UW-Madison College of Agricultural and Life Sciences
Center for Integrated Agricultural Systems

Research Brief #60

Apple disease control alternatives

Sooty blotch and flyspeck are fungal diseases that can reduce the economic value of fresh market apples. While these diseases don't affect yield or quality below the surface, they can badly discolor apple skin. These diseases are especially serious for growers using integrated pest management (IPM) and organic practices.

Researchers at UW-Madison are working with these apple growers to test alternative treatments for sooty blotch and flyspeck. Two alternative sprays—a mixture of an amino acid and a B vitamin, and a baking powder ingredient—show potential for controlling these diseases on scab-resistant apple varieties in Wisconsin orchards.

What's at stake?

Wisconsin farmers gain more than just value-added organic and IPM marketing opportunities by reducing or eliminating fungicide use in their orchards. The EPA has identified two of the fungicides commonly used to control sooty blotch and flyspeck as possible carcinogens. Reduced use of these fungicides can potentially protect the health of farmers, farm workers, and apple eaters.

Reducing reliance on fungicides may also give growers a head start on the implementation of the Food Quality Protection Act. This act creates a single, health-based safety standard for pesticide residues in food and the environment. The act requires lower pesticide residue tolerances for food eaten often by infants and children. Because children eat a lot of apples, the Food Quality Protection Act may affect how apple growers manage pests and diseases.

The main fungicides used for sooty blotch and flyspeck control that might be affected by this legislation are captan, thiophanate methyl (Topsin), and benomyl (Benlate). Being a suspected carcinogen, captan is at risk for greater restrictions during re-registration. Topsin, also a possible carcinogen, is currently under EPA review. Benlate was recently discontinued by its manufacturer.

There are also health and environmental concerns with sulfur, the standard organic tool for controlling sooty blotch and flyspeck. The EPA re-registration decision for sulfur states that it causes eye and skin irritation, and that it reduces soil pH.

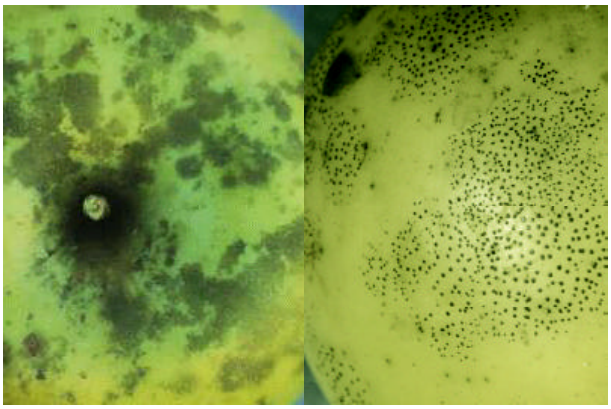
This study is part of the Pesticide Use and Risk Reduction Project at CIAS. Since 1999, this project has supported research on options to high-risk pesticides that may be affected by the Food Quality Protection Act. Researchers John Andrews, Patricia McManus, and Jessica O'Mara, all of the UW-Madison Plant Pathology Department, received funding from this project and the USDA Sustainable Agriculture Research and Education program.

What are these diseases?

Flyspeck and sooty blotch are caused by different fungi. The environmental conditions that favor the development of these fungi are so similar, however, that the diseases often occur together. The fungi that cause these diseases overwinter on the twigs and branches of apple, pear, and other woody plants. About two to three weeks after petal fall, they are spread to the fruit by wind and splashing rain. The spores germinate best at temperatures of 60-80°F and develop at a relative humidity of 90-95 percent.

Apples affected by sooty blotch have greenish or black splotches on their skins. Flyspeck appears as clusters of tiny black dots. Both diseases are illustrated in the photos below.

In conventionally managed apple orchards in Wisconsin, flyspeck and sooty blotch are minor diseases controlled with some of the same fungicides applied for apple scab. Apple growers who plant scab-resistant varieties and don't treat trees for scab can have big problems with sooty blotch and flyspeck.



Apples infected by sooty blotch (left) and flyspeck (right).

While cultural controls aimed at increasing air circulation around trees can reduce sooty blotch and flyspeck, they are often not enough. Three years of research in Wisconsin orchards have shown that alternative treatments can possibly help.

How well did the alternatives work?

The project research team tested two alternative sprays for sooty blotch and flyspeck control. The first was a mixture of methionine and riboflavin (or MR) and the second was potassium bicarbonate in an oil base. These alternatives were compared with two control treatments: sulfur and water. (Please see box at right for details.) These alternatives were tested over three years on two Wisconsin farms in Gays Mills and Cottage Grove.

The researchers tested these treatments on Prima cultivars in 1998 and 1999, and Jonafree and Freedom cultivars in 1999 and 2000. Overall, spraying MR and potassium bicarbonate every two weeks from June through August provided some control of sooty blotch and flyspeck on all three cultivars.

"In every year and on every cultivar, the methionine-riboflavin treatment significantly reduced flyspeck and sooty blotch as well as or better than sulfur," said project researcher Patricia McManus. "The potassium bicarbonate treatment was effective against both diseases, but it did not perform as consistently as the methionine-riboflavin treatment."

In 1998, the bicarbonate treatment resulted in a higher incidence of sooty blotch on the Prima apples than the sulfur control. In 1999 and 2000, the bicarbonate treatment resulted in a higher incidence of flyspeck on the Prima (in 1999) and Freedom (in 2000) apples than the sulfur control. In all other years, on all cultivars, the bicarbonate treatment performed as well as or better than sulfur.

The researchers noticed slight russeting (scarring) of the fruit in some of the trials. Russeting is not uncommon with pesticides, and it is a known problem when sulfur is used. In future trials, the researchers plan to test these alternatives for side effects like russeting.

Should I try these alternatives?

Both of these alternatives need additional field testing, and the more promising methionine-riboflavin treatment is not yet commercially available. While growers may want to consider these alternatives when planning long-term pest control strategies, they may not want to try them now.

Treatments used in study

MR Formulation: d,l-methionine and riboflavin, freshly mixed and supplemented with sodium dodecyl sulfate and a trace amount of copper sulfate

Bicarbonate: Potassium bicarbonate with paraffin oil polymer

Positive control: Wettable sulfur

Negative control: Water

Potassium bicarbonate is currently available commercially as Kaligreen or Armicarb. To date, the Organic Materials Review Institute (OMRI) has approved Kaligreen, but not Armicarb, for use on organic farms.

McManus suspects that using Kaligreen or Armicarb will cost growers slightly more than using a conventional fungicide. "In order to justify the extra expense, a grower would need to be able to market the fruit under an organic or other environmental label and get more money for that designation," she said.

Kaligreen is significantly more expensive than sulfur, but it may be a safer product. Given the erratic performance of the bicarbonate treatment compared to the sulfur, however, organic growers may be better off waiting for a methionine-riboflavin product to reach the market.

If growers decide to try a potassium bicarbonate spray, McManus suggests that they experiment with it on a small scale rather than spray an entire orchard. Until more field tests are done, potassium bicarbonate use poses a small risk of poor results or slight fruit damage.

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The Center for Integrated Agricultural Systems (CIAS) brings together university faculty, farmers, policy makers, and others to study relationships between farming practices, farm profitability, the environment, and rural vitality. Located at the University of Wisconsin-Madison, it fosters multidisciplinary inquiry and supports a range of research, curriculum development, and program development projects. For more information on the Center or on the research in this Brief, contact:

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