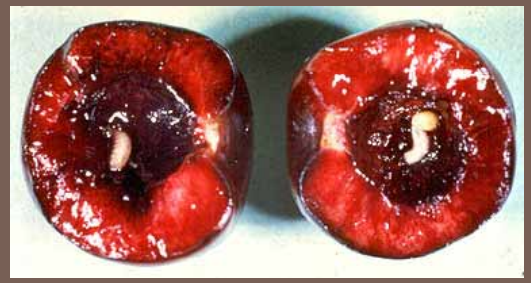


CHERRY FRUIT FLY CONTROL UPDATE – USDA RAMP PROJECT

Diane Alston, USU Extension Entomologist

Utah Tart Cherry Grower Meeting, Payson, UT

March 20th, 2009

UtahState University

Efficacy of new insecticides

- 2004-07: 19 orchard trials
  - 15 trials on commercial farms
  - 4 trials on university research farm
- Objectives:
  - Evaluate, demonstrate, & encourage adoption of insecticide alternatives to Guthion for CFF management
  - Test & refine strategies, technologies, & timing for alternative products
  - Develop and validate predictions of fruit injury from trap catch

GF-120 application

Photo courtesy of Tim Smith, WSU Extension

Electric pump sprayer mounted on 4-wheeler applies a strip of spray along the mid- and upper-line of each tree row

Efficacy of new insecticides

Commercial orchard trials (1-12 acres)

Year	Orch #	Treatment*	# CFF larvae^
2004	1	Guthion	0
		Provado	0
	2	Dimethoate	0
		Provado	0
	3	Guthion	0
		Imidan	0
		Provado	0
2005	4	Guthion	0 c
		Provado	2.4 a
		GF-120	0.8 b
	5	Guthion	0
		GF-120	0
2005	6	Guthion	0
		GF-120	0
	7	Guthion	0
		GF-120	0
2006	8	Provado/Guthion	0
	9	Provado/Imidan	0
	10	Provado/GF-120	0
	11	Provado/GF-120	0
	12	GF-120	0
	13	Provado/Guthion	0.0002
	14	Provado/GF-120	0
	15	Provado/GF-120	0.0004

*Total of 2-6 applications per season, ^Cumulative # CFF larvae per 100 fruit (2,000-5,000 fruit sampled per orchard)

Efficacy of new insecticides

Research orchard trials

Year	Orch #	Treatment*	# CFF larvae^
2004	16	Untreated	44.7 a
		Guthion	1.1 b
		GF-120	0.3 c
2005	17	Untreated	9.3 a
		Guthion	1.3 b
		GF-120	0.1 c
2006	18	Untreated	10.0 a
		GF-120	4.0 b
		GF-120+AC	3.3 b
		GF-120+AA	0.3 c
		Success	2.3 bc
		Provado	1.8 bc

Year	Orch #	Treatment*	# CFF larvae^
2007	19	Untreated	9.1 a
		GF-120	1.9 b
		GF-120+AA	0.8 b
		GF-120+U	1.4 b
		GF-120+TY	0.5 b
		GF-120+CCJ	0.9 b

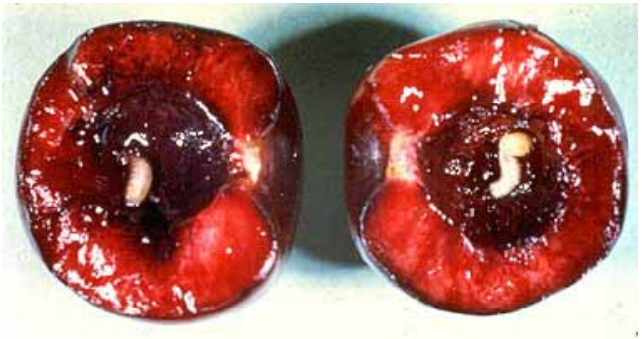
*Total of 2-6 applications per season; AC=ammonium carbonate, AA=ammonium acetate, U=urea, TY=torula yeast, & CCJ=concentrate cherry juice (10% w/v)

^Cumulative # CFF larvae per 100 fruit (2,000-5,000 fruit sampled per orchard)

Imidacloprid (Provado)

- Prevented WCFF fruit injury in 13 of 15 commercial orchard trials
- In Orchard 4 (2.4% fruit injury), crop load was small and external, home yard sources of fruit flies compromised Provado's performance
- In Orchard 13 (0.0002% fruit injury), fruit maturity was advanced
  - 16% of fruit was rosy in color on June 12 (collection date of infested fruit)

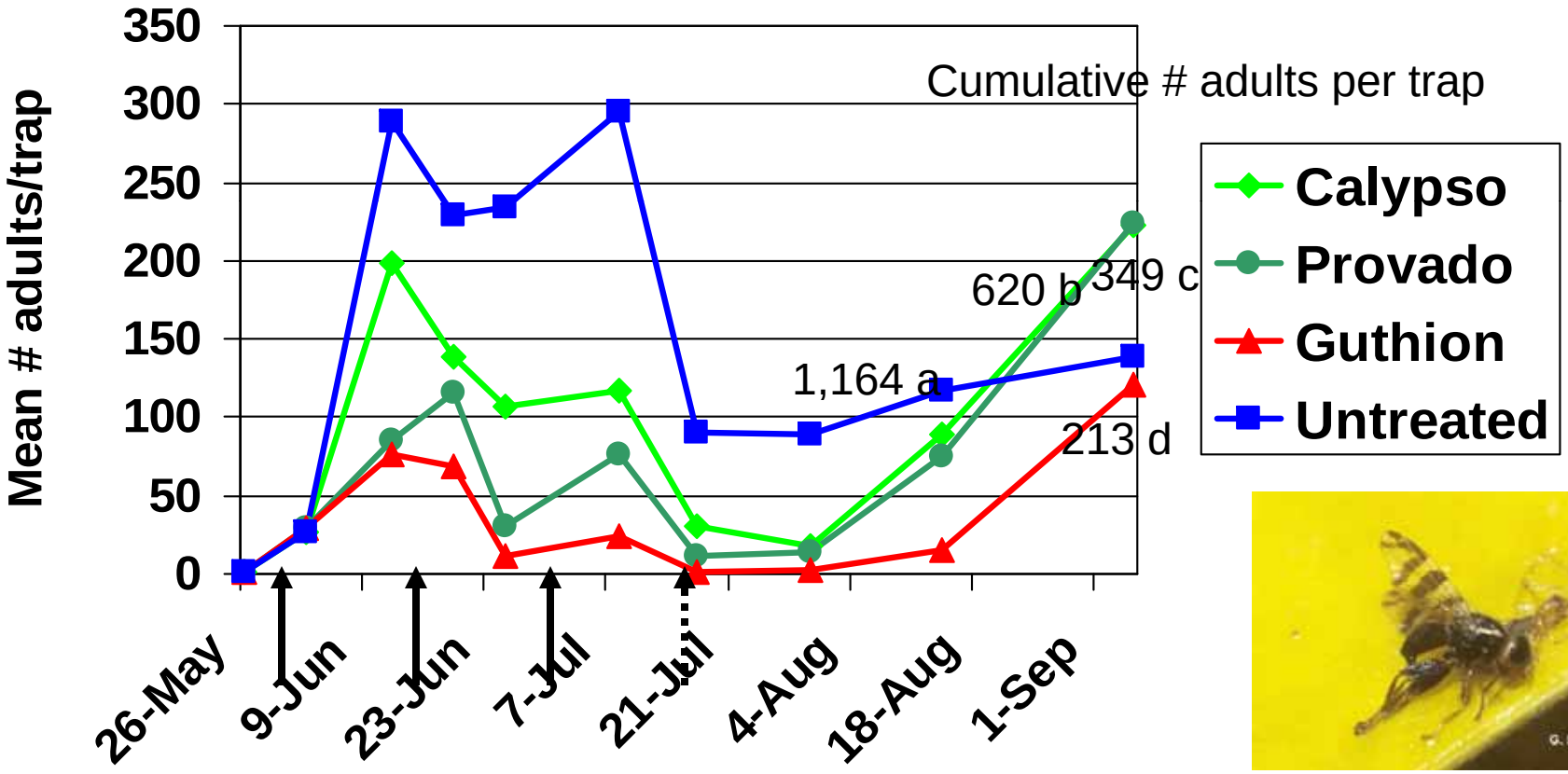
Home yard sweet cherry tree



Spinosad (GF-120 NF)

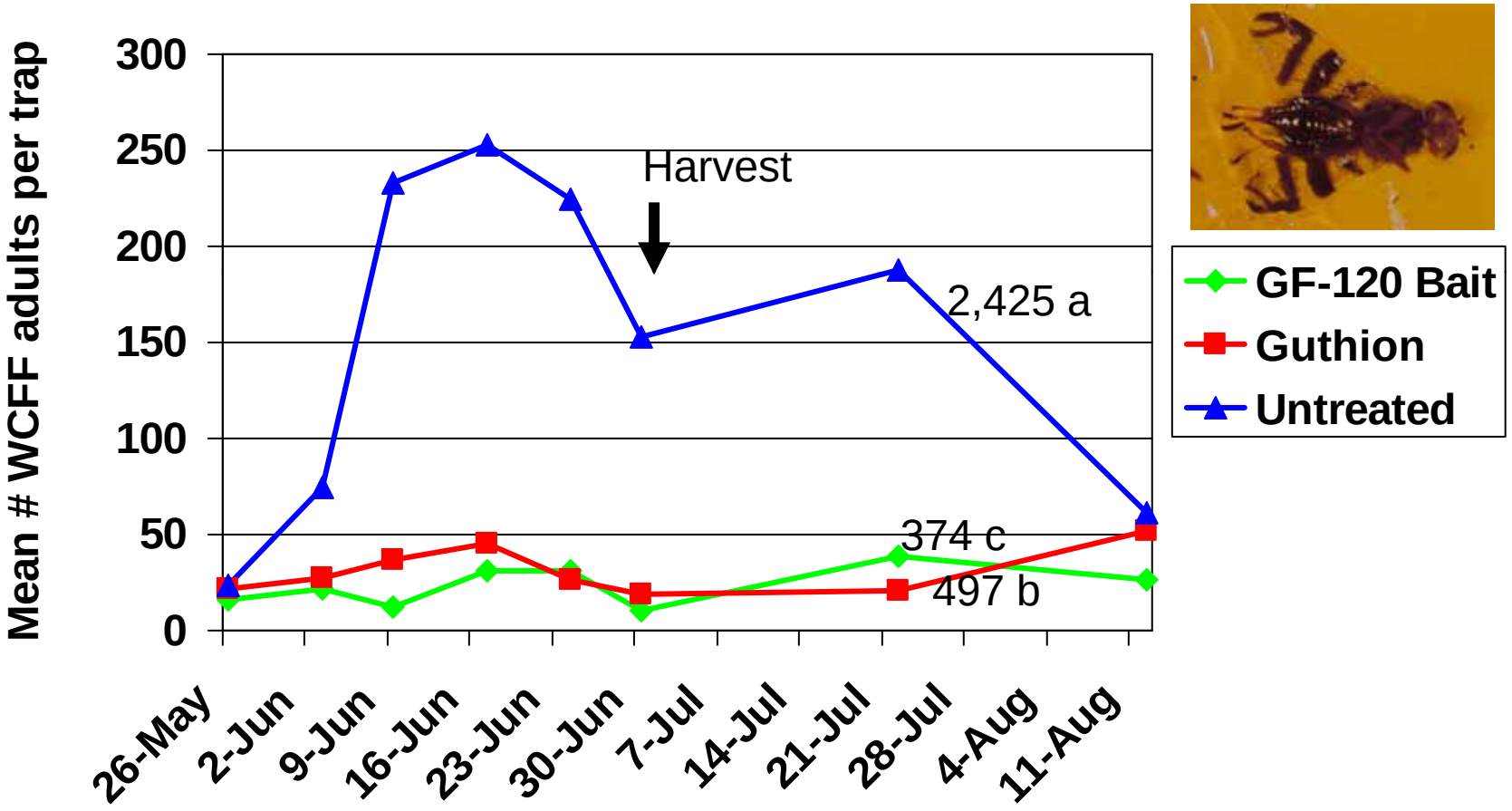
- GF-120 prevented WCFF fruit injury in 13 of 15 commercial orchard trials
- GF-120 did not completely protect fruit in any of the 4 research orchard trials
- Fruit fly densities were 2-100× times higher in research orchards (21-1,211 cumulative adults per trap) than in commercial orchards (0-12 cumulative adults per trap)
  - High CFF densities & close proximity of untreated plots were major reasons for control failures
  - Despite high CFF densities & influx of gravid females, GF-120 kept fruit injury $\leq$ 4.0 larvae per 100 fruit
- 10% AA (w/v) improved performance of GF-120 in 2006 trial, but no added attractants enhanced GF-120 in 2007 trial

Life Stage Suppression – Neonicotinoid insecticides are moderate adulticides



Solid arrows indicate insecticide spray timings; broken arrow indicates cherry harvest date

Life Stage Suppression – Spinosad is a good adulticide



GF-120 Bait and Guthion dramatically suppressed WCFF pops.
Guthion: 76% flies caught next to Untreated
GF-120 Bait & Guthion suppressed populations post-harvest

GF-120 Mode of Action

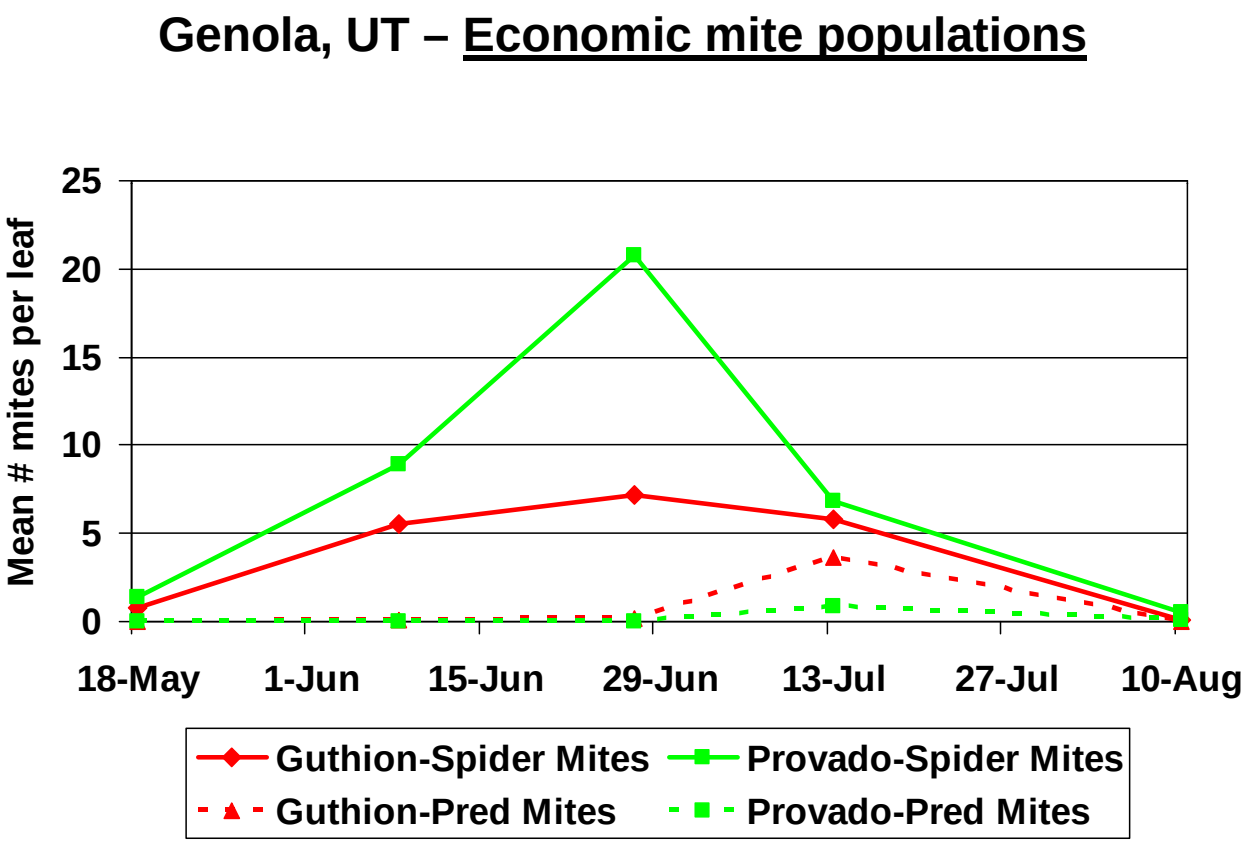
- Bait in GF-120 is arresting adults reasonably well, but it isn't highly attractive
- Bait droplets encountered during routine adult foraging
- Adult fruit flies that feed on GF-120 are killed quickly
- 0.02% a.i. spinosad is highly toxic to adults when ingested
- Need to keep enough GF-120 available for adult population size
- Not rain-fast
- Reapply every 5-7 d & after rain

Provado Mode of Action

- Contact – only moderate adulticide
- Systemic – kills larvae (eggs) inside fruit
- Under high populations in research orchard trials – 14 d of fruit protection

Non-target effects on mites

- Stimulation of spider mites
- Follows 2-3 applications of Provado
- Predaceous mite densities lowered none or moderately
- Primary mechanism: Stimulation of reproduction
- No non-target effects of spinosad detected



Provado increased spider mite densities vs. Guthion
Pred mites increased in mid July – too late

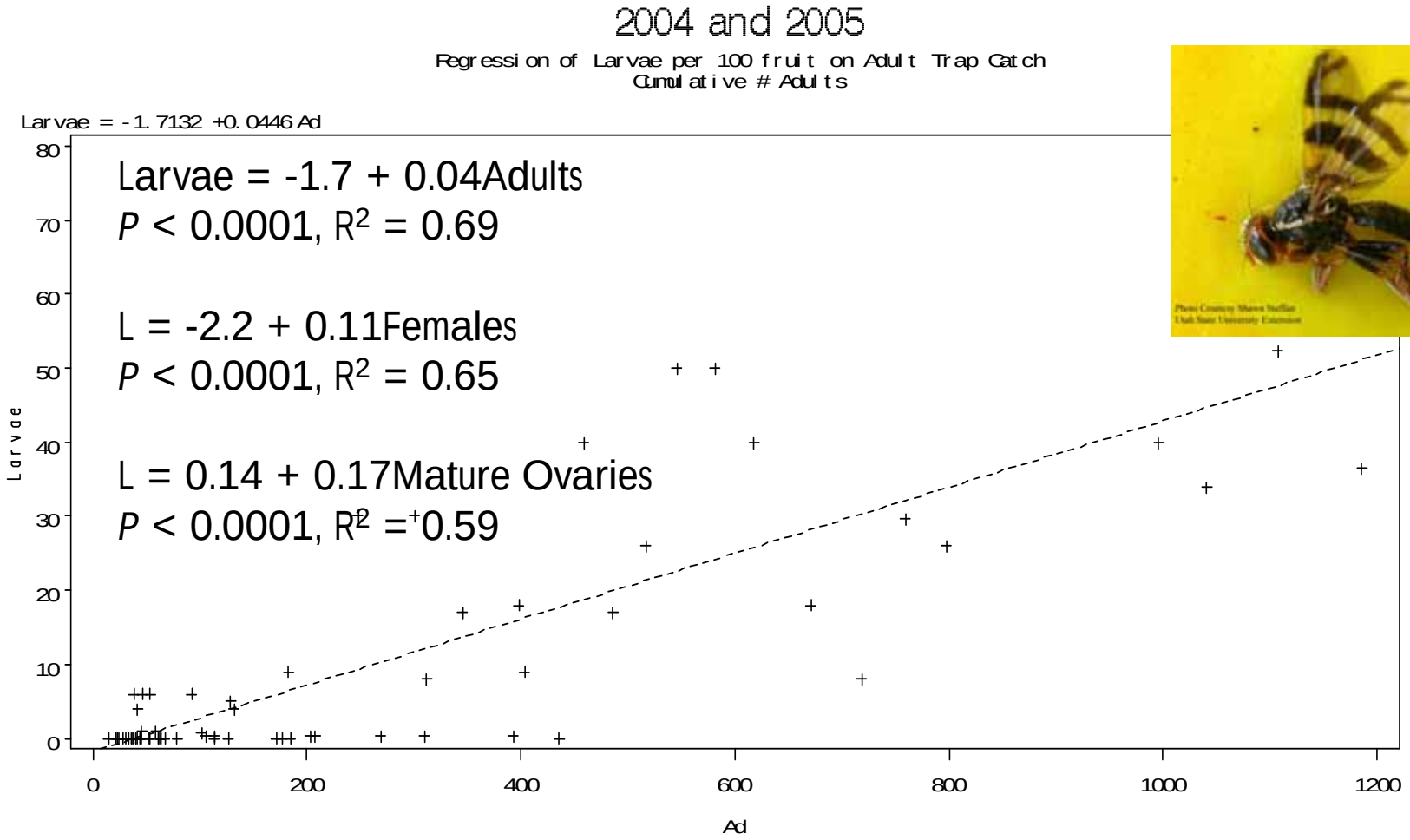
Comparison of insecticide labels

- **GF-120**
  - 4 h REI
  - 0 d PHI
  - 10-20 fl oz/acre
  - Coarse spray droplet size (4-6 mm)
  - 1:4 or 1:5 dilution with water
  - Strip application
  - PPE:
    - Coveralls, gloves, shoes
- **Provado**
  - 12 h REI
  - 7 d PHI
  - 6-8 fl oz/acre
  - Minimum of 10 days between sprays
  - Post-bloom only
  - Toxic to bees
  - Full cover spray
  - PPE:
    - Coveralls, gloves, shoes

Insecticide efficacy summary

- Spinosad (GF-120 and Success) and imidacloprid (Provado) offer greater flexibility in REIs and PHIs than organophosphate insecticides
- GF-120 offers an alternative application method
- The two products differ in pest target stage
  - Provado: larvicide (ovicide), moderate adulticide
  - Spinosad: adulticide
- GF-120 cannot protect fruit against migrating females that contain mature eggs
  - Prevented fruit injury for orchards $\leq$ ~ 20 cumulative CFF on traps
- Important to rotate applications of neonicotinoid (Provado) with other insecticide classes
  - Stimulation of spider mites

Relationship between adult trap catch and larval densities in fruit



Prediction of fruit injury from adult trap catch

- For untreated & treated cherries combined
  - 100 adults ⟹ 4 larvae
  - 100 females ⟹ 11 larvae
  - 100 females with mature ovaries ⟹ 17 larvae
- >0.11 females and 0.17 gravid females corresponded to infested fruit
- Need to analyze with larger data set & refine predictions

Immature (no mature eggs) and mature (at least one fully developed egg)

New Insecticides

Insecticides (Broad spectrum)
Cherry fruit fly

- Delegate (spinetoram; Dow) – new spinosyn insecticide – ingestion, moderate residual, moderate systemic movement
  - 4 hr REI, 7 day PHI
- Altacor (rynaxypyr; Dupont) – new class, "anthranilic diamide", interferes with calcium gates in muscles, affects movement – ingestion, long residual, moderate systemic movement
  - 4 hr REI, 10 day PHI
- Voliam Flexi (chlorantraniliprole + thiamethoxam; Syngenta) – mixture of an anthranilic diamide & a neonicotinoid – contact/ingestion, long residual, strong systemic movement
  - 12 hr REI, 14 day PHI

Insecticides (Broad spectrum)
Cherry fruit fly

- Assail (acetamiprid; UPI) – neonicotinoid – contact/ingestion, systemic
  - 12 hr REI, 7 day PHI
- Actara (thiamethoxam; Syngenta) – neonicotinoid - contact/ingestion, systemic
  - 12 hr REI, 14 day PHI

Miticides

Cherry

- Envidor (spirodiclofen; Bayer) – disrupts energy production - pome & stone fruits
- Nexter (pyridaben; Gowan) – disrupts respiration - pome & stone fruits
- Onager (hexythiazox; Gowan) – mite growth inhibitor - pome & stone fruits
- Zeal (etoxazole; Valent) – mite growth inhibitor - cherry (sweet & tart) & non-bearing fruit & nut trees

Chemical Activity Properties

(from Dr. John Wise, Michigan State University)

Compound	Mode of Action	Mode of Entry	Insecticidal Activity	Speed of Activity
Organophosphates	Nerve Poison	Contact/Ingest	Lethal	Fast
Carbamates	Nerve Poison	Contact/Ingest	Lethal	Moderate
Pyrethroids	Nerve Poison	Contact/Ingest	Lethal / Repellent	Fast
Insect Growth Regulators	Hormonal	Ingestion / egg contact	Lethal / Sublethal	Slow
Spinosyns	Nerve Poison	Ingestion	Lethal	Fast
Oxadiazines	Nerve Poison	Ingest/contact	Lethal	Slow
Neonicotinoids	Nerve Poison	Contact/Ingest	Lethal / Antifeedant Ovipos deterrence	Moderate
Anthranilic Diamides	Ryanodine Receptor Modulators	Ingestion	Lethal	Slow

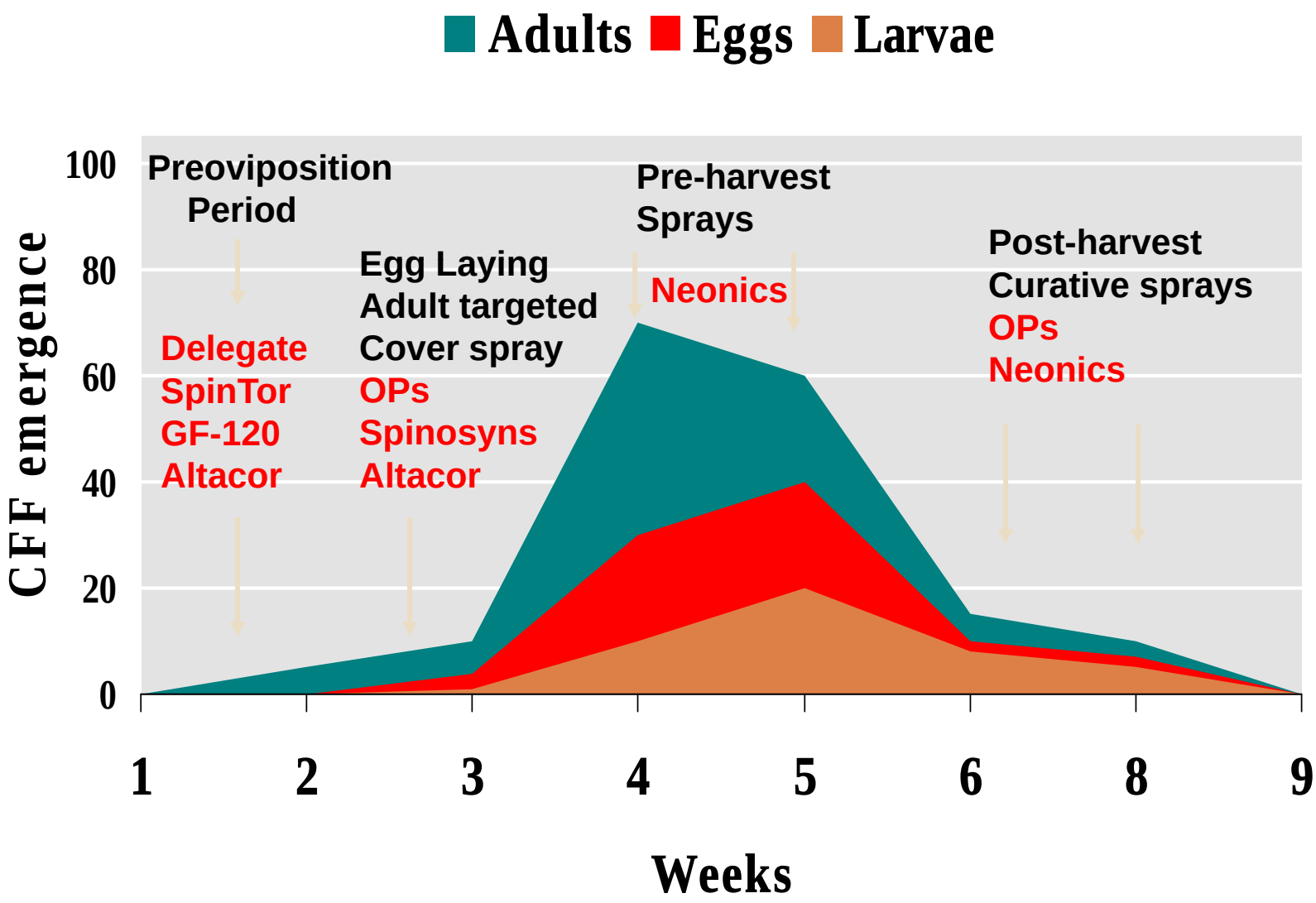
Physical and Chemical Properties
(from Dr. John Wise, Michigan State University)

Compound	Residual (on plant)	Systemic Activity *	Rainfastness (M, H,S)**
Organophosphates	Medium	1	M
Carbamates	Short	1	M
Pyrethroids	Short	1	M
IGRs	Medium-Long	2	M
Spinosyns	Short	2	H
Neonicotinoids	Medium	3	S
Oxidiazines	Medium	1	H
Anthranilic Diamides	Long	2	H

* 1 - weak, 2 - moderate, 3 – Strong; ** H – highly rainfast, M – moderate, S – systemic in plant

Optimal Timing for Cherry Fruit Fly Control

(from Dr. John Wise, Michigan State University)



Phase Out of Guthion (Azinphosmethyl)

- End date for registration on apple, pear & cherry: September 30, 2012
- Maximum amount of active ingredient per season/per acre:
  - **Apple**
    2009: 3.0 lbs.
    2010: 2.0 lbs.
    2011-2012: 1.5 lbs.
  - **Pear**
    2009-2010: 2.0 lbs.
    2011-2012: 1.5 lbs.
  - **Cherry**
    2009: 1.5 lbs.
    2010-2012: 0.75 lbs.
- Current buffer restrictions:
  - Human-occupied buildings – 60 ft
  - Bodies of water/aquatic habitats – 60 ft

RAMP Research Plans for 2009

- On-farm comparisons of new insecticides
  - GF-120, Provado, Altacor, Delegate, Volium flexi, Assail, Actara
- Further test/refine relationship between trap catch and fruit injury
- Evaluate determination of female fly reproductive maturity on yellow sticky traps