

Blueberry workers overview



Wild and cultivated blueberries grow throughout the Northeast, and many of these blueberries are collected manually by migrant and seasonal workers mid-June through mid-August. The process of harvesting blueberries presents the potential for work-related injuries and



Bush pruning work:

- Moderate pruning in early spring, annually. Weather varies.
- Use of pruners- require repetitive pincer grasping.
- Physical hazards- branches in front of and above workers.
- Bending and reaching involved



Blueberry harvesting work:

- Seasons vary; but peak is generally mid-June to mid-August.
- Working piece rate: emphasis is on speed. Most use the biggest rake they can handle, increasing strain potential
- Working in stooped posture: worker's torso is bent over most of the time
- Carrying loaded buckets exceeding NIOSH recommendations

Northeastern blueberry varieties:

Lowbush (wild) (6-18"):

- Grow wild in northeastern states
- More bending/kneeling
- Work around support wires or netting
- Doesn't require ladders
- Harvested with rakes

Highbush (cultivated) (8-10' high):

- Grow from Florida to Maine
- More reaching- creates strain
- Ladders may be needed
- Harvested by hand or mechanical harvesters



Blueberry workers overview

Practices used in maintaining blueberry bush health include::



Mulching– Blueberries have a shallow root system. Plants must be mulched with a 3 to 4 inch deep layer of organic mulch.



Irrigation– Plants must be supplied with a uniform and adequate water supply from blossom time through harvest.

- **Fertilization**– Applied 3 to 4 weeks after planting in a circle 15 to 18 inches from the plant.
- **Weed management**– Weeds must be controlled around blueberry plants to ensure the best growth of the plants.



Bird Control– Netting should be used as soon as the first fruits turn blue and until the harvest is complete to protect the plants from birds.



Insect and disease management– Few insect and disease problems, but the plants must be protected to avoid berry and leaf damage.

Halsey, Melanie. Available online at: www.ces.ncsu.edu/plymouth/hort/berries/blueberry/bbpage1.html

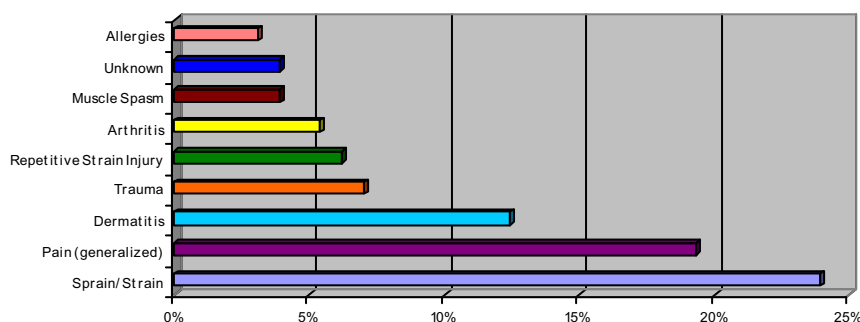
Blueberry workers Common health problems

While raking, harvesters may work in wet environments, may work around nets, and may come into contact with natural irritants and pesticides. Harvesting and pruning may contribute to musculoskeletal disorders, especially in the back, knees, wrist, arm and shoulder.

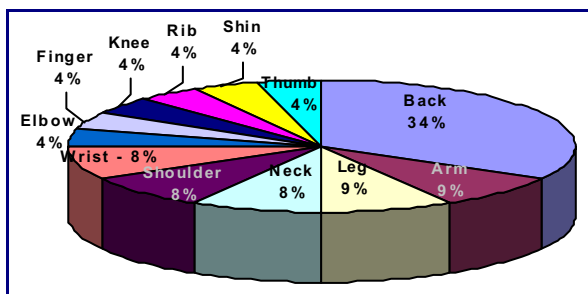
Medical conditions commonly seen in blueberry workers

Results from a 3-year NEC surveillance study taking place in ME, MA, CT, NY, NJ, PA and MD at federally supported Migrant Health Centers. Injury and Illness events were documented in patient medical charts and close to 1700 injuries and illnesses were identified in all commodities.

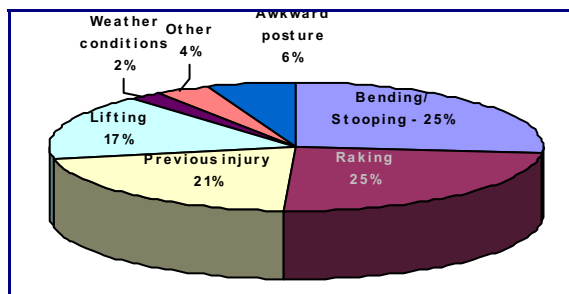
**Common Diagnoses: Blueberry Harvest workers
1999-2002***



Location of Strain/Sprain:



Strain Injury Contributing Factors

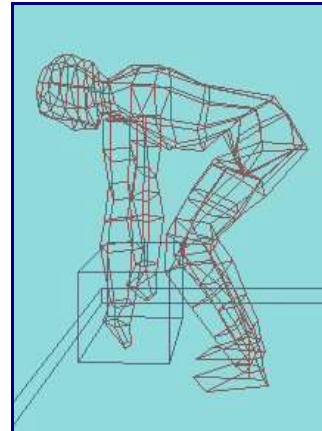


*from:

Multi-state Study of Occupational Injury and Illness Among Migrant and Seasonal Workers, 1999-2002. Available at: http://www.nycamh.com/research/res_projects/entry_detail.asp?entryid=10

Blueberry workers

Factors contributing to back, neck and knee strain



**Severe trunk
flexion 90°**

Back, neck and knee strain

- A blueberry harvest worker maintains the awkward posture shown above for the majority of the day.
- He only leaves this awkward posture when he carries the filled buckets—which can weigh 26kg on some farms, exceeding the NIOSH recommendation of 21kg—to the edge of his picking zone.
- For the majority of the day, his time is spent in severe flexion with a 90° trunk angle, shown above.
- More strain is added to the legs and knees as one or two legs are usually bent.
- Some workers who only rake with one hand will relieve discomfort by placing non-raking hand on corresponding knee.

C. Fairfield Estill, S. Tanaka. [Ergonomic Considerations of Manually Harvesting Maine Wild Blueberries](#). *Journal of Agricultural Safety and Health*. 4(1):43-57; 1998.

Blueberry workers

Factors contributing to wrist, hand, and elbow strain



- Rakes used in lowbush blueberry are made of steel or aluminum, average weight of 1.7kg
- Continuous static grip is maintained on handle
- The amount of force required to pull the rake through the berries is about 9kg.

20% of reported pain of blueberry workers occurred in the wrist/hand; 11% in the elbow*

“Rakers’ wrist”

- Rakers generally move their wrist in the radial and ulnar direction while raking blueberries.
- Shown above, the wrist is ulnarly deviated when the rake is being placed under the bushes.
- As the rake is pulled through the bush, the wrist is deviated in the radial direction.
- The range of movement of the wrist is anywhere between 15 and 45 degrees.
- Workers average 32 raking cycles per minute (once every two seconds)
- This severe and repetitive wrist deviation is one of the main contributors to wrist pain in rakers.
- In a few cases, symptoms and clinical findings are consistent with Carpal tunnel or de Quervain’s disease
- A few workers rely more on elbow and shoulder movement than wrist motion in order to alleviate pain.

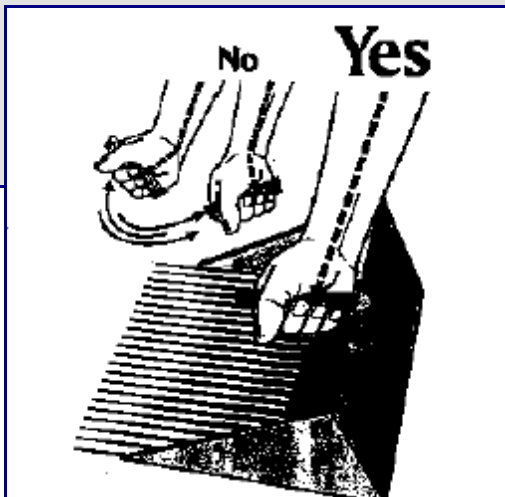
*C. Fairfield Estill, S. Tanaka. Ergonomic Considerations of Manually Harvesting Maine Wild Blueberries. Journal of Agricultural Safety and Health. 4(1):43-57; 1998.

Blueberry workers

Simple equipment interventions

Suggest to the Farmworker:

- Add diameter to the rake handle to make it the right size for the harvester (use pipe foam, electrical tape etc)
- Add a handle to each side so that it can be used with both hands. One hand is on the center handle, and the other is on one of the other two handles instead of using a “pinch grip” to guide the rake
- Switch hands often
- Don't wait too long to empty rakes
- Keep wrist straight while raking, not move side to side (see below)



Speak to farm owner about the use of roller rakes



These rakes tend to be somewhat heavier, but take the strain off the lower

back. The other disadvantage of the roller rake is that it is difficult to maneuver on uneven surfaces.

Manufactured by: Acadian Mountain Works 902-882-2349
Cost: \$300 (lasts several years)

Make a roller rake by adding a long handle and a roller on the bottom of the rake.

http://www.sfc.ucdavis.edu/Pubs/articles/tip6_newrake.pdf

Skin Irritation-Second most frequent work-related injury of blueberry harvesters

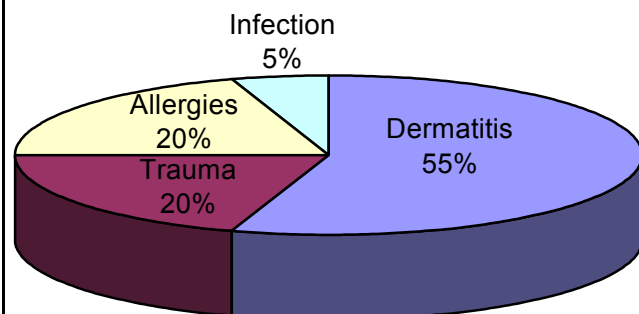
“Natural Irritants” include:

- ▶ Dust
- ▶ Sun
- ▶ Pollen
- ▶ Water
- ▶ Plants (i.e. peach fuzz, poison ivy, etc)

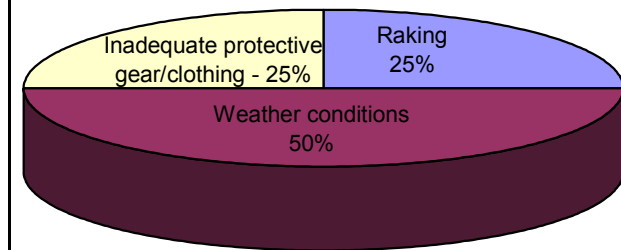
Skin Irritations include:

- ▶ Hives
- ▶ Eczema
- ▶ Dermatitis
- ▶ Burns

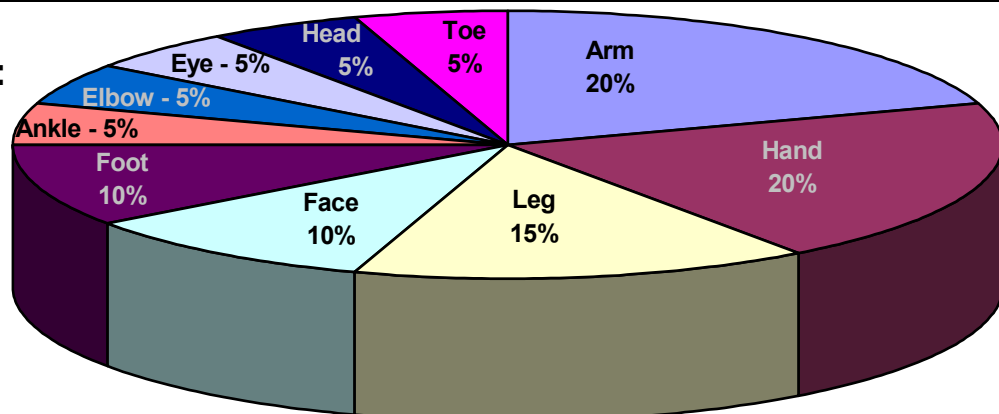
Diagnoses of Irritant Exposures:



Contributing Factors of Irritant Exposures:



Part of Body with Irritant Diagnoses:



Poison Ivy/Oak/

Sumac - Common natural irritants

- Form of allergic contact dermatitis.
- Urushiol is the chemical in the sap of poison ivy and oak plants that causes a rash, blisters, and an itch.
- Growers often spray herbicides beneath plants to keep undergrowth closely cropped. Poison ivy is immune to many of these chemicals, so competition from other plants is eliminated and poison ivy can spread freely.

Treatment:

- Immediately cleanse exposed skin with rubbing alcohol (alcohol removes the skin’s protection along with the urushiol).
- Wash skin with water.
- Take a shower with soap and warm water.
 - ▶ Do not use soap before this point because it will pick up some urushiol from the surface of the skin and spread it around.
- Any tools, clothes, shoes, or other items that came into contact with the urushiol should be wiped off with alcohol and water.

Stehlin, Isadora. Poison Ivy Treatment Guide. FDA Consumer Magazine. http://pediatrics.about.com/cs/conditions/a/poison_ivy.htm

Skin Irritation-Second most frequent work-related injury of blueberry harvesters

Exposure to Irritants-15% of injuries and illnesses

- ▶ 50% of agricultural occupational skin disease is due to plants, trees, and natural vegetation.
- ▶ Less than 20% is due to reactions to pesticides and chemicals.
- ▶ Majority of occupational skin diseases affect hands, forearms, and other open skin areas, such as the face.
- ▶ 90% of most cases of occupational dermatitis are contact dermatitis.
- ▶ Contact dermatitis is the most common occupational illness in the US.

Irritant Contact Dermatitis: Most prevalent form of contact dermatitis. Occurs when a compound comes into direct contact with the skin, often more than once.



Photographs from <http://www.dermnet.com>

Allergic Contact Dermatitis: Less prevalent. Requires a sensitized immune system. Most common plant causing this reaction is poison oak/ivy.



Irritant reactions:

- ▶ Caused by contact with acids, alkaline materials, solvents, or other chemicals.
- ▶ Working around moisture, dirt, detergents, and chemicals increases risk.
- ▶ With enough exposure to the chemical, anyone can develop a reaction.
- ▶ Characterized by erythema and unilocular bullae, resulting from epithelial necrosis.
- ▶ Reaction usually resembles a burn.

Allergic reactions:

- ▶ Immune system must be sensitized to a chemical or material prior to reacting (not everyone reacts to certain chemicals).
- ▶ Skin reaction usually takes over 24 hours to develop and can last for a few weeks.
- ▶ Acute allergic contact dermatitis is characterized by microvesicles.
- ▶ Skin inflammation varies from mild irritation and redness to open sores.

Treatment:

All exposure sources must be detected and eliminated. Total removal from exposure often helps resolve reaction rapidly.

-Severe reaction: May take months to recover.

-Uncomplicated case: Reaction may resolve in 3-7 days, but skin will remain vulnerable for at least 3 weeks.

Adams, RM. *Occupational Skin Disease, 2nd Ed.* Philadelphia: W.B Saunders Company, 1990.

Phytocontact Dermatitis: Reactions in the Skin Caused by Plants. Safety & Health Assessment & Research for Prevention Report: 63-8-2001. <http://www.lni.wa.gov/sharp/derm>

Chemical Exposure - Third most frequent work-related injury of blueberry harvesters

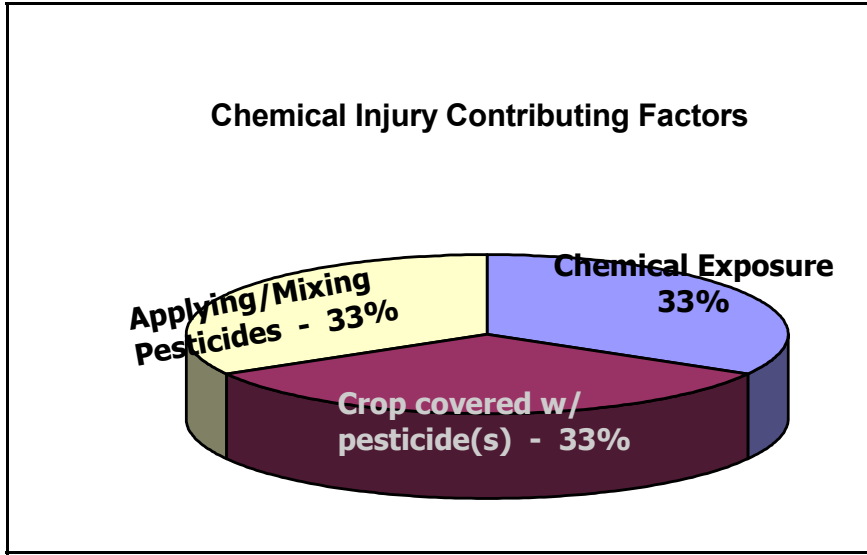
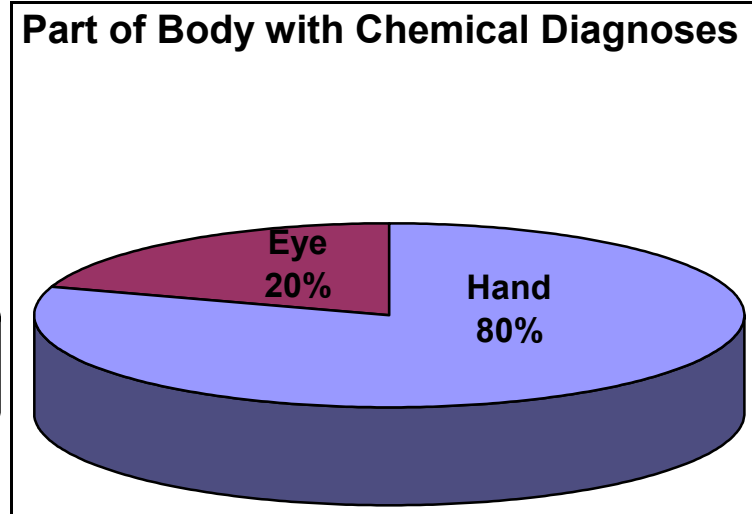
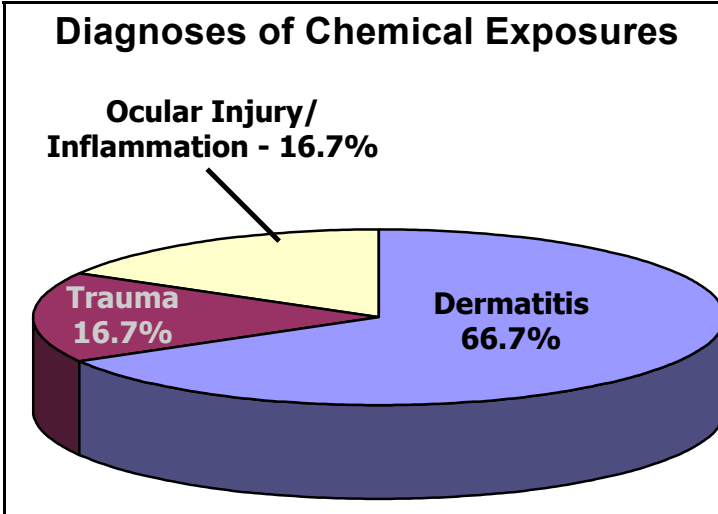
Exposure to Chemicals— 5% of injuries and illnesses of blueberry harvesters

Important on-site requirements for growers that can help you with diagnosis and treatment:

- (1) Pesticide information should be posted in the field in a central location.
- (2) A decontamination site for chemical handlers is required.
- (3) Information on chemical exposures to farmworkers and their care-givers is mandatory.

(4) Growers need to conform to REI (Restricted Entry Interval) recommendations:

- Generally: REI is 12 hours
- Pesticides with a Caution label: REI is 24 hours
- Pesticides with a Danger label: REI is 48 hours



From the 2001/2002 NYCAMH/NEC study. Sample size for blueberry workers is 10.

Pesticide Exposure - General Information

Becoming familiar with these pesticide properties may help you with diagnosis & treatment:

- (1) Organic carbon adsorption coefficient, K_{oc} : describes the relative affinity or attraction of the pesticide to soil materials (its mobility in soil).
- (2) Biological degradation half-life, $T_{1/2}$: measure of persistence of the pesticide in soil.
- (3) Maximum contaminant level (MCL), or the lifetime health advisory level (HAL) : Measure of health risk to humans of pesticide contaminated drinking water.
- (4) Aquatic toxicity, LC_{50} : Measure of the ability of the pesticide to cause 50% mortality in aquatic test species.

PESTICIDE INFORMATION SUMMARY

COMMON NAME	TRADE NAMES	DAYS TO HARVEST	REENTRY INTERVAL	TO BEES	TOXICITY	
					TO APPLICATOR	
					ORAL	DERMAL
azinphos-methyl	APM, Sniper, Guthion	14		high	high	moderate
<i>Bacillus thuringiensis</i>	Foray	0		low	low	low
boscalid	Lance	0	4 hours	low	low	low
captan	Captan, Maestro	2	48-72 hours	low	low	low
deltamethrin	Decis	14		high	low	low
dimethoate	Cygon, System, Lagon	15		high	moderate	moderate
fenhexamid	Elevate	1		low	low	low
ferbam	Ferbam	40		low	low	low
propiconazole	Topas	60		low	low	low
permethrin	Pounce	sprout		high	moderate	low
phosmet	Imidan	15		high	moderate	low
pyraclostrobin	Cabrio	1	24 hours	low	low	low
thiophanate-methyl	Easout, Senator	1		low	low	low
trichlorfon	Dylox	30		moderate	moderate	moderate
triforine	Funginex	60		low	low	low

**"Days to harvest" is the minimum number of days from the last application of the product to first harvest.*

**This is not an exhaustive list of pesticides. This list contains only those pesticides that migrant and seasonal blueberry harvesters are most likely to encounter.*

Rick Delbridge and Dick Rogers. *Wild Blueberry Insect and Disease Management Schedule*. AgraPoint International Inc., 2004. Available online at: http://www.agrapoint.ca/publications/Blueberry_%20Guide_v2004.pdf

Patterns of Pesticide Usage through the Blueberry Season

Rates of product are for mature plants

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.
Green Tip			
Mummy berry (Monilinia)	Funginex 190 EC Topas 250 E	1.7 L 500 mL	The maximum residue limit is now zero in the US. Topas may still be used in Canada, however, treated blueberries are not suitable for shipment to the US since they may contain Topas 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.
Anthracnose & Phomopsis canker	Cabrio 20 EG Bravo 500	1.0 kg 7.2 L	Do not apply more than 2 consecutive applications of Cabrio.
Blueberry leaf-tier (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 leaf-rollers) if applied when insects or damage first appears prior to bloom. For more info on blueberry leaf-tier, refer to insect fact sheets section at: www.gov.ns.ca/nsaf/elibrary/archive/hort/wildblue/insects/
Pink Bud			
Anthracnose & Phomopsis canker	Same as Green Tip section		
Bloom - WARNING - Spraying pesticides during bloom is hazardous to bees. Spray in the evening or when bees aren't working.			
Botrytis blossom blight & fruit rot	Maestro 80 DF Captan 80 WDG Elevate 50 WDG Lance 70 WDG Ferbam 76 WDG	2.25 kg 2.25 kg 1.70 kg 0.56 kg 3.75 kg	Creates problem when wet periods occur. Apply fungicides at 7-10 day intervals. Use shorter interval when disease pressure is high. Don't apply more than 2 consecutive applications of Elevate or Lance (are from different chemical families) before alternating to another effective fungicide with a different mode of action. Don't apply Ferbam beyond mid bloom.
Petal Fall			
Anthracnose & Phomopsis canker	Same as Green Tip section		Do not apply Bravo beyond petal fall.
Cherry fruitworm (Grapholitha packardii) & Cranberry fruitworm (Acrobasis vaccinii)	Guthion Solupak Sniper Malathion 25 W Sevin XLR PLUS	1.12 kg 1.12 kg 2.25 kg 4.00 L	Cherry fruitworm is native to North America. In Canada it had only been reported from Ontario and British Columbia.
Early Berries Begin to Ripen			
Blueberry fruit fly (Rhagoletis mendax) or Blueberry maggot fly	Lagon 480 E Guthion Solupak Sniper Imidan 50 WP Sevin XLR PLUS Malathion 25 W	825 mL 2.25 kg 2.25 kg 2.25 kg 4.00 L 2.25 kg	DO NOT apply Lagon more than two times per season and DO NOT apply to foliage when the temperature is 25°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.
Botrytis fruit rot	Maestro 80 DF Captan 80 WDG Elevate 50 WDG Lance 70 WDG	2.25 kg 2.25 kg 1.70 kg 0.56 kg	Apply fungicides at 7-10 day intervals. Do not apply more than 2 consecutive applications of Elevate or Lance (are from different chemical families) before alternating to another effective fungicide with a different mode of action.

Rick Delbridge and Dick Rogers. Highbush Blueberry Insect and Disease Management Schedule. AgraPoint International Inc., May 2004. **Available online at:** http://www.agrapoint.ca/publications/Highbush_Guide_2004.pdf

Commodities-Blueberry

Non-chemical pest management strategies

Cultural techniques to reduce insect infestation

Suggesting these alternatives to using pesticides may be helpful in preventing chemical exposure incidents:

▶ **Fire pruning:** Pruning by burning can help reduce annual weed pressures, some insects, diseases, and mosses. The burn must be intense and uniform in order to be effective, but it will reduce organic matter in the soil. A pruning rotation may be used to balance the costs and benefits.

▶ **Buffer zones:** Creating buffer zones of diverse plant communities around fields will create a physical barrier that limits accessibility for insects. The zone can grow vegetation that supports beneficial insects, such as wild flowers for predators, pollinators, and parasites.

▶ **Manual weed removal:** Patches of weeds in low densities are often easier to remove by hand or by clipping. If the plants are clipped in mid July before seed production, seed production will be limited and the plants will not be problematic during harvest.

▶ **Grass mulch:** Grass mulch in a developing or bare field can limit broadleaf weed development. The vegetative cover will prevent new weeds from growing throughout the season, and will minimize erosion effects. Some non-living mulches such as sawdust will maintain the soil moisture while suppressing weeds. If the burning method is used, reapplication of mulch will be necessary.

▶ **Cleaning equipment:** Simply cleaning equipment before moving it from one field to another can help minimize the spread of weed seed.

Rick Delbridge and Dick Rogers. Highbush Blueberry Insect and Disease Management Schedule. AgraPoint International Inc., May 2004.



Fire pruning

2003 Drift Study of Two Aerially Applied Blueberry Pesticides

From 1999 to 2003, the Main Board of Pesticides Control (BPC) assessed two Maine river watersheds (Narraguagus and Pleasant River) for pesticide drift occurrences. The aerially applied pesticides studied included a fungicide called Orbit (active ingredient=propiconazole) and an insecticide called Imidan (active ingredient=phosmet).

Drift cards and water samples were used to detect resulting residues of the off-target pesticides within hours after spraying. The samples that tested positive for pesticides ranged in their distances from the spraying area due to wind speed. The distances ranged from less than 100 feet to 21,800 feet.

Results from years 2000-2003 showed



that both phosmet and propiconazole drifted from their applied area, and were found on drift cards and in water samples. Hexazinone, terbacil, and chlorothalonil were among other pesticides detected during the study. It is clear that there is a risk of pesticides in ground water and on surfaces thousands of feet away from farms applying pesticides aerially. Farmworkers are especially at risk for pesticide exposure, and must be aware of restricted entry intervals after pesticides are applied.

Reference for Drift Study (right): Heather Jackson. 2003 Drift Study of Two Aerially Applied Blueberry Pesticides. Maine Board of Pesticides Control, December 2004. Available online at: <http://www.state.me.us/agriculture/pesticides/pdf/bluedrift.pdf>