

Update on Pest Management with New Chemistries

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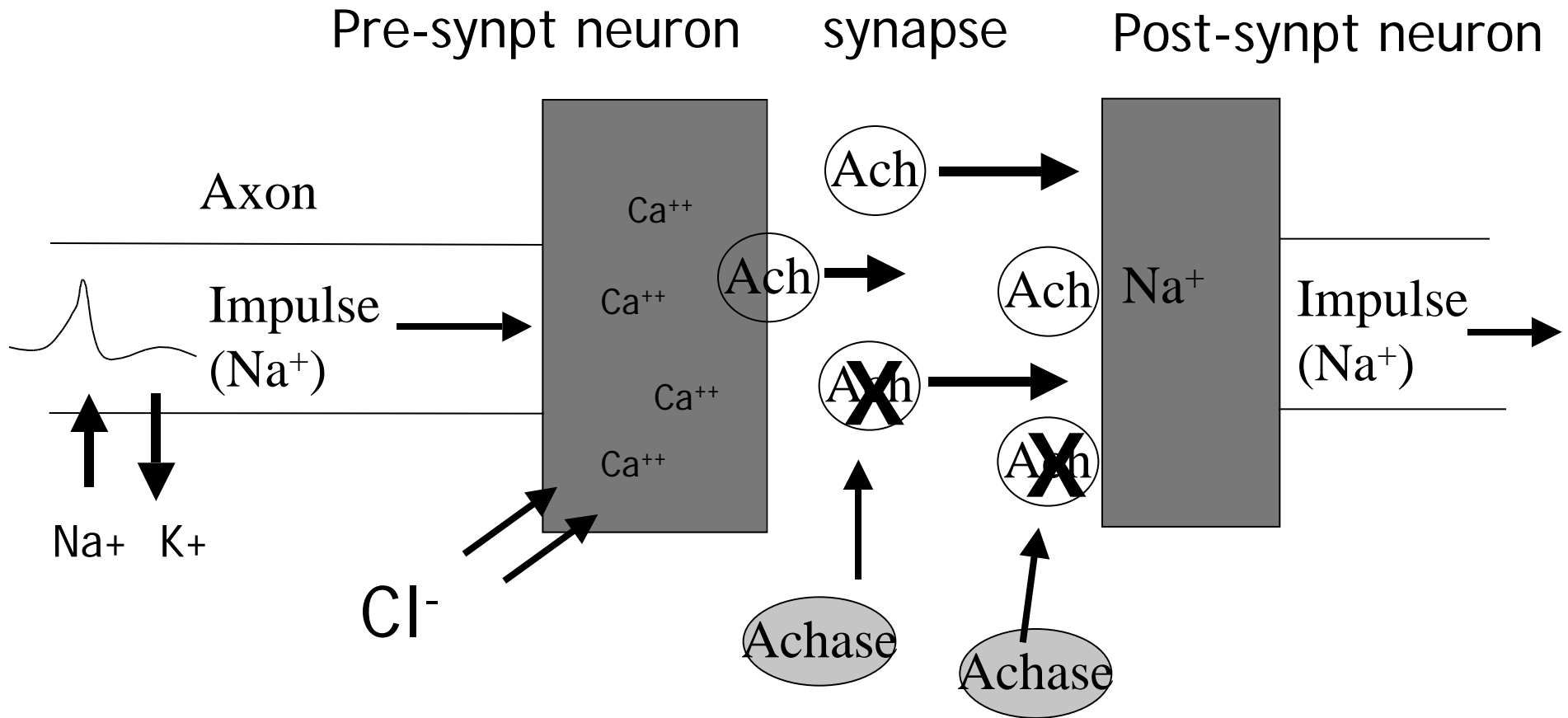


New Chemistries in IPM

- Mode of action of various new insecticides
- Use patterns against Lepidopteran pests
 - Lacanobia
 - Leafroller
 - Codling moth

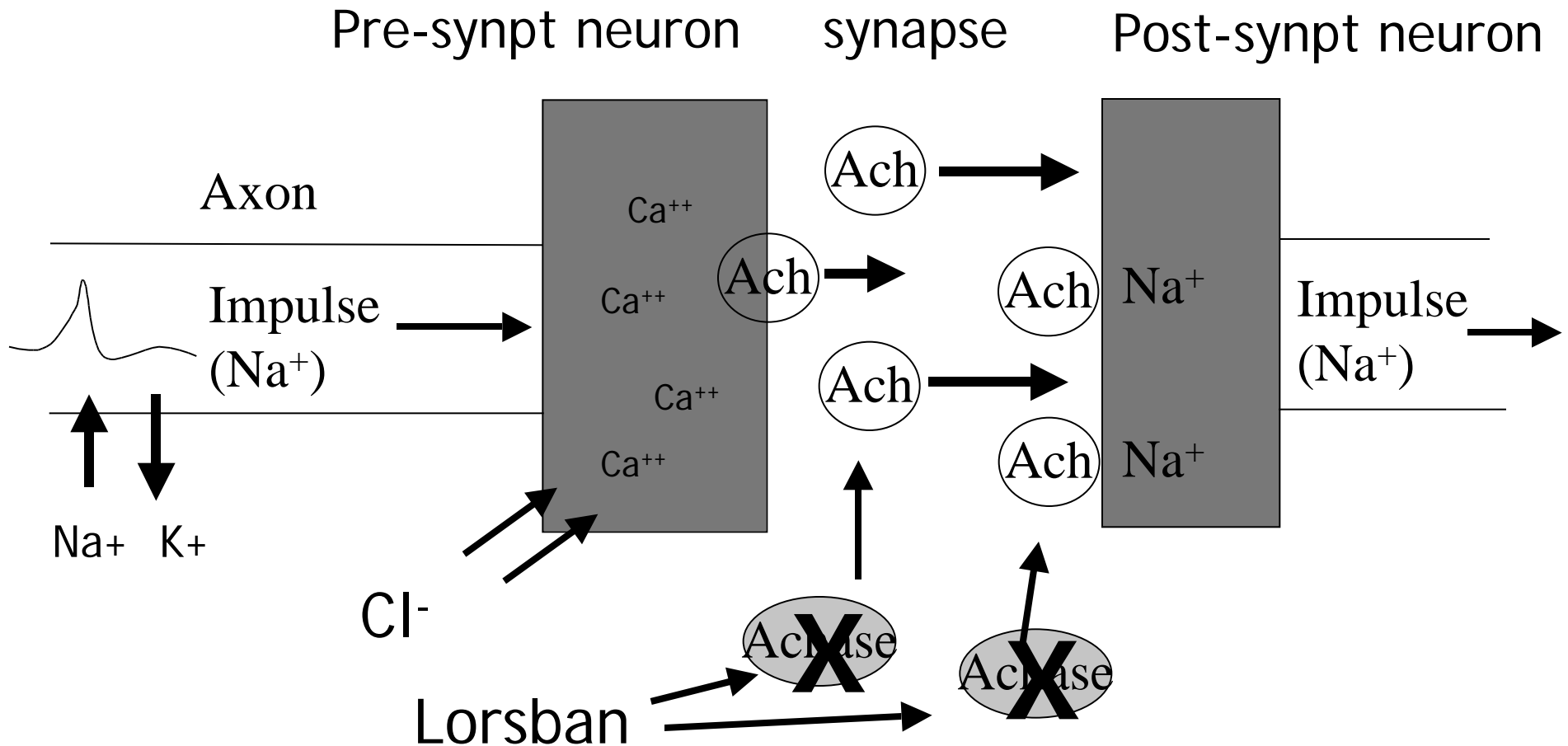


Normal nerve synapse



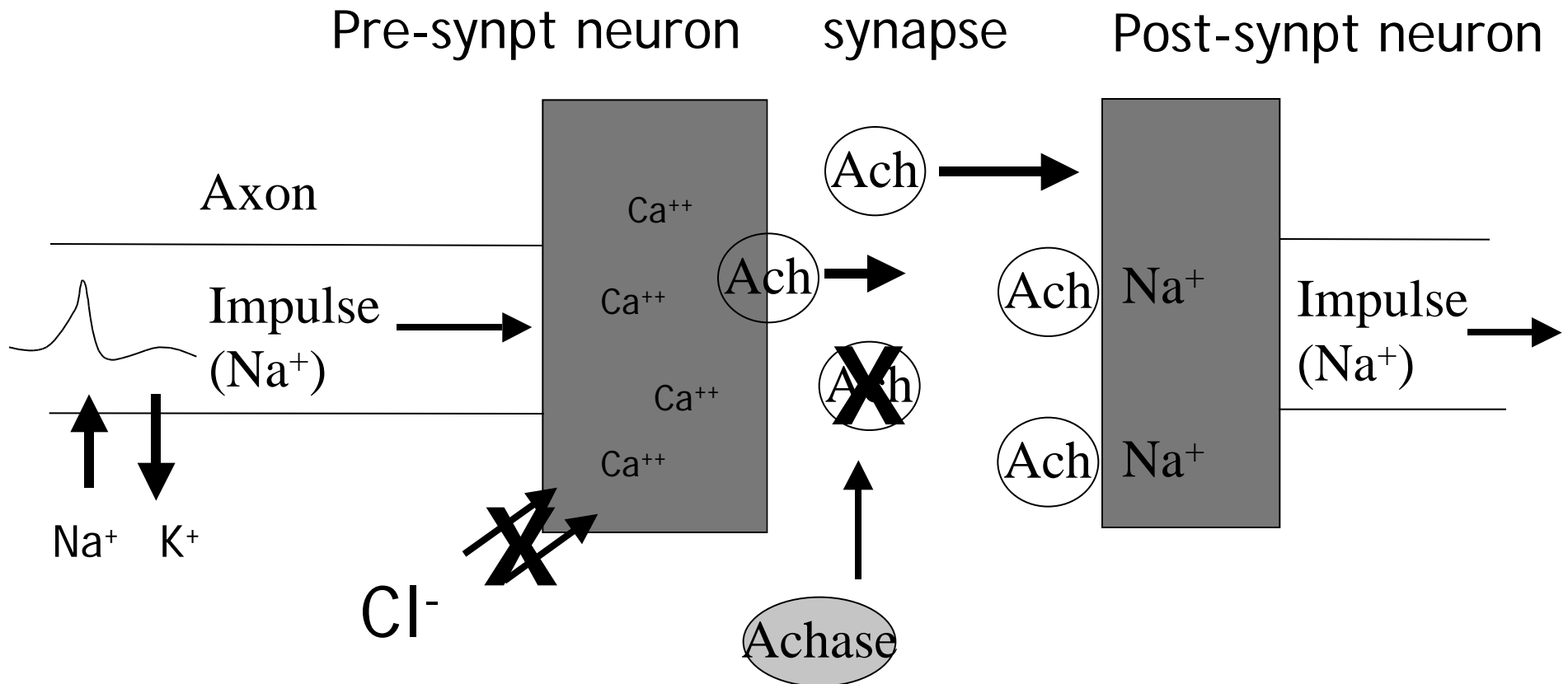
Acetyl cholinesterase inhibitors (OPs)

- *Continuous firing of post-syn nerve*



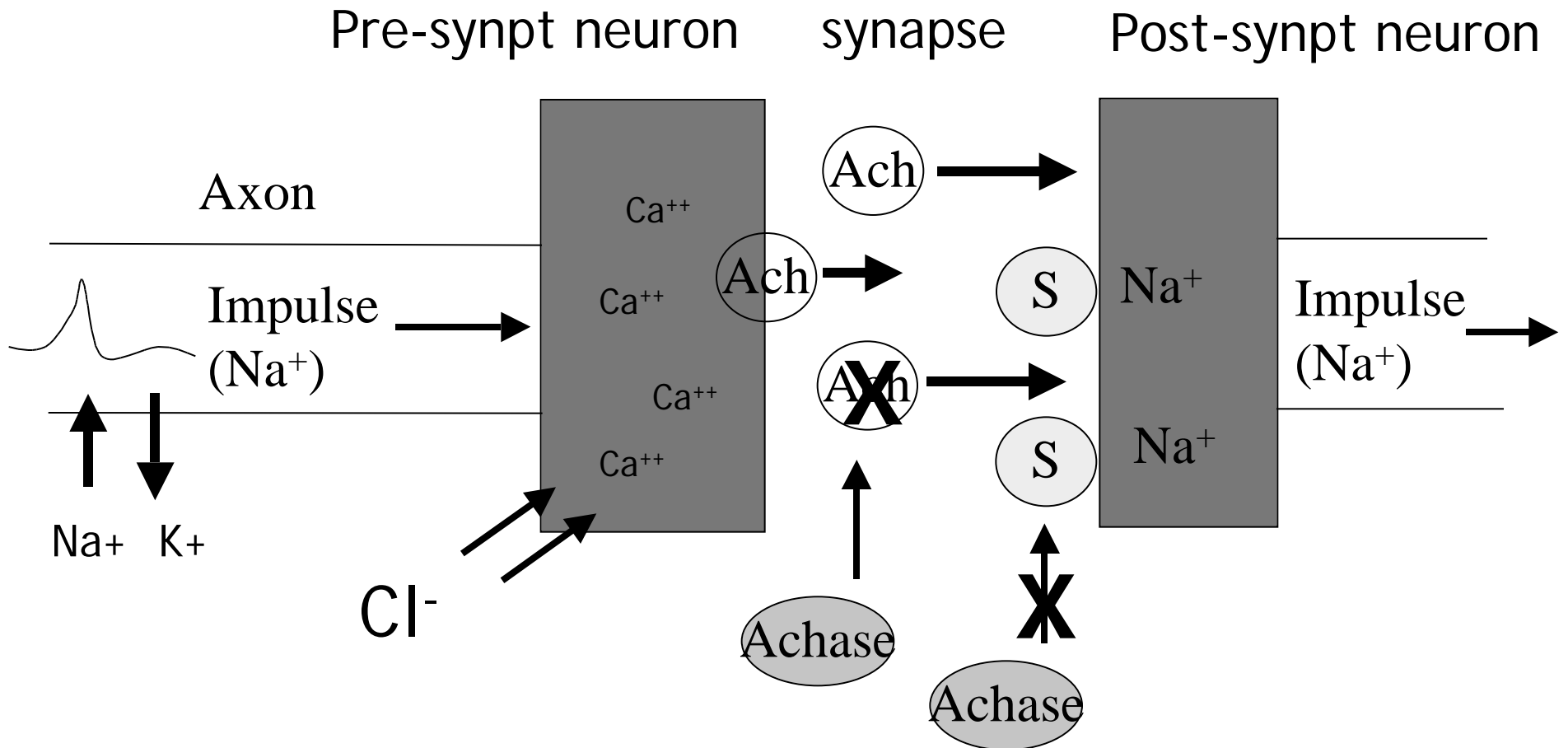
Chloride channel blockers (Pyrethroids, Thiodan)

- *Excessive Ca^{++} induced release of Ach*



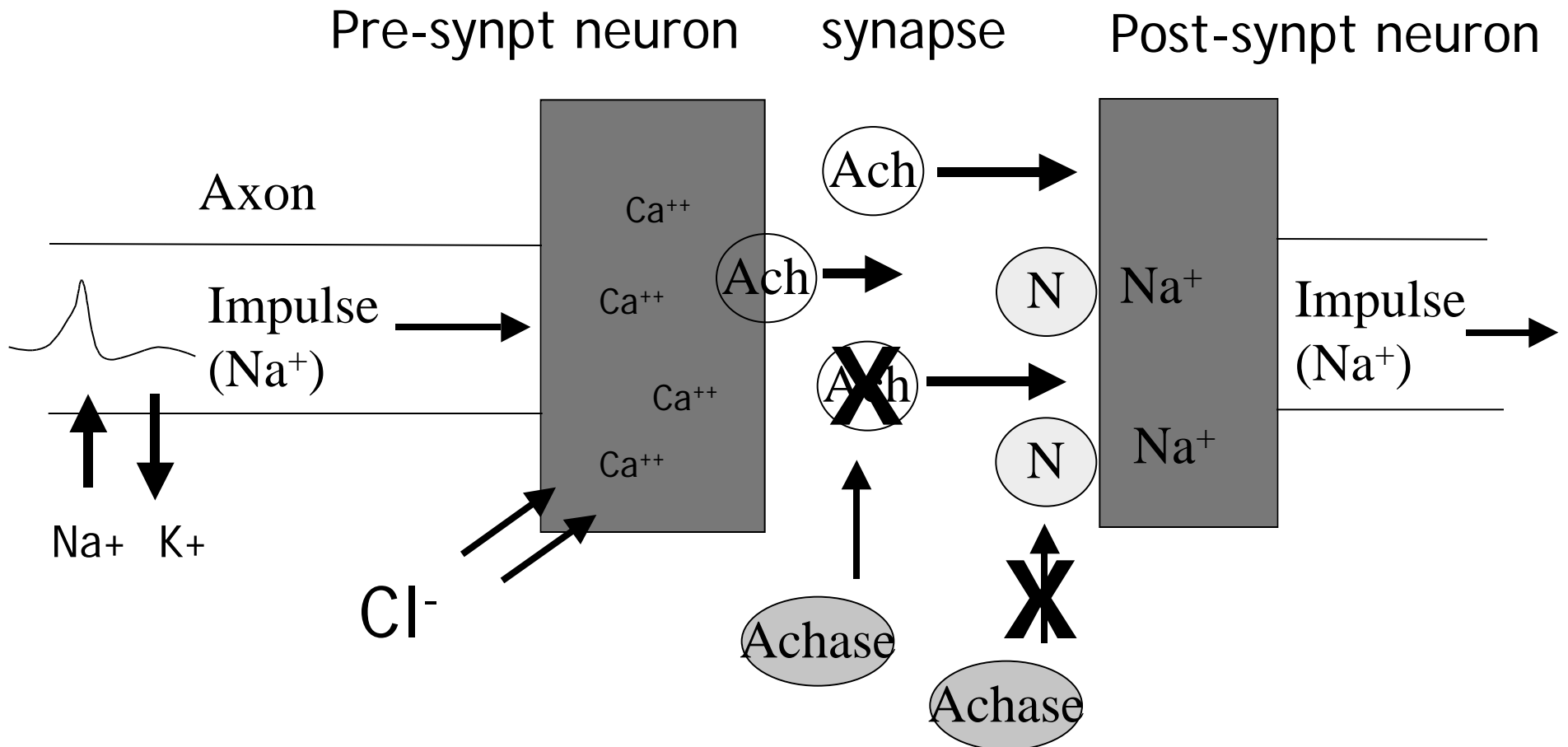
Success

- *Competes with Ach on post-syn m/b, not removed*



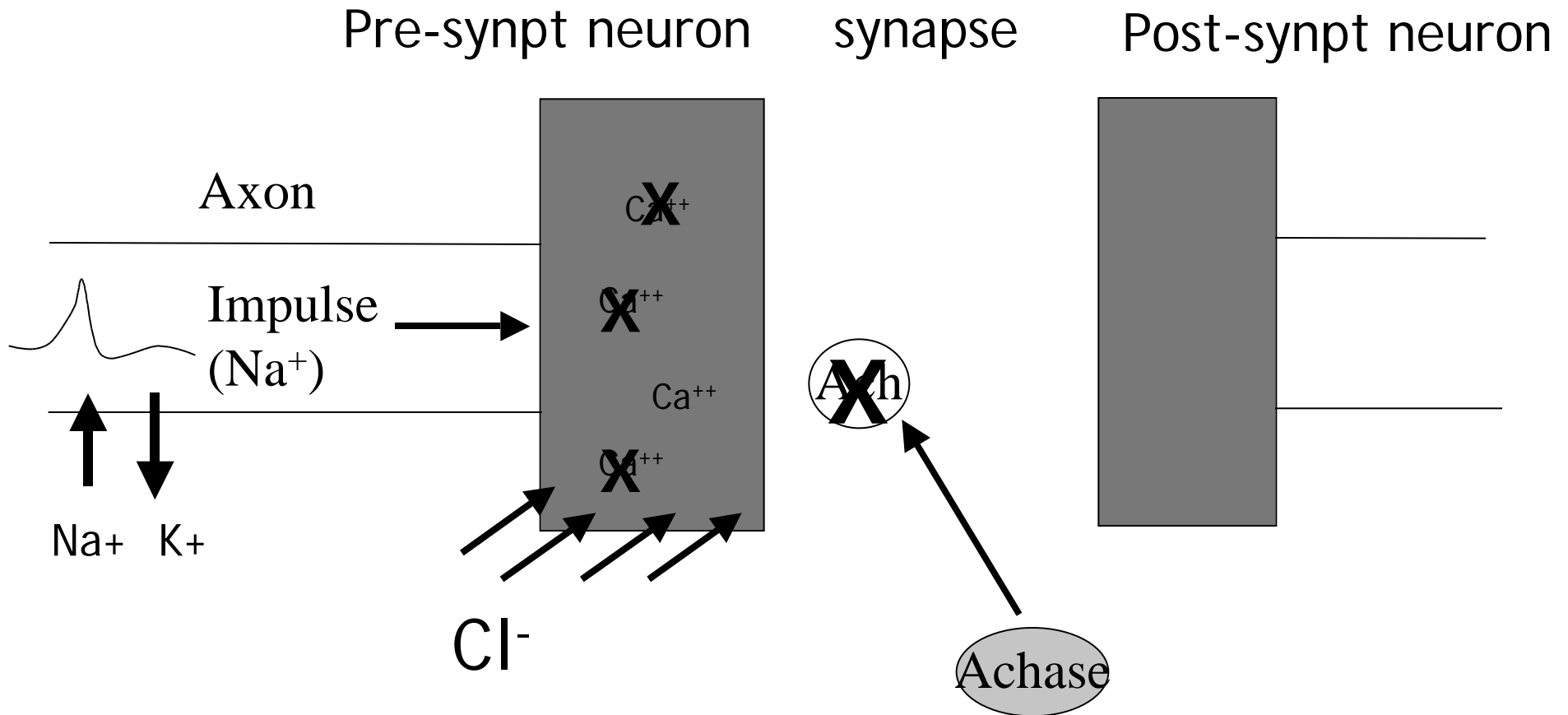
Chloronicotinylns (Assail, Provado)

- *Competes with Ach on post-syn m/b, not removed*



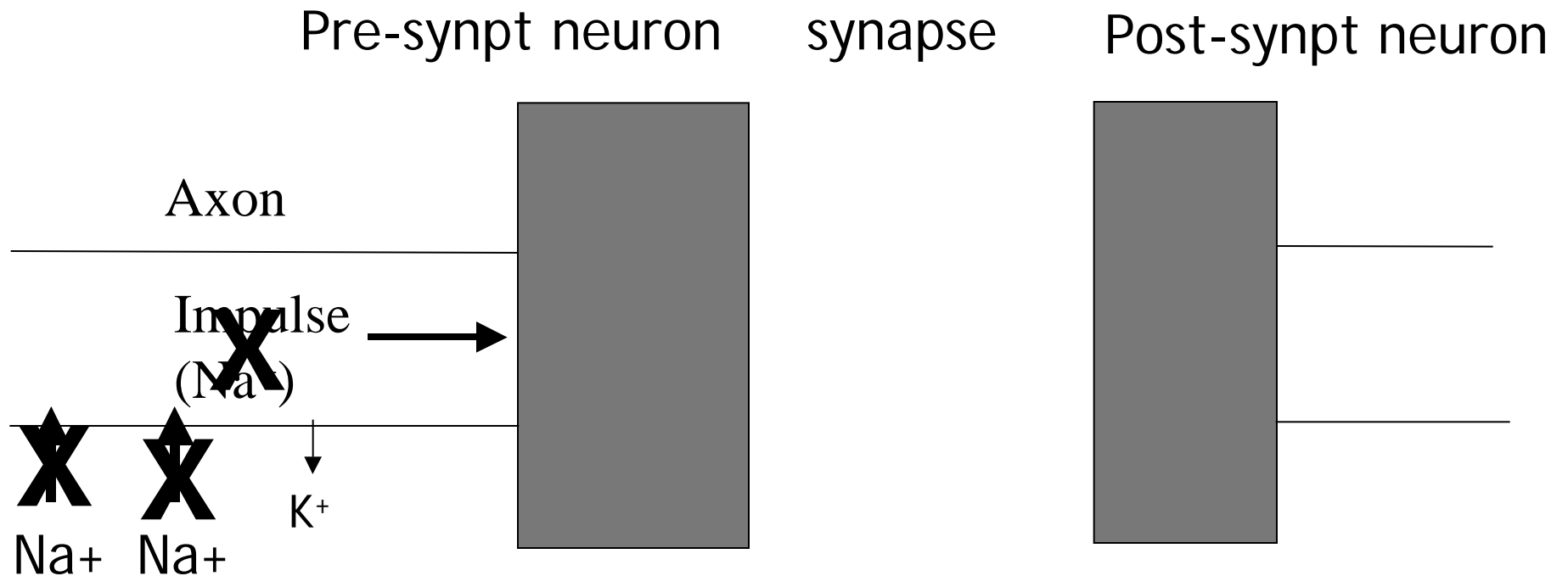
Proclaim (emamectin benzoate)-

- Enhanced flow of Cl^- , stopping release of Ach



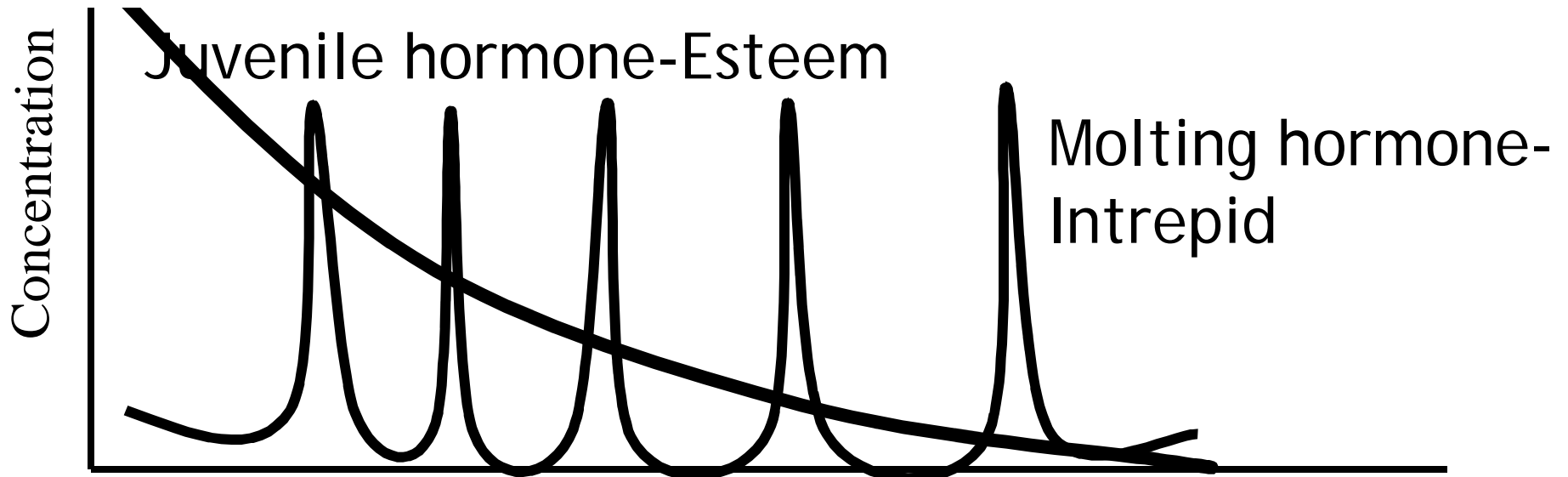
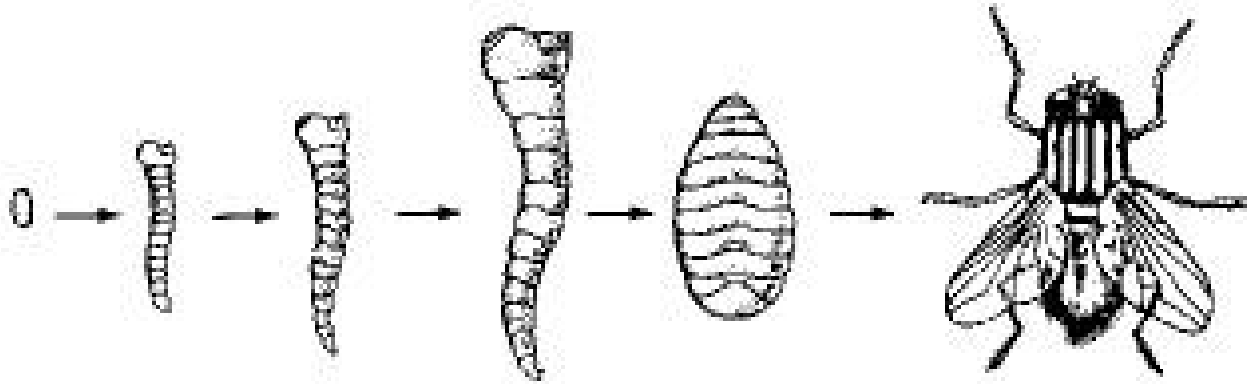
Avaunt (indoxacarb)-

- Sodium channel blocker, stops impulse



Insect growth regulators

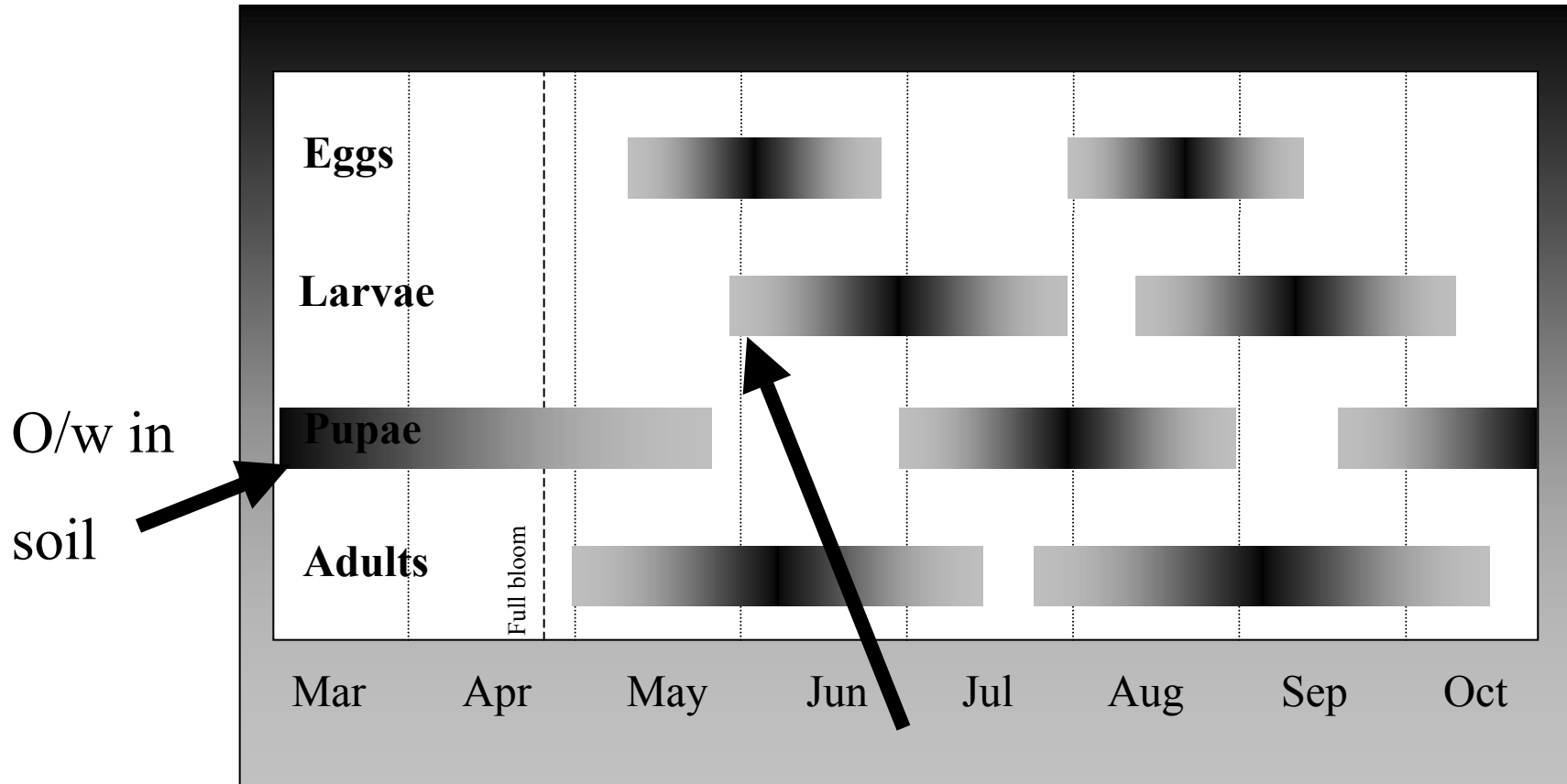
- Mimic insect's natural growth hormones



Developing an IPM Program

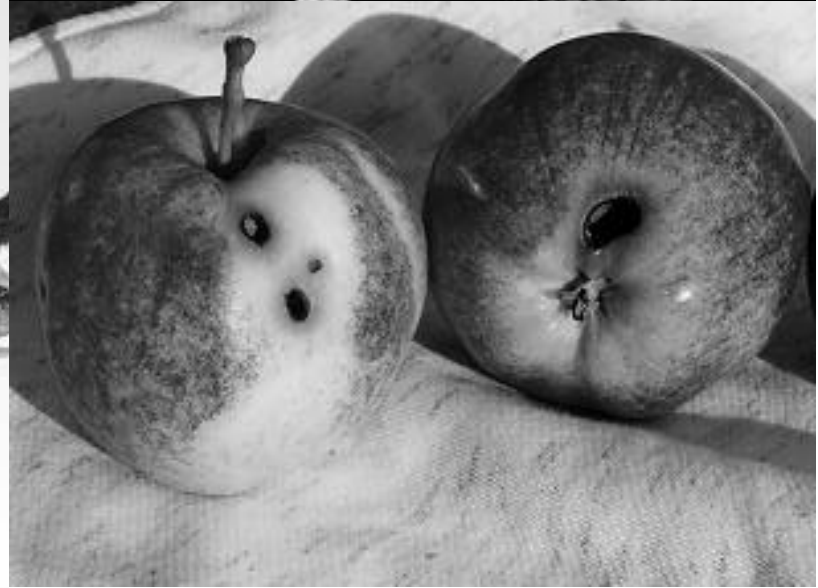
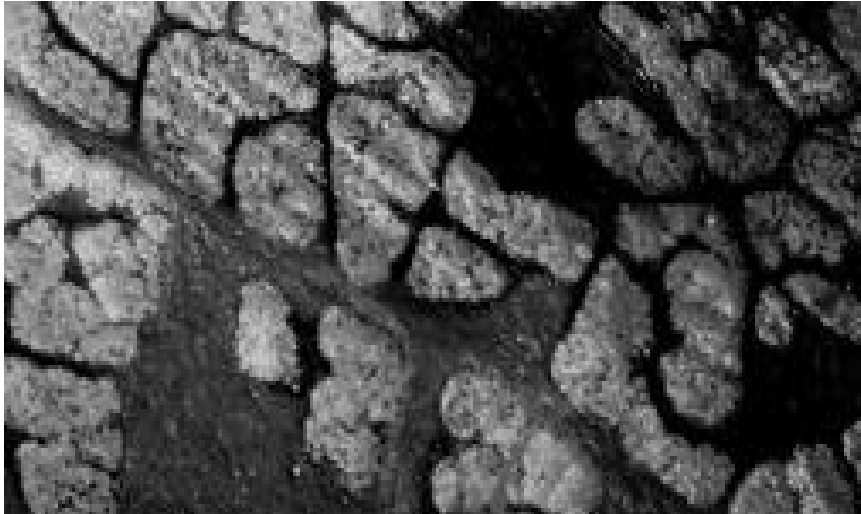
- **Biology of the pest**
 - Description, life cycle, damage, hosts
- **Measuring pest density**
 - Sampling techniques
 - What is a treatable population (most difficult for IPM)
- **When to spray**
 - Implementing a degree-day model
- **What to spray**
 - Bioassays and field trials to select products

Lacania Biology- *Life History*



Significant numbers of larvae remain in tree until maturity

Lacania Biology- *Injury*



Lacnobia- *Sampling*

- **Bucket trap**
 - Pheromone lure and kill strip
 - Highly attractive
 - Important if running DD model
 - Catch of 100-150/week is a good warning



Lacania- *Sampling*

- **Beating trays**
 - Essential for species ID
 - Larvae difficult to sample
 - Density of 1/10 samples is warning sign



Lacnobia- *Sampling*

- **Visual sampling**
 - No substitute for visual sampling
 - Look for egg deposition
 - Detect hatch
 - Larvae difficult to find, damage easy to see
 - Feeding on 30% of shoots or trees is high population



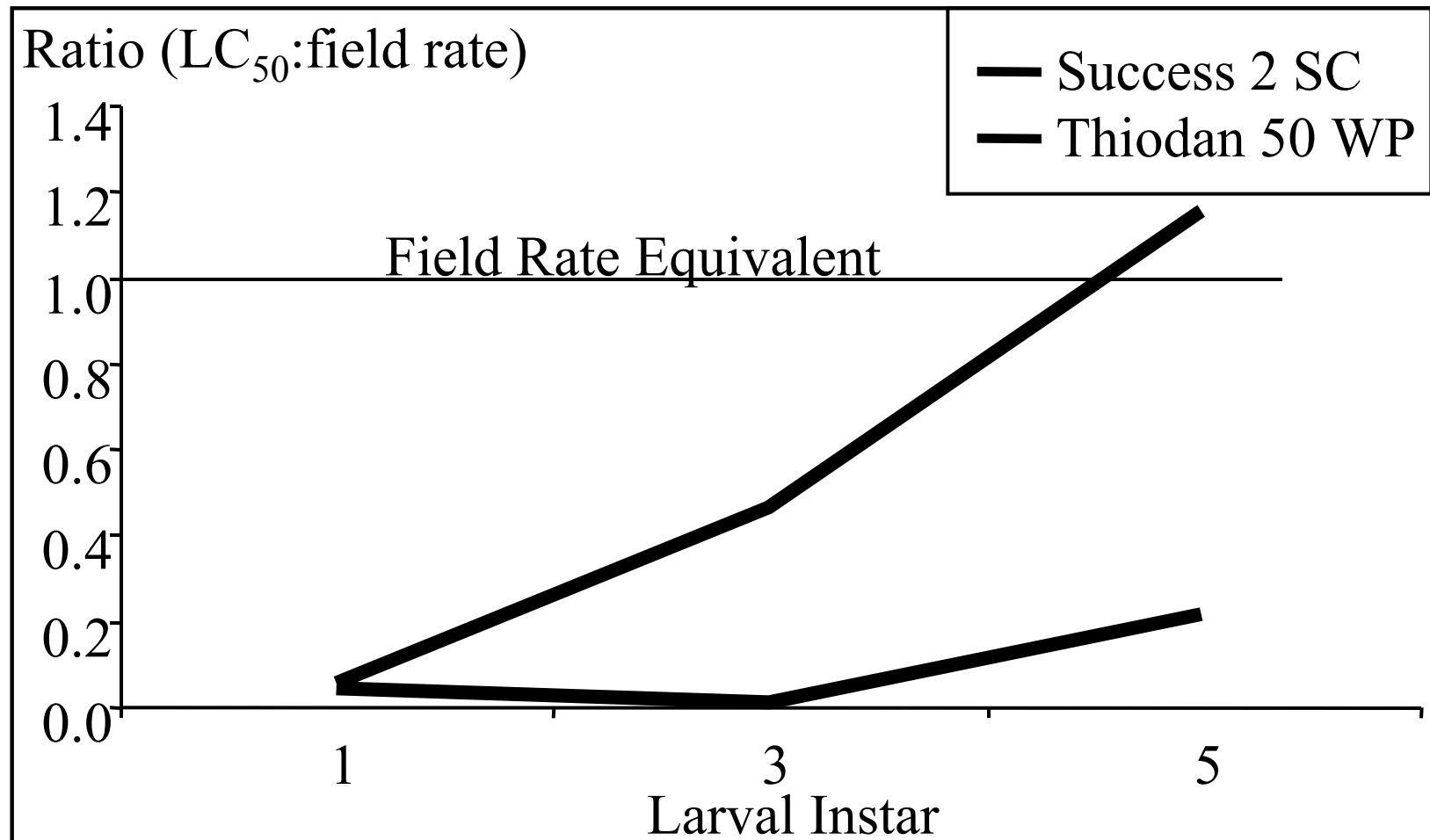
Lacnobia Sampling- ***Varietal susceptibility***

- **Red vs. Golden may be associated with skin, wax**
- **Harvest date important**
 - Gala harvested before larvae reach damaging stages
 - Red harvested when larvae first reach maturity
 - Fuji exposed for entire larval generation
- **Thresholds most accurate for 1st generation**

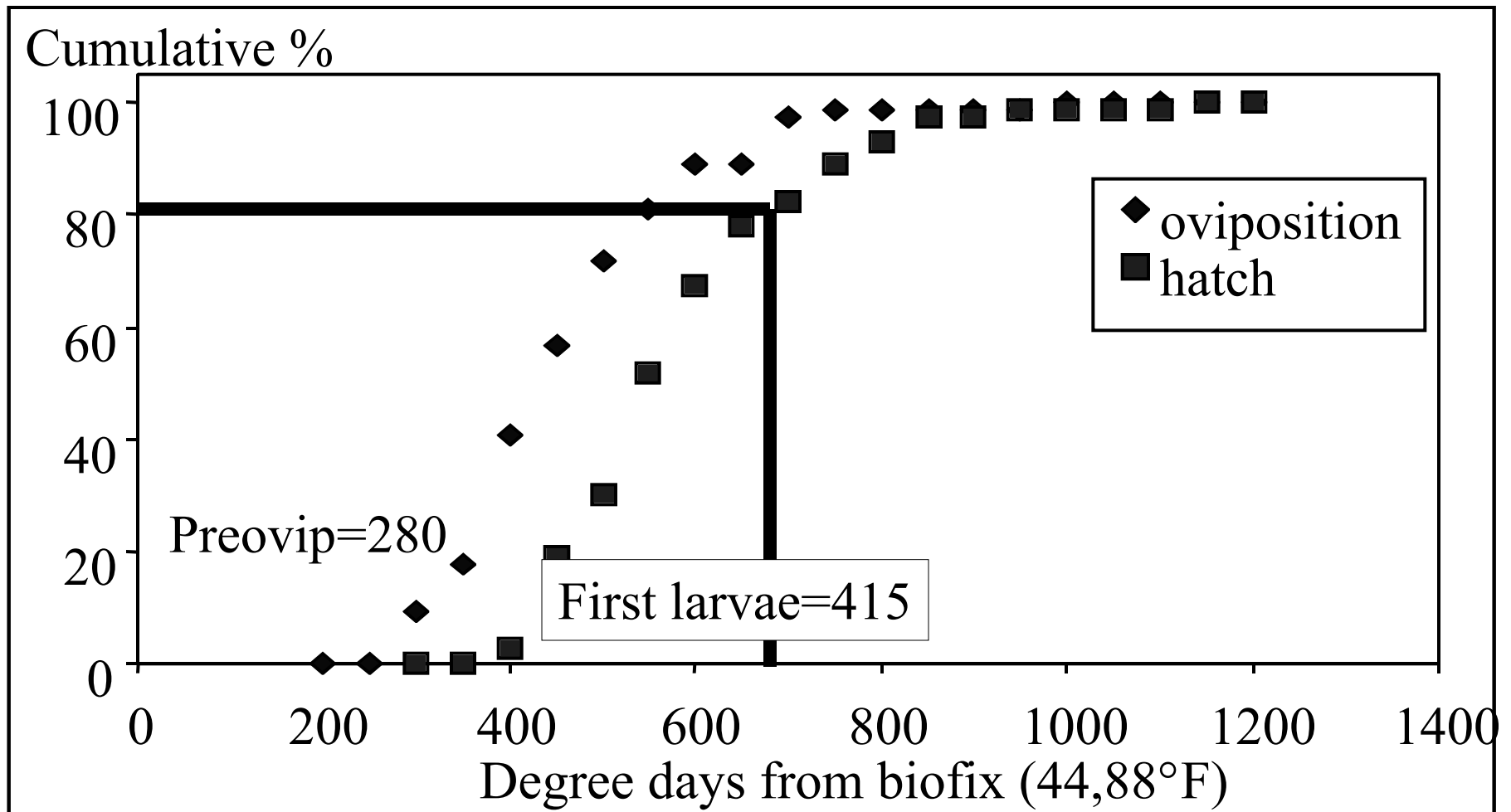
Lacnobia- *When to spray*

- **Soft chemicals most effective against younger larvae**
- **Predictive model to optimize timing**
 - Majority of eggs have hatched
 - Larvae still in susceptible stages
- **Model parameters**
 - Thresholds 44°F and 88°F
 - Horizontal cutoff method

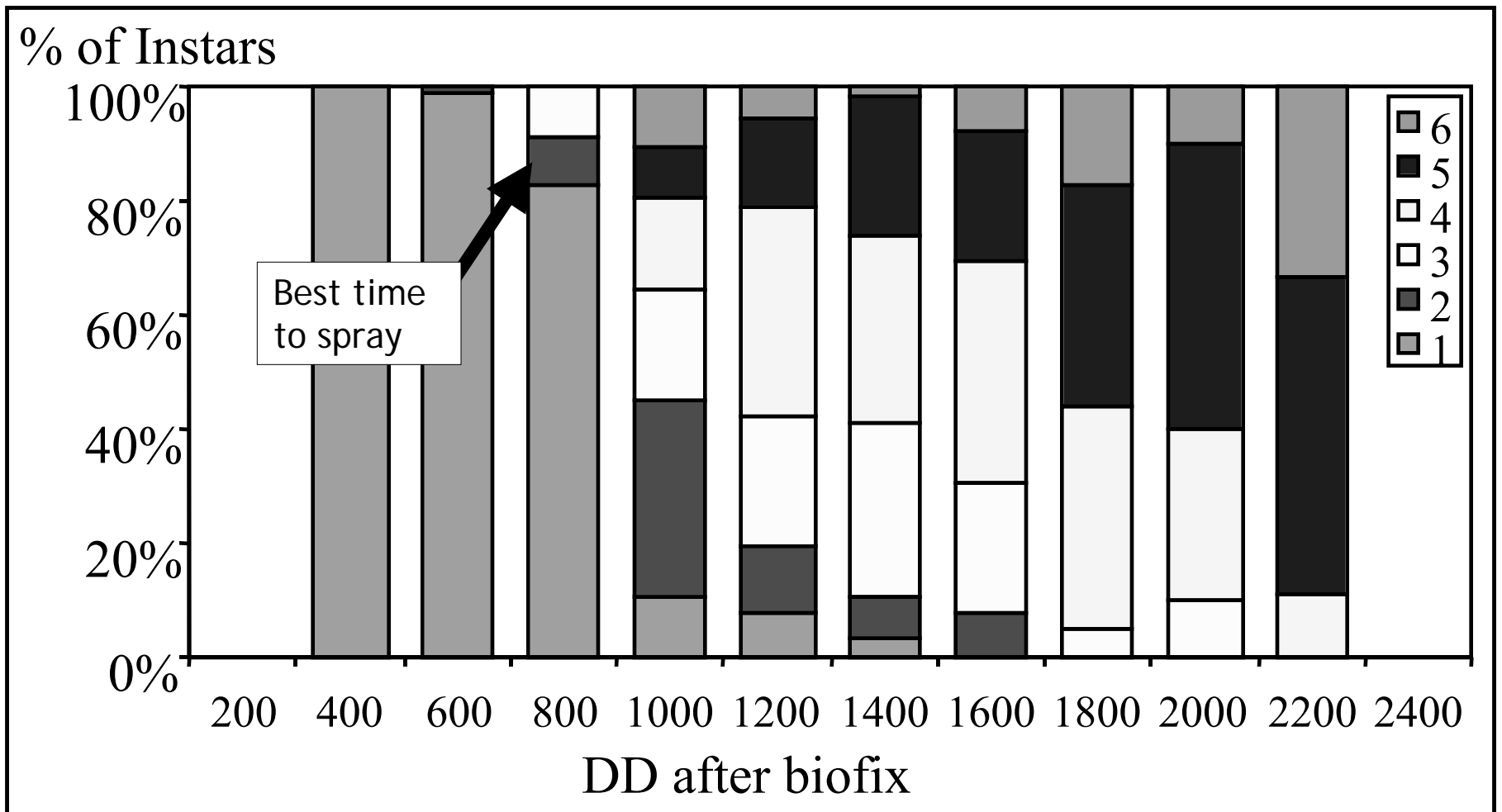
Lacania Model- *Stage specific activity of Success*



Lacania Model- *When to spray*



Lacania Model- *When to spray*



Lacnobia Control- *“Old chems”*

Chemical	Rate/a	Application	% reduction in feeding
Malathion/ methoxychlor	4 qts	1 app. at 800 DD (1st brown lv)	66
Thiodan	3 lbs	1 app. at 800 DD (1st brown lv)	75
Lannate	3 qts	1 app. at 800 DD (1st brown lv)	100

Lacnobia Control- *“New chems”*

Chemical	Rate/a	Application	% reduction in feeding
Avaunt	6 oz	1 app. at 400 DD (hatch)	99, 95
Avaunt	6 oz	1 app. at 800 DD (1st brown lv)	99, 97, 95, 88
Intrepid	16 oz	1 app. at 800 DD (1st brown lv)	93, 90
Success	6 oz	1 app. at 400 DD (hatch)	37
Success	6 oz	1 app. at 800 DD (1st brown lv)	85, 74, 82, 83

Lacnobia Control- *Organic*

Chemical	Rate/a	Application	% reduction in feeding
Neem products		3 apps (hatch)	88, 63, 78
Natural pyrethrums		3 apps (hatch)	68, 77
Surround	25 lbs	3 apps (hatch)	77
Surround	50 lbs	3 apps (hatch)	88

Leafroller- *Sampling*

- **Adults**

- Poor correlation between pheromone traps and injury

- **Larvae**

- Intensive sampling required to detect small, clumped populations (grid-like pattern)
- Clusters at PF and shoot-tips from 20% hatch during summer (DD models available)

- **Thresholds**

- 1-2% infested buds or shoots
- Previous max thresholds of 5% not realistic with control measures available

Leafroller Control- *Recommendations*

- **Delayed dormant**
 - Lorsban
- **Pink-petal fall**
 - Bt's (Dipel, Javelin, Biobit, Crymax, MVP)
 - Intrepid, Esteem, Success
- **Summer (20% hatch, possible rpt at 10 d)**
 - Bt's (Dipel, Javelin, Biobit, Crymax, MVP)
 - Intrepid, Success

Leafroller Control- *Lorsban*

- **Active Ingredient**

- Chlorpyrifos (organophosphate)

- **Mode of Action**

- Acetyl cholinesterase inhibitor in nerve synapse

- **Use pattern**

- After HIG in apples, prebloom

- **Efficacy**

- DD application v. important in LR management
- Historically most active LR chemical
 - Recent reduction in efficacy noted

Leafroller Control- *B. thuringiensis*

- **Active Ingredient**
 - Bacterial insecticide, 'old' chemical
- **Mode of Action**
 - Toxin activated by alkaline insect gut, v. selective
 - Specific to lepidopteran
- **Use pattern**
 - 2 Apps between pink-PF in apples
 - Target young larvae in summer (20% hatch, + 10d)
- **Efficacy**
 - Effective and cheap

Leafroller Control- *Intrepid*

- **Active Ingredient**
 - Methoxyfenozide
- **Mode of Action**
 - IGR, molt accelerating compounds (MAC)
 - Specific to lepidopteran
- **Use pattern**
 - Petal fall app. most effective
 - May target CM with same spray (ovicidal activity)
- **Efficacy**
 - Very effective against LR, moderate against CM eggs

Leafroller Control- *Success*

- **Active Ingredient**
 - spinosad
- **Mode of Action**
 - Naturally occurring fermentation product
 - Binds Na⁺ channel on the post-synaptic membrane
- **Use pattern**
 - Petal fall application effective
 - One spray at 20% hatch during summer
- **Efficacy**
 - Very effective against LR

Leafroller Control- *Esteem*

- **Active Ingredient**

- Pyriproxyfen

- **Mode of Action**

- Juvenile hormone mimic, like Comply
- Kills larvae during molt to pupal stage

- **Use pattern**

- Target larger larvae at PF in apple
- May target LR and CM with same spray (ovicide)
- 45 d preharvest interval limits summer use

- **Efficacy**

- Provides 'suppression' of LR

Leafroller Control- *Stomach poisons*

- **New chemistries must be ingested to be effective**
 - B. thuringiensis, Intrepid, Esteem, Success
 - Coverage critical
 - Apply during periods of active feeding
- **Intrepid and Success better alternative than Bt during cool spring conditions**
 - Residual activity (Intrepid > Success > Bt)

Leafroller Control- *Alternatives*

- **Surround**

- Particle film technology (kaolin)
- Inhibits movement/colonization of larvae
- target young larvae (o/w or hatch)
- Cumulative effect of applications

- **Pheromones**

- Isomate 250 mg dispenser
 - Apply 200 d/a at same time as CM
- Effectiveness seen over time
 - Average reduction in population around 50%
- Must be used in an intensive monitoring program

Predicting viable LR alternatives

Leaf-disk bioassay of field collected larvae

Chemical	LC50	Field rate	Toxicity
Intrepid	5.88	75	0.078
Success	0.70	30	0.063
Avaunt-PLR	1.12	33	0.036
Avaunt-OBLR	5151.0	33	156.1
Assail	107.6	44	2.45
Proclaim	0.0006	4	0.0002

Field testing new LR products

Chemical	Rate/a	No. apps/yr	% reduction in larvae
Intrepid	16 fl. oz.	1	98, 95, 100
Success	6 oz.	1	100, 90, 100
Esteem	16 fl. oz.	1	100
Proclaim	4 oz	1	100, 96, 96

Codling Moth Control- ***Recommendations***

- **Pre-bloom**
 - Pheromones
- **Ovicides**
 - Intrepid
 - Esteem
 - Oil
- **Larvicides**
 - Guthion
 - Imidan
- **New products**
 - Assail
 - Avaunt
 - Virus

Codling Moth Control- *Pheromones*

- **Product selection**
 - Get accurate data on release rates and longevity
- **Choose appropriate rates for orchard pressure**
- **Must be part of intensive management program**
 - Apply products early (early April if necessary)
 - Monitor trap catch
 - Scout for injury
 - Don't neglect supplemental sprays

Predicting viable CM alternatives

-Reduced larval entries

Chemical	LC50	Field rate	Toxicity
Guthion	6.9	300	0.023
Imidan	12.9	840	0.015
Assail	3.1	44	0.075
Success	9.3	30	0.310
Proclaim	0.5	4	0.125
Avaunt	21.3	33	0.645
Intrepid	470.3	75	5.33

Predicting viable CM alternatives

-Delayed mortality (after 21d)

Chemical	LC50	Field rate	Toxicity
Proclaim	0.07	4	0.175
Intrepid	1.2	75	0.089
Virus	No significant reduction		

Predicting viable CM alternatives

-Ovicidal products

Chemical	LC50	Field rate	Toxicity
Assail	34.9	44	0.793
Esteem	1.9	32	0.059
Intrepid	0.9	75	0.012

Field testing new CM products

Chemical	Rate/a	No. apps/yr	% reduced inj at harvest
Guthion	2.0 lb	4	96, 97, 89, 93, 98, 90
Imidan	5.0 lb	4	96, 97
Assail	0.2 lb	4	90, 91, 89, 70

Field testing new CM products

Chemical	Rate/a	No. apps/yr	% reduced inj at harvest
Intrepid	16 fl. oz.	6 oviposit	90
Intrepid	16 fl. oz.	6 hatch	82, 75, 81
Success	6 oz.	6	76, 61,
Avaunt	6 oz.	10	62, 66

Field testing new CM products

Chemical	Rate/a	No. apps/yr	% reduced inj at harvest
Oil (Orchex)	1 %	6	60
Surround	50 lbs	6 oviposit	66
Surround	50 lbs	6 hatch	69
Virosoft	1.1 fl. oz.	12	14, 5

Non-target affects of Assail

Chemical	# Spider mites/lf	# Predators/lf	Ratio
Test #1			
Assail	84	0.16	525:1
Imidan	2.8	3.0	0.9:1
Untreated	4.5	2.3	2:1

Non-target affects of Assail

Chemical	# Spider mites/lf	# Predators/lf	Ratio
Test #2			
Assail	34	0.2	170:1
Intrepid	7.7	1.6	4.8:1
Guthion	3.9	2.6	1.5:1
Untreated	7.5	7.7	1:1