Strategic Use of Fungicides for Cottonball Control

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Cottonball disease, caused by the fungus *Monilinia oxycocci,* is an economically important disease in many Wisconsin cranberry marshes. Many aspects of the biology and ecology of cottonball are not understood, and consequently, reliable cultural and non-chemical means of control (e.g., resistant cultivars, biocontrols) have not been developed. Thus, control of cottonball has been, and continues to be, dependent on fungicides, particularly those in the sterol demethylation inhibitor (DMI) group. Fungicides are not the final word for cottonball control, however. More sustainable control methods are needed and are being investigated, but their implementation is many years away.

The availability and registration status of fungicides for cottonball control are currently in a state of flux. Federal registration and marketing of FunginexB (triforine) have been voluntarily canceled by Ciba-Geigy Corporation. However, growers may continue to use existing stocks of Funginex® under a 24(c) Special Local Needs label that expires July 25, 1999. Orbit® (propiconazole) had an emergency label (Section 18) during the 1996 growing season. A request for a Section 18 label for Orbit® in 1997 has been submitted to the EPA. The registration status for Orbit® will be reported in the WSCGA News and the CCM Newsletter as information becomes available.

For the moment, let's assume that we will have Orbit® and remaining stocks of Funginex® in 1997 for cottonball control. By combining what we know about cottonball and how the DMI fungicides (such as Funginex® and Orbit®) work, a rational control strategy can be developed. Understanding the disease cycle of cottonball (Figure 1) is critical in making decisions regarding when to spray. The idea is to identify "weak links" in the disease cycle where the pathogen is vulnerable to DMIs and points where the plant is receptive to uptake of DMIs.

Cottonball disease cycle

The cottonball fungus, *M. oxycocci*, overwinters in sclerotia which are the hard, mummified remains of previous seasons' infected fruit. In the spring, small mushroom-like structures called apothecia grow from some of the sclerotia. Ascospores are ejected from the apothecia, starting at about budbreak and continuing until just before bloom. Maximal ascospore release occurs over a 10- to 14-day period when the majority of shoots are ½ to 1 ¼ inches long and very susceptible to infection. Infection probably requires water and moderate temperatures, although this has not been determined experimentally. The exact sites on the elongating uprights where the fungus penetrates are not known. Infection results in "tip blight" symptoms: crooked over shoot tips, tan discoloration of leaves, and blasted blossom buds starting about a week before bloom.

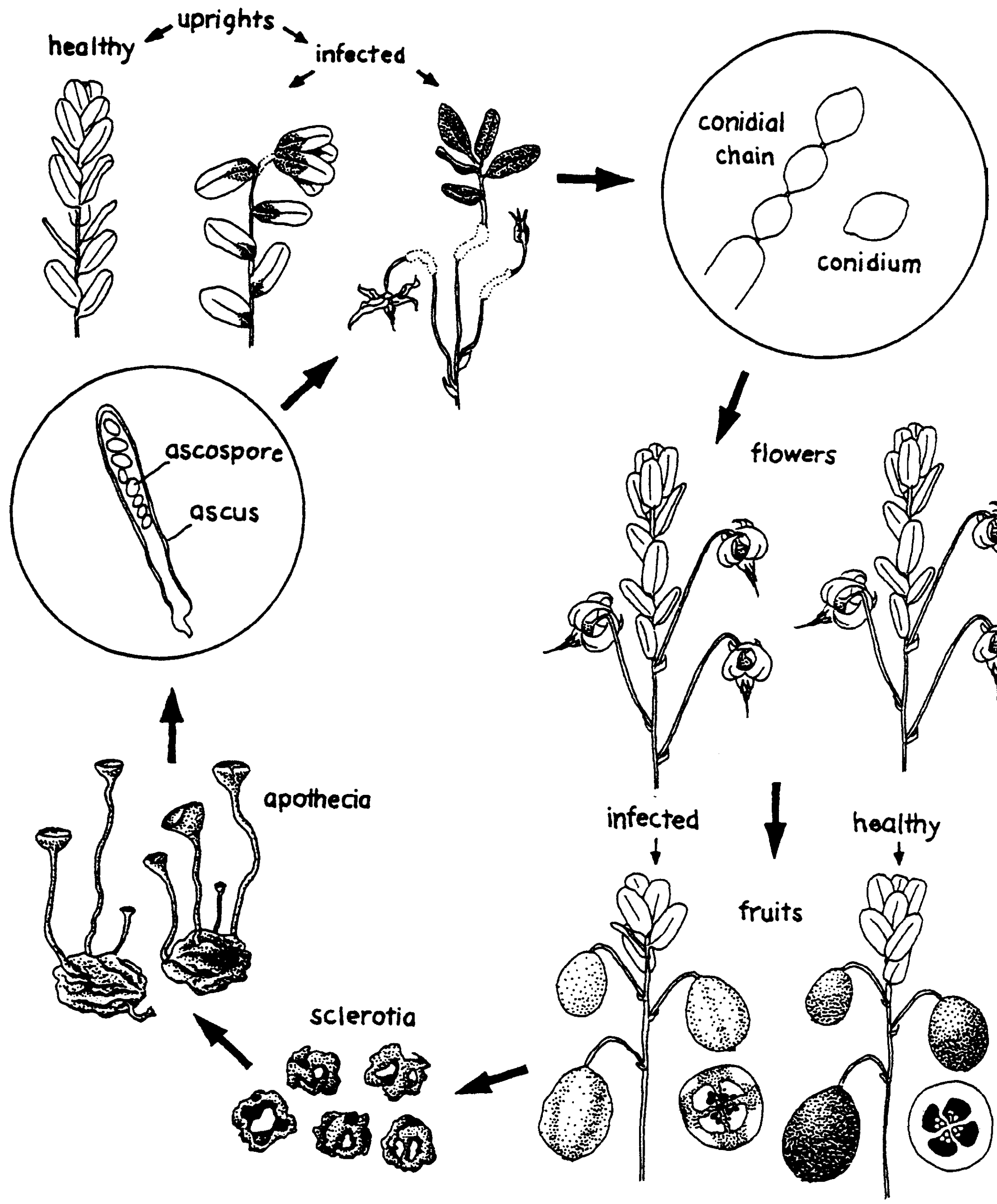

Figure 1. Cottonball disease cycle.

Just before bloom, the fungus produces spores (conidia) on infected floral and vegetative uprights. Conidia are carried to flowers by wind (the role of insects is unknown) and presumably infect by germinating on the stigma and growing down the style to the developing ovary, analogous to the pattern of pollen germination and growth. As the fruit matures, the fungus fills the seed cavity and eventually grows into the fleshy tissue. By harvest, sclerotia develop in 25-50% of the infected fruit; berries that do not have sclerotia by harvest time decompose by the following spring.

How sterol demethylation inhibitor fungicides work

The DMI fungicides Funginex® and Orbit®, though chemically distinct, inhibit fungi in the same way. Both inhibit the formation of a sterol molecule that is an important component of the fungal cell membrane but is not present in plant cell membranes. Both fungicides are locally systemic; that is, they are taken up through the plant surface and are transported upwardly (acropetally) in the transpiration stream and to a limited extent in the downward direction (basipetally). While on the surface of the plant, the DMIs provide protection against fungal infection; that is, the fungus is not allowed to penetrate the plant. Because they are taken up by the plant and are locally systemic, the DMIs also have after-infection (post-infection, eradicant, kick-back) activity; that is, they stop the fungus after it has penetrated.

The degree of protection and after-infection activity conferred by the fungicide varies among the DMIs and has not been tested for cottonball or any disease on cranberry. Based on other plant-pathogen systems, however, Funginex® provides 1 day of protection and 3 days of after-infection activity; Orbit® provides 4 to 5 days of protection and 2 days of after-infection activity (Figure 2). The Funginex® label and the proposed Section 18 label for Orbit® suggest making applications at 10- to 14-day intervals. Based on our knowledge from other diseases controlled by DMIs, 10 days is probably better than 14 days--the gap in which plant tissue is unprotected should be minimized. Uptake and activity is enhanced if the product is allowed to dry thoroughly and is not washed off by rain or irrigation water. Uptake is also better through tissues with a thin or no cuticle (protective waxy coating). On cranberry, elongating shoots have relatively thin cuticles and the stigma of the flower has no cuticle, so uptake should be very good in the tissues where infection occurs.

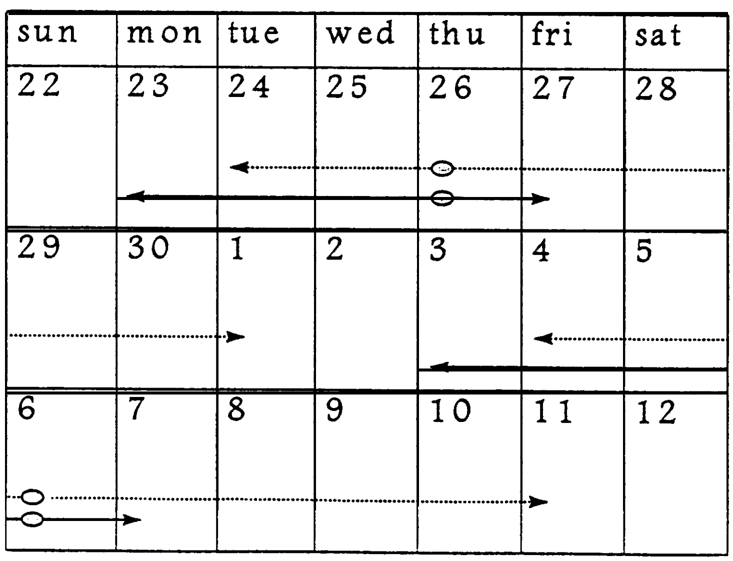

Figure 2. Comparison of protection and after-infection activities of Orbit® (-----) and Funginex® (______).

Getting the fungicide to its target

Another critical factor affecting fungicide performance is coverage. Is the fungicide reaching its target? Considering how small spores are relative to elongating shoots, it's not hard to imagine infection occurring in a tiny island of unprotected tissue (Figure 3A). We don't know exactly where on the elongating shoot the cottonball fungus penetrates, so the safe bet is to make sure that coverage of elongating shoots is thorough to prevent primary infection by ascospores. On the flower, infection probably occurs through the stigma and growth of the fungus through the style, so fungicide application will be most effective when stigmas and styles are exposed (Figure 3B). The stigmas and styles are small targets that are oriented downward and sometimes beneath a canopy of leaves. Fungicides must penetrate the canopy to ensure good coverage of susceptible flower parts. Coverage is generally better when greater spray volumes are used. The time and money invested in calibrating and upgrading spray equipment will be repaid in better pest control.

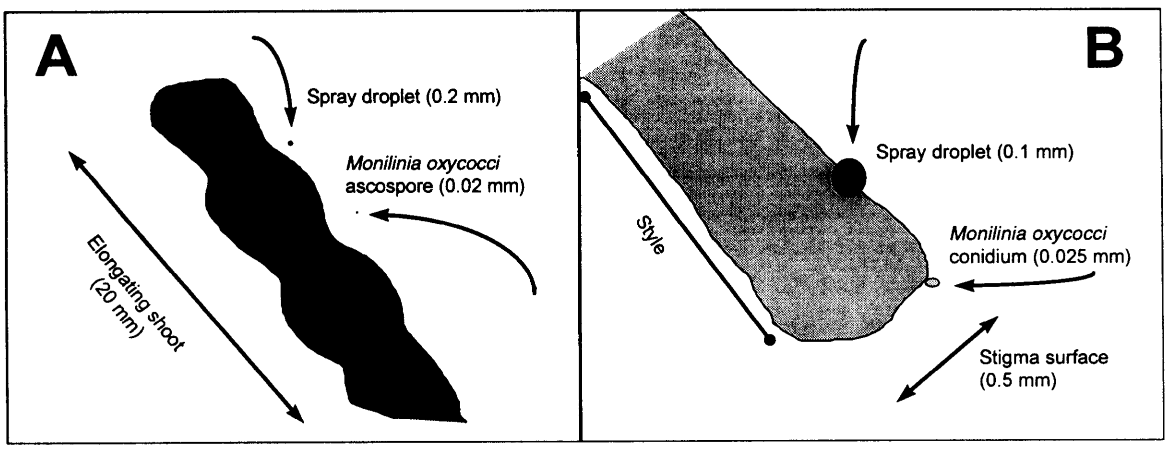

Figure 3. Relative sizes of ***Monilinia oxycocci*** spores, spray droplets, and plant parts. **A,** primary infection of an elongating shoot by an ascospore. **B,** secondary infection of a stigma by a conidium. Drawings are approximately to scale, but scales are different for A and **B.** For simplicity, one spray droplet and one spore are shown in **A** and **B;** in reality, numerous spray droplets and spores would be landing on plant parts.

Practical questions on cottonball and fungicides

This section will attempt to address questions that growers have posed about cottonball and the fungicides used to control it. Answers are based on research conducted in Wisconsin unless otherwise indicated.

Budbreak and bloom each occur over a period of several weeks, but protection and after-infection activity of fungicides are optimal for only a few days. When is the best time to spray?

Budbreak applications should be: 1) when greater than 50% of shoots are starting to elongate; and 2) about 10 days later. Bloom applications should be: 1) when 10-20% of flowers are open; and 2) about 10 days later. Measure these percentages objectively rather than “eyeballing” it. Toss a ring (about 6-8 inches in diameter) into a representative spot in the bed, and determine the number of elongating uprights per total uprights, or the number of open flowers per total flowers. Multiply the fractions by 100 to get percentages. Do this at least five times and in different parts of the bed and calculate the average reading. On any given date at one location, different cultivars will be at different stages of development. Spray schedules should be adjusted accordingly.

Does spraying Funginex® or Orbit® during bloom reduce yield?

No, based on a total of eight field trials conducted by three researchers at four locations in Wisconsin. Follow directions on the label, and minimize the risk of spray injury by spraying in the early morning or evening.

Which works better-Funginex® or Orbit®?

Orbit® has outperformed Funginex® in reducing fruit infection when all four applications were made. It is not known whether one fungicide is better than the other in preventing tip blight.

If disease pressure is low, can the rate of Funginex or Orbit be reduced?

Do not go below rates recommended on the 24(c) and Section 18 labels (24 oz per acre for Funginex®; 4-6 oz per acre for Orbit®). With DMIs used to control diseases on other crops, failure has often been attributed to skimping on fungicide rates. Also, using low rates of DMI fungicides over several years could increase the rate at which fungal populations develop resistance to the DMIs.

References

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