HIGHBUSH BLUEBERRY INSECT & DISEASE MANAGEMENT SCHEDULE

FOR NOVA SCOTIA

Nova Scotia Guide to Pest Management in Highbush Blueberry 2011

[High2-11]

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LIABILITY STATEMENT

Recommendations in this guide are given for general information only and do not give the user the right to use a product in a manner not in accordance with the pesticide label or Pest Control Products Act. AgraPoint International Inc., by funding and printing this publication, and the editors/authors, do not offer any warranty or guarantee and do not assume any liability for crop loss, animal loss, health, safety, or environmental hazard caused by the use of any pesticide, advice, or recommendation in this schedule. Pesticides used in this schedule are products labeled for the target and crop. This information was retrieved from the PMRA online database of Pest Control Products Registered in Canada. The list of products presented in this schedule is intended to be complete, based on products known to be available in the region, but in no way is guaranteed to be complete. Some of the products listed may not be available. Trade names are given as a convenience to producers and are neither an endorsement of the product nor a suggestion that similar products are not available or effective.

IMPORTANT NOTE ON FUNGINEX

The US equivalent of Funginex has been removed from the US market and all minimum residue levels have been removed for the active ingredient of Funginex, “triflorine”. In Canada, as of spring 2006, this product is still legal to use. However, fruit that has been treated with Funginex will not be suitable for export to the US as the potential for minimal residues on the fruit exist.

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HIGHBUSH BLUEBERRY INSECT & DISEASE MANAGEMENT SCHEDULE

Blueberry Site Selection & Preparation

Preparation for blueberry planting must be done several years in advance. Select a site with good air and water drainage. Take a soil sample and have it analyzed. Soils should have high soil acidity (low pH) and high organic matter content. Sandy loam soils are best with a pH of 4.5 – 5.2. Organic levels can be increased through the use of cover crops and the addition of peat moss. If the land was in sod, check for white grubs (see note under New Planting).

Nematode levels should also be checked. Sampling can be done almost anytime except in the winter when the ground is frozen. The highest populations tend to be found in June and mid September to mid October**.** Sample as you would a normal soil sample. Using a soil auger, take at least 10 -15 sub-samples from a maximum of 2.5 ha. Samples should be taken 20-25 cm deep => remove and discard the top 2 cm if the soil is bare. Mix the sub-samples well and put 0.5-1.0 L of soil in a plastic bag and refrigerate at 5-10° C. Contact AgraPoint International Inc. for assistance in finding laboratories that do nematode analysis.

New Planting

Rates of product are for mature plants. Unless the label states otherwise, use 700-1000 L of water per hectare, or use enough water to obtain good coverage of the foliage and wood.

Insect / Disease[1]	Product	Rate / ha	Note
Dormant, Spring, Summer & Fall			
Godronia canker	Physical removal / cultural		Prune out and burn infected wood. Jersey, Earliblue and Bluecrop are highly susceptible; Berkeley, Blueray, Burlington, Rubel and Coville are moderately susceptible while Rancocas is quite resistant.
Phomopsis Canker	Physical removal / cultural		Weymouth, Earliblue and Berkeley are particularly susceptible varieties. Coville and Jersey are also damaged by *Phomopsis*
May to September			
White grubs (Several species)	Cultural		Several species. Specimens should be identified to help determine appropriate action. Cultural tips: 1) Delay planting for 2 years after removing sod or pasture crop. 2) Eliminate grasses between rows and especially around bushes. 3) Monitor white grubs in grassy areas outside plantings, e.g. Lawns, parking lots. Treat these areas with approved products if grubs reach 5/900 cm^2 (5/ft^2). Grubs need to be properly identified. There are very few products that can be used in Nova Scotia. 4) There are no products approved for use within plantings. Therefore, proper site preparation and clean cultivation are the only options. 5) Monitor plants for signs of stress such as stunted growth, reduced vigor and poor root systems. If these symptoms occur, check the soil for white grubs.

[1] Proper identification of insects and plant diseases is essential for an effective IPM program.

Established Planting

Rates of product are for mature plants. Unless the label states otherwise, use 700-1000 L of water per hectare, or use enough water to obtain good coverage of the foliage and wood.

Insect / Disease	Product	Rate / ha	Note
Dormant, Spring, Summer & Fall			
Godronia & *Phomopsis* canker	Physical removal / cultural		Prune out and burn infected wood. Remove red-flagging shoots during the growing season.
Scale Insects and general Clean-up	Lime Sulfur	see notes	Apply once per season when plants are dormant (January-March). Spray to runoff and apply with ground equipment only. 50 L with 12.5 L Dormant oil spray in 1000 L of spray volume. Or 25 L with 6.25 L Dormant oil spray in 500 L of spray volume. Or 5 L with 1.25 L Dormant oil spray in 100 L of spray volume.
Green Tip			
Pytophthora Root Rot	Aliette	5.6 kg/ha	For spring applications, apply the first spray when there is 7 cm of new growth and continue on a 14-21 day interval. Use a sufficient volume of water for good coverage. Observe a PHI of 1 day. **Do not exceed 22.4 kg product/ha per year. Do not apply more than 4 times per year.** Use sufficient water volume for good coverage of blueberry bush. Apply in a spray volume of 300-1000 L/ha. Maintain a buffer zone of 8 meters between areas to be sprayed and aquatic environments. Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours.
Mummy berry (*Monilinia*)	Funginex 190 EC	1.7 L	The maximum residue limit is now zero (0) in the U.S.A. Funginex may still be used in Canada; however, treated blueberries are not suitable for shipment to the US since they may contain Funginex residues. Apply if mummy berry has been a problem previously. Apply when green tissue is showing and mature apothecial cups are present. Apply a second application 10-14 days later. Anything that reduces the number of over wintering mummies will reduce infections. Therefore, rake over wintered berries from under the bushes into the area between the rows and disc or rotovate every 4-5 days for 3 weeks beginning when buds begin to swell to destroy the developing apothecia. Open windbreaks to allow better air circulation. Bluejay, Elliott, Duke, Stanley, Darrow and Jersey are quite resistant. Burlington and Earliblue are moderately resistant. Berkeley, Weymouth, Bluecrop, Coville and Blueray are susceptible.
	Topas 250 E	500 mL	
	Mission 418 EC	300 mL	
	Allegro 500 F	2.24 L	Apply as a foliar spray in 300-1000 L/ha. Do not make more than 4 applications per year. Application interval is 7 to 10 days. Begin applications at bud break and repeat applications every 7-10 days until petal fall. 30 day PHI. **SUPPRESSION ONLY**
	Serenade MAX	3.5-6.0 kg/ha	**Serenade MAX and Serenade ASO are biopesticides that may only suppress the indicated diseases**. Begin application at bud break stage of development. Repeat as necessary on a 7-14 day interval
	Serenade ASO	24 L/ha	
Anthracnose & *Phomopsis* canker	Cabrio 20 EG	1.0 kg	Do not apply more than 2 consecutive applications of Cabrio.
	Bravo 500	7.2 L	
	Switch 62.5 WG	775 to 975 g/ha	Make the first application during early bloom. A second application may be made 7 to 10 days later. A third application can be made if conditions remain favorable for disease development.

	Pristine WG	1.3-1.6 kg/ha	Begin applications prior to disease development and continue on a 7 to 14 day schedule. Use a shorter interval and/or higher rates when disease pressure is high. The maximum number of applications per season is 4.
	Allegro 500 F	2.24 L	Apply as a foliar spray in 300-1000 L/ha. Do not make more than 4 applications per year. Application interval is 7 to 10 days. Begin applications at bud break and repeat applications every 7-10 days until petal fall. 30 day PHI. **SUPPRESSION ONLY**
	Aliette	5.6 kg/ha	Begin foliar sprays in the spring at approximately the pink bud stage and continue on a 14-21 day interval. Use a sufficient volume of water for good coverage. Observe a PHI of 1 day. **Do not exceed 22.4 kg product/ha per year. Do not apply more than 4 times per year.** Use sufficient water volume for good coverage of blueberry bush. Apply in a spray volume of 300-1000 L/ha. Maintain a buffer zone of 8 meters between areas to be sprayed and aquatic environments. Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 24 hours.
Blueberry leaftier (*Croesia curvalana*)	Decis 5 EC	150 mL	Label recommends 1200-1500 L water per hectare. Will also control spanworm (125 mL) (and other caterpillars such as winter moth and leafrollers) if applied when insects or damage first appears prior to bloom.
Pink Bud			
Anthracnose & *Phomopsis* canker	Same as for Green Tip		
Bloom - WARNING – Spraying pesticides during bloom is hazardous to bees. Spray in the evening or when bees are not working			
Botrytis blossom blight & fruit rot	Maestro 80 DF	2.25 kg	*Botrytis* blight becomes a problem during bloom when wet periods occur. Apply fungicides at 7-10 day intervals. Use shorter interval when disease pressure is high. Do not apply more than 2 consecutive applications of Elevate or Lance (they are from different chemical families) before alternating to another effective fungicide with a different mode of action. Do not apply Ferbam beyond mid bloom.
	Captan 80 WDG	2.25 kg	
	Elevate 50 WDG	1.70 kg	
	Lance 70 WDG	0.56 kg	
	Ferbam 76 WDG	3.75 kg	
	Switch 62.5 WG	775 to 975 g/ha	Make the first application during early bloom. A second application may be made 7 to 10 days later. A third application can be made if conditions remain favorable for disease development. **One of the actives in this product is persistent and may carryover. It is recommended that any products containing fludioxonil not be used in areas treated with this product during the previous season.**
	Pristine WG	1.3-1.6 kg/ha	Begin applications prior to disease development and continue on a 7 to 14 day schedule. Use a shorter interval and/or higher rates when disease pressure is high. The maximum number of applications per season is 4.
	Serenade MAX	3.0-6.0 kg/ha	**Serenade Max and Serenade ASO are biopesticides that may only suppress the indicated diseases.** Begin applications at first sign of the disease or when conditions become conducive for disease development. Repeat as necessary on a 7-10 day interval. ***May also control Bacterial blight (see product label).***
	Serenade ASO	4.0-15.0 L/ha	
Petal fall			
Anthracnose & *Phomopsis* canker	As under Green Tip		Do not apply Bravo beyond petal fall.

Cherry fruitworm (*Grapholitha packardi*) & Cranberry fruitworm (*Acrobasis vaccinii*)	Malathion 25 W	2.25 kg	Cherry fruitworm, *Grapholitha packardi*, although native to North America, is not listed by Chapman and Lienk (1971)[2] as being found in Maritime Canada. In Canada it is has only been reported from Ontario and British Columbia. However, cherry fruitworm has been included in this guide because it is possible that the range may have expanded to include the Maritimes. Therefore monitoring and proper identification of all specimens is highly recommended.
	Sevin XLR PLUS	4.00 L	
	Assail 70 WP	160 g/ha	Begin application we egg hatch begins. Apply in a minimum of 187 litres of water per ha.
	Rimon 10EC	1.35-2 L/ha	Apply in 374-1122 litres of water per hectare. Apply on a 10-14 day interval with a maximum of 3 applications per year. Do not apply within 8 days of harvest.
Early Berries Begin to Ripen			
Blueberry fruit fly (*Rhagoletis mendax*) a.k.a. Blueberry maggot fly	Assail 70 WP	136-160 g/ha	Apply within 7 days of the first blueberry fruit fly capture on a sticky trap. Use high rate when vegetation is dense, Do not make more than 4 applications per season. Do not apply more than once every 12 days. **Do not apply during bloom. 12 hour REI**
	Lagon 480 E	825 mL	DO NOT apply Lagon more than two times per season and DO NOT apply to foliage when the temperature is 25^{o}C or higher. Apply insecticides for blueberry fruit fly 5-10 days after the first adult fly is captured in a Rhagoletis yellow panel trap. A second spray may be necessary if flies continue to be captured 7-10 days after the first spray.
	Imidan 50 WP	2.25 kg	
	Sevin XLR PLUS	4.00 L	
	Malathion 25 W	2.25 kg	
	GF-120 NF Naturalyte Fruit Fly Bait	1.0-1.5 L	**OMRI listed Product**. Apply with a large spray droplet size (4-6 mm). Begin applications as soon as traps indicate flies are present. Repeat on 7 day intervals, use a shorter interval during rainy periods. Apply to one side of every row. Max 5 applications per season.
Botrytis fruit rot	Maestro 80 DF	2.25 kg	Botrytis can be a problem when fruit ripens. Apply fungicides at 7-10 day intervals. Do not apply more than 2 consecutive applications of Elevate or Lance (they are from different chemical families) before alternating to another effective fungicide with a different mode of action
	Captan 80 WDG	2.25 kg	
	Elevate 50 WDG	1.70 kg	
	Lance 70 WDG	0.56 kg	
	Pristine WG	1.3-1.6 kg/ha	Begin applications prior to disease development and continue on a 7 to 14 day schedule. Use a shorter interval and/or higher rates when disease pressure is high. The maximum number of applications per season is 4.

[2] Chapman, P.J and S.E. Lienk. 1971. Tortricid Fauna of Apple in New York (Lepidoptera: Tortricidae). New York State Agricultural Experiment Station, Geneva, NY.

Potential or Occasional Pests

Insect / Disease / Other	Note
Birds	Observation has indicated that the best way to repel birds is to drive them away very early in the morning by using special noise-making shotgun shells. Other noise-making devices are apparently less effective. Some useful tips can be gleaned from the BC Bird IPM Plan at www.agf.gov.bc.ca/cropprot/birdipmplan.pdf
Phytophthora root rot	This disease has not been found in Nova Scotia. However, Ridomil Gold is registered for control should the disease appear here. Apply 37 mL of Ridomil Gold 480EC / 100 m of row to the soil surface in a one meter wide band centered over the row. Apply in the early spring prior to growth. Apply a minimum of 200 L of water / hectare. Do not apply more than once a year.
Crown gall *Agrobacterium spp.*	Blueberries are susceptible to crown gall. This bacterium that causes the condition can attack crowns and roots causing galls to form. The organism can carry-over in soils for many years or can be introduced on infected planting stock. To reduce the risk of crown gall problems, purchase healthy plants from reputable nurseries. Also, avoid mechanical injury to the roots and over fertilization. Winter injury and feeding damage from soil inhabiting insects can also promote crown gall infections.
Viruses and mycoplasma-like organisms	Highbush blueberry is susceptible to a number of these diseases including shoe string, scorch, stunt, ring spot, shock, mosaic, etc. Buy planting stock from reputable propagators. Inspect your plants regularly in the field and remove infected plants when found. In some cases insects are vectors.
Aphids	Assail 70 WP can be used to control aphids. Apply at 56-86 g/ha. **Do not apply during bloom.** There is a 48 hour REI for pruning and a 12 hour REI for all other work. Max 4 applications per season. Fulfill 50WG can be used at 193 g/ha (500-1000 L of water/ha). Apply pre-bloom and post harvest application only. Maximum 2 applications per year. **Do not apply within 85 days of harvest.**
Other insects to watch for	Various weevils and moth larvae, leafhoppers, oystershell scale, lecanium scale and thrips. Insects on highbush blueberry have not been studied well so it is highly recommended that growers learn as much about insect identification as possible and to establish an effective monitoring program.

PESTICIDE EMERGENCY CONTACT INFORMATION

Poison Control Centres		
Nova Scotia	800.565.8161 **or** 902.428.8161	IWK, Halifax, NS
New Brunswick	911	Ask for Poison Information
Prince Edward Island	800.565.8161 **or** 902.428.8161	IWK, Halifax, NS
Newfoundland	709.722.1110	Dr. Charles A. Janeway Child Health Care Centre, St. John's, NF

Environmental Emergencies (Pesticide Spills)	
Transport Canada Regional Operations Centre (24 hours)	
Nova Scotia	800.565.1633
New Brunswick	800.565.1633
Prince Edward Island	800.565.1633
Newfoundland	800.563.9089

ABBREVIATIONS & CONVERSIONS

Formulation and Measurement Abbreviations			
FORMULATIONS		MEASUREMENTS	
DF	Dry flowable	mL	millilitre
EC, E	Oil-based emulsifiable concentrate	kPa	kilopascal
EW	Water-based concentrate	kg	kilogram
EG	Water dispersible granule	g	gram
L	Liquid	L	litre
WDG	Wettable dry granule	BIU	Billions of International Units
WP, W	Wettable powder	ppm	parts per million (1000 ppb)
SC	Suspension concentrate	ppb	parts per billion (1/1000 ppm)

Helpful Conversions[3]	
kPa X 0.14 = pounds per square inch (psi)	millilitres X 0.035 = fluid ounces
hectares X 2.47 = acres	litres X 35 = fluid ounces
kilograms X 2.2 = pounds	litres X 0.22 = imperial gallons
kilograms per hectare X 0.89 = pounds per acre	litres per hectare X 14.17 = fluid ounces per acre
kilograms per hectare X 0.40 = kilograms per acre	litres per hectare X 0.40 = litres per acre
	degree-days C X 1.8 = degree-days F

[3] **Pesticide Units of Measurement**
It is not recommended to convert label rates to imperial units because there is a high probability of mathematical and rounding errors. Present day pesticides are formulated to be more effective in smaller amounts. Therefore, even small conversion errors can lead to the use of incorrect rates (either too high or too low). Use metric – you will be glad you did!

PESTICIDE INFORMATION SUMMARY

Read product labels for re-entry intervals, precautions, and other product specific details.

COMMON NAME	TRADE NAMES	DAYS TO HARVEST*	TOXICITY*			
			TO PRED MITES	TO BEES	TO APPLICATOR	
					ORAL	DERMAL
acetamiprid	Assail	7	-	high	low	low
Bacillus subtilis	Serenade Max	0	low	low	low	low
boscalid	Lance	0	low	low	low	low
boscalid, pyraclostrobin	Pristine	0	low	low	low	low
Calcium polysulphide	Lime Sulphur	-	high	mod	mod	low
captan	Captan, Maestro	2	low	low	low	low
carbaryl	Sevin	2	mod	high	mod	mod
chlorothalonil	Bravo	54	low	low	low	low
cyprodinil, fludioxonil	Switch	1	-	-	low	low
deltamethrin	Decis	14	high	high	low	low
diazinon	DZN, Diazinon	5	high	high	mod	mod
dimethoate	Lagon	15	high	mod	mod	mod
fenhexamid	Elevate	1	low	low	low	low
ferbam	Ferbam	40	low	low	low	low
fluazinam	Allegro	30	low	low	low	low
fosetyl-al	Aliette	1	low	low	low	low
malathion	Malathion	1	low	high	low	low
novaluron	Rimon	8	low	mod	mod	mod
phosmet	Imidan	15	mod	high	mod	low
propiconazole	Topas, Mission	60	low	low	low	low
pyraclostrobin	Cabrio	29	low	low	low	low
spinosad	GF-120 NF Naturalyte Fruit Fly Bait	0	low	low	low	low
triforine	Funginex	60	low	low	low	low

***** Days to harvest intervals and toxicity ratings are provided as a guide only. Always refer to the label.

LABEL DEFINITIONS

DAYS TO HARVEST - Is the minimum number of days from the last application of the product to first harvest. This interval has been set to ensure that any residue of the pesticide left on the fruit at harvest is within an acceptable tolerance. Read the label and do not spray nearer to harvest, or later than the growth stage recommended.

TOXICITY TO BEES - Bees are important pollinators of highbush blueberries. If a pesticide must be applied during the bloom period, choose products with the least toxicity to bees. Spray in late evening or early morning when bees are not present. Spray deposit should be dry before bees begin foraging. If you

have rented bees, notify the beekeeper that you intend to spray. Give enough advance notice so that the bees can be moved. Do not allow pesticide spray to drift onto hives. The presence of large numbers of dead bees at the hive entrance may be an indicator of pesticide poisoning.

TOXICITY TO APPLICATOR - Poisoning as a result of pesticide exposure can result from inhalation, ingestion (Oral), or absorption through the skin (Dermal). It is essential that protective clothing, respirator and eye protection are worn when handling products listed as having a high or moderate toxicity. However, since pesticides may also have adverse affects after long term sublethal exposures it is recommended that protective equipment be worn when using all pesticides. Some of the wettable powder (W or WP) formulations recommended in this guide are now available in low exposure packaging (Instapak, Solupak) or low dust formulations such as dry flowable (DF) and wettable dry granule (WDG). Use of these products reduces inhalation exposure during handling.

RESISTANCE MANAGEMENT - The inappropriate use of some products leads to selection pressures within pest populations which gradually increase the number of more tolerant organisms within the population. Current disease concerns are for the development of resistance in the Botrytis blight fungus to Elevate, Senator and Lance (they are from different chemical families). To slow the development of resistance, use the products at appropriate rates and rotate with other fungicides from different chemical families or groups. Avoid application of more than two consecutive sprays of the same fungicide or a fungicide from the same chemical family. If additional protection or control is required, choose a product from a different chemical family. Refer to the labels for more detailed information on resistance management.

Insect resistance management is based on the same principles. Among the key strategies are 1) monitor insect populations, 2) use economic thresholds and treat only as a last resort, 3) rotate controls (chemical vs non-chemical options) and modes of action (different chemical families), and 4) use appropriate rates. For a very informative self-paced course on insect resistance management, have a look at the free online NCGA course on the Dow AgroSciences web site at http://209.98.16.17/index.html?org=dow .

PESTICIDE POISONING - If you suspect poisoning from exposure to a pesticide, consult the label for immediate first-aid instructions. Transport the person to your nearest hospital or call 911. Take the label information or the sealed pesticide container with you since it supplies treatment information. **The Pest Control Products Act Number (P.C.P. No.) on the label will enable the attending physician to obtain specific treatment guidelines from the Poison Control Centre.**

HOW TO REDUCE / AVOID PESTICIDE USE

By applying good management practices, growers can sometimes reduce or eliminate the need for some pesticides. Good management practices include:

- Learn to recognize blueberry pests and diseases.
- Monitoring is essential to establishing an effective IPM program.
- If new to implementing an IPM program, uncertainty and risk can be reduced or eliminated by using qualified supervision. AgraPoint can provide advice on who to contact and how to proceed.
- Learn the thresholds and trust them. Thresholds have been established based on cost/benefit analyses and years of experience. Minor threshold adjustments may be warranted in some cases but should be discussed with an IPM Specialist/Consultant before using. If economic or action thresholds do not exist for a particular pest, lobby for research that will help resolve this situation.
- Sanitation. Remove and destroy diseased stems and branches from the field. This is especially important for canker control.

- Know the product you are using. Some products are more effective under specific conditions, such as temperature, or are only effective when the target pest is at a specific stage of development. Read the label carefully.
- Choose the planting site carefully. Wet, poorly drained soils can lead to root problems.

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