

Cranberry Fruit Rot: Current Status and Management

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Cranberry fruit rot can be divided into four categories: (i) field rot, which is caused by fungi in the field up to the time of harvest; (ii) storage rot, which is caused by fungi while berries are being stored; (iii) scald, which is caused by exposure to sunlight, either direct or reflected off sand; and (iv) sterile breakdown, in which fruit decay in the apparent absence of fungi. Sterile breakdown is more common in storage, although it can occur in the field before harvest. For example, deterioration of fruit following scald injury can occur in the absence of pathogens. The focus of this article will be on field rot. Field rot is not a concern for most growers in Wisconsin, although in any given year, economically significant losses occur on some marshes.

In 1999 and 2000, several ‘Stevens’ beds in Cranmoor (just west of Wisconsin Rapids) were surveyed for field rot. Field rot incidence ranged from 2% to 8% by berry count; the incidence by berry weight was somewhat lower, since rotten berries often weigh less than healthy berries. Newer upland plantings did not differ from older traditional planting in fruit rot incidence. The major fruit rot pathogen identified in that survey was *Physalospora vaccinii* (blotch rot). However, in miscellaneous sampling conducted in 1998 through 2003, we found that where fruit rot incidence was high (about 15% to 40% of berries rotted), fungi in the genus *Colletotrichum* were the problem. Therefore, *Colletotrichum*, although not as common as *Physalospora*, is more likely to cause significant losses.

Cultural practices. Several cultural practices should be considered in areas where fruit rot is a problem. Reflooding beds in the spring to remove “trash” probably reduces fruit rot inoculum, since many of the fruit rot fungi overwinter and produce spores on dead leaves. Fungi generally proliferate if vines remain wet for several hours at a time. A dense canopy of vines, such as from too much nitrogen, will remain wet for long periods of time. Irrigating in the evening will result in longer periods of wetness than morning irrigation and may lead to fungal fruit rot. Finally, fruit rot is often less severe in seasons following sanding, possibly because the sand buries the leaf litter that harbors pathogens.

Fungicides. Five broad-spectrum fungicides are currently available to combat fruit rot. These are described and their relative strengths and weaknesses are pointed out.

- **Bravo** (chlorothalonil). This is the most effective fruit rot fungicide, but it can be phytotoxic, especially if applied during early bloom. Forms of phytotoxicity reported in research trials and by growers include reduced fruit set that sometimes (but not always) translates into reduced yield; burned flowers; and red flecks and burns on berries.
- **Abound** (azoxystrobin). Abound was registered on cranberry in 2003. It has been deemed “reduced-risk” because of its low toxicity and lack of carcinogenicity to mammals. It is also easy on birds and bees. However, it is toxic to fish, so be sure to read and follow the instructions on the product label to prevent fish kill.

- **Ferbam** is the active ingredient in a few different products (e.g., Carbamate, Ferbame, Ferbam). It is used in New Jersey, especially during bloom because it's not phytotoxic.
- **Mancozeb** is the active ingredient in Dithane, Penncozeb, and a few other formulations. In research trials, mancozeb has proven only moderately effective against field rot, and it reduces fruit color if applied during bloom or to fruit.
- **Copper** comes in many forms (e.g., copper hydroxide, copper oxychloride, copper sulfate) marketed under numerous names. Copper fungicides are marginally effective against fruit rot at best. In the eastern U.S. where field rot incidence commonly exceeds 50%, coppers generally do better than not spraying at all, but they fall far short of the other fungicides. In Wisconsin, copper has never been different from the untreated check in research trials.

A major limitation in developing a spray program to manage fruit rot is that we don't know which species of fungi are releasing spores at what time. Spray programs are not fine-tuned for controlling specific pathogens (e.g., no specific program to control *Colletotrichum*). Therefore, we assume pathogens are present and apply broad-spectrum fungicides when plants are most susceptible to infection. Over the past several years, research by Peter Oudemans at Rutgers University and Frank Caruso at University of Massachusetts has demonstrated that the most critical time to spray is *bloom through early fruit set stages*. They found that delaying the first Bravo spray until after bloom was much less effective. For example, applying Bravo during late bloom (once at 50% out of bloom and a second time 10 days later at 80% out of bloom) resulted in 8% field rot at harvest, whereas applying Bravo at 10 and 20 days after bloom resulted in 42% field rot at harvest, only slightly better than the 60% rot in the untreated check.

Where does the new fungicide Abound fit into a fruit rot spray program? Abound has not been as consistently effective against rot as Bravo in field trials, but it is not phytotoxic. Therefore, it may have role during early to full bloom. Abound is effective against the cottonball pathogen, so if both field rot and cottonball are problem, then Abound would be a good choice during bloom. Abound has a very specific mode of action, however, so fungicide resistance is a great concern. Abound should not be used in more than two consecutive sprays. The label allows up to six sprays per season, but a maximum of four should be enough for control of cottonball and field rot in Wisconsin.

Considerations for 2004. If field rot was less than 10% in 2003, you're at about "par" for Wisconsin. You should probably just take your chances in 2004, because fungicides are not likely to pay for themselves at that level of rot. However, if rot was greater than 15%, and especially if pathogens were identified in the rotten fruit, then fungicides are probably justified in 2004. Bravo has the proven track record *if sprays are started during full to late bloom*. Abound has been as good as Bravo in some but not all trials, but Abound is safe during bloom.

Possible field rot spray programs. Several possible spray programs to manage fruit rot, and relevant comments, are listed in the table below. In the eastern U.S., many growers spray Bravo two or three times per season and reduce rot from about 50-100% to 5-10%. In Massachusetts growers apply chemicals in very dilute form (hundreds of gallons of water per acre) through the irrigation system and do not experience phytotoxicity from Bravo. In New Jersey mancozeb or ferbam is often used during early

bloom to avoid potential phytotoxicity. In Wisconsin, two sprays (full bloom and early fruit set) are probably adequate, since we almost never see 50% field rot. The efficacy of a single spray of Bravo has not been studied, but the best timing would probably be at early fruit set—fruit are susceptible at this time and the risk of phytotoxicity is less than during bloom. Abound would almost certainly be better than nothing, but Abound has not been as consistently effective as Bravo in trials.

Program	10-20% bloom	50-60% bloom	Early fruit set	Comments
1	Bravo	Bravo	Bravo	At high or low rate, likely to be effective, but risk of phytotox.
2	Abound	Abound	Bravo	If Abound used at high rate, should be effective; phytotox. risk less than #1
3		Bravo	Bravo	Phytotox. risk
4		Abound	Bravo	Phytotox risk less than #3
5		Abound	Abound	Little or no phytotox risk, but possibly less effective than #3 or 4

What about hail and fruit rot? To my knowledge, the benefits of fungicides applied to hail-damaged fruit has not been demonstrated in the field. In 1995 Teryl Roper at University of Wisconsin tested the effect of fungicides applied to fruit mechanically injured with a cow magnet. In this experiment there were three groups of fruit with various degrees of injury: (i) bruised, but skin intact; (ii) skin broken; and (iii) undamaged fruit. Half the fruit in each group were inoculated with fungi by dipping them into cranberry ditch water, while the other half were not inoculated. Then fruit were sprayed with Bravo, Penncozeb, or nothing. Some fruit were held at room temperature while another group was stored in a refrigerator. The main findings were: (i) bruised fruit rotted more quickly than healthy fruit, but broken fruit rotted the fastest of all; (ii) fungicides applied to bruised or broken fruit did not reduce rot; and (iii) fruit rotted faster at room temperature than in the cold.

Growers themselves are in the best position to do a real-life field study to test the effect of fungicides after hail; they know where the hail hit and can get out there within a day to apply treatments. It's critical, however, to leave at least a few areas unsprayed for later comparison to sprayed areas. This can be done either by turning off nozzles or covering plants with a tarp, and then marking with flags which areas are which.