Blueberry Pollination Research Update

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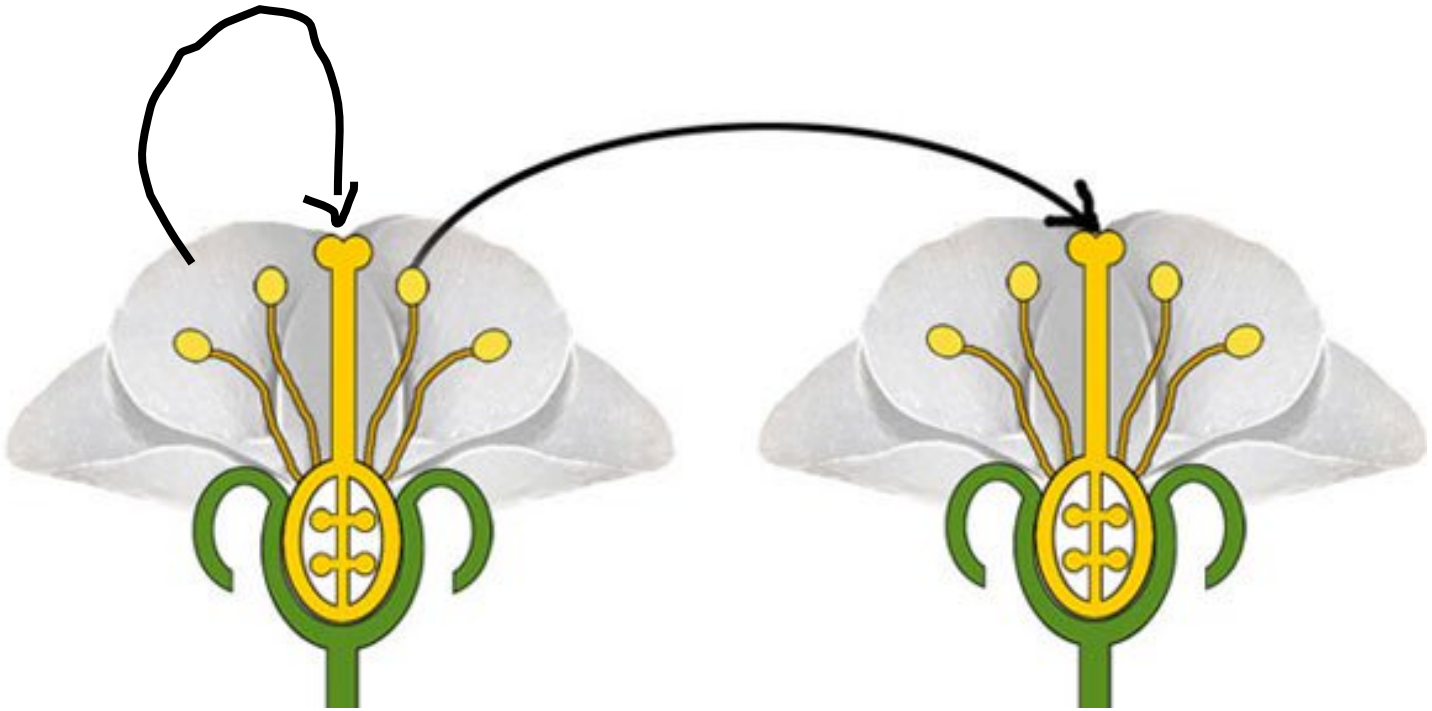
Funding: UF Blueberry Breeding Program

Bees essential for blueberry production



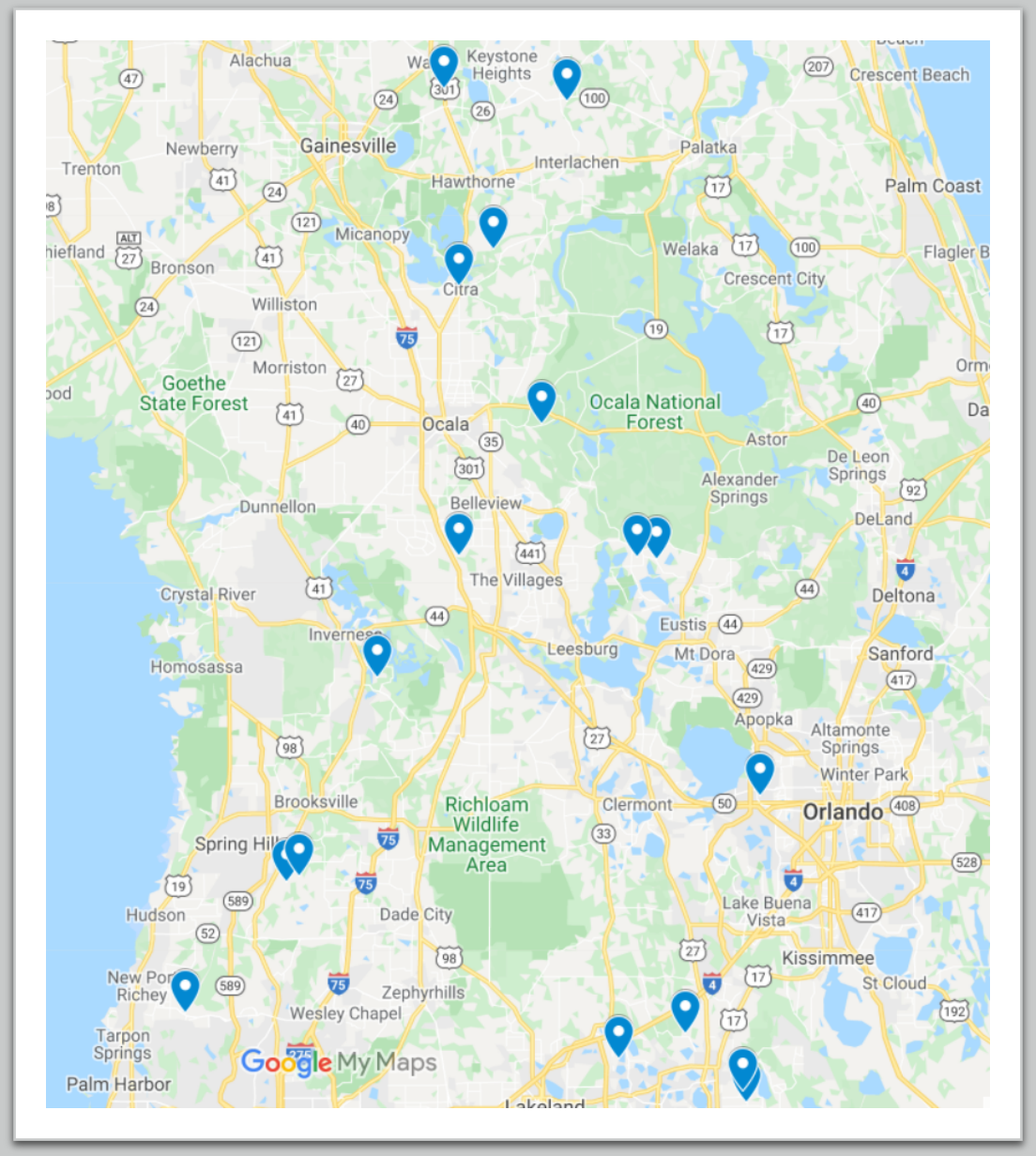
Bees assist with self and cross pollination

Pollinators vary in behavior and efficacy

Growers rely heavily on managed honey bees but guidelines are minimal

Questions

1. Does higher bee stocking density result in greater pollination?
   - Visitation to flowers
   - Fruit set and yield
2. How does hive quality vary, and does this affect pollination?
3. Is fruit set and yield limited by bee visitation rates?



Methods

4 farms 2019; 20 farms 2020

- Gradient of honey bees (0.75 – 11.75 hives/acre)
- Gradient of bumble bees (0 – 4 hives/acre)

Farm	Year studied	HB density (2019; 2020)	BB density (2019; 2020)	Size (acres)	Management	Proportion blueberry	Proportion agriculture	Proportion grassland	Proportion woodland
1	2020	1.96	0.71	28	Conventional	0.002	0.063	0.419	0.387
2	2020	1.97	0	63	Conventional	0.035	0.703	0.142	0.011
3	2020	1.78	0	18	Conventional	0.009	0.046	0.129	0.709
4	2020	4.17	0	240	Conventional	0.054	0.687	0.179	0.006
5	2020	3.00	0.33	40	Conventional	0.001	0.214	0.279	0.217
6	2019; 2020	3.50; 4.02	0.33; 0.33	43	Conventional	0.001	0.094	0.377	0.350
7	2019; 2020	8.00; 7.14	0.60; 0.48	84	Conventional	0	0.082	0.099	0.772
8	2020	3.60	0	30	Organic	0.001	0.504	0.181	0.229
9	2019; 2020	3.00; 3.00	0.15; 0.05	200	Organic	0	0.020	0.099	0.818
10	2020	1.26	0	19	Organic	0.020	0.218	0.142	0.108
11	2020	0.888	0	16	Organic	0.001	0.196	0.357	0.365
12	2020	11.00	0	8	Conventional	0.001	0.072	0.334	0.150
13	2020	3.86	0.21	28	Conventional	0.029	0.018	0.077	0.674
14	2020	0.71	0.27	45	Conventional	0.044	0.069	0.182	0.274
15	2020	1.60	0.40	15	Organic	0.001	0.330	0.125	0.484
16	2020	1.33	0.67	9	Organic	0.001	0.365	0.435	0.195
17	2020	11.64	0	14	Conventional	0.023	0.207	0.343	0.414
18	2020	6.40	1.00	10	Conventional	0	0.004	0.034	0.139
19	2019; 2020	3.00; 3.13	0.10; 0.14	115	Conventional	0.037	0.140	0.682	0.085
20	2020	5.00	0	20	Conventional	0	0.015	0.065	0.867

*Hive density not correlated with size, management, or landscape

*No known apiary or large source of honey bees

Methods

<u>4 rows per cultivar per farm</u>

- Bee visitation rates per 120 m row
  - 4 – 9 times per row over bloom
  - Adjusted for number of open flowers per row

<u>10 bushes per cultivar per farm</u>

- Fruit set and yield on marked branches
  - Proportion fruit set
  - Total berry weight per 100 flowers
  - Average seed number per berry

Methods

Hive assessments

- 20 hives per farm
  - Grading 1-5
  - Number foragers per 1-min
  - Peak bloom
  - Good weather
  - Explains 63% variation across hives (80% explained by invasive assessments)

~91% honey bees

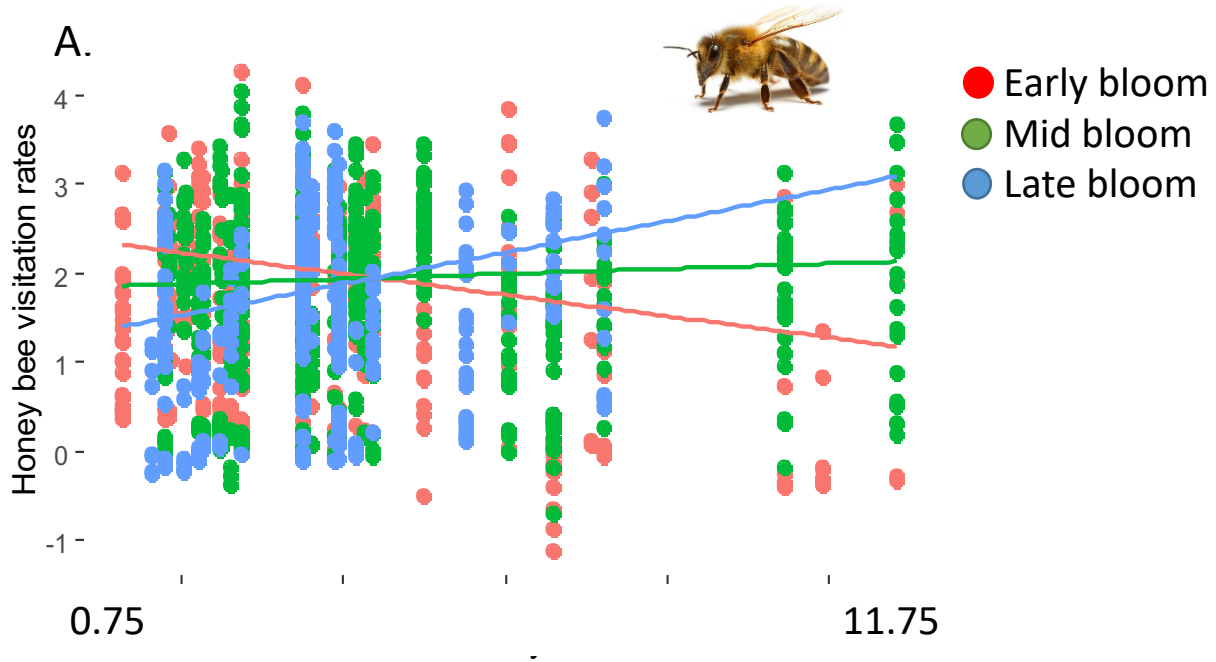
~ 6% bumble bees

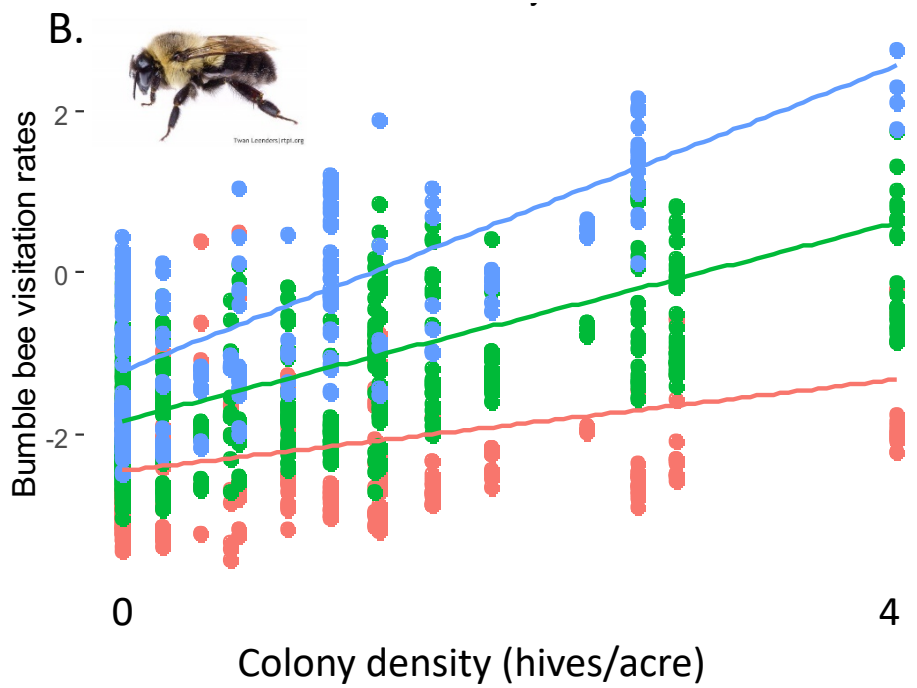
~ 3.1% SE blueberry bee

Results

*Honey bees dominant visitors

*Identical across years

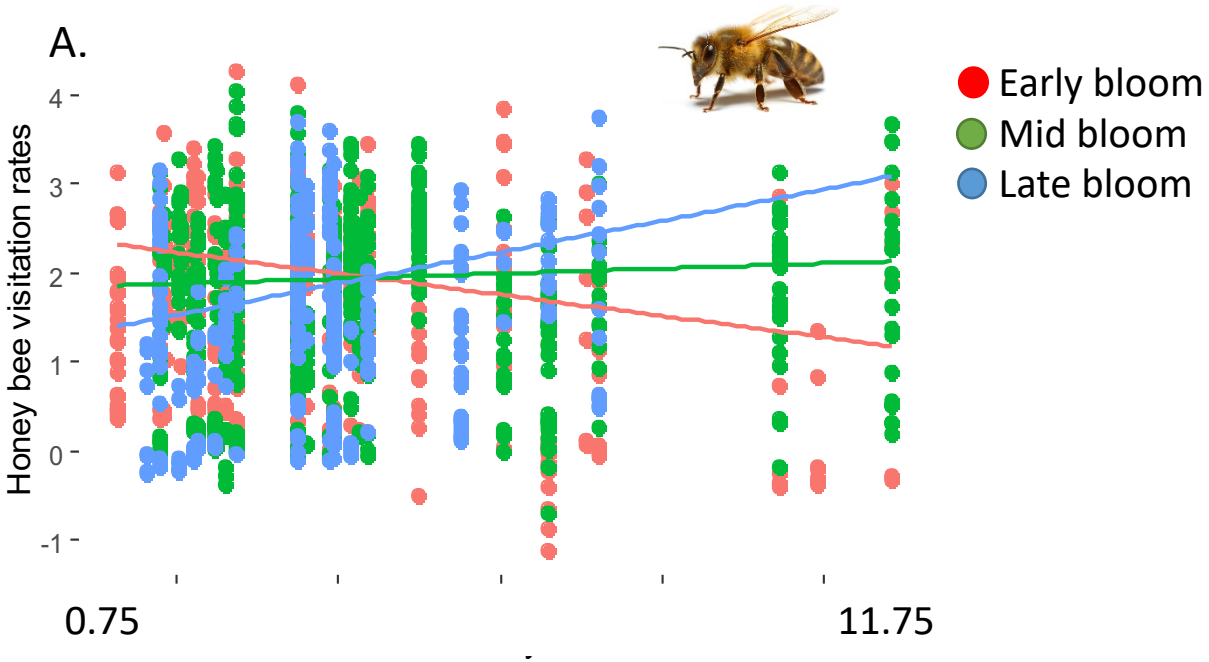


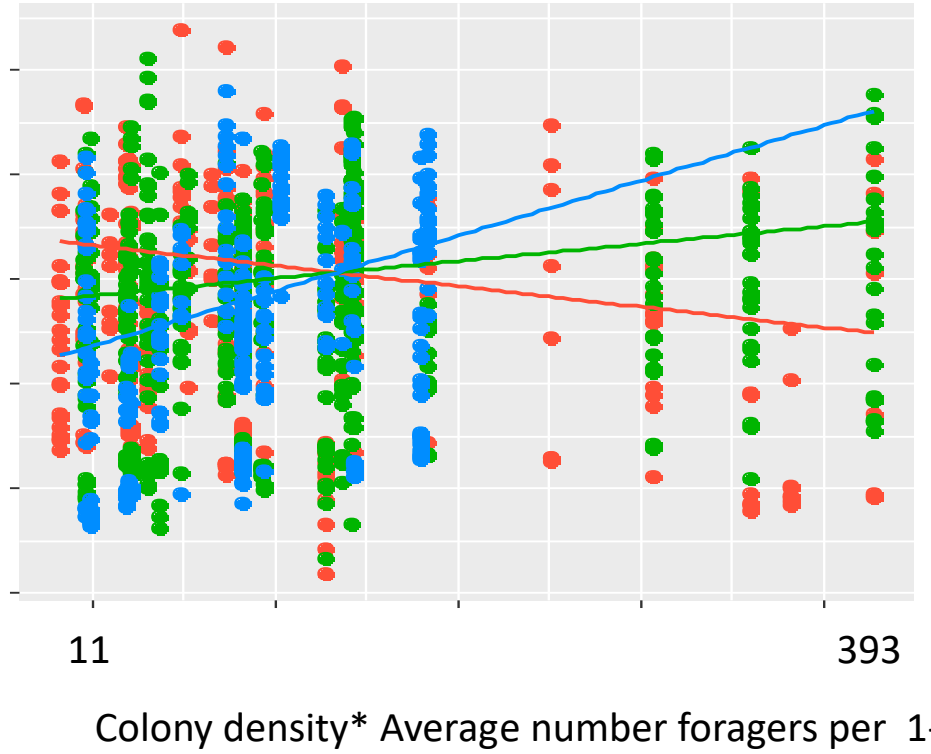


* Higher honeybee hive density only associated with higher visitation rates at the end of bloom

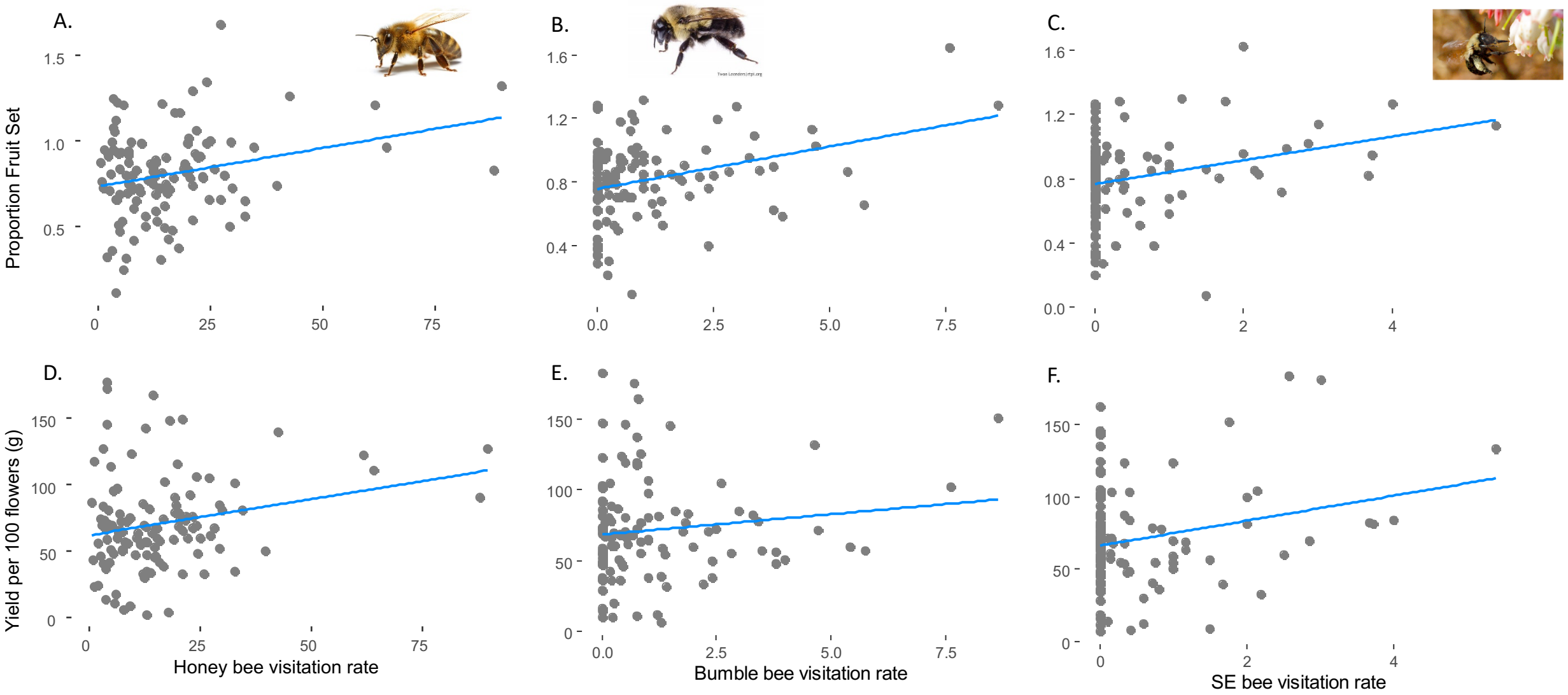
* Higher bumble bee density associated with higher bumble bee visitation rates throughout bloom

* Incorporating hive strength makes relationship more positive; still only in latter half of bloom

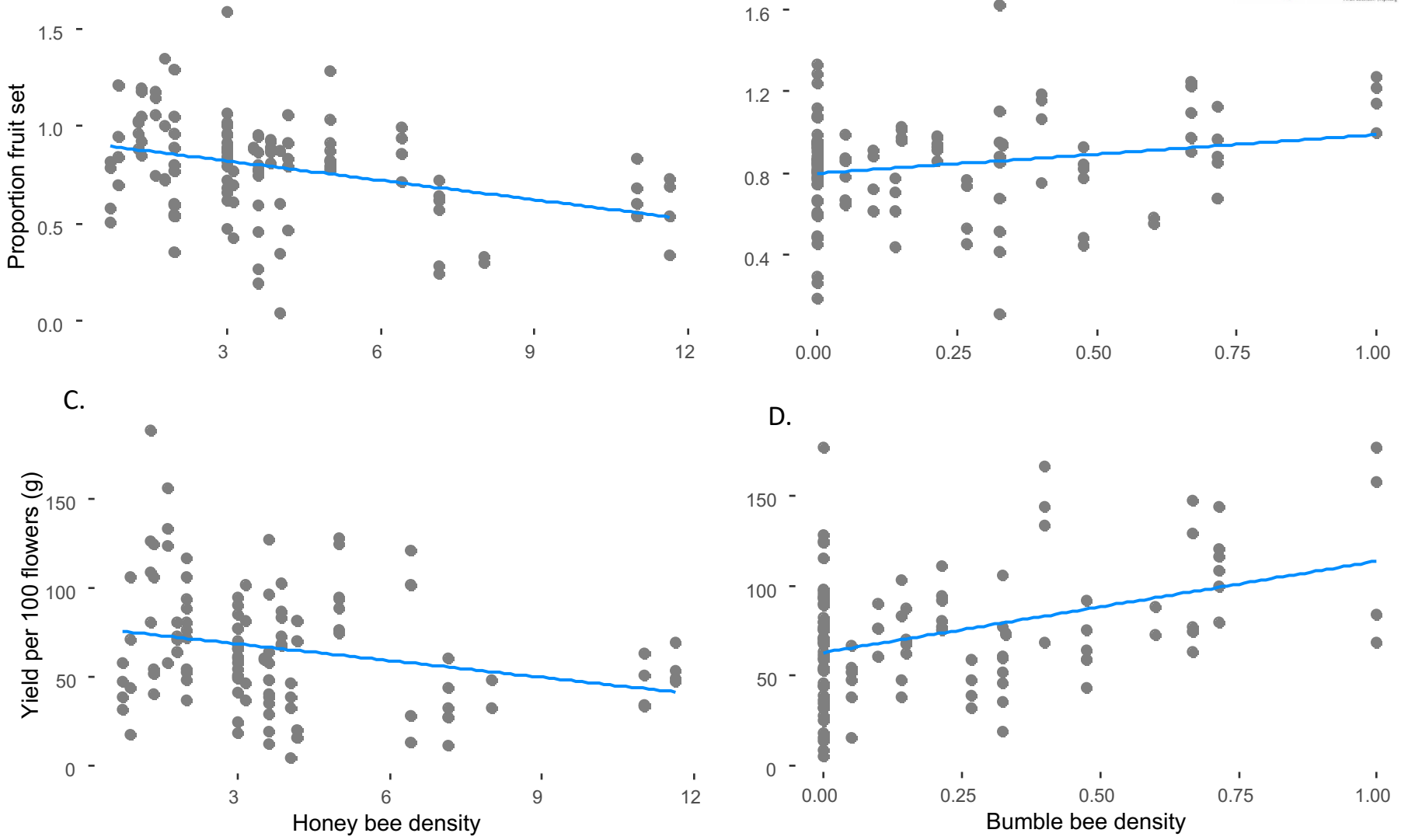




* More bee visitors of all types result in more fruits



*Bumble bee hive density but not honey bee hive density associated with more fruit



Conclusions

- Yields can improve with greater bee visitation
- All bee visitors have a positive effect on yields
- The southeastern blueberry bee is the most effective on a per visit basis, but populations are variable
- Higher bumble bee stocking density associated with greater bumble bee visitation rates and yields
- Higher honey bee stocking density associated with higher honey bee visitation rates in late bloom, no positive effect on yields
- Honey bee hive quality important to consider

Conclusions

<u>Why don’t we see correlation between honey bee hive density and yield?</u>

- Increased visitation rates only in late bloom
  - Competing bloom
  - Lack of attraction to blueberry flowers
  - Seasonality in foraging
- Quality assessments did not fully capture hive strength
  - Hive strength matters as much/more than stocking density
- Other management factors influence yield
  - But relationship with bumble bees
  - Bagged branches
- Farms saturated with honey bees

Recommendations

Bumble bees up to 1 quad per acre

- Coexistence with honey bees can be challenging
- Will die within ~8 weeks (annual)
- Colonies < 500 workers (compared to honey bee colonies with > 10,000 workers)
- Per visit efficacy and per bee value higher than honey bees

Honey bees

- Is more better?

1-min hive assessments in good weather in peak bloom can be valuable for assessing hive quality

Future Work

- Paired approach: same grower and beekeeper
  - High vs. low honey bee density: manipulative
- Correlating different methods for assessing hive strength
  - Invasive vs. non-invasive
- Variation across cultivars
  - Attractiveness to bees
  - Pollination needs

- Funding: USDA NIFA SCRI grant

  UF Blueberry Breeding Program