Using Insect Habits for Pest Management

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Agenda and Purpose

We will walk through some methods for controlling pests naturally and even using their own behavior against them.

We will also cover our study through the North Central SARE and on-farm lessons learned.

I'll stop and answer questions throughout!

Who are we?

Healthy Hills Farm is a small urban/suburban homestead-style farm in Cincinnati, we sell primarily at a local farmer's market and in the community.

Mixed Crop Veggies
Goat Milk Soap
Pasture Raised Eggs
Nigerian Dwarf Goats

What was our study?

We studied how a theory on insect behavior could be used to help reduce the damage done by pests, in order to avoid using pesticides. We used pumpkins as our crop of choice to see what could be done. This was a one year study funded by SARE (Sustainable Agriculture Research and Education).

NORTH CENTRAL SARE
Sustainable Agriculture Research & Education

Appropriate/Inappropriate Landings Theory

It has been shown that fewer insects are found on plants growing in a diverse ecosystem than on plants in bare soil or a monocrop system…

However, the answer to why has been in debate.

This theory says that after receiving chemical cues to the area, they land indiscriminately on a green object, but not any other color, such as the brown soil.

https://warwick.ac.uk/fac/sci/lifesci/wcc/research/pests/companionplanting/biologist_jun03.pdf

Theory Explained

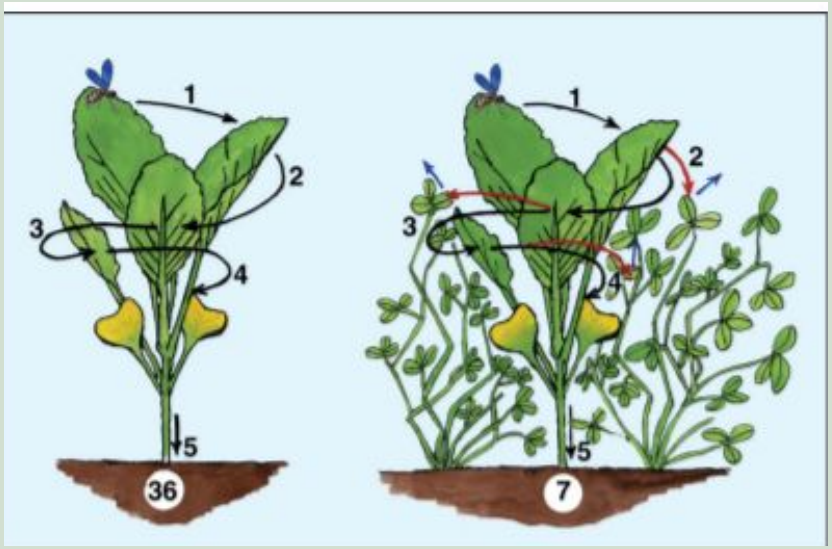
Host plant selection needs three things to happen:

1. Volatile chemicals released by the plant bring the insect to the area.
2. Insects find the visual stimuli of a green object, which could be a host plant, another plant, green paper, green plastic, ect.
3. The insect uses chemical receptors on its mouthparts and feet to confirm if where it has landed is the correct host plant to feed and/or lay eggs.

Step 3 - Confirmation

If the insect makes an appropriate landing, it then makes a series of short flights, from leaf to leaf.

All the landings in the series of short flights must be appropriate landings in order to lay eggs.



https://warwick.ac.uk/fac/sci/lifesci/wcc/research/pests/companionplanting/biologist_jun03.pdf

Effect of Interplanting

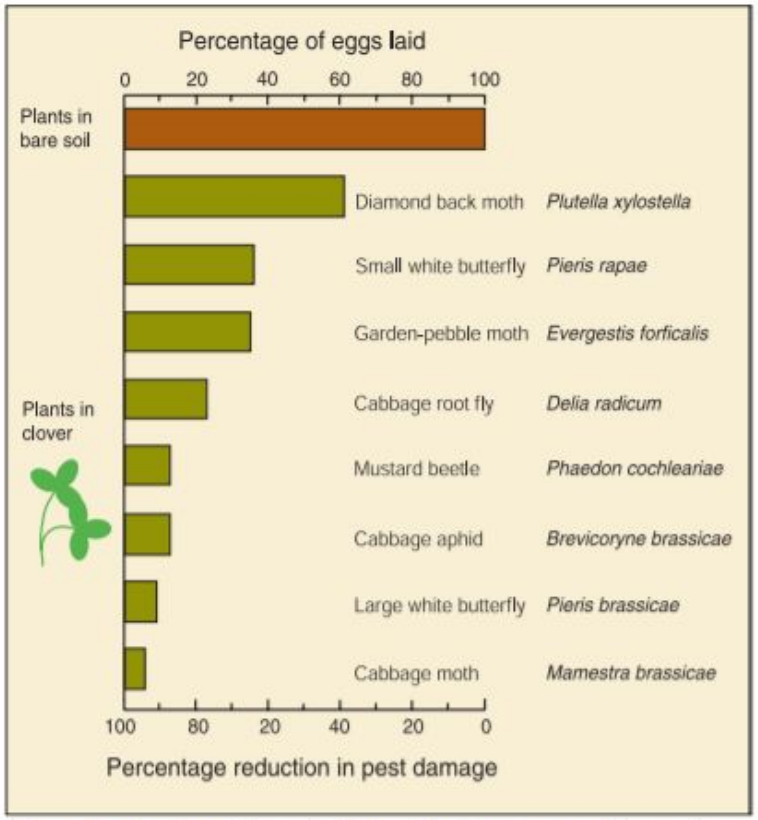


Figure 1. Numbers of eggs laid by eight insects on cabbage plants growing in clover (green columns) expressed as percentage of eggs laid on similar plants growing in bare soil (top brown column).

Practically then, plants in neat rows, or in bare soil, are easy for insects to land and re-land on.

Surrounded by other plants, some insects land on a non-host plant and fly off without damage or egg production.

https://warwick.ac.uk/fac/sci/lifesci/wcc/research/pests/companionplanting/biologist_jun03.pdf

How this could be used

If we are able to use this information to disrupt the egg cycle, we could lessen the damage from pests without using any chemicals or insecticides.

Of 24 plants tested in the Finch and Collier study, marigold, mint, onion, sage and thyme were no more disruptive than non-aromatic plants. This opens the door to match more regionally and seasonally appropriate plants to your crop.

Other insect tricking - Trap Cropping

Trap cropping purposefully attracts pests away from one crop to something that they would prefer. You are sacrificing the trap plant in order to save another.

https://ipm.missouri.edu/MEG/2017/3/Trap_cropping/2013-trap-cropping-4BH-end-of-rows.JPG

Pheromone Traps

Insects use pheromones to signal mates, warn others and find food. We can use this to trap them!

http://npic.orst.edu/ingred/ptype/pheromone.html

Color-based traps

Insects can also be attracted to specific colors and can be used to trap them.

Yellow is an attractive color for many insects.

Thrips are attracted to yellow and blue.

Horse flies are attracted to shiny black.

https://bughunter.tamu.edu/collection/colors/

Insect Specific Predators

Specific predatory insects can be brought in to consume targeted pests, but care should be made in the selection and quantity if purchased.

Native beneficial insects can be lured in naturally using certain plants.

Habitat host plants can attract predatory insects, such as dill for parasitic wasps.

https://www.nhm.ac.uk/content/dam/nhmwww/discover/parasitic-wasps/parasitic-wasps-full-width.jpg.thumb.1160.1160.jpg

Predatory Insect Examples

Cotesia Wasps - A predatory wasp that lays it eggs inside the tomato hornworm.

Ladybugs - Eats hundreds of aphids or mites each day.

Ground Beetles - Shiny black beetles that eat pests in in/on the soil such as slugs and cutworms.

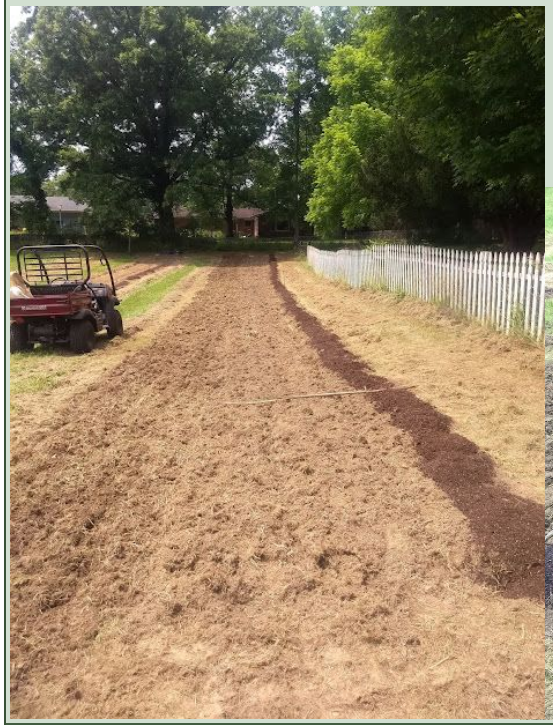
Green lacewings - The larva eats small, soft-bodied insects and the adult is actually a pollinator.

Our Project Results - 5/22

Around 140’ long

6/13

Planting Day



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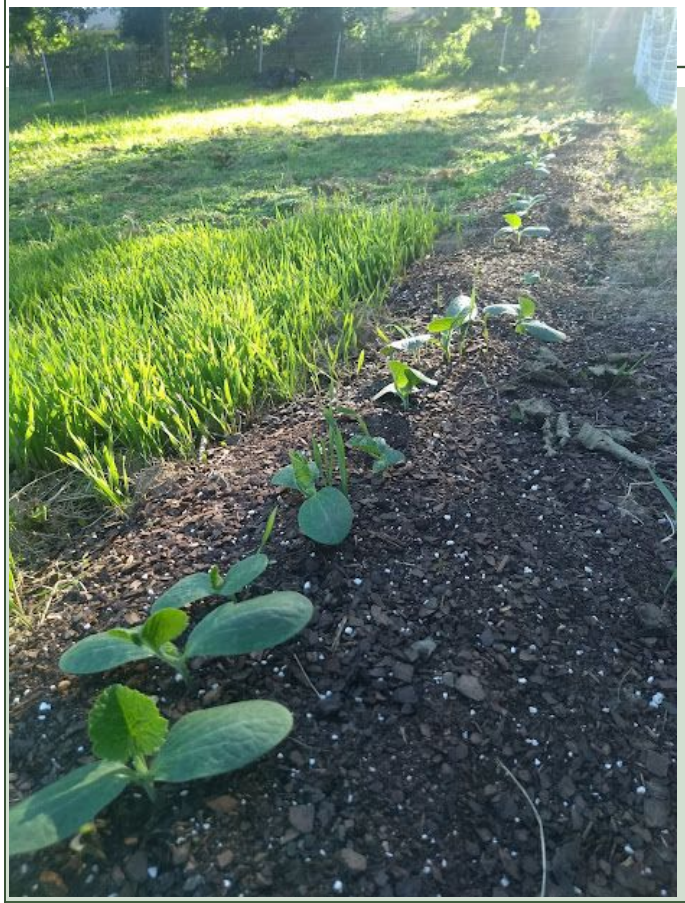

First true leaves emerging

Beginning to see pest damage

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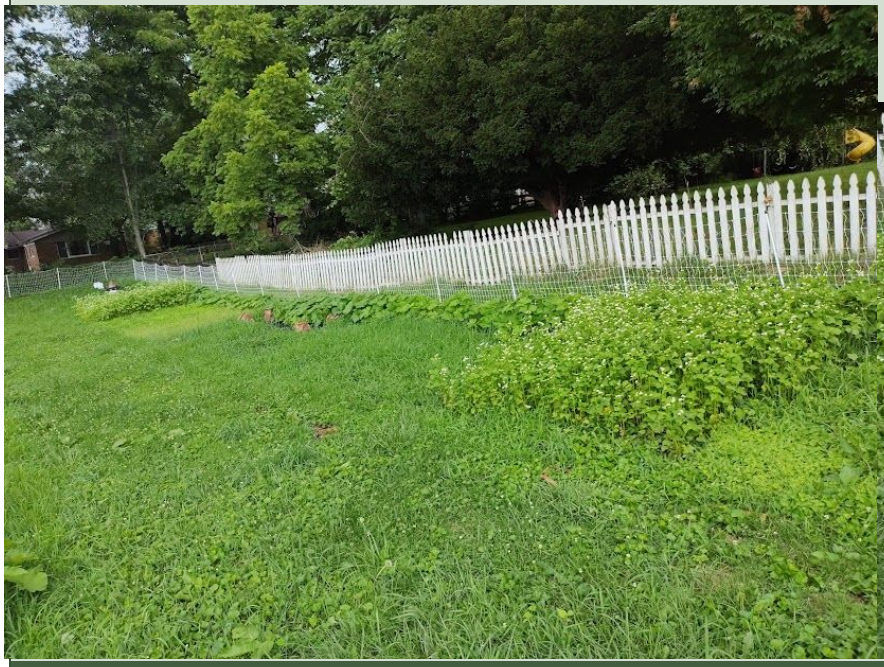

Squash Vine Borers…

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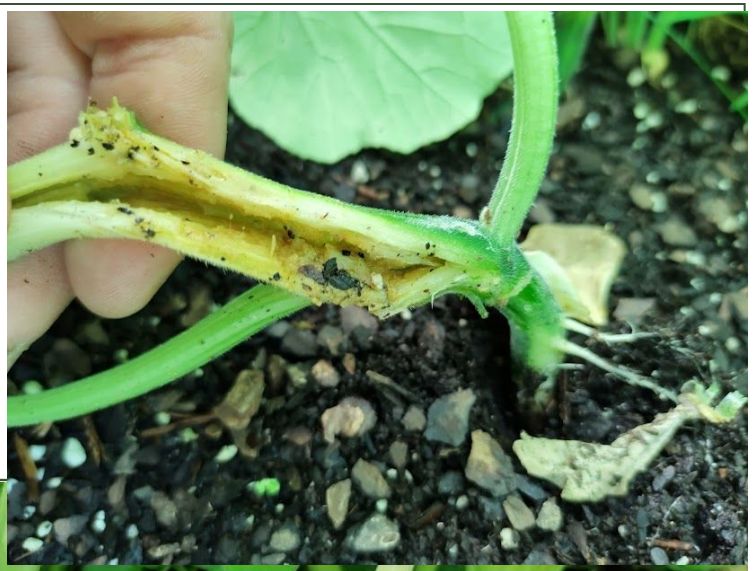

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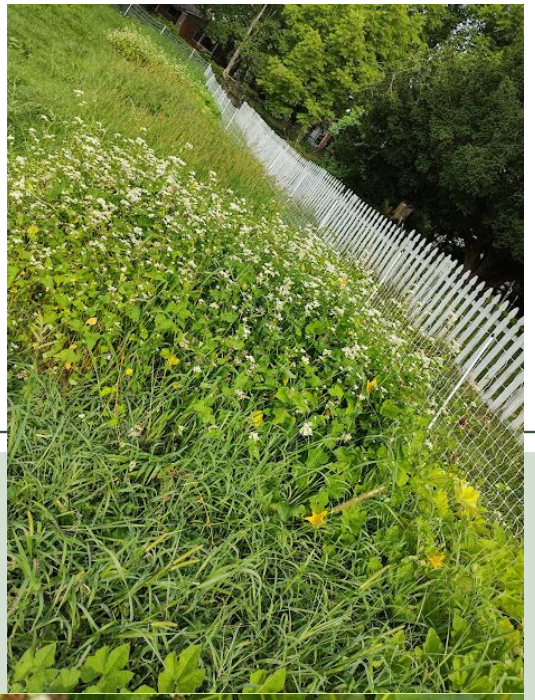
Squash Bugs start showing up in larger numbers.

More 8/7



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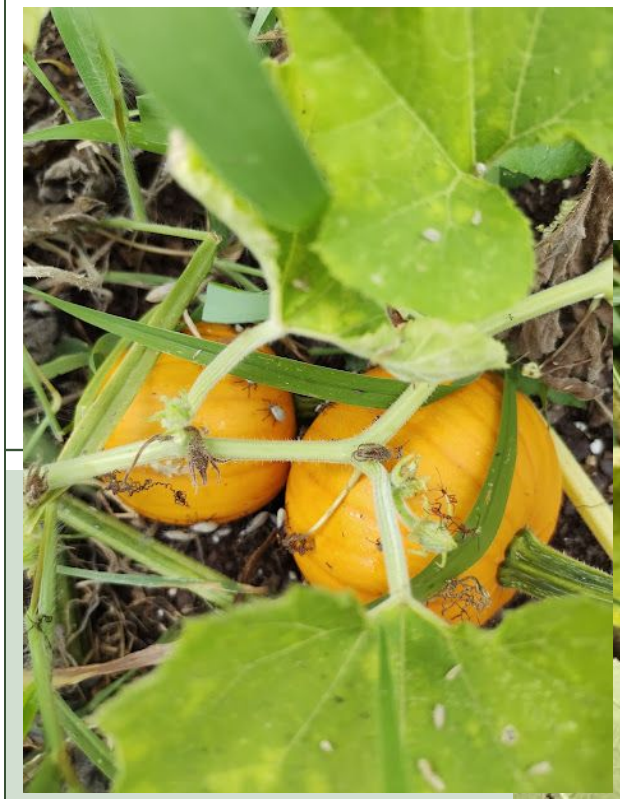
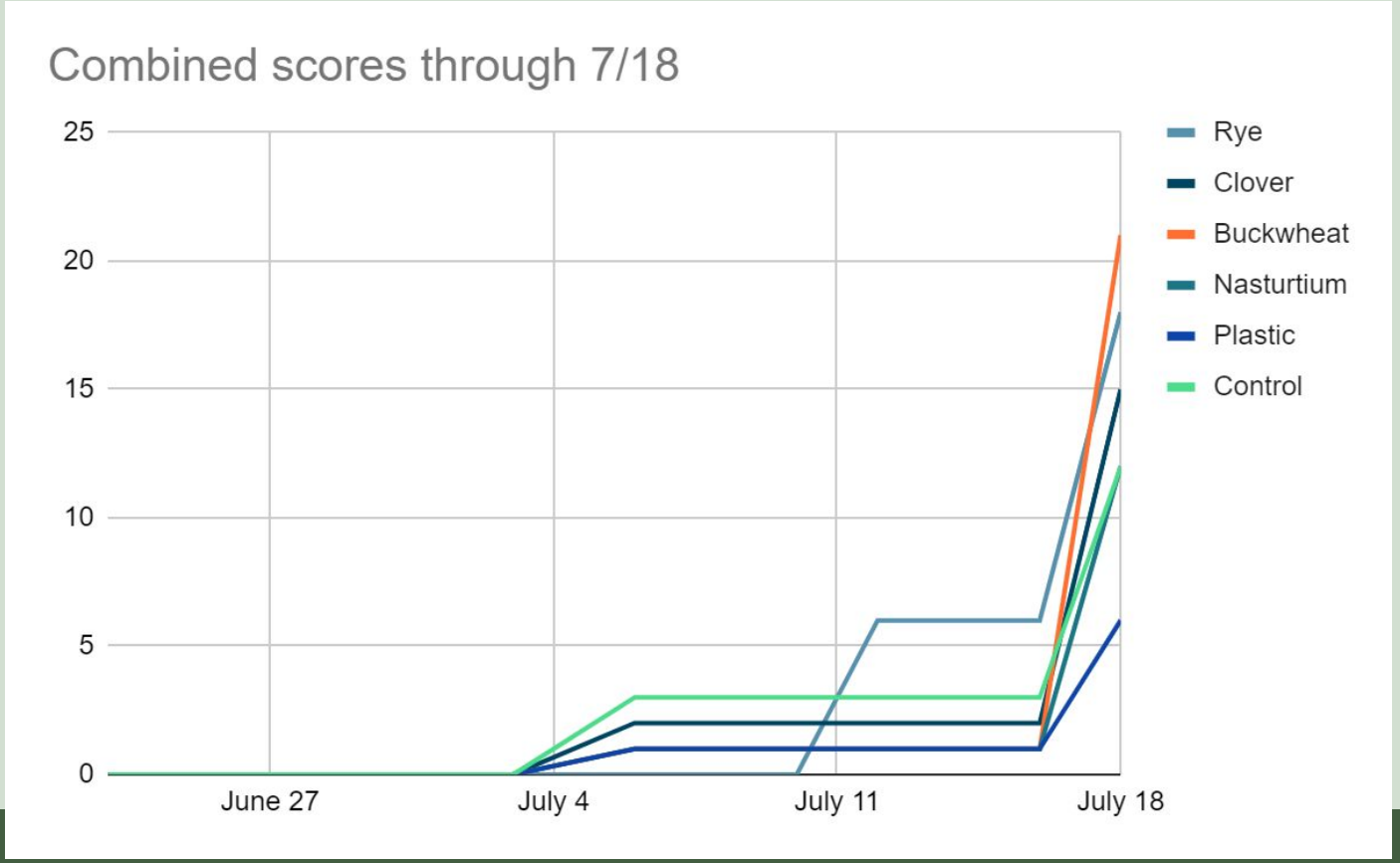


Our results ended up being able to be viewed in two parts…pre and post SVB.



August 7th

Post SVB arrival, we lost a fair amount of plants. We began to see the arrival of Squash Bugs and took notes of their damage and eggs.

Baby Bear - Rye	(3) 10+ leaves w/ eggs
Baby Bear - Clover	(3) 4 leaves w/ eggs
Baby Bear - Buckwheat	(0) 0 leaves w/ eggs
Baby Bear - Nast	(0) 0 leaves w/ eggs
Baby Bear - Plastic	(0) 0 leaves w/ eggs
Baby Bear - Control	(3) 2 SVB removed
Rival - Rye	(0) 0 leaves w/ eggs
Rival - Clover	(3) 3 SVB removed
Rival - Buckwheat	(3) 2 SVB removed
Rival - Nast	(2) 1 plant w/ md. SB damage
Rival - Plastic	(3) 2 SVB removed
Rival - Control	(3) 2 SVB removed

August 26th

Baby Bear - Rye	(3) 2 healthy vines all with bugs
Baby Bear - Clover	(3) Yellowing and damage, bugs on all plants
Baby Bear - Buckwheat	(0) 1 leaf damaged at edge, no bugs found
Baby Bear - Nast	(3)All plants dead
Baby Bear - Plastic	(2) Medium pest damage on all plants
Baby Bear - Control	(3) Heavy damage on all plants
Rival - Rye	(2-3) Medium to heavy damage on all plants
Rival - Clover	(3) Eggs found on 6 plants
Rival - Buckwheat	(1) 1 leaf w/insect damage, no bugs sighted
Rival - Nast	(3) All plants dead
Rival - Plastic	(3) Heavy pest damage on all plants, no bugs sighted
Rival - Control	(1) 1 plant with light damage

Final Observation

September 15th

Baby Bear - Rye	All plants dead
Baby Bear - Clover	All plants dead
Baby Bear - Buckwheat	1 alive
Baby Bear - Nast	All plants dead
Baby Bear - Plastic	1 alive
Baby Bear - Control	All plants dead
Rival - Rye	1 alive
Rival - Clover	3 alive
Rival - Buckwheat	5 alive
Rival - Nast	All plants dead
Rival - Plastic	1 alive
Rival - Control	1 alive

Conclusions

In our trials, Squash Vine Borers were not deterred by the presence of other foliage and heavily damaged many of the plants in July.

However, we did notice that Buckwheat was far more effective than any other companion crop at keeping Squash Bug numbers down.

Questions Remain

Why was the SVBs not deterred? Was it due to the foot traffic stomping down the foliage near the plant stem by us recording data?

Did buckwheat work well on SBs because of its rapid growth and size?

Would rye and the plastic have done better if they covered the tops of the leaves better?

Questions?

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References:

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https://bughunter.tamu.edu/collection/colors/#:~:text=Shallow%20trays%2C%20generally%20painted%20yellow,insects%20such%20as%20winged%20aphids.