

## INSECT MANAGEMENT 2011

Prepared by Anne L. Averill and Martha M. Sylvia

MANAGEMENT GUIDELINES PROVIDED HERE SERVE ONLY AS REMINDERS. FOR MORE COMPLETE INFORMATION, REFER TO EXTENSION MATERIALS AVAILABLE AT THE CRANBERRY STATION.

**MANAGEMENT GUIDELINES**

**Reducing inputs to cut costs of production.** Some key insect management practices should be the last ones eliminated to save money. The following are listed in descending order of importance for most bogs. It is seldom advisable to skip the initial cranberry fruitworm spray (the first spray in IPM-based programs when most pinheads have set and berries have begun to size up) unless late water has been held. This first spray targets the largest portion of the population. Sweep netting in mid-May to detect cranberry weevil, cutworms, gypsy moth, and black-headed fireworm outbreaks is important. It is likely that if insecticide inputs are lowered, black-headed fireworm and weevil levels will increase; *Sparganothis* fruitworm levels should drop. When infestations of weevil or fireworm establish, management inputs must be intensified in subsequent years. Finally, walking the bog early and late in the season to inspect for winter moth larvae, soil insects, mites, and webbing of fireworms allows detection of pests that can affect the acreage in subsequent years or require renovation.

**Start scouting bogs early May.** Black-headed fireworm and winter moth may be active early but are difficult to see until mid-May. Always gauge levels of pest caterpillars in their early stages! As the caterpillars of many species grow larger, they cling more tightly to the vine or hide in daytime and are harder to pick up in daytime sweep netting. Small black-headed fireworm caterpillars may cling to the top of the net. Some serious pests are active during and after bloom, especially black-headed fireworm, brown spanworm and cranberry weevil, so it is important to continue scouting during and after bloom. Be aware that some pests, particularly cranberry weevil, gypsy moth, black-headed fireworm, and brown spanworm, may be very patchy or in coves or edges, so thorough assessment of total acreage is essential. Many stages of insects are active only at night and are concealed during the day, such as large cutworms, root weevil adults, white grub adults, or some moth species.

**Sweep netting.** Using a 12” net and 180° sweeps into the vine, sweep netting should be conducted at least once a week. A sweep set consists of 25 sweeps across the bog. The insects in the net should be properly identified, counted, and recorded. Conduct 1 set of 25 sweeps for each acre. For larger pieces (more than 20 acres), at least 1 sweep set/2 acres is advisable. In multiple-acre pieces, calculate the average number of each insect in all of your sweep sets. Treat only after the average numbers of each insect in your series of sweep sets exceeds these values, and after other external concerns have been considered including cost of application, expected returns, weather, etc.

	AVERAGE #			AVERAGE #
ADD UP: blossomworm, false armyworm, other cutworms, and gypsy moth	<b>4.5</b>		black-headed fireworm	<b>1-2</b>
flea beetle	<b>15</b>		<i>Sparganothis</i> fruitworm	<b>1-2</b>
brown spanworm, green spanworm	<b>18</b>		cranberry weevil	<b>4.5 spring 9 summer</b>

In sweep net sampling, the average numbers of a pest that we use to trigger a management measure is only a rule of thumb. It serves as an indication that an insect pest is being sampled at numbers that we consider high and worthy of attention. Significant pressure by cranberry weevil and particularly by black-headed fireworm and *Sparganothis* fruitworm should be attended to in the spring; infestations are harder to manage in the summer.

**Pheromone traps.** Traps should be used for timing management of cranberry girdler, black-headed fireworm, and *Sparganothis* fruitworm and should be up by June 1. Use 1 trap/10 acres. Place on upwind side of bog. Check and clean traps weekly, recording number of moths captured. Change bait every 3

## 8 Insects

weeks. Check descriptions of adult moths in extension materials because non-target species are sometimes caught. Intrepid and Confirm sprays need to go on several weeks earlier than conventional insecticide sprays (such as Diazinon).

For black-headed fireworm: when treating summer generation with Intrepid or Confirm, apply insecticide 2 weeks after **onset** of moth flight, and again 10 days later. Timing for conventional insecticide is 10 days after **peak** moth flight, usually during bloom.

For Sparganothis fruitworm: if treating with Intrepid or Confirm, apply insecticide 3 weeks after the moth flight **begins**, and again 10-14 days later. Timing for conventional insecticide is 10-14 days after **peak** moth captures, ca. mid-to-late July.

For girdler: treatments are usually in July. Refer to the section on cranberry girdler for timing of specific treatments. Even though trap catches are low, serious larval infestations can exist.

**Intrepid and Confirm (Insect growth regulator products)**. Growth regulators are caterpillar-specific and conserve natural enemies and pollinators. These compounds need to be eaten to work. These compounds are most effective when applied multiple times and in low gallonage against small caterpillars feeding on foliage. The best choice is Intrepid, which has higher activity than Confirm, but Intrepid is restricted use and is Zone II restricted. Use aerial application or low-volume ground applications when possible to improve performance. Coverage and well-timed chemigation systems are critical for good efficacy (6 minutes or less rinse time); excessive chemigation washout will remove active material. A spray adjuvant should be used. 6 hours drying time following application is required. New vine growth is not protected. Larval death may not be observed until a week or more has passed. Pollinator safe!

**Bacillus thuringiensis (B.t.) based products**. Examples include Dipel, Xentari and Biobit. These compounds are most effective when applied multiple times and in low gallonage against small caterpillars feeding on foliage. Well-timed chemigation systems are critical for good efficacy (6 minutes or less rinse time). Thorough coverage is essential and repeat applications may be necessary. *Early attention to infestation is critical*. Caterpillars stop feeding after eating compounds but may take several (3-10) days to die. Use aerial application or low-volume ground applications when possible to improve performance. Addition of a spreader/sticker (e.g., Bond, Stik) may be critical, check label.

**Spinosyn-based products**: includes Delegate, SpinTor, and Entrust (an organic formulation). Delegate is the most active and provides longer residual control than SpinTor; Delegate is the compound of choice. Spinosad-based products are fast acting nerve poisons but are still reduced-risk compounds. Allow 7 days between applications. These compounds are the better choice (compared to Intrepid or Confirm) once the caterpillars have reached a larger size. For Delegate, only use lowered rates if rinse time is 4 minutes or under. For SpinTor, when chemigating, a short rinse time (6 minutes or less) is necessary for good efficacy. Keep in mind that spinosyn products can be toxic to natural enemies. These products are all **highly** toxic to bees. Sprays made over bees when they are actively foraging must be avoided (this includes Entrust, even though it is an organic formulation!). However, dried residues are essentially non-toxic. If treating during bloom, be sure that overnight conditions are such that evening chemigation applications will dry by morning.

**Restricted Use Pesticides (Lorsban, Diazinon, Intrepid, and Actara)** A pesticide license (private applicator certification) is required to purchase, handle and apply these compounds to your bog.

**BEES!! MOST INSECTICIDES ARE HIGHLY TOXIC TO BEES, ESPECIALLY DIRECT APPLICATIONS AND RESIDUES. DO NOT APPLY OR ALLOW TO DRIFT TO CRANBERRIES IN BLOOM OR NEARBY BLOOMING PLANTS/WEEDS IF BEES ARE FORAGING. REMOVE HONEY BEE HIVES OR ADVISE BEEKEEPER IF SPRAYS ARE APPLIED. REMEMBER THAT NATIVE WILD BEES, SUCH AS BUMBLE BEES, ARE ALSO VULNERABLE TO SPRAYS APPLIED AT BLOOM AND THAT POPULATIONS WILL DWINDLE OVER TIME IF THEY ARE NOT PROTECTED.**

<b>EARLY SEASON CATERPILLARS</b>
----------------------------------

<b>BLACK-HEADED FIREWORM</b>
------------------------------

**Bolded selections are the best choices for management. All rates are per acre.**

Assail 30 SG	4.0-6.9 oz	7 days between applications, 2 applications allowed, 1 day PHI.
<b>Avaunt</b>	6 oz	7 days between applications. 30 day Pre-Harvest Interval (PHI). No flow-through bogs, hold water 1 day.
<b>Delegate WG</b> (spinetoram)	3-6 oz	Do not exceed 19.5 oz/season. 7 days between applications. Delegate is more active and has greater residual than SpinTor. Only use lowered rates if rinse time is 4 minutes or under.
SpinTor 2SC (spinosad)	4-10 fl oz	Do not exceed 29 oz/season. 7 days between applications. For SpinTor, a short rinse time (6 minutes or less) is necessary.
<b>Diazinon 50 W</b>	4 lb	It is advisable to hold water for at least 3 days. 5 day REI!! 3 applications/season, 7 day PHI, and 14 day spray interval, except AG500 which has a 7 day spray interval.
<b>Diazinon AG 500</b>	2 qt	
<b>Diazinon AG 600 WBC</b>	51 fl oz	
Imidan 70W	1.33-4 lb	Efficacy may be reduced at pHs found in bog water (pH 6-7). REI 3 days, 10 day spray interval, 14 day PHI.
<b>Intrepid 2F</b>	10-16 fl oz	Insect growth regulator products; these compounds need to be eaten to work. Intrepid is more active and has greater residual than Confirm. Note however, Intrepid is restricted use and Zone II restricted. See product discussion on page 8. Safe for pollinators and natural enemies.
Confirm 2F	16 fl oz	
Lorsban 4E, Nufos 4E	1.5-3 pt	Rates as low as 1.5 pts (aerial) or 2 pts (chemigation) are reported to give satisfactory control. 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, then release gradually. Note: 75 WG formulation is not restricted use.
Chlorpyrifos 4E AG	1.5-3 pt	
Lorsban Advanced, Hatchet	3 pt	
Lorsban 75 WG	2 lb	
Orthene 97, Acephate 97, 97UP	1 lb	Do not apply within 10 days of start of bloom due to bee concerns. 1 application/season. Observe 90 day PHI, except 75 day PHI with Acephate 90, 97, 97UP only – check label.
Acephate 90 WSP, 90 WDG	1.1 lb	
Acephate 90 Prill	1.1 lb	
Sevin XLR Plus	1.5-2 qt	5 applications/season, 7 day spray interval, 7 day PHI.
Sevin 4F, Carbaryl 4L	1.5-2 qt	
Sevin 80S (Solupak)	1.88-2.5 lb	

**Watch out:** Fireworm can be a very serious problem! *Best approach is to start inspecting in early spring*—pest is easy to manage if infestation is detected early. Larvae hatch in mid-May; even earlier in odd warm springs. While sweeping in May, look for very small, hard-to-see larvae on the net rim. Small larvae are less likely to be picked up in the net than larger larvae. Infestations are often patchy and more numerous along edges, where vines are overgrown, where leaf trash has accumulated, or where winter flooding was withdrawn early. Spot treatment is desirable here.

2nd generation is active during bloom. Use pheromone traps to time management of 2nd generation. Black-headed fireworm moths are only 1/4" long and are black and gray; be aware that the pheromone trap often picks up a much larger, non-pest moth. When treating summer generation with growth regulators (Intrepid or Confirm), timing is 2 weeks after **onset** of moth flight, and again 10 days later. For other insecticides, such as Diazinon, Delegate, or Avaunt, apply insecticide 10 days after **peak** moth flight, usually during bloom.

Infestations move rapidly! Spring generation is a much easier target than the second generation (occurs during bloom).

## 10 Insects

### YELLOW-HEADED FIREWORM

Lorsban, Orthene, Sevin, and spinosyn products (**Delegate**, SpinTor, and Entrust) can be used as specified for black-headed fireworm (see page 9).

**Intrepid** and **Diazinon**, FIFRA 2EE recommendations, can be used as specified for black-headed fireworm (see page 9).

Yellow-headed fireworm may appear on beds that are not completely flooded in the winter. Eggs hatch in May. Caterpillars are all yellow and are impossible to distinguish from Sparganothis. It is often the case that totally winter-flooded beds have Sparganothis and partially, poorly winter-flooded beds, have yellow-headed fireworm. The yellow-headed fireworm pupa has a knob at its top, which Sparganothis pupae do not have.

### SPARGANOTHIS FRUITWORM

**Bolded selections are the best choices for management. All rates are per acre.**

Assail 30 SG	4.0-6.9 oz	7 days between applications, 2 applications, 1 day PHI.
<b>Delegate WG</b> (spinetoram)	3-6 oz	Do not exceed 19.5 oz/season. 7 days between applications. Delegate is more active and has greater residual than SpinTor. Only use lowered rates if rinse time is 4 minutes or under.
SpinTor 2SC (spinosad)	4-10 fl oz	Do not exceed 29 oz/season. 7 days between applications. For SpinTor, a short rinse time (6 minutes or less) is necessary.
<b>Intrepid 2F</b>	10-16 fl oz	Insect growth regulator products, these compounds need to be eaten to work. Intrepid is more active and has greater residual than Confirm. Note, however, Intrepid is restricted use and Zone II restricted. See product discussion on page 8. Safe for pollinators and natural enemies.
Confirm 2F	16 fl oz	
Lorsban 4E, Nufos 4E	1.5-3 pt	<u>Poor choice for most bogs</u> , nearly all populations are resistant. Limit 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, then release gradually. Note: 75 WG formulation is not restricted use.
Chlorpyrifos 4E AG	1.5-3 pt	
Lorsban Advanced, Hatchet	3 pt	
Lorsban 75 WG	2 lb	
Orthene 97, Acephate 97UP	1 lb	Poor choice for most bogs, nearly all populations are resistant. Do not apply within 10 days of start of bloom due to bee concerns. 90 day PHI except 75 day PHI with some Acephate formulations.
Acephate 90 WSP, 90 WDG	11.1 lb	
Acephate 90 Prill	1.1 lb	

Small *Sparganothis* caterpillars are picked up in the sweep net in mid-May. Check for caterpillars in yellow loosestrife weed tips that have rolled leaves; this will give you an idea of the larva's appearance so you can ID them in the net. The 2<sup>nd</sup> generation in July feeds on both fruit and foliage. With both generations, always target the small caterpillars. Keep an eye on Ben Lears, which tend to be hardest hit; Howes the least. The 2<sup>nd</sup> generation feeding on Ben Lears develop faster and may feed inside the fruit.

Beginning in June, use pheromone traps to determine moth flight. When managing a population, you want to target caterpillars as they are hatching, not the adult moths. If treating with growth regulators (Confirm or Intrepid), apply insecticide earlier in the moth flight; 3 weeks after the moth flight **begins**, ca. early July, and make at least one more application 10-14 days later. When treating with other insecticides, such as Delegate, apply 10-14 days after **peak** moth captures, ca. mid-to-late July.

Nearly all Sparganothis populations are resistant to Lorsban and Orthene. Intrepid and Delegate are excellent alternatives and good choices. Late water has not been shown to be effective against this insect, but it does synchronize moth emergence.

<b>CUTWORMS (BLOSSOMWORM, FALSE ARMYWORM) and HUMPED GREEN FRUITWORM</b>
--

**Bolded selections are the best choices for management. All rates are per acre.**

Dipel ES	1-4 pt	<i>Bacillus thuringiensis (B.t.)</i> products. Multiple applications, addition of an adjuvant, and good coverage in low gallonage are essential. Target larvae when small. Safe for pollinators and natural enemies.
Biobit	0.5-2 lb	
Xentari	0.5-2 lb	

**Delegate WG** (spinetoram) 3-6 oz Do not exceed 19.5 oz/season. 7 days between applications. Delegate is more active and has greater residual than SpinTor. Only use lowered rates if rinse time is 4 minutes or under.

SpinTor 2SC (spinosad) 4-10 fl oz Do not exceed 29 oz/season. 7 days between applications. For SpinTor, a short rinse time (6 minutes or less) is necessary.

Diazinon 50 W	4-6 lb	FIFRA 2EE recommendation. Hold water for at least 3 days. 5 day REI!! 3 apps/season, 7 day PHI, and 14 day spray interval, except AG500 which has a 7 day minimum.
Diazinon AG 500	2-3 qt	
Diazinon AG 600	51-76.5 fl oz	

<b>Intrepid 2F</b>	10-16 fl oz	Insect growth regulator products, these compounds need to be eaten to work. Intrepid is more active and has greater residual than Confirm. Note, however, Intrepid is restricted use and Zone II restricted. See product discussion on page 8. Safe for pollinators and natural enemies.
Confirm 2F	16 fl oz	

Late Water False armyworm and blossom worm may be managed with late water. See Late Water Section.

Lorsban 4E, Nufos 4E	1.5-3 pt	Rates as low as 1.5 pts (aerial) or 2 pts (chemigation) are reported to give satisfactory control. 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, then release gradually. Note: 75 WG formulation is not restricted use.
Chlorpyrifos 4E AG	1.5-3 pt	
Lorsban Advanced, Hatchet	3 pt	
Lorsban 75 WG	2 lb	

Orthene 97, Acephate 97, 97UP	1 lb	Do not apply within 10 days of start of bloom due to bee concerns. 1 application/season. Observe 90 day PHI, except 75 day PHI with Acephate 90, 97, 97UP only – check label.
Acephate 90 WSP, 90 WDG	1.1 lb	
Acephate 90 Prill	1.1 lb	

Sevin XLR Plus	2 qt	5 applications/season, 7 day spray interval, 7 day PHI.
Sevin 4F, Carbaryl 4L	2 qt	
Sevin 80S (Solupak)	2.5 lb	

The action threshold for cutworms is an average of 4.5 larvae per 25 sweeps. Count all cutworms and gypsy moths together. Very young false armyworm caterpillars are whitish with black spots, each with a black spine. These caterpillars tend to loop like spanworms but gradually drop this movement. Early detection is important because they consume the terminal buds before new growth starts. As cutworms get older, they will not be picked up in day sweeps. Night sweeps may be required to gauge infestation at that point.

## 12 Insects

### SPANWORMS (GREEN SPANWORM, BROWN SPANWORM, BIG CRANBERRY SPANWORM, WINTER MOTH)

**Bolded selections are the best choices for management. All rates are per acre.**

Avaunt	6 oz	7 days between applications, no flow-through bogs, hold water 1 day.
Dipel ES	1-4 pt	<i>Bacillus thuringiensis (B.t.)</i> products. Multiple applications, addition of an adjuvant, and good coverage in low gallonage are essential.
Biobit	0.5-2 lb	
Xentari	0.5-2 lb	
<b>Delegate WG</b> (spinetoram)	3-6 oz	Do not exceed 19.5 oz/season. 7 days between applications. Only use lowered rates if rinse time is 4 minutes or under.
SpinTor 2SC (spinosad)	4-10 fl oz	Do not exceed 29 oz/season. 7 days between applications. For SpinTor, a short rinse time (6 minutes or less) is necessary.
If infestation appears during bloom, remember these compounds are highly toxic to bees, but that dried residues are non-toxic; thus, sprays must go on at night and dry by morning.		
<b>Intrepid 2F</b>	10-16 fl oz	Insect growth regulator products, these compounds need to be eaten to work. Intrepid is more active and has greater residual than Confirm. Note, however, Intrepid is restricted use and Zone II restricted. See product discussion on page 8. Safe for pollinators and natural enemies.
Confirm 2F	16 fl oz	
Imidan 70W	1.33-4 lb	Efficacy may be reduced at pHs found in bog water (pH 6-7). REI of 3 days, 10 day spray interval, 14 day PHI. Beware bee toxicity.
Lorsban 4E, Nufos 4E	1.5-3 pt	Toxic to bees -- do not apply when bees are present. Limit 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, then release gradually. Note: 75 WG formulation is not restricted use.
Chlorpyrifos 4E AG	1.5-3 pt	
Lorsban Advanced, Hatched	3 pt	
Lorsban 75 WG	2 lb	
Orthene 97, Acephate 97, 97UP	1 lb	Do not apply within 10 days of start of bloom due to bee concerns. 1 application/season. Observe 90 day PHI, except 75 day PHI with Acephate 90, 97, 97UP only – check label.
Acephate 90 WSP, 90 WDG	1.1 lb	
Acephate 90 Prill	1.1 lb	
Pyronyl Crop Spray	12 fl oz	Spot treating using low gallonage may be helpful for patchy infestations. Beware bee toxicity – do not apply when bees are present.
Pyganic EC 1.4	16-64 fl oz	
Pyganic EC 5.0	4.5-18 fl oz	

For green and brown spanworm, the action threshold is an average of 18 small larvae in 25 sweeps. Threshold may be lowered for large larvae. **Be aware of brown spanworm infestations during bloom** that may be patchy. Newly hatched brown spanworms cling like thin threads to the inside of the net. For big cranberry spanworm, the action threshold is 4.5 in 25 sweeps. As spanworms get older, they will not be picked up in day sweeps.

Green spanworm caterpillars start to appear in early season sweeps; brown spanworm caterpillars appear later. A flight of brown moths in June may be an indication of a brown spanworm problem but only target caterpillars with sprays! Big cranberry spanworms appear in mid-June. They can be very destructive, occurring in patches. Caterpillars are dark brown with bumps across their back and grow to 2.5" in size. Spot treating may work.

**Scout for winter moth much earlier than other spanworms.** Winter moth is a spanworm species and may be present as early as May 1. If you have a history of winter moth infestation, you may need to apply a prophylactic spray early in the season. Populations may reoccur as larvae balloon in. Injury may be done to the developing tips before populations can be detected.

Other miscellaneous spanworms appear in patches and grow larger than the common green and brown spanworm, so it may be advisable to lower the action threshold by half if these infestations occur.

<b>GYPSY MOTH</b>
-------------------

**Bolded selections are the best choices for management. All rates are per acre.**

Assail 30 SG	4.0-6.9 oz	7 days between applications. 2 apps, 1 day PHI.
<i>Bacillus thuringiensis</i> ( <i>B.t.</i> ) products		See discussion under cutworm or spanworm (pages 11 and 12).
<b>Intrepid 2F</b>	10-16 fl oz	Insect growth regulator products, these compounds need to be eaten to work. Intrepid is more active and has greater residual than Confirm. Note, however, Intrepid is restricted use and Zone II restricted. See product discussion on page 8. Safe for pollinators and natural enemies.
Confirm 2F	16 fl oz	
Late Water		Holding late water kills eggs laid on the bog as well as prevents establishment of tiny caterpillars that drift in from infested uplands. See Late Water section.
Orthene 97, Acephate 97, 97UP	1 lb	Do not apply within 10 days of start of bloom due to bee concerns. 1 application/season. Observe 90 day PHI, except 75 day PHI with Acephate 90, 97, 97UP only – check label.
Acephate 90 WSP, 90 WDG	1.1 lb	
Acephate 90 Prill	1.1 lb	
<b>Sevin XLR Plus</b>	1.5-2 qt	5 apps/season, 7 day spray interval.
<b>Sevin 4F, Carbaryl 4L</b>	1.5-2 qt	
<b>Sevin 80S (Solupak)</b>	1.88-2.5 lb	

Insecticides (Diazinon, **Delegate**) applied for cutworms or spanworms may provide control. Action threshold is an average of 4.5 larvae/25 sweeps. Check for patchy infestations and spot treat, i.e., along edges facing uplands with infested trees. Check previously infested areas -- eggs can overwinter on flooded bogs. Early detection is key; larvae consume terminal buds before new growth starts.

<b>CRANBERRY WEEVIL</b>
-------------------------

<b>Actara</b> (thiamethoxam)	2-4 oz	Effective against both spring and summer adult populations. Lower rates effective. <u>Restricted Use and Zone II restricted</u> . Do not apply by air or to flow-through bogs. Highly toxic to bees – do not apply within 5 days of bee arrival. Hold water 5 days.
<b>Belay</b> (clothianidin)	4 fl oz	<u>Use only for summer adult populations after bees are gone</u> . Highly toxic to bees, more than 5 days after treatment!. 12 hr REI, 21 day PHI. If you use Belay for weevil, you cannot use it for soil application. Total amount allowed is 12 oz.
<b>Avaunt</b> (indoxacarb)	6 oz	<u>Effective against spring weevil populations only</u> . Do not use after bloom against weevil in summer. Only 2 apps allowed targeting weevil in spring, prior to bloom. 7 days between applications. No flow-through bogs, hold water 1 day. Toxic to bees.
Lorsban 4E, Nufos 4E	1.5-3 pt	<u>Poor choice for most bogs</u> , many populations are resistant. 60 day PHI. Impound water for 5 days, then release slowly. Note: 75 WG formulation is not restricted use. Toxic to bees.
Lorsban Advanced, Hatchet	3 pt	
Lorsban 75 WG	2 lb	

Action threshold is an average of 4.5 weevils in 25 sweeps for spring population, and 9 weevils in summer. Summer feeding is not as damaging as spring feeding and egg-laying. Adult weevils are found throughout the growing season. See sweep netting section page 7. Sweep when warm, sunny, and calm. Let net contents settle: weevils "play dead" when disturbed. Do not count non-pest gray weevils. Spring weevils move in from outside bog; consult sweep records from previous years to determine invasion pattern. Even if threshold is exceeded, sometimes it is advisable to wait 1-2 wks in spring to treat. Weevil numbers may continue to rise as more weevils move in. However, waiting too long becomes risky if blossom buds have appeared and eggs are being laid. Late water is not effective against weevil.

## 14 Insects

### CRANBERRY FRUITWORM

**Bolded selections are the best choices for management. All rates are per acre.**

For most bogs, a properly timed first cranberry fruitworm spray is the most important one of the season.

Assail 30 SG	4.0-6.9 oz	7 days between applications, 2 apps, 1 day PHI. Toxic to bees.
<b>Delegate WG</b> (spinetoram)	3-6 oz	FIFRA 2EE recommendation. Do not exceed 19.5 oz/season. Highly toxic to bees, but thoroughly dried residues are safe. Thus, sprays must go on at night and dry by morning if sprayed during bloom
<b>Diazinon 50 W</b>	4-6 lb	Toxic to bees. It is advisable to hold water for at least 3 days.
<b>Diazinon AG 500</b>	2-3 qt	5 day REI!! 3 applications/season, 7 day PHI, and 14 days between
<b>Diazinon AG 600 WBC</b>	51-76.5 oz	sprays, except AG500 which has a 7 day minimum.
Imidan 70W	1.33-4 lb	Toxic to bees. Efficacy results have been very variable. If chosen, use higher rate. Efficacy may be reduced at pHs found in bog water (pH 6-7). REI of 3 days, 10 day spray interval, 14 day PHI.
<b>Intrepid 2F</b>	10-16 fl oz	FIFRA 2EE recommendation. Zone II restricted. Ground applications <u>only</u> are highly effective. Chemigation gives moderate to good level of control in well-timed systems. Safe for bees and natural enemies.
<b>Late Water</b>		Holding late water is an excellent choice as it severely reduces fruitworm. However, moths may move into late water-treated beds from other areas of infestation, so it is advisable to spot check for eggs. Refer to Late Water Practice on next page.
Lorsban 4E, Nufos 4E	1.5-3 pt	Toxic to bees. Rates as low as 1.5 pts (aerial) or 2 pts (chemigation) can
Chlorpyrifos 4E AG	1.5-3 pt	give control. 2 apps/season. Do not mix with other insecticides.
Lorsban Advanced, Hatchet	3 pt	Observe 60 day PHI. Impound water for 5 days, then release slowly.
Lorsban 75 WG	2 lb	Note: 75 WG formulation is not restricted use.
<b>Sevin XLR Plus</b>	1.5-2 qt	Toxic to bees. Sevin XLR Plus is formulated to have minimal
<b>Sevin 4F, Carbaryl 4L</b>	1.5-2 qt	bee toxicity once the spray dries. Limit of 5 applications/season,
<b>Sevin 80S (Solupak)</b>	1.88-2.5 lb	7 day spray interval, 7 day PHI.

### CRANBERRY FRUITWORM MANAGEMENT

#### FOR ALL PRACTICES

1. Every pump system should be scouted separately as one piece.
2. To be valid, sampling of berries by size and bog area must be random because moths select larger berries particularly along bog margins and inner ditches.
3. Use a magnifier to look for eggs. Look at eggs carefully to be sure they are alive. As you move into the season, many eggs are dead or parasitized. Do not count these.
4. Target only eggs. Do not treat in attempt to control caterpillars in the fruit. Research shows that sprays made after caterpillars have entered fruit are minimally effective.
5. For beds with very high fruitworm pressure and large fruited varieties, it may be cost effective to apply Intrepid 2F in lowest water gallonage/acre even before or at 50% out-of-bloom. There is no risk to pollinators with this compound.
6. Timing first spray using % out of bloom: In the event of unusually warm or cool weather during fruit set it may be advisable to shorten or lengthen accordingly the interval between 50% out-of-bloom and the first spray.
7. It is not necessary or desirable to mix compounds for effective control.



**STANDARD PRACTICE**

**1ST TREATMENT - CALCULATE % OUT-OF BLOOM (# of blossoms that have lost petals or become fruits)**

To properly time your first spray, you must calculate the % out-of-bloom every couple of days as pinheads start to form, usually around the end of June. You are trying to accurately assess when 50% OOB occurs. For each acre of bog, randomly collect 10 uprights and record the number of pods, flowers, pinheads, and fruit. Calculate using the following:

$$\% \text{ out-of-bloom} = \frac{\text{total number of pinheads and fruit}}{\text{total number pods, flowers, pinheads, and fruit}} \times 100$$

*Apply 1st treatment 7-9 days after 50% out-of-bloom for Howes and for Early Blacks, Ben Lears and Stevens spray 0-7 days after 50% out-of-bloom. Timing of this spray is critical. If fruitworm pressure has been high in previous years and berries are sizing up, spray should occur very soon after 50% OOB in early cultivars. Delegate, sprayed only at night when residues can be dried by morning, is the compound of choice for during-bloom sprays. Keep in mind that all insecticides, with the exception of the growth regulators (Confirm and Intrepid), are toxic to bees.*

**2ND TREATMENT**

Apply 2nd treatment about 10 days after 1st treatment.

**ADDITIONAL TREATMENTS - MONITOR EGGS TO TRIGGER SPRAYS**

One week after your 2nd treatment, inspect 50 randomly picked berries/A (with a minimum of 200 berries per piece, no matter how small piece is) for viable eggs. Follow guidelines in table below to determine necessity of additional sprays. If egg numbers trigger spray, spray ASAP. If no egg is found, repeat berry inspection process every 3-4 days until Aug. 15 or longer if eggs are still being detected.

**SCOUTING PRACTICE**

**1ST TREATMENT - CALCULATE % OUT OF BLOOM**

Apply 1st treatment 7-9 days after 50% out-of-bloom (half the blossoms have lost all petals or become fruits) for Howes and apply 0-7 days after 50% out-of-bloom for Early Blacks, Ben Lears, and Stevens. *If fruitworm pressure has been high in previous years and berries are sizing up, spray timing is critical and should not be delayed long after 50% OOB has been reached.*

**ADDITIONAL TREATMENTS USING SCOUTING PRACTICE**

Five days after treatment, inspect 50 randomly picked berries/A (with a minimum of 200 berries per piece) for eggs. Follow guidelines in table below to determine necessity of additional sprays. If egg numbers trigger spray, spray ASAP. If no egg is found, repeat berry inspection process every 3-4 days until Aug. 15.

**LATE WATER PRACTICE**

Late water may effectively reduce fruitworm pressure. It is possible that sprays can be eliminated for cranberry fruitworm but berries must be monitored for eggs throughout the fruitworm season as the moths are very mobile and may move into your bog from external sources.

**TREATMENTS - MONITOR EGGS TO TRIGGER SPRAYS**

As fruits set, begin inspecting 50 randomly picked berries/A (with a minimum of 200 berries per piece) for eggs. Follow guidelines in table below to determine necessity of spray. If egg numbers trigger spray, spray ASAP. If no egg is found, repeat berry inspection process every 3-4 days until Aug. 15. If fruitworm pressure is low through fruit set, it may be safe to extend intervals between berry sampling dates.

TABLE USED (for all practices) TO DETERMINE NECESSITY OF MAKING A SPRAY

Number of acres	Number of berries checked	Number of viable eggs needed to trigger spray
0-5	200-250	1
5-7	251-350	2
7-9	351-450	3
9-11	451-550	4
11-13	551-650	5
13-15	651-750	6
for each additional 2 acres	add 100 berries	add 1 egg

## 16 Insects

### SOIL INSECTS

#### BLACK VINE WEEVIL AND STRAWBERRY ROOT WEEVIL

Nematodes	Availability limited—need to plan ahead and order well in advance of application. Target immatures in soil. Apply in early evening in May and/or September. Best results occur when soil temperatures are higher than 56°F. Irrigate before and after application. Chlorpyrifos (e.g., Lorsban) has been reported to adversely affect nematodes.
Fall Flood	Flood for 10-14 days as soon as possible after harvest. May also impact vines to some degree. Warmer water enhances effectiveness.
Winter Flood	If you can winter flood, populations should be less abundant.

In the spring, look for grubs in soil associated with areas of dying vines (often near bog edge) that may have an orange halo of vines around edges. Grubs feed on the bark of the vine. Adult beetles emerge in June; they must feed for about 4 weeks before egg-laying starts. Night sweep for weevils at edge of weevil-damaged areas, starting after dusk but before dew forms in mid-June through July. Notched new foliage indicates adult feeding. Sweep when vines are dry. These pests are more abundant in bogs with no winter flooding or high spots.

#### SCARAB GRUBS

Admire Pro	7-14 fl oz	Imidacloprid products, rate per acre. Soil drench treatment for oriental beetle. May suppress cranberry root grub and cranberry white grub, but data is lacking and multiple years likely required to see effect. Limit 2 apps/season <u>but 1 app at higher rate is recommended</u> . No aerial app, 30 day PHI. <i>Best results are achieved when the compound is present just prior to egg hatch—this can be determined by monitoring oriental beetle flight with pheromone traps starting in late June-early July. Application should be made 3 weeks after <b>peak</b> flight of the beetles (or slightly earlier).</i> Irrigate before and after application, but do not apply to saturated soil. Compound has very long soil residual. Highly toxic to bees; do not apply when pollinators are on bog.
MANA Alias 4F	8-16 fl oz	
Admire 2F	16-32 fl oz	
Alias 2F	16-32 fl oz	
Widow	16-32 fl oz	
Belay (clothianidin)	12 fl oz	Highly toxic to bees. Apply as a soil drench only after bees have been removed or all bloom gone. 12 hr REI, 21 day PHI. If you use Belay as a soil drench, you cannot use it as a foliar application on weevil, flea beetle or fruitworm. Total amount allowed is 12 oz.
Summer flood	Remove winter flood and allow bog to dry out. Reflow mid-May and keep well flooded until mid-July. This will eliminate cranberry root grub and cranberry white grub larvae, as well as the crop for that year. Oriental beetle and <i>Hoplia</i> are probably also impacted by the summer flood.	
<b>Cranberry root grub</b>	- grubs turn into low-flying beetle adults that look like bumblebees; they emerge from the soil during cranberry bloom and set. Males fly after dawn through mid-morning.	
<b>Cranberry white grub</b>	- grubs turn into large-bodied "June bugs" as adult beetles and are active in the evening in May and June.	
<b>Oriental beetle</b>	- small beetle (5/8 inch), vary greatly in color and pattern from light brown to black. Grubs develop over two years and are similar in appearance to small white grubs. An adult sex pheromone trap is available.	
<b><i>Hoplia equina</i></b>	- adult beetles emerge synchronously from the soil during bloom in late afternoon. The small brown beetles are about 5/16 inch in size. The grubs develop over two years and are similar in appearance to small white grubs.	

In the spring, look for grubs in both root layer and lower soil associated with areas of weak or dying vines. Because it is unknown if Oriental Beetle and *Hoplia* respond to summer flooding, let us know if you summer flood for these species. In grub-infested areas, try to avoid stress to vines such as high doses of Casoron and drought. For *Hoplia* only, there is some evidence of nematode efficacy. Call the Cranberry Station for additional advice.

## CRANBERRY GIRDLER

Nematodes	Availability limited—need to plan ahead and order well in advance of application. Apply Nematodes 2 weeks after <b>end</b> of moth flight. Target immatures in soil.
Fall Flood	Flood for a week as soon as Early Blacks are harvested, starting no later than Sept. 25. Vines must be completely covered. It may be necessary to flood late varieties with berries on the vine. May also impact vine health to some degree.
Regular Sanding	Sanding with 1-3 inches every 3rd year will reduce favorable girdler habitat.

In June through July, appearance of silvery-white moths with a "snout" on front of head that make short, jerky flights as you walk through the vines may signal a problem, but be sure to target immatures in soil with control treatment. If there is a history of girdler on your bog, use pheromone traps to time treatments. Be aware of girdler's true appearance; a very similar non-pest moth is also picked up in traps. A bad girdler infestation can exist even with low pheromone trap catches. Just below the trash line, look for old feeding damage that may be quite deep in the wood of the vine. Thorough trash flows are beneficial.

## STRIPED COLASPIS

Admire Pro	7-14 fl oz	Imidacloprid products. Soil drench <u>targets immatures</u> in soil. When adult beetles are picked up in net, application should be made to target larvae as eggs hatch. Compound has very long soil residual. No aerial application. Limit 2 apps/season, but <u>1 app at higher rate is recommended</u> . Irrigate before and after application. Highly toxic to bees; apply after bloom in mid-late July. 30 day PHI.
MANA Alias 4F	8-16 fl oz	
Admire 2F	16-32 fl oz	
Alias 2F	16-32 fl oz	
Widow	16-32 fl oz	
Belay (clothianidin)	12 fl oz	Highly toxic to bees. Apply as a soil drench targeting immatures in the soil only after bees have been removed or all bloom gone. 12 hr REI, 21 day PHI. If you use Belay as a soil drench, you cannot use it as a foliar application on weevil, flea beetle or fruitworm. Total amount allowed is 12 oz.
Diazinon 50 W	4-6 lb	FIFRA 2EE recommendation <u>targets adults</u> . It is advisable to hold water for at least 3 days. Check labels; most are 3 apps/season, 5 day REI, 7 day PHI, 14 day spray interval, except AG500 which has 7 day minimum.
Diazinon AG 500	2-3 qt	
Diazinon AG 600 WBC	51-76.5 fl oz	
Sevin XLR Plus	1.5-2 qt	FIFRA 2EE recommendation <u>targets adults</u> . Do not apply when bed is in bloom. 5 apps/season, 7 day spray interval, 7 day PHI.
Sevin 4F & Carbaryl 4L	1.5-2 qt	
Sevin 80 WSP & 80S	1.88-2.5 lb	

Imidacloprid (Admire/Alias) and Belay should target hatching eggs in the soil. Diazinon and carbaryl (Sevin) sprays should target adults being picked up while sweep netting. Highly toxic to bees; advise beekeepers to remove or cover hives before application; these daytime applications will kill native bees foraging during bloom. The beetles are ca. 1/6" long and oblong-oval. Head area is metallic greenish-black and wings blackish, striped with yellow. Legs and antennae are yellow.

Grubs in soil feed in root area, killing vines. Adult feeding results in distinct notching in top leaves of uprights, particularly in infested area.

## 18 Insects

### MISCELLANEOUS PESTS

#### CRANBERRY TIPWORM

Early season tipworm injury often is high, but good vine health enhances rebudding. Appearance of injury does not mean that insects are still present. Only very late-season injury, which is rare, appears to consistently reduce yield. Stressful vine conditions in the year of injury may also result in yield reduction. Diazinon is labeled for tipworm, but control is very poor. Sprays are strongly discouraged for this insect.

#### CRANBERRY FLEA BEETLE

**Bolded selections are the best choices for management. All rates are per acre.**

Actara	2-4 oz	May provide suppression of flea beetle only. Restricted Use and Zone II Do not apply by air or to flow-through bogs. Hold water 5 days!
Assail 30 SG	4.0-6.9 oz	7 days between applications, 2 applications, 1 day PHI.
Belay (clothianidin)	4 fl oz	Foliar applications targeting adults. Highly toxic to bees and foliage is toxic for more than 5 days after application. Use only after bees are removed or bloom is complete. If you use Belay as a foliar application, you cannot use it for a soil application. Total amount allowed is 12 oz.
OR		
Belay (clothianidin)	12 fl oz	Post-bloom application - apply as a soil drench targeting immatures in soil after adults were seen. Highly toxic to bees. 12 hr REI, 21 day PHI. If you use Belay as a soil drench, you cannot use it as a foliar application on weevil, flea beetle or fruitworm.
Delegate WG	3-6 oz	FIFRA 2EE recommendation. Delegate may provide suppression of flea beetle only. Do not exceed 19.5 oz/season. 7 days between applications.
<b>Sevin XLR Plus</b>	1.5-2 qt	5 applications/season, 7 day spray interval, 7 day PHI.
<b>Sevin 4F, Carbaryl 4L</b>	1.5-2 qt	
<b>Sevin 80S (Solupak)</b>	1.88-2.5 lb	
<b>Diazinon 50 W</b>	4-6 lb	FIFRA 2EE recommendation. Hold water for at least 3 days.
<b>Diazinon AG 500</b>	2-3 qt	Check labels; most are 3 apps/season, 5 day REI, 7 day PHI, and
<b>Diazinon AG 600 WBC</b>	51-76.5 fl oz	14 day spray interval, except AG500 which has a 7 day minimum.

Adult flea beetles are active in late July through September. Beetles and their feeding injury are very patchy, often in areas of lush vine. High levels of beetle feeding can impact bud development for the following year. Firm thresholds have not been quantified, but sweep net counts of 15 per 25 sweeps on average over all acreage is the current rule of thumb.

#### SOUTHERN RED MITE (SRM)

<b>Nexter</b>	3.5-7.0 oz	2 apps/season. Ground and chemigation only – no aerial application. Hold water for 3 days after application. No flow-through bogs. 5 hours of drying time required.
Oberon	12-16 fl oz	FIFRA 2EE recommendation, but efficacy data are needed for SRM. Apply by ground and chemigation only – no aerial application. Hold water 1 day after app, 12 hr REI.
<b>Late Water</b>		Research shows that late water can eliminate mites in the year that the flood is held. In the second year following late water, mite pressure may still be low. See Late Water Section.

Look for tiny red mites in sweep net and for red/orange streaks on rim of net or white card. Use a 10X magnifier to examine leaves to determine that mites are present; misidentifications frequently occur. Areas of discolored vines late in the season are often an indicator of mite infestation.

**MANAGEMENT NOTES FOR ALL INSECT RECOMMENDATIONS**

1. **READ AND FOLLOW LABEL INSTRUCTIONS.** Do not use a pesticide for control of a pest not on the label unless a specific recommendation is made by a person authorized to do so (FIFRA 2EE). Pesticide-treated bogs may need to be posted. Check labels. Workers and scouts should be notified prior to treatments and informed about re-entry times. See label for variation in restricted entry times and worker protection standards (WPS). **ONLY APPLY INSECTICIDES IF DAMAGING NUMBERS ARE PRESENT – DETERMINE THIS BY SCOUTING EACH BED.**
2. **LATE WATER --** See Late Water section for more details. Late water research shows that the flood severely reduces mites, cranberry fruitworm, false armyworm, blossomworm, and gypsy moth.
3. **REFLOODING OPTIONS –**
  - a) About May 18<sup>th</sup> for 10 hours controls false armyworm and blossomworm.
  - b) About June 1-12<sup>th</sup> for 10 hours controls green spanworm, small black-headed fireworm, spotted and black cutworms and armyworms, but is likely to **increase fruit rot** and **seriously reduce the crop.**
  - c) About May 12<sup>th</sup> and holding up to July 15-20<sup>th</sup> kills all insects, but with the loss of crop.
  - d) Sept. 20-30<sup>th</sup>. Flooding within this time for a week every third year discourages girdler and blossomworm. A 3 or 4 week flood at this point will manage cranberry fruitworm. These floods are best done when fruits have been removed. Research shows that this flood timing may negatively impact vine health.
4. **SANDING --** Regular uniform sanding helps check girdler and green spanworm.
5. **LEAFMINERS --** There is no evidence that available registered insecticides control these insects.
6. **FOR COMPLETE GUIDELINES --** Refer to materials available at the Cranberry Station. Management guidelines provided here serve only as reminders. Review the Insect Management BMP in the UMass Best Management Practices Guide.

**7. BEES!! MOST INSECTICIDES ARE HIGHLY TOXIC TO BEES, ESPECIALLY DIRECT APPLICATIONS AND RESIDUES. DO NOT APPLY OR ALLOW TO DRIFT TO CRANBERRIES IN BLOOM OR NEARBY BLOOMING PLANTS/WEEDS IF BEES ARE FORAGING. REMOVE HONEY BEE HIVES OR ADVISE BEEKEEPER IF SPRAYS ARE APPLIED. REMEMBER THAT WILD BEES, SUCH AS BUMBLE BEES, ARE ALSO VULNERABLE TO SPRAYS APPLIED AT BLOOM AND THAT POPULATIONS WILL DWINDLE OVER TIME IF THEY ARE NOT PROTECTED.**

<b>INSECTICIDE TOXICITY TO HONEYBEES</b>		
Admire	imidacloprid	<b>super toxic</b>
Actara	thiamethoxam	
Belay	clothianidin	
Nexter	pyridaben	
Delegate	spinetoram	
SpinTor/Entrust	spinosad	
Lorsban	chlorpyrifos	<b>highly toxic</b>
Avaunt	indoxacarb	
Diazinon	diazinon	
Imidan	phosmet	
Orthene	acephate	
Sevin	carbaryl	
Assail	acetamiprid	<b>"practically non-toxic"</b>
Intrepid	methoxyfenozide	
Confirm	tebufenozide	

## 20 Insects

### ORGANIC OPTIONS FOR INSECT MANAGEMENT

Organic production may not be a profitable option unless there is low-moderate insect pressure and a good water supply. Cranberry fruitworm, black-headed fireworm and cranberry weevil pose the greatest threats to viability.

Growers who wish to be certified by an organic certification organization need to go through *Bay State Organic Certifiers* ([www.baystateorganic.org](http://www.baystateorganic.org)). Every certifier must work under standardized USDA rules and all inputs must be listed with OMRI (Organic Materials Review Institute, [www.omri.org](http://www.omri.org)). This list can be found on the web [www.omri.org](http://www.omri.org) and a hard copy is supplied with certification. Some products are listed as A (allowed) others as R (restricted). The restricted products have certain conditions attached to them that have to do with the generic materials in the product (amounts or frequency of application, etc.). OMRI also has a Generic Materials List. Three years of no synthetic chemical applications are necessary before a crop can be certified organic.

Use of cultural practices (sanding and water floods) is the most effective strategy in organic management.

Late Water -- Holding late water is an excellent choice to greatly reduce cranberry fruitworm pressure; however, moths may move into late water-treated beds from other areas of infestation. False armyworm, blossomworm, gypsy moth, and southern red mite may be managed with late water. See Late Water Section.

Fall Flood -- May be used to reduce cranberry girdler populations. Flood for 10-14 days as soon as possible after harvest. May also impact vines to some degree. Warmer water temperatures enhance effectiveness.

Sanding -- If you can sand, populations of most insects should be less abundant.

Winter Flood -- If you can maintain a good winter flood, populations of most insects should be less abundant.

These are options cleared for organic management on cranberry, but efficacy is not quantitatively assessed.

#### Azadirachtin products

Aza-Direct	1-3.5 pt	Target small caterpillars with this biological insecticide – it serves as a repellent, antifeedant, and interferes with the molting process. Restricted.
Neemix 4.5	4-16 fl oz	

#### Bacillus thuringiensis (B.t.) products

Dipel DF ( <i>kurstaki</i> strain)	0.5-1 lb	These compounds are most effective when applied multiple times in low gallonage against small caterpillars feeding on foliage. Treating early infestations is critical. Well-timed chemigation systems are critical for good efficacy (6 minutes or less rinse time). Beware, not all B.t.'s are certified organically or have cranberry on the label.
Biobit HP ( <i>kurstaki</i> strain)	0.5-1 lb	
Xentari ( <i>aizawai</i> strain)	0.5-1.5 lb	

M-pede Insecticidal Soap 1-2% solution No chemigation allowed.

#### Neem Oil Products

Trilogy	Useful as a dormant application for suppression of southern red mite egg hatch. Do not chemigate. Use 1% rate for ground application or 1 qt/A for aerial application in 10 gallons of water. Be aware that it accelerates plant growth stage and adjust frost protection accordingly. Also suppresses eggs and motile mites post bloom.
---------	--

Nematodes Availability limited. Expensive but available organic option for grub and girdler management.

Pyganic EC 1.4	16-64 fl oz	Restricted. Spot treating using low gallonage may be helpful for patchy infestations. Note: other Pyrethins with added piperonyl butoxide are not allowed.
Pyganic EC 5.0	4.5-18 fl oz	

Entrust 80W 1.25-3 oz This compound is an effective, fast-acting, but short-lived spinosyn insecticide. Do not exceed 9 oz/season. More effective than Bt once caterpillars have reached a larger size. When chemigating, a short rinse time (6 minutes or less) is necessary for good efficacy. Only use lowered rates if chemigation system is 4 minutes or under. Spinosyn compounds are highly toxic to bees, but thoroughly dried residues are safe. Thus sprays must go on at night and dry by morning. Apply when drying conditions are optimal overnight.

Some fungicides are certified organical for disease management in cranberry. They include many of the coppers, OxiDate (128 fl oz/100 gallons of water; apply 25-100 gal/solution/treated acre), and Serenade ASO or MAX, a biofungicide labeled for mummy berry, botrytis, and bacterial canker at 2-6 qts/A.