Cranberry Disease Management: Impacts of Letting It All Go

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The recent economic crisis in the cranberry industry has called into question every ounce of pesticide used and every hour of labor invested in spraying to manage disease, insect, and weed pests. In an effort to reduce production, questions are being raised regarding the long-term impacts of not spraying and in some cases, not harvesting or only partially harvesting beds. These questions are hard to answer because up till now, pest management research has focused on maximizing yields. However, if we piece together everything we know about the biology of cranberry pests and their history on Wisconsin marshes, we can attempt to predict the risk of "letting it all go" for the major types of diseases in Wisconsin: fruit rots (including cottonball, field rot, and storage rot); leaf spot diseases; and shoot (upright) diseases.

Cottonball. The disease cycle and biology of cottonball have been covered at length in previous Cranberry School Proceedings. Briefly, the fungus *Monilinia oxycocci* invades flowers and fills fruit with the fungus. The diseased fruit harden into mummies, which serve as the overwintering stage. In the spring, small mushrooms grow from the mummies and release spores. The spores infect newly elongating cranberry shoots. Just before and during bloom, infected shoots turn brown and become covered with *Monilinia* spores. These spores are carried by wind and/or bees to flowers, starting the cycle anew.

In weighing the long-term impact of not controlling cottonball, the following points should be considered:

- The fungus absolutely depends on fruit to complete its life cycle—it cannot overwinter in leaves or wood.
- The fungus not only overwinters as mummies but persists, possibly for decades, in this form.
- If there are no fruit, there will be no new mummies formed. So, one way of reducing disease, if you don't care about yield loss, would be to prevent fruit set altogether (e.g., freezing or flooding).
- Harvesting removes most mummies. Harvesting is possibly the most effective way to control cottonball.
- Not harvesting will increase the pathogen population in the field.

Bearing these points in mind, the long-term impact of not controlling cottonball would be a steady increase in disease. In the future, a more intensive fungicide program would be needed to bring cottonball under control. The long-term impact of not harvesting cottonball-infected fruit would be similar to not spraying, but the effects might be felt sooner. Although it has not been tested experimentally, harvesting is almost certainly more effective than spraying a fungicide to reduce the population of the pathogen. The

bottom line: Don't let a cottonball-infested bed go unharvested, or partially harvested. At least not for many years in a row.

Fruit rot. Fruit rot is generally broken into two categories: field rot, which occurs before harvest and impacts all growers; and storage rot, which occurs after harvest and impacts fresh fruit growers. Fungicides are marginally effective in controlling storage rot, and most fresh fruit growers make at least one spray per season. Because field rot disease pressure is generally low in Wisconsin, fungicides have rarely been used by processed market growers, even when profit margins were high. This no/low fungicide input program has been the rule for many years in Wisconsin, and we have not seen an increase in field rot. There are occasional bad years (1998, for example), but there is no evidence that one needs to spray the following year to bring field rot under control. Rather, it seems the weather in any given year is the deciding factor. So the long-term impact of not spraying for fruit rot would be little or none.

What about not harvesting or only partially harvesting? Intuitively, one would expect this to be a disaster—all that rotten fruit sitting in the field waiting to infect next year's crop. Indeed, it would be a mess, but the impact on fruit rot would probably not be great. Here's the rationale:

Research in the Cranmoor area shows that in most beds, fruit rot at harvest is around 5% or less. So, an unharvested bed would contain 5% rotten fruit and 95% healthy fruit. Healthy fruit usually contain fungi, but these fungi are predominantly non-pathogens or the very weak berry speckle pathogen *Phyllosticta elongata*. So, healthy fruit probably don't carry a lot of pathogen inoculum through the winter. Also important is the fact that most fungal pathogens sporulate profusely on old or dead leaves but not so much on fruit. And leaves outnumber fruit by far. So, even if pathogens *did* overwinter in unharvested fruit, the amount would be negligible compared to the amount overwintering in all those leaves. Harvest removes leaves as well as fruit, but more leaves get left behind than get harvested, and previous history in Wisconsin suggests that they don't cause big fruit rot problems in most years. So the long-term impact on fruit rot of not harvesting would probably not be noticed.

Leaf spot diseases. Many different fungi cause spots on cranberry leaves in Wisconsin. In general, these fungi do not affect fruit quality directly, but one of them, the red leaf spot fungus, can make a small wound on fruit through which the black spot fungus infects. In rare cases, leaf spot diseases are so severe that they contribute to premature leaf drop (leaves drop in the second rather than the third year). Very little research has been conducted on leaf spot diseases, so making predictions based on biology is difficult. However, based on experience, we know that healthy, vigorous plantings will stay that way for decades without spraying for leaf spot diseases. Likewise, beds with severe leaf spot problems will stay that way if not sprayed. So, the impact of not spraying on healthy beds would be none, while diseased beds would continue to be diseased. Leaf spot fungi carry out their lives on leaves rather than fruit, so not harvesting should have little impact on long-term health a bed.

Shoot (upright) diseases. Several diseases affect uprights—upright dieback, Phytophthora root and runner rot, and stem gall (canker) are a few. However, the most common causes of dead uprights are probably not living (biotic) factors but rather are non-living (abiotic) in origin. This would include winter injury, drought or heat stress, poor drainage, and chemical injury (e.g., fertilizers and pesticides). Unfortunately, "dead upright" symptoms look similar, at least at first glance, no matter what the cause. To figure out the problem, one has to take a much closer look at the uprights themselves, the pattern of death in the field, and when during the season symptoms appeared. Upright dieback, stem gall, and Phytophthora were discussed in detail in the 1999 Cranberry School Proceedings.

Stem gall (canker). Of all the causes of upright death, this is the easiest to identify. A close look at uprights and/or runners reveals swollen stems with rough and splitting bark. A closer look with a hand lens reveals that small galls and bumps are the cause of swelling and splitting. Stem gall is apparently caused by bacteria that go berserk under certain conditions. Uprights are killed, but runners send out new shoots, so a planting usually recovers from stem gall within a few years. The bacteria are not controlled by fungicides, so not spraying should have no impact on stem gall. The bacteria might infect through wounds created during harvest, so not harvesting might actually help a bed recover from the disease.

Upright dieback. This disease is characterized by orange-bronze uprights scattered among healthy uprights. The shoot dies from the tip back, and dead shoots are often adjacent to healthy shoots on the same runner. The cause is believed to be the fungus *Phomopsis vaccinii*, which infects during shoot elongation. The fungicide Bravo is applied one to three times from budbreak up to early bloom. In beds with chronic upright dieback, not spraying would probably result in the disease persisting and possibly being severe if mid-summer weather were very hot. Under such conditions, viscid rot (a fruit rot caused by *Phomopsis*) might flare up. *Phomopsis* overwinters and carries out its life cycle primarily in shoots, so not harvesting should not have a great impact on upright dieback.

Phytophthora root and runner rot. In Wisconsin, we don't have the worst species of *Phytophthora* (*P. cinnamomi*), and most cases of Phytophthora root and runner rot can be resolved by improving drainage. In fact, without good drainage, the fungicide available for controlling this disease, Ridomil, will not help. Ridomil has generally been recommended only when *Phytophthora* persists despite good drainage, conditions which are rare. The long-term impact of not spraying under such conditions would probably be the continued decline and death of uprights, especially if large amounts of water are needed for frost protection and/or irrigation. *Phytophthora* thrives in water. Not harvesting would limit water movement during fall when *Phytophthora* is active. The lack of harvest flood might ultimately reduce the growth and spread of *Phytophthora*, thereby allowing a bed to recover from root and runner rot.