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1-1-2007

Insect Management

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Averill, Anne L. and Sylvia, Martha M., "Insect Management" (2007). *Cranberry Chart Book - Management Guide.* Paper 71.
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INSECT MANAGEMENT 2007

Prepared by Anne L. Averill and Martha M. Sylvia

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

MANAGEMENT GUIDELINES

Reducing inputs to cut costs of production. Within a cost-cutting framework, 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. If late water was not held, it is **not** advisable to skip the initial spray (the first spray in IPM-based programs) for **cranberry fruitworm** that occurs 7-9 days (Howes/Blacks) or 3-7 days (Ben Lears/Stevens) after 50% out of bloom. This targets the largest portion of the population. When poorly managed, cranberry fruitworm pressure builds over time and is harder to manage. Sweep-netting of all acreage at 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 infestation of weevil or fireworm establishes, management inputs must be intensified in subsequent years. Finally, walking the bog early and late in the season to inspect for 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 pest 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. Continue sweeping at least until the start of bloom. Be aware that some serious pests are active during and after bloom, especially black-headed fireworm, brown spanworm and cranberry weevil, and that you should continue to closely monitor your bog. 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 average number of each insect in your series of sweep sets exceeds these values, and after other external concerns have been brought to bear including cost of application, expected returns, weather, etc.

	AVERAGE #
ADD UP: blossomworm, false armyworm, other cutworms, and gypsy moth	**4.5**
brown spanworm, green spanworm	**18**

	AVERAGE #
black-headed fireworm	**1-2**
Sparganothis fruitworm	**1-2**
cranberry weevil	**4.5**

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. Caution should be taken before ignoring high numbers of cranberry weevil, black-headed fireworm, and Sparganothis fruitworm in the spring since established infestations are harder to manage in the summer and the following year.

8 Insects

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 weeks. Check descriptions of adult moths 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 conventional insecticide, apply insecticide 10 days after **peak** moth flight, usually during bloom. Timing for Intrepid or Confirm is 2 weeks after **onset** of moth flight and again 10 days later.

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

For girdler; treatments are usually in July. Refer to the section on cranberry girdler for timing of specific treatments. Be aware that a bad infestation can exist even with low trap catches.

Intrepid and Confirm (Insect growth regulator products). Growth regulators are caterpillar specific and conserve beneficial insects. 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. Well timed chemigation systems are critical for good efficacy (6 minutes or less rinse time); chemigation washout will remove active material. Thorough coverage is essential. A spray adjuvant should be used. 6 hours drying time following application is required. New growth is not protected. Death may not be observed until a week or more has passed. Pollinator safe! Check labels for directions and **consult Cranberry Station for specific guidance and efficacy information**.

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. Spot applications of low gallonages with backpack sprayers are a good option. Addition of a spreader/sticker (e.g. Bond, Stik) may be critical, check label.

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

Guthion and all Azinphos-methyl formulations have been cancelled for use on cranberries.
Do not use Guthion or any Azinphos-methyl formulations on your bog.

BEES!! 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 BEES OR ADVISE BEEKEEPER IF SPRAYS ARE APPLIED.

EARLY SEASON CATERPILLARS

BLACK-HEADED FIREWORM

Intrepid 2F	10–16 oz	Intrepid is more active and has greater residual than Confirm.
Confirm 2F	16 oz	Confirm must be used (not Intrepid) if bogs are in Zone II areas.

Insect growth regulator products. Use Intrepid if allowed but note Intrepid is restricted use and Zone II restricted. 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); chemigation washout will remove active material. Thorough coverage is essential. A spray adjuvant should be used. 6 hours drying time following application is required. New growth is not protected. Death may not be observed until a week or more has passed. Pollinator safe!

Diazinon 50 W, 50 WSB	4 lb	It is advisable to hold water for at least 3 days. Limit 6 apps/season at rates listed at left, limit 4 applications/season if higher labeled rates for cutworms and fruitworm used. 7 day PHI, 14 day spray interval. Note REI is 24 hrs except for AG600 which is 5 day REI.
Diazinon AG 500	2 qt	
Diazinon AG 600	51 oz	
Diazinon 5W	51 oz	
Imidan 70W	1.33–4 lb	Efficacy may be reduced at pH's found in bog water (6-7 pH). REI 3 days, 10 day spray interval, 14 day PHI. Beware bee toxicity.
Lorsban 4E, Nufos 4E & Chlorpyrifos 4E AG	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.
Lorsban 75WG	2 lb	Observe 60 day PHI. Impound water for 5 days, then release gradually.
Orthene 97, Acephate 97UP	1 lb	1 application/season. Observe 90 day PHI.
Orthene 75S & 75 WSP	1 1/3 lb	High bee toxicity, do not apply after 10 days prior to bloom.
Sevin XLR Plus	1.5-2 qt	Sevin XLR Plus is formulated to have minimal bee toxicity once the spray dries. Avoid applying Sevin within 10 days of start of bloom.
Sevin 4F & Carbaryl 4L	1.5-2 qt	
Sevin 80S, 80 WSP	1.88–2.5 lb	Limit 5 applications/season, 7 day spray interval, 7 day PHI.

SpinTor 2SC (Spinosad)6-10 ozDo not exceed 29 oz/season. 7 days between applications.

Spintor is an effective, fast-acting, but quite short-lived reduced risk insecticide. This is the better tool to use (compared to Intrepid or Confirm) once the caterpillars have already 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. Keep in mind that SpinTor is moderately toxic to aquatic invertebrates and bees.

Watch out: Fireworm can be a very serious problem! *Best approach is to start 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 the very small larvae on the rim of the sweep net. It is very hard to see the small larvae and they are less likely to be picked up in the sweep net than larger larvae. Further, the infestation most often is patchy, and larvae are often more numerous along edges, where vines are overgrown, where leaf trash has accumulated, or where winter flooding was truncated. 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 conventional insecticide, apply insecticide 10 days after **peak** moth flight, usually during bloom. Timing for Intrepid or Confirm is 2 weeks after **onset** of moth flight and again 10 days later.

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

YELLOW-HEADED FIREWORM

Lorsban, Orthene, Sevin, and Spintor 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 has been reported several times recently, typically on beds that are not completely flooded in the winter. Eggs hatch in May and 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, which Sparganothis pupae do not have.

SPARGANOTHIS FRUITWORM

Intrepid 2F	10–16 oz	Intrepid is more active and has greater residual than Confirm.
Confirm 2F	16 oz	Confirm must be used (not Intrepid) if bogs are in Zone II areas.

Insect growth regulator products. Use Intrepid if allowed but note Intrepid is restricted use and Zone II restricted. 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 minute or less rinse time); chemigation washout will remove active material. Thorough coverage is essential. A spray adjuvant should be used. 6 hours drying time following application is required. New growth is not protected. Death may not be observed until a week or more has passed. Pollinator safe!

Lorsban 4E, Nufos 4E & Chlorpyrifos 4E AG	1.5-3 pt	Poor choice for most bogs, nearly all populations are resistant. Limit 2 apps/season. Do not mix with other insecticides.
Lorsban 75WG	2 lb	Observe 60 day PHI. Impound water for 5 days, release slowly.
Orthene 97, Acephate 97UP	1 lb	Poor choice for most bogs, nearly all populations are resistant.
Orthene 75S &75 WSP	1 1/3 lb	High bee toxicity, do not apply after 10 days prior to bloom.
SpinTor 2SC (Spinosad)	6-10 oz	Do not exceed 29 oz/season. 7 days between applications.

Spintor is an effective, fast-acting, but quite short-lived reduced risk insecticide. It is an important tool for quickly knocking down outbreak populations of resistant Sparganothis. This is the better tool to use (compared to Intrepid or Confirm) once the caterpillars have already 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. Keep in mind that SpinTor is moderately toxic to aquatic invertebrates and bees.

Small *Sparganothis* caterpillars can be picked up in the sweep-net in mid May. Check for caterpillars in loosestrife weeds that have rolled leaves; this will give you an idea of the larva's appearance so you can ID them in sweep net. The 2nd 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 2nd 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. When treating with conventional insecticide, spray 10-14 days after **peak** moth captures, ca. mid-to-late July. When treating with Confirm or Intrepid, apply earlier in the moth flight; treat 3 weeks after the moth flight **begins**, ca. early July, and make at least one more application 10-14 day later.

Nearly all populations are resistant to Lorsban and Orthene. Intrepid, Confirm, and SpinTor are alternatives and good choices. Late water has <u>not</u> been shown to be effective against this insect, but it does synchronize moth emergence.

CUTWORMS (BLOSSOMWORM, FALSE ARMYWORM) and HUMPED GREEN FRUITWORM

Bacillus thuringiensis (*B.t.*) products -- These compounds are most effective when applied multiple times and 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); chemigation washout will remove active material. Thorough coverage is essential and repeat applications may be necessary. New growth is not protected. Pollinator safe!

Dipel ES	1-4 pt
Biobit	½-2 lb
Xentari	½-2 lb

Insect growth regulator products -- 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); chemigation washout will remove active material. Thorough coverage is essential. A spray adjuvant should be used. 6 hours drying time following application is required. New growth is not protected. Death may not be observed until a week or more has passed. Pollinator safe!

Intrepid 2F	10–16 oz	Intrepid is more active and has greater residual than Confirm.
Confirm 2F	16 oz	Confirm must be used (not Intrepid) if bogs are in Zone II areas.
Diazinon 50 W	4-6 lb	FIFRA 2EE recommendation. Hold water for at least 3 days.
Diazinon AG 500	2-3 qt	Limit 4 applications/season at higher rates; 6 applications/season
Diazinon AG 600	51-76.5 oz	allowed at lower rates. 7 day PHI; 14 day spray interval.
Late Water		False armyworm and blossomworm may be managed with late water. See Late Water Section.
Lorsban 4E, Nufos 4E & Chlorpyrifos 4E AG	1.5-3 pt	Rates as low as 1.5 pts (aerial) or 2 pts (chemigation) have been reported to give satisfactory control. 2 applications/season. Impound water for
Lorsban 75WG	2 lb	5 days, then release gradually. Do not mix with other insecticides.
Orthene 97, Acephate 97UP	1 lb	1 application/season. Observe 90 day PHI.
Orthene 75S & 75 WSP	1 1/3 lb	High bee toxicity, do not apply after 10 days prior to bloom.
Sevin XLR Plus	2 qt	Avoid applying Sevin within 10 days of start of bloom. Sevin XLR Plus
Sevin 4F & Carbaryl 4L	2 qt	is formulated to have minimal bee toxicity once the spray dries. Limit of
Sevin 80 WSP & 80S	2 1/2 lb	5 applications/season, 7 day spray interval, 7 day pre-harvest interval.
SpinTor 2SC (Spinosad)	6-10 oz	Do not exceed 29 oz./season 7 days between applications.

Spintor is an effective, fast-acting, but quite short-lived reduced risk insecticide. This is the better tool to use (compared to Intrepid or Confirm) once the caterpillars have already 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. Keep in mind that it is moderately toxic to aquatic invertebrates and bees.

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 spanworm 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.

SPANWORMS (GREEN SPANWORM, BROWN SPANWORM, BIG CRANBERRY SPANWORM)

Bacillus thuringiensis (*B.t.*) products -- These compounds are most effective when applied multiple times and 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); chemigation washout will remove active material. Thorough coverage is essential and repeat applications may be necessary. New growth is not protected. Pollinator safe!

Dipel ES	1-4 pt
Biobit	½-2 lb
Xentari	½-2 lb

Imidan 70W	1.33–4 lb	Efficacy may be reduced at pH's found in bog water (6-7 pH). REI of 3 days, 10 day spray interval, 14 day PHI. Beware bee toxicity.

Insect growth regulator products -- 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); chemigation washout will remove active material. Thorough coverage is essential. A spray adjuvant should be used. 6 hours drying time following application is required. New growth is not protected. Death may not be observed until a week or more has passed. Pollinator safe!

Intrepid 2F	10–16 oz	Intrepid is more active and has greater residual than Confirm.
Confirm 2F	16 oz	Confirm must be used (not Intrepid) if bogs are in Zone II areas.

Lorsban 4E, Nufos 4E & Chlorpyrifos 4E AG	1.5-3 pt	Limit 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, release slowly.
Lorsban 75 WG	2 lb	Beware Bee Toxicity – do not apply when bees are present.

Orthene 97, Acephate 97UP	1 lb	Limit 1 application/season. Observe 90 day PHI.
Orthene 75S & 75 WSP	1 1/3 lb	Do not apply from 10 days prior to bloom until all berries set.

Pyronyl Crop Spray	12 oz	Spot treating using low gallonage may be helpful for patchy infestations.
Pyganic EC 1.4	16-64 oz	
Pyganic EC 5.0	4.5-18 oz	

SpinTor 2SC (Spinosad)	6-10 oz	Do not exceed 29 oz/season. 7 days between applications.

Spintor is an effective, fast-acting, but quite short-lived reduced risk insecticide. This is the better tool to use (compared to Intrepid or Confirm) once the caterpillars have already 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. Keep in mind that it is moderately toxic to aquatic invertebrates and bees.

For green and brown spanworm, the action threshold is an average of 18 larvae in 25 sweeps. Threshold of 18 may be lowered if these spanworms are large. ***Be aware of brown spanworm infestations during bloom*** that may be quite clumped in bog areas. Newly hatched brown spanworms cling like thin threads to the inside of the sweep 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. Night sweeps are required to gauge infestation.

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.

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

GYPSY MOTH

Bacillus thuringiensis (*B.t.*) products		See discussion under cutworm or spanworm (page 11 and 12).
Insect growth regulator products		See discussion under cutworm or spanworm (page 11 and 12).
Intrepid 2F	10–16 oz	
Confirm 2F	16 oz	
Late Water		Holding late water kills eggs laid on the bog as well as prevents establishment of many tiny caterpillars that drift in from infested uplands. See Late Water section.
Orthene 97, Acephate 97UP	1 lb	1 application/season. Observe 90 day PHI.
Orthene 75S & 75 WSP	1 1/3 lb	High bee toxicity, do not apply after 10 days prior to bloom.
Sevin XLR Plus	1.5-2 qt	High Bee Toxicity. Do not apply when bees are present. Sevin XLR Plus is formulated to have minimal bee toxicity once the spray dries. Limit of 5 applications/season, 7 day spray interval, 7 day pre-harvest interval.
Sevin 4F & Carbaryl 4L	1.5-2 qt	
Sevin 80 WSP	1.88–2.5 lb	
& Sevin 80S	1.88–2.5 lb	

Insecticides (Diazinon, Lorsban, SpinTor) applied for cutworms or spanworms may provide control for gypsy moth.

The action threshold for gypsy moths is an average of 4.5 larvae/25 sweeps. Check for patchy infestations that can be spot treated, i.e., along bog 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.

CRANBERRY WEEVIL

Actara	2-4 oz	Works well against both spring and summer weevil populations. Lower app rates work. No aerial apps allowed. 8 oz max limit/season. 7 days between applications. 30 day PHI. Restricted Use and Zone II restricted. High Bee Toxicity – do not apply once bees have arrived!
Lorsban 4E, Nufos 4E & Chlorpyrifos 4E AG	1.5 -3 pt	Poor choice for most bogs, many populations are resistant. Limit 2 apps/season. Do not mix with other insecticides.
Lorsban 75 WG	2 lb	Observe 60 day PHI. Impound water for 5 days, then release slowly.

Action threshold is an average of 4.5 weevils in 25 sweeps. 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. Late water is not effective against weevil.

AVAUNT is NOT labeled yet for use in cranberry for 2007.
DO NOT USE AVAUNT on your bogs until label has been approved.
Check with Cranberry Station for label progress.

CRANBERRY FRUITWORM

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

Diazinon 50 W Diazinon AG 500 Diazinon AG 600, 5W	4-6 lb 2-3 qt 51-76.5 oz	It is advisable to hold water for at least 3 days. Limit 4 apps/season at higher rates, 6 applications/season at lower rates. Observe 7 day PHI, allow 14 days between applications.
Imidan 70W	1.33–4 lb	Efficacy results have been very variable. If chosen, use higher rate. Efficacy may be reduced at pH's found in bog water (6-7 pH). REI of 3 days, 10 day spray interval, 14 day PHI. Beware bee toxicity
Intrepid 2F	10–16 oz	FIFRA 2EE recommendation. Zone II restricted. Ground applications only are effective. This compound is not recommended for 1st and 2nd fruitworm sprays: chemigation application will only give low levels of control. Pollinator safe!
Late Water		Holding late water is 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 & Chlorpyrifos 4E Lorsban 75WG	1.5-3 pt 2 lb	Rates as low as 1.5 pts (aerial) or 2 pts (chemigation) can give control. Limit 2 apps/season. Do not mix with other insecticides. Observe 60 day PHI. Impound water for 5 days, then release gradually.
Sevin XLR Plus Sevin 4F & Carbaryl 4L Sevin 80 WSP Sevin 80S	1.5-2 qt 1.5-2 qt 1.88–2.5 lb 1.88–2.5 lb	Avoid applying Sevin within 10 days of start of bloom. Sevin XLR Plus is formulated to have minimal bee toxicity once the spray dries. Limit of 5 applications/season, 7 day spray interval, 7 day pre-harvest interval.

CRANBERRY FRUITWORM MANAGEMENT

FOR ALL PRACTICES

1. Every pump system should be scouted separately as 1 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, it may be cost effective to apply Intrepid 2F in lowest water gallonage 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 unusual 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 *(1/2 of blossoms have lost petals or become fruits)*
To 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. 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 Early Blacks, 5-7 days for Ben Lears and 3-5 days for Stevens. Timing of this spray is critical.

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

ADDITIONAL TREATMENTS - MONITOR EGGS TO TRIGGER SPRAYS
A 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 spray. If egg numbers trigger spray, spray ASAP. If no egg is found, repeat berry inspection process every 3-4 days until Aug. 15.

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 Early Blacks, 5-7 days for Ben Lears and 3-5 days for Stevens. ***Timing of this spray is very critical***.

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 spray. 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 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

SOIL INSECTS

BLACK VINE WEEVIL AND STRAWBERRY ROOT WEEVIL

Nematodes	Availability limited. 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 immediately 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 temperatures enhance 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. Adults 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 Admire 2F Alias 2F	7-14 oz 16-32 oz 16-32 oz	Target oriental beetle immatures in soil with a soil drench treatment. In turf and blueberry, oriental beetle grubs are suppressed; we have limited, but moderately good efficacy data in MA cranberry. Limit 2 apps/season but 1 app at higher rate is recommended. No aerial application. 30 day PHI. Newly-hatched grubs are most vulnerable and best results are achieved when the compound is present just prior to egg hatch—this can be determined by monitoring beetle flight with pheromone traps starting in late June-early July. *The application should be made 3 weeks after* ***peak*** *flight of the beetles (or slightly earlier).* Irrigate before and after application, but do not apply to saturated soil. Admire has a long residual in the soil. Kills bees: Apply when bees are not at risk.
Summer flood		Drain bog thoroughly from early April to May 12. Reflow May 12 and keep well flooded until July 20. This will eliminate cranberry root grub and cranberry white grub larvae, as well as the crop for that year. Oriental beetle and *Hoplia* are probably also impacted by the summer flood. Check for true cutworm infestations after flood removal.

Cranberry root grub - grubs turn into beetle adults that are low-flying bumblebee mimics; they emerge from the soil during cranberry bloom and set. Males fly after dawn through mid-morning.

Cranberry white grub - grubs turn into large-bodied "June bugs" as adult beetles and are active in the evening in May and June.

Oriental beetle - 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.

Hoplia equina - 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.

CRANBERRY GIRDLER

Diazinon 14G	21 lb	MDAR and EPA approved a Special Local Needs Permit for 2007 and 2008 in MA. Availability limited, order product ahead from dealer. Limit 1 application/season. Target immatures in soil. Do NOT apply aerially. Apply 2 weeks after **end** of moth flight, mid-July. Water in thoroughly to increase efficacy and reduce bird hazard. Avoid puddling. Do not apply to bare ground or ditch water. Hold water 7 days. Spot treat isolated infestations.
Nematodes		Availability limited. Apply Nematodes 2 weeks after **end** of moth flight. Target immatures in soil.
Fall Flood		Flood for a week as soon as Early Blacks are harvested starting not 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 vines 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 Admire 2F Alias 2F	7-14 oz 16-32 oz 16-32 oz	Soil drench targets immatures in soil. When adult beetles are picked up in net, application should be made to hit larvae as eggs hatch. Admire has a very long residual. No aerial application. Limit 2 applications/season, but 1 app at higher rate is recommended. Irrigate before and after application. Kills bees: applications should be made when bees are not at risk.
Diazinon 50 W Diazinon AG 500 Diazinon AG 600, 5 WP	4-6 lb 2-3 qt 51-76.5 oz	FIFRA 2EE recommendation targets adults. It is advisable to hold water for at least 3 days. 4 apps/season at higher rates, 6 apps/season allowed at lower rates. 7 day PHI and 14 day interval between applications.
Sevin XLR Plus Sevin 4F & Carbaryl 4L Sevin 80 WSP & 80S	1-2 qt 1-2 qt 1.25–2.5 lb	FIFRA 2EE recommendation targets adults. Do not spray within 10 days of bloom. Limit 5 apps/season, 7 day spray interval, 7 day PHI. Sevin XLR Plus is formulated to have minimal bee toxicity once spray dries.

Diazinon and carbaryl (Sevin) sprays should target adults when they are active at bloom and are being picked up while sweep netting. They are ca. 1/6” long; oblong-oval. Head area metallic greenish-black and wings blackish, striped with yellow. Legs and antennae yellow. Diazinon and carbaryl efficacy levels may vary greatly.

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

MISCELLANEOUS PESTS

CRANBERRY FLEA BEETLE

Actara	2-4 oz	8 oz max limit/season. Zone II restricted, no aerial apps. Beware bee tox.
Sevin XLR Plus Sevin 4F & Carbaryl 4L Sevin 80 WSP & 80S	1.5-2 qt 1.5-2 qt 1.88–2.5 lb	Avoid applying Sevin within 10 days of start of bloom. Sevin XLR Plus is formulated to have minimal bee toxicity once the spray dries. Limit of 5 applications/season, 7 day spray interval, 7 day pre-harvest interval.
Diazinon 50 W, 50 WSB Diazinon AG 500 Diazinon AG 600, 5W	4-6 lb 2-3 qt 51-76.5 oz	FIFRA 2EE recommendation. Hold water for at least 3 days. Limit 4 applications/season at higher rates, 6 applications/season allowed at lower rates. Observe 7 day pre-harvest interval.

Adult flea beetles are active in late July through September. Beetles and their feeding damage 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

Nexter	4.4-7.0 oz	Low-end rates provide control in most chemigation systems. Limit 2 applications/season. Apply by ground and chemigation only – no aerial application. Required water holding for 3 days after application. No flow through bogs. 5 hours of drying time required. This is the same active ingredient as Pyramite.
Late Water		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.

CRANBERRY TIPWORM

Spray trials in MA have shown that available insecticides do not control tipworm, probably because this insect has developed resistance. Early-season tipworm damage often is high, but good vine health enhances rebudding. Appearance of damage does not mean that insects are still present. Only very late-season damage, which is rare, appears to consistently impact yield. Stressful vine conditions in the year of damage may also result in yield reduction. Diazinon is labeled for tipworm, but control is very poor. Sprays are not encouraged for this insect.

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 (page 46). Late water research shows that the flood severely reduces mites, cranberry fruitworm, false armyworm, and gypsy moth.

REFLOODING –

a) About May 18th for 10 hours controls false armyworm and blossomworm.
b) About June 1-12th 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 12th and holding up to July 15-20th kills all insects, but with the loss of crop.
d) Sept. 20-30th. 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 impact vines.

3. **SANDING** -- Regular uniform sanding helps check girdler and green spanworm and may temporarily suppress early season tipworm populations.

4. **LEAFMINERS** -- There is no evidence that available registered insecticides control these insects.

5. **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.

6. BEES!! 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 BEES OR ADVISE BEEKEEPER IF SPRAYS ARE APPLIED.

CAUTIONS

Insecticides Product	Maximum actual toxicant/A	Pre-harvest interval (PHI)	Restricted entry interval (REI)	Maximum number of applications
Actara (Thiamethoxam)**	0.125 lb	30 day	12 hrs	(8 oz.)***
Admire, Alias (Imidacloprid)	0.5 lb	30 day	12 hrs	2
B.t. based products	NA	No PHI	4 hrs	-
Confirm (Tebufenozide)	1 lb	30 days	4 hrs	4
Diazinon *	12 lb	7 days	24 hrs/5 days	4 or 6
Diazinon granular *	0.5 lb/1,000sq ft	7 days	12 hrs	1
Imidan (Phosmet)	15.6 lbs	14 days	24 hrs/3 days	-
Intrepid (Methoxyfenozide)**	1 lb	14 days	4 hrs	4
Lorsban (Chlorpyrifos)*	1.5 lbs	60 days	24 hrs	2
Nematodes	NA	No PHI	0 hrs	-
Nexter	1 lb	21 days	12 hrs	2
Orthene, Acephate	1 lb	90 days	24 hrs	1
Pyrenone or Pyronyl	60% PBO + 6% Pyrethrins	No PHI	12 hrs	-
Sevin (Carbaryl)	4 lb	7 days	12 hrs	5
SpinTor (Spinosad)	0.55 lb	3 days	4 hrs	6

* = restricted use pesticide, requires a pesticide license to buy and apply.
** = Zone II restricted and restricted use, requires a pesticide license to buy and apply.
*** = Actara has no specific application limitations except the total amount applied.

ORGANIC OPTIONS FOR INSECT MANAGEMENT

Cranberry insect management is difficult even with all the commercial synthetic compounds available. Be aware that organic production may not be a viable option unless there is low insect pressure and a good water supply available. 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)*. Every certifier must work under standardized USDA rules and all inputs must be listed with OMRI (Organic Materials Review Institute, www.omri.org). This list can be found on the web 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 puts out 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 pest control 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, and southern red mite may be managed with late water. Holding late water kills gypsy moth eggs laid on the bog as well as prevents establishment of many tiny caterpillars that drift in from infested uplands. See Late Water Section (page 46).

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 winter flood, populations of most insects should be less abundant.

These are options that are 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 oz	

Bacillus thuringiensis (*B.t.*) products

Dipel DF (*kurstaki* strain)	½-1 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 (*kurstaki* strain)	½-1 lb	
Xentari (*aizawai* strain)	½-1½lb	

M-pede Insecticidal Soap 1-2% solution no chemigation

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 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 oz	

Spinosad products — This compound is an effective, fast-acting, but quite short-lived insecticide.
Entrust 80W 1.25-3 oz — Do not exceed 9 oz/season. This is the better tool to use (compared to *Bacillus thuringiensis*) once caterpillars have already 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. Keep in mind that Entrust is moderately toxic to aquatic invertebrates and bees.

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