SWD Monitoring Methods and Applications

Hannah Joy Burrack
Department of Entomology

entomology.ces.ncsu.edu
facebook.com/NCSmallFruitIPM
@NCSmallFruitIPM

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION
Empowering People · Providing Solutions

Impacts of SWD - 2013

Stakeholder responses

249 respondents from 28+ states

39% conventional growers, 8.5% organic growers, 9.4% extension, 1.7% crop consultants, 3.4% homeowners, 0.85% fruit marketers, 3.4% other

Impacts of SWD - 2013

Stakeholder responses

249 respondents from 28+ states

Highbush blueberries: 155

Blackberries: 102

Raspberries: 80

Strawberries: 72

Cherries: 32

Grapes: 62

Impacts of SWD - 2013

Impacts in blueberries

Ave. crop loss	Minimum crop loss	Maximum crop loss	No. respondents increased pesticide use	Cost of increased pesticide use	No. respondents with increased labor cost	Ave. percentage labor increase
4.7%	0%	100%	99	84%, $153/acre	72	25%

Impacts of SWD - 2013

Impacts in blackberries

Ave. crop loss	Minimum crop loss	Maximum crop loss	No. respondents increased pesticide use	Cost of increased pesticide use	No. respondents with increased labor cost	Ave. percentage labor increase
12%	0%	100%	75	87%, $192/acre	56	27%

Impacts of SWD - 2013

Impacts in raspberries

Ave. crop loss	Minimum crop loss	Maximum crop loss	No. respondents increased pesticide use	Cost of increased pesticide use	No. respondents with increased labor cost	Ave. percentage labor increase
16.3%	0%	100%	59	87%, $202/acre	49	29%

Impacts of SWD - 2013

Impacts in strawberries

Ave. crop loss	Minimum crop loss	Maximum crop loss	No. respondents increased pesticide use	Cost of increased pesticide use	No. respondents with increased labor cost	Ave. percentage labor increase
3.9%	0%	50%	50	70%, $185/acre	43	28%

Key questions

What monitoring tools are available for SWD?

How should monitoring information be interpreted?

How should monitoring be implemented in different crops?

Monitoring tools – Adult traps

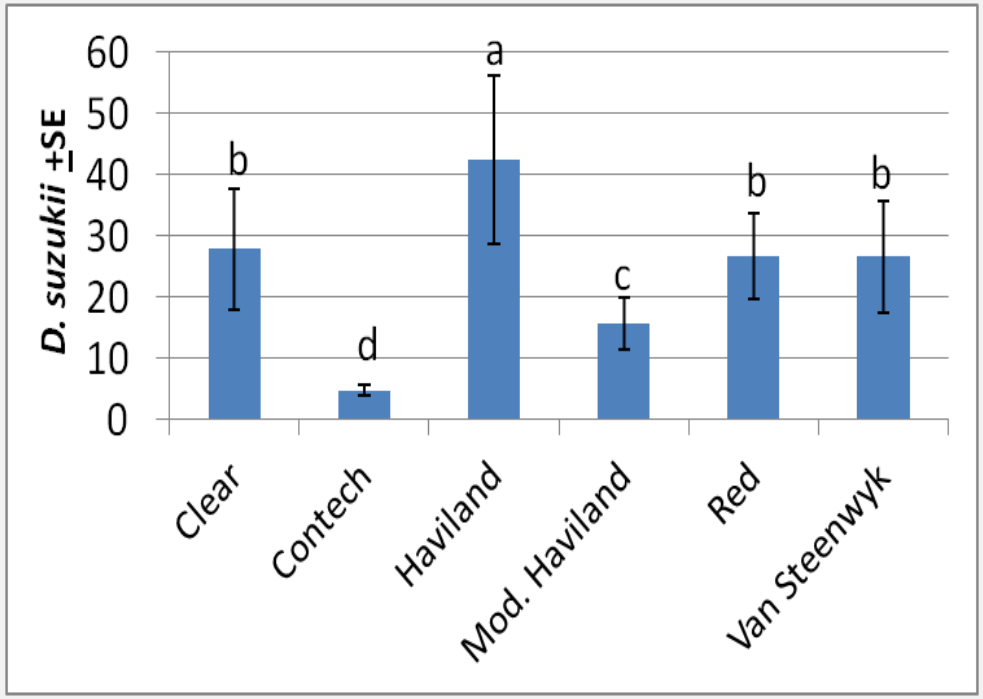
Red cups (with or without black band)

“Standard” deli cup

Contech commercial trap

BioBest commercial trap

Monitoring tools – Trap design



Pooled results from 16 trapping locations

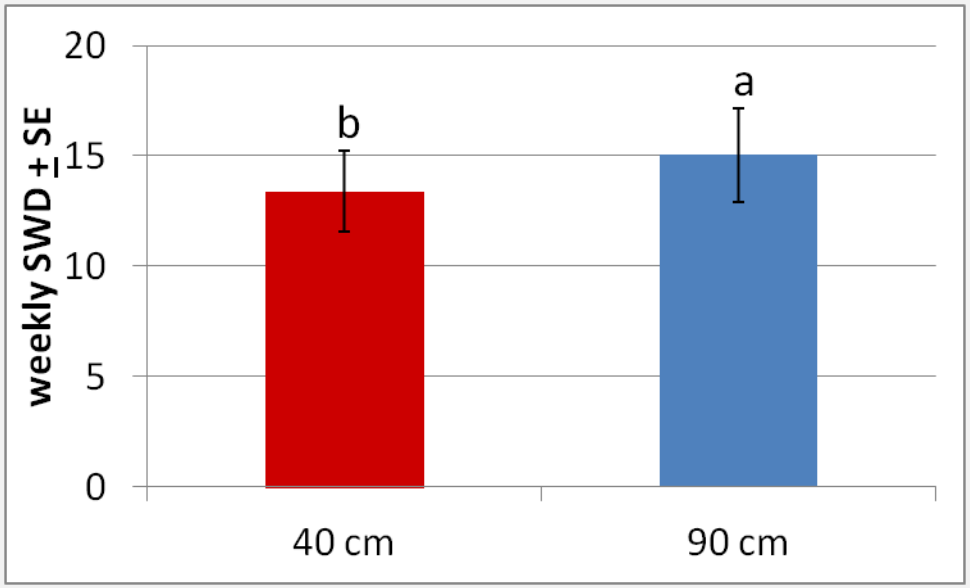
trap*crop(state) $F_{45,185} = 6.5$, $P < 0.001$

trap $F_{5,185} = 77.9$, $P < 0.001$

(Lee, et al. 2012)

Monitoring tools – Trap design

Trap comparisons conducted at 16 sites in 7 states/provinces during 2012

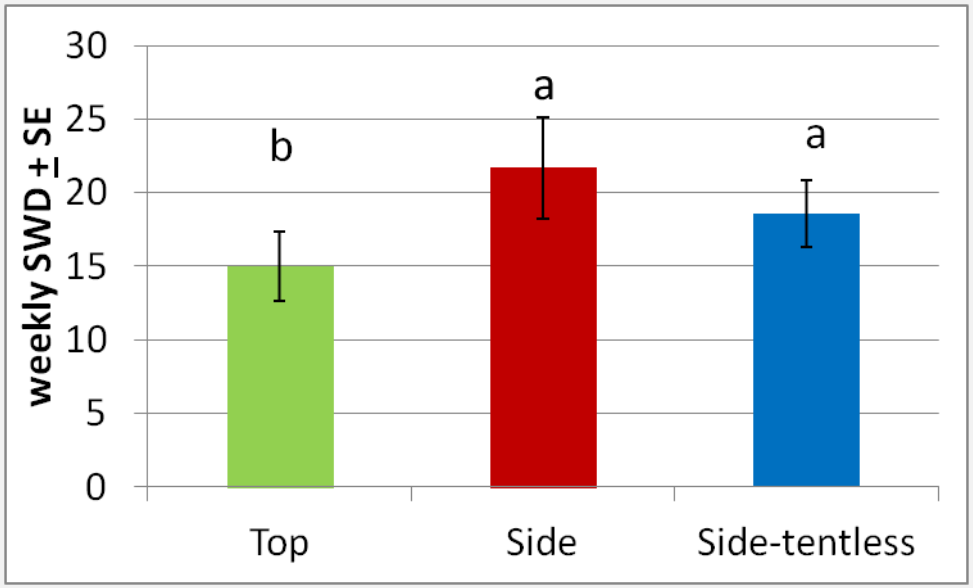


Coordinated by Jana Lee, USDA ARS

Traps with greater bait surface area caught 12% more flies

Monitoring tools – Trap design

Trap comparisons conducted at 16 sites in 7 states/provinces during 2012

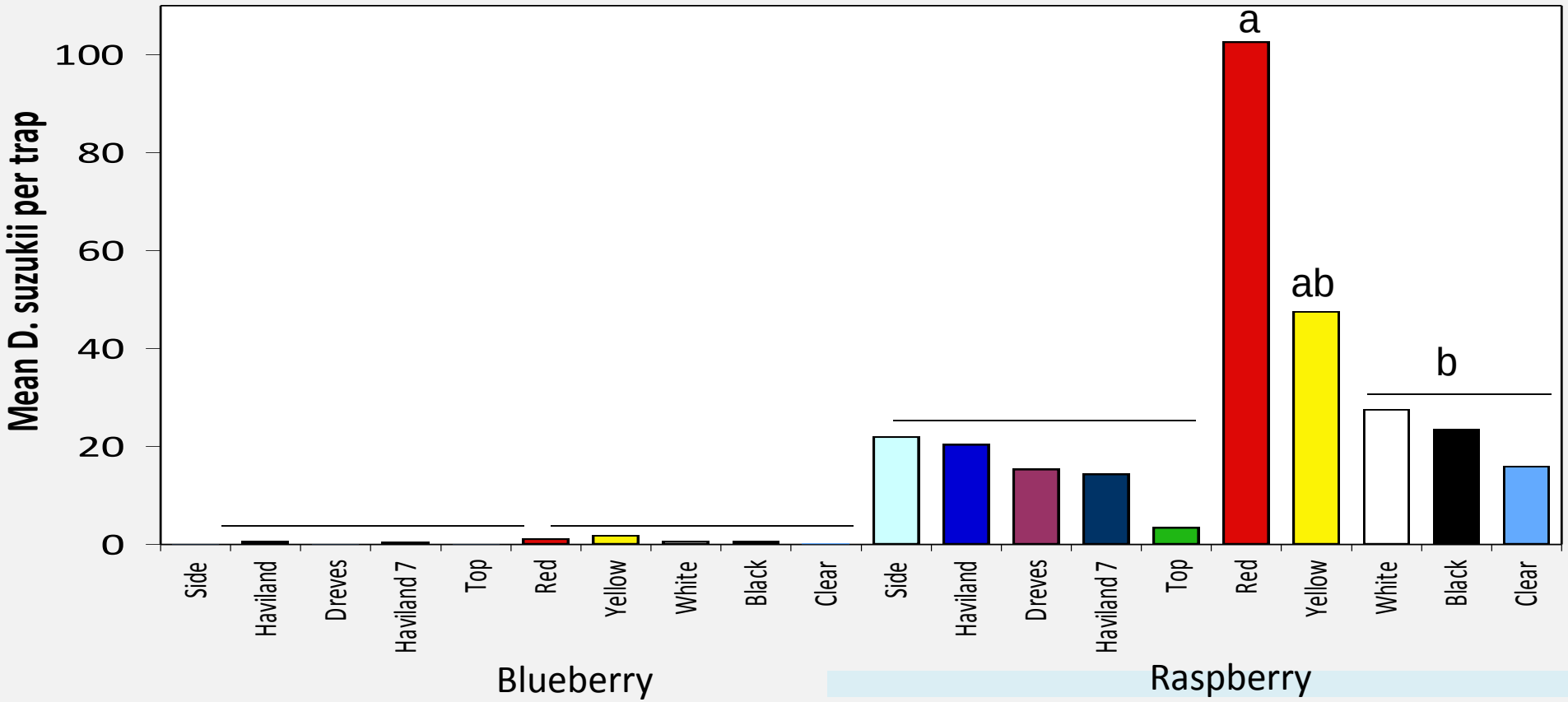


Coordinated by Jana Lee, USDA ARS

Traps with side entries caught more flies

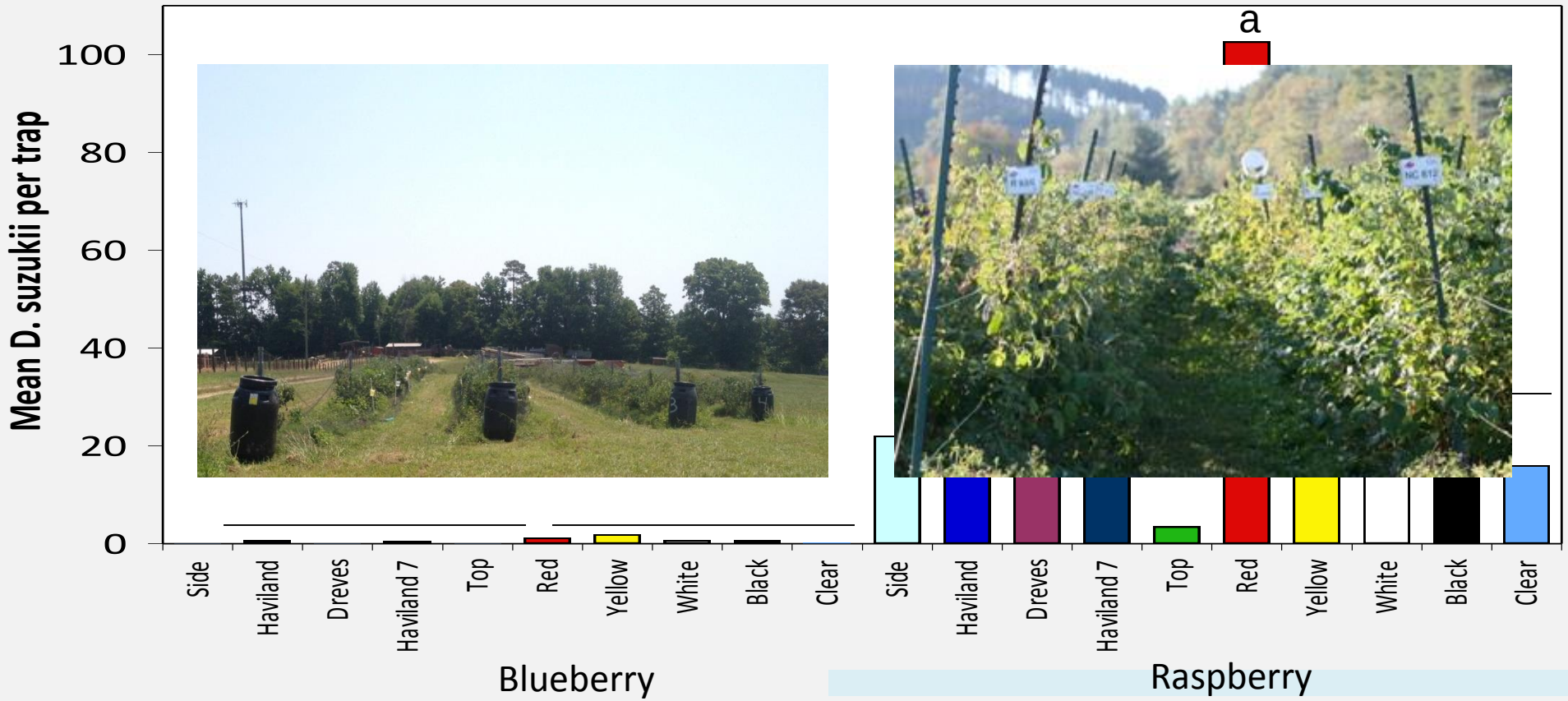
Monitoring methods - Traps

Trap color and entry location compared in 2012 in a similar multi state experiment



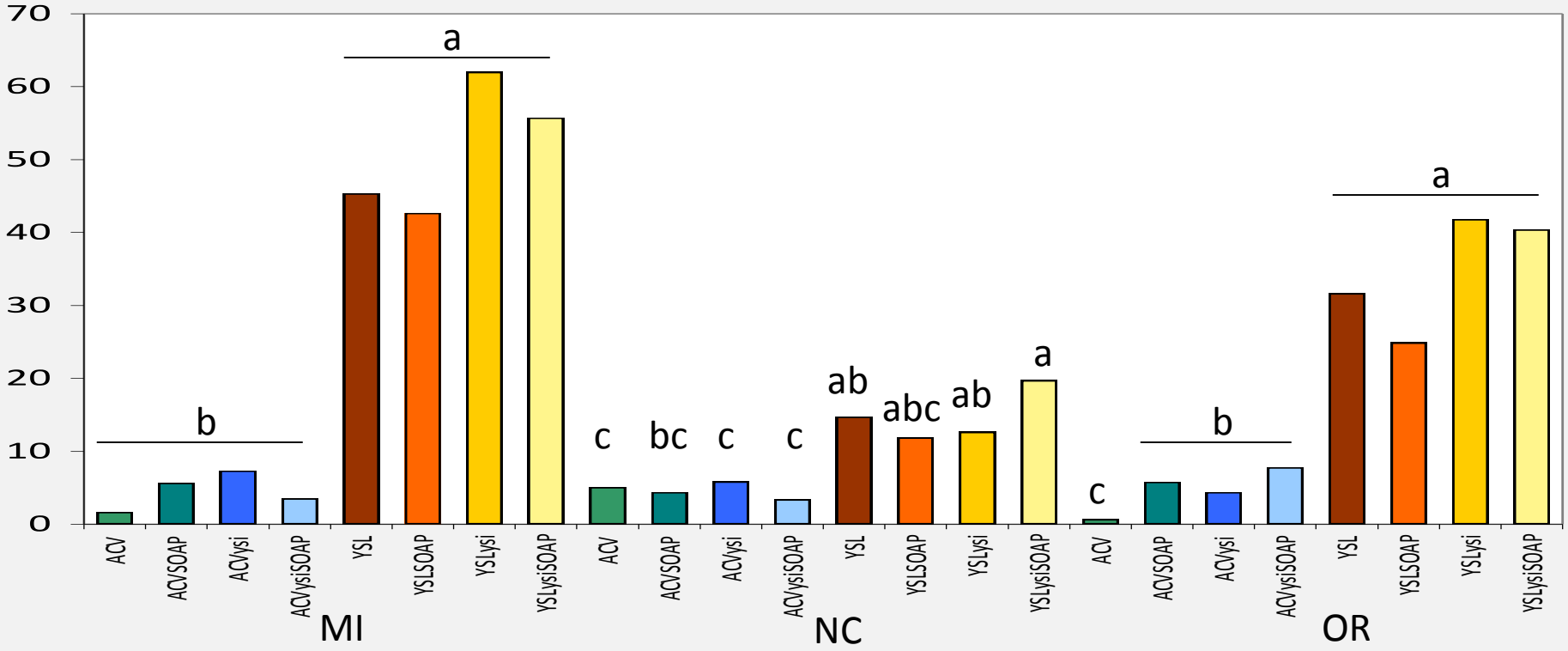
Monitoring methods - Traps

Trap color and entry location compared in 2012 in a similar multi state experiment



Monitoring tools – Baits
2012 comparisons

Multistate bait comparisons; MI, NC, and OR



NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Treatment 1
Apple cider vinegar + soap

Treatment 2
Yeast & sugar solution

Treatment 3
Fermenting bait plus ACV

Treatment 4
Droskidrink

Treatment 5
Synthetic lures over ACV

Treatment 6
Synthetic lures over drowning solution

Methods

10 states

Sites in blueberries, caneberries, or grapes

No SWD were captured in strawberry plots

6 treatments

Traps check, lures changed weekly

Male and female SWD and non SWD Drosophilids counted

Statistical analyses

Mixed model ANOVA via SAS Proc Mixed

For pooled data: state, week, and crop = random effects

Trap capture data were log transformed and proportion data were arcsine square root transformed to improve normality.

Satterwaite estimation was used to calculate degrees of freedom due to heteroscedasticity.

Pairwise comparisons of the adjusted means were conducted using the Games-Howell adjustment.

Treatment 1
Apple cider vinegar + soap

150 ml of ACV, 4 ml soap/gal

Treatment 2
Yeast & sugar solution

2 Tbsp yeast, 8 Tbsp sugar, 24 fl oz water, 0.76 ml unscented soap

Treatment 3
Fermenting bait in ACV

69 g whole wheat flour, 8 g sugar, 1.3 g yeast, 4 ml ACV, 100 ml water (4 fl oz per trap) *floating in* 150 ml of a solution of 600 ml, 67 ml 95% ethanol, 3.3 ml soap

Treatment 4
Droskidrink

150 ml of a solution of 450 ml ACV, 150 ml red wine, 12 g muscavado sugar

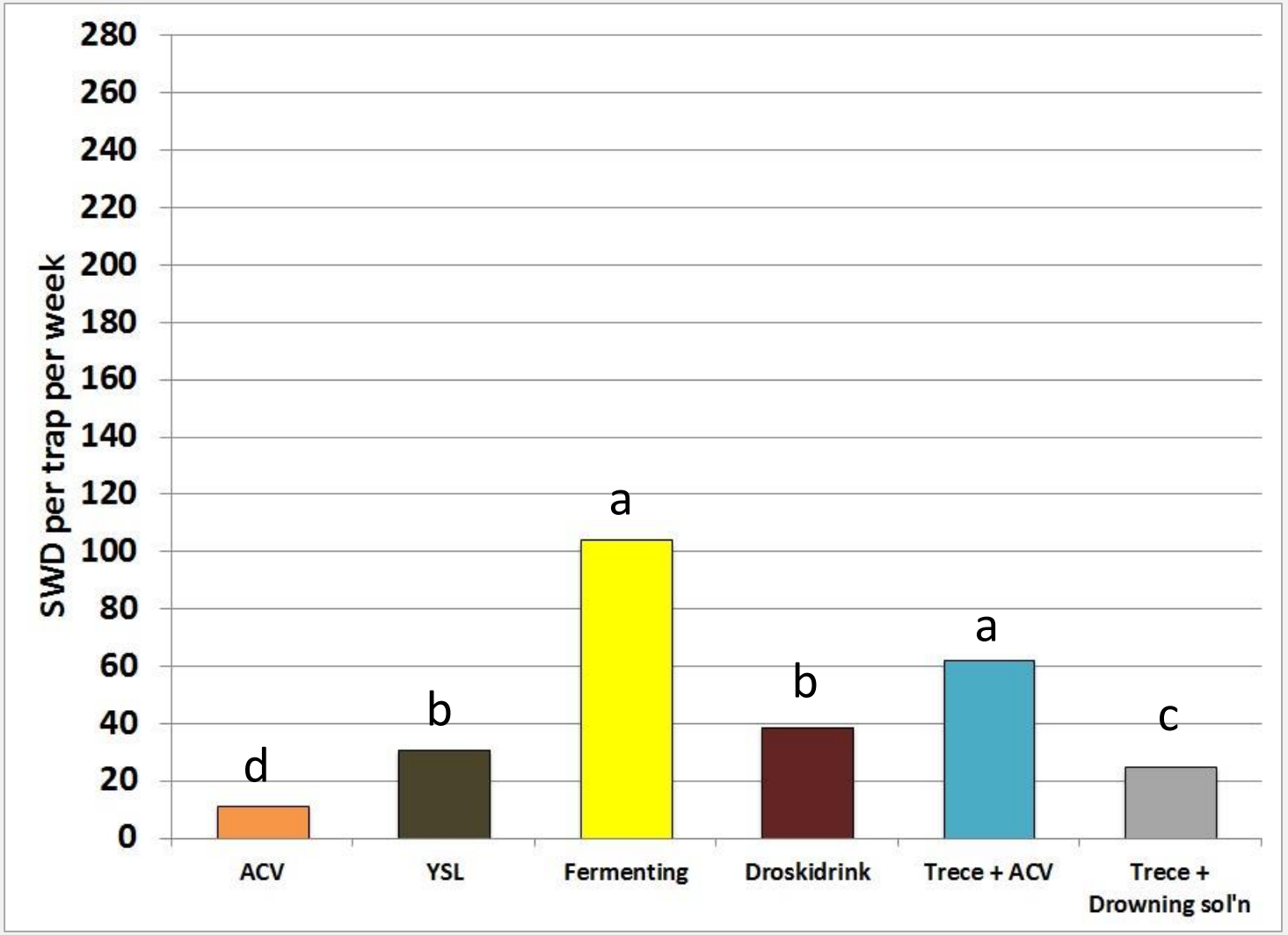
Treatment 5
Synthetic lures over ACV

150 ml of ACV, 4 ml soap/gal

Treatment 6
Synthetic lures over drowning solution

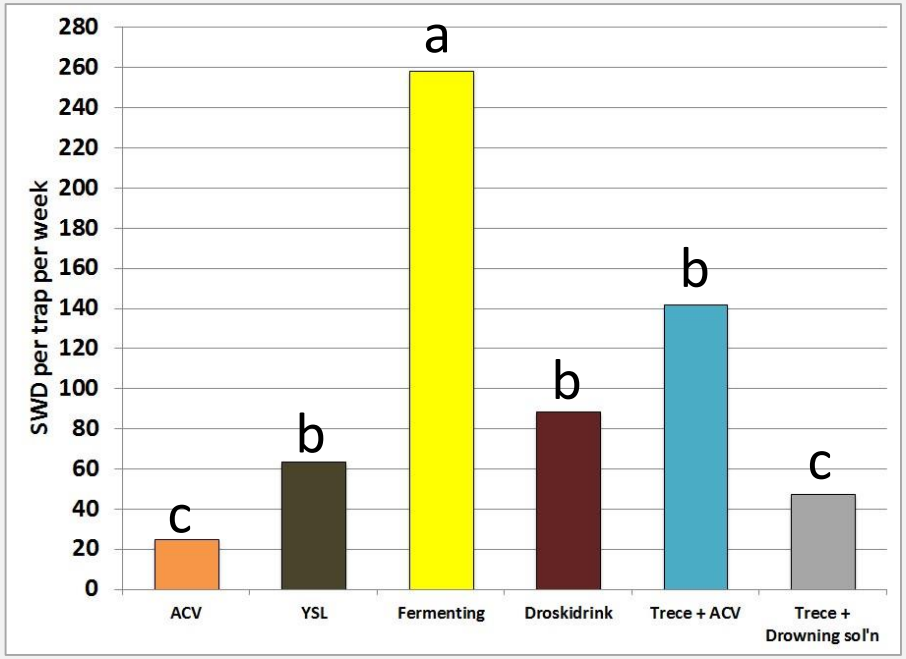
150 ml of a solution of 600 ml water, 6 g borax, and 0.24 ml soap

1. Fermenting bait and synthetic lures over ACV captured more flies when all states and crops were pooled

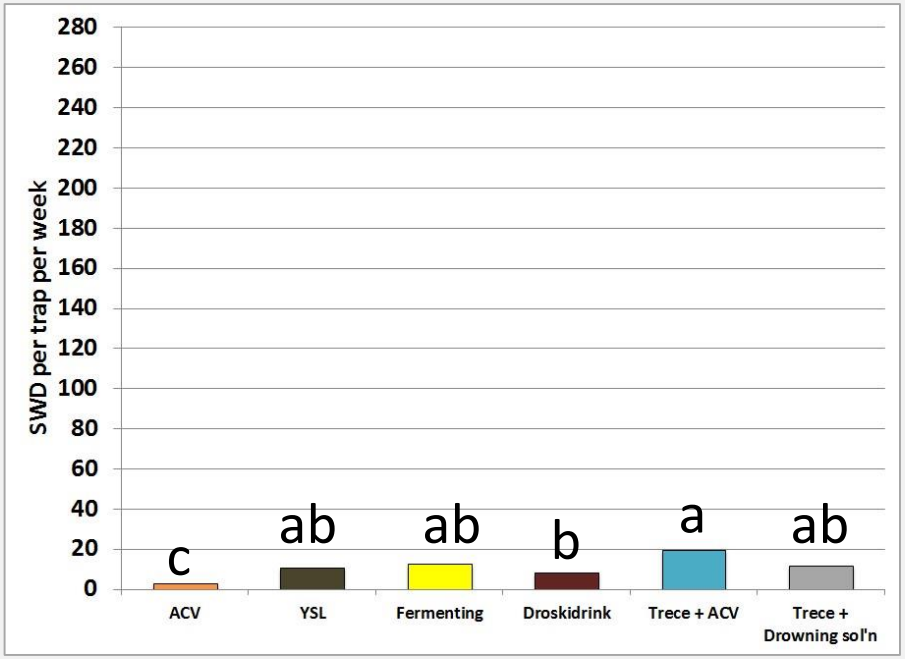


F = 89.57; df = 5, 1937; p < 0.0001

2. More flies were captured in caneberry sites, and fermenting bait was more attractive than synthetic lure over ACV in caneberries.



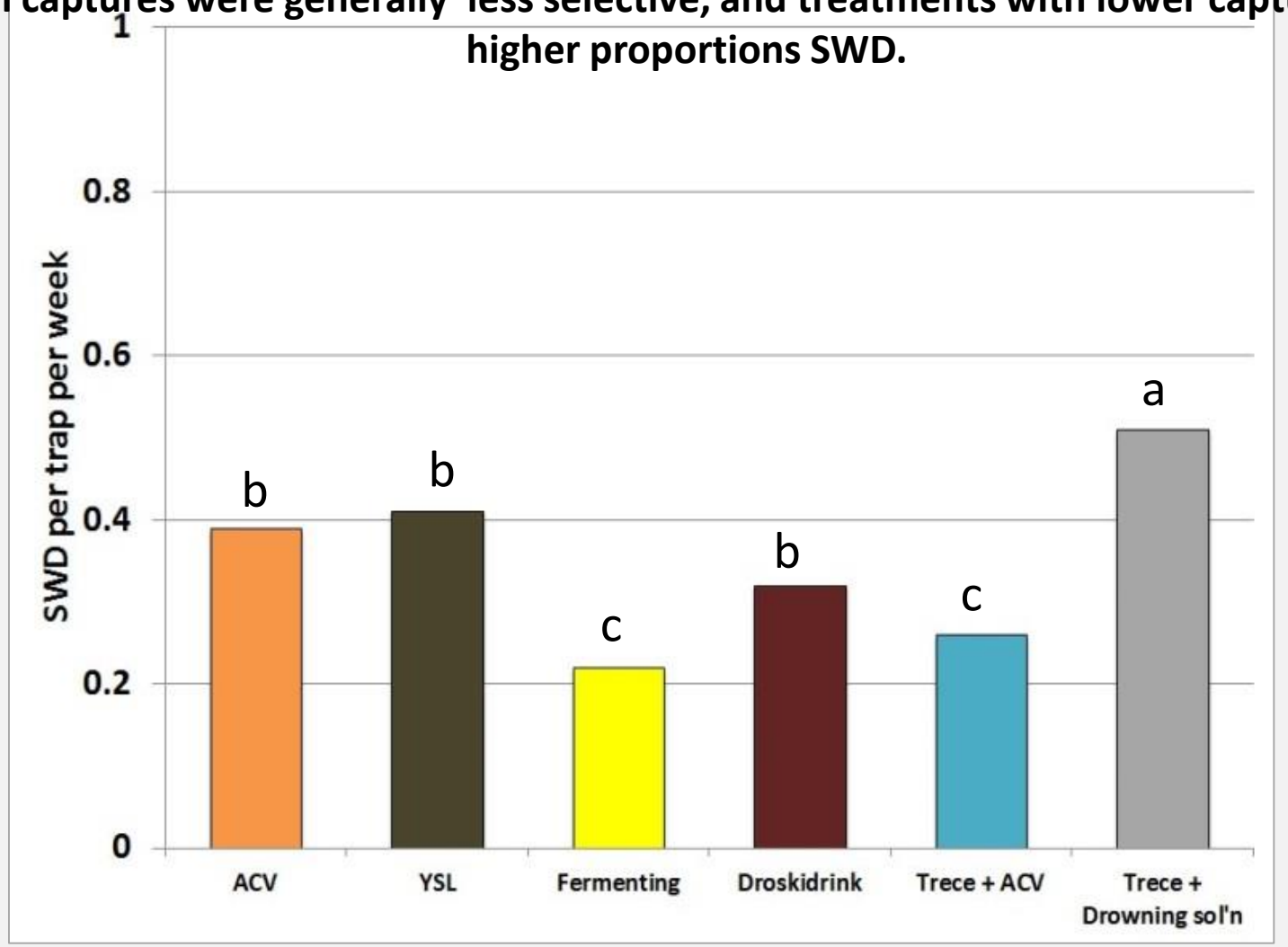
Caneberry sites



Blueberry sites

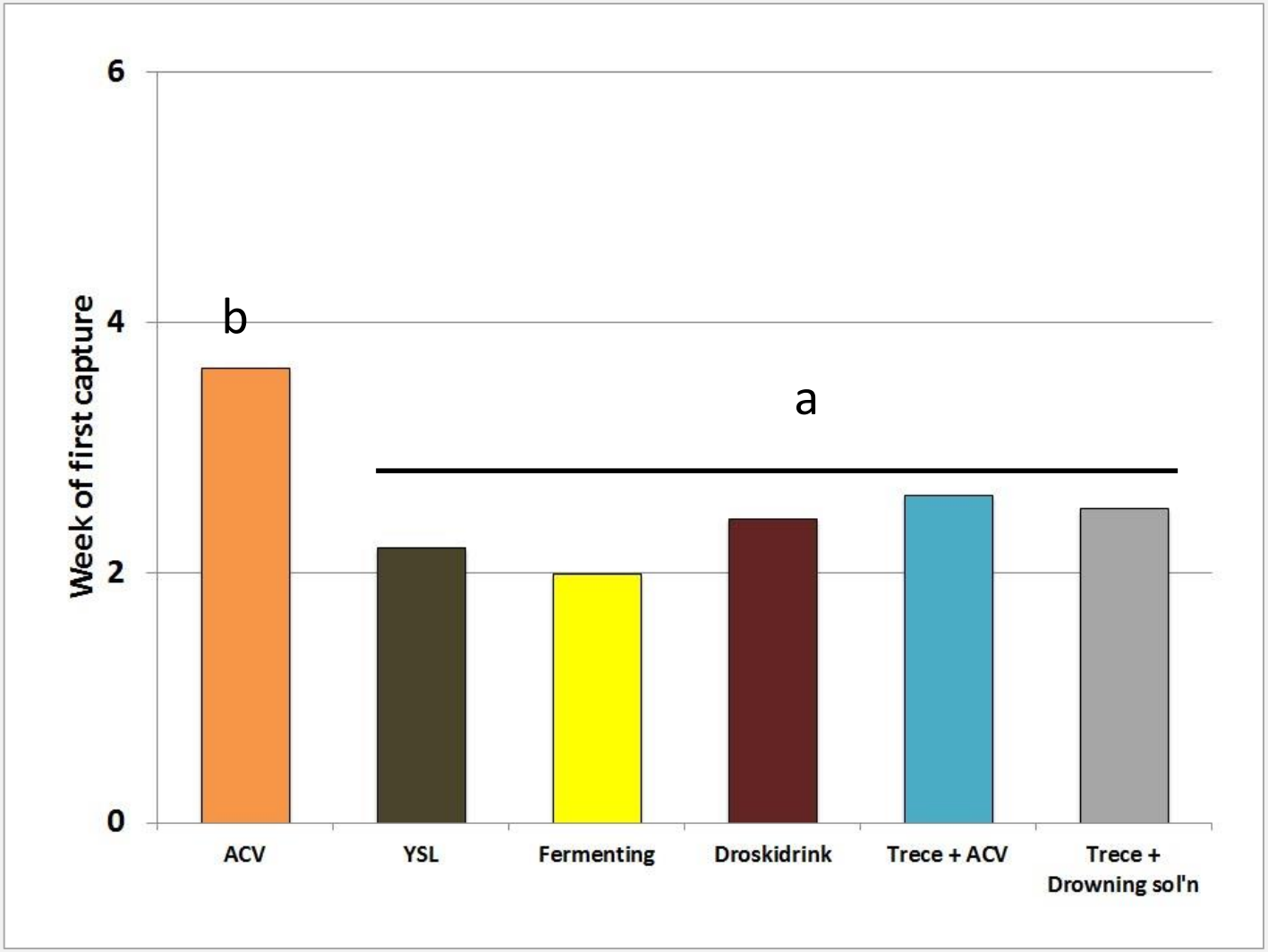
$F_{crop*treatment} = 16.41$; df = 10, 1962; $p < 0.0001$

3. None of the baits were highly selective for SWD, but ACV, YSL and synthetic lure over drowning solution generally caught a larger proportion of SWD. Treatments with high captures were generally less selective, and treatments with lower captures had higher proportions SWD.



Proportion SWD, pooled sites: $F = 71.96$; $df = 5, 1115$; $p < 0.0001$

4. All baits/lures captured flies earlier than ACV.



F = 12.47; df = 5, 138; p < 0.0001

Adult monitoring - Conclusions

For the time being, bait/lure is likely more important than trap design

No currently available trap, lure, or bait has been demonstrated specific for SWD or to predict infestation across crops

How should growers monitor SWD?

Adult monitoring

Identification tools

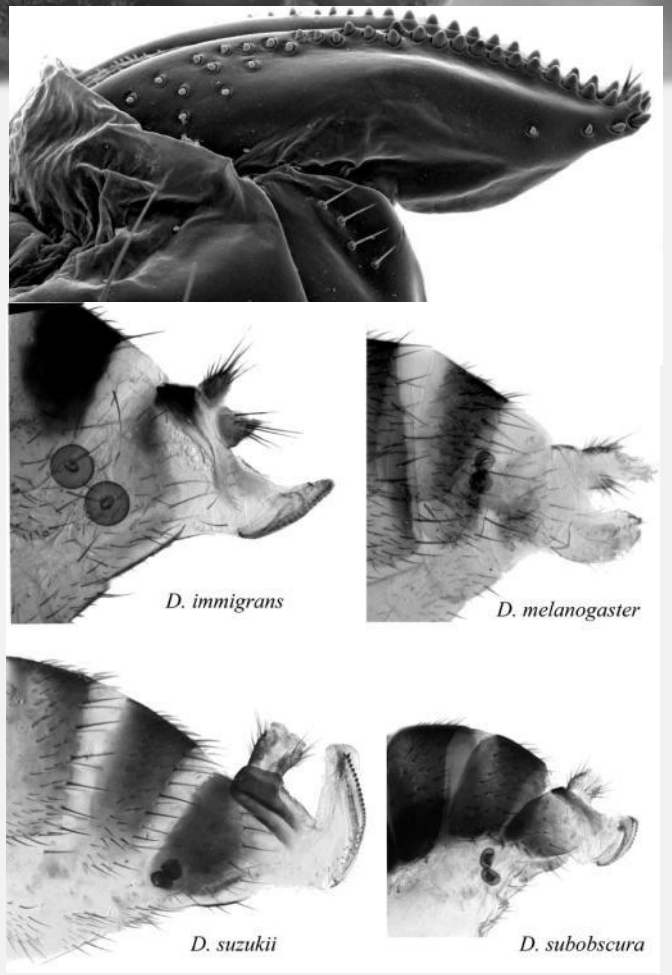
Via: http://www.instructables.com/id/10-Smartphone-to-digital-microscope-conversion/

Because no trap/bait/lure combination is selective for SWD:

Be prepared to ID flies if you plan to trap!

Adult monitoring
Identification tools

Via: http://www.instructables.com/id/10-Smartphone-to-digital-microscope-conversion/



(Hauser 2011, Pest Management Science)

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Adult monitoring - Conclusions

For the time being, bait/lure is likely more important than trap design

No currently available trap, lure, or bait has been demonstrated specific for SWD or to predict infestation across crops

How should growers monitor SWD?

Monitoring tools – Fruit sampling

Fruit samples should be collected from each field/variety block at each harvest

A “salt test” is a quick way to assess larval presence
¼ cup salt dissolved 1 gal water
Poured over a thin layer of fruit
Larvae should be visible within 15 minutes

Salt tests may miss small larvae
Drosophila larvae cannot be distinguished by species – do not sample rotting fruit!

Key questions

What monitoring tools are available for SWD?

How should monitoring information be interpreted?

How should monitoring be implemented in different crops?

How does an infestation develop?

Big question: Does proximity to non-crop habitat affect fruit infestation levels?

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Katie Swoboda, PhD student

How does an infestation develop?

Transects ≥ 20 m apart

Traps

Yeast sugar water bait in 32 fl oz cups; ~20 m apart

Fruit collection

~40 ripe fruit around each trap

Sites

2 commercial blackberry fields

Katie Swoboda, PhD student

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

How does an infestation develop?

Fruit Infestation

- Date
  - 2 July- no infestation

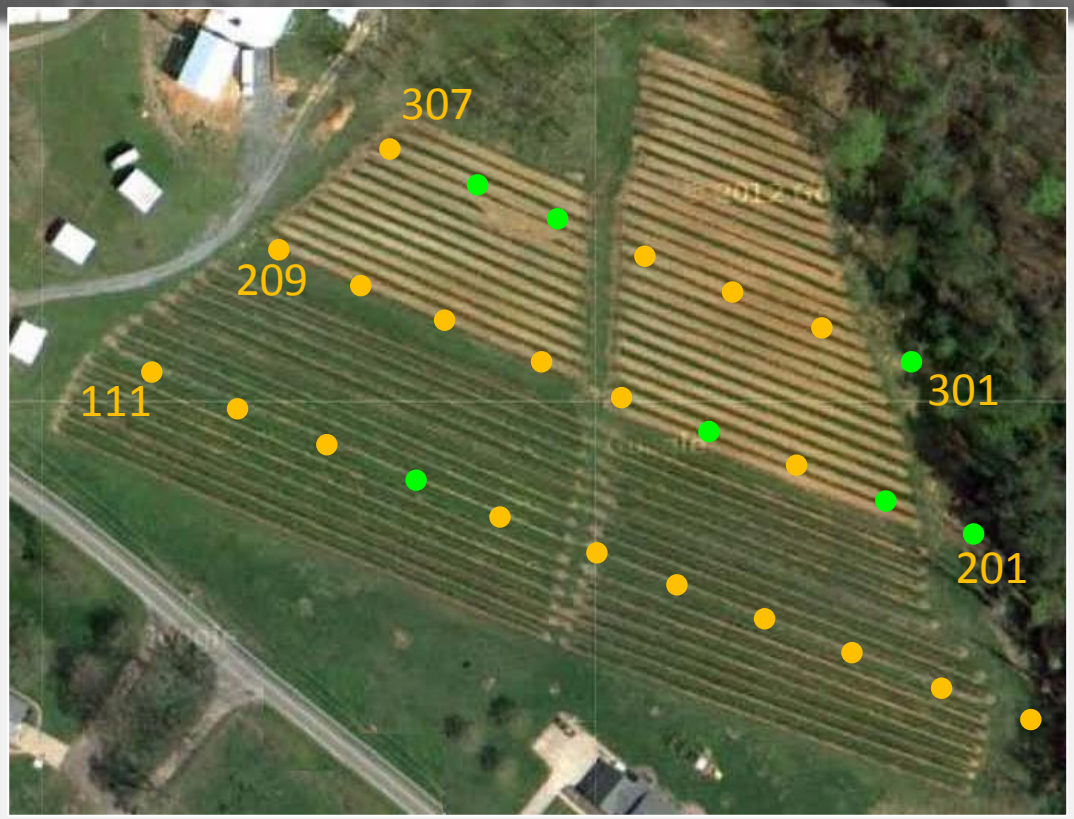
Katie Swoboda, PhD student

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

How does an infestation develop?

Fruit Infestation



- Date
  - 2 July- no infestation
  - 9 July- 1-2 pupae/40 fruit

Katie Swoboda, PhD student

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

How does an infestation develop?

Fruit Infestation

- Date
  - 2 July- no infestation
  - 9 July- 1-2 pupae/40 fruit
  - 16 July- ≤ 44 pupae/40 fruit

Katie Swoboda, PhD student

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

How does an infestation develop?

Fruit Infestation

- Date
  - 2 July- no infestation
  - 9 July- 1-2 pupae/40 fruit
  - 16 July- ≤ 44 pupae/40 fruit
  - 23 July- fewer pupae than 16 July

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

How does an infestation develop?

D. suzukii females in traps for one transect

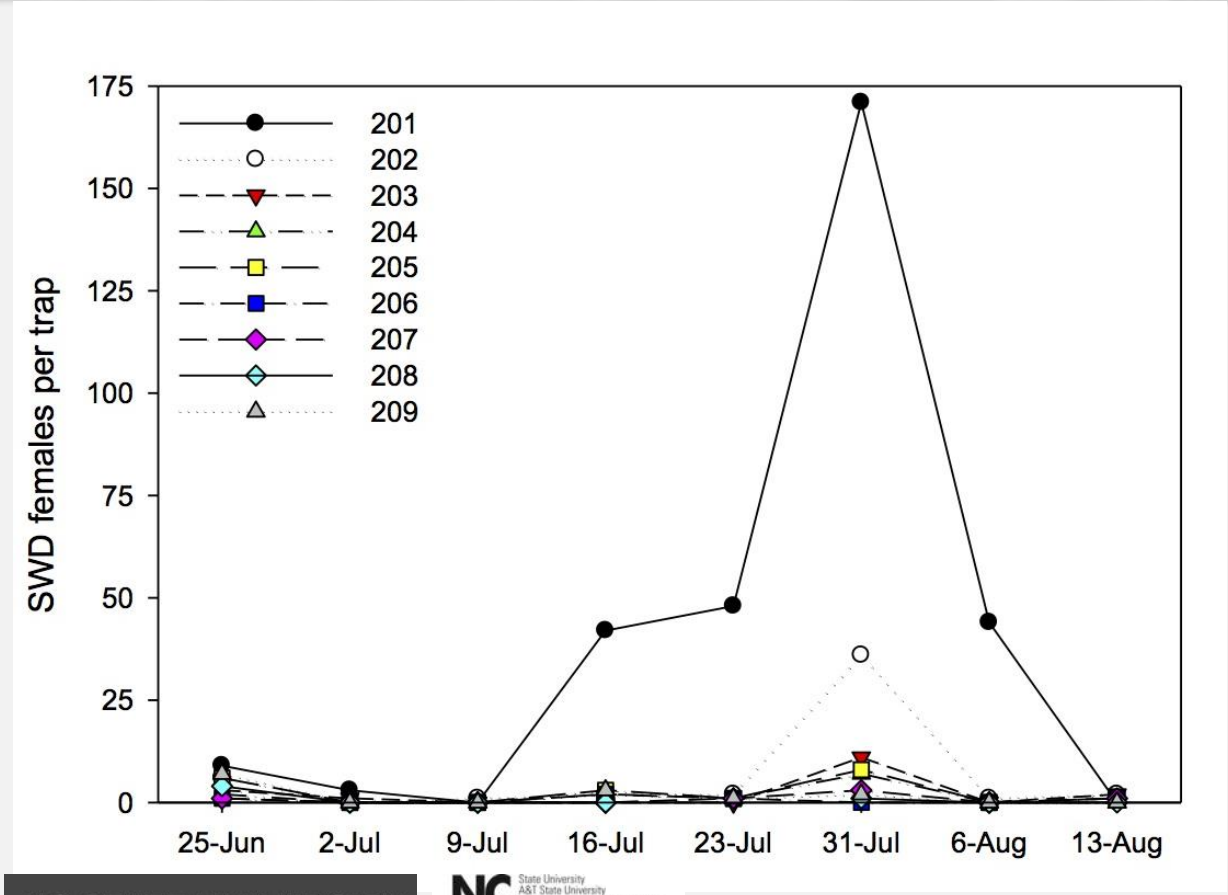
- No obvious pattern to initial infestation presence (July 9th)
- Infestation **rates** (larvae/berry) were higher at field edges near woods
- In general, very few females were caught in traps within the crop fields
- Similar patterns were observed at the other sites
- **Results are preliminary**

NC STATE UNIVERSITY
NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Katie Swoboda, PhD student

How does an infestation develop?

D. suzukii females in traps for one transect



- Trap captures highest outside fields and within fields were not necessarily indicative of infestation presence/absence

Katie Swoboda, PhD student

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Monitoring tools – Fruit sampling

Videos and demonstration

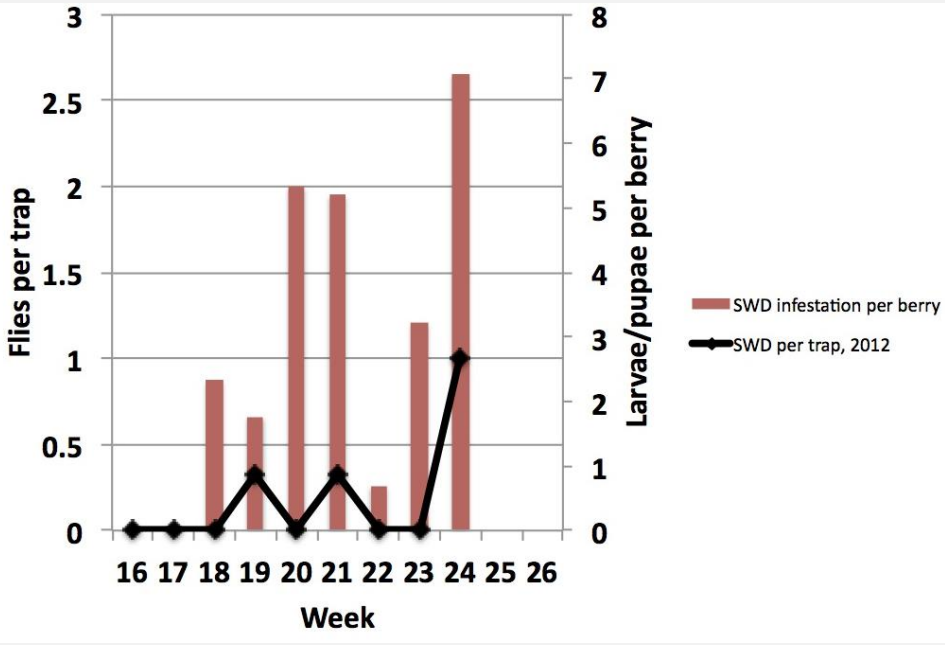
Key questions

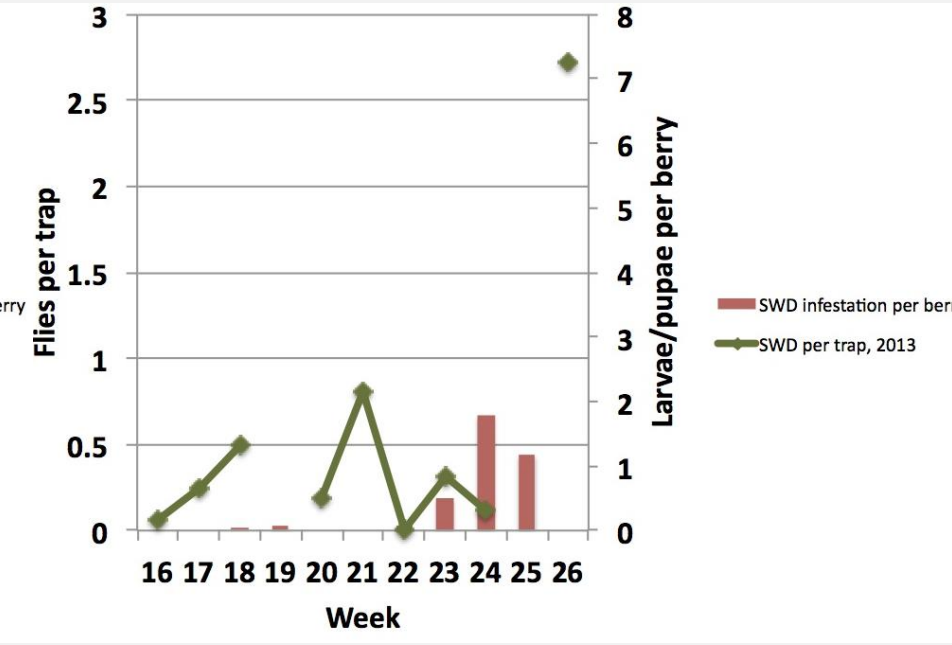
What monitoring tools are available for SWD?

How should monitoring information be interpreted?

How should monitoring be implemented in different crops?

Implementing monitoring
Strawberries





2012 – ACV

Spring fruiting only

2013 – YSL

NC STATE UNIVERSITY

NC State University A&T State University COOPERATIVE EXTENSION Empowering People · Providing Solutions

Implementing monitoring
Blueberries

Consider fruiting period and if SWD has been detected in other crops

Management recommendations *Blackberries and raspberries*

Highly preferred, typically later fruiting than other hosts

Read us @ entomology.ces.ncsu.edu
Like us @ facebook.com/NCSmallFruitIPM
Follow us @NCSmallFruitIPM