (over 86°F), high soil moisture, dense canopies, and frequent irrigation. It seems most plausible that a combination of late planting dates and record high summer temperatures created unusually favorable conditions for the pathogen in the northern part of the valley.

Although not a new disease to the state, the increased damage from the disease this year may mean that this will be a bigger issue next year if the environment is conducive and the disease is not properly managed. Southern blight is caused by the fungus *Sclerotium rolfsii*. The fungus survives in soil as hardened structures called sclerotia for at least five years. Each infected plant can literally produce tens of thousands of sclerotia and then become more widely distributed in a field with each successive field operation. Although this disease may initially only affect a few plants in the field, southern blight can be serious enough to cause significant yield loss within a season or two. With a host range of over 500 plants, this fungus can easily persist from year to year in infected crop debris.

How to identify southern blight in the field

Southern blight misdiagnosis is likely if it occurs in an area where it has not historically been an issue. Scouting and mapping infested locations in fields during the summer months will greatly help in determining what options can be taken before the sclerotia levels become too numerous and cause severe crop loss. It can be easy to confuse southern blight with other crown rotting diseases, for example Fusarium crown rot. Accurate diagnosis is critical to effective control. You can distinguish southern blight in the field based on the following diagnostic traits, one or more of which is often, but not always present. Part of the trick to diagnosis is not to just look at the plant, but also look at the soil right around the crown.

These small tan to reddish brown sclerotia form at the base of the plant and / or in the soil right around the plant. The sclerotia look like alfalfa seeds when young but turn brown with age (Photo credit: J. Nunez).

White fungal mycelium (thread-like strands) growing INTO the soil. No other fungus will grow extensively in the soil. Sometimes you also see sclerotia in the soil (R) (Photo credit: R: C. Swett, L: J. Nunez).

White fan like mycelial (thread like) growing on the crown / affected tissues. Severely affected plants can have vascular discoloration, which may be confused with Fusarium wilt (Photo credit: J. Nunez).

Plants go from looking healthy to dead in less than a week—this is much faster than most crown rots (Photo credit: C. Swett).

In affected fields, the disease patches are roughly circular. From a distance, they look like bands of dead plants (Photo credit: L: J. Nunez, R: C. Swett).

If none of these characteristics are present, the best way to diagnose the disease is to put infected tissue in a plastic bag on a moist paper towel and leave at room temperature for one to two weeks. The southern blight fungus will produce distinct fan like growth within about 5-7 days. After about 5-14

days, it will make round white balls that then turn into amber colored sclerotia (R). Both the fan growth and the sclerotia are unique to this fungus (Photo credit: C. Swett).

In-season fungicide applications

Southern blight acts fast, so as soon as you detect the problem, it is critical to get out there to spray. Fungicides work by covering the crown tissue both above and below the soil, killing the fungus around the crown. For vegetable crops, fungicides such as flutolanil, penthiopyrad, and tebuconazole are known to be effective in the management of southern blight. However these products are registered on only a few vegetables so make sure to check crop registration before using these on any vegetable crop. Also, some of these fungicides have severe plant-back restrictions, so crop rotations need to be carefully planned. As always, make sure to read and follow label directions to avoid any problems.

Perhaps the biggest obstacle to fungicide control of southern blight is application timing and method. Because southern blight is basically a summer time disease it rears its ugly head when most crops are near maturity with a full canopy cover. Getting fungicides to the base of the stem and onto the surface of the soil is very difficult especially for fields on drip irrigation systems. Chemigation through sprinklers is a better option especially on crops like garlic and onions which do not have a dense canopy.

If the crop has a dense canopy that the fungicide cannot penetrate, then a fungicide application will not work to control the disease. Fungicide control is most effective in narrow canopy crops, including onions, garlic, beans, sunflower, and potato to a certain extent. In dense canopy such as tomatoes, melons, peppers, and vegetables grown for seed, like lettuce, fungicide applications are only effective early in the season, before the canopy expands.

The question has been raised regarding whether it's possible to apply the fungicide by drip chemigation (through the drip line). If it is buried drip, then no—it would take a lot of water to get to the soil surface, which would be likely to cause other problems; several trials have been conducted in the past in Kern County, and it's never worked. Surface drip would work, but this irrigation method is not common in California.

Managing soil moisture

Manipulating your irrigation to maintain a dry surface may help reduce losses if you detect the fungus in your field. The one advantage of drip irrigation is that the soil surface can more easily be kept dry, which inhibits infection by *Sclerotium rolfsii*. However, alternating wet and dry periods can be a problem--wet periods followed by dry episodes can be particularly conducive to disease development.

Crop rotation

If you have detected southern blight in your field, one of the best things you can do the following year is to plant a narrow canopy crop that you can effectively manage with fungicides. The disease can be effectively controlled in these crops, preventing sclerotia from increasing.

Rotations with non-host crops are limited because of the wide host range of the pathogen. Poor-host crops such as corn and small grains (wheat, millet, oats) can help to significantly reduce sclerotia levels in the field. Most if not all of these crops can become infected by the fungus, but either they are not good hosts and/or the environmental conditions during the growing season are not conducive to pathogen growth. For instance, wheat can be a host, but it's typically too cold for fungal growth during the time that wheat is grown. On the other hand, rotation with highly susceptible crops such as legumes such as beans, peas and hairy vetch can greatly increase soil infestation levels. Mustard cover crops can suppress southern blight, and may be useful for organic producers, where fumigation is not an option.

Soil treatment

Once sclerotia levels become too numerous in a field then fumigation should be considered. Fumigation with metam sodium (Vapam, K-Pam) can be effective, but ideally it needs to be applied through sprinklers so it percolates down into the soil at least 6 inches to kill the fungus in the soil zone where it is active. Because of restrictions in application, sprinkler application is not allowed in many counties, so you have to shank it in. This method of application is not as effective since the fumigant does not penetrate deep enough into the soil. Fields with shanked applications may still suffer major southern blight losses. Also, the requirement of buffer zones for metam applications means the field may become re-infested in short time as sclerotia are moved from the buffer zones into the rest of the field with various tractor operations.

Deep plowing will bury the sclerotia and get it away from attacking plants at the soil line. Sclerotia deeper than 6 inches are usually parasitized by other microbes and are killed over time. Of course, plowing is not an option for fields where buried drip irrigation systems are already installed.

Sclerotia near the surface of the soil can be killed when exposed to high temperatures (105-120°F) for two to four weeks during the summer months. Solarization alone is not generally considered a viable management strategy, but when soils were solarized before addition of a biological control or a fungicide, disease was reduced by 70-100% compared to the same biological or chemical treatment without solarization. Make sure to prepare the soil for planting before solarizing, since cultivation and the incorporation of amendments can bring buried sclerotia back to the upper soil layers.

There are several fungi that appear to have some antagonistic effects on southern blight including RootShield (*Trichoderma harzianum*). There are no field studies that indicate efficacy of bacterial products (eg. Serenade Soil) and, to the authors knowledge, there are no studies to support the use of plant defense-inducing products such as Regalia.

Disease resistance

For most crops, southern blight resistant cultivars are not available. However, for vegetable crops such as tomatoes, there are some rootstocks reported to be resistant to southern blight, which are currently under study in field trials in California. These may be a promising option for small scale and organic producers.

Crystal Gazing--What's going to happen next year?

This was an unusually hot summer and crops went in late due to late spring rains—this combination of factors likely accounts for the widespread occurrence. If crops are planted on time next year, and / or it is not so hot, then the disease might not rear its ugly head. But one thing to keep in mind for folks that had fields with southern blight this year—now, inoculum levels are higher, so it's going to take less to become a problem next year.