AGRICULTURAL
GUIDE
Published by the University of Missouri-Columbia Extension Division

R

Blue Mold in Tobacco

Einar W. Palm, State Extension Plant Pathologist
Walter Ruldolph, and Eldon Ratcliffe
Area Extension Agronomists

Blue mold is a disease of tobacco caused by a fungus. The first reported incidents of the disease were in the Georgia-Florida area in 1921. According to reports, the disease caused only slight damage and was not observed again until 1931 when it appeared not only in Georgia but also in North and South Carolina, Maryland and Virginia. Later, it appeared in other states and areas.

Blue mold caused extensive damage in plant beds between 1931 and 1965. During this time, preventive control programs were initiated that provided adequate protection. Treatments consisted of spraying or dusting plant beds (when plants were about the size of a dime) with fungicides containing ferbam, zineb, maneb or metiram. Treatments were continued twice a week until transplanting to the field was completed.

Between 1968-1978, blue mold was considered a minor plant bed problem because of widespread use of preventive fungicides, increased fumigation of seed beds with methyl bromide, and use of plastic covers for plant production.

In 1979, a dramatic change occurred. In mid-May, the disease appeared in the Georgia-Florida area as a field epidemic. It rapidly spread northward and westward. Fourteen southern and eastern states and Ontario, Canada, sustained losses that exceeded $252 million. This figure represents the highest loss ever recorded to a single disease in the U.S. A leaf form of the disease was destructive in flue-cured, Burley, cigar filler and cigar shade tobacco. A systemic form was also noted in late crops in the Burley area (especially North Carolina) and some fields were completely destroyed.

In 1980, the disease was reported in Cuba on January 1. Again, it spread north and west from the Georgia-Florida area. The tobacco growing areas of the south, New England and Canada sustained over $239 million in losses.

In 1981, field epidemics and losses were variable in the southern and eastern states. For instance, Kentucky and West Virginia had epidemic conditions with significant losses, while Virginia and Ohio had light occurrences. For the first time, there were blue mold infections in several fields in northwest Missouri, around the Weston tobacco area. No reports from other areas of the state were received or confirmed.

Blue mold can cause rapid, serious damage to tobacco fields.

It is believed that the inoculum for the 1981 infections in Missouri may have been carried by surface winds from infected fields in Kentucky or Tennessee on or around July 24. The infected fields in the Weston area were first observed

Blue mold is caused by a fungus, *Peronospora tabacina,* which is most serious in wet weather.

in August. Unlike the hot and dry conditions in 1980, weather in Missouri in July and August of 1981 was unusually rainy. These wet conditions were conducive to infection.

Cause

Blue mold is caused by the fungus *Peronospora tabacina*. This fungus is in the group of fungi sometimes called **water molds** because it requires considerable surface water on the host parts to cause infection. The outbreaks of 1979-81 were probably caused by a new form of the fungus, more destructive than the old form, which mainly caused problems in plant beds.

The fungus produces two types of spores: (1) **oospores** are resistant sexual spores for overwintering in the plant debris; and (2) **conidia** are asexual spores; produced in large numbers, Conida are wind-borne for distances of 30 to 60 miles and perhaps as far as 200-600 miles during cloudy, cool and windy weather.

These microscopic spores land on tobacco leaves. If temperature and moisture conditions are favorable, the spores germinate, send branches into the leaf tissues and start infection centers. In a relatively short time (six-10 days), new spores can be produced from the leaf spots to reinfect other leaves. One plant may have 200 to 400 leaf lesions, and each lesion (½ inch in diameter) can produce as many as four million spores. This means that the number of spores produced by one plant may exceed 800 million. Multiplying this figure by the number of infected plants suggests that trillions of spores can be introduced into the air during weather favorable for the fungus. This rapid spore production explains how and why this disease can literally explode over a wide area and cause extensive damage in a short time.

Symptoms

Blue mold has a variety of symptoms, depending upon age of plants and the type of infection. In the plant bed, you can observe somewhat circular patterns of infected plants. The infections spread away from those areas. In young plants, leaf yellowing and cupping occur. Leaves turn brown and the plants may die. Surviving plants may have various degrees of systemic infection. Before the time of stem elongation after transplanting, severe systemic infections can occur. These infected plants not only die in the field but then can also be sources of inoculum for other plants. These plants will have leaves that are distorted and yellowed. Brown streaks can be seen in the vascular tissues when the lower stems are split. Extreme suckering is also a symptom of systemic infection.

Leaf infections can occur on established plants in the field from air-borne spores. You will see leaf spots of various shapes and sizes. Usually, the spots begin with a yellow area that turns brown. Sporulation will appear white to grey-blue (thus the name "blue mold"). As the fungus ages on the leaf spots, the downy growth will become light brown in color.

Weather Conditions

Wet, cool conditions past the normal transplanting season provide favorable conditions for fungus development, spread and infection. Spore production can occur from 46-86 degrees F (8-30 degrees C). Temperatures above 86 degrees F or below 46 degrees F restrict spore production. The incubation period (infection to sporulation) can vary from four to 15 days, depending upon day-night temperature differentials, tobacco variety and strain of pathogen. Night temperatures from 50 to 65 degrees F (10-18 degrees C) and daytime temperatures from 70-85 degrees F (21-29 degrees C) are ideal for disease development. A relative humidity of 95 percent for a minimum of three hours and at least one hour of free water are necessary for spore germination. A dark period of one to one and one half hours preceding light is necessary for sporulation.

Control

The epidemics of 1979, 80 and 81 were most likely due to wind-blown spores from areas to the east and south, perhaps from Cuba or other Carribean countries. Cool and moist weather conditions during the early part of the season are considered favorable for spore production, movement, plant

Blue mold causes leaf spots which are irregular brown areas with a blue-grey downy growth on the surface.

infection and disease development.

The following control program is suggested to reduce chances of occurrence and possible losses if and when the disease should appear.

Step 1 - Bury all old crop residues. Farmers who did not break fields last fall are encouraged to complete this practice in the spring before planting.

Step 2 - Destroy all stalks by burning after harvest of the leaves. Since blue mold can go systemic, old stalks could be a source of infection for the new crop. The resistant oospores could be harbored in old stalks. No one knows whether this form is important in initiating the disease, but you should exercise caution.

Step 3 - Plan to control blue mold in the bed site. Two methods are available.

Ridomil treatment is the most effective method. It involves the use of Ridomil 2E (metalaxyl - Ciba-Geigy). This systemic fungicide is applied at the rate of 1 quart per acre in 50 gallons of water (1 fluid ounce or 2 tablespoonfuls in 2 gallons of water per 150 square yards) just before or following seeding. For best results, seed the bed, apply the Ridomil broadcast spray, and then irrigate with water. Or Ridomil can be applied just before seeding. Rake the bed lightly, and then seed. The bed will be protected for 70 days.

Protectant fungicide treatment is a second method which involves spraying or dusting beds once or twice a week with protective fungicides such as ferbam, maneb, mancozeb, metiram, or zineb. Fumigating the bed with methyl bromide prior to planting will also help to reduce the chances of bed infections.

Completely destroy all beds once protective fungicides are stopped and transplanting is complete. Keep up protective sprays until the bed is destroyed.

Note: These treatments are only adequate to control blue mold in the plant bed and will not control blue mold in the field following transplanting. Follow the directions in Step 4 for field planted tobacco.

Step 4 - Develop plans for field control. In the field, the grower needs to create a less favorable environment for blue mold by using proper cultural practices and by attacking the blue mold fungus with fungicides. The following are suggested for controlling blue mold in the field:

Take steps to reduce leaf wetness and shade which are necessary for blue mold development. Select fields that are open and avoid low, wet and shady areas. Open up hill and row spacing to improve air and light penetration. Avoid sites with a history of blue mold.

A fungicide program is the best insurance available at present for preventing blue mold. Which program you use should be based on the amount of risk you choose to take and the disease potential suspected.

Preplant incorporated soil treatment: Use Ridomil 2E as a broadcast soil application, incorporated in the top 2-4 inches of soil. Under low disease pressure, use 1-2 quarts per acre of Ridomil 2E.

Outbreaks of blue mold in Missouri have occurred late in the season. The label recommendation for prolonged control of blue mold is to make a supplemental application of 1 quart per acre Ridomil 2E at the last cultivation (layby). Ridomil 2E cannot be applied at layby, unless it was also applied preplant.

Preventive foliar spray treatment: Apply streptomycin sulfate (Agri-mycin 17 or Agri-Strep D) at 1 pound per 100 gallons of water.

Other foliar spray treatments include fungicides containing maneb (Dithane M22-special, Manzate 200, Dithane M-45) applied at 1½ pounds per 100 gallons of water and 20 to 40 gallons per acre.

These treatments must be started *before* the disease appears and repeated frequently, as often as twice a week during times when weather is conducive to blue mold infection until threat has passed. A total of 10 to 14 applications may be necessary for full season protection, depending on the weather.

Step 5 - Use warning system. Following the 1979 blue mold epidemic, the North American Blue Mold Warning system was initiated, somewhat after the model of an earlier USDA system used during the 1940s and 1950s. A national coordinator, W. C. Nesmith, University of Kentucky, compiles information from state coordinators during the entire growing season.

In Missouri, area agronomists obtain local reports (written, telephone, oral, field observations) from community reporters (growers and agribusiness personnel) and make follow-up investigations. They forward these reports and findings to the state coordinator (state extension plant pathologist at the University of Missouri-Columbia). They are substantiated by laboratory examination and reported immediately to the area agronomist. They are also summarized and forwarded immediately by phone to the national coordinator.

The national coordinator compiles the information into a weekly warning statement that includes occurrences of blue mold outbreaks in the United States, anticipated changes in disease status caused by weather, and suggested controls. The Missouri coordinator interprets the composite warning statements based on the local weather and disease situation. This information is disseminated in the Weekly Insect, Disease, and Weed Situation reports and the IPM computer network. Urgent information is handled by telephone directly to area agronomists and other extension personnel directly involved with tobacco farmers.

The system functions on an ''as needed'' basis. Reports are not made until disease activity is detected. Once initiated, reporting continues until disease activity stops. When blue mold is confirmed in a county, the area extension specialists and the state coordinator immediately activate the warning system. If blue mold becomes active, regular and frequent informational updates will be made, including daily forecasts from the Department of Atmospheric Sciences, UMC.

■ Issued in furtherance of Cooperative Extension Work Acts of May 8 and June 30, 1914 in cooperation with the United States Department of Agriculture. Leonard C. Douglas, Director, Cooperative Extension Service, University of Missouri and Lincoln University, Columbia, Missouri 65211. ■ An equal opportunity institution.

7899 Revised 2/85/6M