

DISEASE MANAGEMENT 2008

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Sources: √ Compendium of Blueberry and Cranberry Diseases by F. L. Caruso and D. C. Ramsdell
√ Univ. of Wisconsin – Madison’s “Fruit Pathology” web pages
√ UMass 2008 Cranberry Chart Book √ American Phytopathological Society (web site)

UPRIGHT DIEBACK (Fairly common in Maine – can expect a few sites annually)

Upright dieback is a poorly understood disease complex that can cause significant damage to new or established beds of cranberry. It is called a "disease complex" because it can be caused by a combination of different fungi and environmental conditions that are poorly understood. The causal fungi are most likely *Diaporthe vaccinii* and its anamorph, *Phomopsis vaccinnii*—also the cause of viscid rot, along with *Synchronoblastia crypta* because they are the ones found most consistently in diseased uprights. **Vines may be made more susceptible to the disease if they have been subjected to winter injury or oxygen deficiency.** The disease may occur at any time during the growing season, and Howes, Early Black and Searles appear to be more susceptible to the disease than other varieties.

Favorable Conditions for the Disease (how the infection occurs is not known):

- Warm temperatures (fungus grows better);
- Periods of hot and/or dry conditions that leave the vines under stress;
- Areas with heavy vine growth (disease can be especially severe in new plantings for this reason);

SYMPTOMS (easily confused with heat stress)

Symptoms first appear as a wilting—or flagging—of the tips (Figure 1), or else as a patchy (mottling) or general yellowing of the uprights. Later, if conditions don’t improve, uprights will turn orange-bronze before they eventually turn brown and die. Diseased uprights are dispersed among healthy vines and may be adjacent to apparently healthy uprights on the same runner. This scattered distribution of diseased uprights coinciding with healthy uprights gives the affected area a ‘salt and pepper’ appearance (Figure 2), but on some runners every upright may be infected.

As a general rule, *large* dead patches of uprights are not the result of upright dieback.

CONTROL

Plants that are still in the early stage of infection can sometimes recover on their own if the weather turns cooler and/or more humid. Adequate irrigation and additional periodic sprinkling in July and August can also help to reduce the level of the disease. *Anything* that minimizes stress on the vines is helpful in combating the disease.

Chemical Options

√ Champ Dry Prill 5.3 lb / A
√ Champ Formula 2 5.3 pt / A
√ Champion WP 8 lb / A

Must be applied pre-bloom.

√ Bravo Weather Stik 4 – 6.5 pt / A
√ Bravo Ultrex 3.8 – 6 lb / A
√ Echo 720 4 – 7 pt / A
√ Echo 90DF 3.25 – 5.75 lb / A

One pre-bloom application should be applied after the terminal bud has broken dormancy and begun to swell or has begun new growth.



Figure 1. Early stage of upright dieback in Maine



Figure 2. A more progressed case of upright dieback in Maine and a good example of the common ‘salt and pepper’ pattern of infection.

Spray Timing for Upright Dieback:

April 30 – May 20 for southern Maine
May 6 – May 26 for downeast Maine

NOTE: *Bravo* does not control upright dieback if applied later than early bloom—by this time the fungus has apparently invaded shoots and is out of reach of protectant fungicides. Fungicides will not cure upright dieback but will prevent the spread of the infection.

FRUIT ROT

There are over 15 different fungal species responsible for causing cranberries to rot. The primary rots have been classified as **Viscid Rot, Early Rot, Black Rot, and End Rot**. *Phomopsis vaccinii* is the organism responsible for Viscid Rot—considered a minor post-harvest disease—and it is also one of the two prime suspects in the cause of Upright Dieback. Early Rot is caused by *Phyllosticta vaccinii*, and can cause severe losses in the field where the growing season is typically long and warm, such as in New Jersey and Massachusetts. The fungus can attack flowers and young berries, as well as stems and leaves, but only in the berries does the damage level reach economic concern. Black Rot is caused by three separate fungi: *Allantophomopsis cytispora*, *Allantophomopsis lycopodina*, and *Strasseria geniculata*. Black Rot is a post-harvest storage rot disease, as are Viscid Rot and, for the most part, End Rot. End Rot is caused by the fungus *Godronia cassandrae* f. *vaccinii* and occurs in all cranberry-growing regions of the country. Not unlike the case with Early Rot, End Rot can cause a twig blight and a kind of leaf spot along with its fruit-rotting ability, but it's only the latter makeup of this fungus that is economically important.

In field experiments, it has been demonstrated that fungal infections resulting in fruit rot are concentrated around the period immediately following bloom.

SYMPTOMS

NOTE: Sometimes there is overlap among the fungi that cause field and storage fruit rots, but in general:

- *Pre-Harvest, Infecting Young Berries Still On The Vines* → probably **Early Rot** (look for round, circular, discolored splotches that take on a bull's eye pattern of alternating dark and light rings that eventually expand outwards until the entire berry is rotten) (some less common field rots are **Bitter** and **Blotch Rot**, and **Hard Rot**—the secondary stage of Cottonball disease; see page 14)
- *After Harvest (i.e. storage rots)* →
 1. Dark black color eight or more weeks after harvest, and berry is relatively firm and dry: **Black Rot**
 2. Seen first at the blossom end of the berry (typical of this rot), and the rotted tissue is soft and watery and berry is elastic to the touch and possibly floating due to gas produced during the rotting process: **End Rot** (berries with End Rot are called “poppers” because even though they are elastic, if pressed too hard they will burst)
 3. Rotting area is viscous and stringy, and berry is soft and off-color: **Viscid Rot** (the word ‘viscid’ describes a surface that is sticky, as though coated with a syrupy secretion) (Viscid Rot is technically a field rot, but most of the rotting occurs in storage).

CONTROL (A total of 4 fungicide applications are usually needed for a bed prone to fruit rot; otherwise, just 1 or 2 applications may suffice)

EARLY BLOOM 10%-20% → Spray again at 10-14 day intervals except where noted.

√ Chlorothalonil 720	4 – 7 pt / A
√ Bravo Weather Stik	4 – 6.5 pt / A
√ Echo 720	4 – 7 pt / A
√ Echo 90DF	3.25 – 5.75 lb / A
√ Bravo Ultrex	3.8 – 6.0 lb / A
√ Equus DF	3.8 – 6.0 lb / A
√ Equus 720 SST	4-6.67 pt / A
√ Abound F	6-15.5 oz / A

Use the maximum rate and 10-day schedule on beds with history of high fruit rot levels. Hold water for 3 days. 12-hr REI.

Should not use Abound more than twice, out of concerns over resistance developing if used from 3 to 6 times per year. Spray at 7 to 10-day intervals rather than 10-14.

√ Indar 75 WSP	4 oz / A
√ Indar 2F	6-12 oz / A

Note: Do not use more than 2 applications of Indar (resistance fears). Do not use prior to bloom. Apply at 7 to 14-day intervals.

√ Ferbam Granuflo	6 lb / A
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Note: Do not apply Ferbam more than 5 times. Apply at 14-day intervals. Rates below the recommended will be ineffective.

MID-BLOOM → Spray again at 7-10 day intervals

√ Dithane DF Rainshield,	3 – 6 lb / A	Addition of a spray adjuvant will improve the distribution and deposition of all of the maneb and mancozeb compounds.
√ Dithane M-45, Manzate 75DF	3 – 6 lb / A	
√ Penncozeb 80WP, Penncozeb 75DF	3 – 6 lb / A	
√ Top Cop	2 qt / A	
√ Penncozeb 4FL, Manex	2.4-4.8 qt / A	√ Maneb 75DF, Maneb 80WP 4.8-6 lb / A
√ Dithane F-45 Rainshield	2.4-4.8 qt / A	√ ManKocide 10.5 lb / A
√ Manzate Flowable	2.4-4.8 qt / A	√ Cuprofix MZ Disperss 7.5-14 lb / A

LATE BLOOM → Spray again at 10-14 day Intervals (no more than 2 more sprays total)

√ Kocide 2000	6 lb / A	Do not combine with any insecticide, as any other product could alter the fungicide, making it phytotoxic to the cranberry plants. Note: Kocide 4.5 LF is <u>highly corrosive</u> to all aluminum irrigation equipment.
√ Kocide 4.5 LF	5.33 pt / A	
√ Nu-Cop 50DF	8 lb / A	
√ Kocide DF, Kocide 101	8 lb / A	
√ Champion WP	8 lb / A	
√ Nu-Cop 3L, 3lb copper flowable	5.33-10.67 pt / A	
√ Champ Formula 2	5.3 pt / A	
√ Champ Dry Prill	5.6 lb / A	
√ Nu-Cop HB	4 lb / A	

FRUIT ROT CULTURAL NOTES

- Howes and Stevens varieties have good fruit rot resistance.
- **Trash Removal:** Cranberry leaves, stems, and fruits left behind after harvest are colonized by several fungi that can cause field and storage rot. This fungi-filled trash serves as a reservoir for fungal infections in subsequent growing seasons. Translation: *trash piles should not be left next to the bed but should instead be deposited at least a quarter mile from the bed if possible.* If a bed is dry-harvested, trash should be removed from a post-harvest flood in the fall or from the winter flood before it is withdrawn.
- **Sanding:** Lowers the incidence of field fruit rot (such as Early Rot) by covering the cranberry litter upon which the fungal fruiting bodies overwinter.
- **Late Water:** (pp 45-47) Late-holding the winter flood helps reduce field rot by disrupting the life cycles of the fungi. During late-water years, fungicides can be reduced (their rates and/or the number of applications) without any sacrifice in fruit quality. This fungicide reduction can also be carried on through the first year after late-water, but by two years after the late-water flood, the fungal inoculum will begin to build up again.
- **Irrigation:** Run sprinklers in the early morning rather than in the evening, during which the vines remain wet for a long time, thereby creating favorable conditions for infection by the fruit rot fungi. On days with excessive temperatures (>100° F on the bed), particularly in newly-planted or recently sanded beds, sprinklers should be run for 1 to 2 hours in the late morning or early afternoon to cool the vines and berries in order to prevent injury. Scalded berries can resemble rotten berries, but without the reddish border as seen in Early Rot.
- **End Rot** may be made worse by excessive use of nitrogen fertilizer during the growing season, prolonged periods of flooding, and bruising of berries during harvest, but chemical control is usually necessary *only* on berries destined for long-term storage or for fresh market sale.

OTHER DISEASES

FAIRY RING [Maine cranberries: rare occurrence, or unobserved from year to year]

We have *perhaps* had this disease in Maine, but not knowingly to any significant extent. It is a root disease that is sporadic in occurrence in Massachusetts and New Jersey, and the severity of the symptoms varies from year to year. It can be spread from one bed to another through uprooted vines during wet or dry harvest and their subsequent dislodgement in the next harvested bed. Picking machines should be freed of vines before moving to the next bed. Damage is usually worst during periods of drought, so keep vines well-irrigated. On a positive note, *the disease does not cause significant losses*. **Symptoms:** A small area of dead or weak vines, where the plants quickly turn yellow to rust-colored before dying, and the uprights usually die from the tip downward, sometimes leading to the misdiagnosis of Upright Dieback. If berries are present, they wither as though suffering from drought stress, which in fact they are—the pathogen produces a dense mat of mycelium around the roots, which physically prevents water from reaching the root system, resulting in drought-like conditions. The disease “ring” can expand outward in all directions at a rate of 12 to 18 inches per year, and when the affected area reaches a diameter of about 6½ feet, the middle often will revive and fill in with healthy plants (either weeds or cranberry vines, or both). **Control:** Control is difficult. Removal of the entire infected area eliminates the pathogen. Water should be kept in the ditches, especially during the hottest and driest times of the summer in order to minimize the drought-induced effect of the pathogen. Application of lime, Sul-Po-Mag (0N-0P-19K-11Mg), and urea helps to rejuvenate any affected vines. **See page 7 for fungicide choices.**

RED LEAF SPOT [As seen on the cover] [Minor disease for Maine cranberries]

Red leaf spot is somewhat common in Maine (varies from year to year in terms of how widespread it is) and easily recognized by the presence of circular, bright red spots on the upper sides of leaves and occasionally on young green berries. The undersides of the leaf spots are paler and eventually become covered with a dense, white, powdery deposit. When several spots develop on a single leaf, they often grow together. Infected leaves are usually shed prematurely. Leaf infections may spread through the petiole (leaf stem) to the young growing vine, causing reddening and eventually death of the stem. The part of the vine above the infected area may continue its normal growth or wither and die, depending on the amount of distortion of the stem tissue. **High nitrogen use will favor the onset of this disease.** Ben Lear variety is especially prone to this disease, whereas Stevens is very resistant to it. **Control:** The early stage of this disease is no cause for panic, and generally sprays for fruit rot will also control this disease. Copper compounds will offer protection against further infection. Injured plants will not be cured, but the infection will be prevented from spreading.

COTTONBALL [Maine cranberries: not yet verified but could be present as it occurs in our wild blueberries fairly commonly under the name of *mummyberry*]

Monolinia oxycoccus - This is the most important disease affecting cranberries *during the growing season* in Wisconsin. There are two phases—a tip blight phase, and a berry-rot phase. The tip blight phase is usually economically insignificant, but the resulting fruit rot phase can reach epidemic levels, as high as 90% of berries lost due to rot. **Symptoms:** Tip blight symptoms appear about three weeks after budbreak and include tan to brown discoloration and wilting or crooking of succulent shoot tips, and a V-shaped pattern of tan discoloration at the base of leaves along the midvein. The V pattern is a good way of distinguishing Cottonball from Upright Dieback disease while in the field. Infected berries fail to ripen. Brown, necrotic bands appear lengthwise on the berry and spread until the entire berry is yellowish-brown. The interior of the berry is filled with white, cottony



fungal mycelia, but the berry remains firm (hard rot). Some infected berries turn dark brown and shriveled, and are referred to as ‘mummies’. **Control:** Cranberry beds should be picked clean to reduce as much as possible the number of mummified fruit left behind, since it is within the ‘mummies’ that the Cottonball fungus overwinters. For fungicide options, Abound can be used. When spraying during bloom—which targets the secondary stage of the infection—Abound appears to do an adequate job. In Wisconsin, they recommend spraying *only* during bloom, and not trying to spray during the tip blight phase of the disease because even when that phase is controlled really well, secondary infection still occurs.

***Phytophthora* ROOT ROT [Maine cranberries: rare and minor – just 1 known case since 1996]**

In other cranberry-growing regions where this disease has sometimes been severe (e.g. Massachusetts, New Jersey, Wisconsin, Oregon and Washington), crop loss can be significant. It occurs most often in beds or portions of beds that have poor drainage or that experience prolonged periods of saturation or standing water during the growing season. **Symptoms:** Above-ground symptoms are easy to see; namely, the absence of vines in discrete areas (often low spots). Uprights in the affected spots are stunted, and the leaves are small and few in number. Few blossoms can be found as well. Below ground, the absence or lack of the small and fibrous feeder roots is a tell-tale sign of this disease, coupled with the fact that diseased vines are consequently easy to pull out from the soil. **Control:** The first line of defense is to manage soil water. Excessive irrigation should be avoided and drainage should be improved. Drainage can be enhanced by sanding and installing drains, digging deeper side ditches, etc. Aliette, Ridomil and Phostrol (see page 7) are fungicides recommended for use against *Phytophthora*.

FUNGICIDE PROFILE:

Abound (Azoxystrobin) Abound is made up of naturally-occurring fungicides called strobilurins that are produced by edible, wood-decaying fungi (*Strobilurus tenacellus* and *Oudemansiella mucida*). In nature, these anti-fungal products help the fungi out-compete other nearby fungi for nutrients.

Characteristics of Abound:

- ◆ Has low acute toxicity; Non-carcinogenic and non-teratogenic.
- ◆ Safe to non-target species and thus highly suitable for inclusion in an IPM program.
- ◆ Not persistent in the environment; Low leaching potential.
- ◆ Will not leave significant crop residues.
- ◆ Very safe to applicators—signal word is CAUTION, and minimal PPE required.
- ◆ Only a 3-day Pre-Harvest Interval; REI (Re-entry Interval) is just 12 hours.
- ◆ Very competitive with Bravo in terms of the level of control it provides against field rot and storage rot. In 1999 Massachusetts field trials, most of the differences in performance between Bravo and Abound were in the neighborhood of just 10 to 20%, and in one case, Abound performed *better* than Bravo by one percent!

Other Notes About Abound:

- ◆ Allowed as many as 6 applications per season, but any number greater than 2 is probably not a wise use of the product because of the potential for resistance.
- ◆ Resistance is more likely to develop when Abound is applied to an already growing fruit rot fungus (i.e. post-infection) rather than in a protective / preventative situation before the fruit rot spores have been able to germinate.
- ◆ Abound is **very** phytotoxic to **McIntosh apples**, so use it very carefully and avoid drift if you happen to be next to a McIntosh apple orchard (other apple varieties may be damaged by Abound as well, so err on the side of caution if you are near an apple orchard of any kind).
- ◆ Abound is retained primarily in the waxy cuticle of treated leaves, flowers and berries but it has only limited post-infection activity against most fungi.

ORGANIC OPTIONS FOR FIGHTING CRANBERRY DISEASES

DISEASE	ORGANIC CONTROL OPTIONS
Cranberry Fruit Rot (over 15 species of fungi play a part)	Kocide®, Late Water (pp 45-47), Trash Flooding, Sanding, Avoiding too much fertilizer, Pruning: so vines dry faster, Irrigating mornings & <i>not</i> evenings.
Upright Dieback	Adequate irrigation (and avoiding oxygen deficiency situations during the winter), Minimize excessive vine growth.
Red Leaf Spot	Kocide®, Trash Flooding, Avoiding too much nitrogen.
<i>Phytophthora</i> Root Rot	Sanding, Trash Flooding, Improving drainage, Fixing low spots.
Fairy Ring	Removal of the entire infected area eliminates the pathogen. Keep water in the ditches, especially when it's really hot and dry.

Kocide® 2000 / 3000

- Helps prevent cranberry fruit rot (starting late bloom);
- Helps stop the spread of red leaf spot;
- No time limitation for Pre-Harvest Interval;
- Maximum of 3 applications per season; Restricted Entry Interval of 24 hours;

OxiDate® (128 fl oz per 100 gallons of water; apply 25-100 gal/solution per treated acre)

Serenade® ASO or MAX (biofungicide labeled for mummyberry/cottonball, botrytis, and bacterial canker at 2-6 qts./A.)

Late Water (LW) Flood

Late Water means pulling the winter flood in late March and reflooding for 2 to 3 weeks, usually from late April to early May (pp 45-47). Do NOT hold LW if the winter has been severely cold and long, oxygen deficiency conditions are suspected, or if the bed has been sanded the preceding fall or current spring. **Be cautious about using LW if the winter has been very mild as well due to lack of dormancy.** Avoid using LW more than two consecutive years as plants may be stressed to a dangerous extent.

- Helps control fruit rot by disrupting the life cycles of the various rot-inducing fungi that attack cranberry; [Fungal inoculum will begin to build up again during the 2nd year after LW, or *sometimes* during the 1st year after LW if the use of LW is the *only step* taken to try to control fruit rot fungi]
- Remove the LW flood if air temperatures are unseasonably warm and/or the water temperature climbs too high (no more than 65°F)