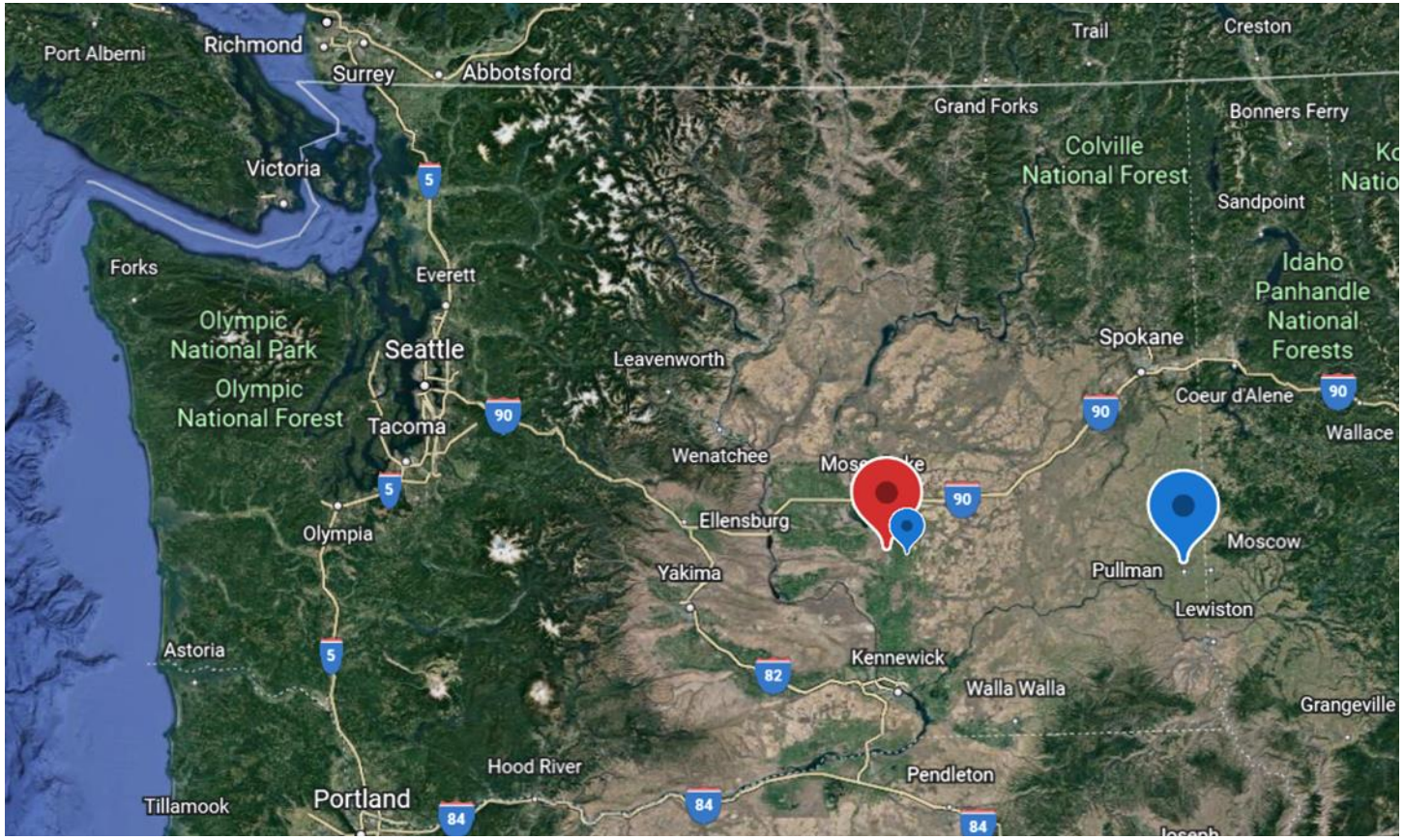
Improving Pollination Quality in Vegetable Seed

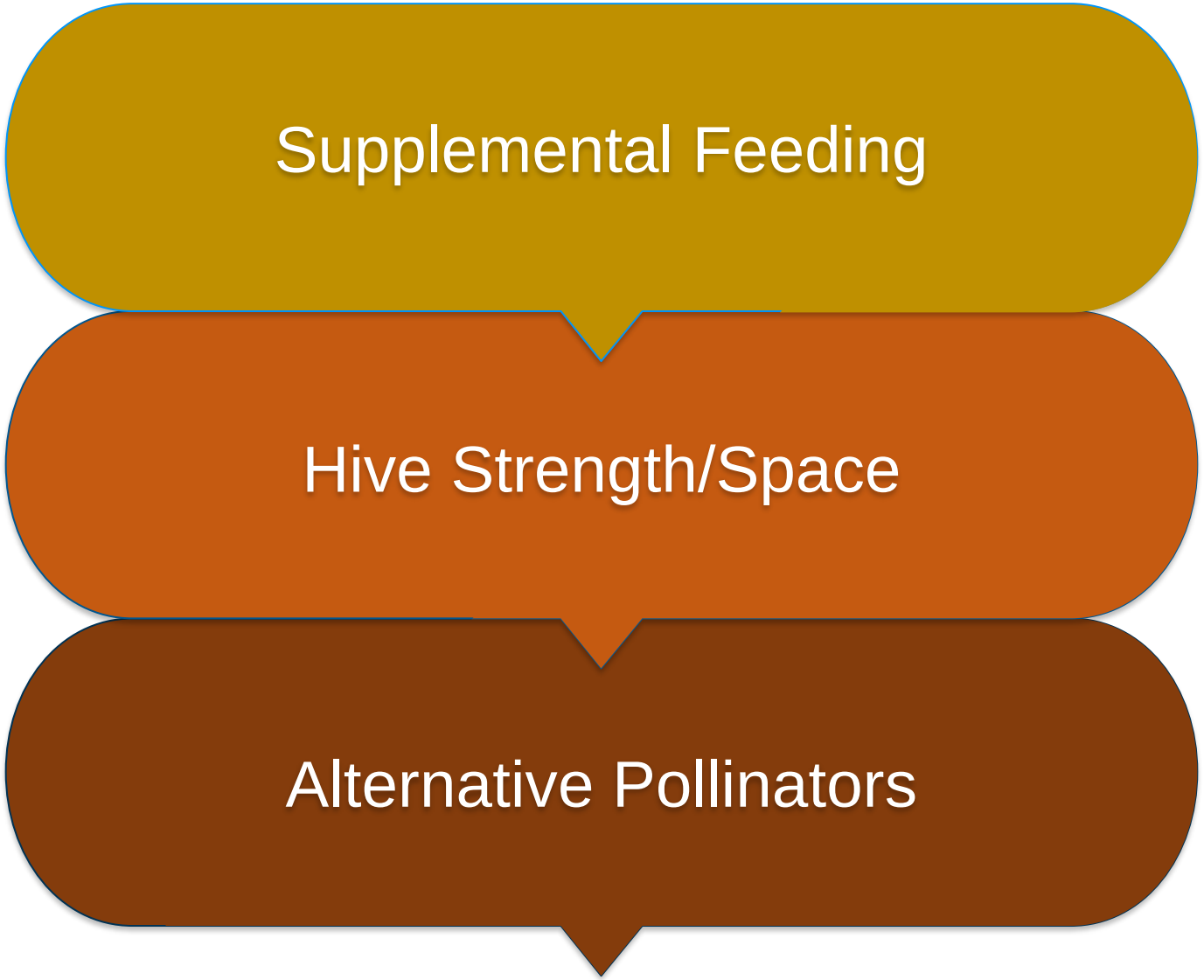
Riley Reed

Photo credit: Beeinformed.org

About me


Port Alberni
Richmond
Surrey
Abbotsford
Trail
Creston
Grand Forks
Bonners Ferry
Colville National Forest
Victoria
Sandpoint
Forks
Everett
Idaho Panhandle National Forests
Olympic National Park
Seattle
Spokane
Leavenworth
Olympic National Forest
Tacoma
Coeur d'Alene
Wallace
Wenatchee
Ellensburg
Olympia
Moscow
Yakima
Pullman
Lewiston
Astoria
Kennewick
Walla Walla
Grangeville
Hood River
Pendleton
Tillamook
Portland
5
90
82
84

Agenda


Supplemental Feeding
Hive Strength/Space
Alternative Pollinators

Definitions

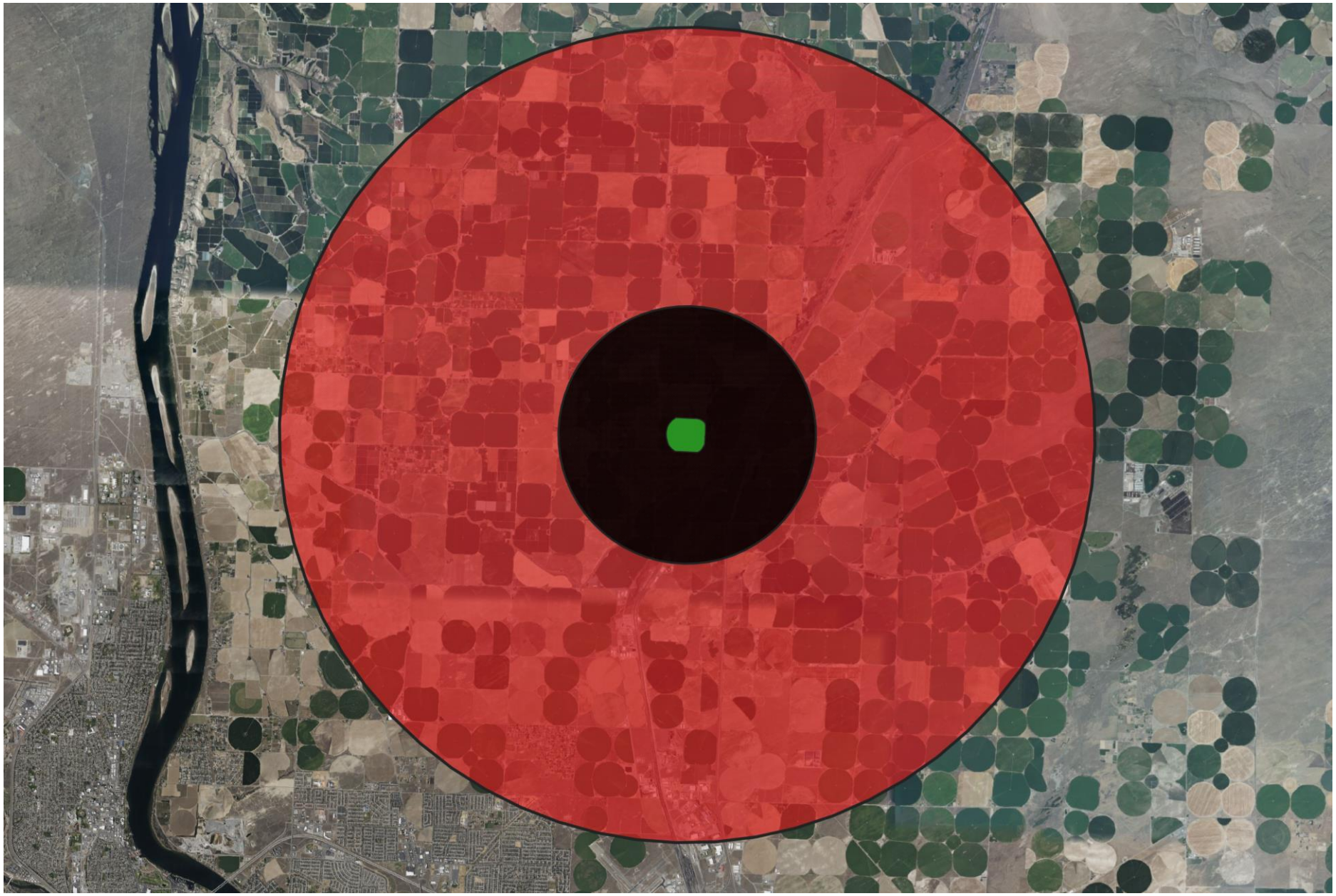
- Frame
- Super
- Forager
- Pollinator mediated gene flow

Supplemental feeding

The problem

- Seed crops rely on isolation between fields to preserve seed purity
- Honey bees are the mostly commonly used agricultural pollinator
- But they can forage at distances much greater than standard isolation distances
- Leads to cross pollination between fields, reduced seed purity, and in some cases transgene escape

Why do honey bees travel so far?



Hypothesis: Providing supplemental in-hive feeding will remove their need to forage at longer distances.

Kiwi growers in New Zealand also struggled to keeps bees on their crop.

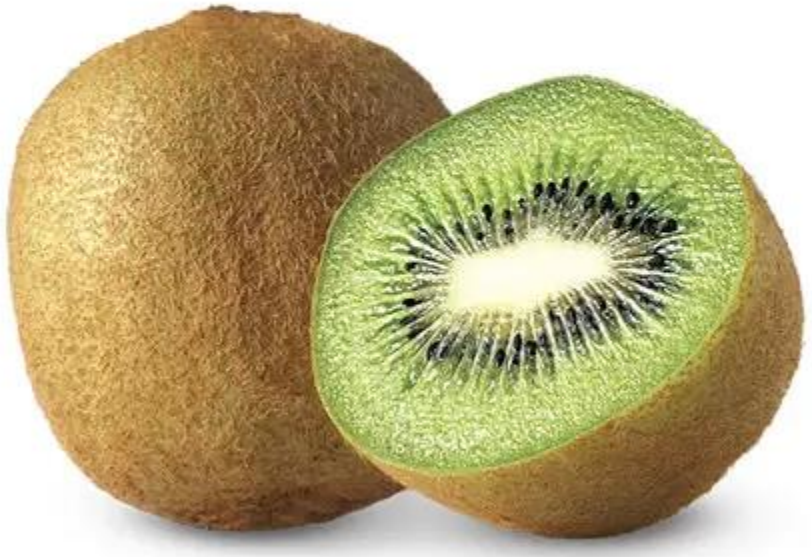


Photo courtesy of Aldi

Feeding pollen substitute decreased the collection of other pollen other plants.

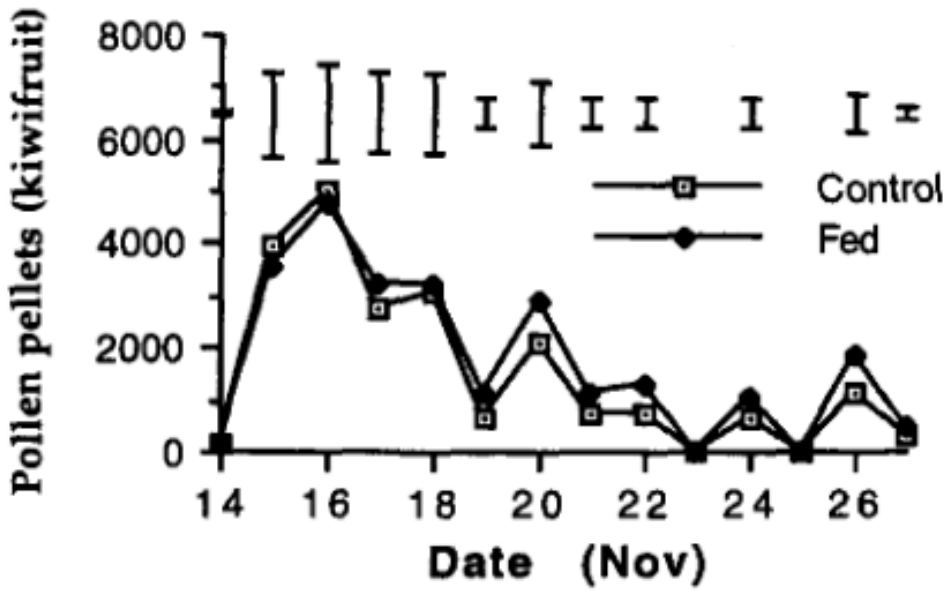


Fig. 1 Average number of kiwifruit pollen pellets trapped per day from control colonies and colonies fed pollen substitutes. The colonies were fed from 14 until 27 November. The vertical lines represent SED values.

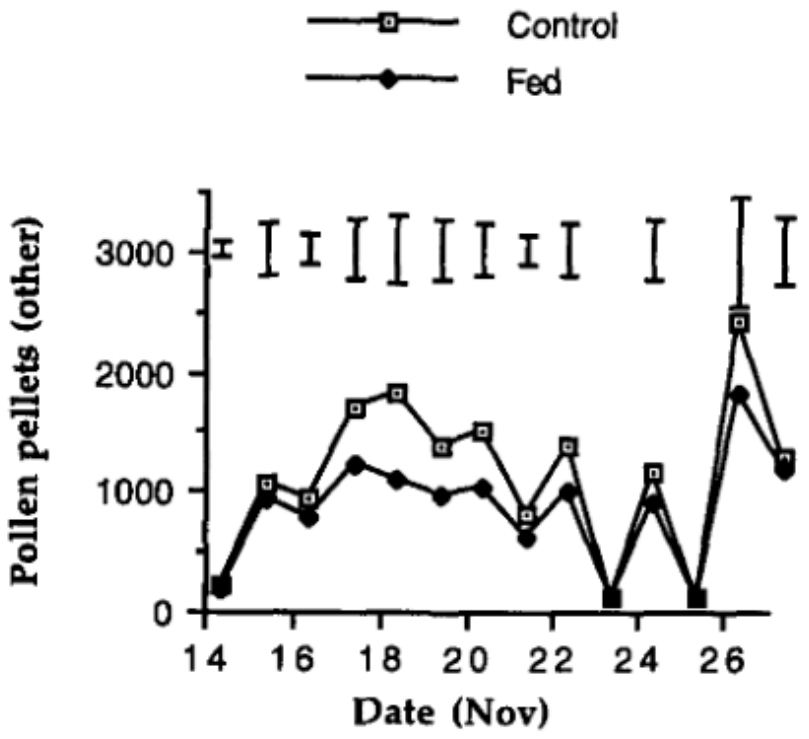
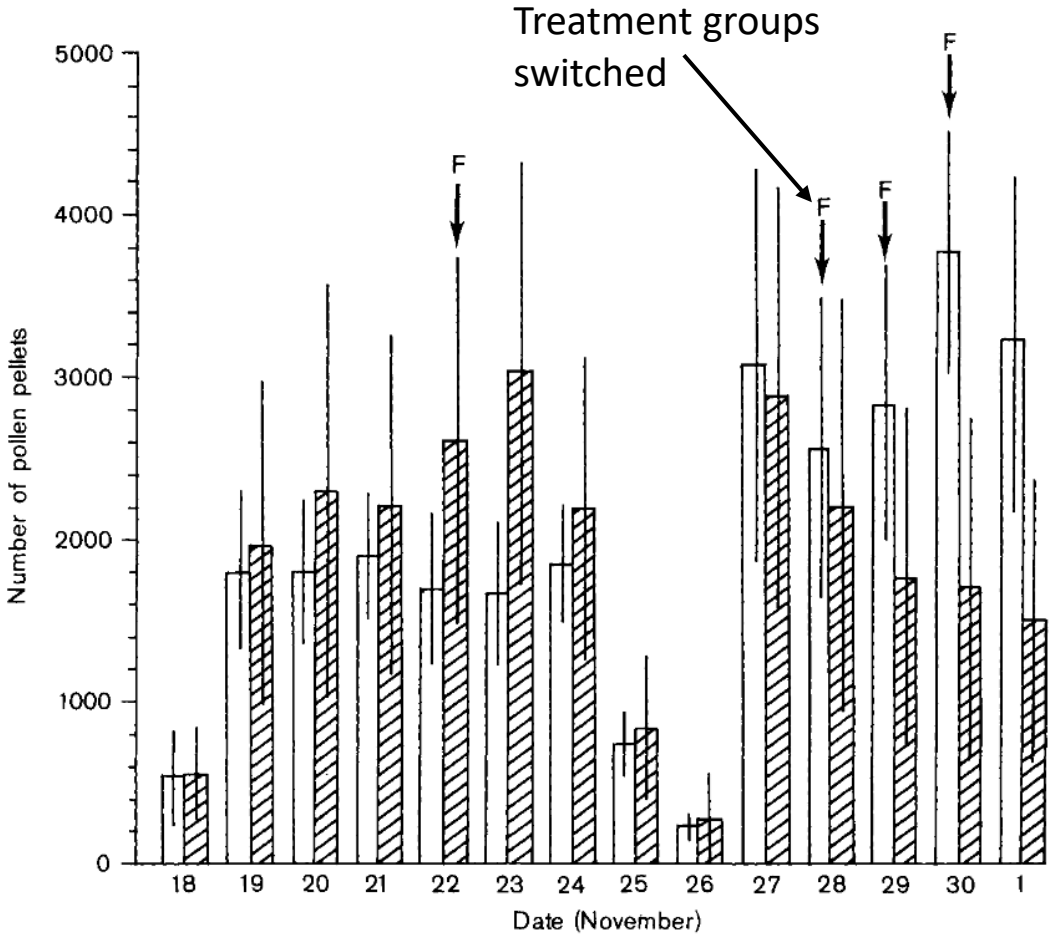


Fig. 2 Average number of pollen pellets other than kiwifruit trapped per day from control colonies and colonies fed pollen substitutes. The colonies were fed from the 14 until 27 November. The vertical lines represent SED values.

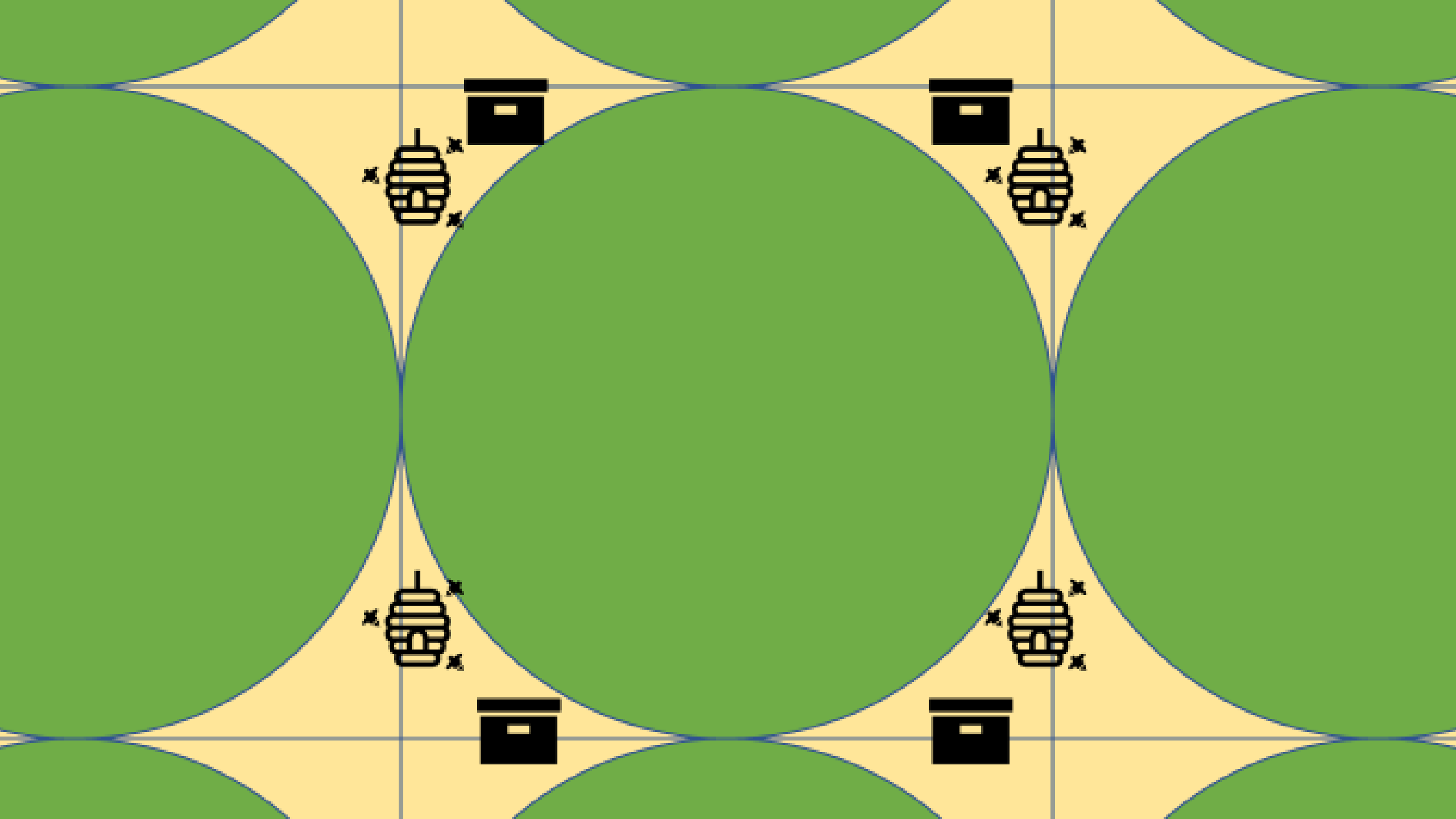
Goodwin et al., 1994

Feeding sugar syrup increase the collection of kiwi pollen.



Goodwin, 1986

Fig. 1 Histogram of the average number of kiwifruit pollen pellets collected each day (clear bars = group A: hatched bars = group B; vertical lines = 95% confidence intervals; F = days when the group indicated was fed).



Pollen testing

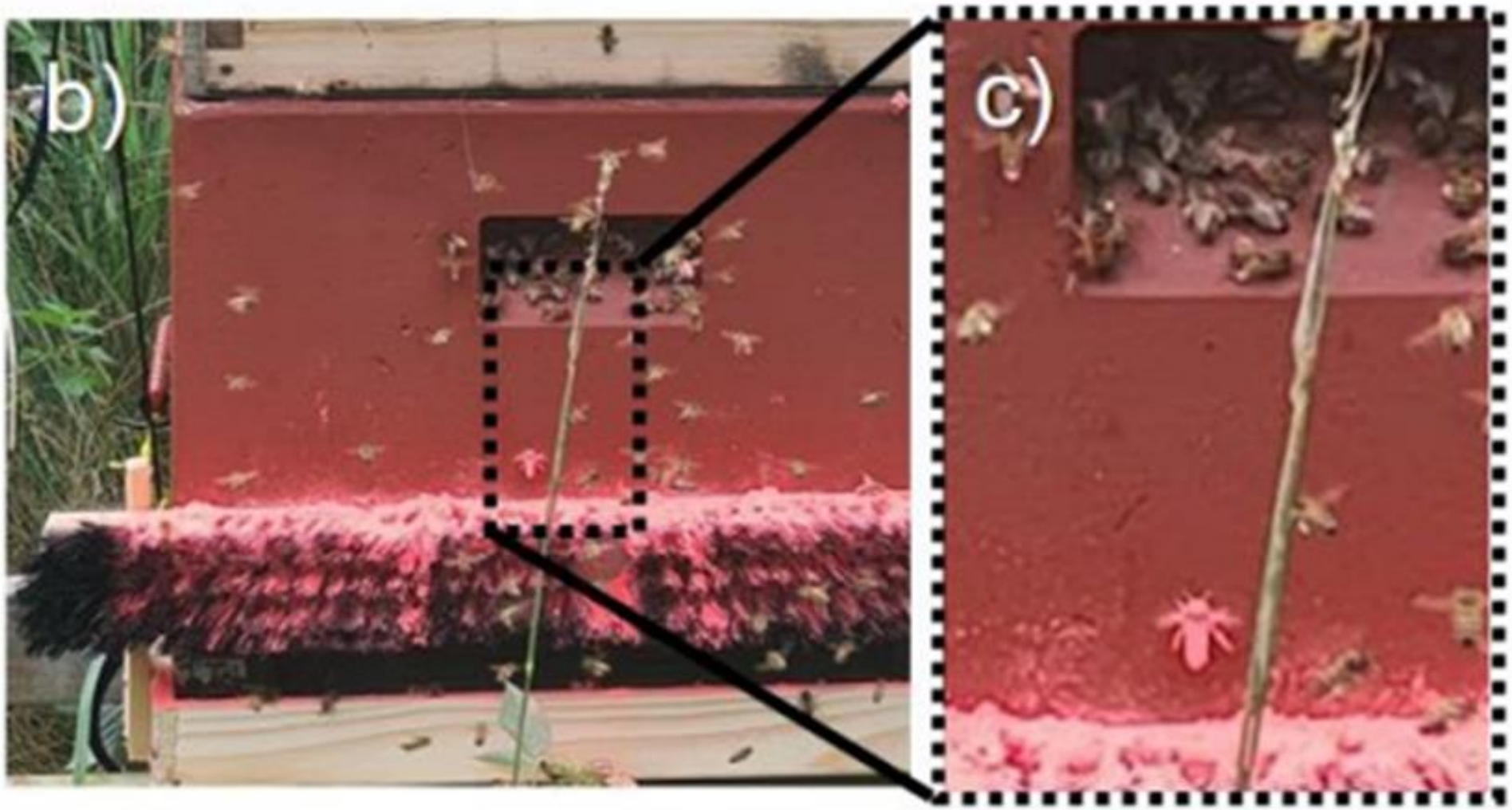
add nutrition label

Expected Outcomes

- Reduce honey bee foraging distance
- Keeping more bees on the field
- Improved seed purity

Summer 2022

Colored powders were removed too quickly.

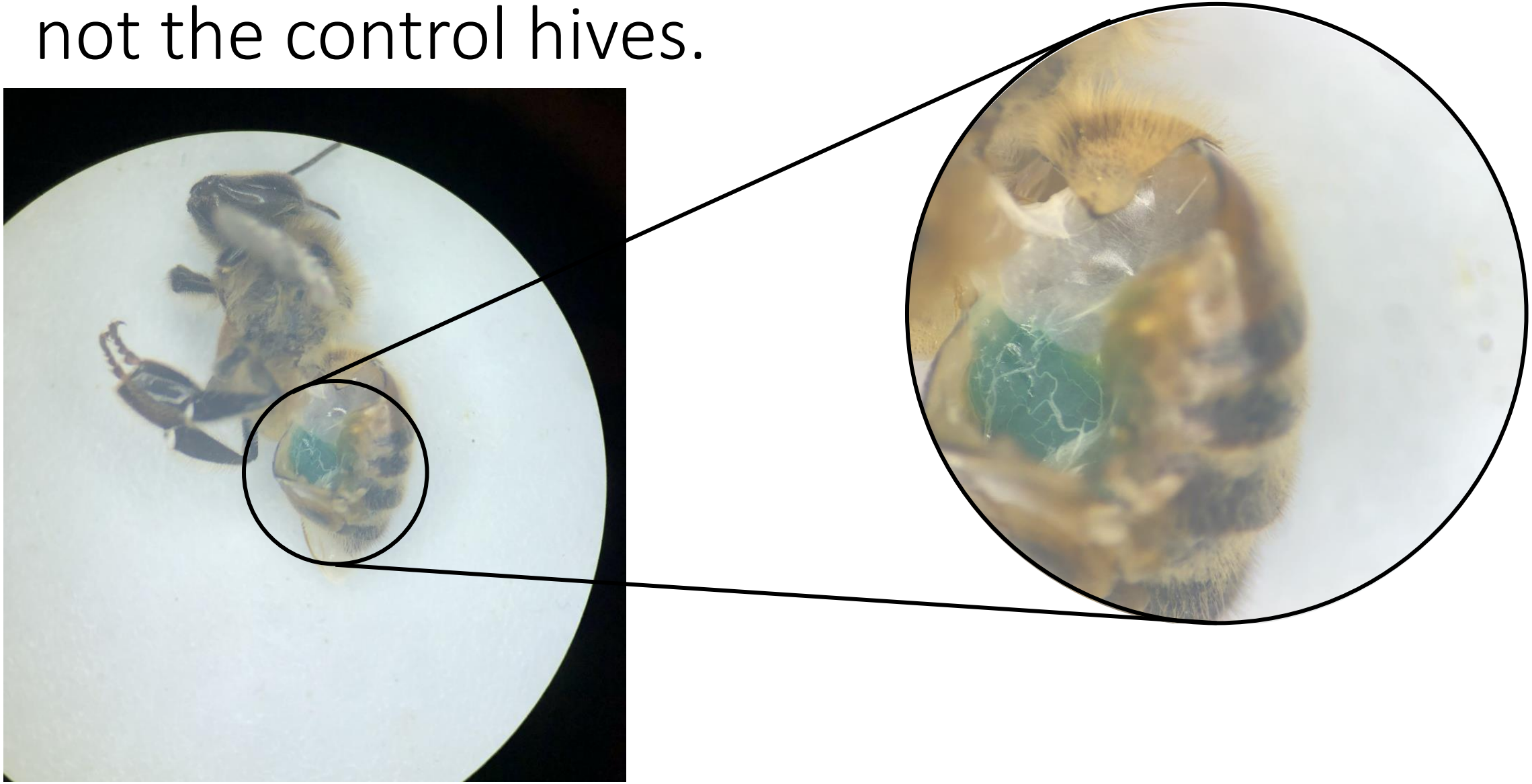


Månefjord et al. 2022

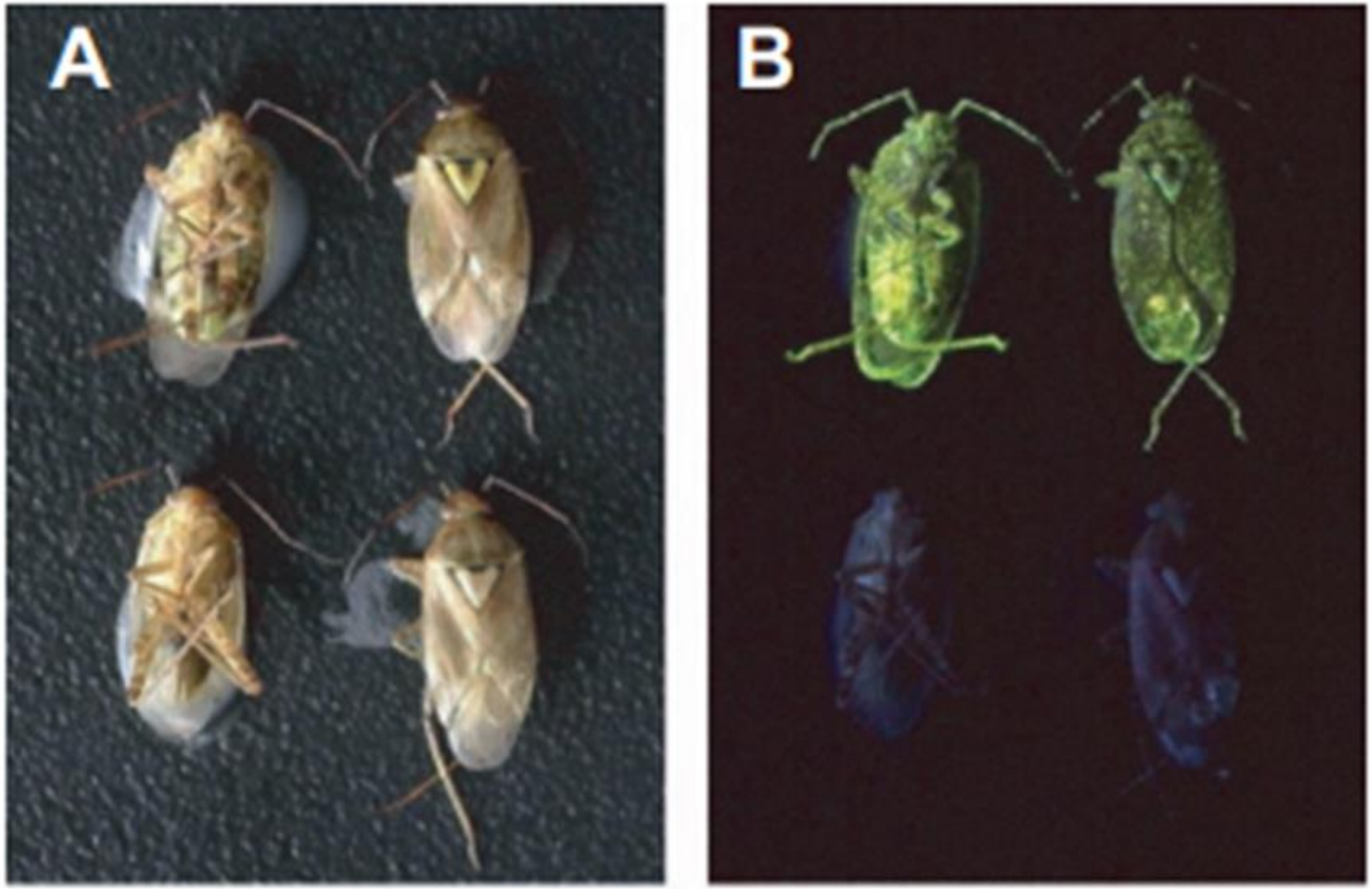
Hand painting requires to much time to mark a sufficient number of foragers.

Spray paint was either cleaned off or lethal to the bees.

Food coloring works for bees being fed but not the control hives.



Fluorophores have not been tested in honey bees but work very well in other insects.



Hagler et al., 2021

Going forward

- Test longevity of several fluorophores on honey bees
- Test impacts of supplemental feeding in other crops
  - Onion seed
  - Genetically modified canola

Summary

- Honey bees forage up to 6 miles, but only when needed
- Supplemental feeding can remove this need
- Bees are very difficult to reliably mark in large quantities

Hive weight

Traditionally growers have preferred the hives with the most frames of bees

=

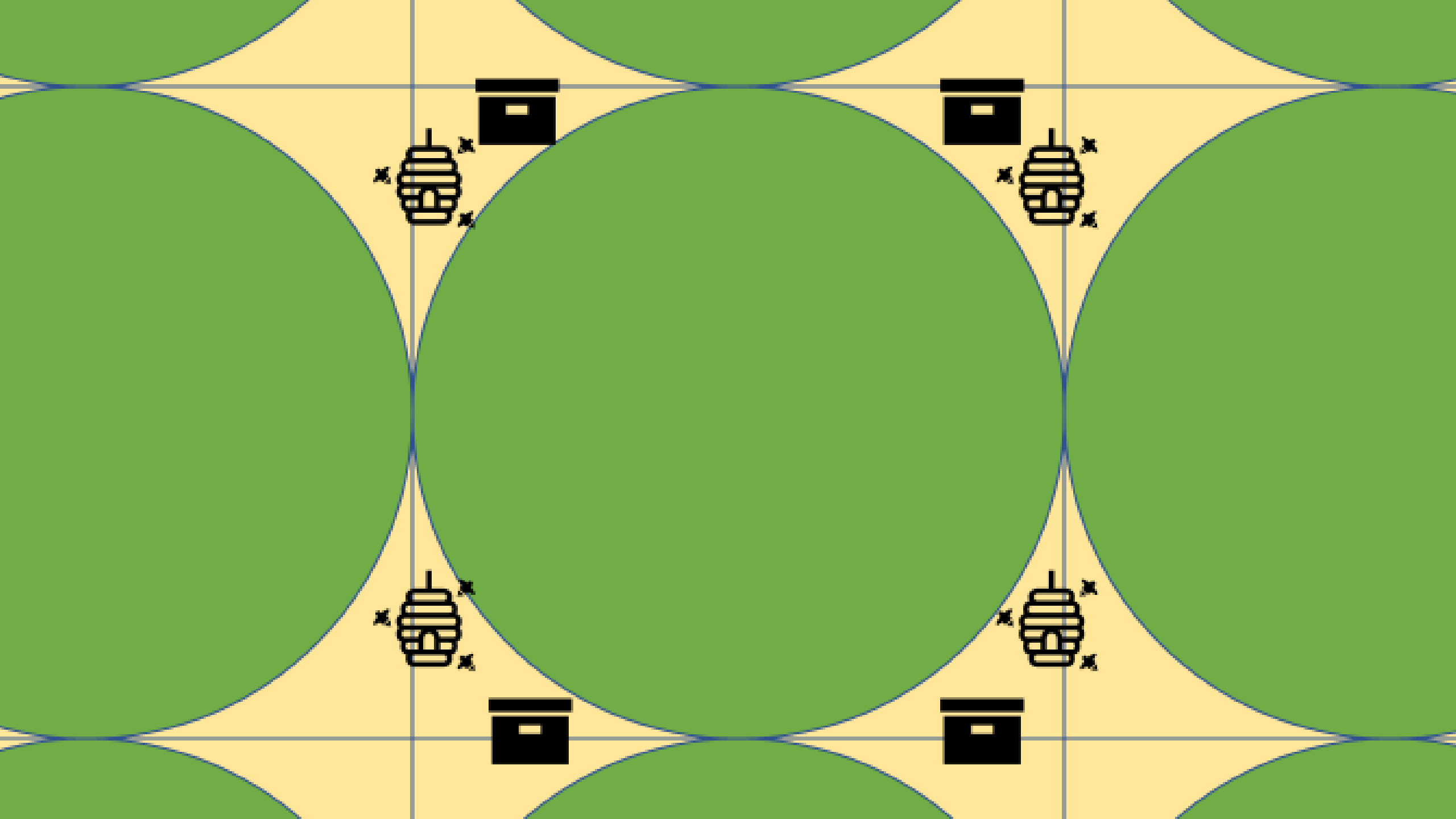
Image courtesy of popeye.com

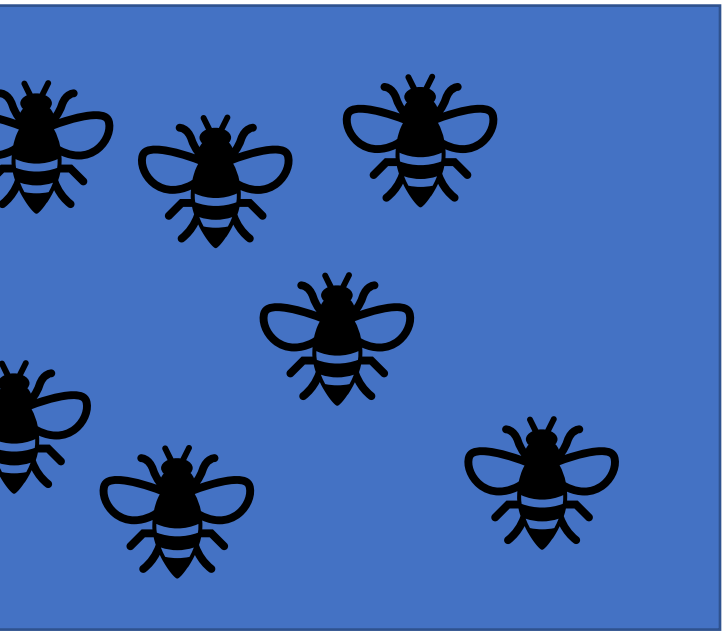
Behavioral studies show that colonies forage less under those conditions

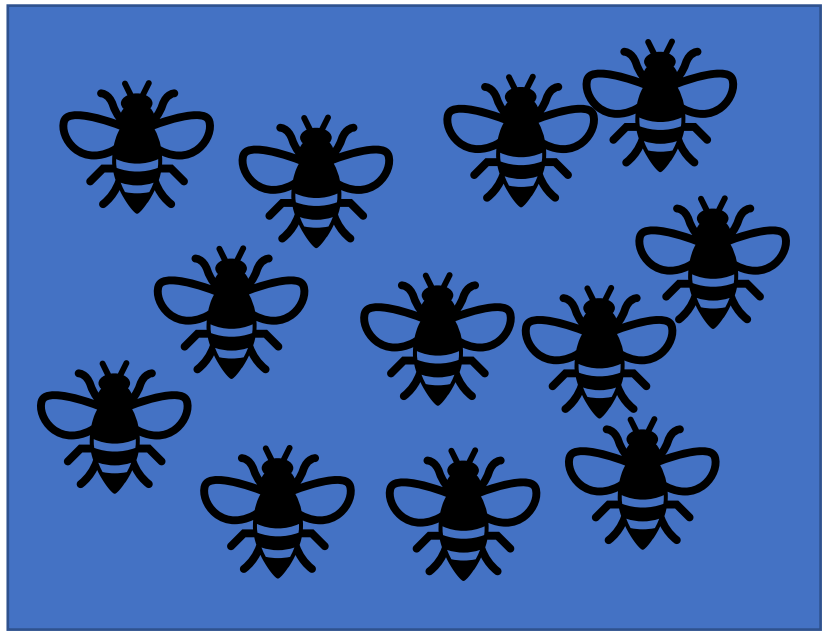
=

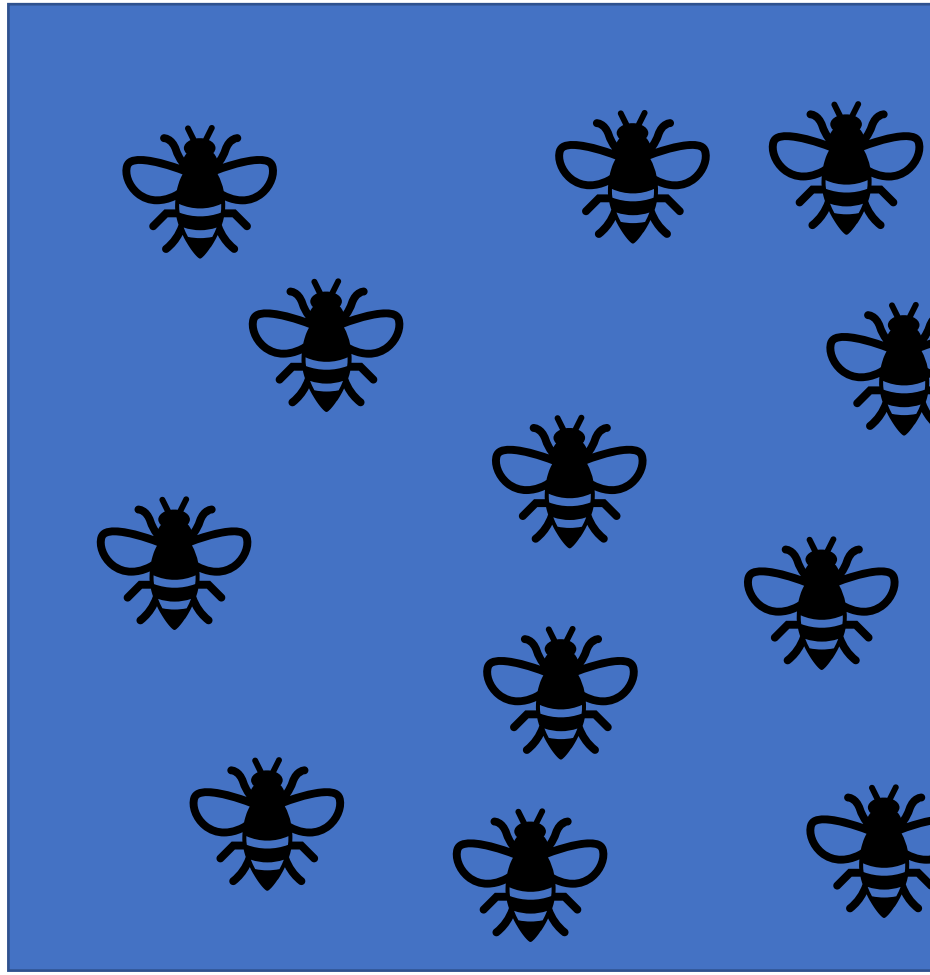
=

Photo by Lily Shui









Expected Outcomes

- Updated colony strength recommendations
- Changes to beekeeping practices including the timing of supering

Summary

- Honey bee foraging behavior decreases as available space in the hive is filled
- The strongest hives may not be the best pollinators
- Supering, splitting, or use of naturally lighter hives may improve pollination

Alternative pollinators

Why do we use honey bees?

Photo courtesy of Sharah Yaddaw and Project Apis m.

Other Pollinators

- Bumble bees
- Solitary bees
- Hover flies
- Blow flies
- Wild pollinators

Bumble bees work well in other crops but haven't really been tested in vegetable seed

Rottler Pest Solutions

Mader et al., 2010

Mader et al., 2010

Several different solitary bees have been used successfully in other crops, but there is little information on their use in vegetable seed

Photo courtesy of Donna Sanders

Photo courtesy of James Cane

Flies

Photo courtesy of Kathy Keatley Garvey

Photo courtesy of All Safe Pest and Termites

Photo courtesy of Territorial Seed Company

Wild pollinators

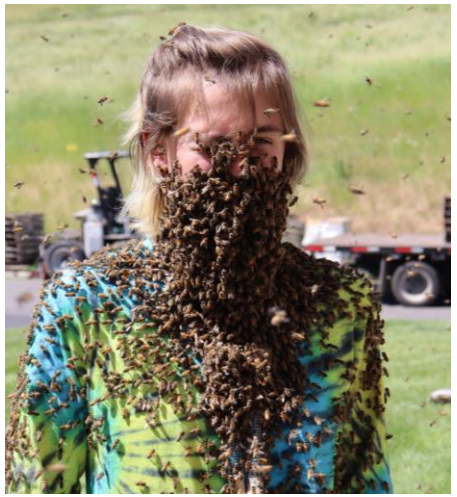
Photo courtesy of Sam Abell and National Geographic

Photo courtesy Omar de Kok-Mercado

In summary, honey bees work best for now, but some other pollinators show promise.

Photo courtesy of Sharah Yaddaw and Project Apis m.

Photo courtesy of Kathy Keatley Garvey



Thanks

bejo

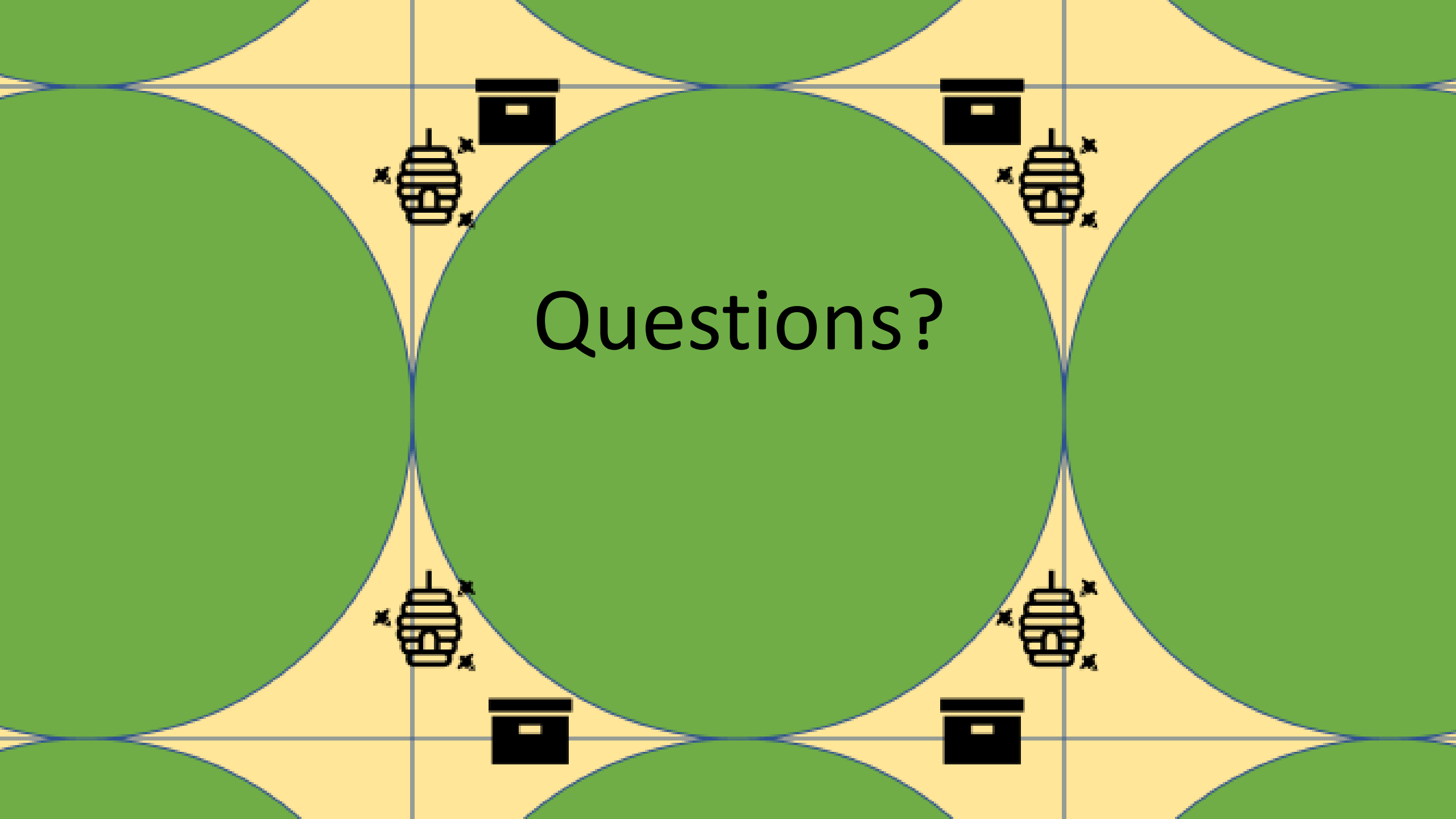
FFAR Fellows
Future Leaders for Food & Agriculture

FAR WEST
AGRIBUSINESS ASSOCIATION

Contacting me

- Riley.reed@wsu.edu
- Linkedin
- Feedback survey
- https://bugmanriley.com/

References


Questions?