

LOSS OF EXOTHERM TERMIL IN GREENHOUSE TOMATOES FORCES GROWERS TO MAKE NEW DECISIONS

Robert Wick and John Howell

The most important fungal diseases of greenhouse tomatoes are Leaf mold (*Fulvia fulva*), Botrytis blight (*Botrytis cinerea*), and Powdery mildew (*Oidium lycopersicum*). Any one of these pathogens can be very destructive when environmental conditions are favorable for disease.

The compelling reason for writing this article is that we have recently lost the fungicide Exotherm Termil (chlorothalonil) as a management tool for controlling these diseases. Tomato was taken off of the Exotherm Termil label because a new ingredient was added to the fungicide, and it does not have clearance on vegetables. Also, an additional ignitor chemical was added which does not have clearance to be used on plants to be consumed as food. **Do not use this new formulation of Exotherm Termil on greenhouse tomatoes or other food crops.**

Leaf Mold: This disease is caused by the fungus *Fulvia fulva*; in older literature it was called *Cladosporium fulva*. It is common on greenhouse tomatoes and uncommon on field grown tomatoes. The pathogen is restricted to tomato. The disease is first apparent as pale yellow spots randomly scattered on the surface of the leaves. Older leaves are affected first. The underside of the leaf, opposite the yellow spots, reveals a greenish felty crop of spores. Affected leaves generally dry up and die. Relative humidity above 85% and temperatures between 70 and 75 degrees Fahrenheit are ideal for disease development. Personnel moving through the greenhouse and working with plants easily dislodge spores and spread the pathogen. Typically, the crop is uniformly affected in a relatively short period of time.

After an episode with leaf mold, remove all tomato debris from the greenhouse. Consider steaming the soil and disinfecting all surfaces. The fungicide Manex (maneb, an EBDC) is registered for this disease on greenhouse tomatoes, however, this material is thought to increase susceptibility to *Botrytis* (see *Botrytis information*).

If your greenhouse has a history of leaf mold, consider growing resistant cultivars. Try several below representing resistance to different *Fulvia* strains:

FULVIA RESISTANT TOMATO CULTIVARS

CULTIVAR	FULVIA STRAIN
Buffalo	C5
Capello*	C5
Caruso*	C5
Cobra*	C5
Dombito	C1, C2
Furon	C2
Junbo	C1, C2

Pink KR15	C5
Pink C4-864	C5
Trend	C5
Ultra Pink	C7
Ultra Sweet	C7
Laura	C2
Vetomold	C2
Vision I*	C5

* From the Netherlands.

Botrytis Blight: Botrytis blight, or Gray mold, is caused by the fungus *Botrytis cinerea*. It is a common greenhouse inhabitant and has a very wide host range. Most growers recognize this disease by the fuzzy, gray crop of spores that develops on lesions. Generally, the fungus attacks old or young tissues and not usually healthy vigorous growth. However, on tomatoes it is common at pruning wounds, older foliage and occasionally at the calyx end of the fruit. It can also cause “ghost spot” of the fruit, a condition where spores infect the fruit but disease is stopped. Temperatures from 65 to 75 degrees Fahrenheit are ideal for disease but humidity above 91% is also necessary. Horticultural oils applied during cool, humid weather, and EBDC fungicides are thought to increase susceptibility to Botrytis.

Managing humidity and reducing leaf wetness is critical to controlling Botrytis (see Controlling relative humidity section). Currently, Armicarb 100 (potassium bicarbonate) is the only fungicide registered for greenhouse tomatoes but it may not be effective for this disease. An on-line publication <http://www.nysipm.cornell.edu/publications/greymold.html> listed Armicarb as a product that increased leaf disease. The same publication reported that Mycostop S drenched into the soil significantly decreased leaf disease. Mycostop is primarily for root diseases, and no claims for Botrytis management occur on the label.

Powdery Mildew: Powdery mildew is a relatively new disease of tomato in the Northeastern US. The disease occurs in other parts of the country but the powdery mildew pathogen is not the same. Researchers at the Connecticut Agricultural Experiment Station have identified *Oidium lycopersicum* as the cause of powdery mildew in Massachusetts and Connecticut. The disease can be moderate to very destructive. Research carried out at the CAES <http://www.hort.uconn.edu/ipm/veg/htms/pmildton.html> indicated that Quadris and Kocide reduced powdery mildew on leaves but did not significantly increase yield. The Quadris label does not specifically mention greenhouse use. Armicarb (potassium bicarbonate) is registered for powdery mildew on greenhouse tomatoes.

Controlling relative humidity: The only practical way to control RH in a greenhouse is by ventilating to exhaust warm, humid air and replace it with cooler air with less moisture. Warm air holds more moisture than cool air. In fact, for every 20 degrees Fahrenheit increase in temperature, the moisture holding

capacity of air nearly doubles. During warm day temperatures, the air contains more moisture than during the cooler evening temperatures. At 75 degrees Fahrenheit, and 100% RH a cubic meter of air holds about 20 grams of water vapor, but at 65 degrees Fahrenheit it can hold only about 15 grams. As air-cools, its ability to hold moisture is reduced and the RH goes up. During the day, a temperature of 75 degrees Fahrenheit and 90% RH are typical. As the temperature cools in the evening the air becomes saturated (100% RH) at about 72 degrees Fahrenheit. As air-cools further to a typical night temperature of 65 degrees Fahrenheit, water condenses on surfaces including pipes, plastic and plant leaves. To avoid this, RH should be reduced before or while the air is cooled to the night temperature. Exhausting the moist warm air and replacing it with cooler outside air that has less water vapor can reduce humidity. Activate the exhaust fans for a short period, and then heat the greenhouse to raise temperature to the desired nighttime level. This may have to be repeated. While the exhaust fans are running, the furnace must not come on or else flue gases can be drawn back into the greenhouse. You can simply turn the furnaces off while venting or install a lockout relay to prevent the heat from coming on until the exhaust fans shut off. With a lockout device, you can use timers to automatically vent and heat during the night. Set the timers so that the exhaust fans come on for 20 to 30 seconds, two to three times per hour if needed. This seems like a waste of fuel and money, but very little fuel is used to reheat the air. High relative humidity can lead to devastating disease loss, which is much more expensive.

Using horizontal airflow (HAF) can also reduce condensation. HAF fans keep air moving in the greenhouse, helping to minimize temperature differentials and cold spots where condensation occurs. Air that is moving is continually mixed and this reduces condensation on plant surfaces. HAF should be used in addition to proper ventilation, not in place of it.

References: 1. Compendium of Tomato Diseases. 1991. Jones, J. B., Jones, J. P., Stall, R. E. and Zitter, T. A. APS Press, www.shopapspress.org St. Paul, MN 100 pp.; 2. Diseases and Pests of Vegetable Crops in Canada. 1994. Howard, R. J., Garland, J. A., and Seaman, W. L. The Canadian Entomological Society of Canada, Ottawa, Ontario (613) 725-2619. 554 pp.