

**CONTINUED TESTING OF
PHEROMONE “MESO-EMITTERS”
FOR MATING DISRUPTION OF
CODLING MOTH IN CALIFORNIA**

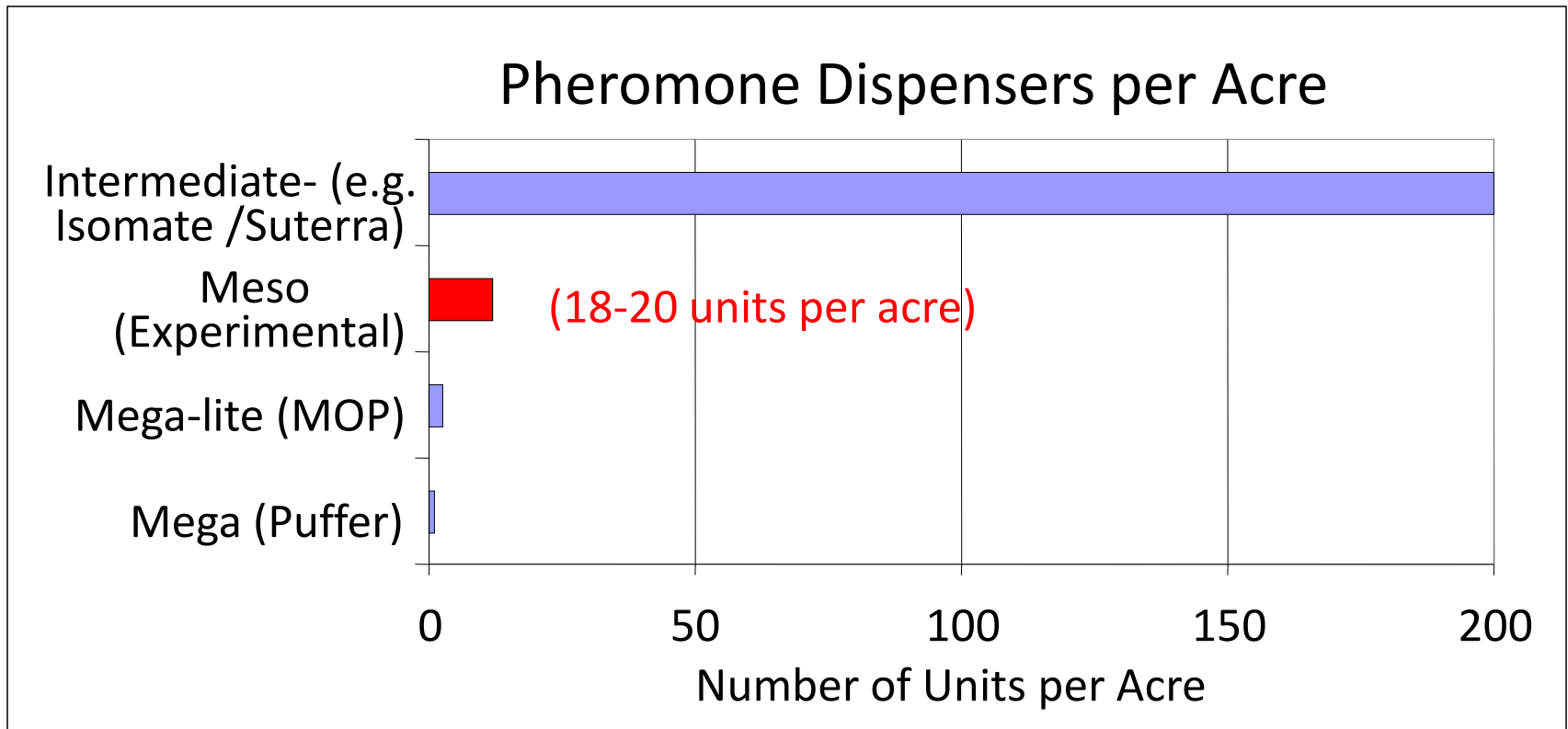
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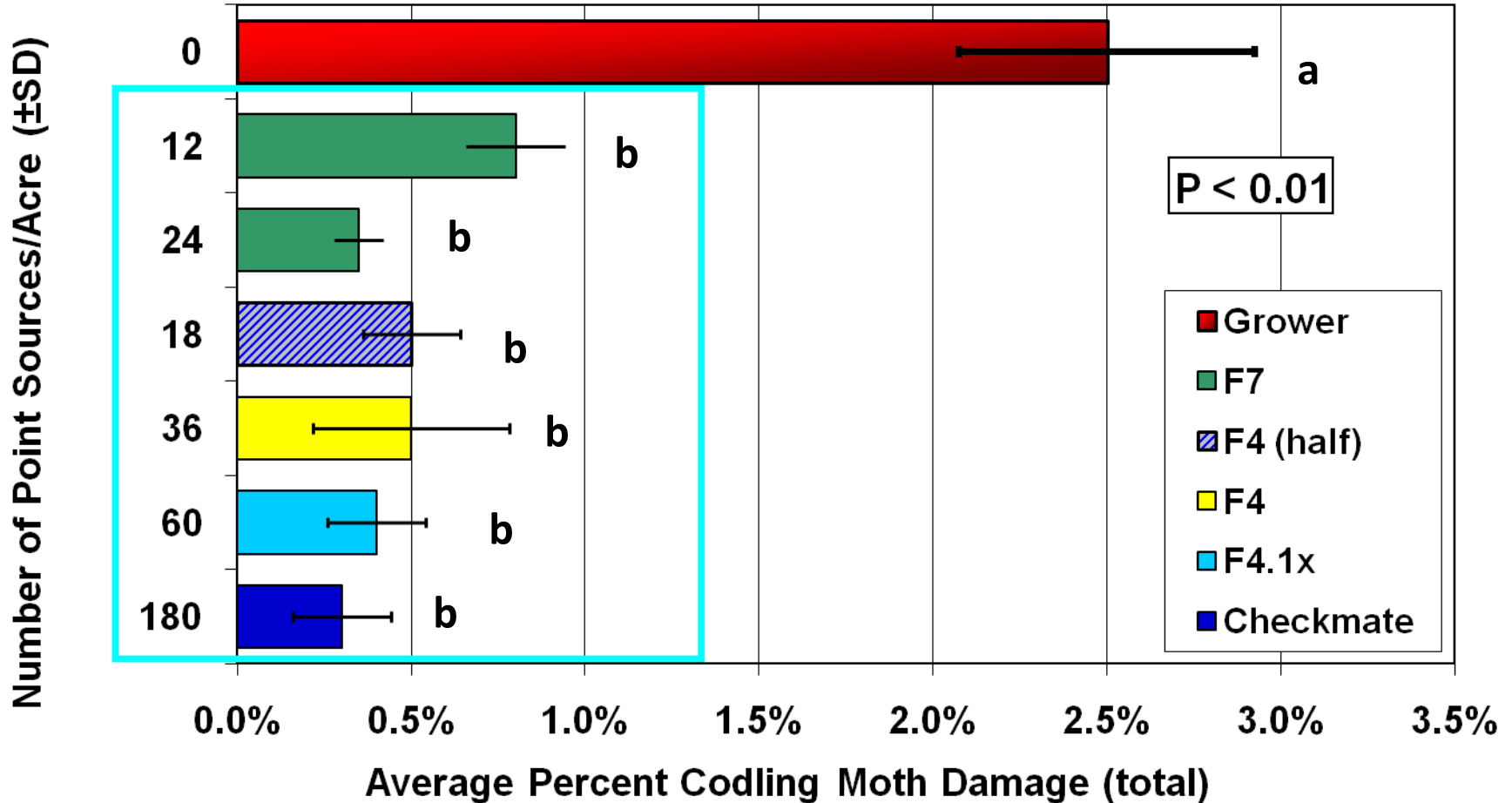
- Goal: build the most cost-effective pheromone program that provides adequate damage suppression
 - Optimize overall costs
 - Build good pheromone strategy
 - Recognizes but minimize insecticide interventions
 - High CM densities often require insecticide supplements
 - Other pests (leafrollers, NOW) may require treatments
 - Does not preclude alternative objective of improved pheromone programs
- 2009 field trial focus – Large block testing of “best” mesos from 2007 and 2008
 - Meso-emitter rate trials (walnuts only) – not shown
 - Meso-emitter large plot efficacy trials (walnuts and pears)

Pheromone “Meso-emitter”

- Hand applied dispenser unit
- Reduced point sources: **18-20 units per acre** vs >160 per acre
- Higher emission rate per unit (vs Checkmate or Isomate)



2007 Walnuts: Point Source Manipulation Total Codling Moth Damage at Harvest



All treatments statistically different from grower standard, yet not from each other

Selected 20 units per acre as starting point

Current Meso-emitter Products

(Differ in Expected Total Pheromone per Acre)



Isomate “rope” (2008)

* 2009 “ring” is a 5-C TT unit that separates to form a ring of 10 single tubes.
Deployed at 20 rings per acre.



G037

CM XL1000
(for comparison)

Suterra membrane type dispensers.
G037 deployed at 18 units per acre.

RATIONALE / POTENTIAL BENEFITS OF REDUCED POINT SOURCES

- Rationale
 - Studies support increased point source strategies
 - **BUT** empirical experience with puffers (e.g. Lake County, walnuts in Locke, CA) demonstrate success using reduced emitter point sources
- Potential benefits
 - More rapid application
 - Reduced labor costs
 - Increased opportunity for pheromone use in walnuts
 - Feasible pruning tower application (walnuts)
 - Target sites not suitable for puffer use

CHALLENGES OF SITE SELECTION FOR PHEROMONE FIELD TRIALS

Need for productive codling moth pressure in trial sites

- Low populations do not produce adequate damage for treatment contrasts
- High populations can overwhelm and bleed across treatments

Changes in Orchard Selection

2009 Field Trials

- Pears

- Targeted orchards in 1st year of “relaxed management” (no insecticide applications, limited weed management, sometimes no water)
- Expectation of codling moth populations increasing over time

- Walnuts

- Used processor data to target sites with 4 year histories of 3-6% damage;

Contrasts

- Pears

- Pheromone programs (10-20 acres) vs Untreated Control (3-5 acres)
- Meso pheromone programs vs Conventional pheromone programs (Isomate or Checkmate)

- Walnuts

- Pheromone programs plus insecticide (5-20 ac) vs same insecticide program (5-20 ac) – “ additive effect of pheromone if damage sufficiently high”
- Meso pheromone programs plus insecticide vs Conventional pheromone programs plus insecticide

Meso-emitter Efficacy Trials

Crop	Site	Treatment Plots (number of acres)			
		Meso (Suterra G037)	Ring (Isomate)	Pheromone Standard *	Control Grower Standard **
Pears	Isleton	1 (14)		1(10)	-
	Walnut Grove	2 (10,20)		2 (5,5)	2 (UTC) (5,5)
	Ukiah	2 (18,18)	1 (16)	2 (6,6)	3 (UTC) (3,5,5)
Walnuts	Colusa		1 (7)	1 (5)	1(5)
	Gustine	1 (16)		1(5)	1(10)
	Knight's Landing	1 (18)		1 (5)	1 (5)
	Linden	1 (20)		1 (5)	1 (5)
	Tracy		1 (20)	1 (5)	1 (UTC) (5)
	Yuba City	1 (5)		1 (5)	1 (8)
Total number of plots = 34 (306 acres)		9 (139)	3 (43)	11 (62)	11 (62)

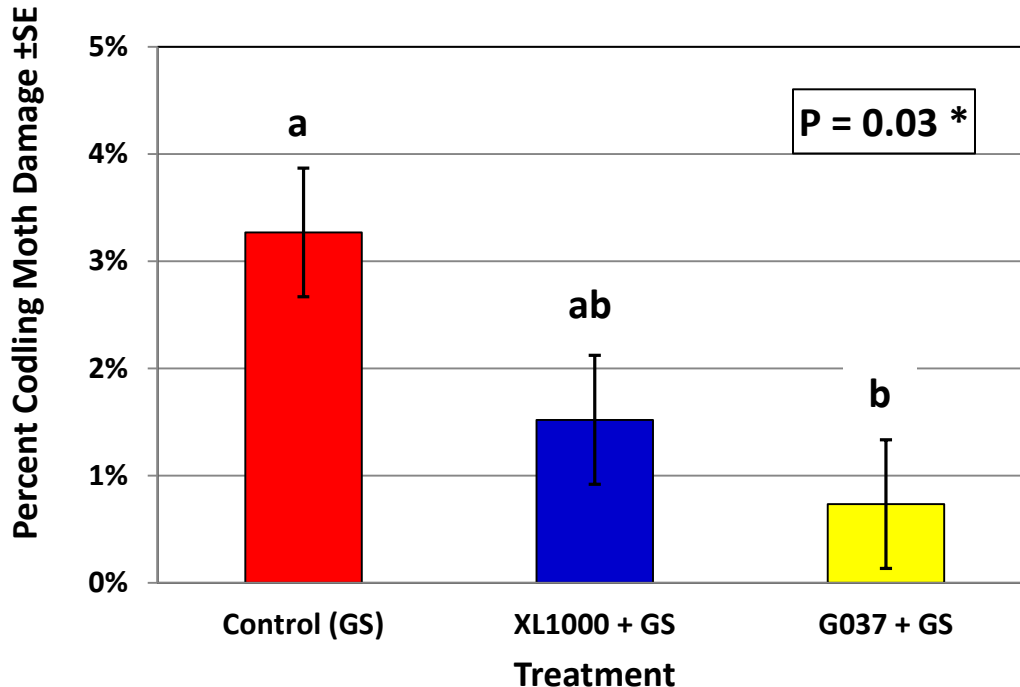
* Pheromone standard was Checkmate CM XL1000 in all sites except organic Isleton pears which was grower-applied Isomate-C TT.

** Organic Isleton pear site was grower applied pheromone to remainder of site. In walnuts, any insecticide treatments were applied uniformly to both control and pheromone treatments. No insecticides were applied in Tracy site.

Suterra Meso-emitter Efficacy

Combined commodity data (n=8)

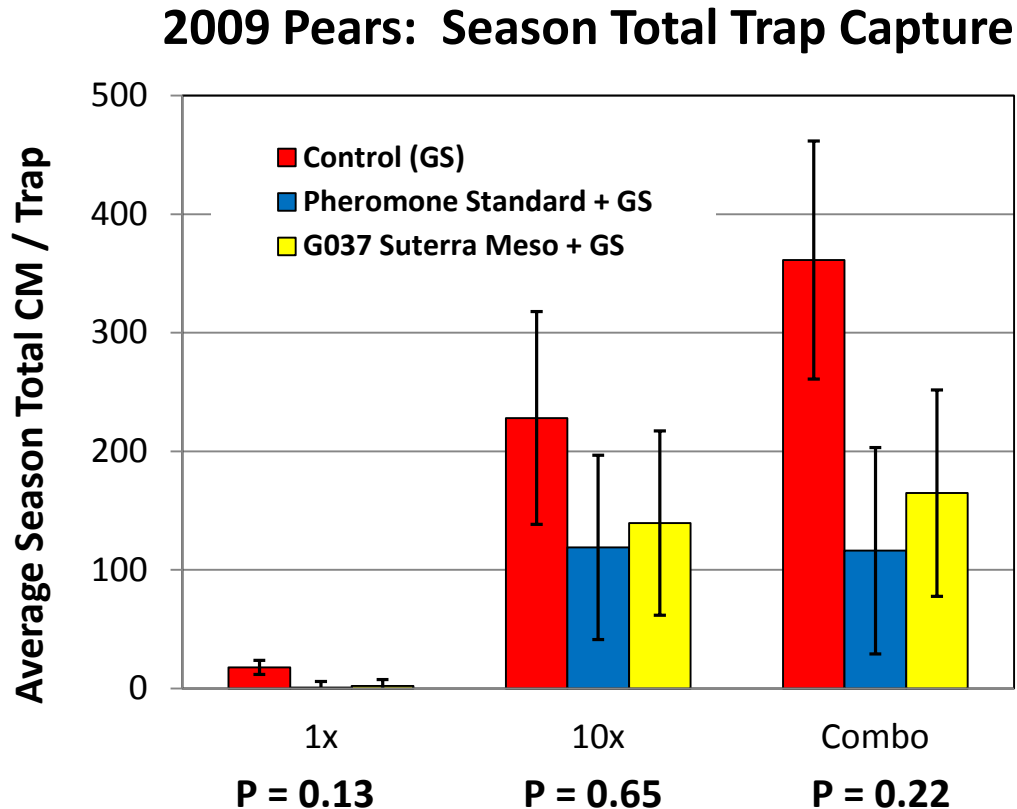
Pear and Walnut Combined Codling Moth Damage at Harvest



- Damage was significantly suppressed by meso program compared to control
- No statistical difference between meso and standard pheromone programs
- Control plots were as follows
 - Pears – untreated controls
 - Walnuts - may have included insecticide treatments applied by the grower uniformly to both control and pheromone plots.

Blocks with 0% damage in all treatments excluded

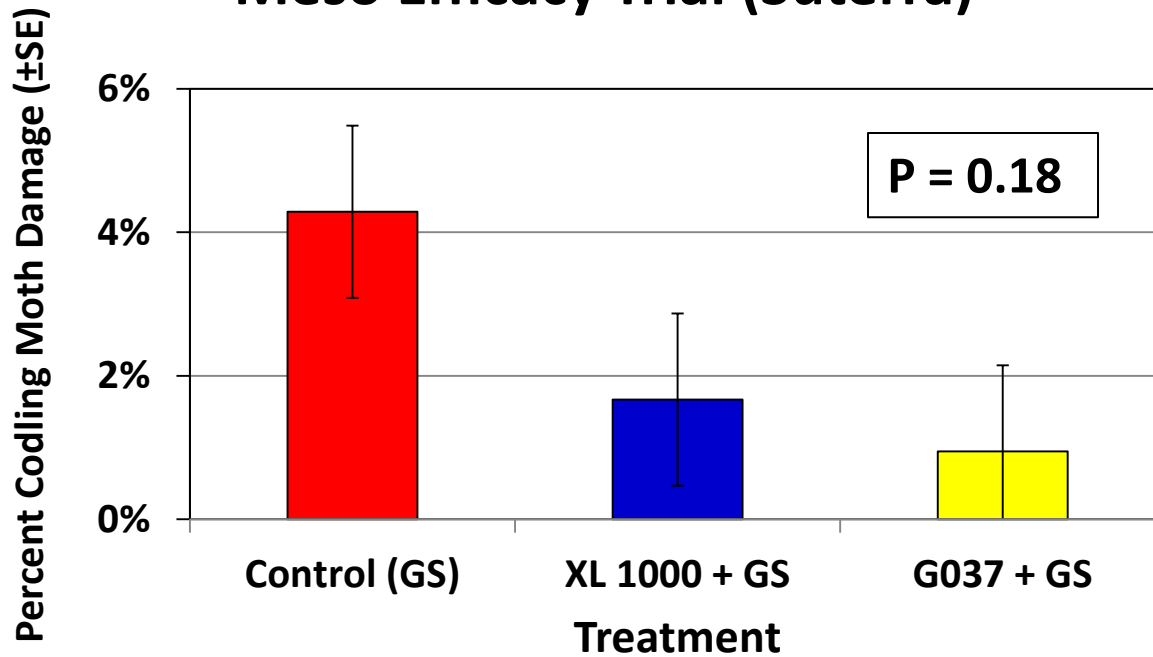
Pears: Trap Capture and Suppression



- For each lure type higher numbers collected in untreated controls
- Lack of independence between plots indicated by low 1x counts in untreated controls
- No significance between plot treatments
- Even with large blocks, there is pheromone intrusion

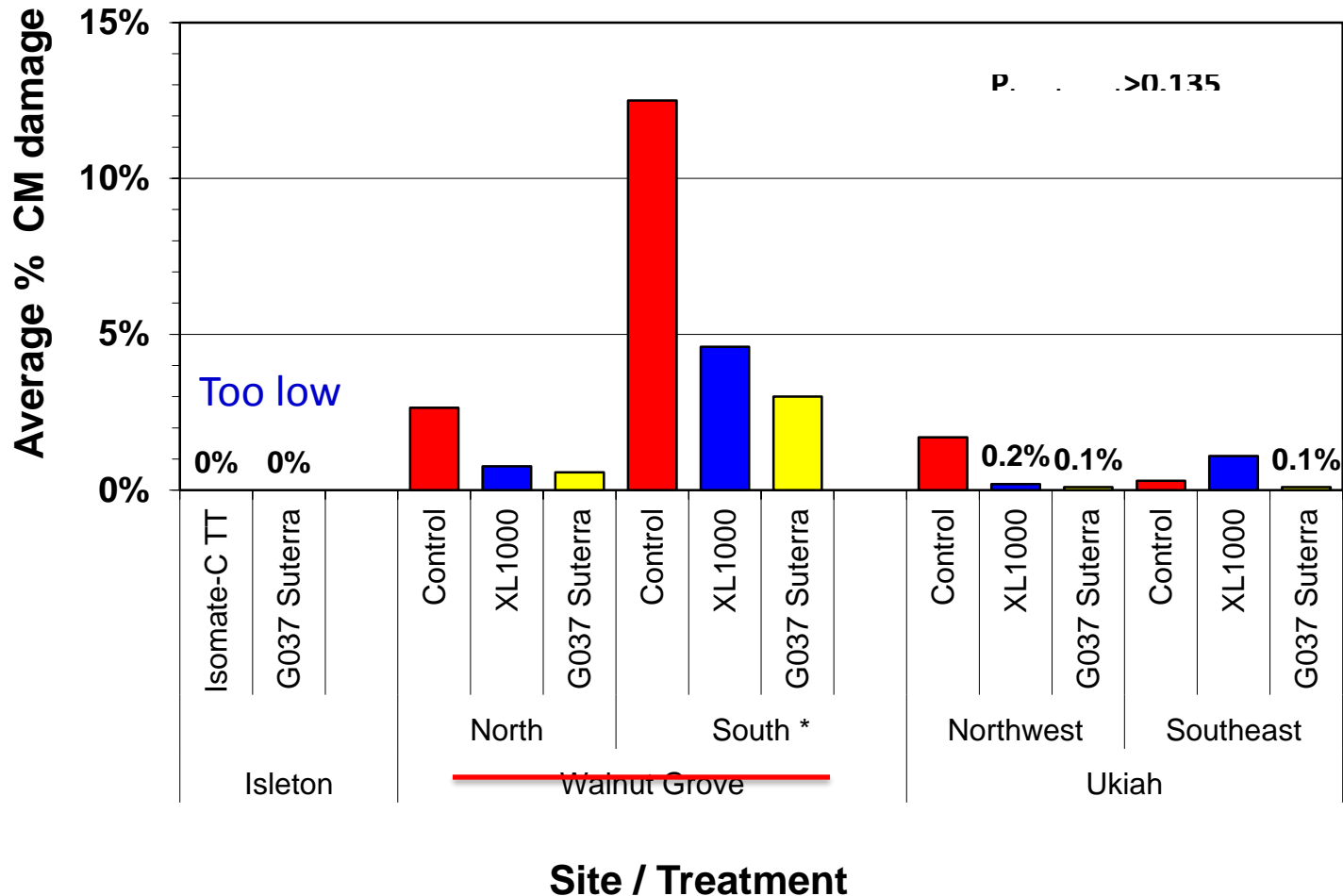
Pear Codling Moth Damage

2009 Pears: Average Percent Damage Meso Efficacy Trial (Suterra)



Pattern is similar to overall trend, but not statistically different due to smaller number of reps and low population levels in one orchard

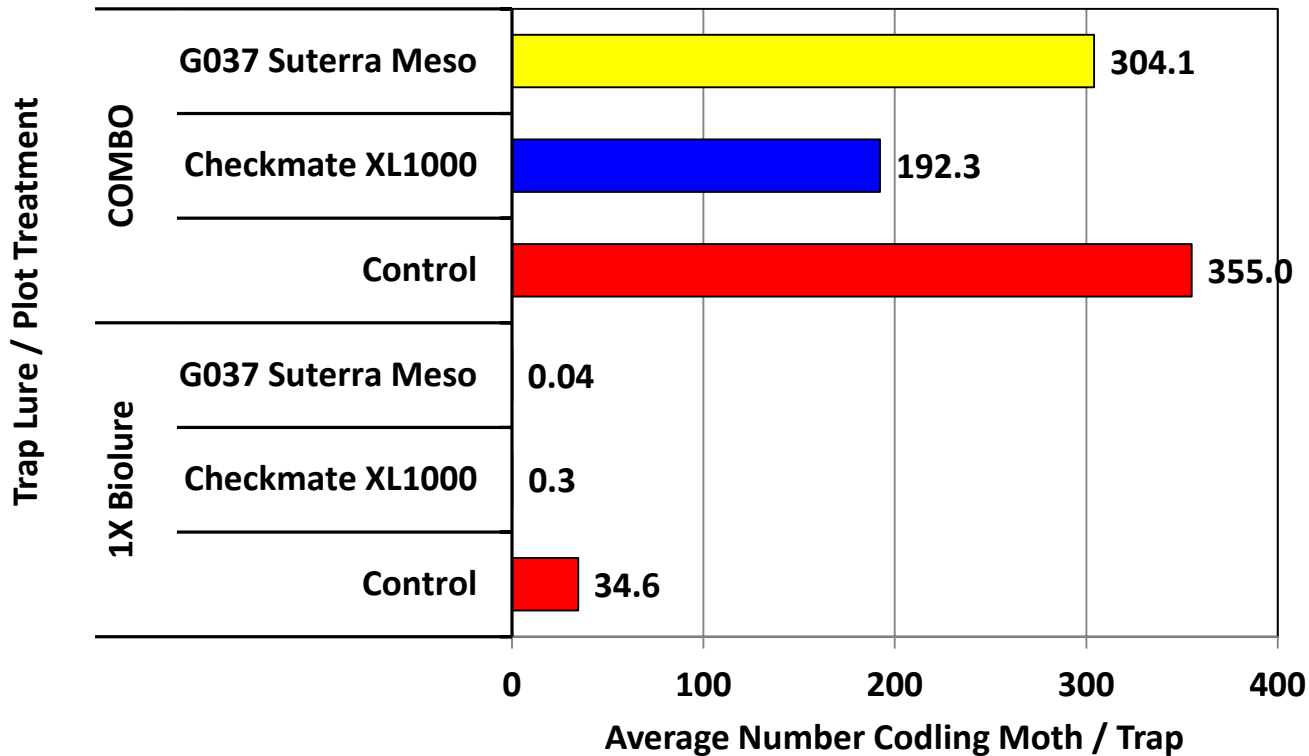
2009 Pears: Suterra Meso Efficacy Trial Codling Moth Damage at Harvest



- Damage patterns relative to treatment were similar across sites

Walnut Codling Moth Trap Counts and Suppression

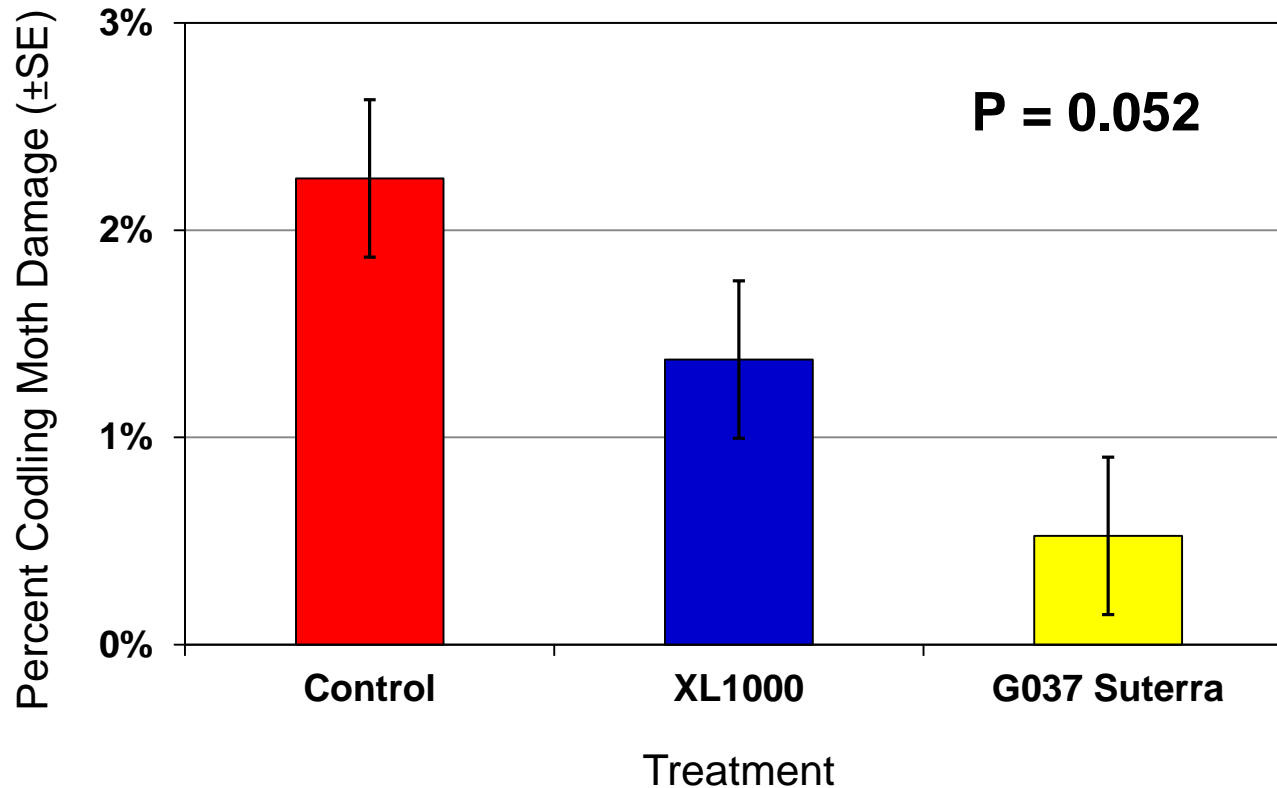
2009 Walnuts: Pheromone Efficacy Trails
Season Total Codling Moth (4-Site Average)



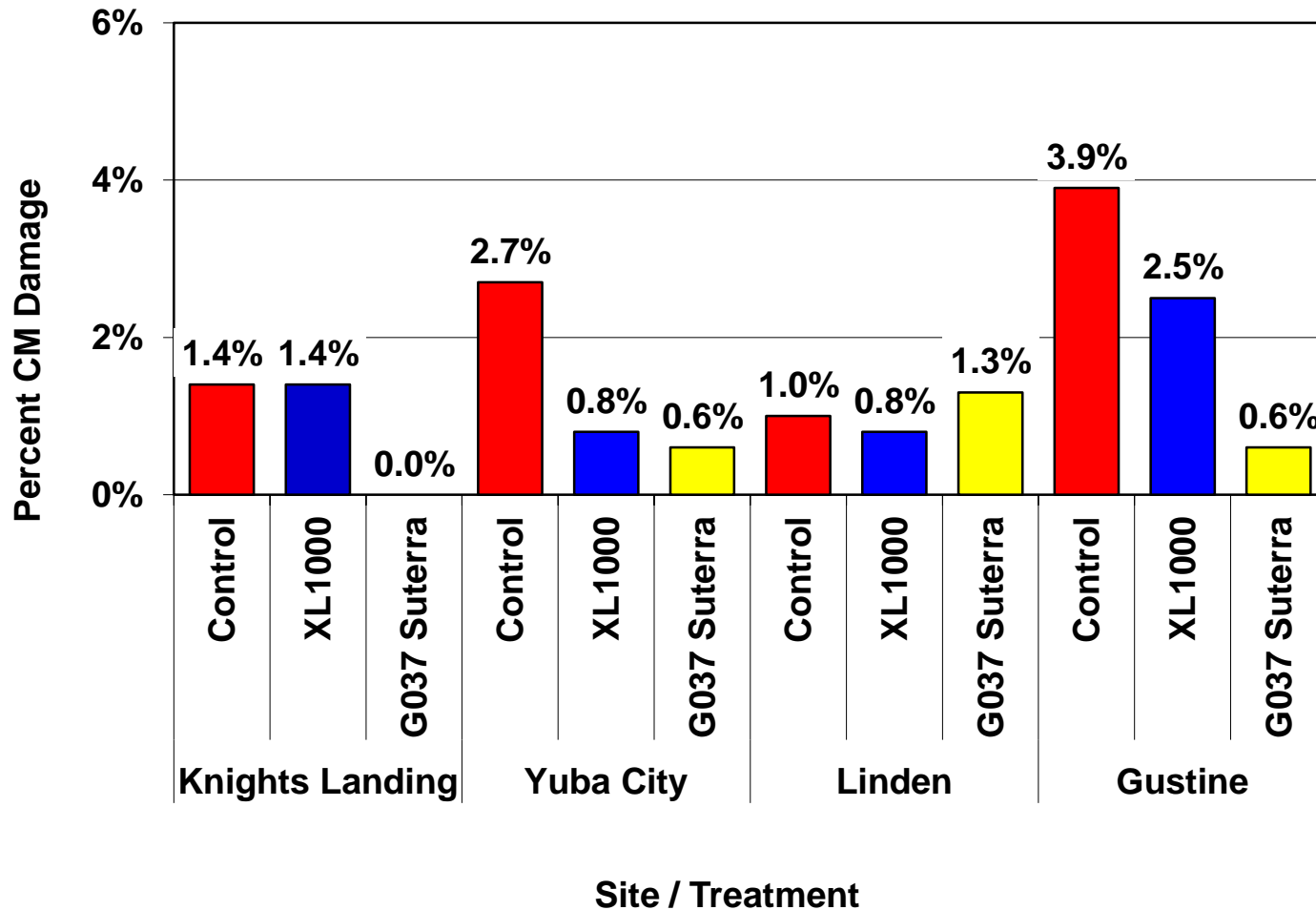
Seasonal moth counts high in all plots (mean 190-360)

Trap suppression comparable at ca. 99%

Codling Moth Damage at Harvest 2009 Walnut Meso Efficacy Trial (4-Site Average)



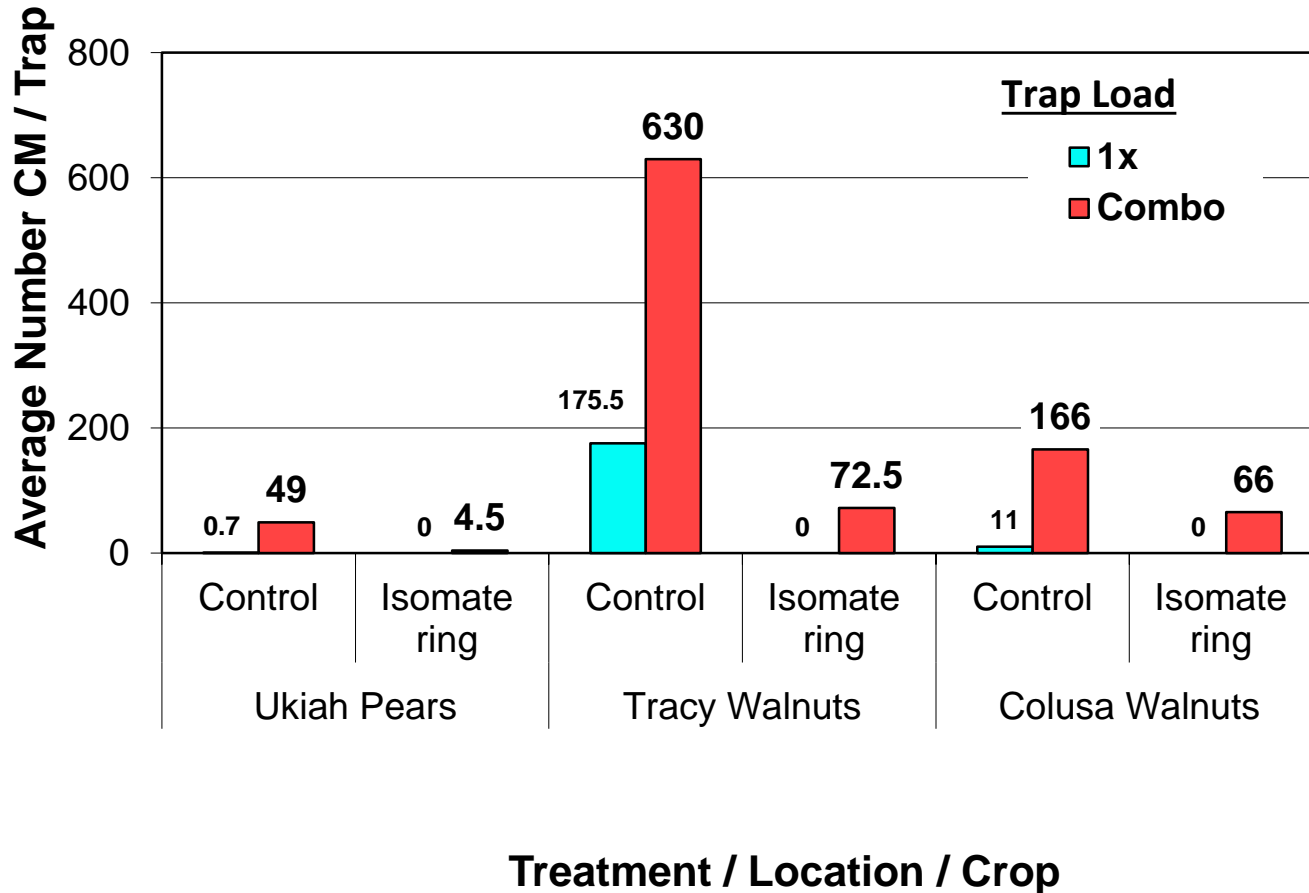
2009 Walnuts: Codling Moth Damage at Harvest Meso-emitter Efficacy Trials (Suterra Membrane)



Variation in both pressure and outcome observed across orchards

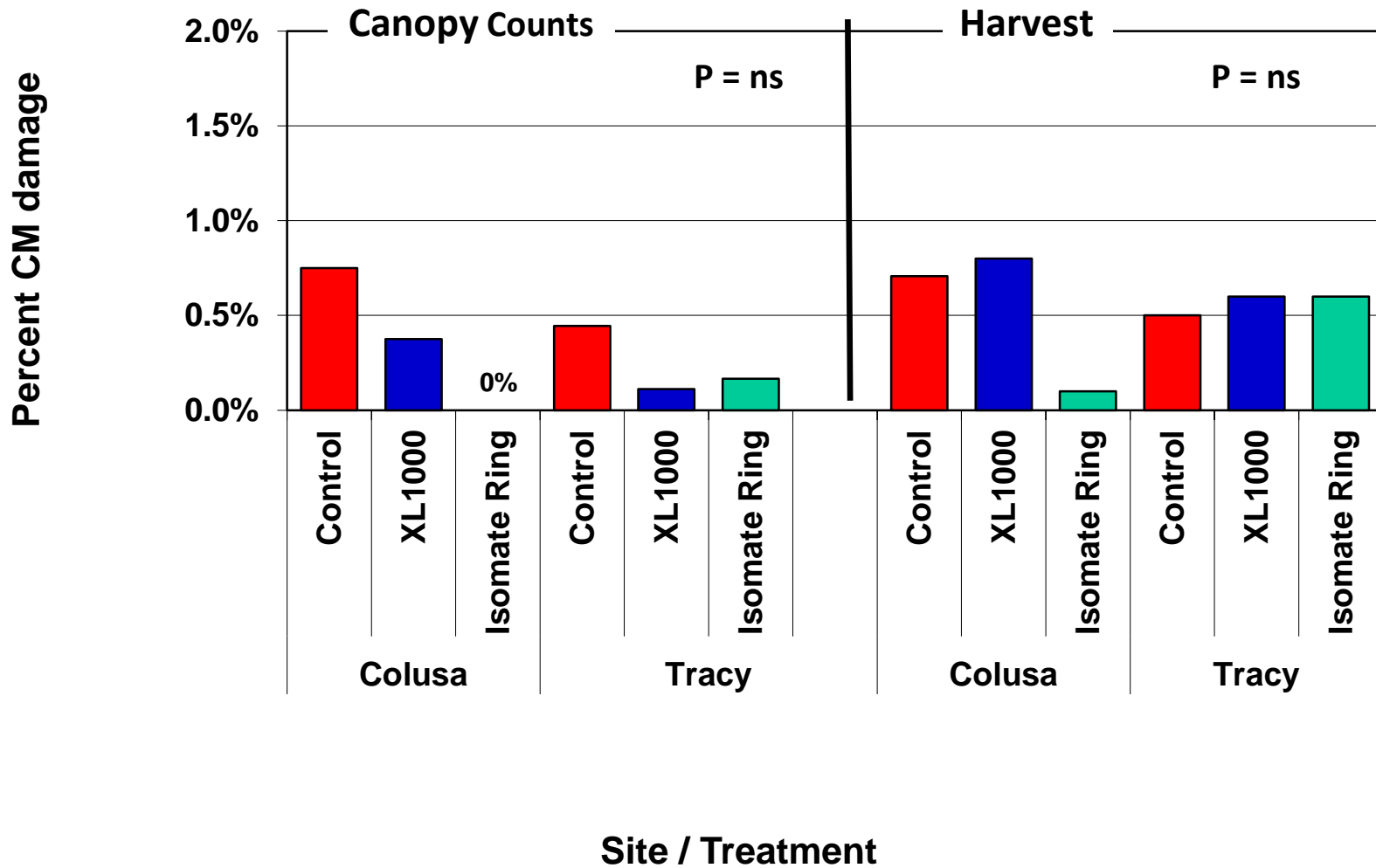
Isomate Rings - Codling Moth Counts

2009 Isomate Ring in Pears and Walnuts:
Average Season Total Codling Moth Per Trap



Good suppression of 1X lures and good population pressures in 2 of 3 orchards

2009 Walnuts: Isomate "Ring" Efficacy Trials Codling Moth Damage



SUMMARY

- Meso-emitter treatments provided control comparable to standard pheromone programs across a range of pressures
- Differences were statistically significant for pooled data from walnuts and pears
- Trap suppression (1x) averaged 95% or more in both meso and standard pheromone programs which is different than in 2008
- Damage suppression patterns were consistent across commodities
- Time of application reduced more than 80% in pears and 90-95% in walnuts.
- First product registration has been submitted