Insects of Nursery Production
Root weevils

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BCLNA NURSERY GROWERS IPM WORKSHOP

February 5, 2018

Presentation by

Mario Lanthier, CropHealth Advising & Research

- 8:20 am Registration opens
- 8:45 am – 10:15 am Spider Mites
- 10:15 am - 10:30 am Coffee Break
- 10:30 am - 12:00 pm Root weevils
- 12:00 pm – 12:45 pm Lunch
- 12:45 pm - 2:15 pm Aphids
- 2:15 pm – 2:45 pm Wrap up, evaluations, CEU sign-up
- 2:45 pm – 3:15 pm Dr. Janice Elmhirst, Summary of Research Project: Foliar Nematode Trials

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This project is supported by Growing Forward 2, a federal-provincial-territorial initiative.

Growing Forward 2
A federal-provincial-territorial initiative

British Columbia

Canada

Insects of Nursery Production

8:45 to 10:00 Spider mites

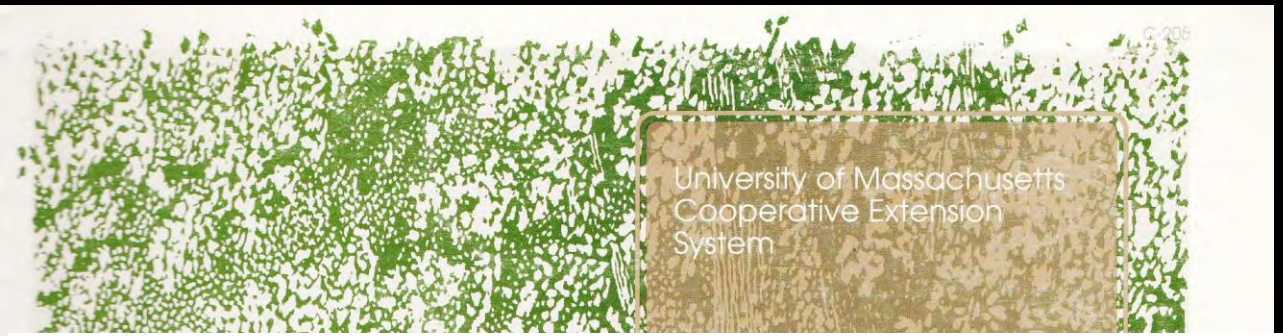
10:15 to 12:00 Root Weevils

12:00 to 12:45 Lunch

12:45 to 2:30 Aphids

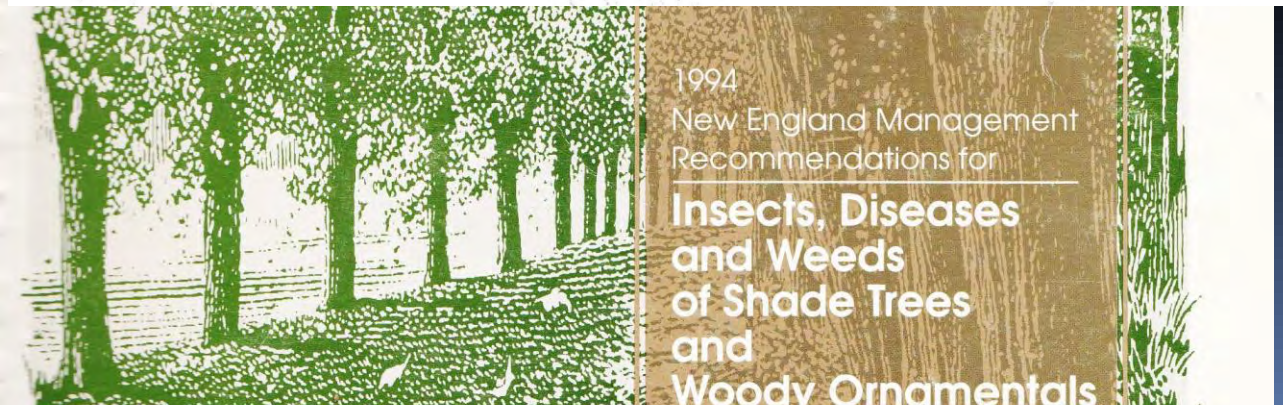
We did have good products for root weevils…

Spray recommendation in 1994 in New England

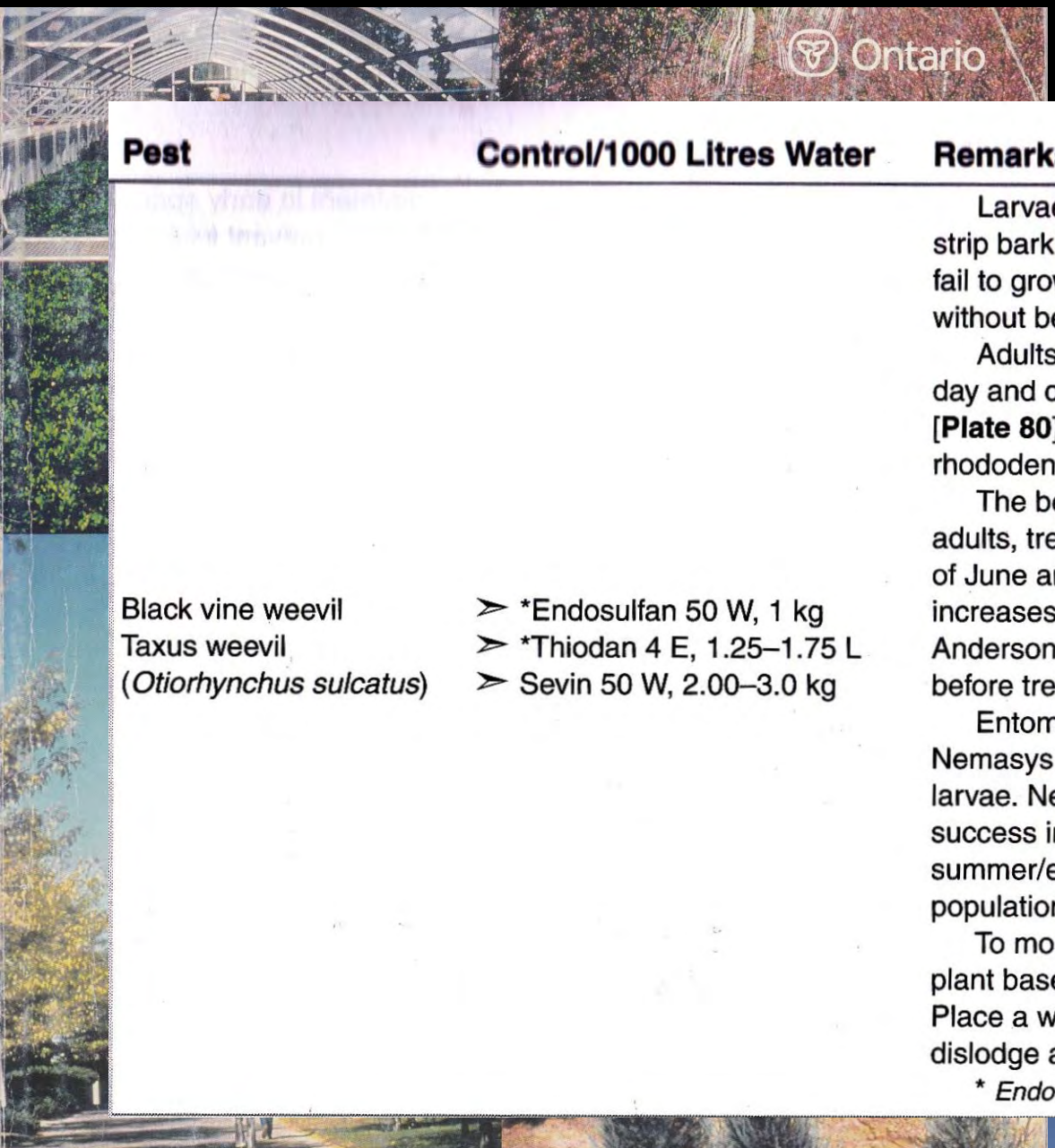


BLACK VINE WEEVIL *Otiorhynchus sulcatus* Pg.240 GDD: 635-1665	Thoroughly wet foliage and stems to runoff on Taxus, Rhododendron. **Comments:** Tiny, hemispherical notches in leaf margins are a sign of adult feeding. The major damage is caused by larvae feeding on the rootlets. This can be a very serious pest. Monitor adults with crumpled burlap around plant base. Adults only active at night. Spray for adults late in the day for best control.	Acephate (container drench (N) only). Azinphos-methyl* (N) Bendiocarb (NL) Chlorpyrifos (NL) Endosulfan ((N) only on Taxus) Fenitrothion (NL) Lambda-cyhalothrin (NL)

* = Restricted, N = Nursery, L = Landscaspe, GDD = Growing Degree Days ** SEE SPECIFIC STATE PESTICIDE REGISTRATION LIST AT END OF MANUAL



Spray recommendation in 2003 in Ontario



Ontario

Pest	Control/1000 Litres Water	Remarks
Black vine weevil Taxus weevil (*Otiorhynchus sulcatus*)	➢ *Endosulfan 50 W, 1 kg ➢ *Thiodan 4 E, 1.25–1.75 L ➢ Sevin 50 W, 2.00–3.0 kg	Larvae are small, white, legless grubs that eat fibrous roots or strip bark off larger roots. [**Plate 81**] Infested plants grow slowly or fail to grow and look dry and off-colour. Transplants often die without becoming established. Larvae control is difficult. Adults are black snout beetles that hide in soil litter during the day and cut crescent-shaped notches in needle margins at night. [**Plate 80**] They also attack arborvitae, hemlock, azaleas and rhododendrons. The beetles have fused wing covers and cannot fly. To control adults, treat foliage, trunk bark and branches during the last week of June and early July. Spray in the evening, as adult activity increases about an hour after sunset. Do not use Thiodan on Anderson yew. Treat some conifer seedlings, especially pine, before treating larger area to test treatment safety. Entomopathogenic nematodes (Heterohabditis Sytem™, Nemasys H™) are available to help suppress populations of larvae. Nematodes work very well in infested containers, with less success in the field. Nematodes can be applied in late summer/early autumn and in mid-spring to suppress larval populations. See label for complete directions. To monitor for adults, wrap a sheet of burlap around infested plant bases. Adult weevils will hide in the burlap during the day. Place a white sheet under the plant and shake vigorously to dislodge any adults.

* *Endosulfan and Thiodan are toxic to fish.*

Products sprayed for root weevils in the 1980s

endosulfan / carbofuran / chlorpyrifos / carbaryl

These products are no longer registered

endosulfan / carbofuran / chlorpyrifos / carbaryl

Decision document from Health Canada

Health Canada Santé Canada

Your health and safety... our priority. *Votre santé et votre sécurité... notre priorité.*

Re-evaluation Note REV2011-01

Discontinuation of Endosulfan

(publié aussi en français)

8 February 2011

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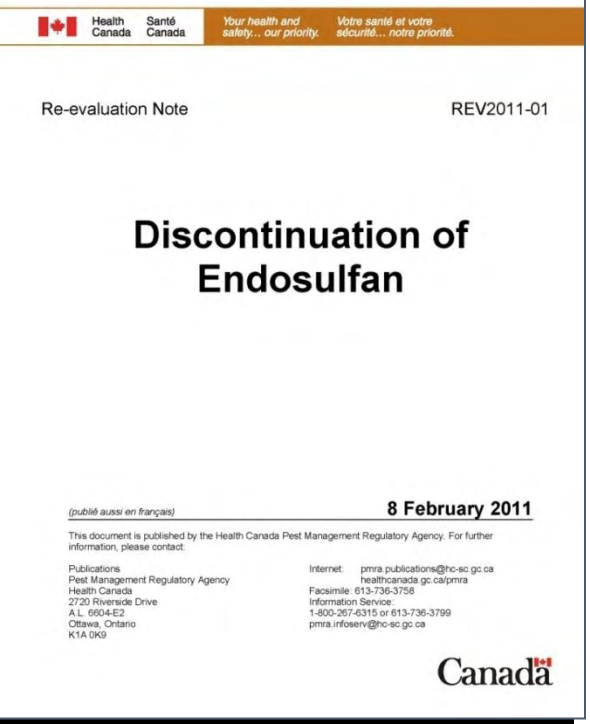
Endosulfan is withdrawn from the market



Health Canada / Santé Canada — Your health and safety... our priority. / Votre santé et votre sécurité... notre priorité.

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Canada

Appendix I Packaging and Label Amendments for Products Containing Endosulfan

Canadian end-use product labels are to be amended to include the following risk mitigation measures, in addition to those that were required by REV2009-09.

1. A **Note to User** box on primary panel showing the last permitted date of use for each crop/site:

NOTE TO USER	
Last date of use is December 31, 2010 on the following crops:	All product formulations: alfalfa, clover, field corn, sunflower, spinach, succulent beans, succulent peas; WP product formulation: above crops *and* field tomatoes, sweet corn, dry beans and dry peas.
Last date of use is December 31, 2012 on the following crops/sites:	apple, bean (dry), broccoli, Brussels sprouts, cabbage, cauliflower, corn (sweet), grape, pea (dry), pear, rutabaga, turnip, greenhouse cucumber, greenhouse tomato, bait station outside food processing plants.
Last date of use is December 31, 2016 on the following crops:	apricot, celery, cherry, cucumber, eggplant, lettuce (head), melon, ornamentals (outdoors), ornamentals (greenhouse), peach, pepper, plum, potato, pumpkin, squash, strawberry, sugar beet, tomato.
It is unlawful to use this product on any crop or site after December 31, 2016.	
This product is not to be used in and around homes or other residential areas such as parks, school grounds and playing fields. It is not for use by homeowners or other uncertified users.	

2. Existing stock of the wettable powder formulation will be overstickered. Moving forward, wettable powder formulation is to be packaged in water soluble bags. Instructions for safe handling of water soluble bags are to be included and should be proposed by the registrant.

Sevin: Restricted re-entry on the new label

Revised Restricted-Entry Intervals (REIs)

Crop	Activity	REI [1] (days)
apples (orchards that have transitioned to high density trellis production) Max. application rate: 1.5 kg a.i./ha (chemical thinning application)	Hand harvest	14
	Hand thinning, hand-line irrigation	14
	Hand pruning, scouting, pinching, tying, training	4
high value trees	All activities	7
Chinese cabbage, dandelion, endive, lettuce, mustard greens, parsley, spinach, Swiss chard, and watercress celery, kohlrabi	High contact activities (hand harvest, hand pruning, irrigation)	5
	Low contact activities (scouting, hand weeding, thinning)	0.5
parsnips	High contact activities (hand harvest, hand pruning, irrigation)	5
	Low contact activities (scouting, hand weeding, thinning)	0.5
peas	High contact activities (hand harvest, irrigation)	5
	Low contact activities (scouting, thinning, hand weeding)	0.5
potatoes	High contact activities (irrigation)	6
	Low contact activities (scouting, hand weeding)	0.5
rapeseed (canola)	All activities (scouting, irrigation)	0.5
root crops	All activities	10
snapbeans	High contact activities (scouting, irrigation)	6
	Low contact activities (hand weeding, mechanical	0.5

Orthene: Restricted re-entry on the new label

Post application:

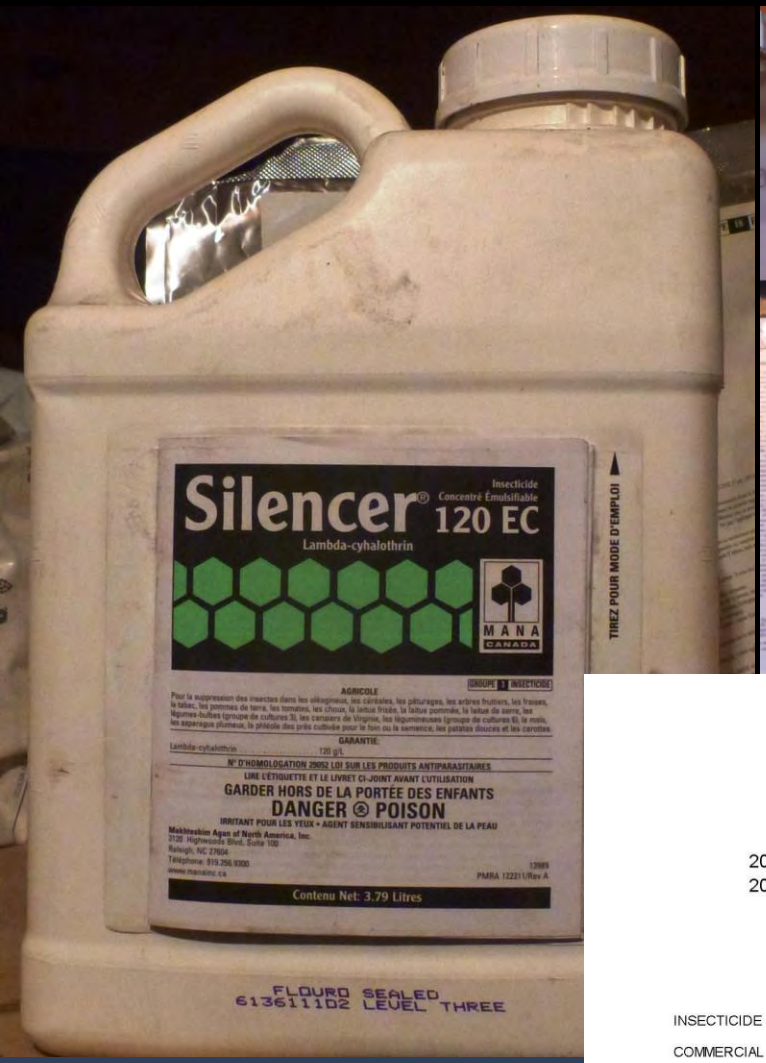
- Do not enter or allow worker entry into treated areas during the re-entry intervals (REIs) as listed below:

Brussels sprouts	12 hours
Cabbage	12 hours
Cauliflower	12 hours
Celery	1 day*
Corn	5 days*
Cranberries	12 hours
Lettuce	1 day*
Peppers	1 day
Potatoes	1 day*
Cut flowers/roses	1 day
Saskatoon berries	3 days
Tobacco	1 day*
Tomatoes	12 hours
Ornamentals	12 hours
Trees	3 days*

* Workers conducting activities that involve significant foliar contact must wear gloves and cotton covers for the following time after the REI:

Corn	4 weeks
Celery	2 weeks
Lettuce	2 weeks
Tobacco	2 weeks
Potatoes	1 week
Trees	1 week"

Products now registered for root weevils



2014-4877
2014-11-07

GROUPS 4 28 INSECTICIDE

MAINSPRING™ X

INSECTICIDE

COMMERCIAL

WETTABLE GRANULE

Broad spectrum insecticide for control of listed insect pests in greenhouse and outdoor ornamentals.

GUARANTEE:
Thiamethoxam 20%
Cyantraniliprole 20%

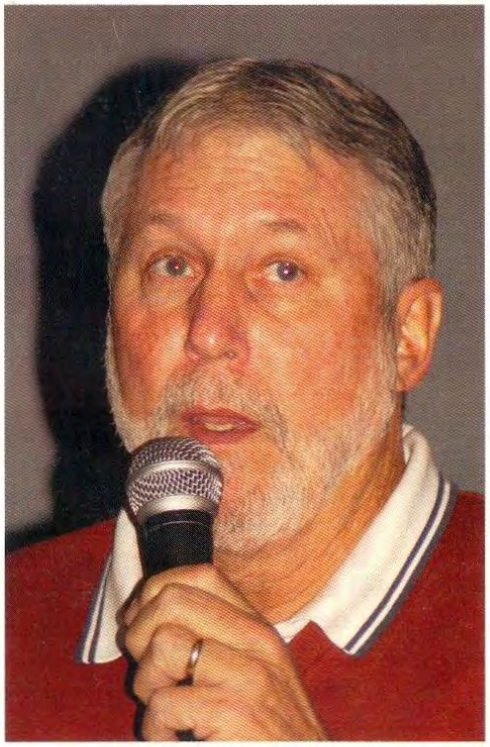
READ THE LABEL AND BOOKLET BEFORE USING

"newer products are 100 to 1000 times less toxic"

PLENTY OF OPTIONS for pest control

The newer products are 100 to 1,000 times less toxic than traditional pesticides.

by Geraldine Warner



Jay Brunner

Growers have plenty of insecticides to choose from for controlling the key apple pests codling moth and leafrollers. Including two new pesticides that will be registered next year, there are nine alternatives to organophosphates for controlling codling moth and eight for controlling leafrollers. Five of those products control both pests, reports Dr. Jay Brunner, director of Washington State University's Tree Fruit Research and Extension Center in Wenatchee.

Guthion (azinphos-methyl) and the reentry interval is four to ten hours, compared with fourteen days for Guthion, Brunner said. The key in using them successfully is understanding the pest and the life stages that the products control, and knowing how to use them to avoid disrupting biological control.

The new pesticides come from several different chemical classes. Esteem (pyriproxifen), Rimon (novaluron), and Intrepid (methoxyfenozide) are insect growth regulators that disrupt the insect's

It's also important not to overuse products, to avoid resistance. If they're not rotated, the pest could develop resistance in as little as five or six years, Brunner warned.

He urged growers to limit their use of a class of insecticide to one generation per season. This means not using the product for another pest if it would expose the pest for which it had already been applied. For example, if Assail is used against codling moth in the first generation, don't use it against aphids in midsummer when

The new products are more expensive but offer value in terms of safety for farmworkers, farm families, and worker management, Brunner said. There's also an opportunity for sound resistance management. "We need to be good stewards

Magazine Good Fruit Grower, Washington State, 2007

Root weevils can also be called Snout beetles

The antennae fits into a groove of the snout

Root weevil species: different size and colours

Black vine weevil, the most common in B.C.

Here it is, hiding just under the soil surface

The adults mostly hide during the day

The adult feeds above ground, mostly at night

Damage by adults: notching of the leaf margin

Feeding by adults on Thuya: notching of the stem

The affected plant shows falling, dying twigs

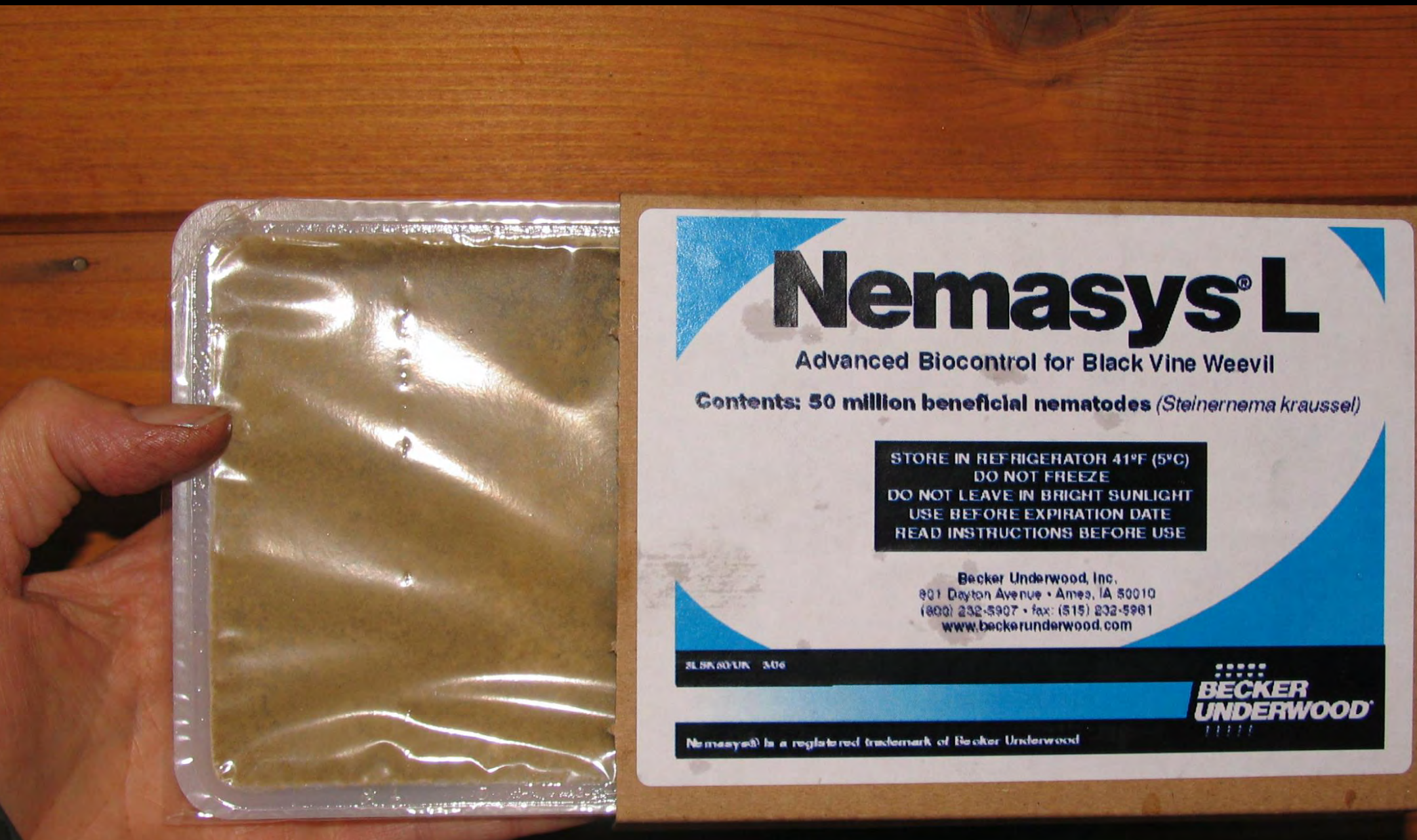
The young stage of root weevils: a grub

Grubs are small size and are found in the soil

Are we OK so far ?

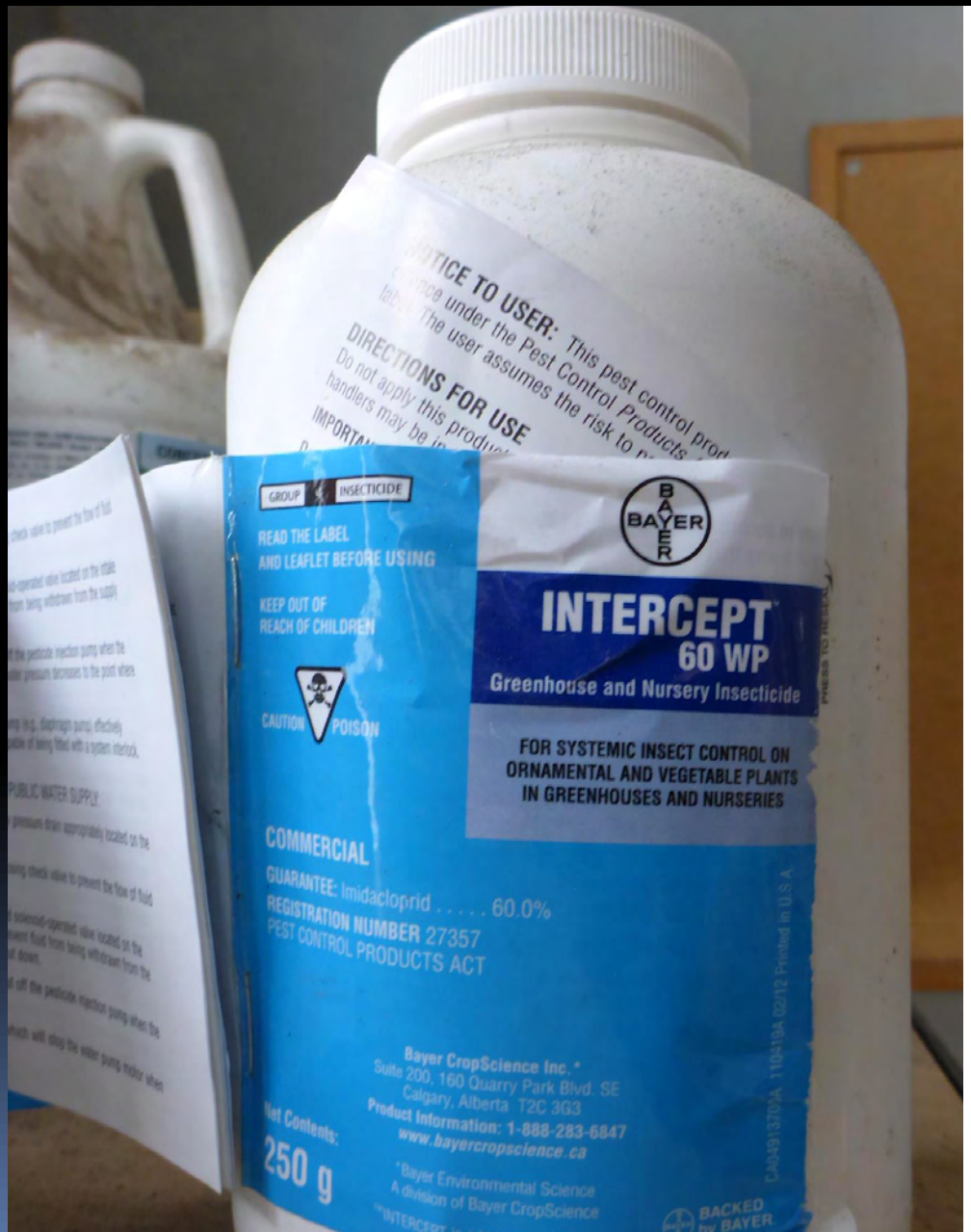
Against grubs: spraying predatory nematodes

Predatory nematodes - A commercial product



Mix the powder in water, apply with a sprayer

For grubs in containers: Drench with Intercept



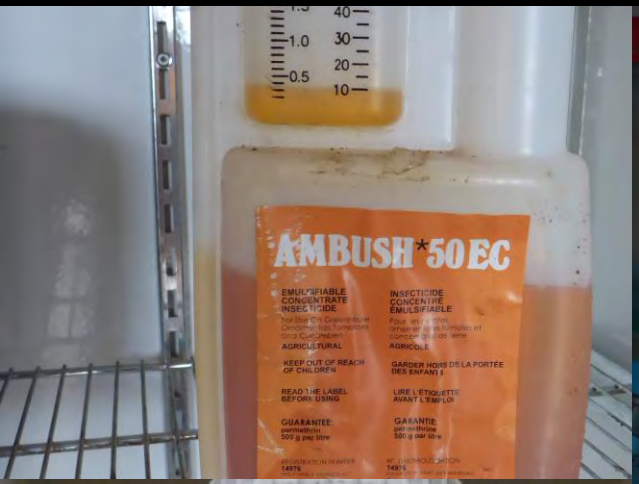
RECOMMENDED DRENCH APPLICATIONS CONTAINER GROWN NURSERY ORNA

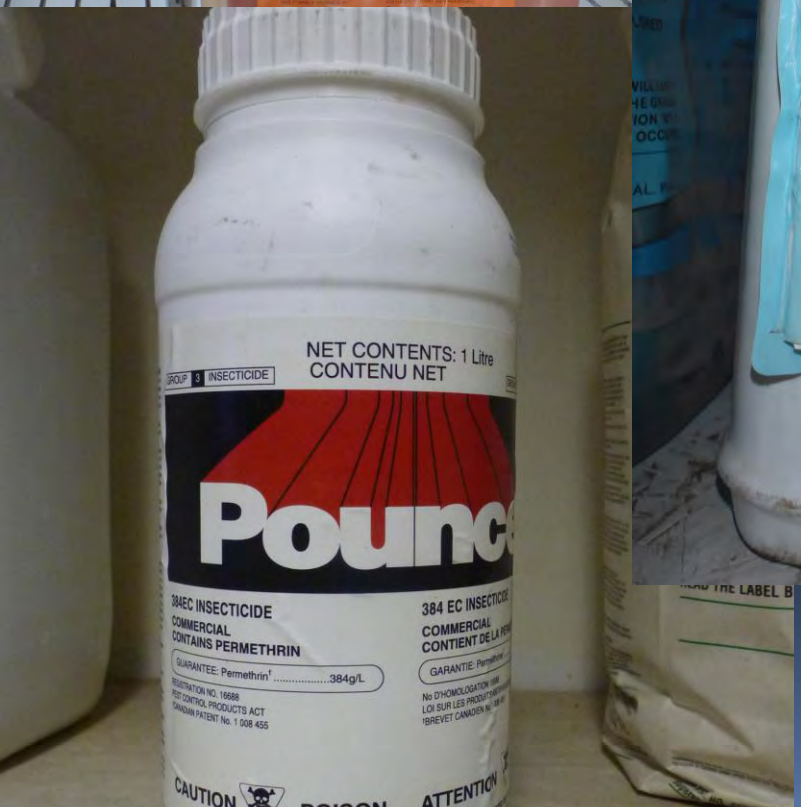
For use on all nursery ornamentals grown in containers as a soil drench using micro-irrigation, drip irrigation, overh hand-held or motorized calibrated irrigation equipment.

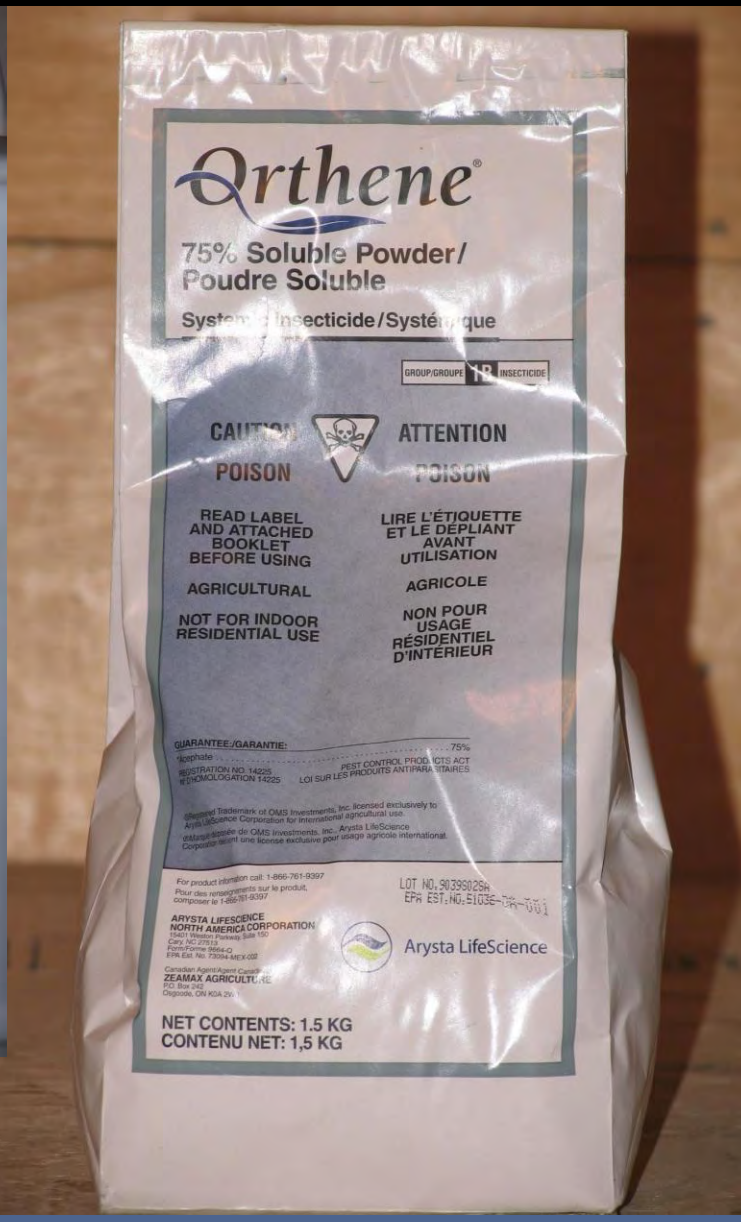
PEST	CROP	USE PATTERN & DOSAGE - INTERCEPT 60 WP		REMARKS
		Container Size mm (inches) in diameter	Rate of Product in mg/Pot	
Larvae of European Chafer (*Rhizotrogus majalis*) and Japanese beetle (*Popillia japonica*)	All Container Grown Nursery Stock including: trees, shrubs, herbaceous perennials and ornamental grasses	180 mm (7") 230 mm (9") 280 mm (11") 300 mm (12")	1.19 1.94 2.87 3.30	Apply to moist media. Use suffic solution to wet most of the pottin loss of liquid from the bottom of Follow application with moderat carefully during the next 10 days loss of active ingredient due to le EXAMPLE: To calculate the surface area of calculate the radius: 180 mm dia radius Then use the formula: (3. $(90^2))/1,000,000 = 0.0254\ m^2$ To calculate the rate of product i 0.0254 x 467 (g product/Ha) = 11 0.00119g / 180 mm pot = 1.19 m A 180-mm container requires 1. If treating 100 containers (180-m amount of product required wou = 119 mg or 0.119 g of product. If desired drench rate is 150 mL pot (this amount should not leac pot) then the amount of water re pots (180 mm dia.) would be (10 15 Litres of water. • Do not apply more than once p • Caution: Do not apply to immat phytotoxicity may occur at the rec application. • INTERCEPT 60 WP should alw conjunction with IPM (Integrated Practices.

Products registered for root weevil on ornamental

Products registered for root weevil: other crops



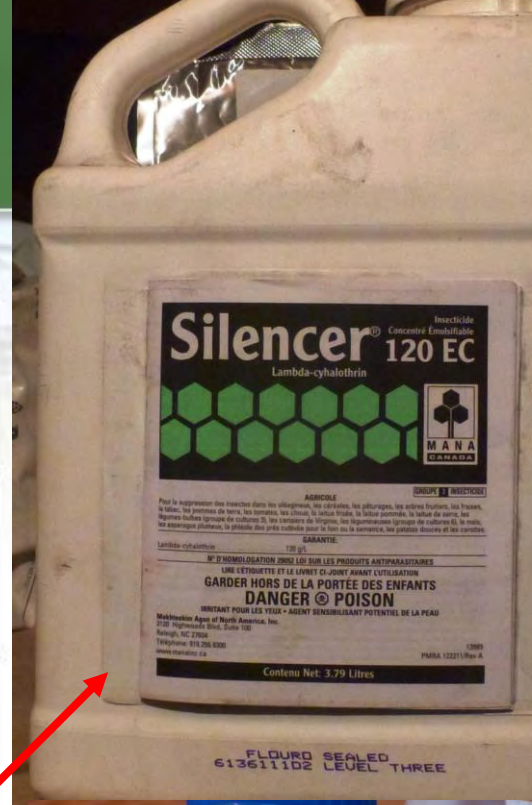


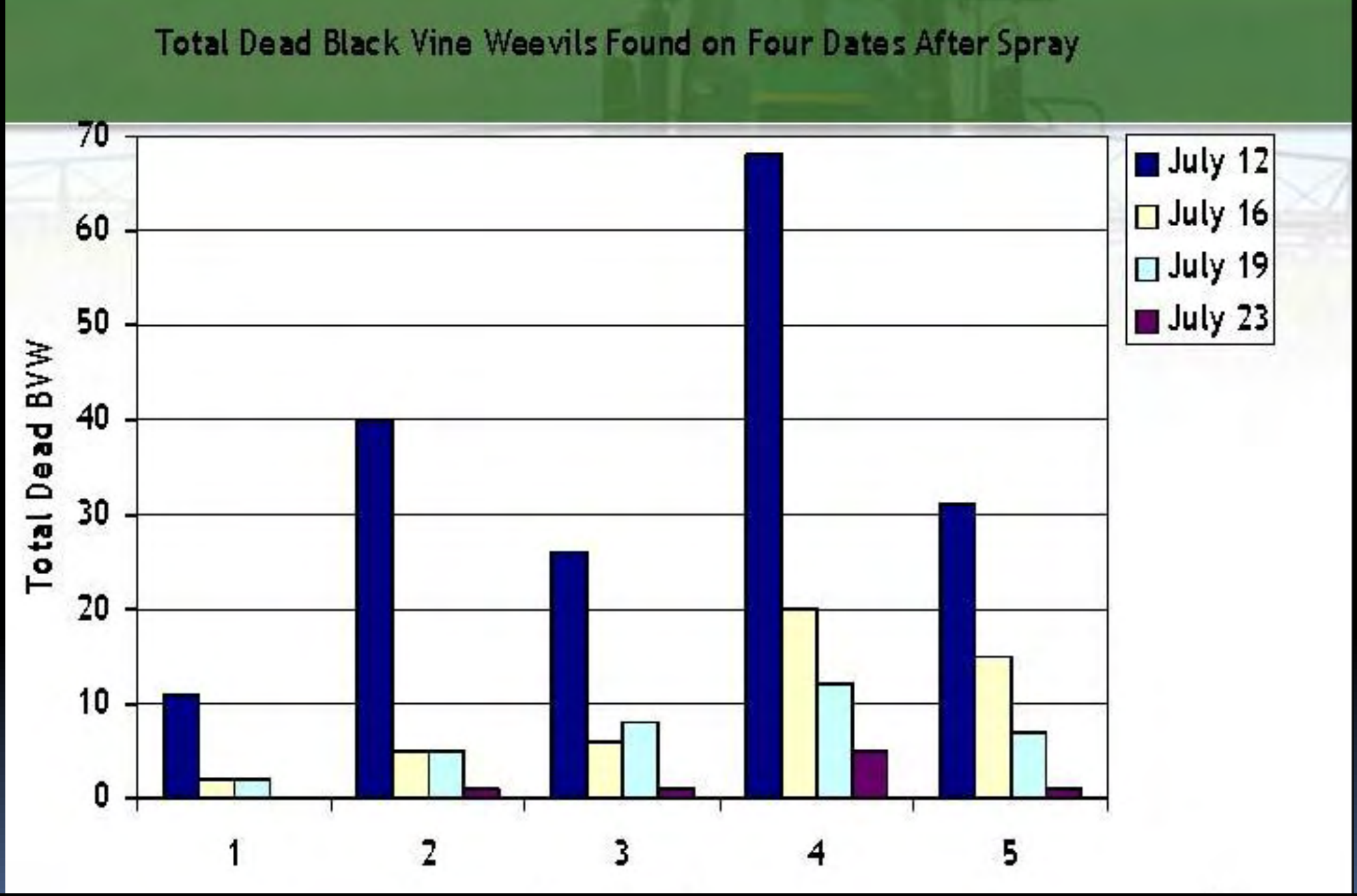


Efficacy studies on insecticides for root weevils

Black Vine Weevils - Dead

Treatment	Rate (g ai/ha)	June 29, 2006	July 4, 2006
Control	-	0.3 b	0.0 b
Bifenthrin	112	10.8 b	3.5 b
Lambda-cyhalothrin	12.5	2.0 b	0.8 b
Thiamethoxam	70	48.3 a	34.8 a





1: Control 2: bifenthrin 3: Acelepryn 4: Flagship 5: Alverde

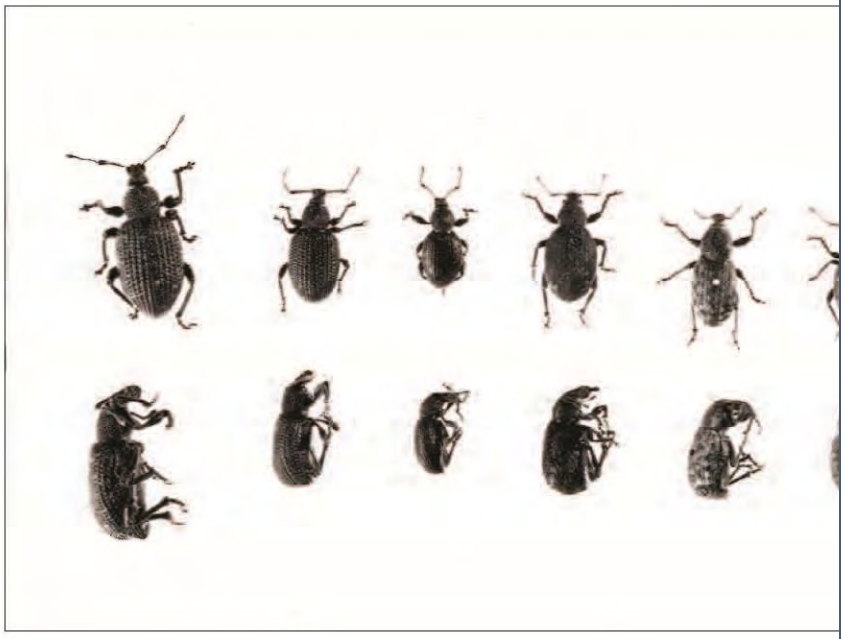
Efficacy studies on insecticides for root weevils

Special Report 1065
January 2007

Proceedings of November 1-2, 2001

North American Root Weev

OSU Department of Entomology, Integrated Plant Pr
and the North Willamette Research and Extension C



Root Weevil Larvae Control in Oregon Strawberries

J. T. DeFrancesco, G. P. Koskela, and G. C. Fisher
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A field trial was conducted in a 3-year-old field of 'Totem' strawberries located at Oregon State University's North Willamette Research and Extension Center near Aurora, Oregon, to determine effects of soil-applied insecticides on root weevil larvae populations. Experimental design was a randomized complete block with four replications. Each plot was comprised of one strawberry row, 25 ft long by 40 inches wide. Untreated plant rows, serving as buffers, separated the treated rows. Treatments were broadcast applied using a CO_2-powered backpack sprayer equipped with a two-nozzle boom at 40 psi, delivering 50 gal of water per acre.

After strawberry renovation, treatments were applied to pre-irrigated strawberry plots on July 27, 2000. Plots were irrigated again imme
treatment applications with approxim
of irrigation (overhead sprinklers). Tr
evaluated in early March 2001 for eff
controlling root weevil larvae by digg
strawberry plants per plot, screening
strawberry crowns and roots through
sieves, and counting the number of li
root weevil complex in this field was
55 percent strawberry root weevil (*O*
ovatus), 30 percent black vine weevil
sulcatus), 10 percent rough strawberr
(*Otiorhynchus rugosostriatus*), and 5
Barypeithes pellucidus (no common n

Treatments

Thiamethoxam (Cruiser 2SC) at 0.2 lb ai/acre
Beauveria bassiana (Naturalis-L) at 43 fl oz product/acre
Carbofuran (Furadan 4F) at 2.0 lb ai/acre
Untreated check

Results

Thiamethoxam and carbofuran resulted in significantly fewer root weevil larvae than the

we conducted in 1999; in that trial,
provided 73.5 percent control, carb

Efficacy studies on insecticides for root weevils

Special Report 1065
January 2007

Proceedings of November 1-2, 2001

North American Root Weevil Workshop

OSU Department of Entomology Integrated Plant Protection Center

Table 1. Root weevil larvae control with soil-applied insecticides, North Willamette Research and Extension Center, 2001.

Treatments	Number live larvae	Control (percent)
Beauveria bassiana (Naturalis-L)	42.5 b*	8.0
Carbofuran (Furadan 4F)	8.0 a	82.7
Thiamethoxam (Cruiser 2SC)	10.5 a	77.3
Untreated check	46.2 b	- - -

*Means followed by the same letter within a column do not differ significantly, based on Fisher's protected LSD ($P \leq 0.05$).

Efficacy studies on insecticides for root weevils

Special Report 1065
January 2007

Proceedings of November 1-2, 2001

North American Roo
OSU Department of Entomology, Integr
and the North Willamette Research an

Registration of New Insecticides for Mint

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Abstract

Platinum 2SC and Furadan 4L provided significant control when applied directly to strawberry root weevil (*Otiorhynchus ovatus*) larvae, while Steward failed to provide control. However, naturally occurring strawberry root weevil larvae were not controlled when Platinum 2SC, Steward, or Furadan 4L were chemigated into the soil. Strawberry root weevil adults that were directly treated were effectively controlled with Orthene 75S, Steward, and all rates of Actara 25 WG.

Introduction

New effective pesticides are needed to replace pesticides that may be lost due to the Food Quality Protection Act (FQPA). These new pesticides need to be compatible with biological control, thus assisting growers in lowering input costs by reducing pesticide applications. The focus of this research was to test new pesticides that may fit these criteria. In the following studies, we tested the efficacy of (1) Platinum 2SC (thiamethoxam) and Steward (indoxacarb) for control of strawberry root weevils in the larval stage, and (2) Actara 25WG (thiamethoxam) and Steward for control of strawberry root weevil adults.

Objective 1: Platinum (thiamethoxam) and Steward (indoxacarb) for control of strawberry root weevil larvae in mint.

Strawberry root weevil (SRW) larvae

the adult stage and not the larvae. We wanted to test

Efficacy studies on insecticides for root weevils

Results and Discussion

All products and rates were effective against the SRW adults after 21 days (Table 5). No feeding was observed for the first 14 days even for the untreated check. SRW adults moved to the bottom of the cage and would not climb on the potted plants to feed. After 14 days, mint stems were taken off the plants, and placed on the bottom of the cages to encourage f Feeding on the plant material at the bottom of th was observed only in the untreated check from 1 DAT. After 21 days, some of the Steward-treate were still alive but had not moved for 7 days. Th immobilized SRW were counted as dead.

Table 5. Mean number of live SRW adults, 14 and 21 days after treatment (DAT) (n = 30).

Treatment	Rate	Mean no. alive 14 DAT	Mean no. alive 21 DAT
Untreated check	---	25.8 a	16.8 a
Orthene 75S	1.0 lb ai/acre	0.2 d	0.0 b
Actara 25 WG	0.023 lb ai/acre	9.4 b	2.2 b
Actara 25 WG	0.047 lb ai/acre	3.0 cd	0.6 b
Actara 25 WG	0.062 lb ai/acre	5.8 bc	0.4 b
Actara 25 WG	0.124 lb ai/acre	0.8 cd	0.0 b
Steward	0.1 lb ai/acre	6.4 bc	0.0 b

Sample means were compared with Fisher's Protected LSD (P = 0.05).
Means with the same letter are not significantly different (Petersen 1985).
Live weevils: $F = 39.9$; $df = 6,28$; $P < 0.05$.

Reference Cited

Advice from Pennsylvania State University…

Insect Advice from Extension

Fact Sheets
Spined stilt bug
Animals
Christmas Trees
Field Crops
Fruit
Honey Bees (Apiculture)
Trees and Shrubs (Woody Ornamental Plants)
Spiders

Black Vine Weevil

Otiorhynchus sulcatus Fabricius

The black vine weevil is a serious pest in nurseries and established landscape plantings. A native of Europe, this species was first reported in Connecticut in 1910. This key pest is the most destructive and widely distributed species of root weevils in the genus *Otiorhynchus*. Adults and larvae prefer rhododendron, *Rhododendron* spp., yew, *Taxus* spp., euonymus, *Euonymus* spp., and Japanese holly, *Ilex crenata*. Larvae also feed on the roots of hemlock, *Tsuga* spp. This pest has been recorded on more than 100 species of cultivated and wild plants. Some landscape pest managers refer to this insect as the taxus weevil.

Description

They recommend spraying at night

Management

To effectively manage adults, apply a registered insecticide according to label directions to host plant foliage during late May through June. Optimal timing of an application against the adult stage of this key pest may be achieved by doing the following. In early May place 6-inch by 6-inch boards on top of the mulch beneath several host plants. Pieces of burlap placed loosely around the base of a host plants may be substituted for the boards. During the middle of the day slowly turn over these boards or pieces of burlap. Note when you observe the first adult black vine weevil on the bottom of one of these monitoring surfaces. Because adults (females) need to feed on host foliage for 21-28 days before they're able to lay eggs, the first foliar application should be made three weeks after detection of the first adult. Since adults do not emerge at the same time, a second foliar spray should be applied according to label directions three weeks after the first one. Spraying foliage in early evening may increase control because adults become active on the host foliage a few hours after sunset.

Applying registered materials according to label directions as soil drenches to container-grown plants from July to mid-October target the larval stage of this pest. The use of beneficial (entomopathogenic) nematodes applied according to label directions may be used to manage the larval stage of this pest in container-grown plants. Be sure to apply water as directed on the product label to the potted plants to be treated with these organisms.

Warning

Pesticides are poisonous. Read and follow directions and safety precautions on labels. Handle carefully and store in original labeled containers out of the reach of children, pets, and livestock. Dispose of empty containers right away, in a safe manner and place. Do not

Insect development: degree day accumulation

Using Degree-Days and Plant Phenology to Predict Pest Activity

Daniel A. Herms
The Ohio State University

Accurate prediction of insect development and emergence is essential for effective pest management, but can be quite challenging. The great diversity of ornamental plants, each with its own complement of insect pests, creates a logistical challenge for planning and implementing a successful pest management program for landscapes and nurseries. Pesticide applications must be timed precisely to maximize effectiveness and minimize the number required. Improperly timed applications are expensive and even make problems worse when they decrease populations of natural enemies without impacting the target pest. Many insects are difficult to detect and monitor, further complicating the accurate timing of pesticide applications. Consequently, pesticide applications are frequently scheduled on a calendar-day basis. However, because of tremendous variation in the weather from location to location and year to year, calendar-based scheduling is frequently inaccurate.

Insects emerge earlier in warm years than in cool ones.

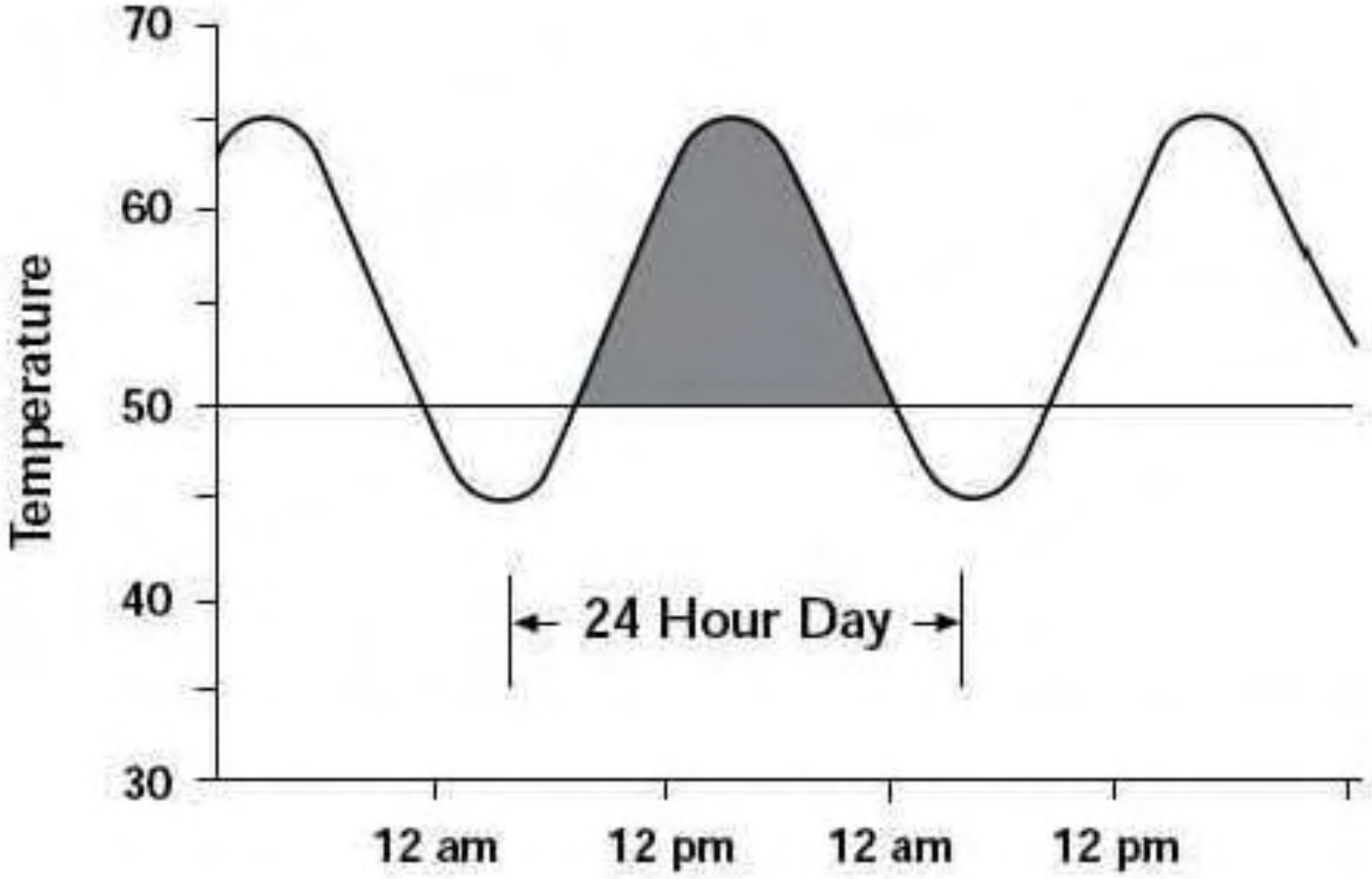
period. However, it is important to understand that degree-days have meaning only in relation to the base temperature that has been specified.

Insect development occurs only between an upper and lower temperature threshold. Development stops when the temperature drops below the lower threshold and resumes when it rises above it. Ideally, when attempting to predict plant and insect development, the lower temperature threshold for development is used as the base temperature for calculating degree-days. The lower developmental threshold temperature is known only for only a few insect pests, but experience has shown that 50·F is a reasonable approximation for many species, and it is commonly used as the base temperature (although other temperatures such as 32·F and 42·F are also sometimes used).

Development of plants and insects also stops when the temperatures exceed the upper threshold for development. In midwestern and northern climates, the upper temperature threshold is not generally exceeded for long enough

Amount of heat accumulated above 50°F (10°C)

Figure 1.



Root weevil: degree day accumulation

Degree day accumulation (base 10°C), Agassiz Station, Environment Canada

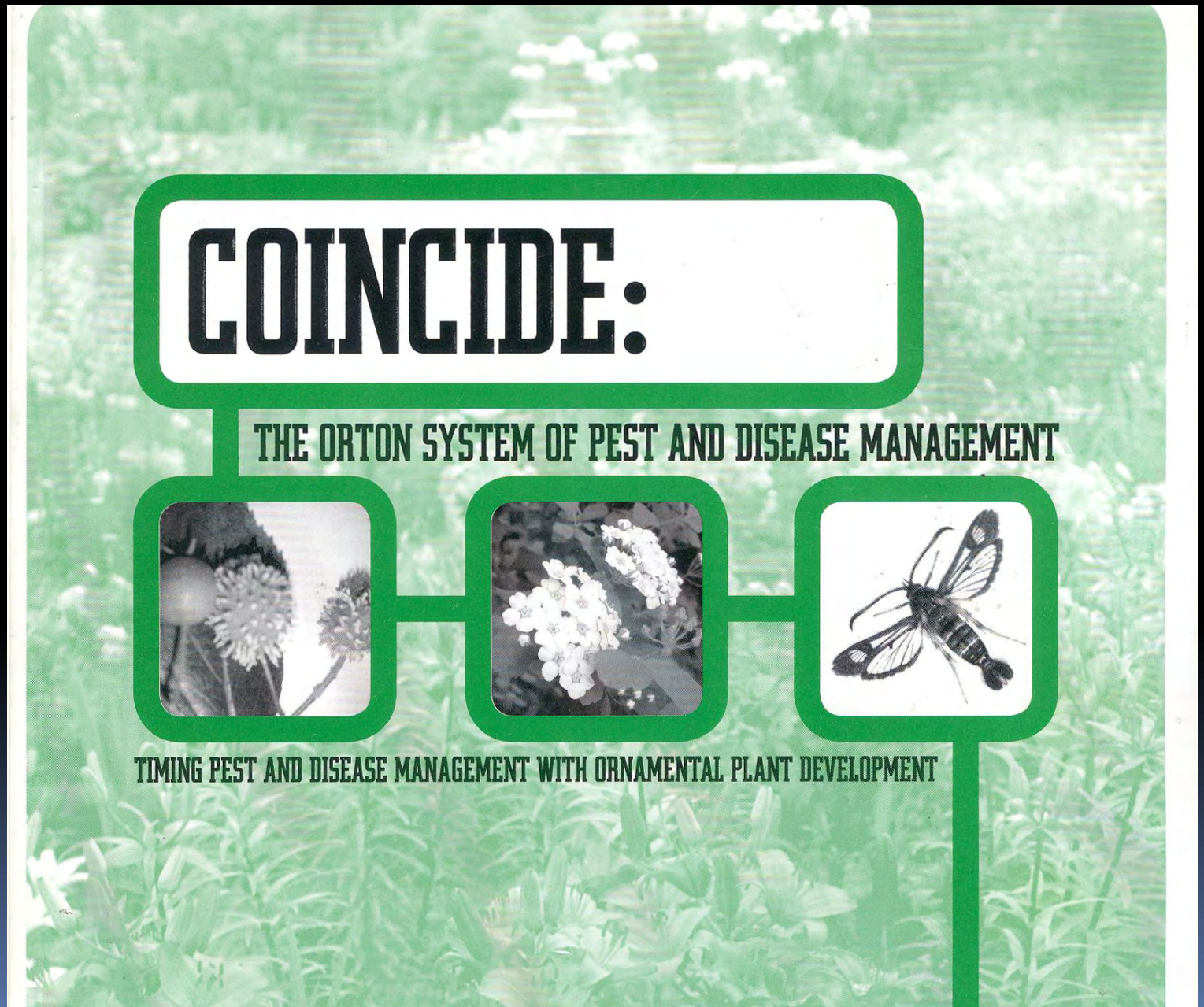
DATE	2017	2016	2015	2014	2013	2012	2011
Up to March 15						0	0
March 31						1	2
April 15						18	2
April 30						43	5
May 15						83	25
May 31						143	64
June 30						271	224
December 31						1104	961
Start first spray						Jun 22	Jun 29
End first spray						July 10	July 16
Start second spray						July 27	Aug 6

Root weevil: degree day accumulation

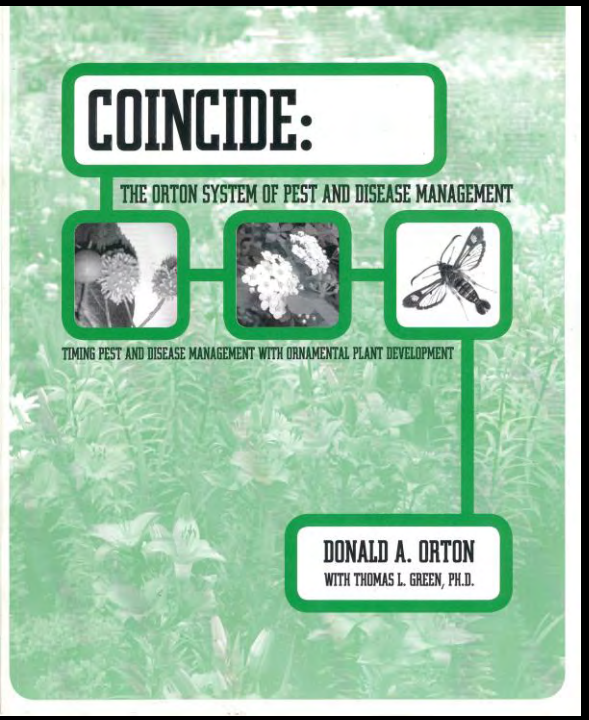
Degree day accumulation (base 10ºC), Agassiz Station, Environment Canada

DATE	2017	2016	2015	2014	2013	2012	2011
Up to March 15	0	2	19	1	1	0	0
March 31	0	12	34	1	20	1	2
April 15	0	52	39	22	32	18	2
April 30	21	116	68	40	44	43	5
May 15	52	226	130	121	145	83	25
May 31	162	289	262	199	199	143	64
June 30	376	499	541	390	406	271	224
December 31	1243	1300	1427	1366	1284	1104	961
Start first spray	Jun 9	May 15	May 27	Jun 4	Jun 4	Jun 22	Jun 29
End first spray	Jun 26	Jun 5	Jun 9	Jun 23	Jun 23	July 10	July 16
Start second spray	July 14	July 1	Jun 28	July 11	July 9	July 27	Aug 6

Root weevil: indicator plants for spraying dates



Root weevil: indicator plants for spraying dates



1st spray:
Horsechesnut
in late bloom
Or
Spiraea
'Snowmound'
blooming

2nd spray:
Catalpa blooming

Any question so far ?