UMassAmherst

Back to Basics: Integrated Pest Management Strategies for Key Insects

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What will I cover today?

Early-season pests

Tarnished plant bug

European apple sawfly

Plum curculio

Summer

Codling moth

Apple maggot fly

BIOLOGY

MONITORING

MANAGEMENT

Biology

	TPB	EAS	PC
			
Overwintering stage	Adult	Mature larva	Adult
Plant part affected	Feeding up to tight cluster usually results in aborted fruit.	Developing fruit	Developing fruit

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TPB damage

- Adults and nymphs feed by sucking the sap from plants. In the process, they inject a toxic digestive enzyme.
- Damaged buds exude clear, and later amber, liquid ooze
- TPB feeding starts at the silver tip stage of bud development, but the majority of feeding occurs from the green tip stage through petal fall.
- Feeding prior to the pink stage will cause the bud to fall off, whereas **feeding after pink stage results in dimpled fruit**.

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EAS biology and damage

- Sawfly overwinter as larvae in the soil and have only one generation per year.
- Adults emerge during pink. Eggs are laid on the calyx end of developing fruit.
- The first instar larvae tunnels just under the epidermis of the developing fruit, resulting in the typical ribbonlike scar (primary injury).
- Older instar larvae bore deeply into the seed chamber of the fruit and can penetrate additional fruit, usually causing fruit abortion.


Photo: Mike Madden


Photo: H. Faubert, URI

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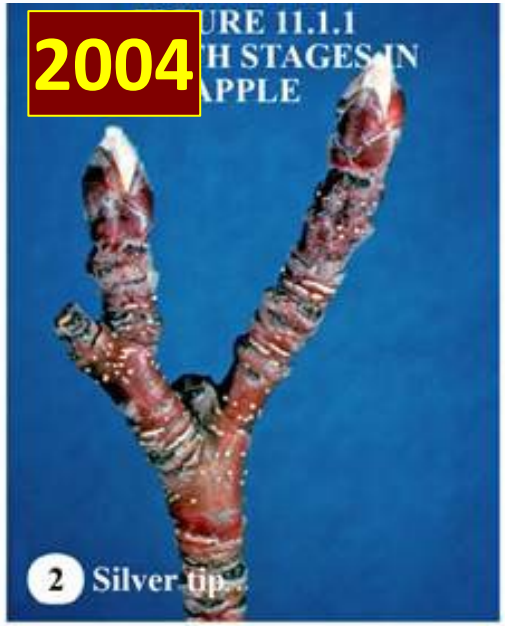
Onset of PC immigration

9-year average

216 DD_{43}



2000, 2002, 2003

2018 2019

2001

2020

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Pest monitoring is the cornerstone of IPM

Monitoring tools

	TPB	EAS	PC
Trap type	White sticky card	White sticky card	▪ Black pyramid trap ▪ Trap trees (effective)
Lure	None	None	Grandisoic acid (GA) = PC pheromone + benzaldehyde
Timing	At or before the silver tip stage. Check traps weekly.	At early pink stage	**Trap tree:** During early bloom
Trap positioning	2 feet above ground	Re-position sticky white rectangle traps at head height, on the south side of the tree	Single perimeter-row odor-baited tree

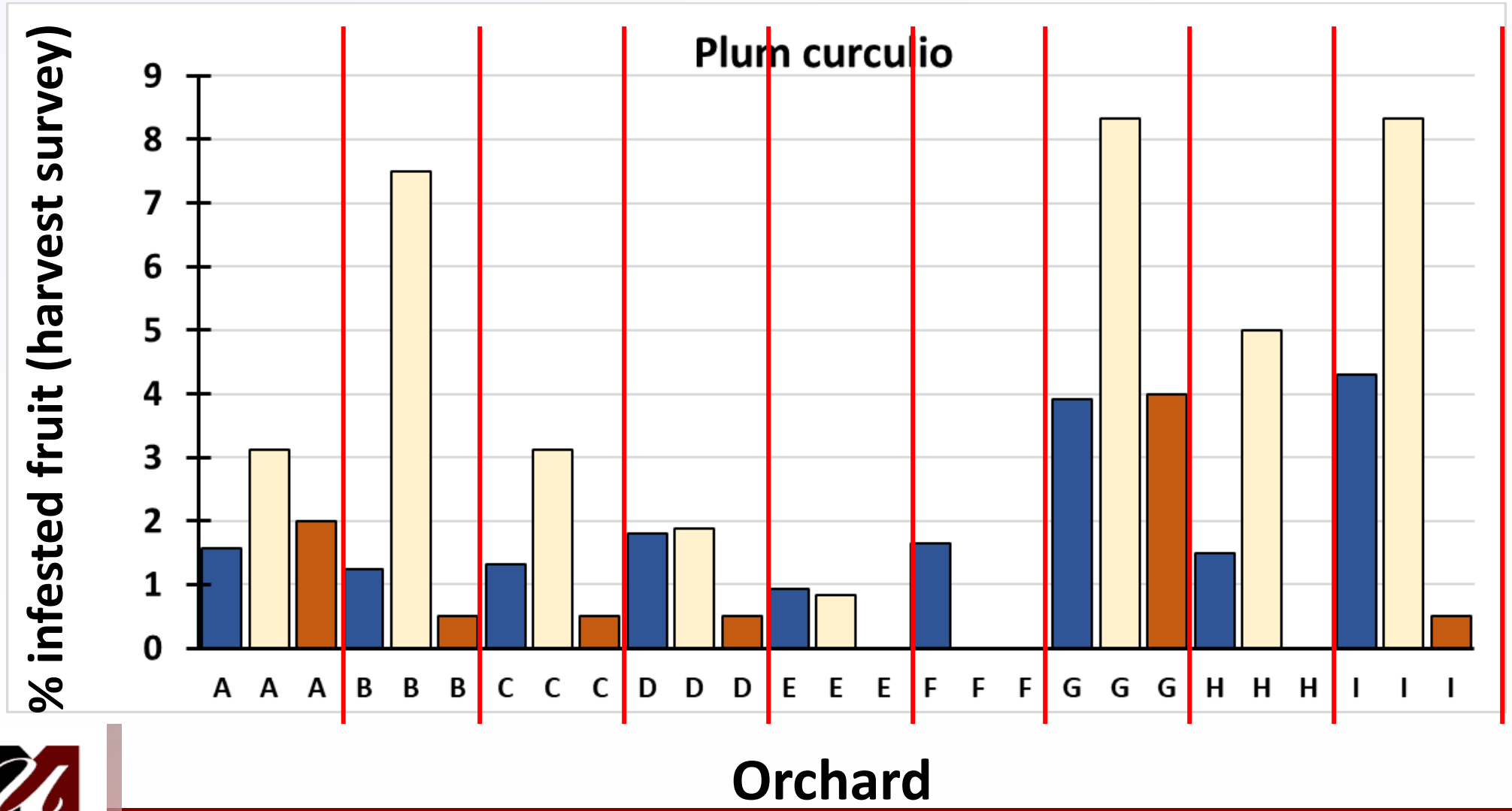
Monitoring tools

	CM	AMF
Trap type	Delta trap	Sticky coated red spheres
Lure	Sex pheromone (various companies)	5-component apple essence
Timing	Bloom	Early June
Trap positioning	On the north side of the tree, at eye level.	Outer third of the canopy

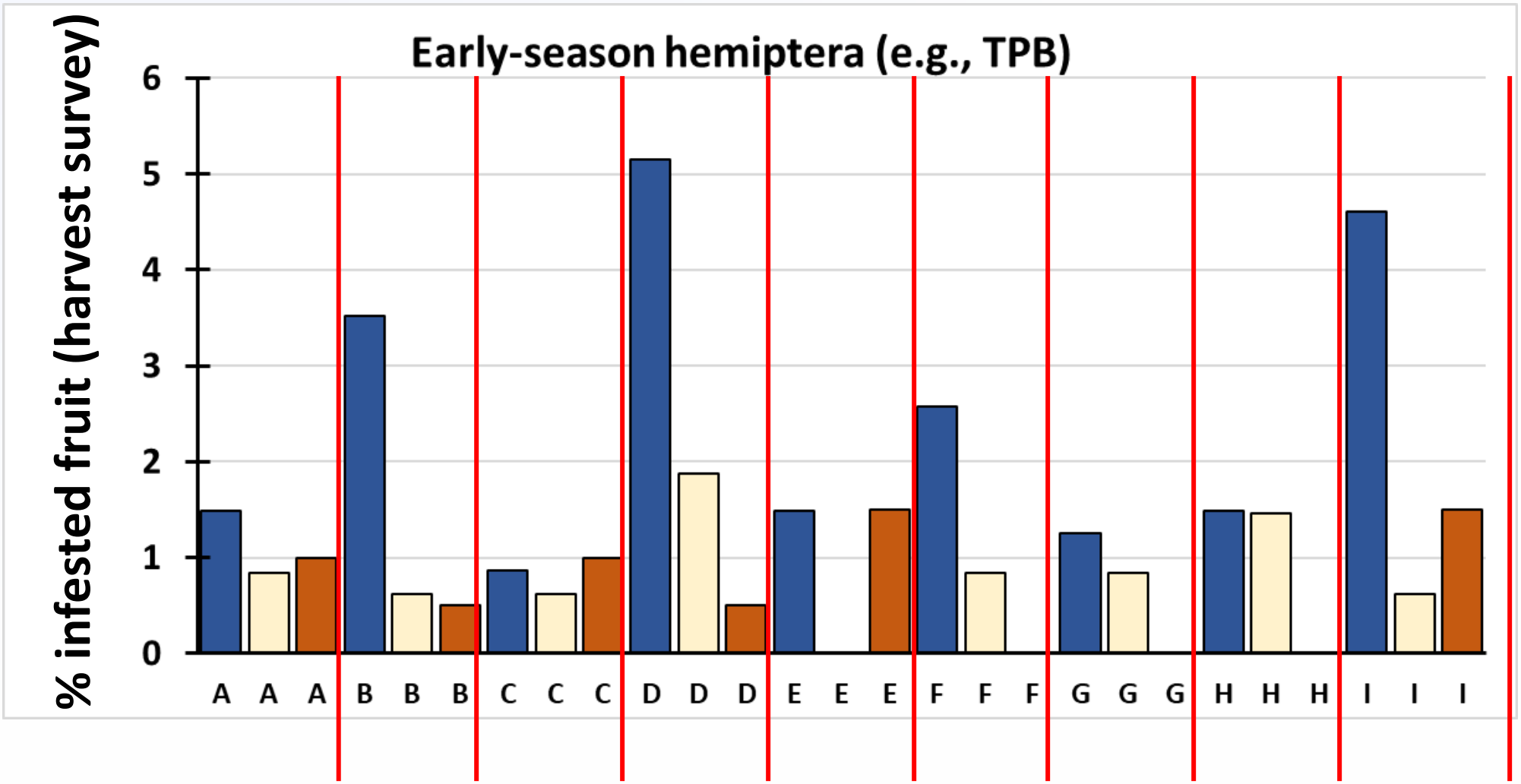
Photo credit: Heriberto Godoy-Hernandez, UMass Stockbridge School of Agriculture

Management:
What and when to spray against insect pests

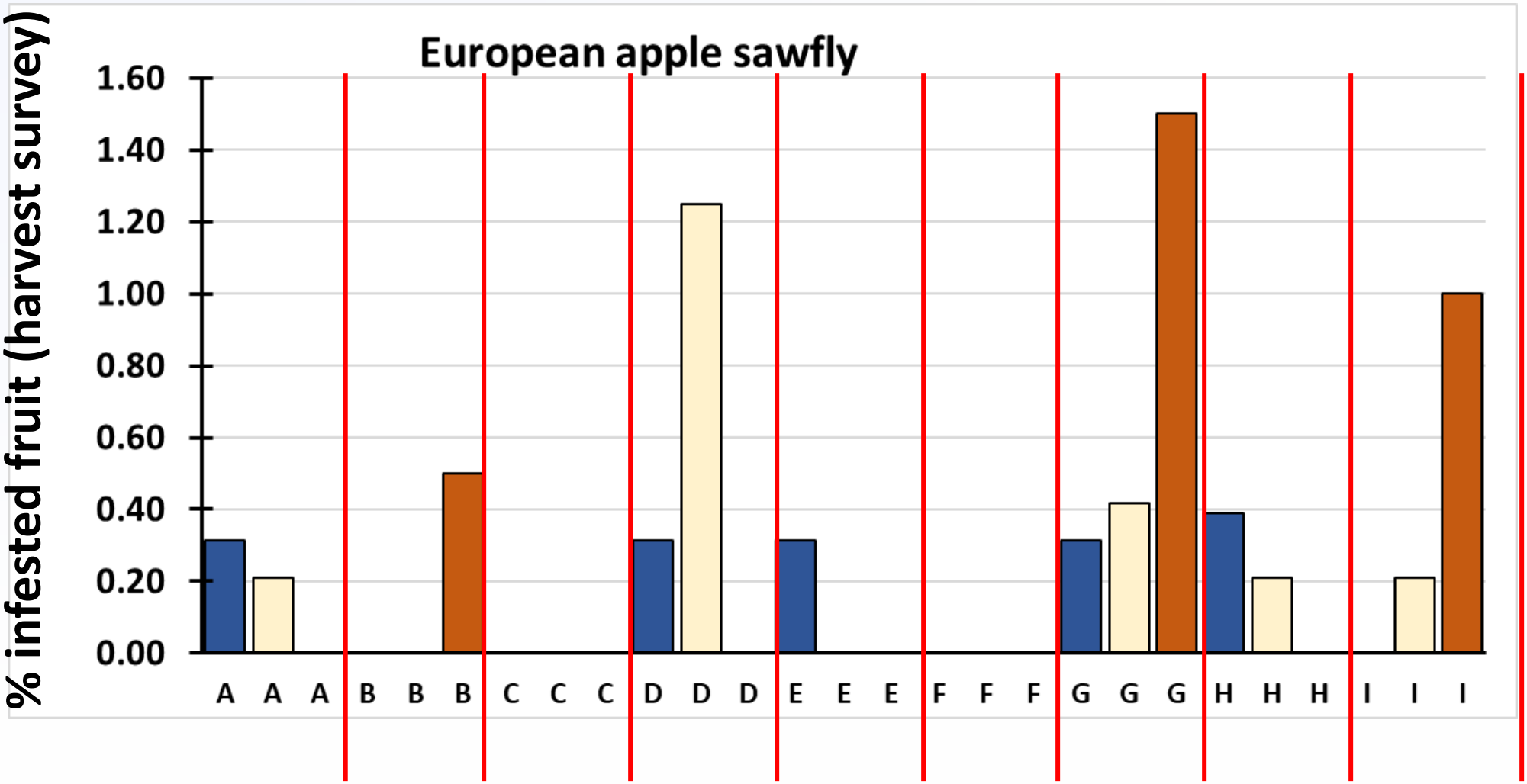
Whole-block injury: Plum curculio



Tarnished plant bug



European Apple Sawfly



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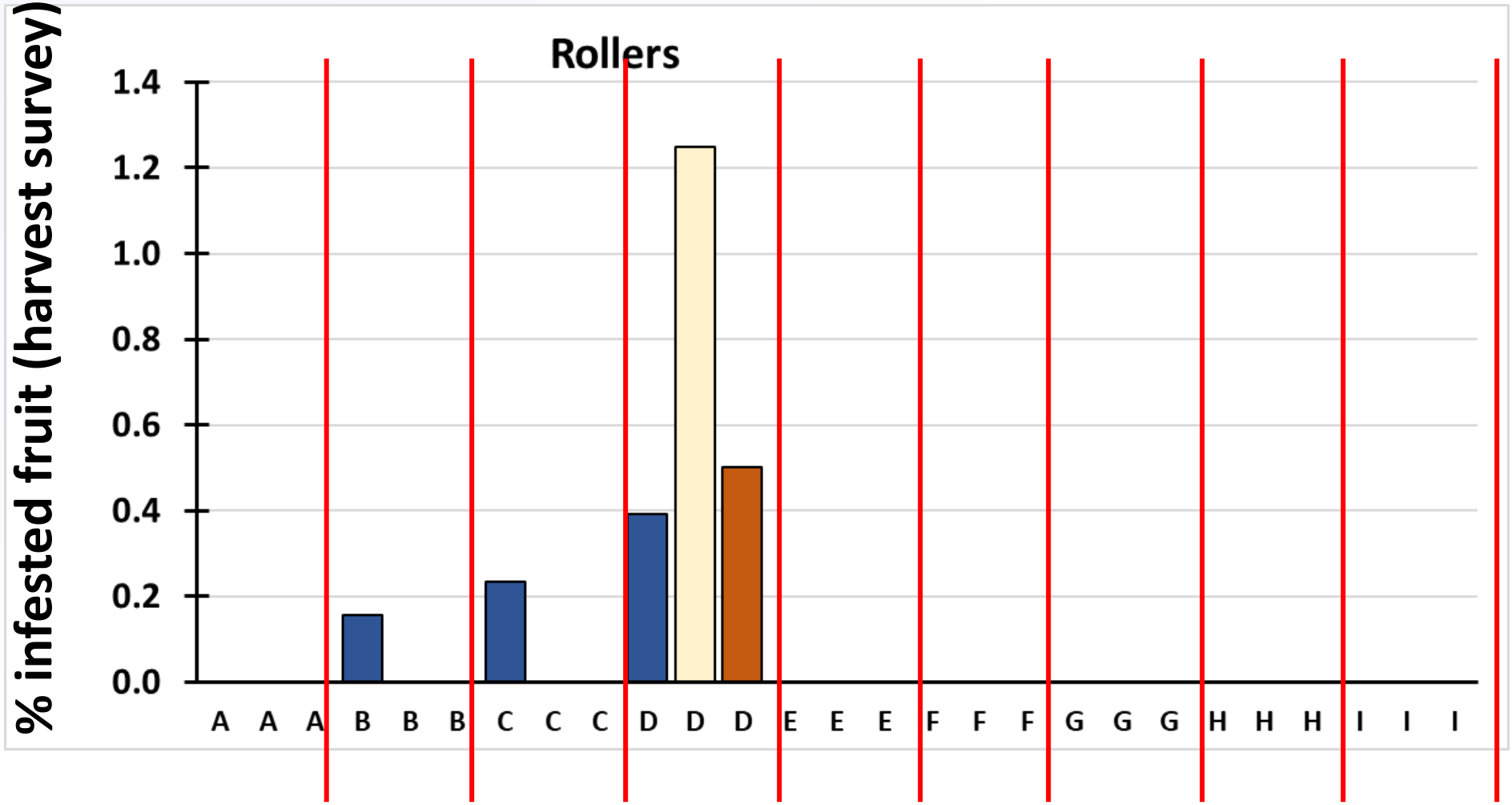
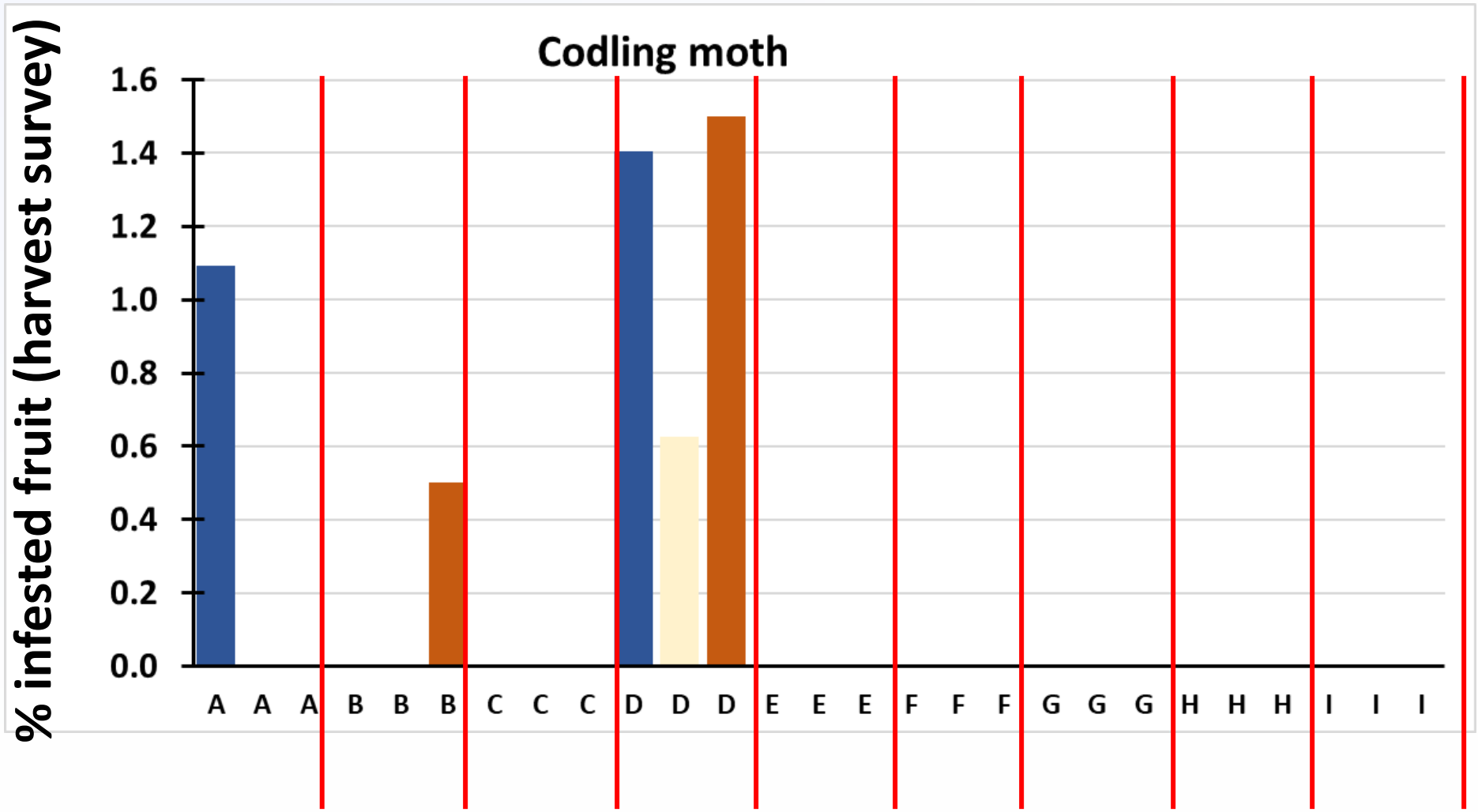
Rollers


2020
2021
2022
Rollers
% infested fruit (harvest survey)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
A A A B B B C C C D D D E E E F F F G G G H H H I I I
Orchard

Codling moth



If fruit injury at harvest is <1%, is it cost-effective to spray pre-bloom against tarnished plant bug?

Action thresholds for TPB (NETFMG)

The current action threshold is 3-4 TPB/trap by the tight cluster stage or 5 TPB/trap by the late pink stage.

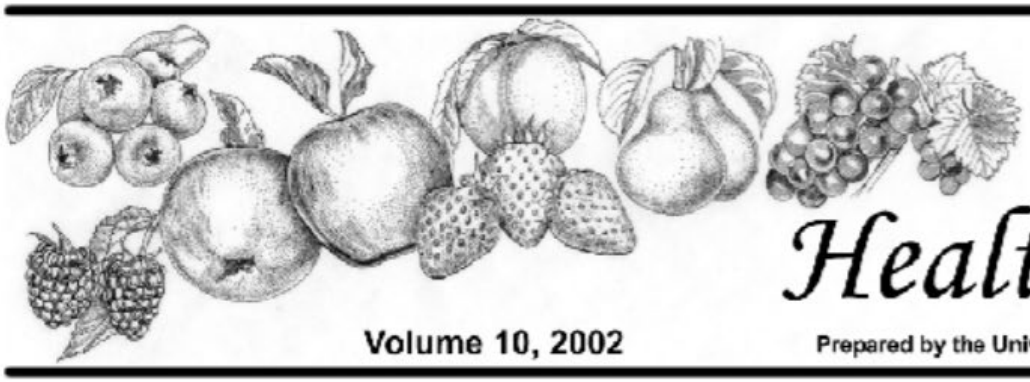
21st ANNUAL MARCH MESSAGE
TO MASSACHUSETTS TREE FRUIT GROWERS
1999

Thresholds refined by Prokopy in 1996-1998:

Type of Market	Cumulative TPB per trap (Silvertip to Tight Cluster)	Cumulative TPB per trap (Silvertip to Pink)
Wholesale (mainly fancy and extra fancy)	3	5
Retail	5	8

Action thresholds for EAS (NETFMG)

- The need for pesticide application is based on cumulative captures from pink to petal fall
- The action threshold is an average cumulative capture of 4-5/trap by petal fall in blocks receiving no pre-bloom insecticide
- Or, average cumulative capture of 6-9/trap by petal fall in blocks with pre-bloom insecticide



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Healthy Fruit

Volume 10, 2002

Prepared by the University of Massachusetts Fruit Team

Issue 7 - May 14, 2002

Current Bud Stages

Location	McIntosh Apple
Belchertown UMass CSO (05/13/02)	Late petal fall – Fruit set

Has anyone seen anything like this in the last 5 years?

European Apple Sawfly

Flight has increased a good deal since last week, with one trap catching over 100 sawflies and several trap catches greater than 30. The lateness of sawfly immigration relative to blossom is good news, since it gives time to apply an effective insecticide before the eggs hatch and larvae begin to tunnel into fruit. Guthion/Azinphos, Imidan, and Actara, all have good activity on sawfly also. Since Surround is essentially a repellent, it should go on before egglaying occurs.

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Action thresholds for CM (NETFMG)

- **IF USING DEGREE DAYS:** Check traps twice a week and begin accumulating degree-days (base 50) after sustained catches in pheromone traps (**biofix**).
- First insecticide applications should be made ~250 DD (base 50) after biofix. For the second generation: at about 1,400 DD to 1,600 DD, using the same biofix as previous spray timing.
- **IF USING TRAP CAPTURE INFO** to treat against CM based on **thresholds**, then CM suggested trap thresholds:
    - If > 5 CM are caught per trap per week using standard lures, there can be problems in fruit from future generations.
    - If trap counts continue to exceed threshold throughout the season, maintain insecticide coverage on a 2-week interval.

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Action thresholds for PC using odor-baited trap trees

- In early bloom, bait the trap tree
- Twice a week starting soon after the petal fall spray, sample each of 25 designated clusters on trap tree
- The simple approach calls for a peripheral-row spray when a threshold of 1 fresh egg-laying scar per 25 fruit is reached
- Step-by-step procedure described in Fact Sheet (UMass Extension)

Action thresholds for AMF

- ✓ Spray insecticides when 2 AMF on average accumulate on unbaited spheres or when 5 AMF on average accumulate on baited spheres

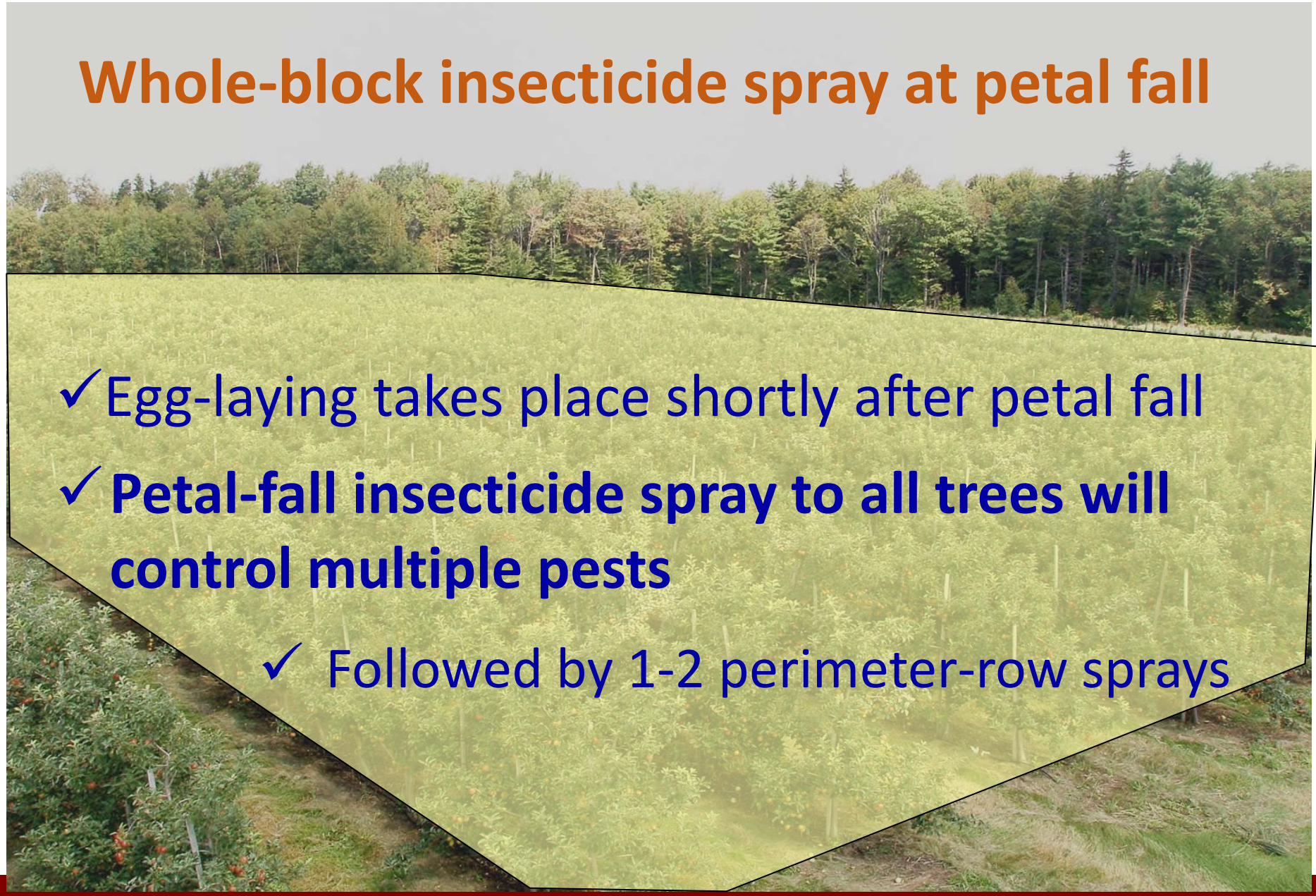
Effective insecticides

New England

Tree Fruit Management Guide

https://netreefruit.org

Timing insecticide sprays against plum curculio is KEY



Whole-block insecticide spray at petal fall

- ✓ Egg-laying takes place shortly after petal fall
- ✓ **Petal-fall insecticide spray to all trees will control multiple pests**
  - ✓ Followed by 1-2 perimeter-row sprays

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Insecticides effective against plum curculio

1A - Carbamates
1B - Organophosphates
4A – Neonicotinoids
22 – Oxadiazines
28 – Diamides
6 - Avermectins
3 - Pyrethroids

IRAC	PRODUCT	RATE/ ACRE	REI- HOURS	PHI- DAYS	EFFICACY	COMMENTS
1A	Sevin		12	3	moderate	
1B	Imidan 70W	2.1 to 5.7	4 days	7	High	
4A	Actara	4.5 to 5.5 oz.	12	35	High	PHI varies with rate.
22	Avaunt eVo	5 to 6 oz.	12	14	High	
28	Exirel	13.5 to 20.5 fl. oz.	12	3	High	Avoid tank mix with Captan.
28	Verdepryn 100SL	5.5 to 11 oz	4	7		
4A + 28	Voliam Flexi WDG	6 to 7 oz.	12	35	High	
6 + 4A	*Agri-Flex SC	5.5 to 8.5 fl. oz.	12	35	High	Add horticultural oil (not dormant oil) at 1 gallon per acre.
3, 28	*Besiege	6 to 12 fl oz	24	21		

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SPRAY TABLE FOR APPLE INSECT PESTS (SUMMER). Source: New England Tree Fruit Management Guide

HIGH - **MODERATE** EFFECTIVENESS

	Active ingredient	IRAC	Apple maggot	Stink bugs	Codling moth	Oriental fruit moth	Obliquebanded leafroller	San Jose scale	Wooly apple aphid	Potato leafhopper
Intrepid 2F *(IGR)*	Methoxyfenozide	18			M	M	H			
Dipel DF **(OMRI)**	B.t.	11A			M	M	H			
Assail 30SG	Acetamiprid	4A	H	M	H	H		M	M	H
Delegate 25WG	Spinetoram	7			H	H	H			
ALTACOR 35WDG	Chlorantraniliprole	28			H	H	H			
Avaunt 30WDG	Indoxacarb	22	M		M	M				H
Exirel	Cyantraniprole	28	M		H	H	H			H
Imidan 70W	Phosmet	1B	H		H	H		M		
Movento 240SC	Spirotetramat	23						H	H	
Voliam Flexi WDG	Thiamethoxam + chlorantraniliprole	28 + 4A		H	H	H	H			H
Belt 4SC	Flubendiamide	28			H	H	H			
Danitol 2.4 EC	Fenpropathrin	3		M	H					
Actara 25WDG	Thiamethoxam	4A		M						H
Entrust SC **(OMRI)**	Spinosad	5			M	M				
Admire PRO 4.6SC	Imidacloprid	4A					H	M	M	H
Verdepryn 100SL	Cyclaniliprole	28								
Spear-Lep	GS-OMEGA/ KAPPA-HXTX-HV1A (peptide)	32			?	?	?			
Senstar	Pyriproxyfen + Spirotetramat	23 + 7C			Suppression only			Suppression only	H	

This list is not exhaustive for every active ingredient or labeled product. No endorsement of products mentioned is intended, nor is criticism implied of products not mentioned.

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Insecticide coverage and RESIDUAL toxicity are very important in the presence of rainfall

Rainfast characteristics of insecticides on fruit

John Wise, Michigan State University Extension, Department of Entomology - Ju
2019

Compound class	Persistence (residual on plant)	Plant penetration characteristics	Rainfast rating
Organophosphates	Medium - Long	Surface	Low
Carbamates	Short	Cuticle Penetration	Moderate
Pyrethroids	Short	Cuticle Penetration	Moderate - High
Neonicotinoids	Medium	Translaminar & Acropetal	Moderate
Oxadiazines	Medium	Cuticle Penetration	Moderate
Avermectins	Medium	Translaminar	Moderate
IGRs	Medium - Long	Translaminar	Moderate
Spinosyns	Short - Medium	Translaminar	Moderate - High
Diamides	Medium - Long	Translaminar	Moderate - High

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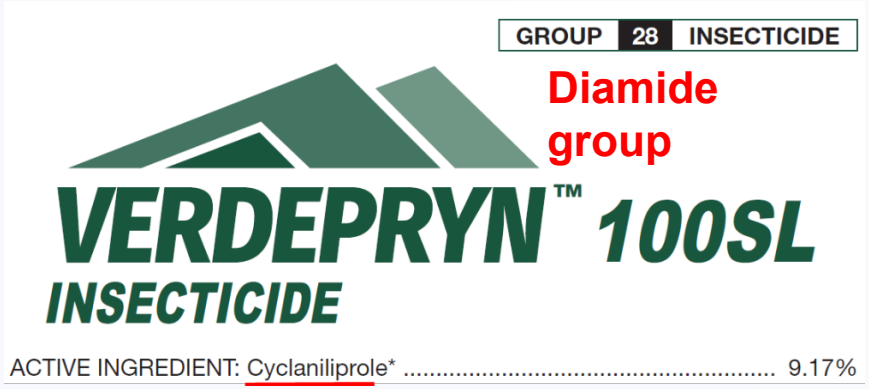

Labeled against many pests in pome and stone fruit, grapes, berries, etc.

- Most diamide insecticides are **translaminar** and **systemic**.
- Long residual activity and broad-spectrum control.
- **Verdepryn**: **REI**= 4hrs, **PHI**= 7 days (pome fruits)
- **Rainfastness** of diamide insecticides: **HIGH** in fruit (up to 1 inch of rainfall).
- **Rainfastness** of oxadiazine insecticides (AVAUNT): **MODERATE** in fruit (up to 1 inch of rainfall).

Source: Dr. John Wise, Michigan State Univ.

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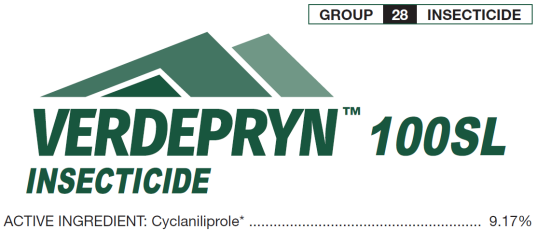

Examples from the label

POME FRUIT PESTS:

- Codling moth
- Obliquebanded leafroller
- Green fruitworm
- Redbanded Leafroller
- Variegated leafroller
- Oriental Fruit moth
- Tufted apple budmoth
- White apple leafhopper
- European apple sawfly
- Spotted tentiform leafminer
- Western tentiform leafminer
- European corn borer
- Oriental Fruit moth
- Western flower thrips**
- Apple Maggot**
- Plum Curculio
- Pear psylla
- Stink bug spp.**

Pear Psylla:

- For best results, apply to first generation nymphs using the high rate of 11 fl oz/A.
- Performance is enhanced when used with an effective adjuvant

Plum curculio:

- For best results, apply higher label rates: 8.2 – 11 fl oz/Acre

**Suppression Only

2021 (UMass) evaluation of Verdepryn for PC control

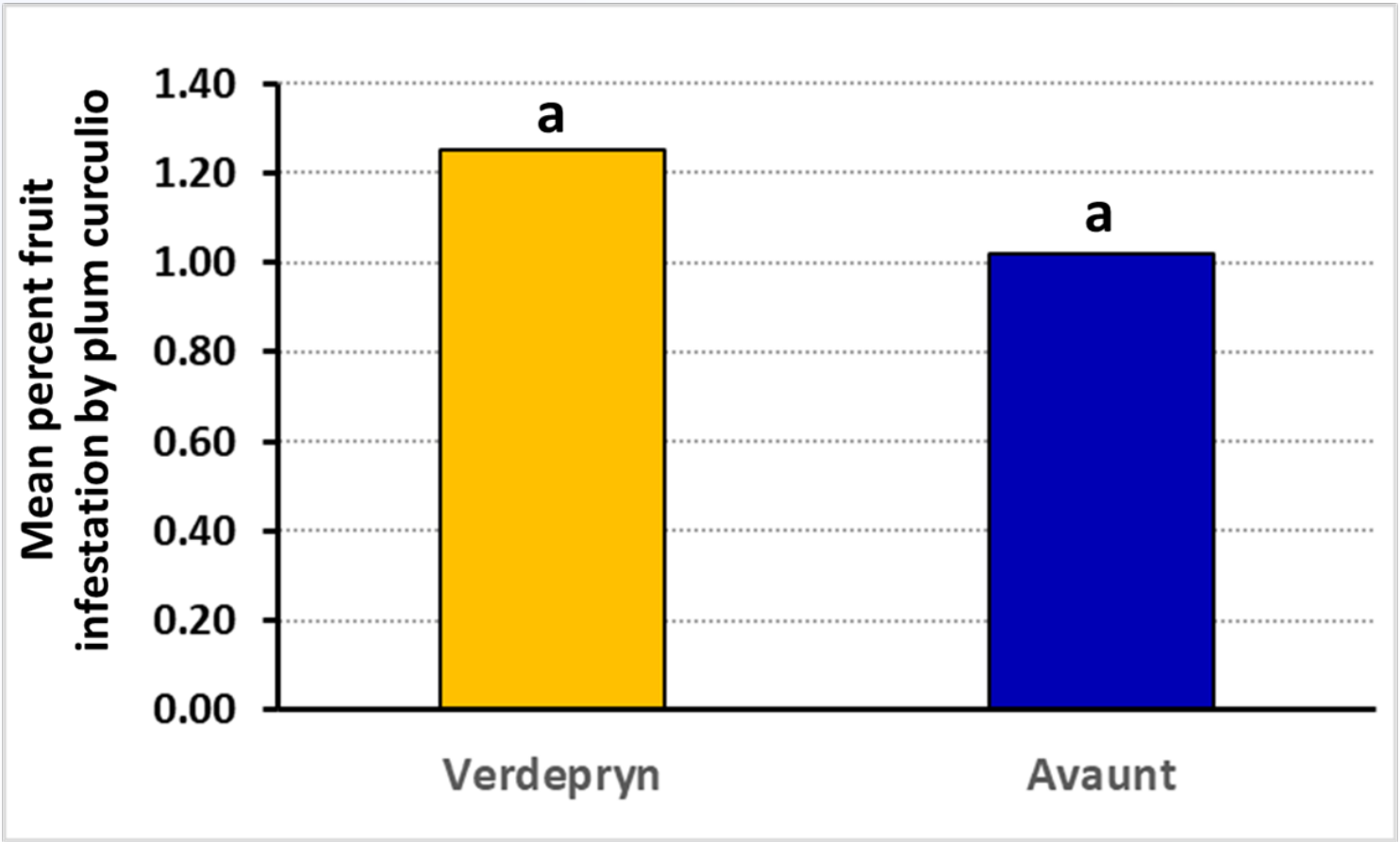

Figure 2. Across six sampled blocks at the UMass CSO, average level of plum curculio injury to sampled fruit according to insecticide type. Same letters above bars denote lack of statistically significant differences between treatments at odds of 19:1.

One fruit grower in Rhode Island evaluated Verdepryn applied against PC at petal fall.

The level of injury recorded in the June 1st sampling was 0.26%

Work in collaboration with H. Faubert (URI)

“We can’t solve problems by using the same kind of thinking we used when we created them”

-Albert Einstein