Apple Arthropod Management & Pesticide Update - Early Season

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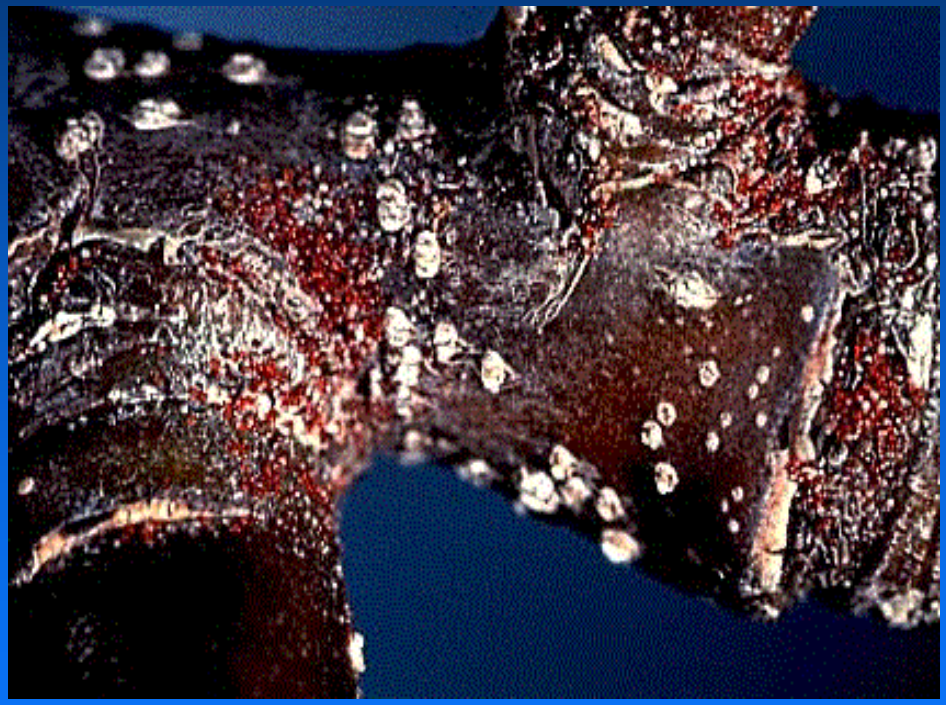
EUROPEAN RED MITE

Panonychus ulmi

Adult female



Overwintering eggs

Some Guiding Principles of Mite Management

• Can be considered a 2-phase process:
- Early season program, against overwintering generation
- Summer program, against new populations

• Usually, a preventive approach (i.e., without need to sample) is advised for early season, depending on previous year's pressure:
- delayed dormant oil, an ovicide-larvacide (Apollo/Savey/Onager/Zeal) applied prebloom or (with addition of Agri-Mek) after petal fall.

• For summer populations, scouting/sampling advised to pick up rapid mite increases on new foliage, especially during early summer when trees are most susceptible.
- Thresholds increase as the summer goes on:
June: 2.5 ERM/leaf; July: 5.0 ERM/leaf; Aug: 7.5 ERM/leaf
- When numbers of motiles (everything but eggs) reach or approach threshold, a "rescue" material can be recommended:

Acramite, Apollo, Carzol, Envidor, Kanemite, Nexter, Onager, Portal, Savey, Vendex, Zeal

Effectiveness of Prebloom Oil Through Time

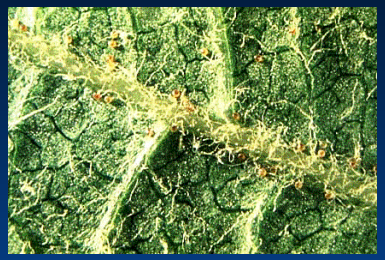
- Winter eggs of ERM become more susceptible to killing with oil as hatch period approaches.
- For effective control, want 95% kill of eggs; can be achieved with adequate spray coverage.
- 100 (acceptable) to 300 (preferred in large trees) gal/A needed.

% Oil needed for effective control at different periods (Chapman & Lienk)

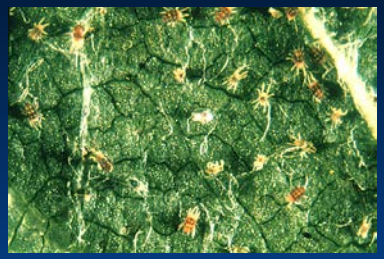
Dormant	Silver Tip	Green Tip	1/2" Green		Tight Cluster	Pink
6%	4%	3%	2%	1.5%	1%	1%

EUROPEAN RED MITE LIFE HISTORY

overwintered eggs;
bases of buds, spurs



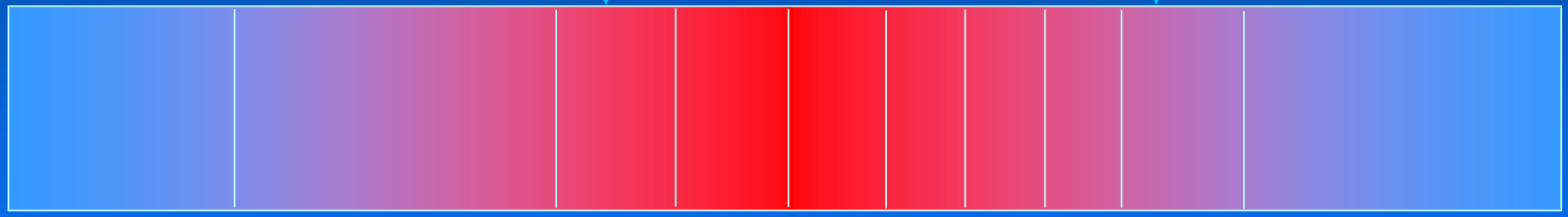
1st
summer
eggs



mixed stages;
7-8 generations

1st
winter
eggs

eggs hatch;
nymphs, larvae



Dormant

TC
(Macs)

Pink

Petal
Fall

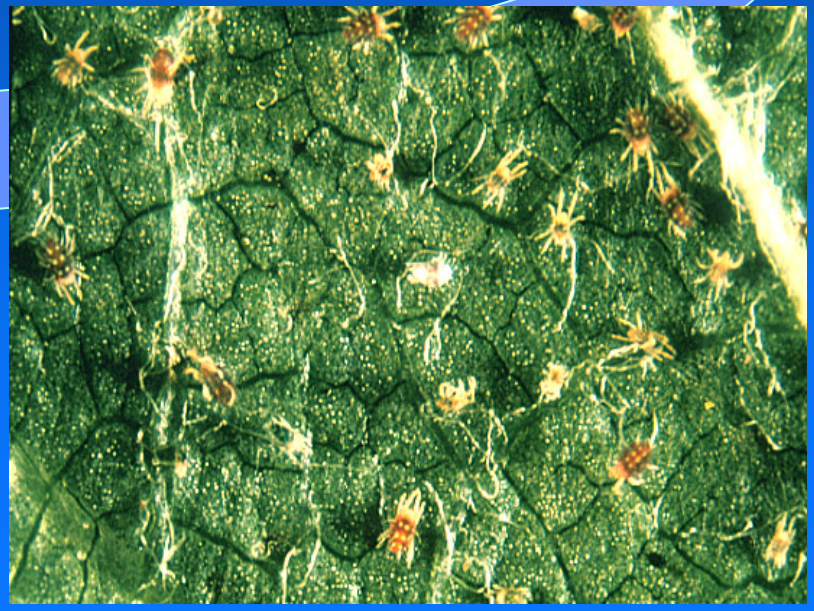
Fruit
Set

mid-
June

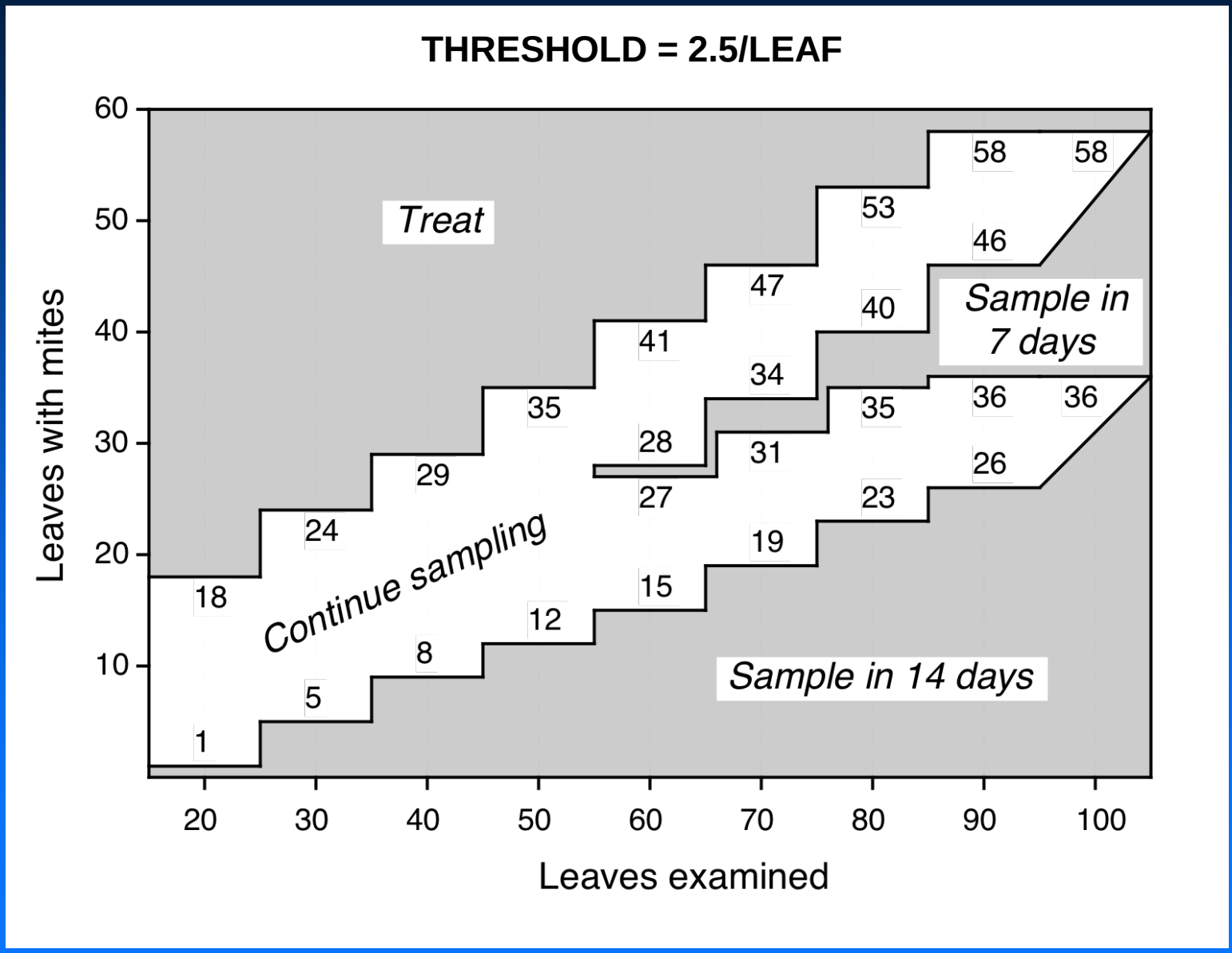
Early
August

EUROPEAN RED MITE

ERM summer motiles



SEQUENTIAL SAMPLING CHART FOR MITES



Managing Mite Resistance

- Because mites have many generations per year, potential to develop resistance is high.

- Resistant mites are theoretically “less fit" or weaker than susceptible individuals
- Have shorter lives:
  - physically smaller or weaker
  - produce fewer offspring
  - take longer to develop
  - mating success is lower
- In the absence of competition from susceptible individuals, resistant pests rapidly multiply.

KEY TO MANAGEMENT OF RESISTANCE TO INSECTICIDES AND MITICIDES:
- Reduce Selection Pressure that Favors the Survival of Resistant Individuals

Potential Tactics for Reducing Selection Pressure for Miticide Resistance
- Treat different generations with materials of different chemical classes.
- Use nonchemical control tactics where possible (e.g., biological control; predators).
- Good miticide stewardship:
  - Apply only when necessary
  - Use correct dosages
  - Obtain adequate coverage
  - Optimize timing

Choosing a Miticide

1992 Options

- oil
- Morestan (prebloom)
- Carzol
- Omite
- Vydate
- Kelthane

• Many more options today, but important to keep in mind how they may/may not differ

[1A] Carzol: carbamate; acetylcholinesterase inhibitor
[12B] Vendex: disrupts ATP formation

[6] Agri-Mek: GABA site; affects Cl-ion channel; inhibits nerve transmissions
[25] Acramite: GABA site (probably); contact activity

[10A] Apollo/Savey/Onager: growth inhibitors
[10B] Zeal: growth inhibitor

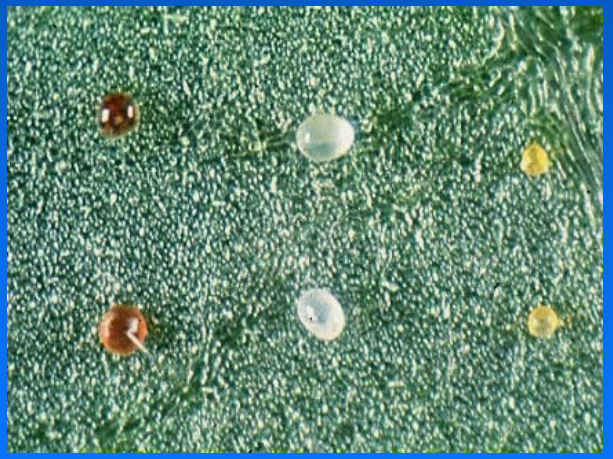
[20B] Kanemite: METI (mitochondrial electron transport inhibitor), Site II
[21] Nexter/Portal: METI (mitochondrial electron transport inhibitor), Site I

[23] Envidor: inhibitor of lipid synthesis

IRAC - Insecticide Resistance Action Committee
• International organization committed to prolonging the effectiveness of pesticides at risk for resistance development.
• The number codes represent Mode of Action Classification Groups.
• An arthropod population is more likely to exhibit cross-resistance to materials within the same group.

BIOLOGICAL CONTROL OF EUROPEAN RED MITE

Major species
Phytoseiidae:
Typhlodromus pyri
Amblyseius fallacis
Stigmaeidae:
Zetzellia mali



Eggs

San Jose Scale

Two generations per year in NY

- Crawlers emerge about mid-June and in early August in WNY
- Can be timed by using DD accumulations:
  - 1st gen: 500 DD (base 50˚ F) from March 1, or 310 DD after 1st adult catch
  - 2nd gen: 1450 DD from March 1, or 400 DD after 1st adult catch
- Can monitor for crawlers using tape traps on scaffold branches

San Jose Scale Treatment Considerations

- Problem populations more common in larger, poorly pruned standard size trees with inadequate spray coverage
- Early season sprays help prevent SJS establishment
  - Oil at dormant to 1/2-inch green
  - ½-inch Green to Tight Cluster:
    - Oil
    - Lorsban 4EC or Supracide
    - Esteem (IGR) *plus oil*
    - Centaur (IGR)

- Early season pruning to remove infested branches, open up canopy for better coverage
- Well-timed summer sprays at 1st and peak (7-10 days later) crawler activity: Esteem, Centaur, OPs, Provado, Movento* (PF-1st cover)

Movento 240SC

Bayer CropScience

Active Ingredient: Spirotetramat

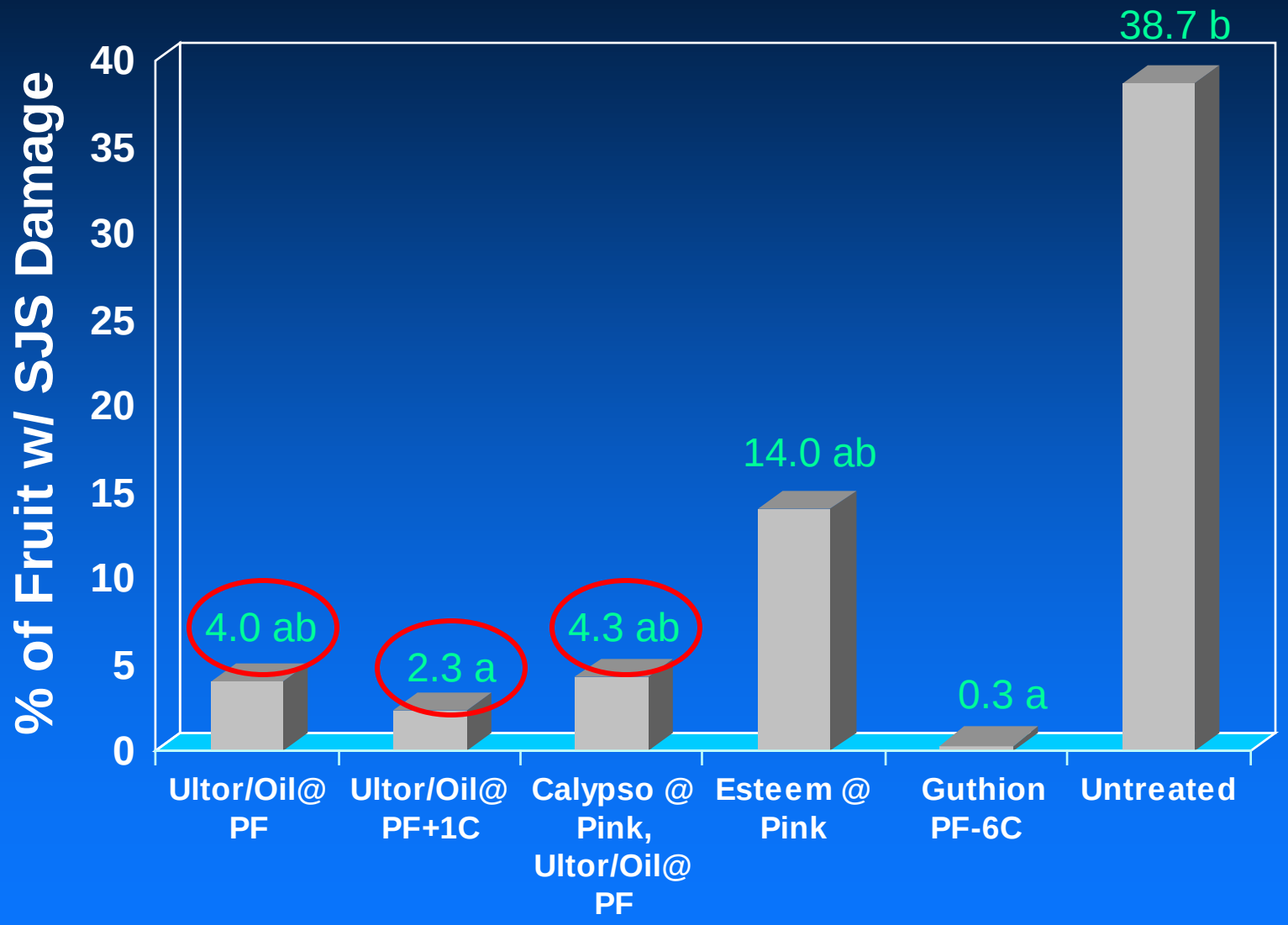
- Tetramic acid insecticide
- 2-way systemic activity, moves to all areas of the plant, including new shoot, leaf and root tissues
- Primary mode of action: ingestion
- Lipid biosynthesis inhibitor active against immatures; also, reduced egg-laying and offspring survival when adults treated
- Primary targets: sucking insect pests
  - Scales, Aphids, Pear Psylla, Mealybugs, Thrips
- Short PHI (7 days) and REI (24 hr)
- Favorable environmental profile
  - minimal risk to beneficial insects

Treatments

H. Reissig & D. Combs, 2007

1.	Ultor 150SC 14.0 oz/A + 1.0% Oil	@ Petal Fall
	Belt 480 SC	@ 2C-6C
2.	Ultor 150SC 14.0 oz/A + 1.0% Oil	@ Petal Fall + 1C
	Belt 480 SC	@ 2C-6C
3.	Calypso 4F 3.0 oz/A	@ Pink
	Ultor 150SC 14.0 oz/A + 1.0% Oil	@ Petal Fall
	Belt 480 SC	@ 2C-6C
4.	Esteem 35WP 5.0 oz/A	@ Pink
	Belt 480 SC	@ 2C-6C
5.	Guthion 50WSP 1.5 lb/A	@ Petal Fall-6C
6.	Untreated Check	

Damage from SJS at Harvest



TARNISHED PLANT BUG

Adult

Older nymph

Damage to fruit

Tarnished Plant Bug

- Monitoring Methods
  - Can use white sticky-board traps, but generally very sensitive
  - Most injury caused by Pink
- Threshold

Prebloom-Petal Fall: 3 bleeding sites/tree, 5 adults by tight cluster or 7 by late pink stage

- Control Tactics
  - Insecticides (advisability questionable): pyrethroids*, Beleaf
  - Good orchard floor management to reduce alternate weed hosts essential

Beleaf 50SG

(Flonicamid) - FMC

- **New Chemistry, new mode of action**
  - Pyradinecarboxamide - “selective feeding blocker”
  - Efficacy against aphids and plant bugs
  - Not yet tested in NY, but NJ reports good results against green peach aphid and TPB in peaches
  - Label also lists rosy apple aphid, green aphids, and woolly apple aphid
- **Low toxicity to beneficial arthropods**
- **Labeled in pome fruits and stone fruits**
- **REI = 12 hrs; PHI = 21 days**

Plum Curculio

Monitoring Methods

After 1-2 warm (60˚ F) evenings following petal fall, egg laying will start

Threshold

Appropriate weather/phenology conditions

Control Tactics

Guthion, Imidan, Actara, Calypso, Avaunt, Pyrethroid

Surround an option for organic growers.

Can stop sprays at 308 DD (base 50˚ F) after petal fall of apples

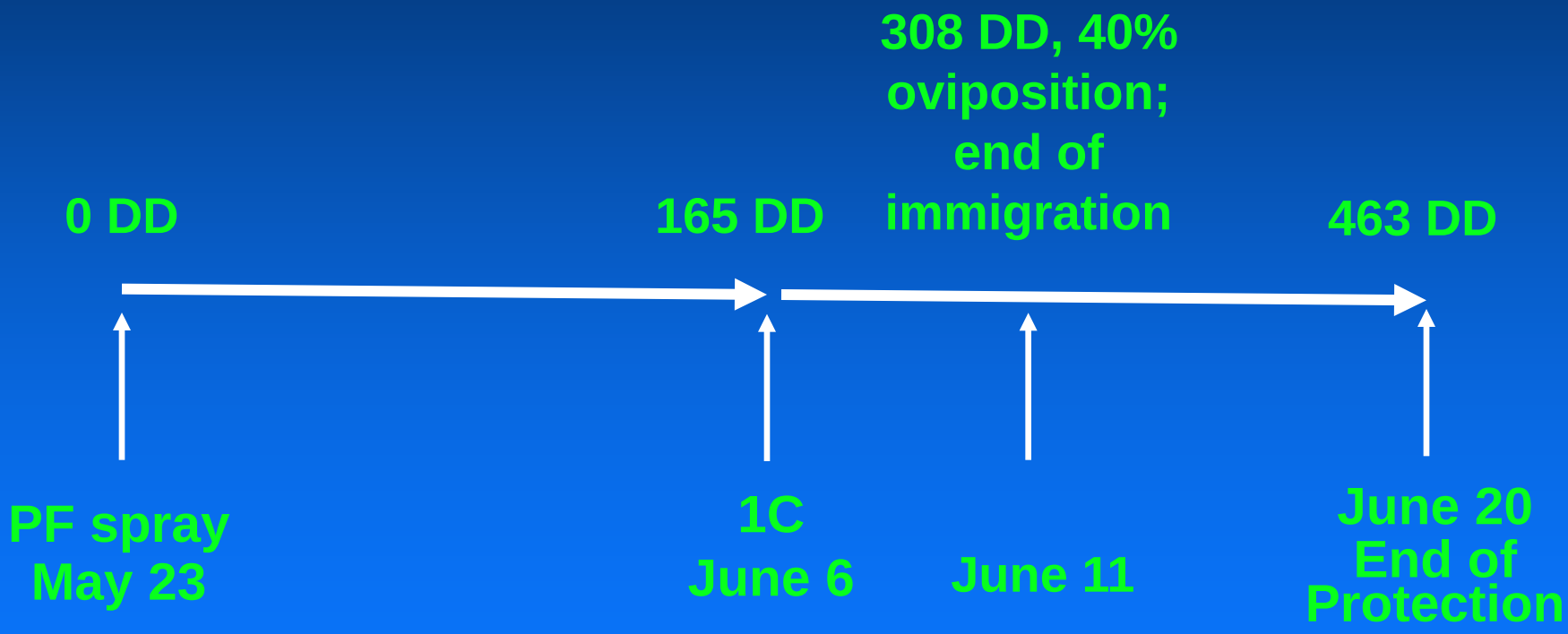
[Warm spring: 2 sprays; cold spring: 3 sprays]

PLUM CURCULIO OVIPOSITION MODEL

- Experimentally derived from modeling cumulative Plum Curculio oviposition and DD accumulation (base temp 50˚ F) after petal fall.

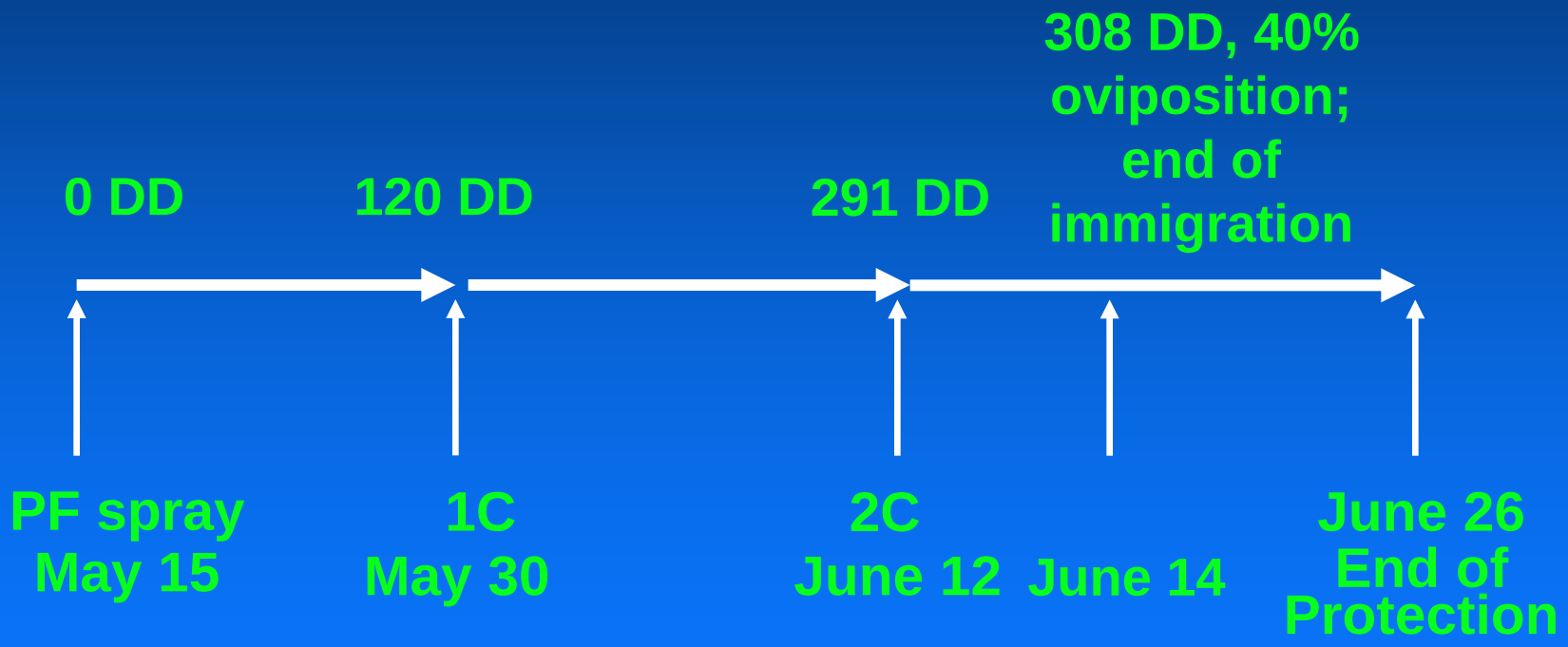
- Model assumes that fruit requires protection from petal fall until about 40% of the cumulative oviposition is completed (308 DD) ➔ corresponds with the end of their immigration into orchard.

EXAMPLE OF PLUM CURCULIO MODEL PREDICTIONS IN GENEVA FOR THE 2005 SEASON



2 Total sprays needed

EXAMPLE OF PLUM CURCULIO MODEL PREDICTIONS IN GENEVA FOR THE 2006 SEASON



3 Total sprays needed

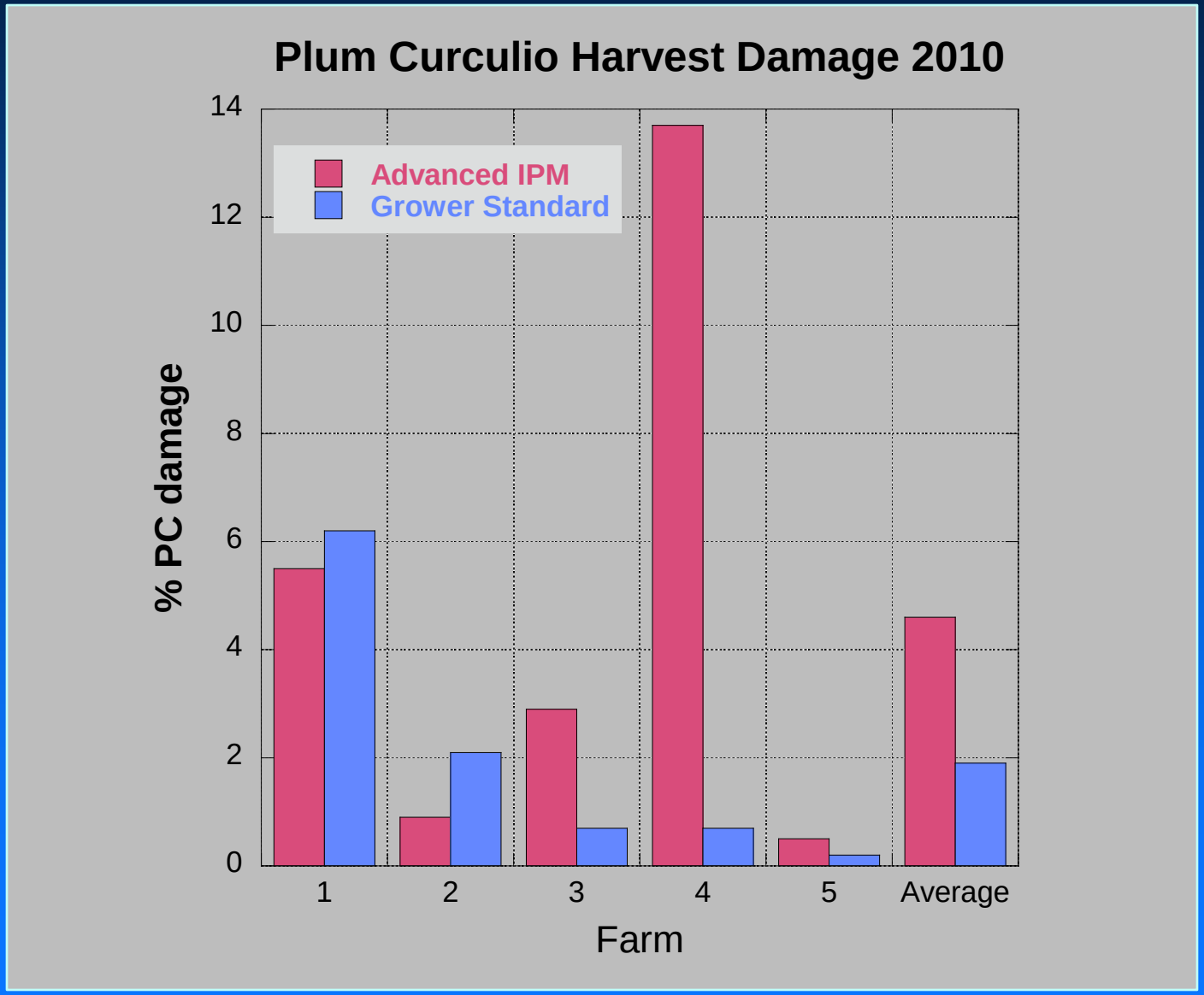
WHY DOES THE MODEL WORK?

- Indigenous and early immigrating PC in treated orchards are killed by the petal fall and any subsequent sprays.
- After 40% oviposition, PC immigration into orchards and movement between trees is nearly over.
- Protection until the end of the oviposition cycle therefore not necessary.

"Advanced IPM" Tactics for Plum Curculio Odor-Baited Trap Tree Approach

- Trap Trees set up around perimeter prior to Petal Fall
- Baited with olfactory attractant (benzaldehyde) and aggregation pheromone
- Full block spray at PF; later sprays applied to trap trees only (according to degree day oviposition model)
- Fruit damage assessments in Trap Tree and nearest neighbor trees at harvest

Results


Plum Curculio Harvest Damage 2010
Advanced IPM
Grower Standard
% PC damage
0
2
4
6
8
10
12
14
1
2
3
4
5
Average
Farm

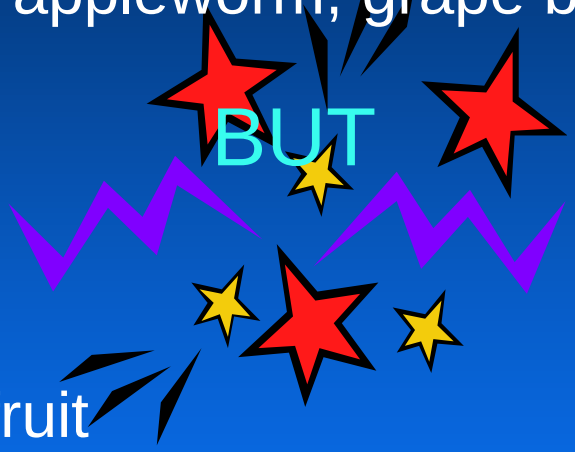
Obliquebanded Leafroller, *Choristoneura rosaceana*

Foliar damage by summer brood

Fruit damage by summer brood

Why OBLR Doesn't Fit the Mold

- 'Terrible Tortricid' - Same family as codling moth, oriental fruit moth, lesser appleworm, grape berry moth



- Prefers foliage to fruit
- Overwinters as a larva, not as a pupa
- Causes feeding damage much earlier than other worms
- Life cycle is out of sync with most other pests
- Has a great capacity to develop insecticide resistance

OBLR Overwintered Brood

- Overwinters as 1st or 2nd instar on tree or in protected location nearby (spins hibernaculum)
- Larva becomes active in spring when buds open
- Ties leaves together to conceal itself
- Often found in blossom cluster, even inside flower
- Feeds on newly set fruit buds; most abort, those that don't are misshapen with large, deep cavities
- Traditionally causes 2-3% damage, often not noticeable; becoming more of a problem.

Control of Overwintering OBLR Larvae - Is it Economically Jusitified?

- Most fruit damaged before petal fall drops before harvest
- OW-OBLR damage at harvest is usually <1%
- Potential benefits from controlling early generation
  - Reduction of early season fruit damage
  - Possible reduction of subsequent damage from the summer generation
- Decisions for Controlling Overwintering OBLR
  - Sample for larvae at bloom
  - Base decision on past history of OBLR infestations

Insecticide Efficacy against Overwintering OBLR

- Recommended products:
  - Proclaim
  - Rimon
  - Intrepid
  - B.t.s
  - Altacor/Belt/Delegate possible, but probably better to save for internal Leps in summer
  - Lorsban 75WG still labeled for PF; suitable for susceptible populations
- Usually one spray (PF) as good as two (Pink & PF)
- Fruit damage usually reduced by 40-60%
- Newer IPM-compatible insecticides may have sub-lethal effects on surviving adults.

Implications for Future Management of OBLR with Soft Insecticides

- Preliminary research suggests “soft insecticides” are not necessarily less toxic to beneficials helping to control OBLR than are conventional materials.
- OBLR adults appear to be very mobile & capable of re-infesting nearby clean orchards during the summer.
- Therefore, stable insecticide control cannot be maintained in relatively small areas, even after multiple seasons of treatment with soft materials.

Delegate 25WG
(Spinetoram) - Dow AgroSciences

- Spinosyn (same class as SpinTor)
  - Chemically modified spinosad to be more active and effective against a broader range of insects
  - Efficacy against internal feeding Lepidoptera such as oriental fruit moth & codling moth; plus leafrollers
  - Additionally, thrips and psylla (rec. use of adjuvant)
  - [“Suppression” against plum curculio and apple maggot]
- Acts by disrupting insect nerve function
- Nontoxic to birds, fish, aquatic invertebrates, and most beneficial arthropods
- Labeled in pome fruits and stone fruits
- REI = 4 hrs; PHI = 7 days

Proclaim 5SG

(Emamectin benzoate) - Syngenta

- Avermectin (2nd generation); related to Agri-Mek
- Labeled in pome fruits (restricted use)
  - Primary target pests are leafrollers, leafminers and fruitworms
  - “Suppression of oriental fruit moth, codling moth, pear psylla, and spider mites”
  - Translaminar, quickly absorbed into leaf tissue
  - Recommend adjuvant (HMO, or non-ionic surfactant)
- REI = 48 hrs; PHI = 14 days

Altacor 35WG

Active Ingredient: Rynaxypyr

- Novel anthranilic diamide insecticide
- Translaminar activity
- Primary mode of action: ingestion
- Affects insect ryanodine receptors (calcium regulation), causes paralysis
- Primary targets: Lepidoptera - OBLR, Codling Moth, Oriental Fruit Moth, European Apple Sawfly, Leafminers
- Short PHI (5 days) and REI (4 hr)
- Favorable environmental profile
  - low impact on beneficial insects
  - does not flare mites or secondary pests
  - low toxicity to bees, birds, fish and mammals

Belt 480SC

Bayer CropScience

Active Ingredient: Flubendiamide

- Novel phthalic acid diamide insecticide
- Translaminar activity, strong rainfast characteristics
- Primary mode of action: ingestion
- Affects insect ryanodine receptors (calcium regulation), causes cessation of feeding, paralysis
- Primary targets: Lepidoptera - OBLR, Codling Moth, Oriental Fruit Moth, Leafminers
- Short PHI (14 days) and REI (12 hr)
- Favorable environmental profile
  - minimal risk to beneficial insects, honey bees

Possible Seasonal Programs Using Reduced-Risk or OP-Replacement Products

Pink

- Rosy Apple Aphid: Actara, Assail, Calypso, Beleaf
  Leafminers: Actara, Altacor, Assail, Calypso

Petal Fall

- Plum Curculio: Actara, Avaunt, Calypso
  Internal Leps: Assail, Avaunt, Calypso, Delegate, Intrepid, Rimon, Altacor, Belt
- OBLR: B.t., Delegate, Intrepid, Proclaim, Rimon, Altacor, Belt
- European Apple Sawfly: Actara, Assail, Avaunt, Calypso, Altacor

Summer

(to be continued...)