Strawberry pre plant meetings, 2019
Pollination recommendations
Pest management considerations

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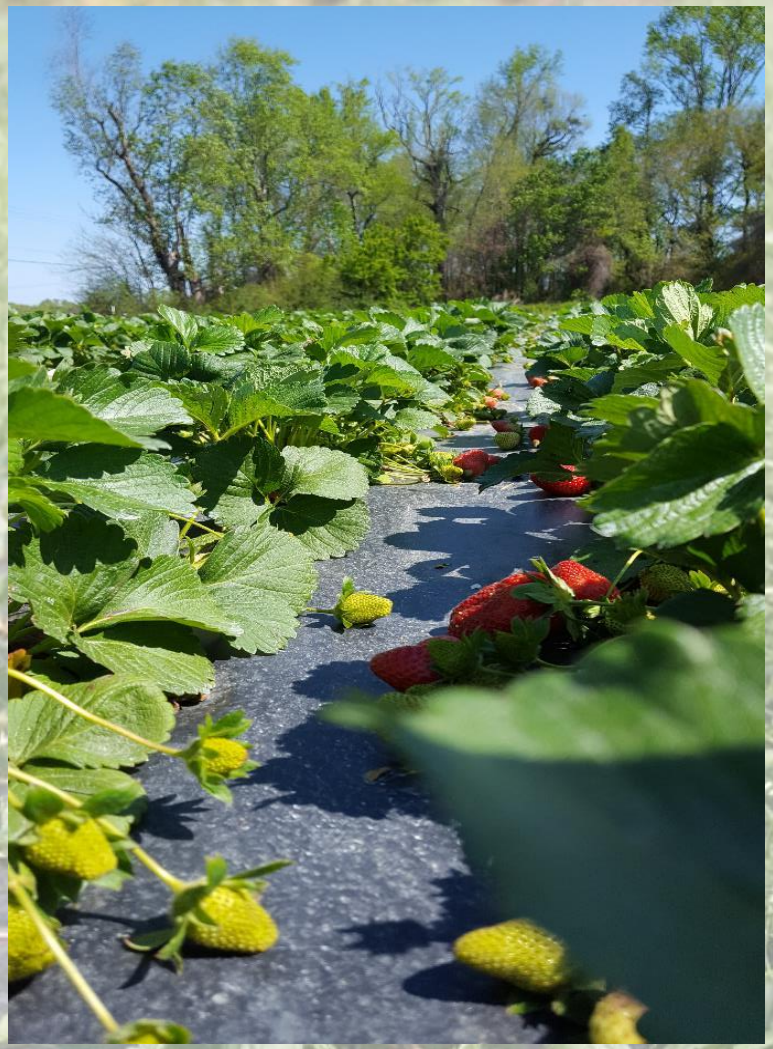
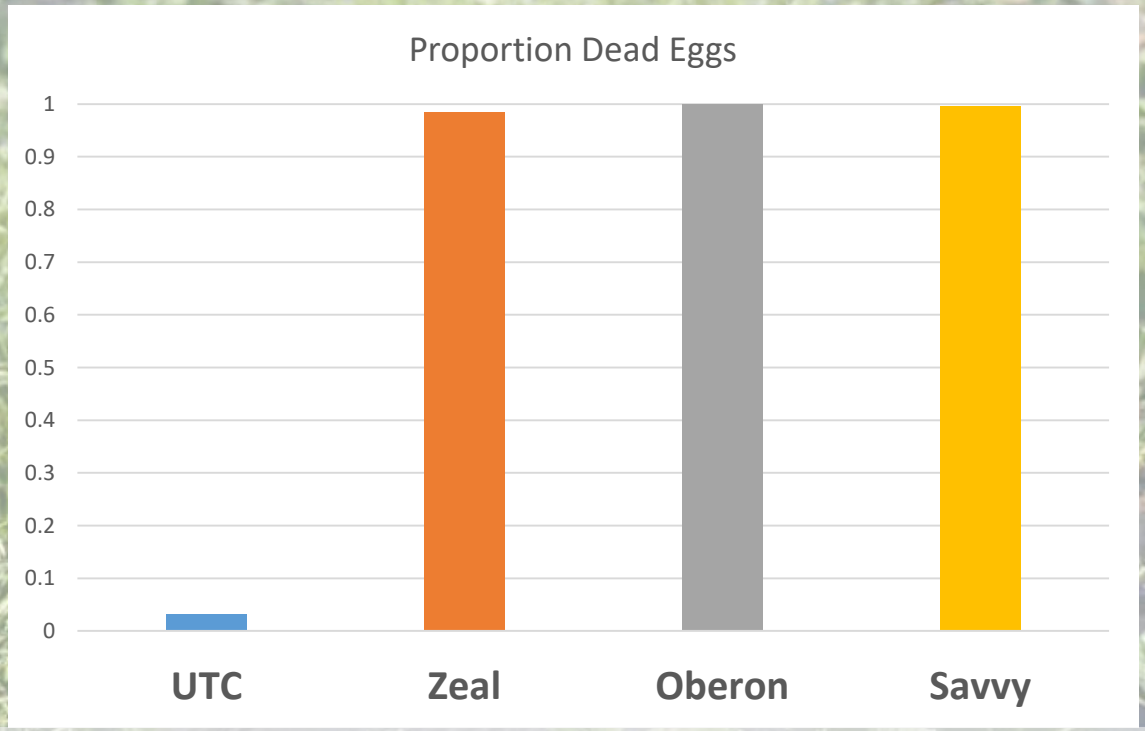
Topics

- Strawberry pollination
  - Who are the Pollinators?
  - Farm Management practices
  - Pollinator Abundance and Diversity
  - Impacts on berry Production
- Pest management considerations
  - Spider mites
  - When is SWD a concern?



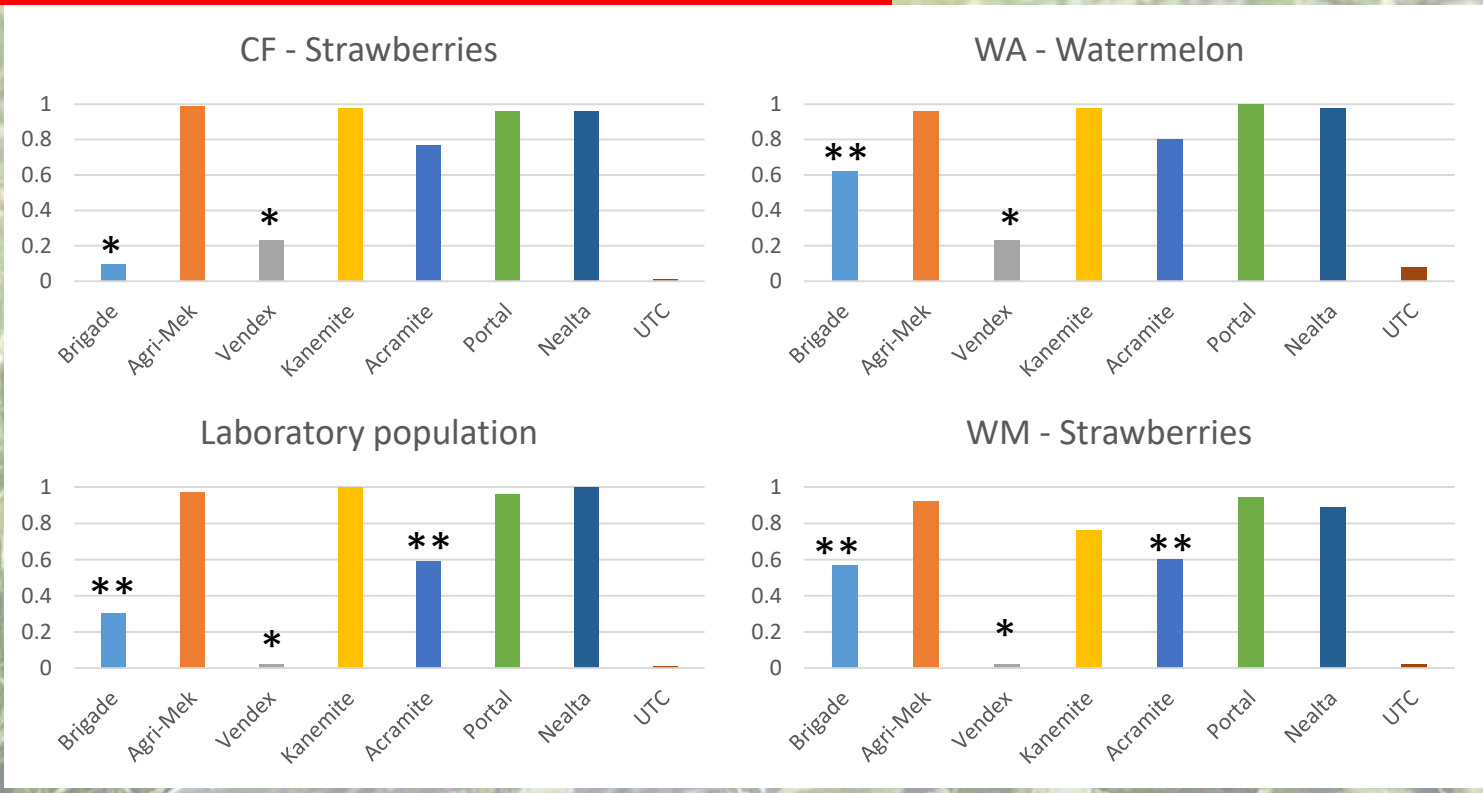
Screening spider mites for resistance

Screening spider mites for resistance



Mites collected from two strawberry fields, one watermelon field, and our laboratory population (4 populations total) appear highly susceptible to all ovicidal materials

Screening spider mites for resistance



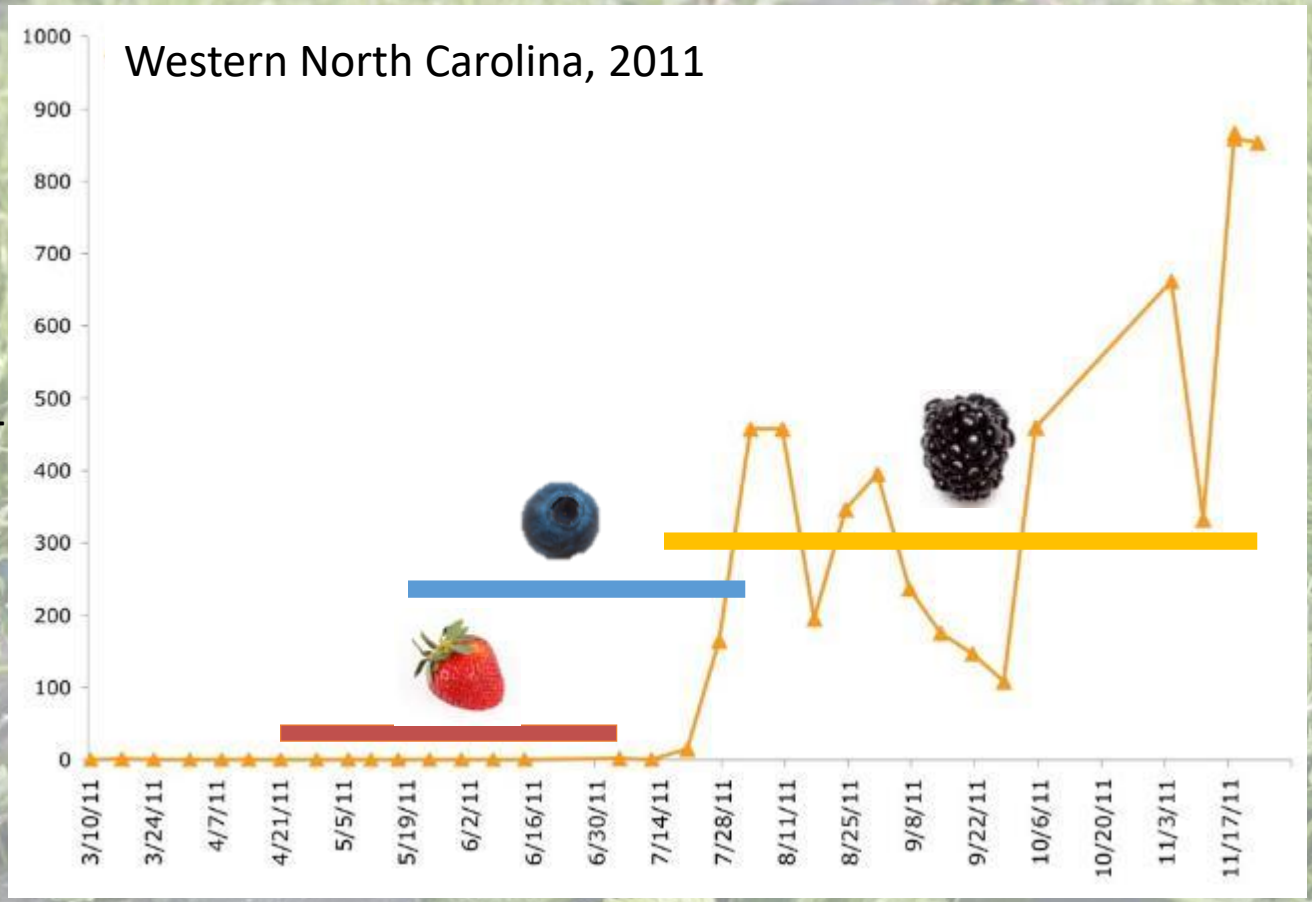
***No different than control**

****Better than control, but weaker than other materials**

Greater variability among adulticides. Brigade and Vendex ineffective.

SWD in strawberries

- **Spotted wing drosophila (SWD) is not a consistent pest in spring-fruiting strawberries**
- **Fall fruiting berries are at high risk**
- **In most years, the small infestation present can be managed through cultural control**

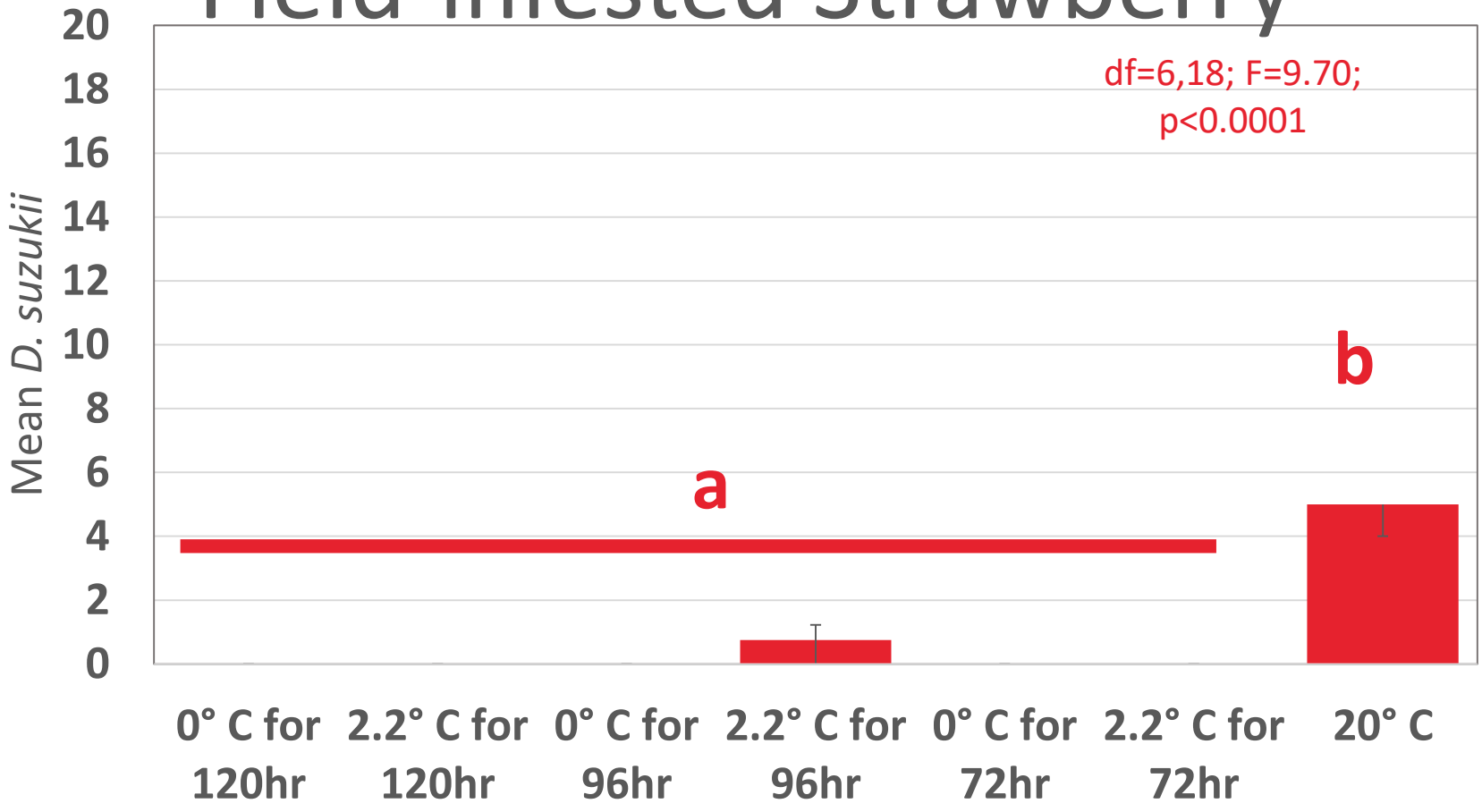


Two types of studies

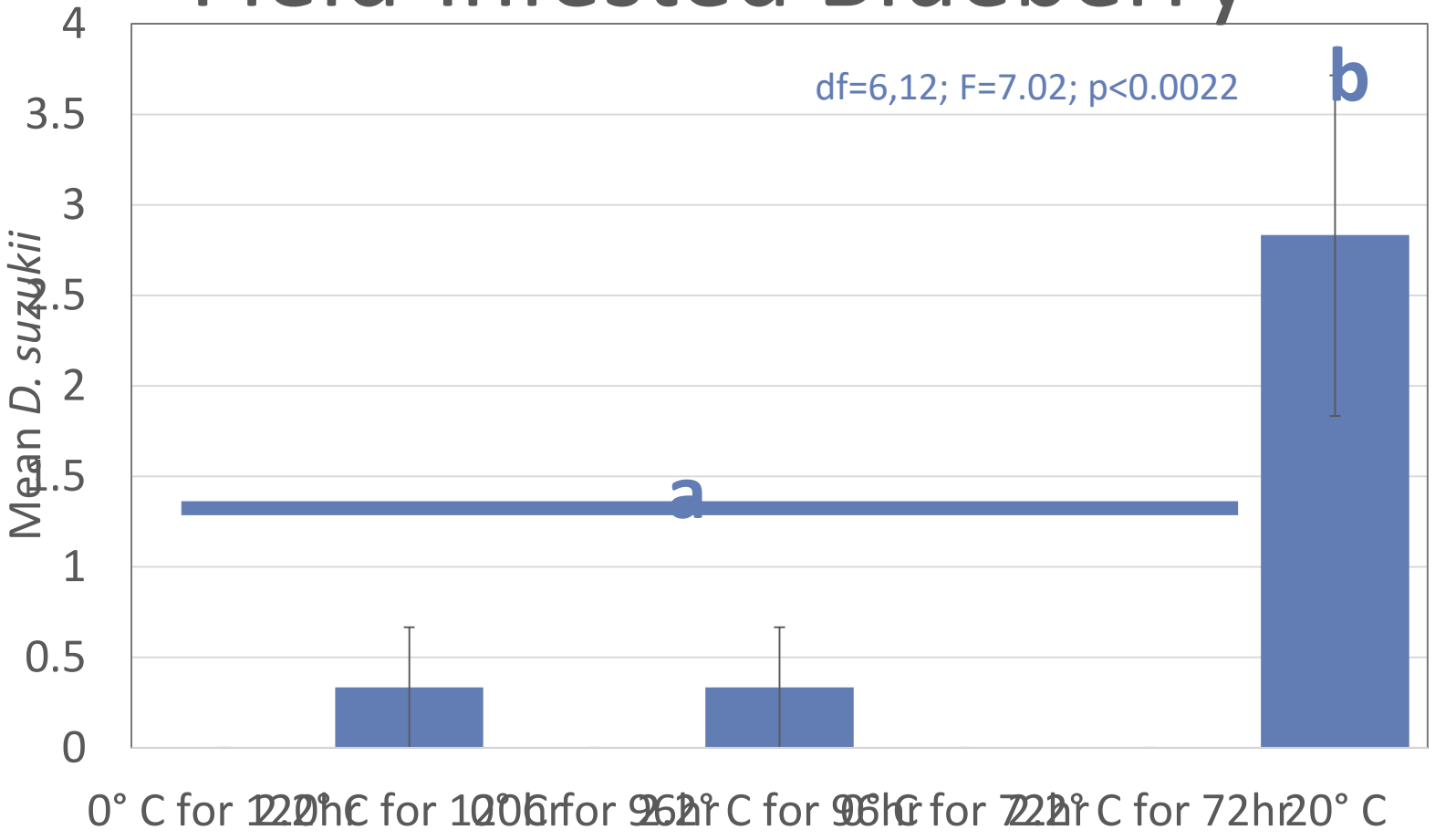
Field-Infested Fruit

Laboratory-Infested Fruit

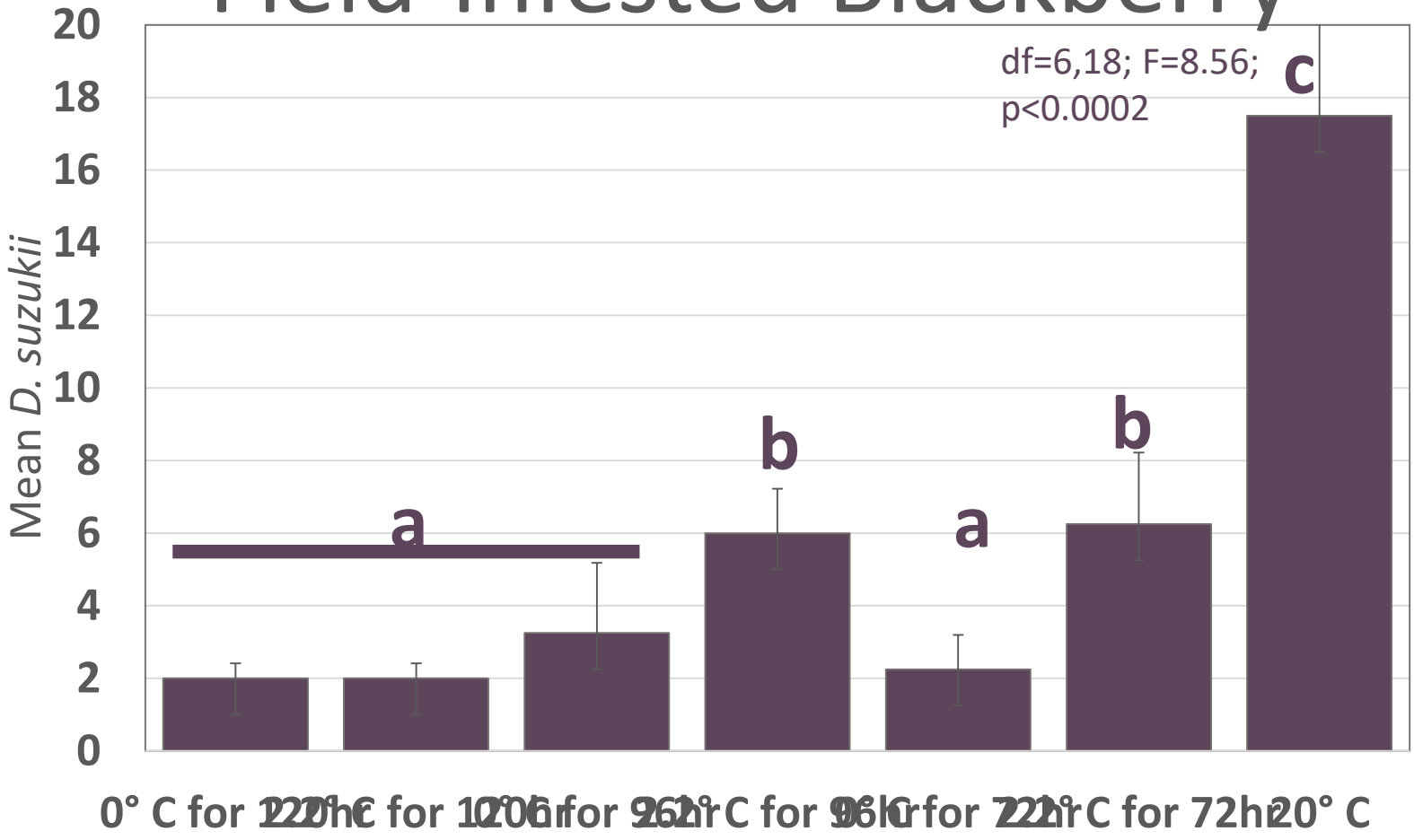
Field-infested Strawberry



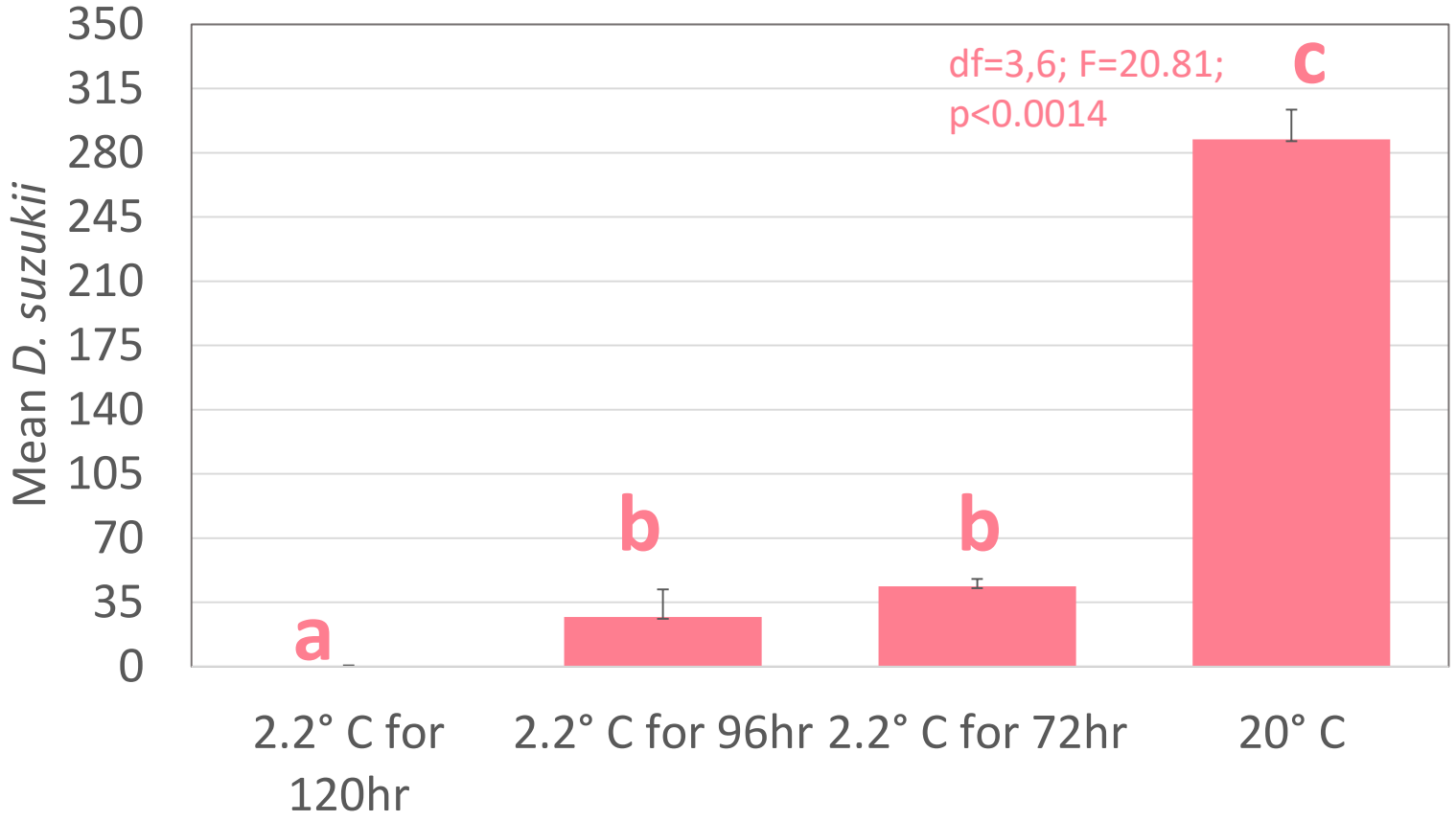
Field-infested Blueberry



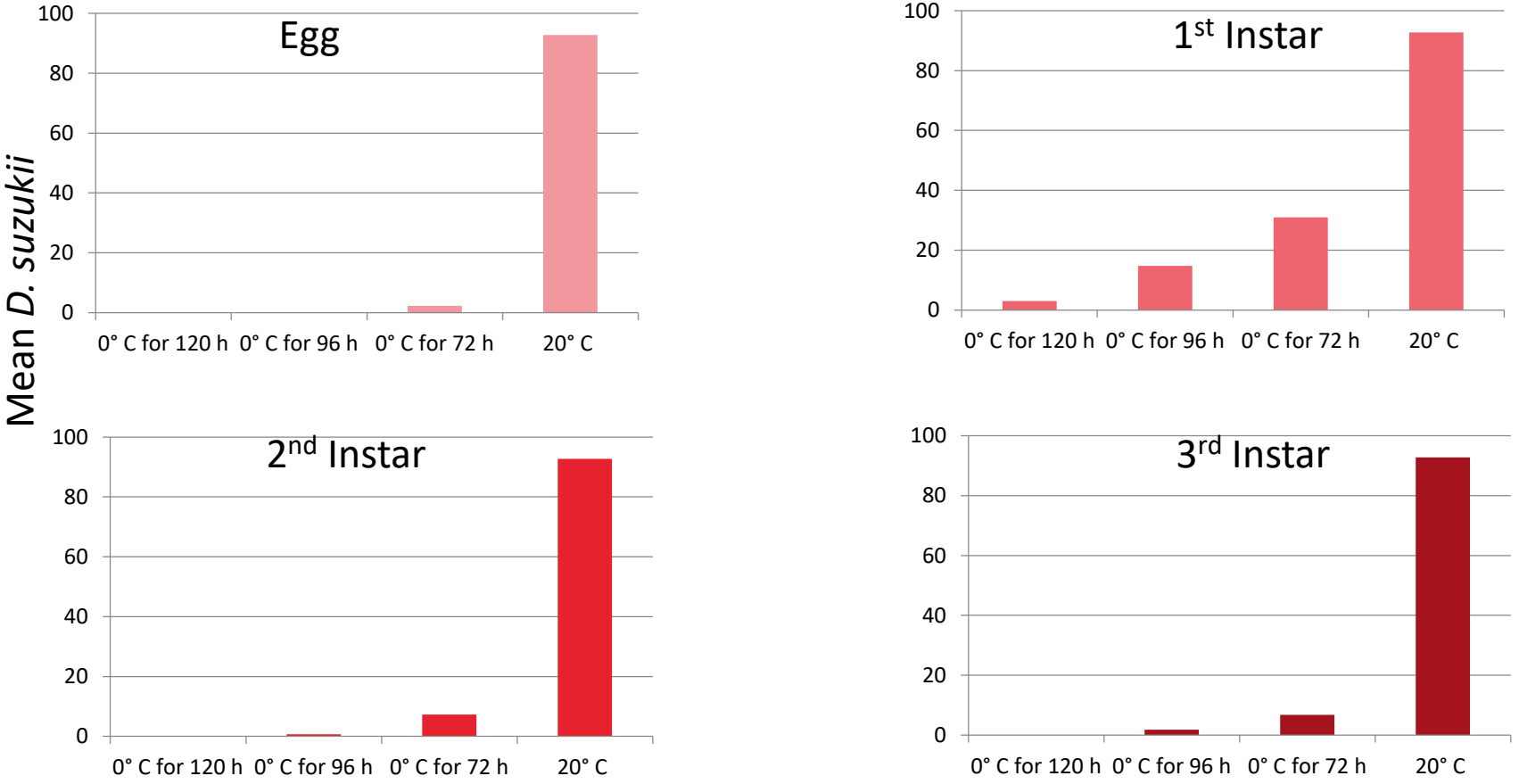
Field-Infested Blackberry



Field-Infested Raspberry



Laboratory-Infested Strawberry



Topics

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  - Who are the Pollinators?
  - Farm Management practices
  - Pollinator Abundance and Diversity
  - Impacts on berry Production
- Pest management considerations
  - Spider mites
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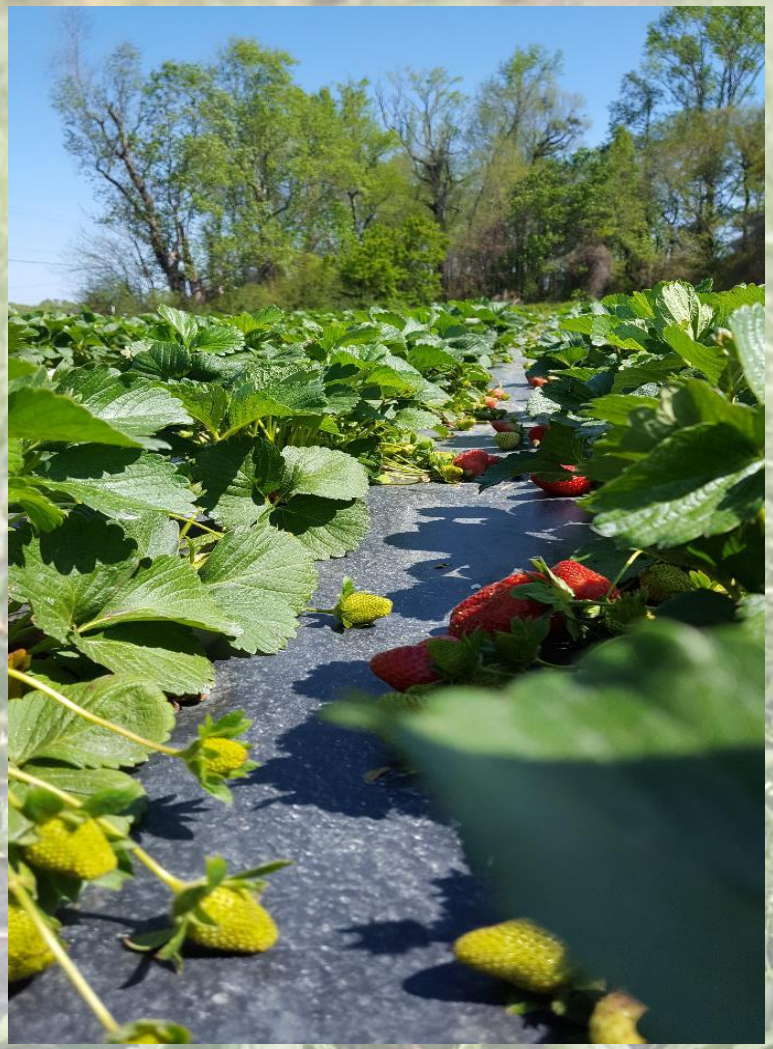
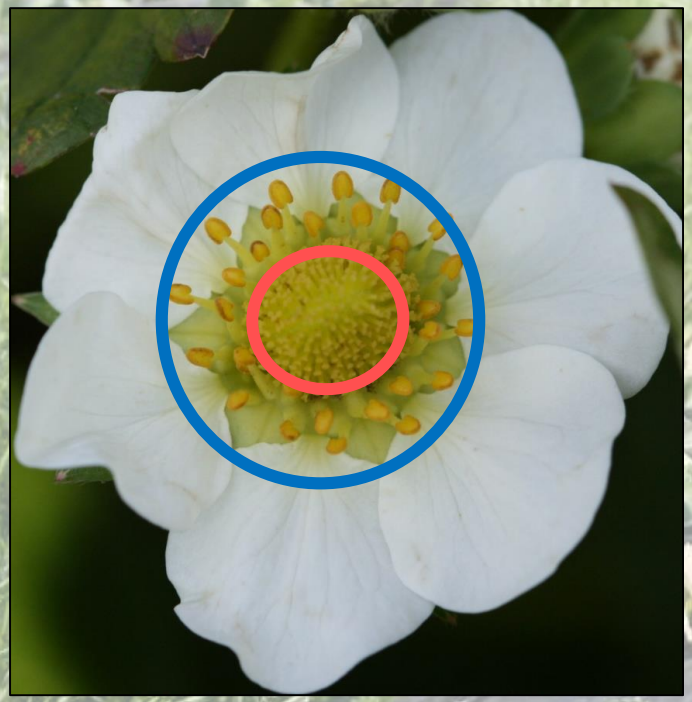
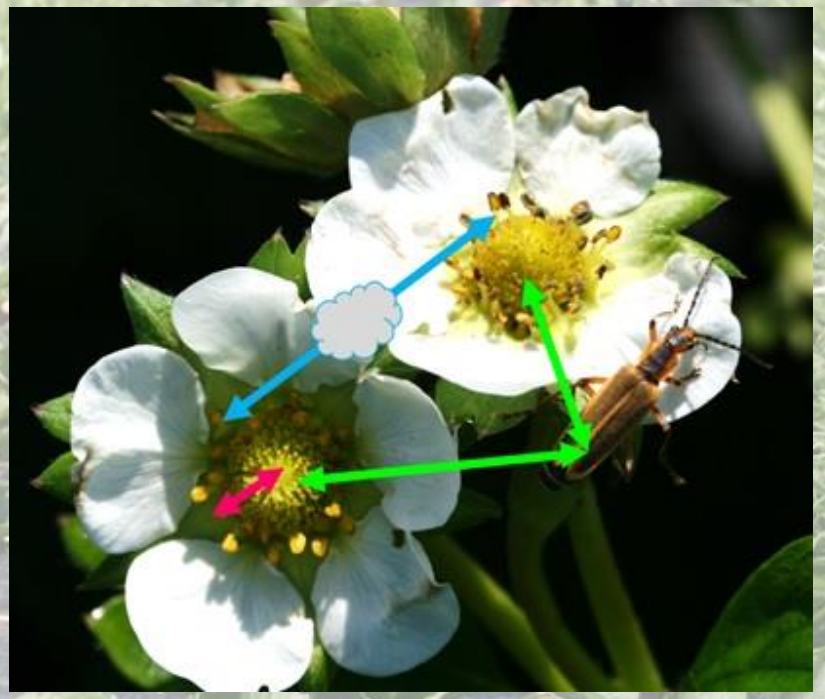


Strawberry pollination





Poor Pollination

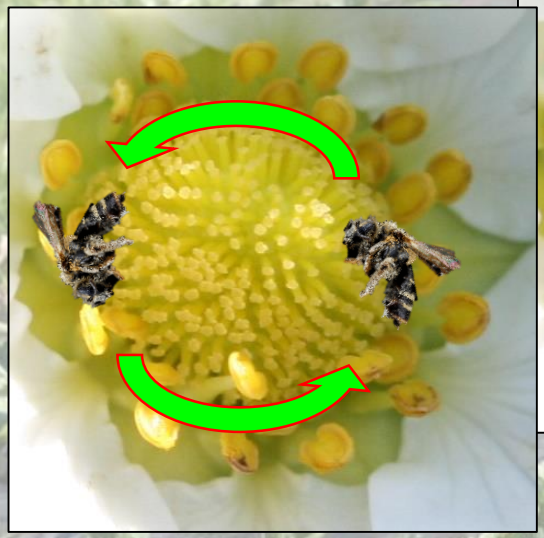
Why is pollinator diversity important?

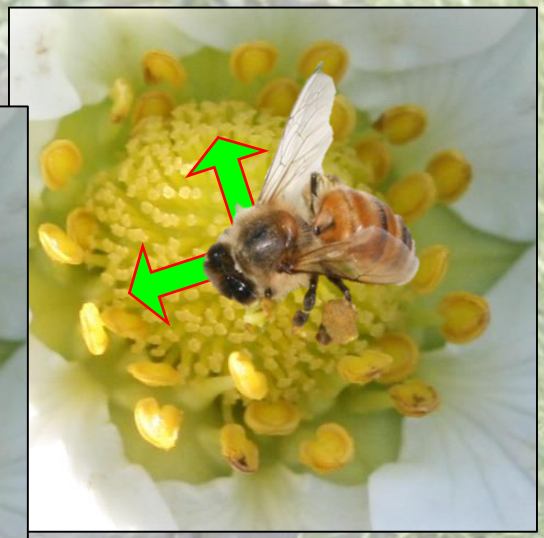
What factors influence pollination?

pollinator behavior,

variable weather,

timing within the day/season, frost protection





Who are the pollinators?

Managed Bees:

Honey Bees

- Hive nester
- Social species

Who are the pollinators?

Wild Bees:

- We collected 12 different bee genera.

Agopostemon:	***15***
Andrena:	***91***
Augochlorella:	***42***
Halictus:	***63***
Lasioglossum:	***970***
Melissodes:	***92***
Megachilie:	***4***
Ceratina:	***3***
Osmia:	***8***
Calliopsis:	***1***
Epeolus:	***2***
Eucera:	***2***

Who are the pollinators?

Wild Bees:

Lasioglossum spp.

- Ground nester
- Solitary species

Sam Droege

Collected at least ~13 different Lasioglossum species/ species groups in 2017.

Who are the pollinators?

Wild Bees:

Andrena spp.

Halictus spp.

Who are the pollinators?

Wild Bees:

Augochlorella spp.

Who are the pollinators?

Other insects:

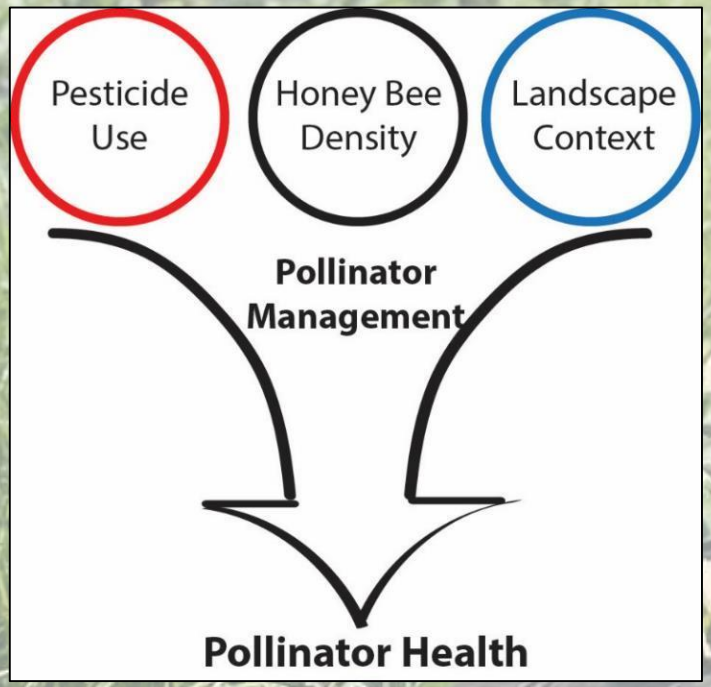
Syrphid flies

Who are the pollinators?

Other insects:

Other flies?

Integrating pest and pollinator management

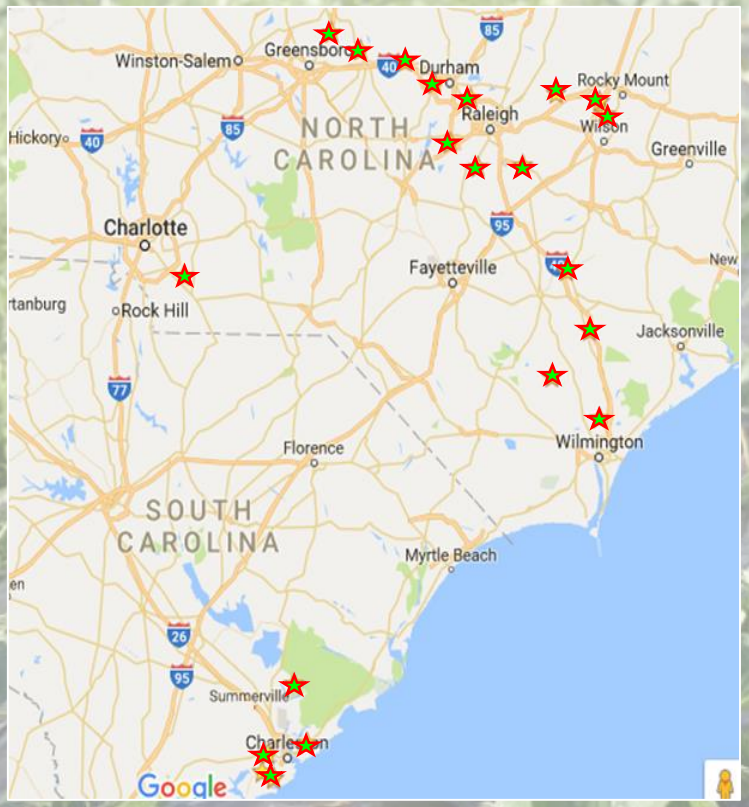


How does

pesticide use, honey bee stocking rate, & landscape

impact bee health and strawberry pollination?

Integrating pest and pollinator management



Pesticide Use

2017

- **13 conventional**
- **7 Organic**

- **6.4 average apps.**
  - **0 low - 24 high**
  - **6 no spray sites**

2018

- **12 conventional**
- **6 Organic**

- **5.8 average apps.**
  - **0 low - 21 high**
  - **6 no spray sites**

Pesticide Use

2017

- 13 conventional
- 7 Organic

- 6.4 average apps.
  - 0 low - 24 high
  - 6 no spray sites

- **Herbicide avg – 0.32**
- **Insecticide avg – 0.89**
- **Acaricide avg – 0.89**
- **Fungicide avg – 4.3**

2018

- 12 conventional
- 6 Organic

- 5.8 average apps.
  - 0 low - 21 high
  - 6 no spray sites

- **Herbicide avg – 0.24**
- **Insecticide avg – 0.94**
- **Acaricide avg – 0.82**
- **Fungicide avg – 3.8**

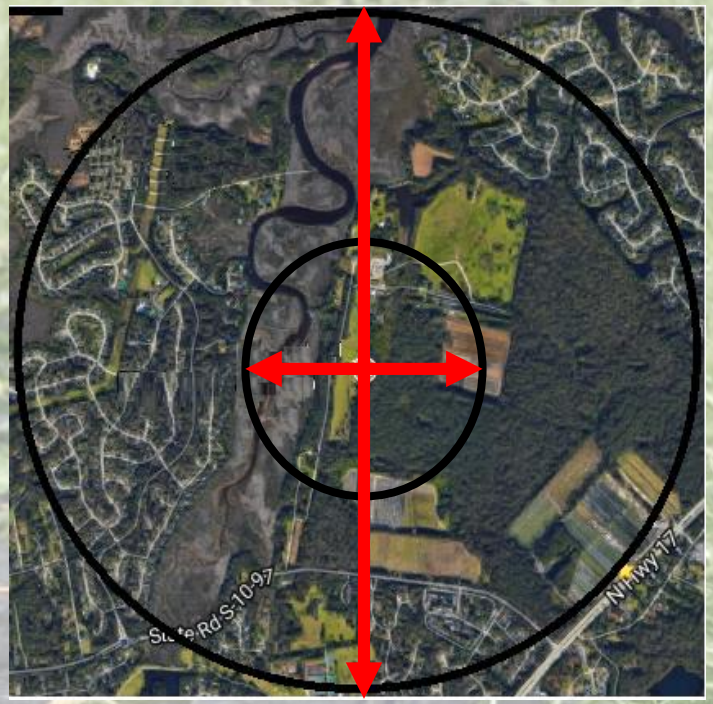
Pesticide Use

- *Conventional*
- *Organic*
- *High intensity*
- *Low intensity*

Landscape

- ***Urban***
- ***Agricultural***
- ***Forest***
- ***Natural***

Honey Bee Stocking Rate



500m & 1500m

Landscape

- **Ag 500m – 1.6% to 78%**
- **Ag 1500m – 1.3% to 78%**

- **Nat 500m – 2.8% to 54%**
- **Nat 1500m – 3.1% to 75%**

Pesticide Use

- *Conventional*
- *Organic*
- *High intensity*
- *Low intensity*

Landscape

- *Urban*
- *Agricultural*
- *Forest*
- *Natural*

Honey Bee Stocking Rate

- ***Hives / acre***

Honey Bee Stocking Rate

2017

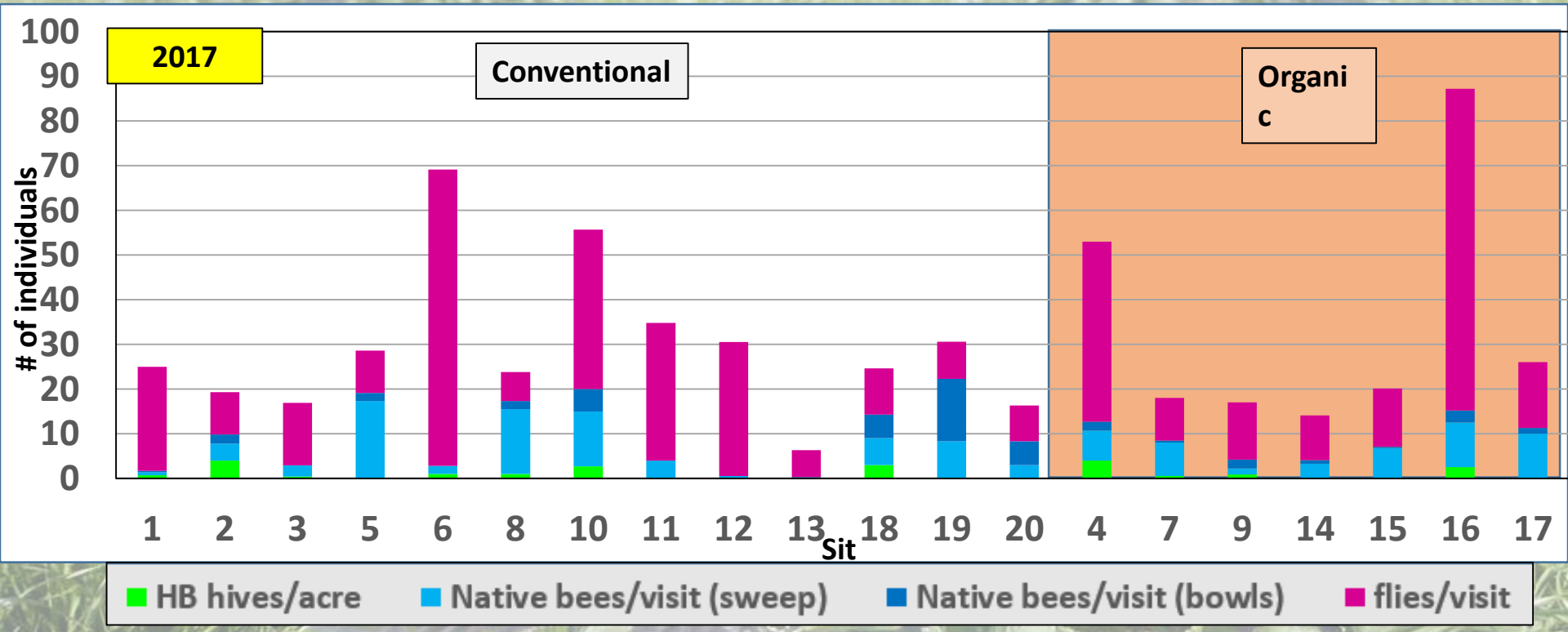
- 1.03 avg hives/acre
- 0 low to 4 high
- 9/20 with none

2018

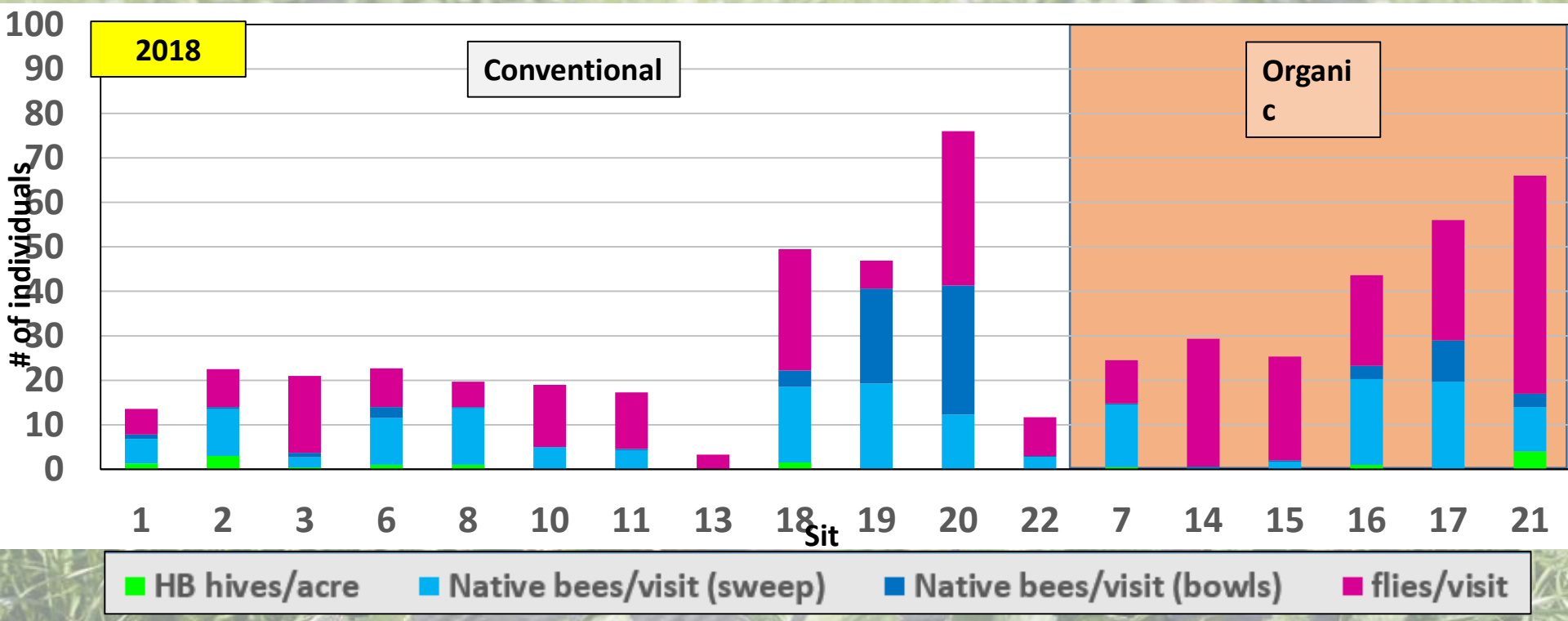
- 0.76 avg hives/acre
- 0 low to 4 high
- 9/18 with none

Measuring pollinators

Pollinator abundance

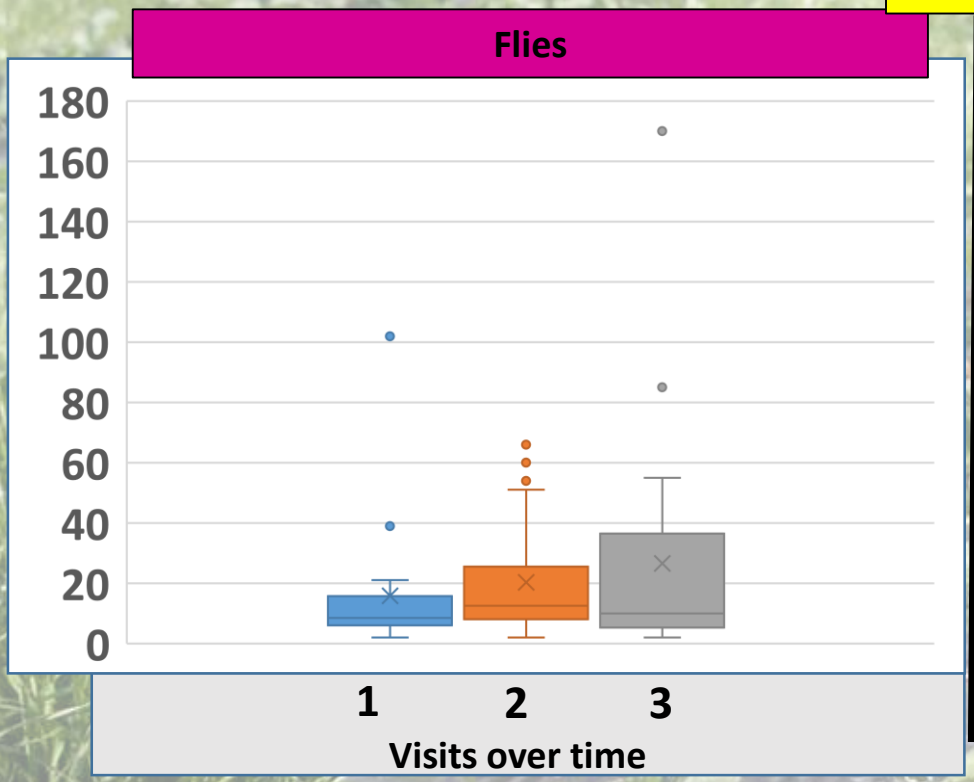


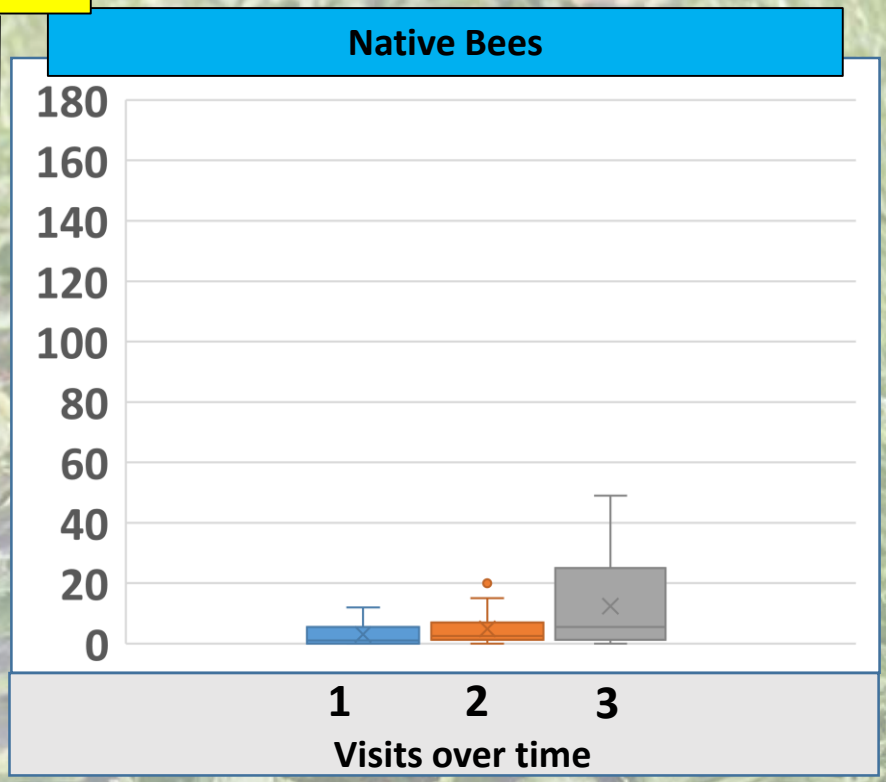
Pollinator abundance



Pollinator Phenology

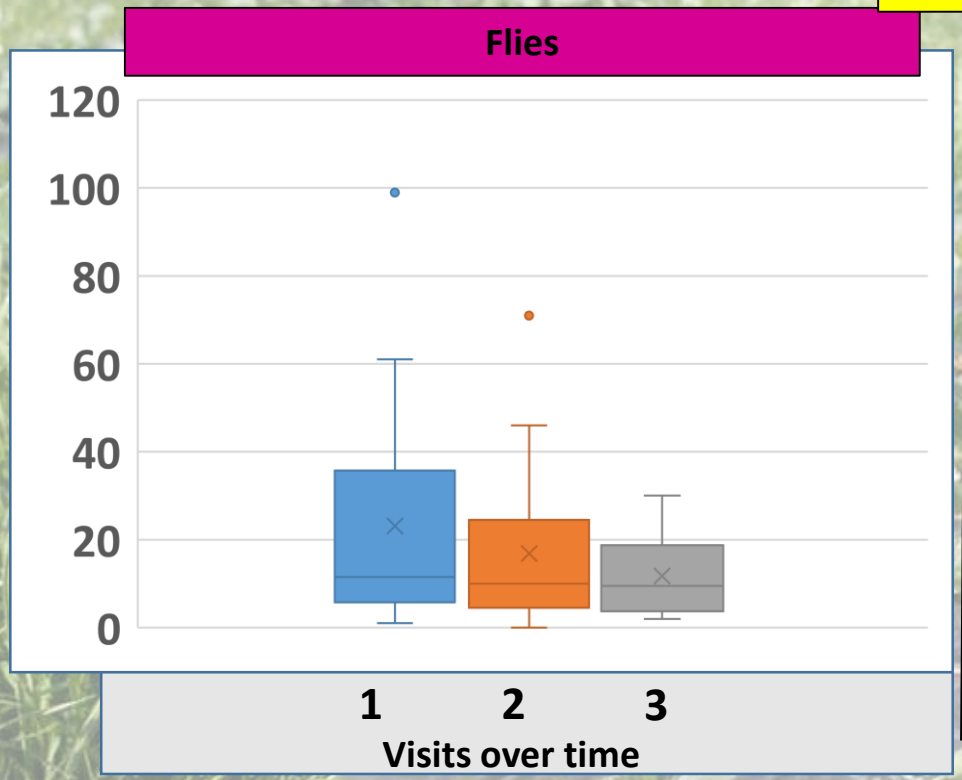
2017

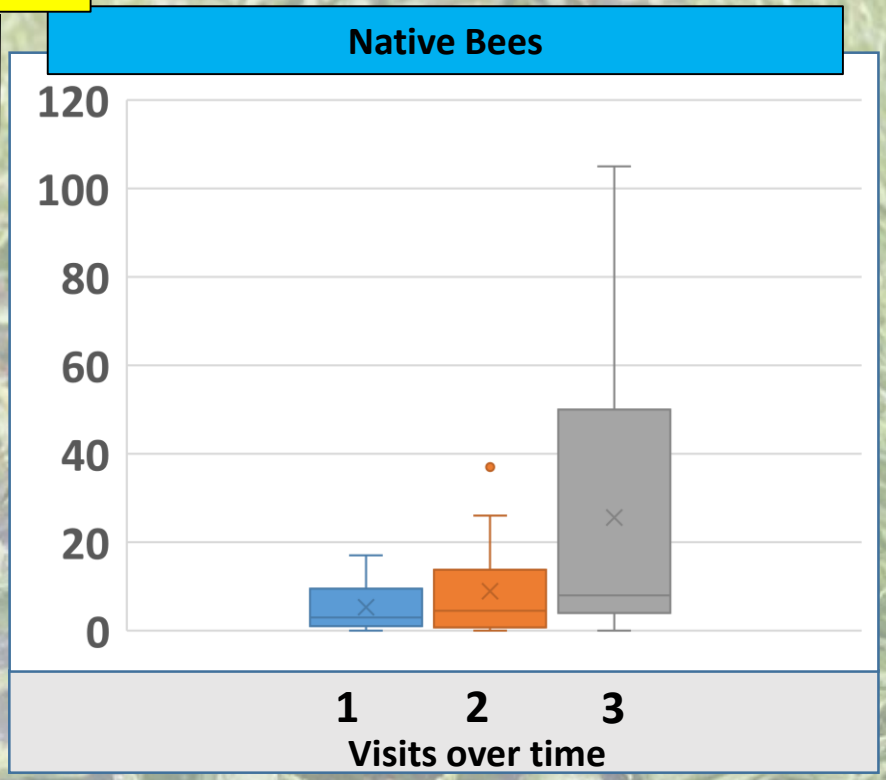




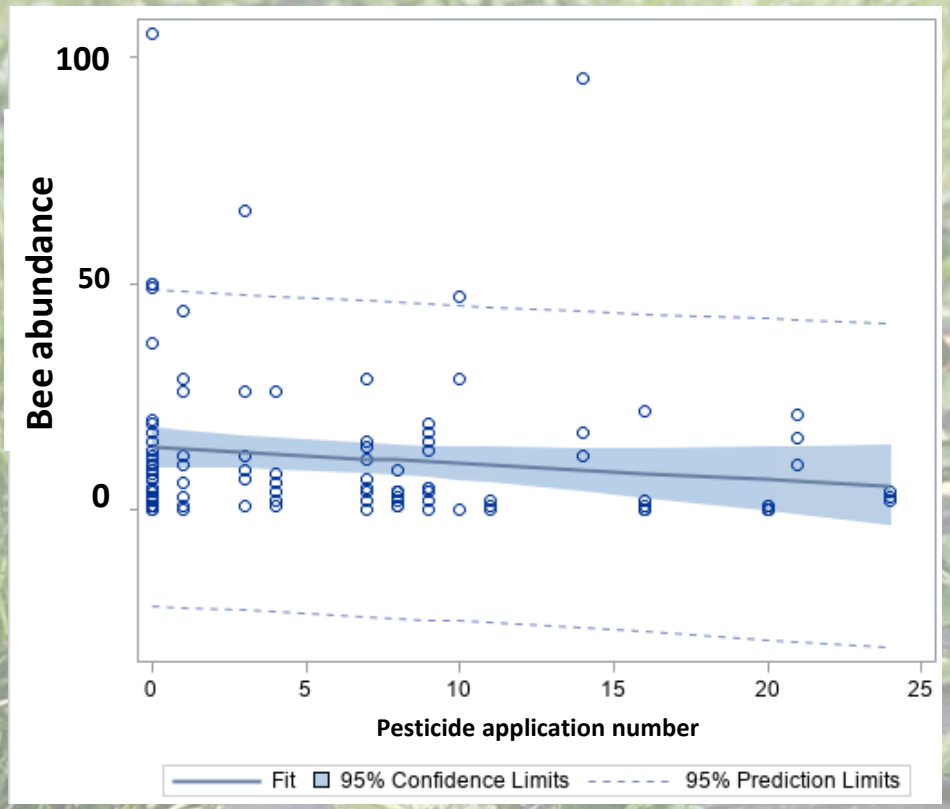
Pollinator Phenology

2018





Pesticide intensity



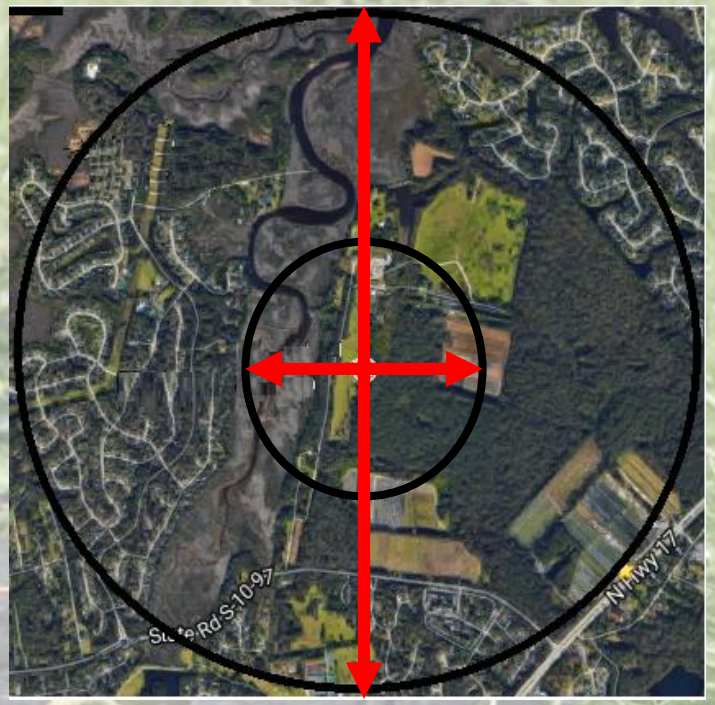
- **Bee abundance decreased with increasing pesticide application number.**
  - **-0.1858 ± 0.044**
- **Bee abundance was higher on conventional farms.**
  - **1.33 ± 0.61**

Landscape

- **Bee abundance was lower when there was greater proportions of natural land at 1500m.**
  - **-2.94 ± 1.39**

Landscape composition may be less important than factors at a finer scale.

(floral diversity/abundance or available bare soil)



500m & 1500m

Honey bee stocking rate

- **Honey bee density had a negative effect or no effect on native bee abundance captured via sweep net.**
  - **-0.47 ± 0.18**
- **Honey bee density had a positive effect on native bee abundance captured via pan trap.**
  - **0.74 ± 0.16**

Native bee diversity

2017

- 1.78 avg. score
- 1 low to 3.35 high

2018

- 1.71 avg score
- 0 low to 3.46 high

Genus diversity did not vary with farm management

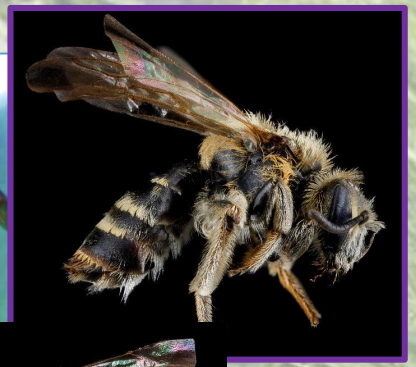
Who are the pollinators?

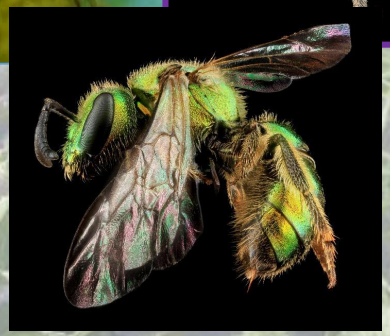
Wild bee abundance and diversity varies along the east coast, but community composition is somewhat similar.

- *NY (Finger Lakes region) – 14 farms, 2 years (organic/low intensity) – pan traps set out for 72hr, twice during the season.
  - https://doi.org/10.1016/j.agee.2015.05.004
- *NC Sampling – 18-20 farms, 2 years (Conv. & Org.) – pan traps set out for 6hr and sweep net sampling for 1.5 hours, three times during the season.

Wild bee genera	NY	NC
Agapostemon	2	15
Andrena	428	91
Augochlora	1	0
Augochlorella	85	42
Bombus	3	0
Calliopsis	0	1
Ceratina	37	3
Epeolus	0	2
Eucera	0	2
Halictus	26	63
Hoplitis	1	0
Hylaeus	5	0
Lasioglossum	364	970
Megachilie	0	4
Melissodes	0	92
Nomada	38	0
Osmia	9	8
Sphecodes	3	0
Xylocopa	1	0

Non-bee Pollinators





Pesticide intensity

- **Pesticide application number had nearly no effect on fly abundance or diversity.**
- **<u>Conventional management</u> had a negative effect on abundance, but a positive effect on 2018 diversity**
  - **Abundance: -0.45 ± 0.19**
  - **Diversity: 2.0 ± 0.67**

Landscape

- **<u>Greater natural land cover</u> had a positive effect on abundance, but a negative effect on 2018 diversity.**
  - **Abundance: 0.58 ± 0.29**
  - **Diversity: -3.18 ± 1.33**
- **<u>Greater agricultural land cover</u> had a positive effect on 2018 diversity.**
  - **2.13 ± 0.89**

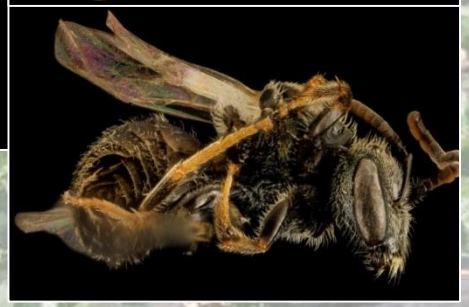
500m & 1500m

Honey bee stocking rate

- **<u>Greater honey bee density</u> had a positive effect on fly abundance, but a negative effect on 2017 diversity.**
  - **Abundance : 0.20 ± 0.07**
  - **Diversity: -0.63 ± 0.17**

Strawberry size and quality

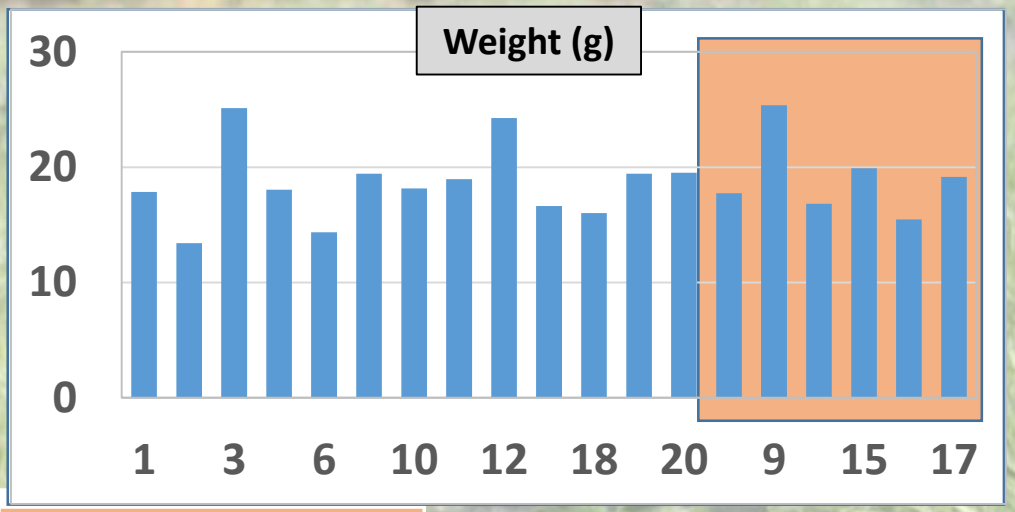
Strawberry size and quality

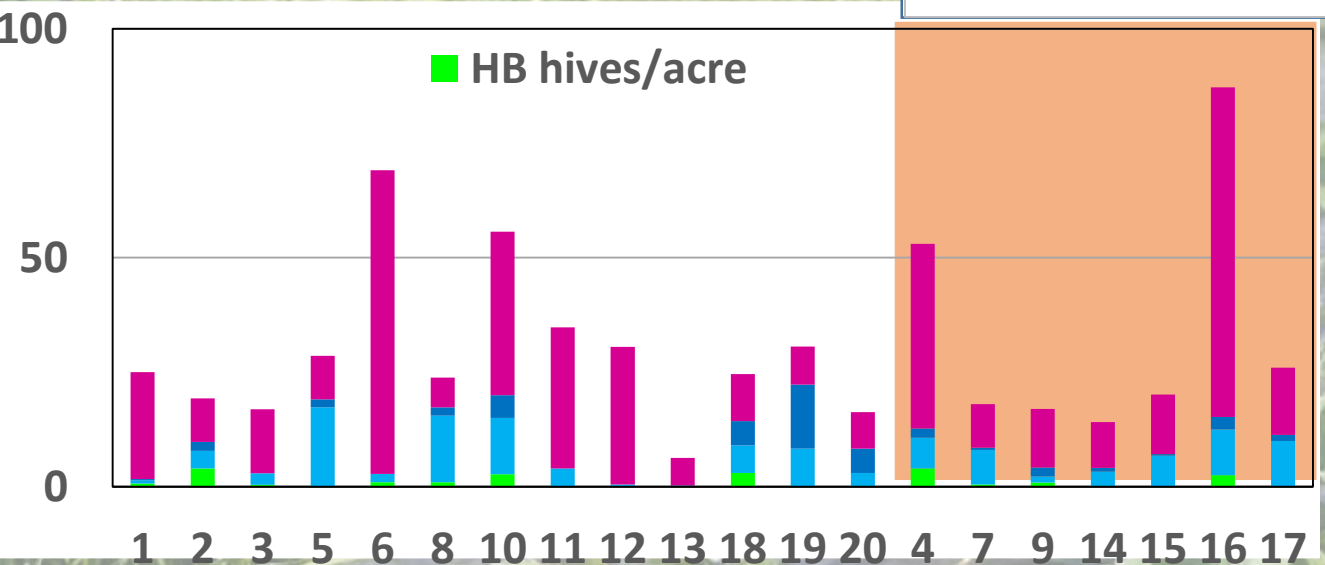


- **Neither native bee abundance nor diversity impacted weight or symmetry…**
  - **Reaching complete pollination?**

Strawberry size and quality

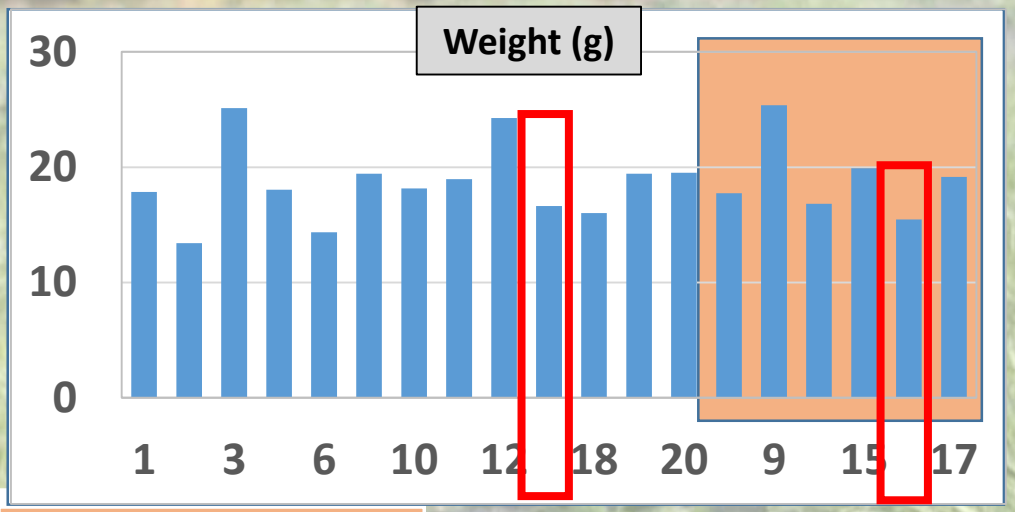
2017

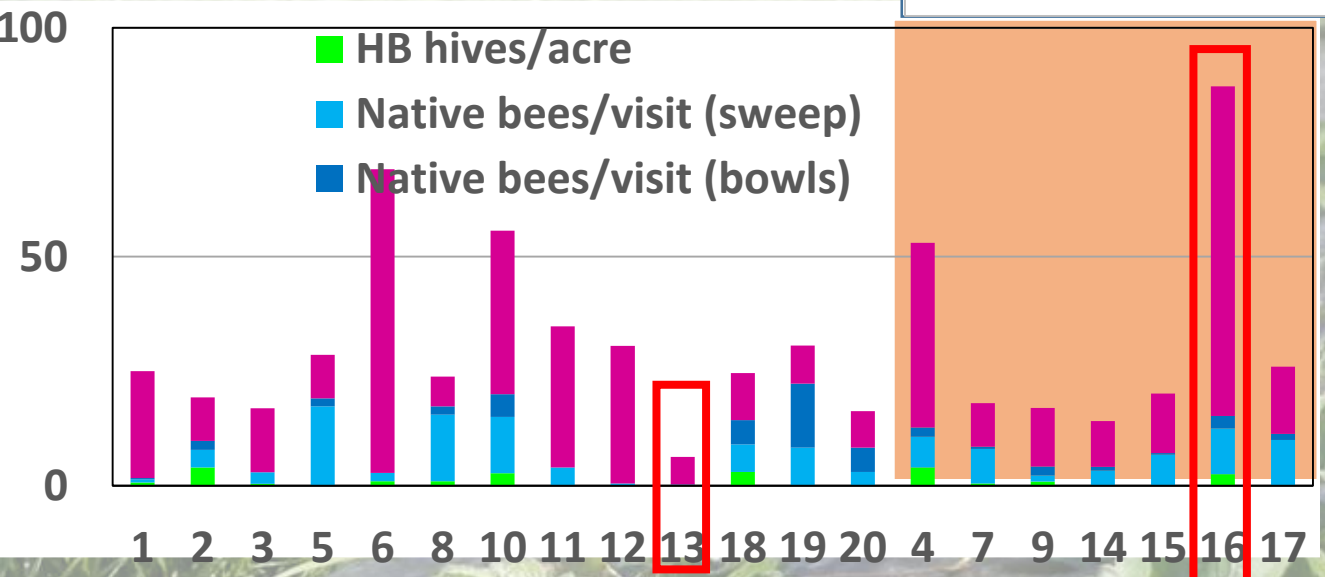




Strawberry size and quality

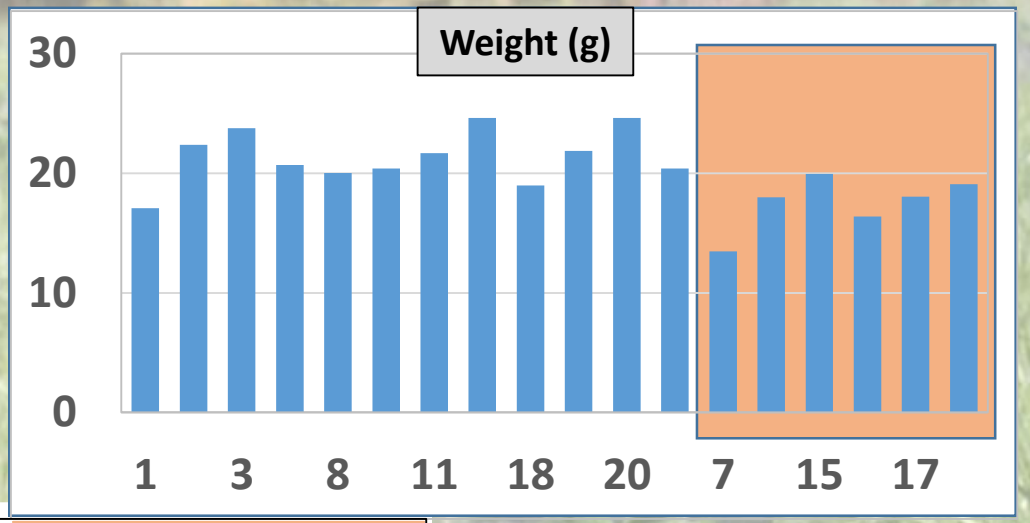
2017

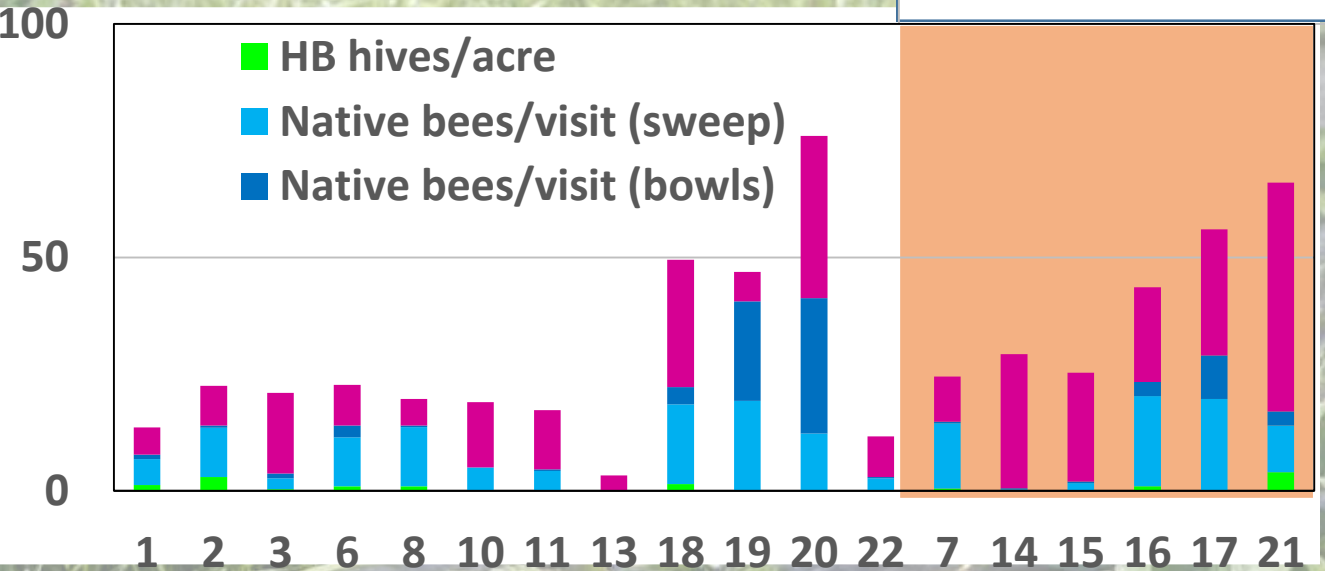




Strawberry size and quality

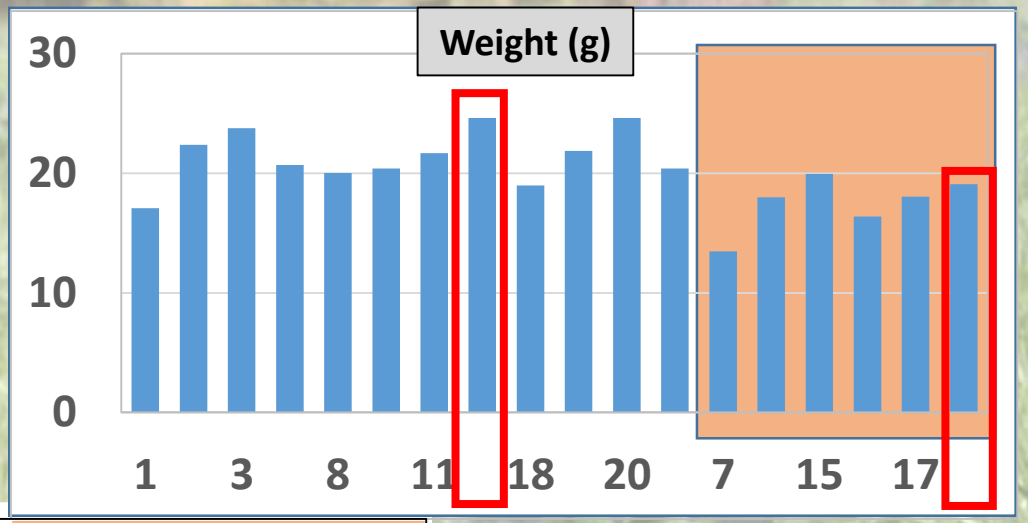
2018

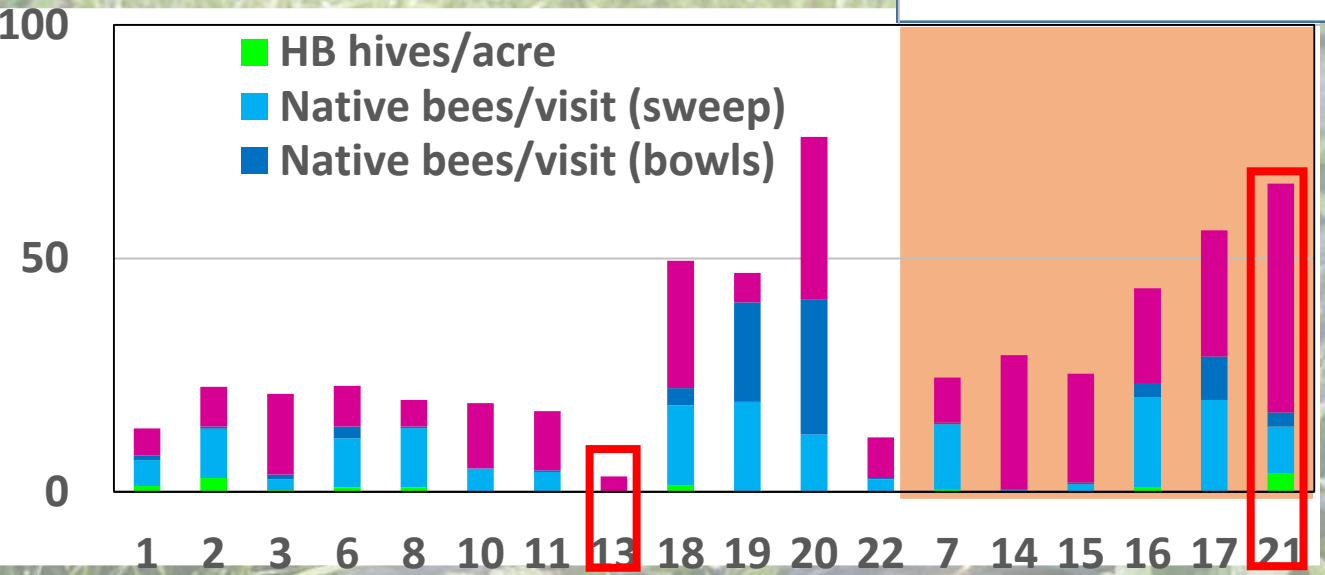




Strawberry size and quality

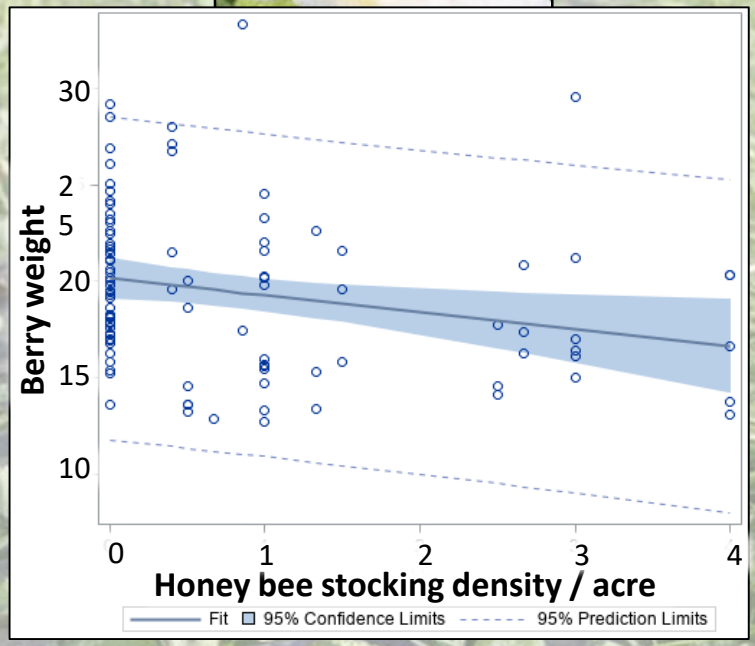
2018





Strawberry size and quality

- **Higher honey bee density had a negative effect on strawberry weight.**



Strawberry size and quality

- **Greater proportions of agricultural land had a positive effect on berry symmetry**

Pollination Conclusions

- **Pesticide (fungicide) use can negatively impact pollinators in strawberries**
- **Insect pollinators do not appear to benefit strawberry weight or symmetry**
- **Therefore pesticide impacts on pollinators may be more important for other crops within a farm.**
- **Stocking too many honey bees may decrease strawberry weight**
- **Unless honey bees are needed for other crops at the same time, stocking them may be unnecessary in strawberries**

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