Effects of nominal thresholds and flush on psyllid spray decisions

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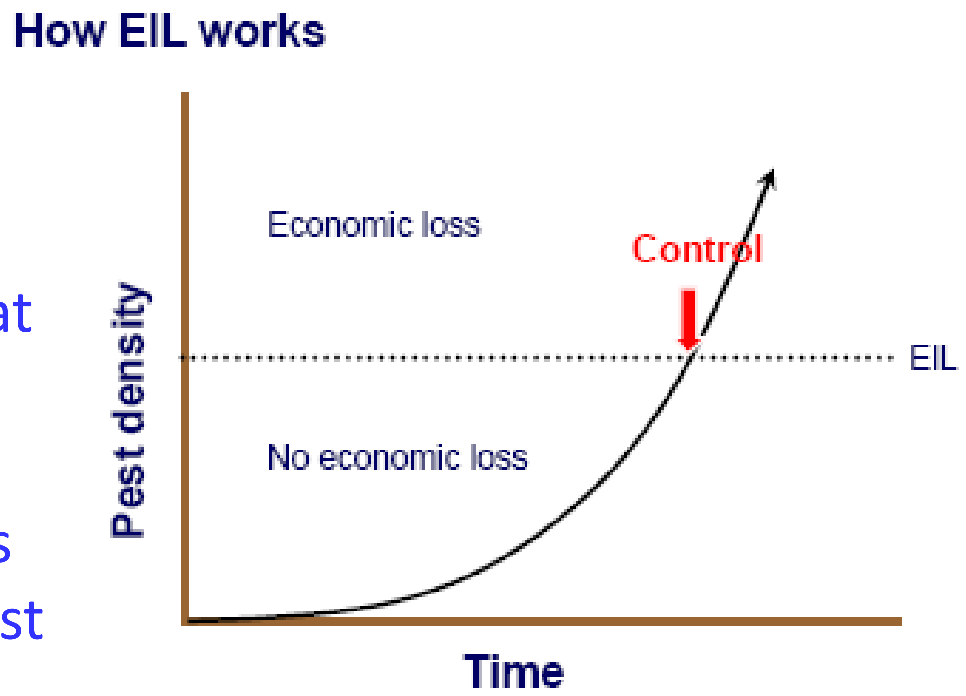
The Economic Injury Level (EIL)

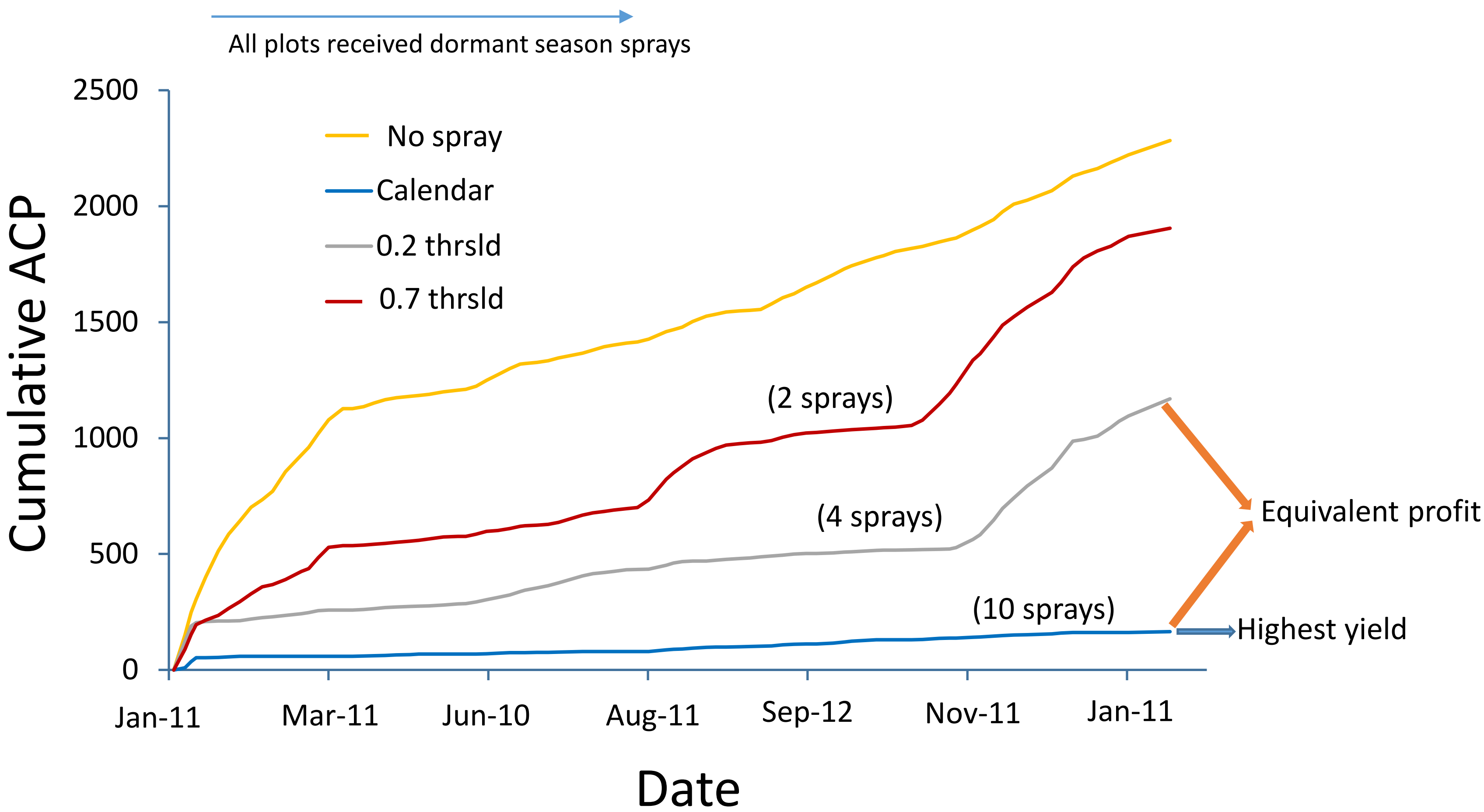
- How do thresholds relate to psyllid damage?
- The role of flush
- Combining a threshold while considering the role of flush

The Economic Injury Level

- Requires regular monitoring
- Known target population that causes economic damage
- Decide whether treatment is necessary after assessing pest populations
- Control measures applied when that known threshold is reached

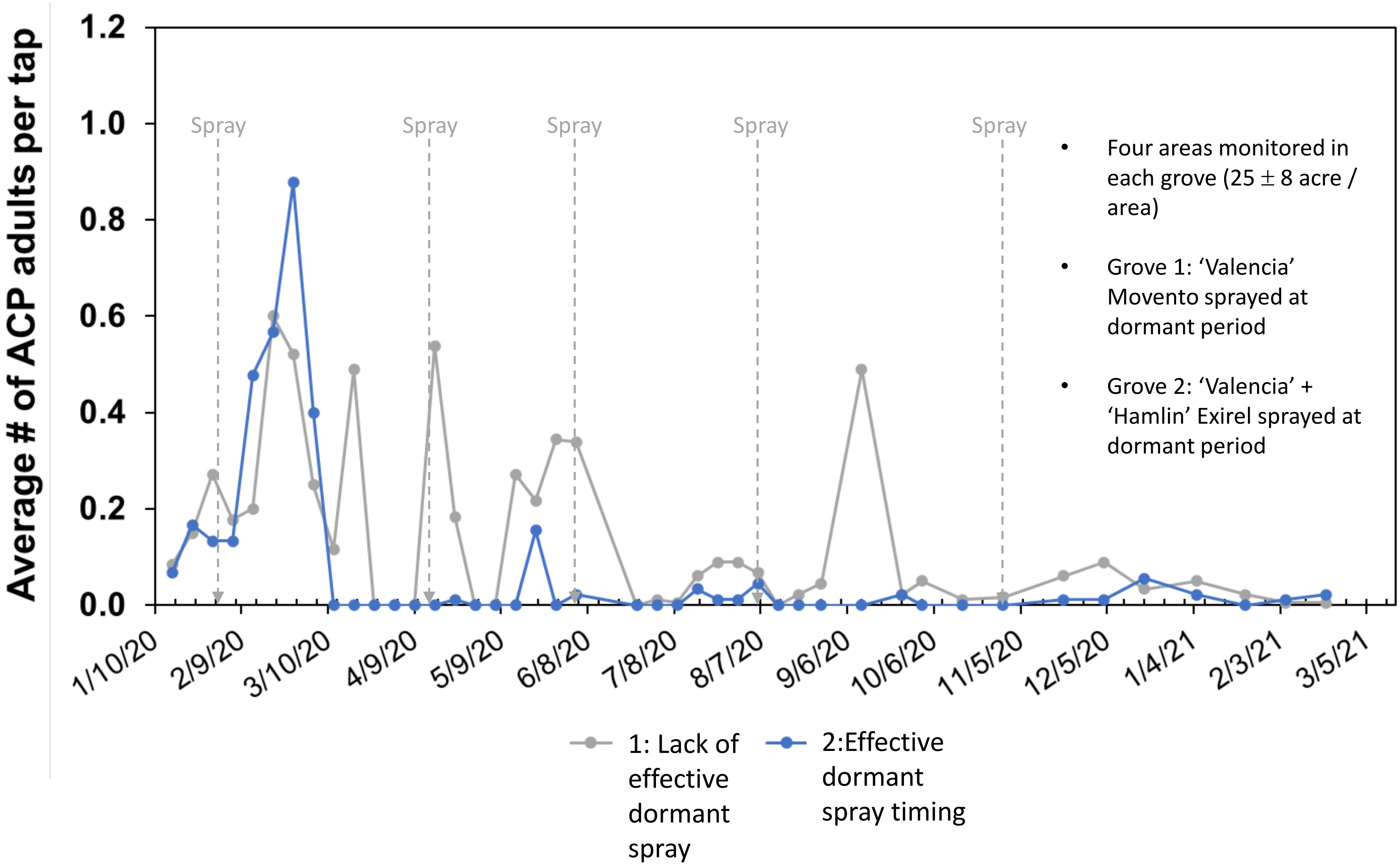


Managing ACP using an Economic Injury Level—Mature Grove



Effectively timed dormant season sprays are critical to establish a sufficiently low ACP population at season's onset in order to implement EIL

Starting out with low ACP population with effective dormant spray is essential for implementing an EIL



- Four areas monitored in each grove (25 ± 8 acre / area)
- Grove 1: 'Valencia' Movento sprayed at dormant period
- Grove 2: 'Valencia' + 'Hamlin' Exirel sprayed at dormant period

Typical recent model for ACP sprays:

- After harvest, a dormant spray has been usually timed before major spring flush using pyrethroid or organophosphate.

- Sprays made on a schedule with intervals determined by length of efficacy of a particular insecticide.

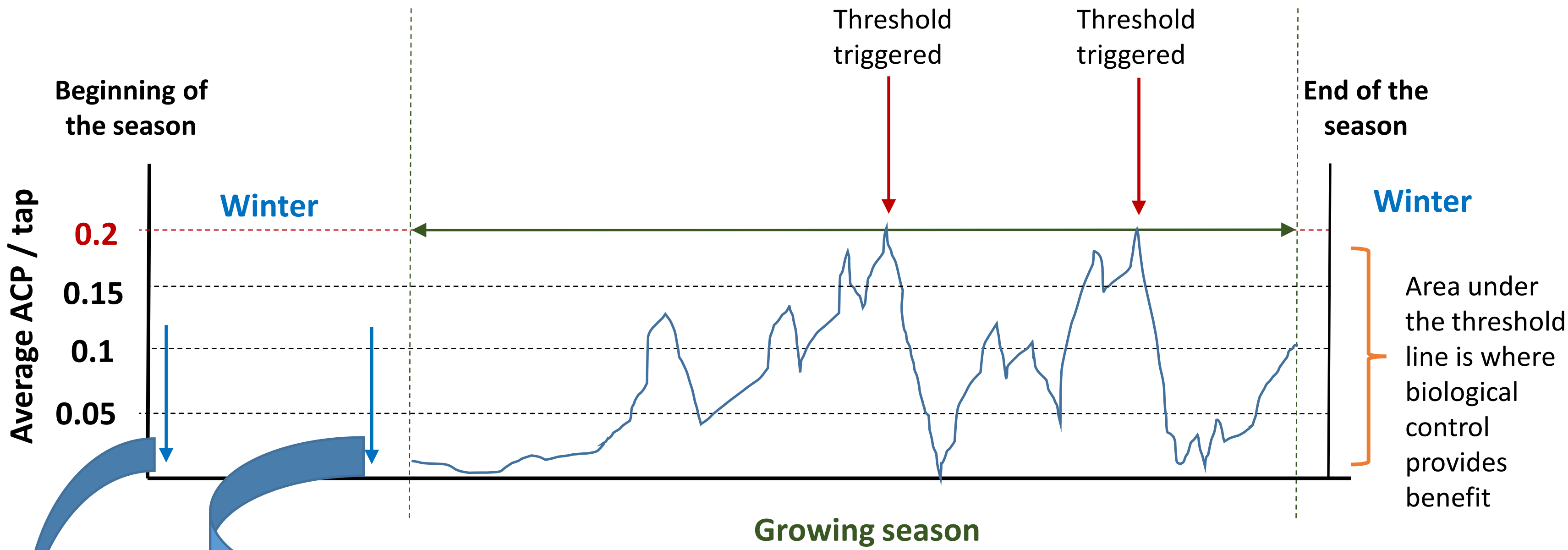
Possible better alternative:

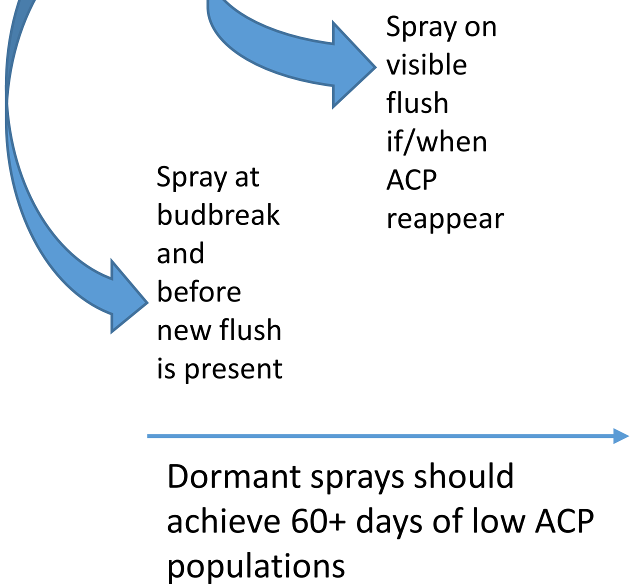
- Spray for adults at bud break at the beginning of each new flush before there is feather flush on which adults can lay eggs.

- Apply second spray on the flush as ACP begin to reappear. This seems to achieve more than 60 days of low ACP populations.

- Hold off spraying until ACP reach threshold (0.2—1 per tap).

Hypothetical example of implementing an Economic Injury Level at 0.2 ACP/ tap





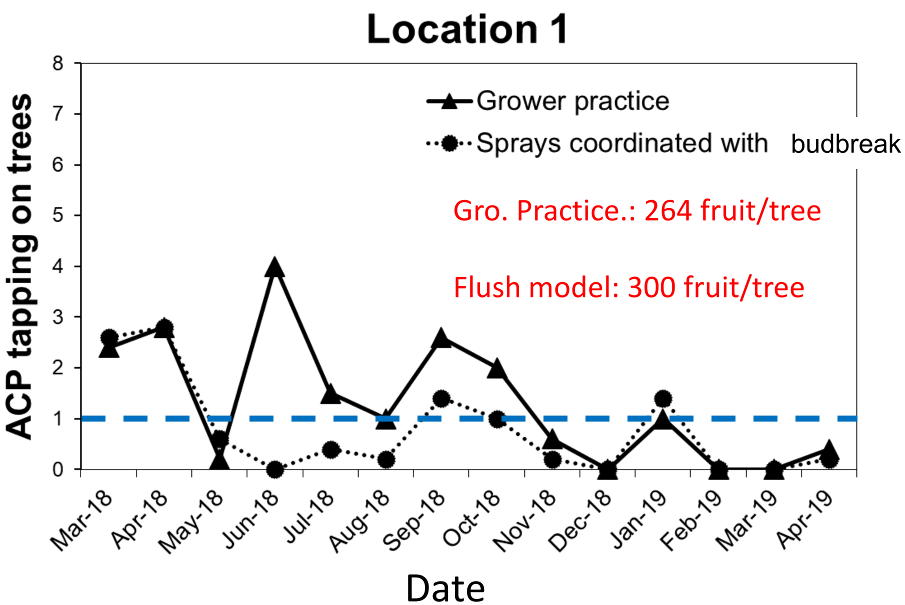
Key Assumptions:

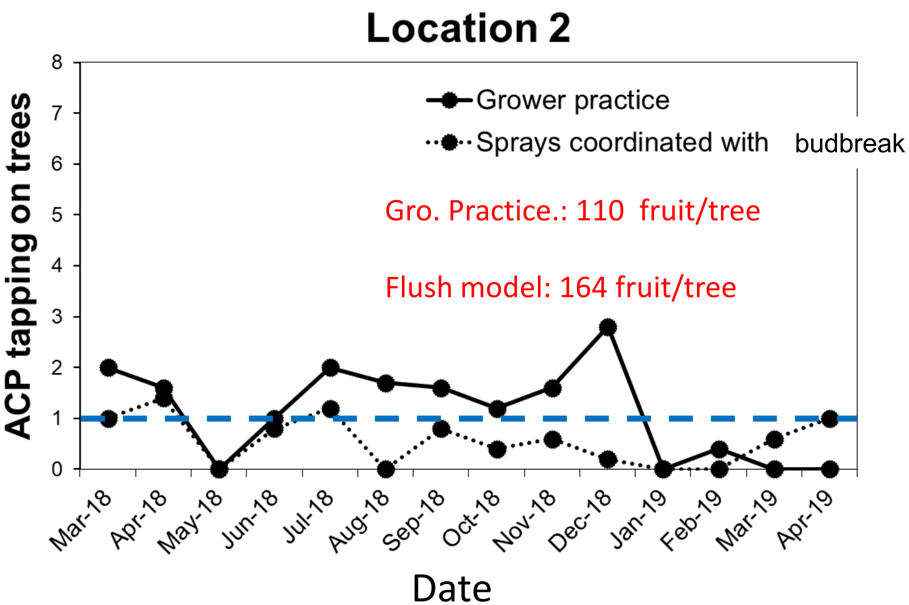
- HLB infection is near 100% and stopping spread is not a goal
- Keeping ACP below the chosen threshold boosts yield via improved tree health

Integrating tree phenology with EIL

- Timing insecticide applications with bud break resulted in better ACP suppression.

- Maintaining ACP populations below a threshold of 1 ACP / tap was associated with better yield.





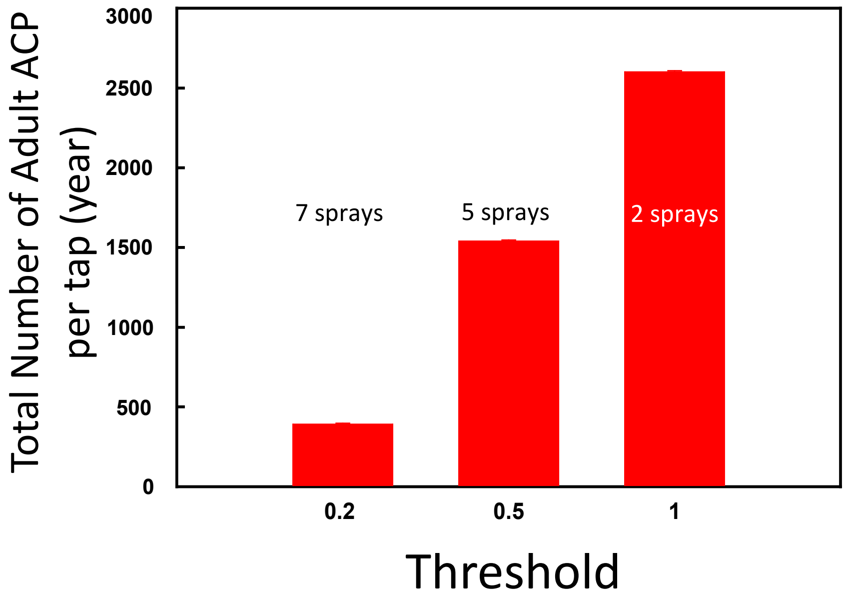
-Solid lines indicate calendar sprays (higher ACP)

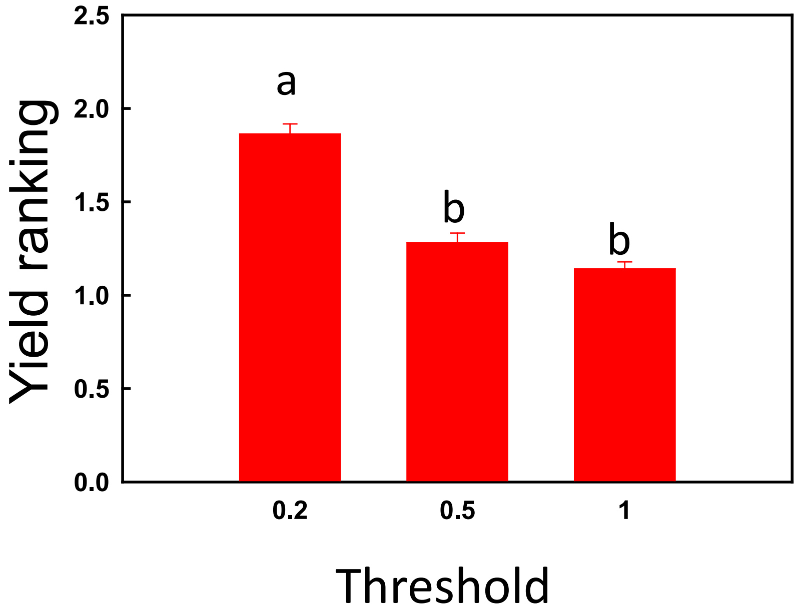
-Dashed lines indicate use of bud break model to predict flushes (lower ACP)

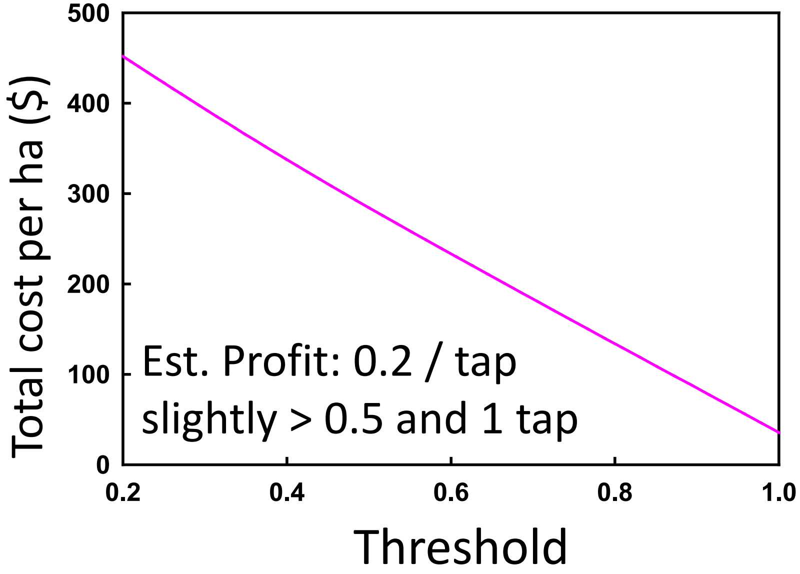
Increasing threshold above 0.2 psyllids/tap in 5 yr old citrus did not return profit

	Threshold		
App Date	0.2 ACP / tap	0.5 ACP / tap	1.0 ACP / tap
May 5, 2020	fenpropathrin (Danitol 2.4EC)	------	------
Jun 9 10, 2020	dimethoate (Dimethoate 4E)	fenpropathrin	------
Jul 7-10, 2020	cyantraniliprole (Exirel)	dimethoate	fenpropathrin
Aug 12, 2020	diflubenuron (Micromite 80WGS)	cyantraniliprole	------
Sep 24, 2020	thiamethoxam (Actara WG)	diflubenzuron	dimethoate
Oct 28, 2020	spinetoram (Delegate WG)	------	------
Dec 18, 2020	abamectin	thiamethoxam	-------

Trend of higher yield with lower threshold; profit loss in 5 yr old trees due to damage by going above 0.2 / tap threshold



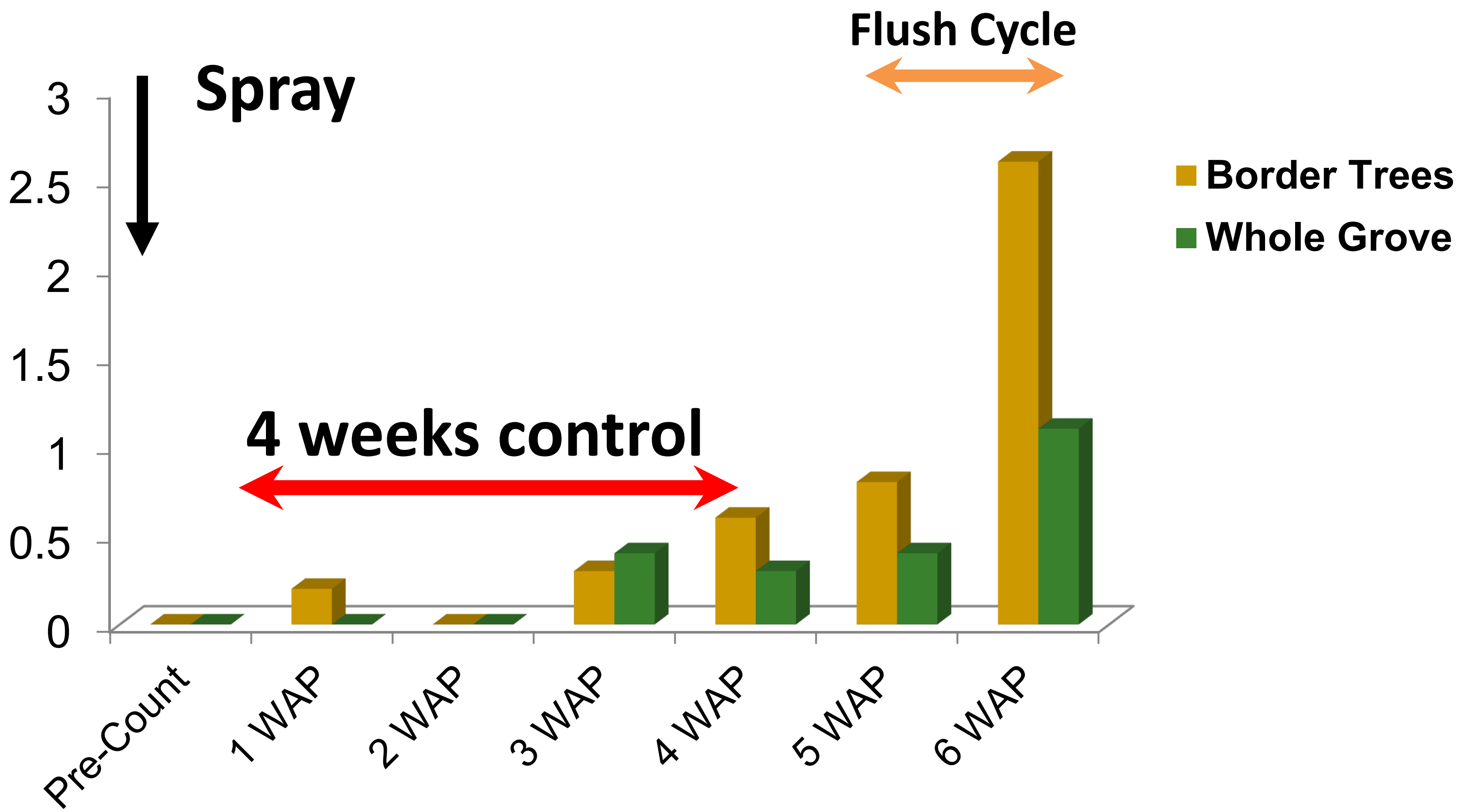




More than one way to reduce costs

- Border treatments
- Targeting flush

Border vs whole grove sprays in blocks previously sprayed

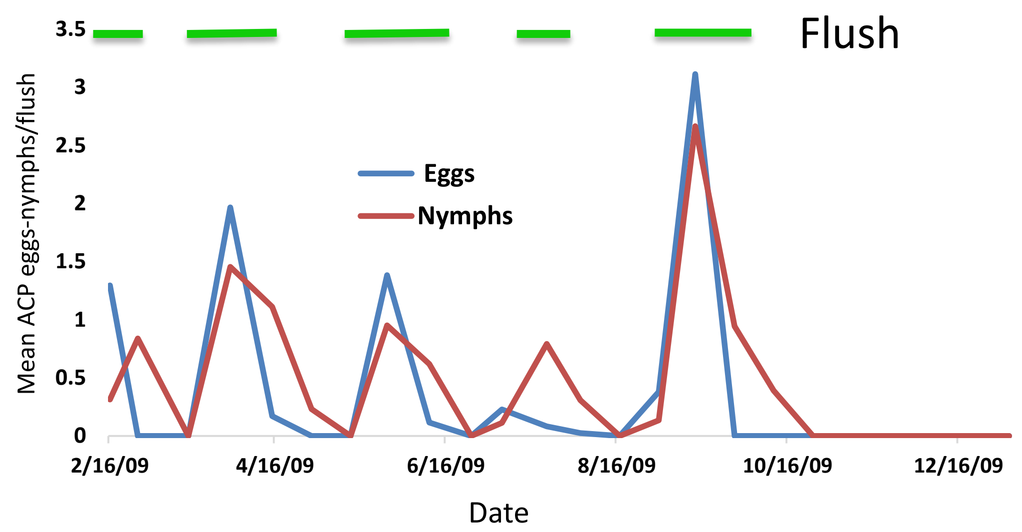


Border sprays can reduce ACP densities for about 4 weeks, but when new flush appears, whole grove applications are more effective

M. Setamou

Importance of Flush shoots:

- Flush cycles are the main driver of ACP population fluctuations: adult recruitment & reproduction

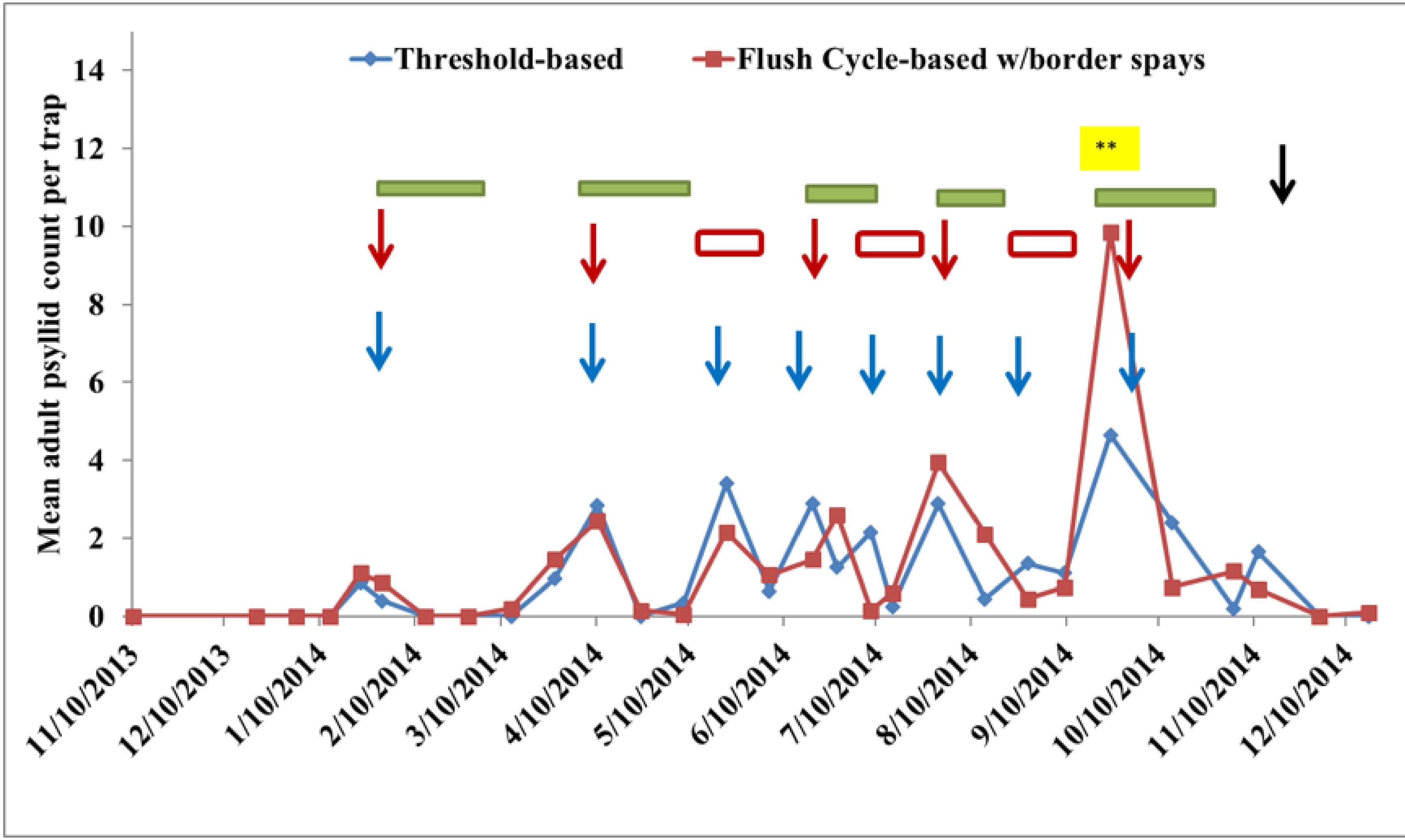


- Higher CLas acquisition (2.7 times more ACP acquire CLas in presence of flush shoots; Setamou et al. 2016)

- Higher CLas transmission when flush shoots are present (Hall et al. 2016)

- Higher CLas titers in leaves during flush cycles (Ibanez & Stelinski, 2019)

Flush-based (phenology) versus nominal threshold



M. Setamou (Texas A & M)

Border sprays reduced cost

Threshold based sprays: 9 whole grove sprays

Phenology-based + Border sprays: 6 whole grove sprays

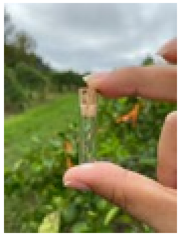
3 Border sprays (0.3)

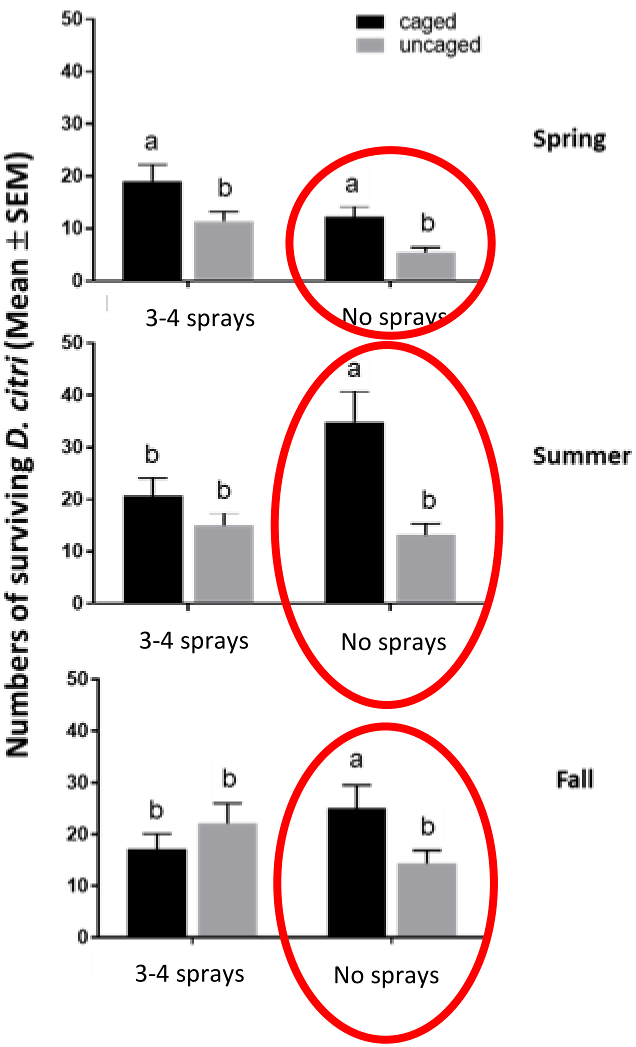
- Insecticide Savings:

$$\% \boldsymbol{Savings} = \mathbf{100} \times \frac{\mathbf{(9-6.9)}}{\mathbf{9}} = \mathbf{23.3\%}$$

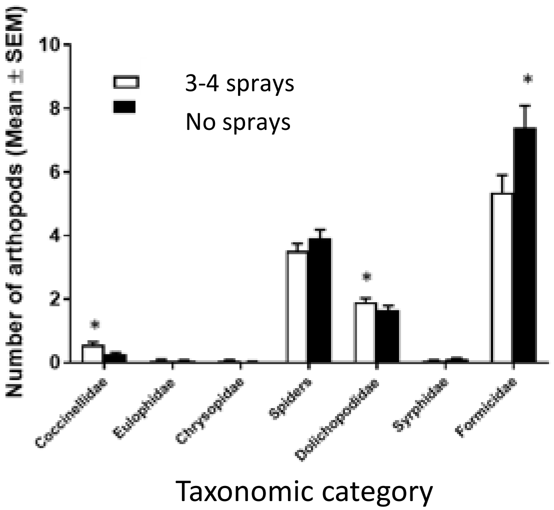
Insecticide savings depend on grove size

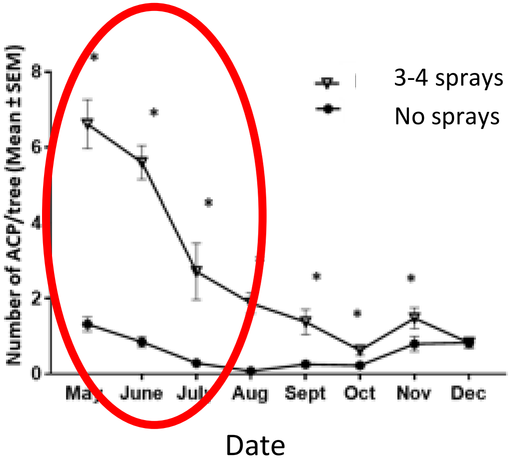
Can you expect greater biological control of ACP by limiting sprays to 3-4 / year?





- The evidence does not support this hypothesis
- There is a measurable decrease in ACP survival caused by natural enemies in unsprayed groves season long, which is disrupted when applying only 3-4 sprays annually.
- Even relatively minimal insecticide use for ACP appears to have large impact on activity of natural enemies on this pest





Managing psyllids while reducing cost

- Psyllid density is related to tree stress—more psyllids--> higher damage, which compromises tree health (yield)
- Spray for adults at bud break at the beginning of first flush before there is feather flush on which adults can lay eggs.
- If the pest population (and the resulting damage) is sufficiently low, it might not pay to take control measures
- As the pest population continues to rise, it reaches a point where the resulting damage (=reduced immune response) would justify taking control measures
- 0.2 psyllids per tap seems like an effective ballpark.
- Border sprays between flush cycles can also reduce cost

Funding: Thank you CRDF