

Managing Pests
with Ecological Farm Design

Hensley's SEED CO. DENVER · COLORADO

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PRESENTED BY THE HENSLEY’S TEAM

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Original Research Farm

Trial site in USDA zone 5b

205 acres, across 10 locations

- 31.6 miles of beds
- 20 acres in breeding nurseries
- 7.5 acres in commercial seed production
- 13.8 acres in trialing
- 40+ acres in cover crops
- 19 greenhouses
- Approx 25 Staff

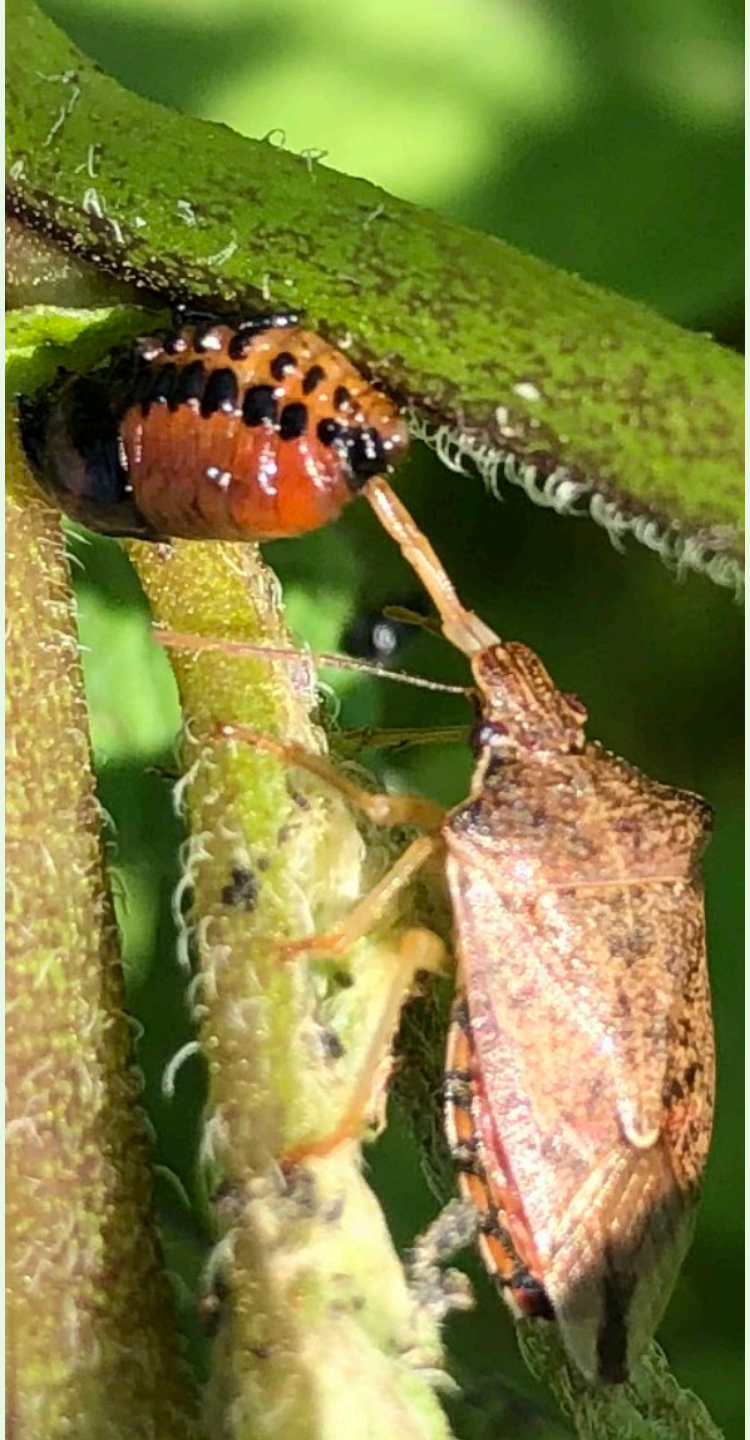




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Beneficials

WHAT?
WHY?
HOW?





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What are Beneficials?

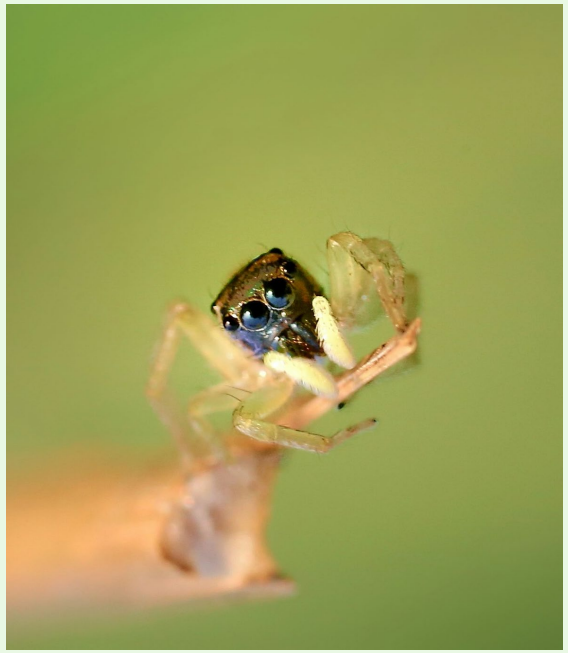
In an agricultural environment, a beneficial organism has a positive impact on the growing process.

Includes:
Insects, arachnids, other animals, plants, bacteria, fungi, viruses, and nematodes.

- Some can be applied as “biopesticides”
- Many are local and are ready to help!

Benefits:
pest control, pollination, and maintenance of soil health.









Source: Maine.gov



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Common Beneficials Found in Maine

Invertebrates



Ladybugs



Big Eyed Bugs



Spined Solider Bugs



Assassin Bugs



Minute Pirate Bugs



Carabid Beetles



Solider Beetles



Hoverflies



Green Lacewings



Predatory Wasps



Spiders

(And Parasitoids)



Parasitic Flies



Parasitic Wasps



Parasitic nematodes

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And Vertebrates!



Source: flapest.org





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Why Use Beneficials?

At the original source, Beneficial Organisms make our operation more sustainable and control more effective.

- Environment
- Economics
- Worker Quality of Life



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How?

Integrated Pest Management (IPM)

"An ecosystem-based strategy that focuses on **prevention of pests or their damage** through a combination of techniques.

"Such as: biological control, habitat manipulation, modification of cultural practices, & use of resistance varieties."
- USDA-NISIC

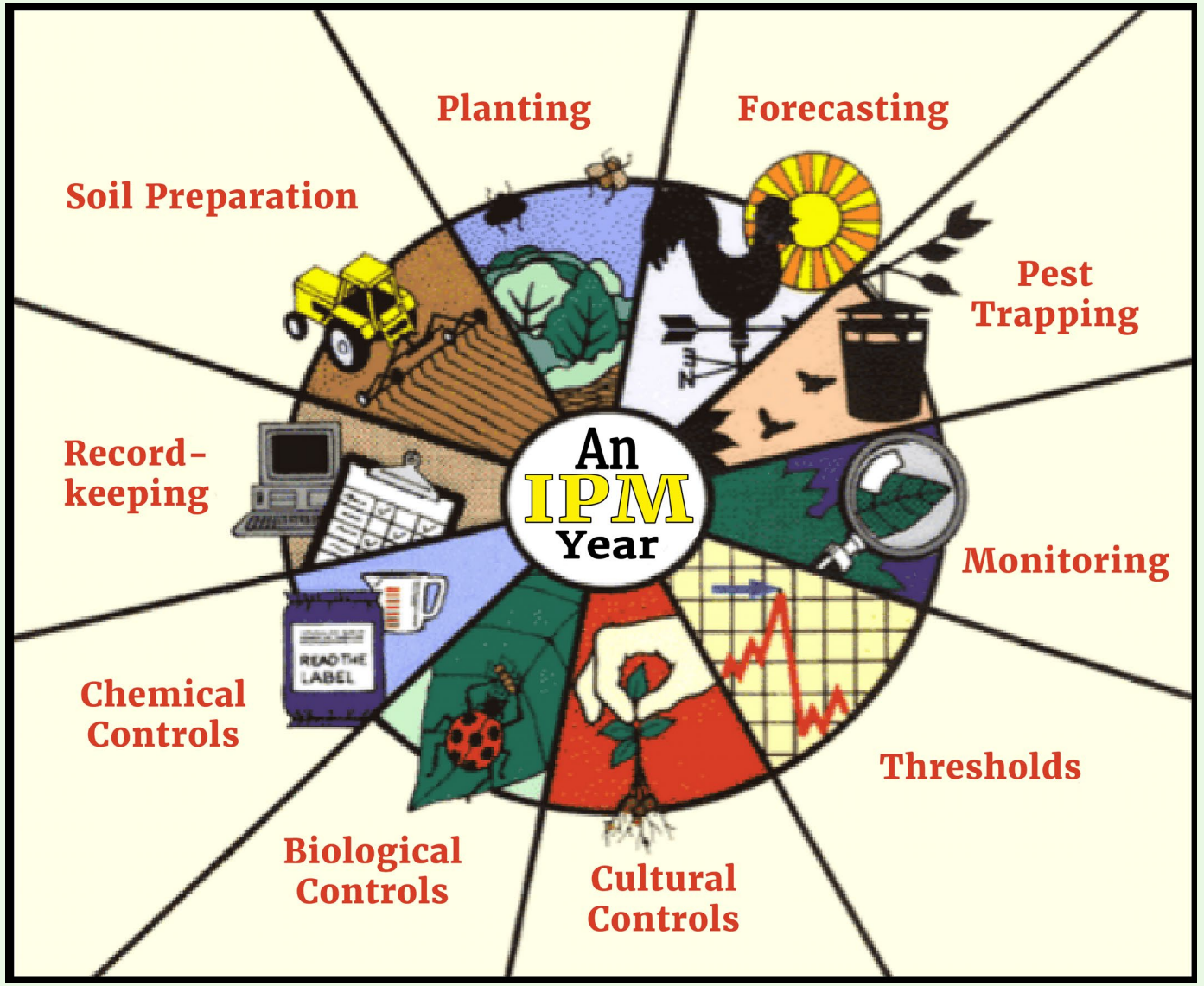


Image source: Nault Lab, Cornell University.

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How?

Biological Controls—Living Insecticides!

Two ways to apply these ‘insecticides’:

1. **Introduce Beneficials**
   Raise and/or release
2. **Ecological Farm Design**
   Modifying habitat to make your farm more attractive to natural enemies.
   - Shelter
   - Food



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How?

Farmscaping

Modification Methods

1. **Augmentation of Beneficial Habitat**
   - Insectary Plants
2. **Reduction of Pest Habitat**
   - Repellent Plants
   - Cultural Factors
3. **Trapcropping**

(*continued on next slide*)



Source: https://thelifeofyourtime.files.wordpress

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How?

Trapcropping

Planting strategy that pulls pests away from cash crops by exploiting their feeding preferences.





Source: extension.umd.edu

Table 1. Ranking of cucurbits by cucumber beetle feeding preference

(Jarvis, 1994)

Higher ranking numbers indicate more preferred varieties by cucumber beetles. Rankings: 1 to 14 means not preferred, greater than 45 means highly preferred.

Summer squash		Winter squash	
Variety	**Ranking**	**Variety**	**Ranking**
Yellow		*Acorn*	
Sunbar	1	Table Ace	6
Slender Gold	2	Carnival	7
Early Prolific Staightneck	20	Table King (bush)	12
Goldie Hybrid	32	Tay Belle (bush)	14
Sundance	33	*Butternut*	
Straightneck		Zenith	13
Seneca Prolific	4	Butternut Supreme	16
Goldbar	5	Early Butternut	25
Multipik	37	Waltham	28
Crookneck		*Buttercup*	
Yellow Crookneck	8	Honey Delight	43

Source: https://attra.ncat.org/

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2023 the original source

Farmscape Plan

Goal:

Enhance pest control in the squash breeding nursery.

Key Questions:

1. What crops do we want to protect?
2. What are key pests attacking these crops?
3. What do we want to attract?
4. How do we attract them?





Source: ipmimages.org

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Farmscape Planning Process

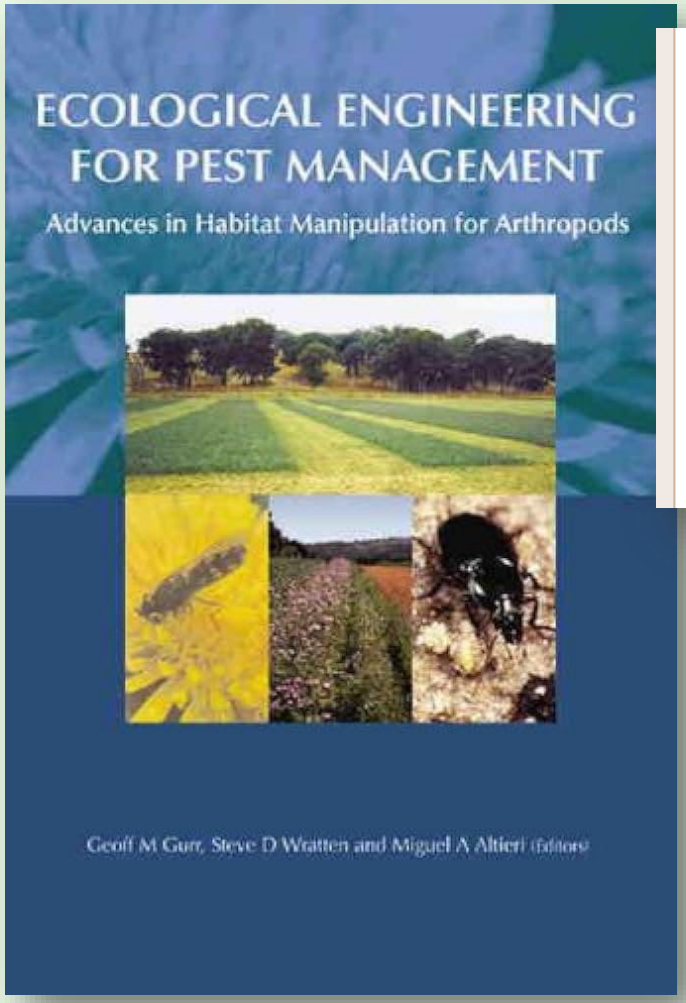
Starting Small—Known Problems—Cucurbit Breeding Nursery

- Cucumber beetle, squash bug, & green peach aphid infestations.
- Pathogen issues: Bacterial wilt and insect vectored viruses.
- Heavy pesticide use with occasional seed crop failure in one instance of chemical phytotoxicity—relied on cultural and chemical strategies.



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Suggested Research Sources





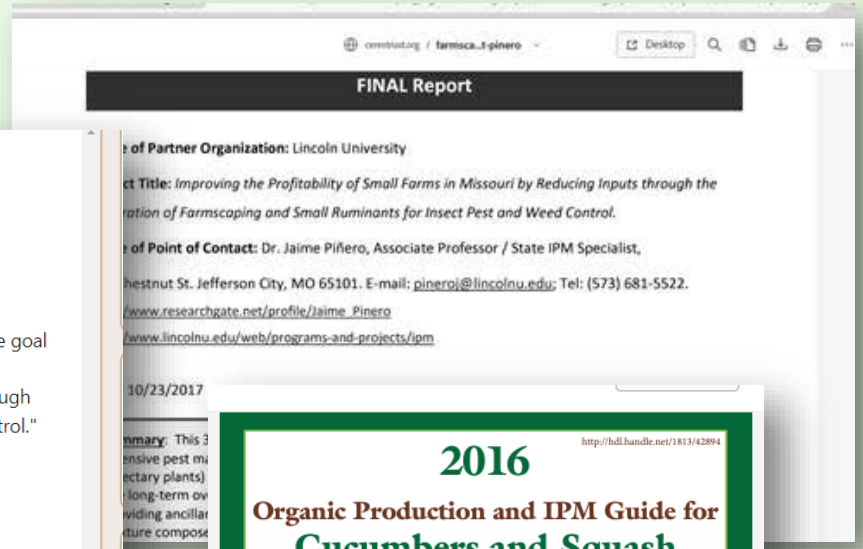
Farmscaping: Making Use of Nature's Pest Management Services

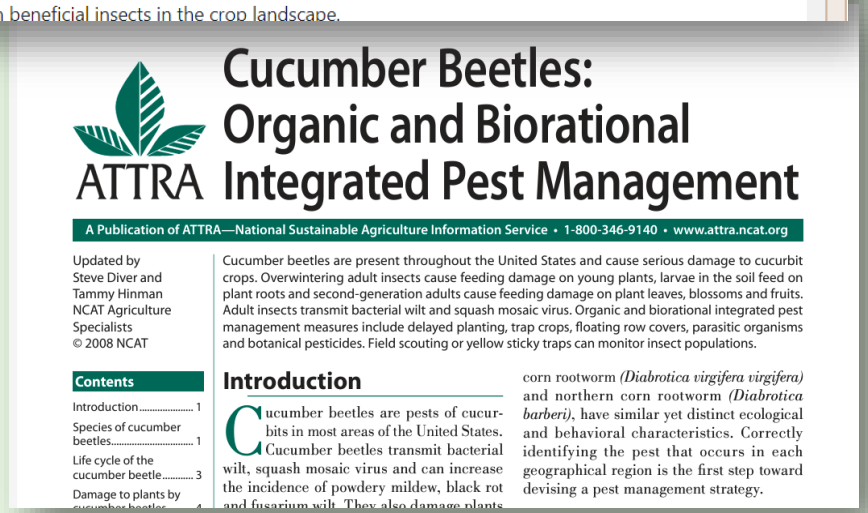
eOrganic author: Geoff Zehnder, Clemson University

Farmscaping is a whole-farm, ecological approach to increase and manage biodiversity with the goal of increasing the presence of beneficial organisms. Many pest populations can be managed by enhancing the efficacy and local abundance of the existing community of natural enemies through modification of the environment, a concept that has been termed "conservation biological control."

Farmscaping methods include the use of insectary plants, hedgerows, cover crops, and water reservoirs to attract and support populations of beneficial organisms such as insects, spiders, amphibians, reptiles, bats, and birds that parasitize or prey upon insect pests.

Insectary plants like mustards interplanted with market crops provide pollen and nectar to attract and maintain beneficial insects in the crop landscape.





Cucumber Beetles: Organic and Biorational Integrated Pest Management

ATTRA

A Publication of ATTRA—National Sustainable Agriculture Information Service • 1-800-346-9140 • www.attra.ncat.org

Updated by
Steve Diver and
Tammy Hinman
NCAT Agriculture
Specialists
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Cucumber beetles are present throughout the United States and cause serious damage to cucurbit crops. Overwintering adult insects cause feeding damage on young plants, larvae in the soil feed on plant roots and second-generation adults cause feeding damage on plant leaves, blossoms and fruits. Adult insects transmit bacterial wilt and squash mosaic virus. Organic and biorational integrated pest management measures include delayed planting, trap crops, floating row covers, parasitic organisms and botanical pesticides. Field scouting or yellow sticky traps can monitor insect populations.

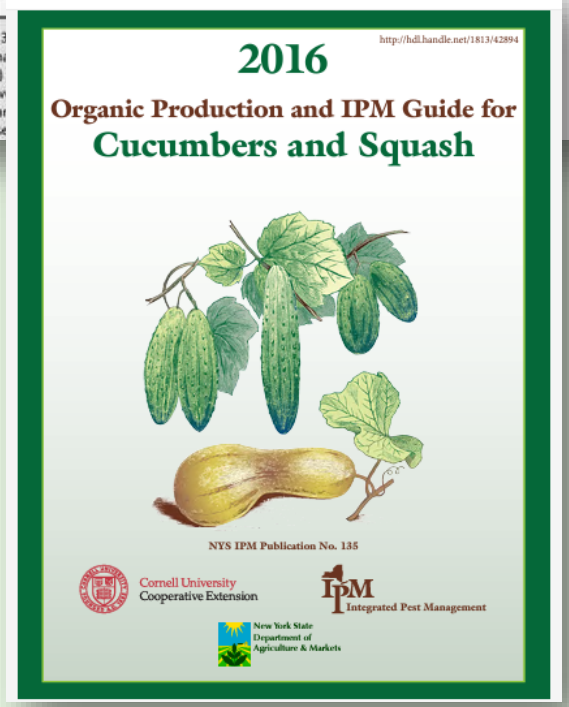
Contents

Introduction 1
Species of cucumber beetles 1
Life cycle of the cucumber beetle 3
Damage to plants by

Introduction

Cucumber beetles are pests of cucurbits in most areas of the United States. Cucumber beetles transmit bacterial wilt, squash mosaic virus and can increase the incidence of powdery mildew, black rot and fusarium wilt. They also damage plants

corn rootworm *(Diabrotica virgifera virgifera)* and northern corn rootworm *(Diabrotica barberi)*, have similar yet distinct ecological and behavioral characteristics. Correctly identifying the pest that occurs in each geographical region is the first step toward devising a pest management strategy.



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Original-source IPM Plan

Cultural, Mechanical, & Biological

1. **Field Culture:**
   - Black plastic beds, with 6ft wide mulched skip lanes.
   - Summer Squash: highest risk crop relocated to “cage farm” = no exposure to in-field risks.
2. **Sowed Beneficial Insectary Crop** (“bug blend”)
3. **Planted Perimeter Trap Crop**
   (Dark Green Zucchini & Blue Hubbard Squash):
   - Repellent plants planted between cash & trap crop.
4. **Physical Barriers**
   - Row cover on cash crop until flowering (continued practice).



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Original-source Blend Insectary Mix Components


Oats

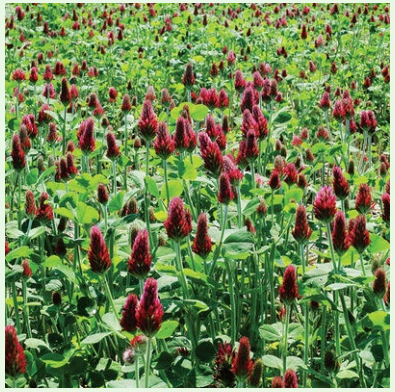

Buckwheat


Phacelia


Alyssum


Dill


Cilantro


Crimson Clover


Medium Red Clover

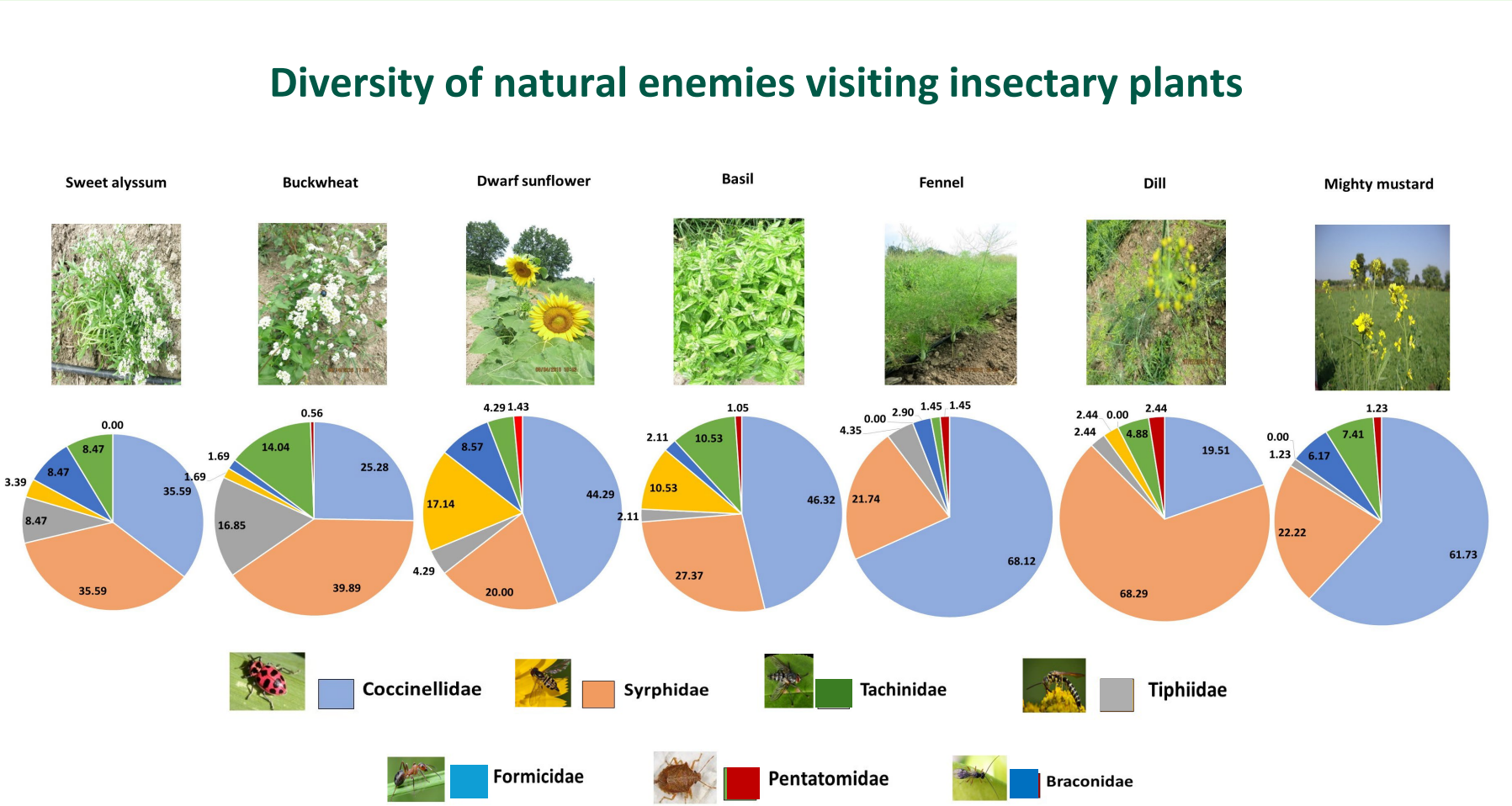

Berseem Clover


Ammi

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Original-source Blend Insectary Mix Components

- Spiders
- Solider Beetles
- Ground Beetles
- Ladybird Beetles
- Rover Beetles
- Minute Pirate Bug (Orius)
- Big Eyed Bug
- Hoverflies
- Braconid Wasps
- Tachinid Flies (esp. Trichopoda pennipes)
- Gryon pennslyvanicum (squash bug egg parasitoid)

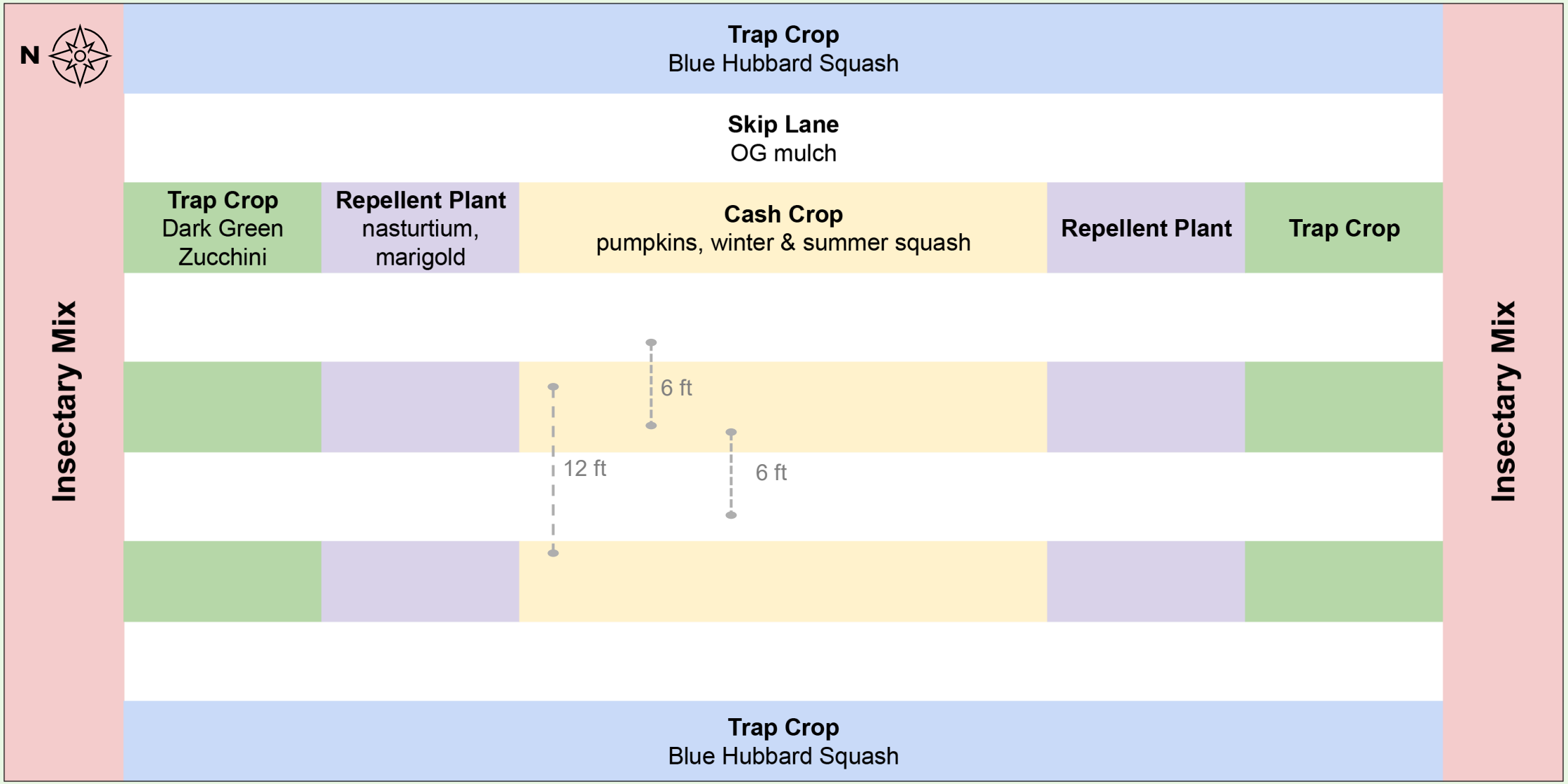


Source: cerestrust.org

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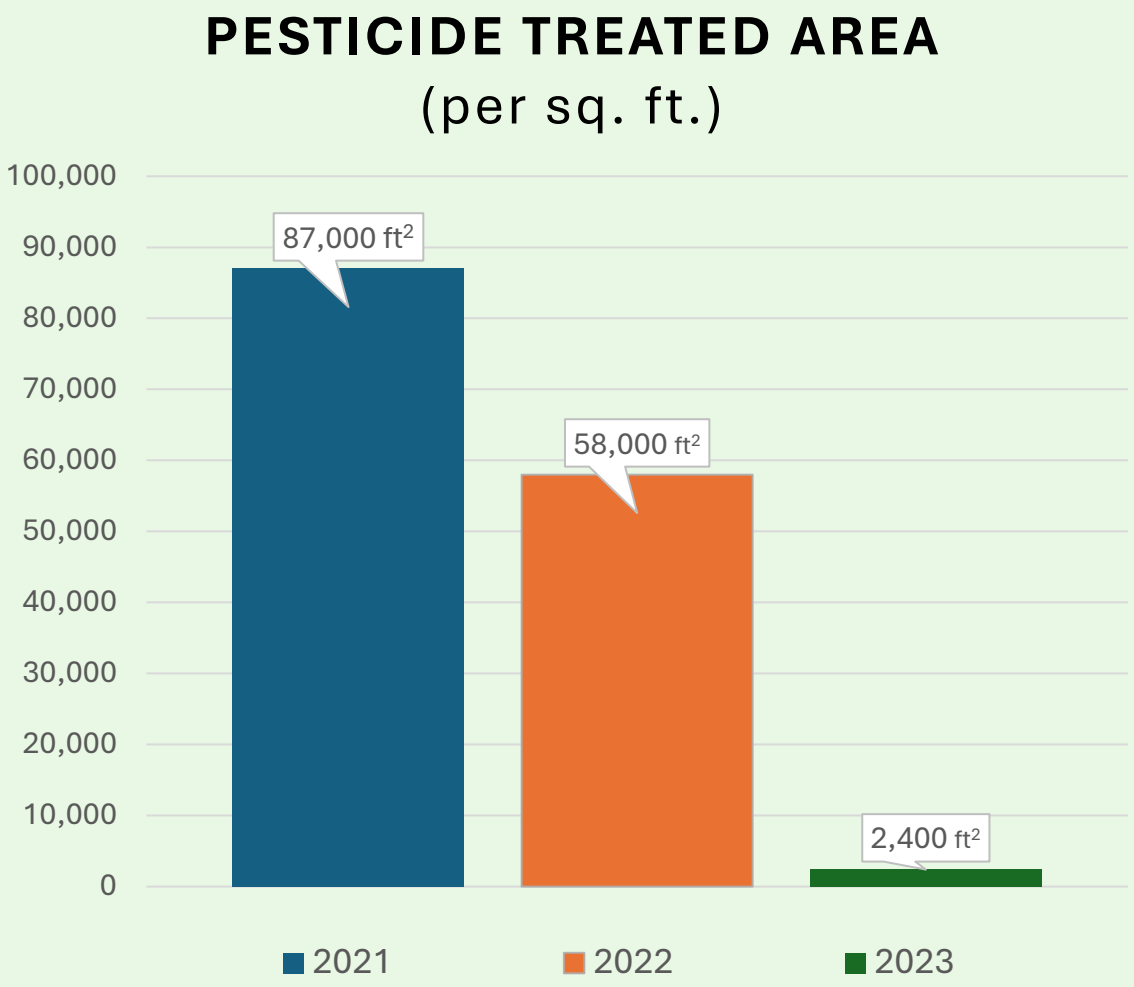
Original-source Farmscape Plan

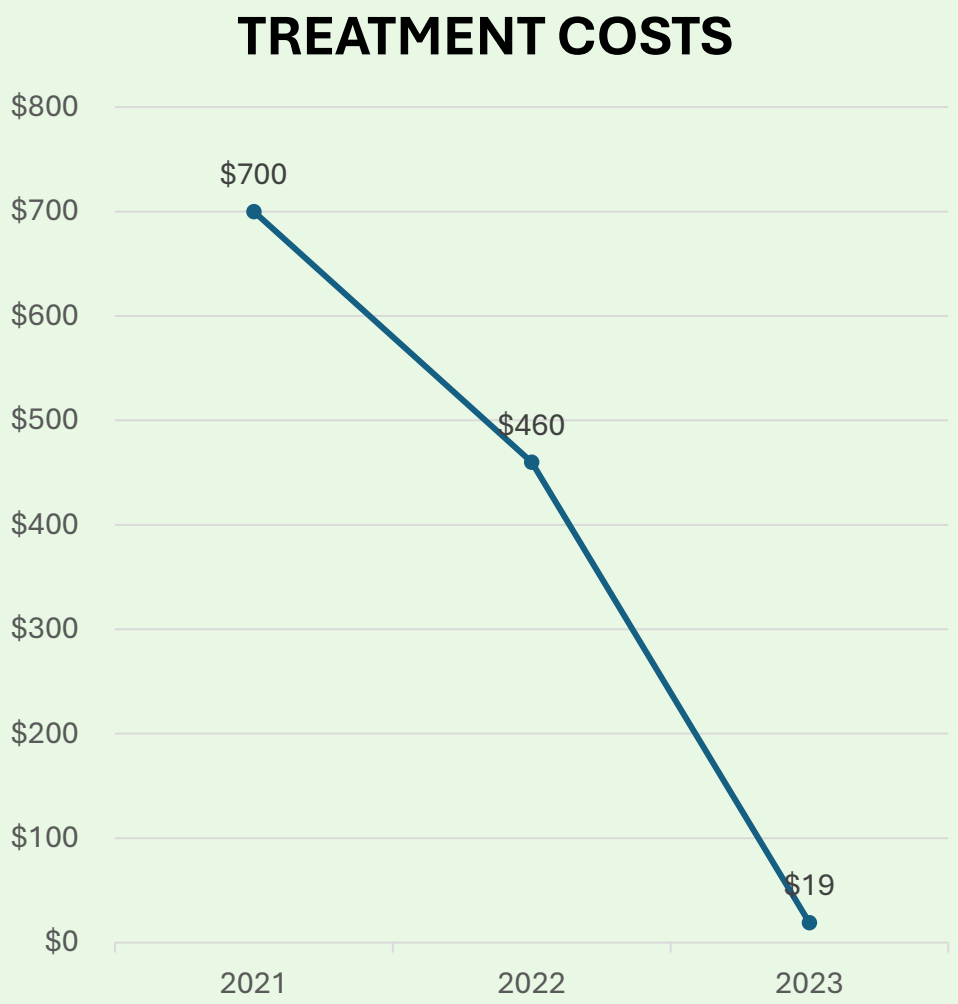
Note: NOT TO SCALE!



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Results





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Results

Beneficial insect populations:

- HUGE hoverfly population.
- Very large ladybeetle populations of various types.
- Large number of minute pirate bug.
- Evidence of parasitized squash bugs (tachinid fly).
- Probably more undetected results—looking forward to future comparisons



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Lessons

- **Being random in plant selection sometimes doesn’t help.**
  - “Chocolate Box Ecology” - Quality, not quantity.
- **Learn & understand the characteristics of the plants you’re using.**
  - Will your floral resources be available to your target beneficials at the right time?
  - Will your trap crop be attractive enough?
  - How does incorporation of these plants affect your land prep?
  - Does the species mix make sense?



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Lessons

- **Learn & understand characteristics of the beneficials you're targeting.**
  - Know dispersal capabilities. Can one planting help the whole farm, or do you need to keep things close?
- **Keep good records!**
- **Be intentional about scouting beneficials**—monitoring is very important, especially for comparison



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The original seed company Farm/Greenhouse Crew 2023

Beneficial Insects

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Using Natural Biologicals For Insect Control:

IN THE GREENHOUSE

ADVANTAGES:

- Not having to spray harmful chemicals.
- No chemical resistance
- Totally natural
- No REI, better use of labor dollars
- Safer for employees
- Great marketing tool!



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Banker Plant:

Growing a plant as a food source for a pest (e.g., aphids) that will in turn feed a beneficial insect in the absence of pests within the cash crop

Indicator Plant:

Using a plant that is known to be susceptible to certain pests so that you can monitor this plant and know when the pest is present. They can also help pull out the pest from your cash crop. Some field crop farmers use this as a trap crop. Blue hubbard squash is sometimes planted on the field edges to catch squash bugs.



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Source: David Cappaert, Bugwood.org

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Sweet Alyssum is a great pollen source for many beneficial insects!

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Source: Phil Sloderbeck,
Kansas State University, Bugwood.org

Bush Beans Used As Indicator Plants

Green beans are a great host for spider mites. They will be drawn “away” from tomatoes in a greenhouse and cans be used for indicator plants (i.e, plants that help you tell when you have a pest present).

I use three or four plants in a house and keep replanting to keep fresh stock available.



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Green Beans As Banker Plants

After the Spider Mites gain in numbers, (as seen in the indicator stage) I can then order the predatory mite P. Persimilis, and even if spider mites are not available on the crop of Tomatoes, the mites will have a food source from the beans and be happy.

Happy bugs will stay and reproduce and give me more “free” good bugs to keep the tomatoes cleaner

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Barley Banker Plants



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A Lacewing Larva Attacks an Aphid

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On the Hunt:

A Praying Mantis



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Frames for the pollination cages on our Research Farm

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Screen Covers on the Frames



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Bumble Bee Hives

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Flysolation Tent System

Using this system allows us to have several types of plants in the same greenhouses without cross-pollination.



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Blue Bottle Flies



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Remember:

Keep	Keep good records
Scout	Scout regularly
Buy	Buy from a reputable source, check the viability upon arrival.

Thank You!



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RESOURCES

- Farmscaping and beneficial insects
- Farmscaping and beneficial insects
- Top 10 Uses for Cover Crops & Farm Seed
- ATTRA Trapcropping Resources
- UMASS Amherst Scouting Resources
- MSU Extension PDF: Commercially Available Biological Control Agents for Greenhouse Insect and Mite Pests
- Growing resources
- Original-source Grower's Library
- About Our Seeds

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Thank You

We hope you enjoyed our presentation

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