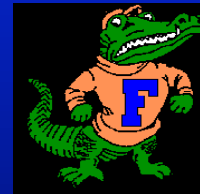


Insecticide Resistance in Asian citrus psyllid Populations

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Introduction and Outline

- Asian citrus psyllid (ACP) vector of *Candidatus liberibacter* that causes “huanglongbing” or citrus greening.
- Principal method of controlling ACP: Insecticides.
- Frequent use of insecticides and reports of failures = raised concerns about resistance.
- Topical assay used to monitor resistance: Ridge (Stelinski Lab), River (Qureshi Lab), Gulf (Stansly Lab)
 - Imidacloprid (Neonicotinoid – 4A)
 - Fenpropathrin (Pyrethroid – 3A)
 - Dimethoate (Organophosphate – 1B)
- Results, SW Florida
- Field study, imidacloprid in young trees
 - Soil application, spray application, untreated check
 - Control and resistance
- Recommendations for reversing resistance to neonics

Survey, SW Florida

- **Insects:**

- Susceptible laboratory colony from CREC used in paralleled projects in Gulf, Ridge and River
- Collections of ACP adults from 10 commercial citrus groves in Lee, Hendry and Collier counties.



- **Insecticides:**

- 6 successive dilutions: 0, 100, 50, 10, 5 and 1 ng/ μ l of technical grade imidacloprid (99.9%), fenpropathrin (99.1%) or dimethoate (99.8%) were applied to each adult ACP.



- **Bioassay**

- Tiny droplet to the dorsal side of the thorax
- Between 5 and 7 ACP orange leaf disc of young orange leaf on agar in a Petri dish.
- 5 reps per concentration read after 24 h



Field collection



ACP adults collected in field using a hand held vacuum converted from a motorized leaf blower

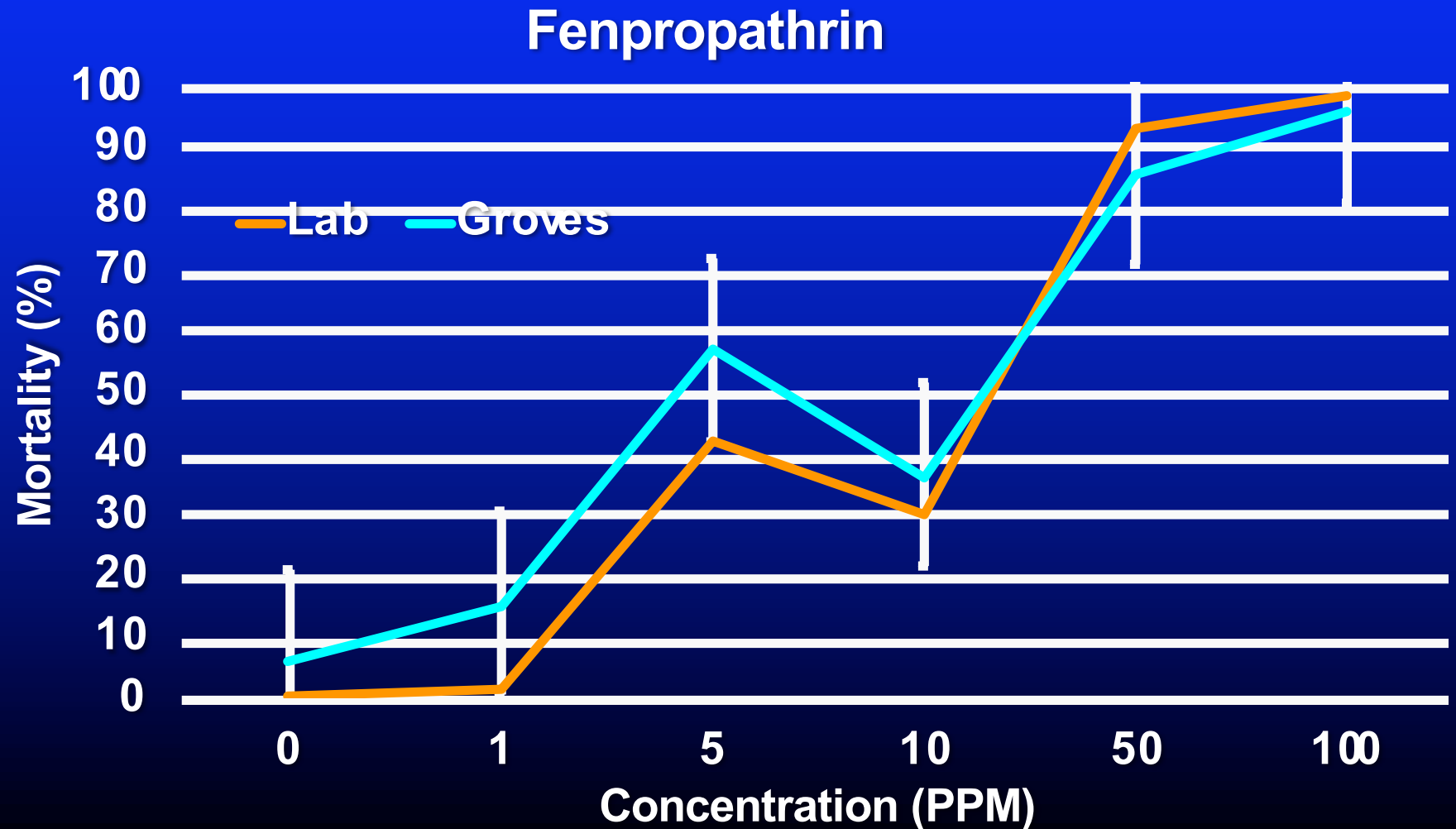


Insects put in acrylic cages and brought to the lab

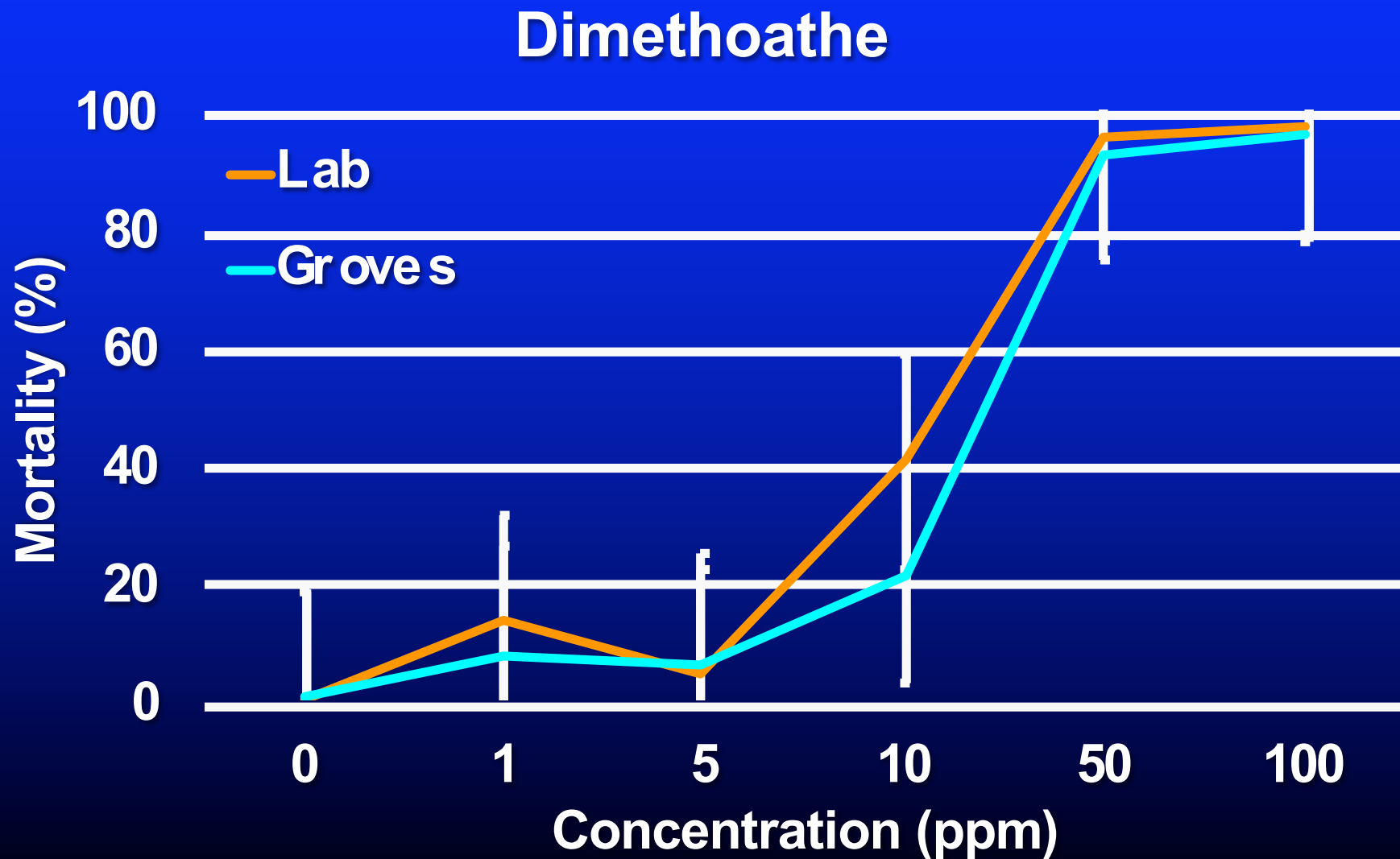


Cages with Murraya plant if held for more than 24 hours

ACP Mortality Rate at 6 different Concentrations of Fenpropathrin



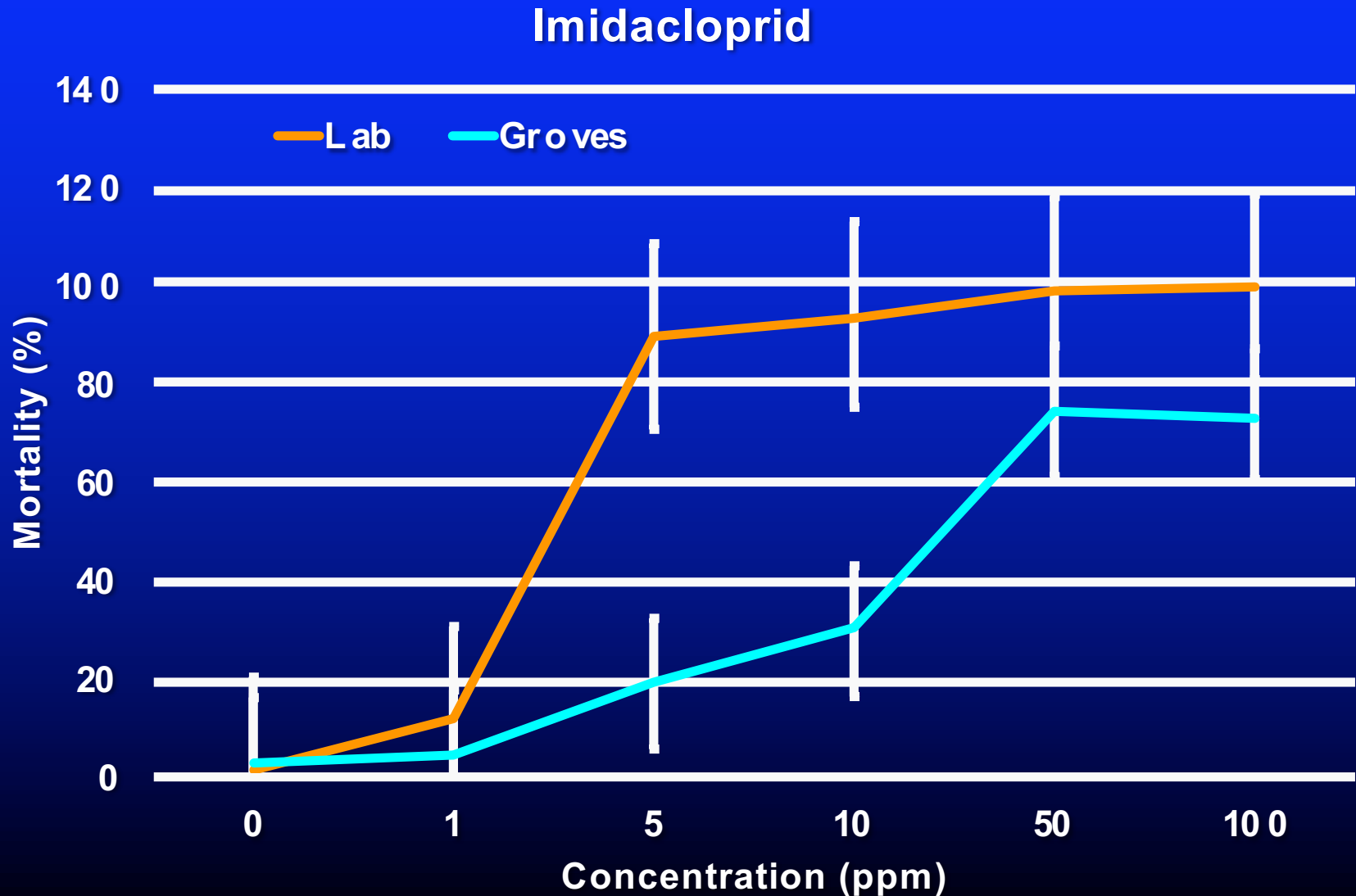
ACP Mortality at 6 Different Concentrations of Dimethoate.



Mortality of ACP Adult field populations using Imidacloprid (99.9%) at 10 ng/μl (PPM)

Susceptible Lab Colony			Locations	Field populations		
ACP total	Dead	Mortality (%)		ACP total	Dead	Mortality (%)
35	35	100	Immokalee North	35	20	57.1
30	30	100	Ave Maria	30	17	56.7
34	34	100	Immokalee South	34	19	55.9
35	35	100	F10- SWFREC	35	18	51.4
35	35	100	Labelle 1	34	17	50.0
25	23	92	F11- SWFREC	25	12	48.0
35	31	89	Felda	35	10	28.6
25	23	92	Labelle 2	25	7	28.0
33	33	100	SWFREC- Main	34	9	26.5
			Grove			
30	30	100	Clewiston	30	7	23.3
25	14	56	Immokalee North	25	5	20.0
35	34	97	Devil's Garden	35	6	17.1
35	35	100	P-Block- SWFREC	105	8	7.6
412	392	95.2		482	155	32.2

ACP Mortality Rate at 6 Different Concentrations of Imidacloprid(ng/μl).



Biology of HLB transmission and acquisition



Time	Stage	Event
1 day	1	Transmission of CLas to the shoot by adult
15 days	2	Acquisition & amplification of CLAS by nymphs
30 days	3	Tree infection and emergence of infected adults
Nymphs 27 X more sensitive to imidacloprid than adults		
Main objective of soil applied systemics is control of nymphs		
Still, effects on adults are indicative of effects on nymphs		
Over use of soil applied neonicotinoids has resulted in resistance		

Conclusions

- Topical Bioassays were conducted to test tolerance of field populations of *D. citri* in SW Florida to the most used insecticide modes of action.
- Moderate to high levels of tolerance to imidacloprid was seen throughout SW Florida
- Little or no tolerance was seen to fenpropathrin and least to dimethoate
- This technique is providing data needed to make informed decisions more effected resistance and pest management strategies.

Trial to evaluate reversal of Imidacloprid resistance in young trees at SWFREC



Latin square
Design with 3
treatments
and 3 reps



Foliar spray every 4 weeks: 44 trees

Untreated Check: 46 trees

Drench every 8 weeks: 47 trees

Drench every 8 weeks: 44 trees

Foliar spray every 4 weeks: 46 trees

Untreated Check: 47 trees

Untreated Check: 44 trees

Drench every 8 weeks: 46 trees

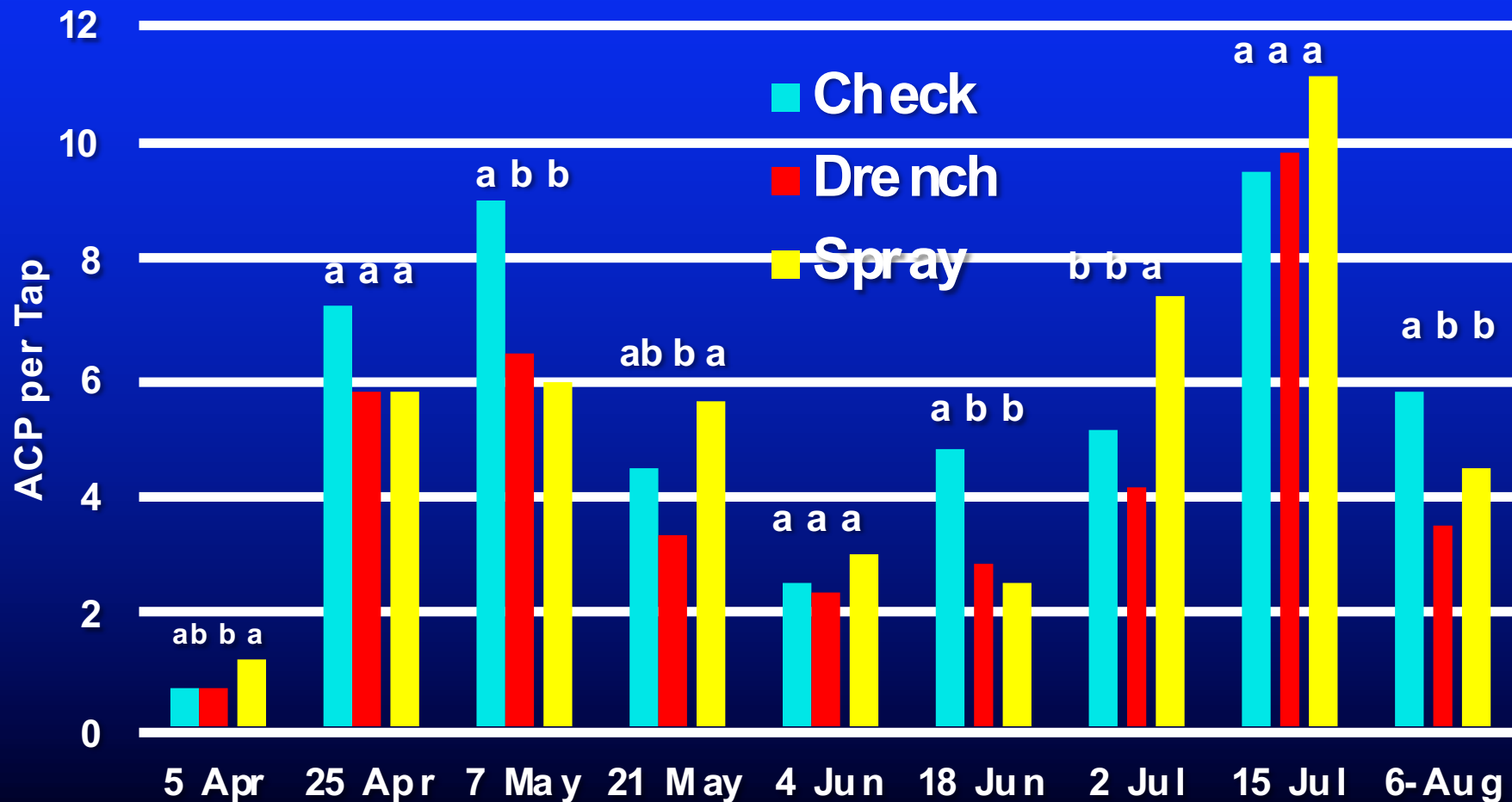
Foliar spray every 4 weeks: 44 trees

8-Dec	Drench	3.5 oz
8-Dec	Spray	1.75 oz
10-Jan	Spray	1.75 oz
8-Feb	Drench	3.5 oz
8-Feb	Spray	1.75 oz
8-Mar	Spray	1.75 oz
10-Apr	Drench	7
10-Apr	Spray	3.5
1-May	Spray	3.5
25-May	Drench	10.5
25-May	Spray	5.25
15-Jun	Spray	5.25
3-Jul	Drench	14
3-Jul	Spray	7
26-Jul	Spray	7
16-Aug	Drench	14
16-Aug	Spray	7

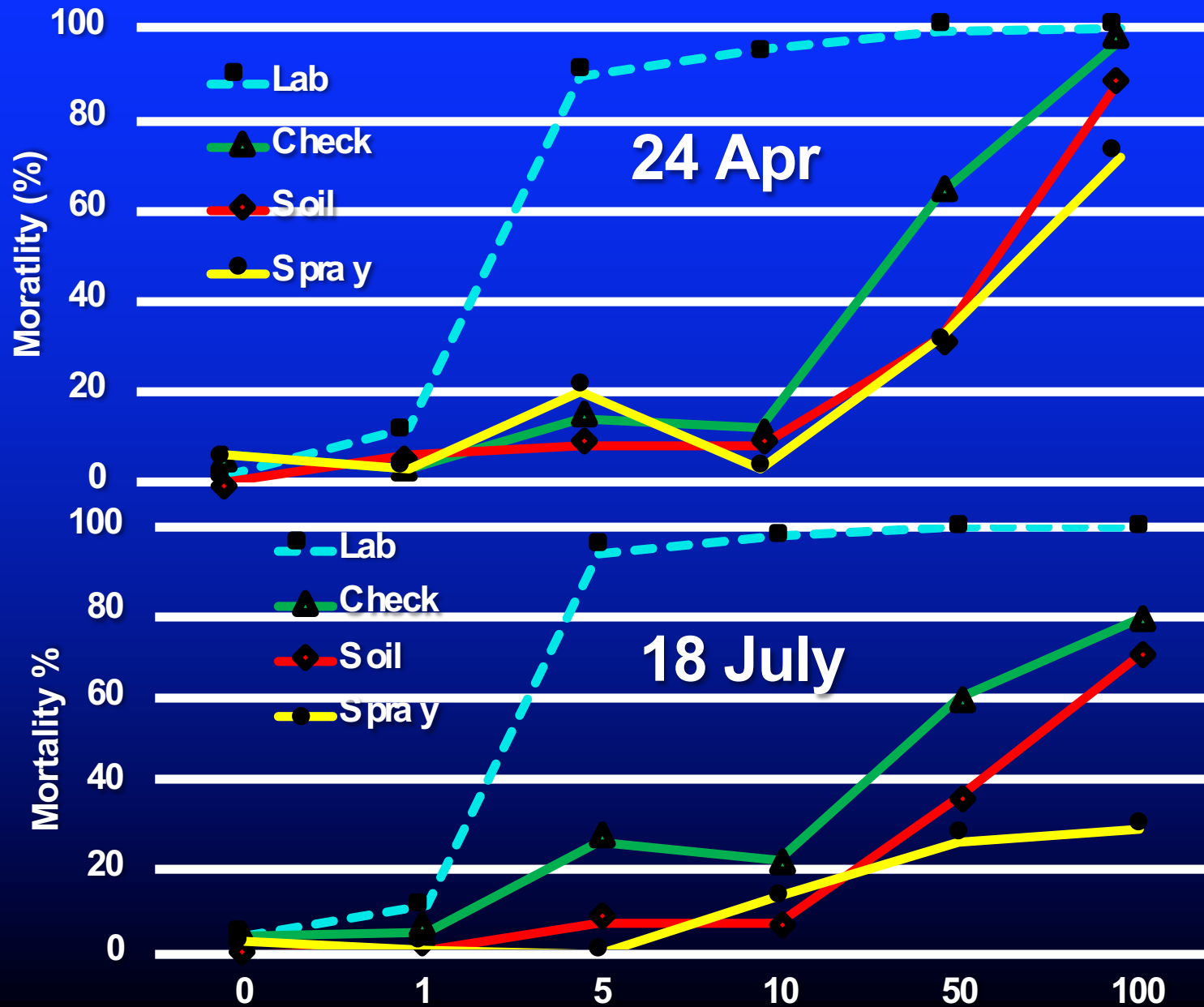
Applications of Admire Pro to young tree block at SWFREC

Rates based on 248
trees per acre in 10 oz
per tree (drench)
using an EasyGo
applicator or 16.5 gal
per grove acre (Spray)
using a high clearance
sprayer

ACP Populations in Imidacloprid trial on young trees at SWFREC



Susceptibility of Lab and Field ACP to Imidacloprid



Implications and Recommendations

- ACP resistance to imidacloprid and other neonicotinoids is wide spread in Florida
- Resistant populations are not controlled by drenches or sprays.
- Resistance imposes a fitness cost to ACP and susceptibility may return if use is curtailed
 - Previously resistant populations may be primed for repeated resistance
- Growers having problems controlling ACP with neonicotinoids should refrain from use for at least 6
- Meanwhile, continue spraying with a rotation of recommended insecticides

Follow-up Recommendations

- After 6 months abstinence try a neonicotinoid as a spray or drench
- The IFAS resistance monitoring team will sample and evaluate ACP in your grove upon request:
 - SW Florida: Phil Stansly and Barry Kostyk, SWFREC
 - Ridge: Lukasz Stelinski, CREC
 - River: Jawwad Qureshi, IRRREC
- If activity returns do not use as a drench more than twice a year or as a spray more than 4 times a year in young trees.
- Reflective mulch can take pressure off insecticides

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