

# *Increasing profits through the use of trap cropping to manage key insect pests of cucurbits*



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# LUCE Integrated Pest Management Program

- Aim: to **develop** and **promote** affordable alternative pest management strategies to combat insect pests of vegetable crops
- Emphasis is being made to provide small, under-represented, low-income farmers with **research-based information** on effective and environment-friendly IPM tactics
- Our long-term goal is that Missouri's farmers increase the level of awareness and adoption of IPM components leading to **increased profits** while **decreasing inputs including pesticide use**

# Managing Squash Bugs and Cucumber Beetles

- 1) Do nothing and hope for the best
- 2) Spray insecticides every week to cash crop
- 3) Sequentially plant cash crops, harvest whatever you can

**EARLY-SEASON  
CONTROL IS KEY**

- Host plant resistance
- Crop rotation
- Soil quality management
- Sanitation
- **Trap cropping**
- Farmscaping/habitat manipulation
- Cover crops
- Use of mulches
- Intercropping
- Alter planting/harvest dates



# Trap Crops

- Most insects show a preference for particular plants
- **Trap Crops:** Plants that are planted next to a higher value crop so as to attract pest as either a food source or oviposition site
- **Trap crops** can attract pests to the border areas, where can they be killed. Pest numbers on the unsprayed cash crop can be reduced



Aggregations of spotted cucumber beetles on young Blue Hubbard squash (trap crop)





Insecticide Free Zone!

Kill the  
pest on  
trap  
crops



# Profit, what's that?

Data Items	2012	2011	2010	2009	2008	2007
CUCUMBERS, FRESH MARKET - ACRES HARVESTED	45,700	41,100	44,200	46,550	46,880	50,960
CUCUMBERS, FRESH MARKET - ACRES PLANTED	47,330	43,750	46,000	49,500	49,120	54,320
CUCUMBERS, FRESH MARKET - PRICE RECEIVED, MEASURED IN \$ / CWT		26.6	22.8	25.6	24.8	24.6
CUCUMBERS, FRESH MARKET - PRODUCTION, MEASURED IN \$	247,957,000	199,353,000	191,752,000	239,131,000	219,073,000	238,925,000
CUCUMBERS, FRESH MARKET - PRODUCTION, MEASURED IN CWT	9,984,000	7,395,000	8,385,000	9,359,000	8,843,000	9,700,000
CUCUMBERS, FRESH MARKET - YIELD, MEASURED IN CWT / ACRE	218	180	190	201	189	190

Data Items	2012	2011	2010	2009	2008	2007
MELONS, CANTALOUPE, FRESH MARKET - ACRES HARVESTED	64,050	71,050	74,730	74,730	71,730	73,820
MELONS, CANTALOUPE, FRESH MARKET - ACRES PLANTED	66,350	72,690	77,430	76,060	73,530	75,930
MELONS, CANTALOUPE, FRESH MARKET - PRICE RECEIVED, MEASURED IN \$ / CWT		18.6	16.7	18.2	18.5	14.8
MELONS, CANTALOUPE, FRESH MARKET - PRODUCTION, MEASURED IN \$	325,337,000	350,208,000	319,176,000	350,392,000	356,781,000	302,485,000
MELONS, CANTALOUPE, FRESH MARKET - PRODUCTION, MEASURED IN CWT	16,952,000	18,870,000	19,228,000	19,279,000	19,294,000	20,426,000
MELONS, CANTALOUPE, FRESH MARKET - YIELD, MEASURED IN CWT / ACRE	265	266	257	258	269	277

<http://www.nass.usda.gov/>

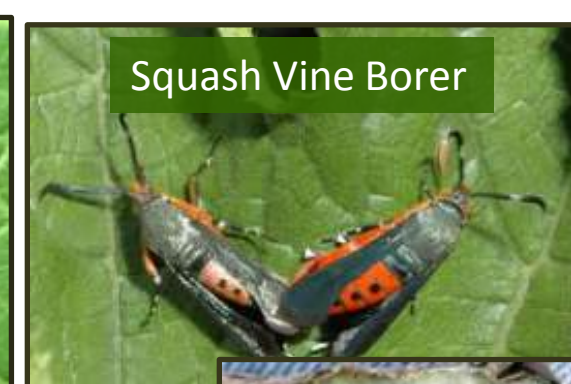
1. Decrease pesticide use and costs
2. Beneficial insects can reproduce in trap crop plants
3. Improve crop's quality
4. Help conserve the soil and environment



# Blue Hubbard squash: An excellent trap crop



Very attractive to adult cucumber beetles  
Not susceptible to bacterial wilt





# One Example

- In Massachusetts, 6 butternut growers planted a **Blue Hubbard** border around fields that ranged in size from 2 to 6 acres. These 6 fields were compared to conventional butternut fields where beetles were controlled with full-field insecticide sprays
- Fields were scouted twice weekly until first leaves, then weekly until flowering. **Borders were sprayed at the first arrival of the beetles**
- Cucumber beetles were only found in the trap crop and insecticides were only applied to the perimeter trap crop.



Two-row perimeter of Blue Hubbard squash around a main crop of butternut squash.

Picture: Univ. of Massachusetts

**90% less insecticide was applied**

# Using Trap Crops for Control of *Acalymma vittatum* (Coleoptera: Chrysomelidae) Reduces Insecticide Use in Butternut Squash

A. CAVANAGH,<sup>1,2</sup> R. HAZZARD,<sup>1</sup> L. S. ADLER,<sup>3</sup> AND J. BOUCHER<sup>4</sup>

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J. Econ. Entomol. 102(3): 1101–1107 (2009)

- Use of Blue Hubbard as a trap crop reduced insecticide use by 94% compared to insecticides applied to the entire field
- Surveyed growers who participated in the experiments and found a high level of satisfaction with the effectiveness and simplicity of the system

# Comparison of Perimeter Trap Crop Varieties: Effects on Herbivory, Pollination, and Yield in Butternut Squash

L. S. ADLER<sup>1</sup> AND R. V. HAZZARD

Department of Plant, Soil, and Insect Science, University of Massachusetts, Amherst MA 01003

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Environ. Entomol. 38(1): 207–215 (2009)

- Excellent performance of Blue Hubbard squash (cash crop was not sprayed)
- Yield in PTC plots was 12.5% higher in plots surrounded by Blue Hubbard, **lowest yield was in sprayed plots**

# Buttercup Squash Provides a Marketable Alternative to Blue Hubbard as a Trap Crop for Control of Striped Cucumber Beetles (Coleoptera: Chrysomelidae)

ANDREW F. CAVANAGH,<sup>1</sup> LYNN S. ADLER,<sup>2,3</sup> AND RUTH V. HAZZARD<sup>1</sup>

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Environ. Entomol. 39(6): 1953–1960 (2010); DOI: 10.1603/EN10056





# Our Missouri Experience: 2012 Research

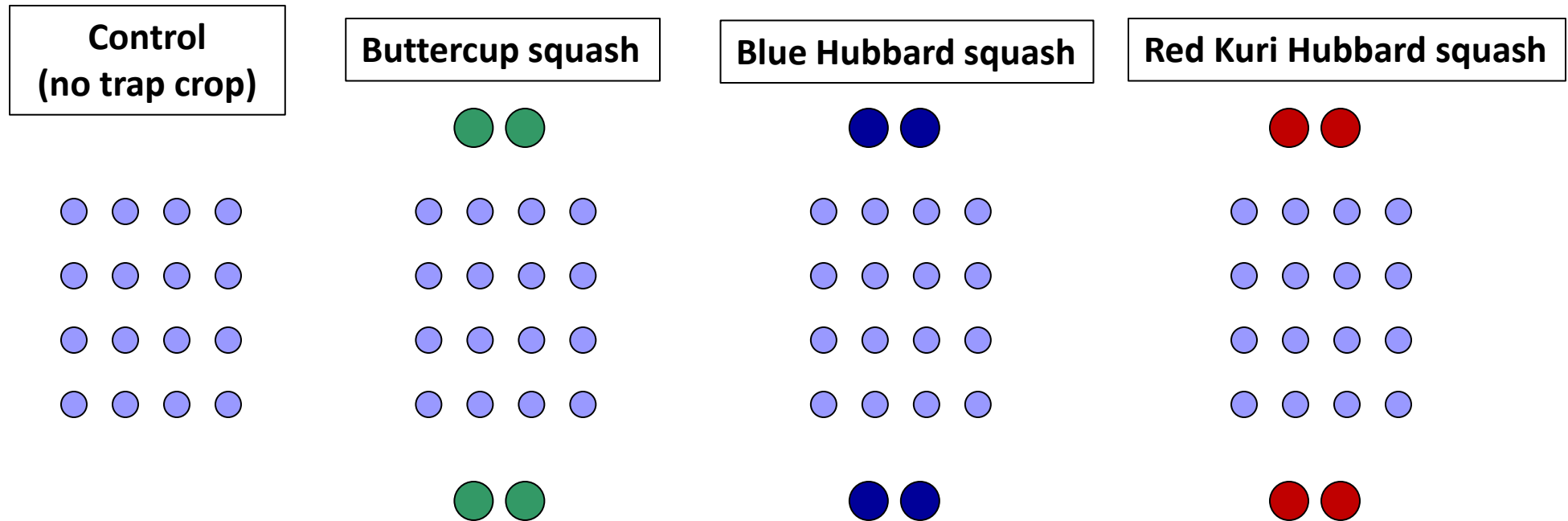


**3 FARMS: 2 IN MISSOURI, 1 IN FLORIDA**





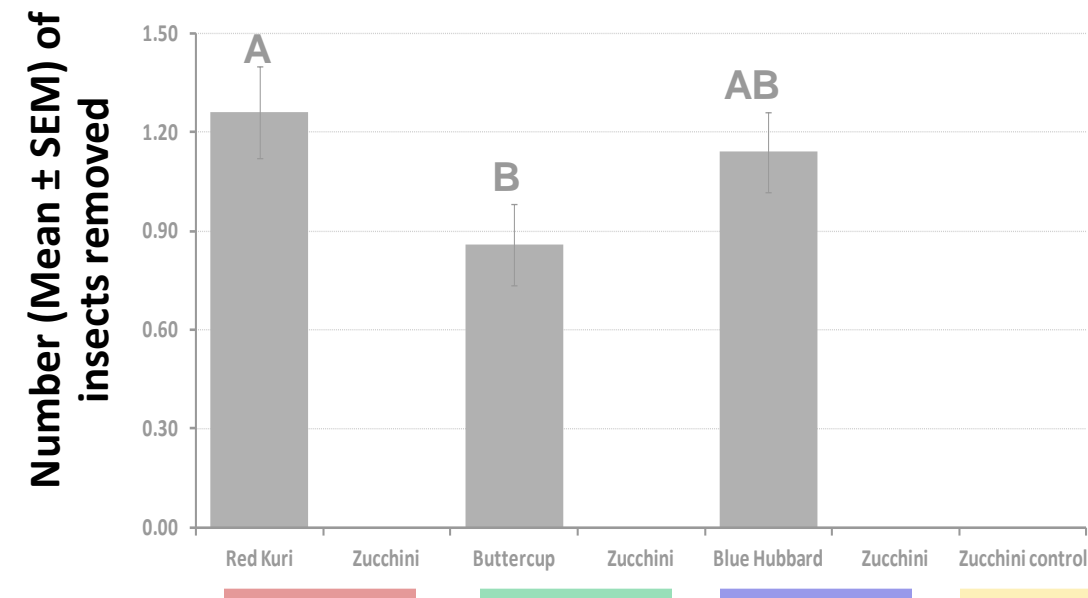
# Experimental Approach



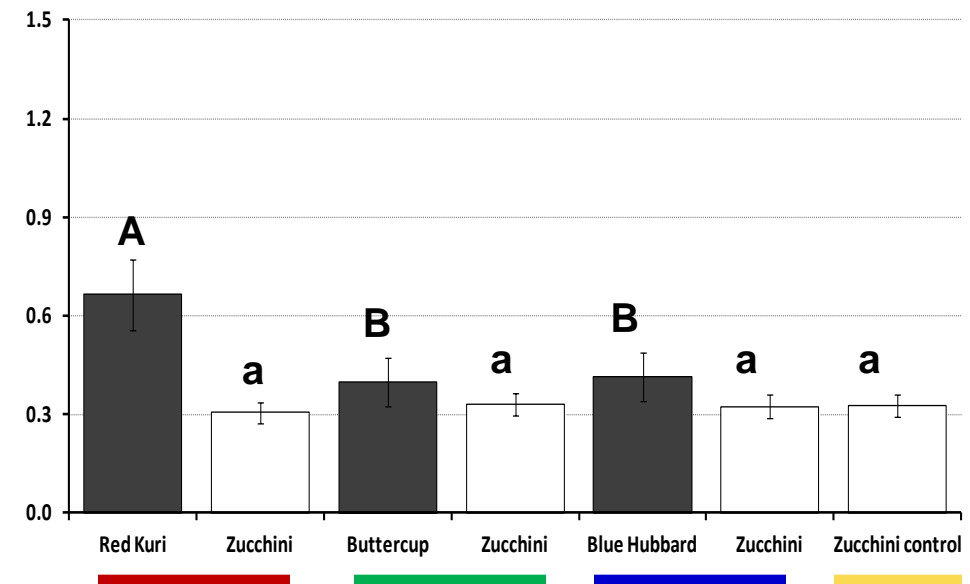
- Cash crop: Zucchini (Spineless Perfection, F1)
- Approach replicated 4 times at each farm (= 48 plots)
- Inter-plant distance: 45 cm; inter-plot distance: 7 m
- **NO INSECTICIDE APPLIED TO ANY PLANT**
- INSECTS COUNTED AND REMOVED 3 TIMES A WEEK FOR 8 WEEKS

## Adult squash bugs

Weeks 1-4



Weeks 5-8



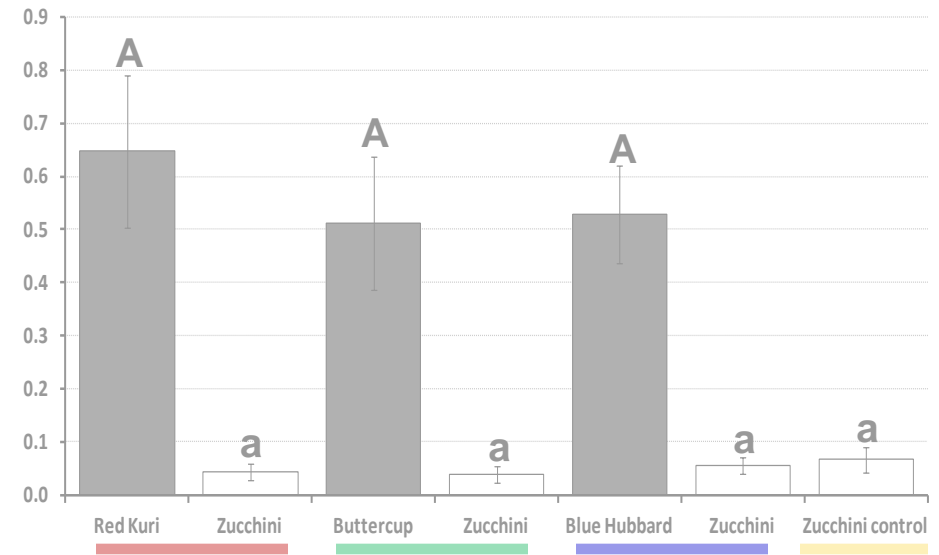
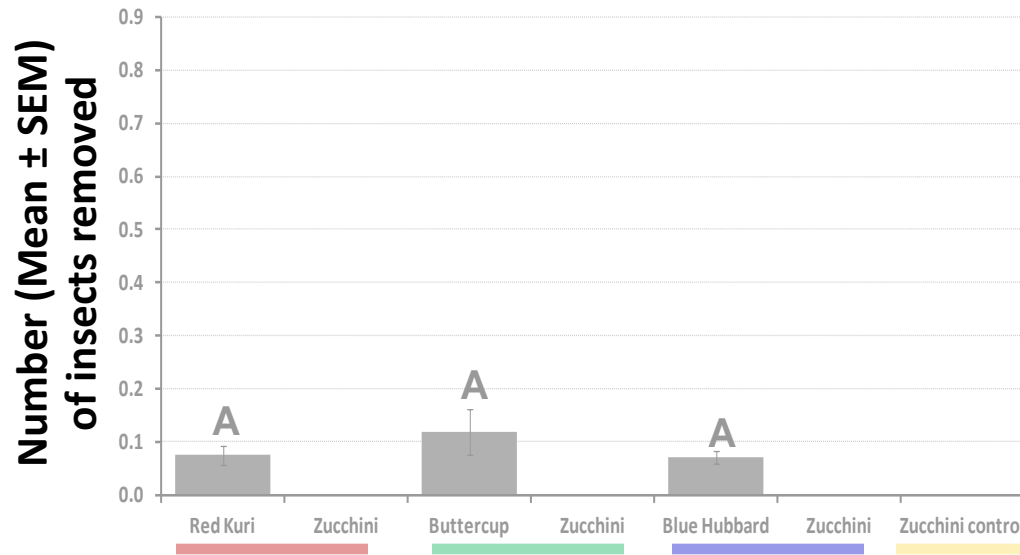
# Missouri Results

## Adult squash bugs

### Carver Farm

Weeks 1-3

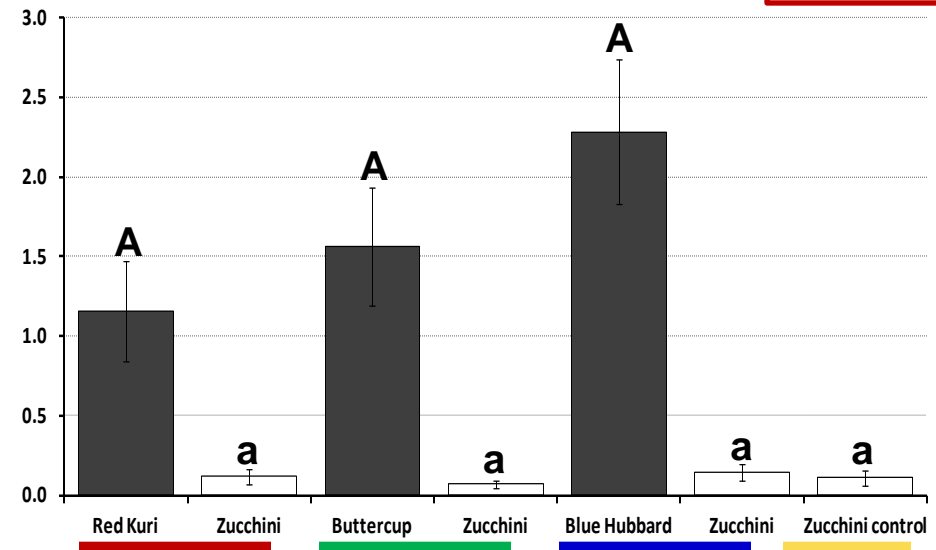
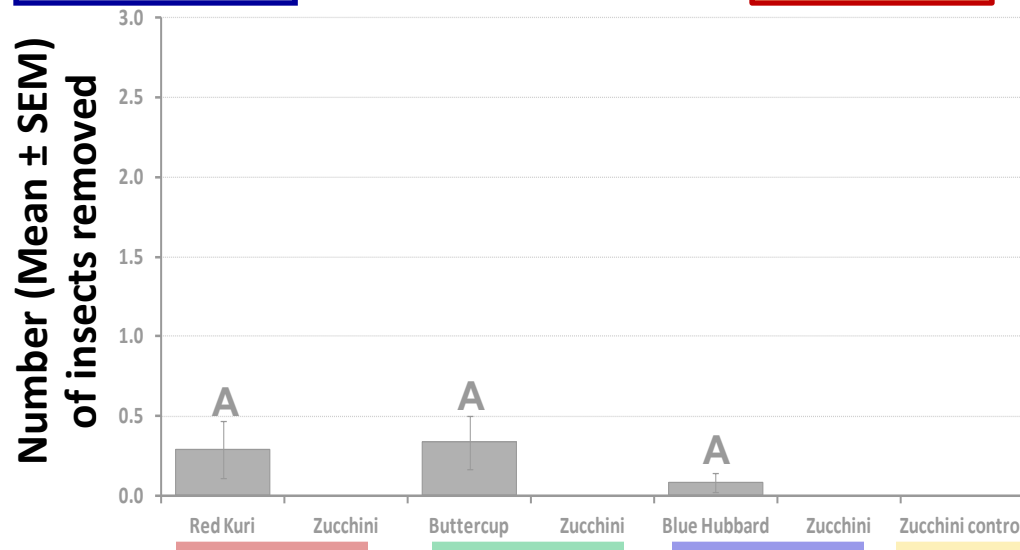
Weeks 4-6



### Busby Farm

Weeks 1-2

Weeks 3-4

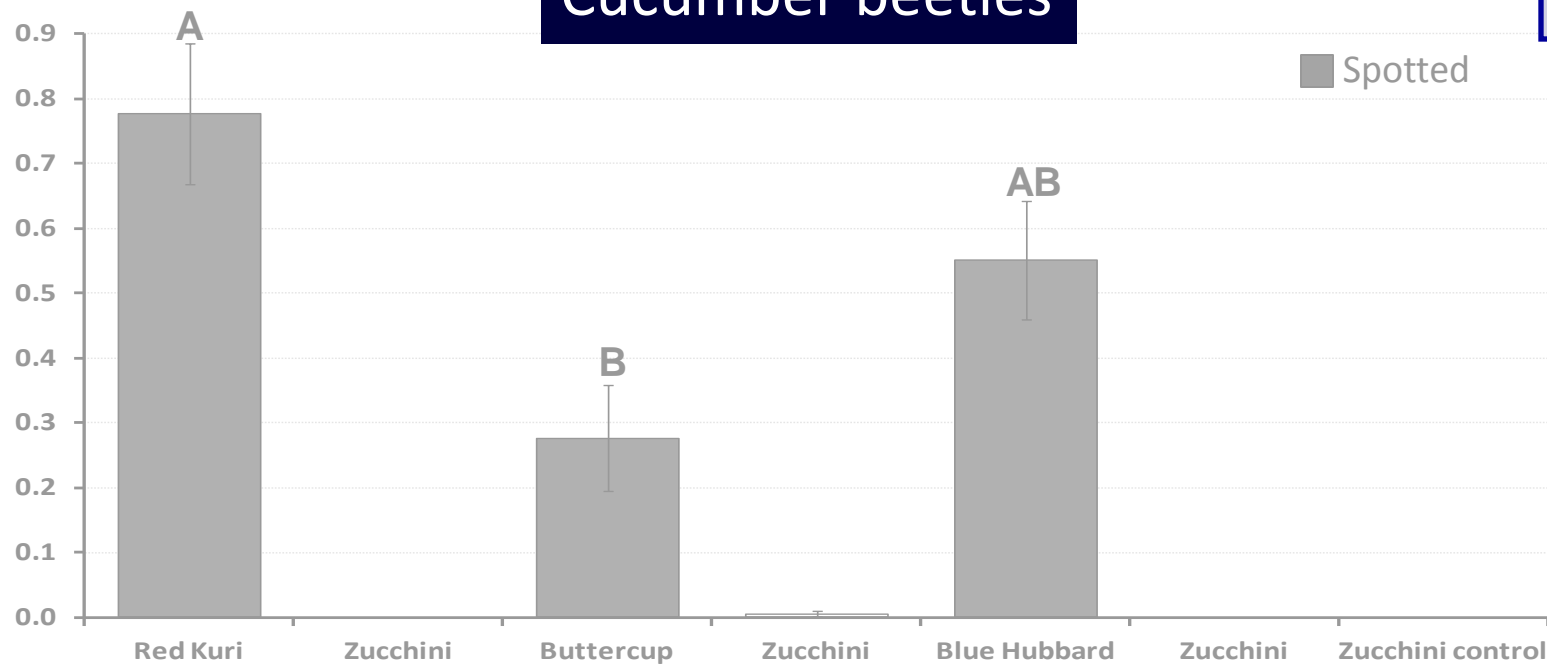


# Missouri Results

## Cucumber beetles

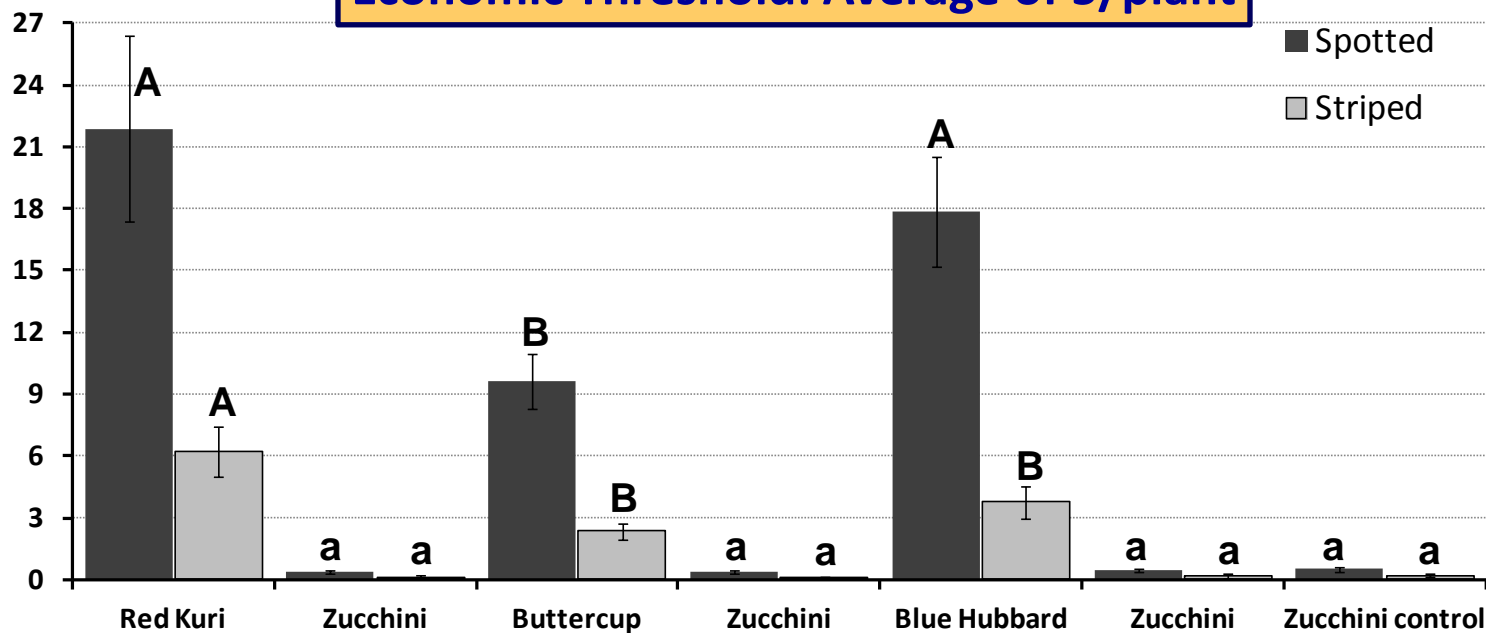
Carver Farm

Number (Mean  $\pm$  SEM) of insects removed



Week 1

Economic Threshold: Average of 5/plant



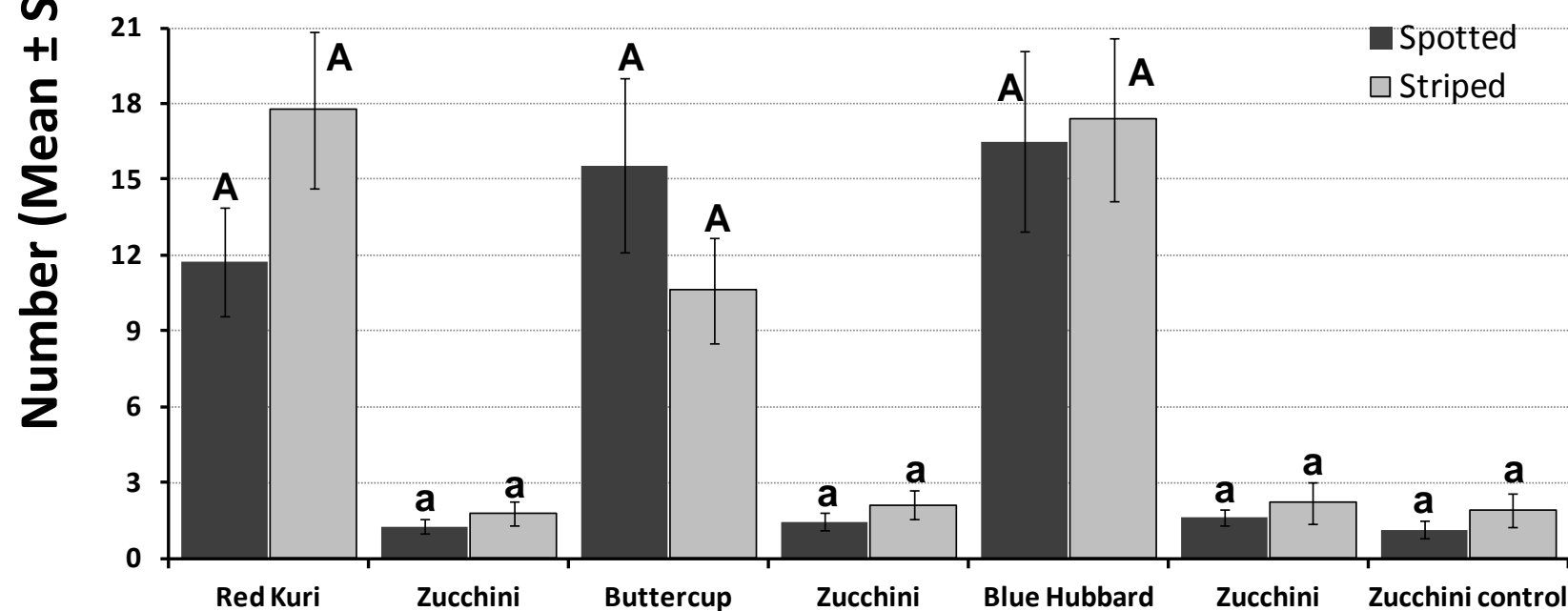
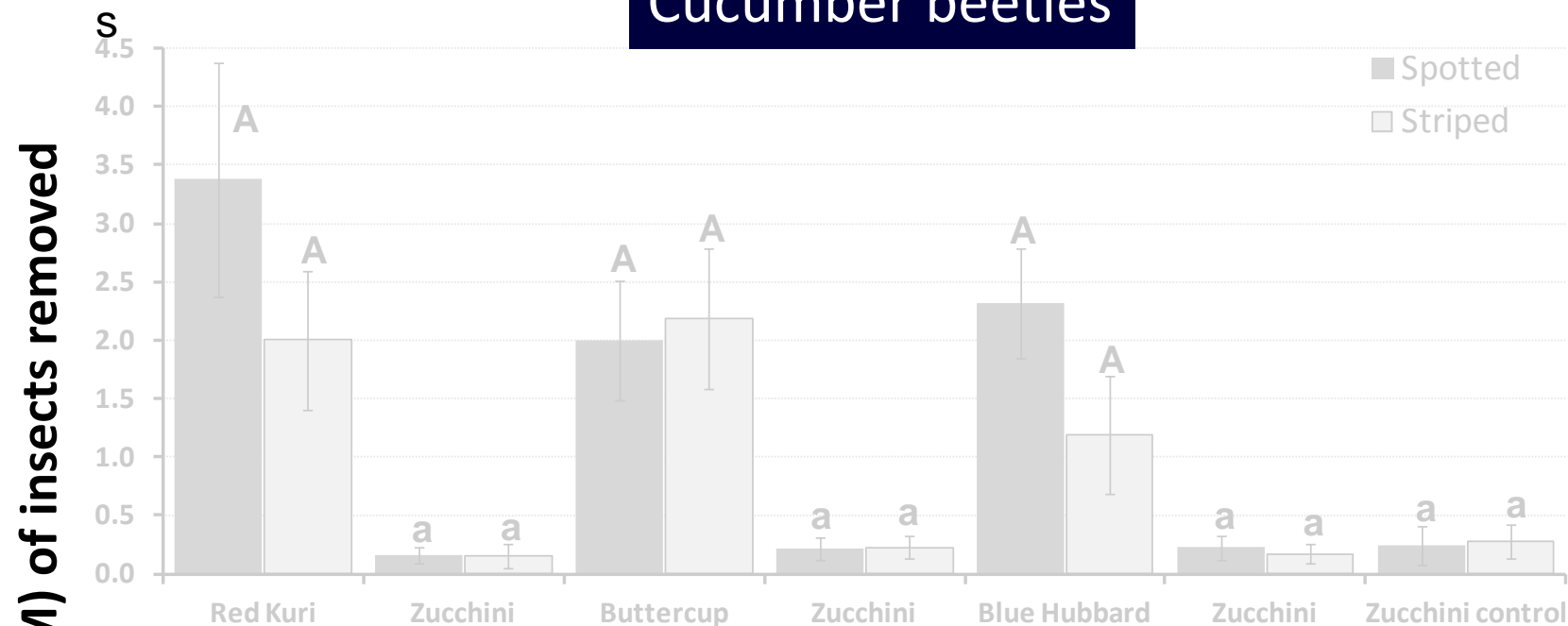
Weeks 2-3

# Missouri Results

## Cucumber beetles

Busby Farm

Week 1



Weeks 2-3



## **Red Kuri Hubbard:**

Performed equally well, or  
better than, Blue Hubbard  
and Buttercup squash



# 2013 Approach:

- Trap Crop plants located at the row ends
- 8 trap crops per row protected 70 Zephyr squash plants (cash crop)



06/07/2013 08:51



Red Kuri  
Hubbard



Zephyr squash (CASH CROP) = 70 seeds per row



Zephyr squash (CASH CROP) = 70 seeds per row



Red Kuri  
Hubbard



Zephyr squash (CASH CROP) = 70 plants per row



Avg. of a sample of 30 plants = 0

Avg. of  
16 plants =



Zephyr squash (CASH CROP) = 70 plants per row



0

# Results

MAY 22, 2013

Red Kuri  
Hubbard



Zephyr squash (CASH CROP) = 70 plants per row



Avg. of a sample of 30 plants = 0

Avg. of  
16 plants =



Zephyr squash (CASH CROP) = 70 plants per row



0.13



Red Kuri  
Hubbard



Zephyr squash (CASH CROP) = 70 plants per row



Avg. of a sample of 30 plants = 0

Avg. of  
16 plants =



Zephyr squash (CASH CROP) = 70 plants per row



0.19

# Results

JUNE 5, 2013

Red Kuri  
Hubbard



Zephyr squash (CASH CROP) = 70 plants per row



Avg. of a sample of 30 plants = 0

Avg. of  
16 plants =



Zephyr squash (CASH CROP) = 70 plants per row



0.25


# 2013 Overall results

At Lincoln  
University  
research farms:

Most insect pests  
(squash bugs,  
spotted and  
stripped cucumber  
beetles) were  
found in trap crop  
plants

**CASH CROPS**  
**NOT SPRAYED**





**How can I use the  
trap cropping  
approach  
in my farm?**



1. In early April, grow your trap crop plants inside your house or in a greenhouse

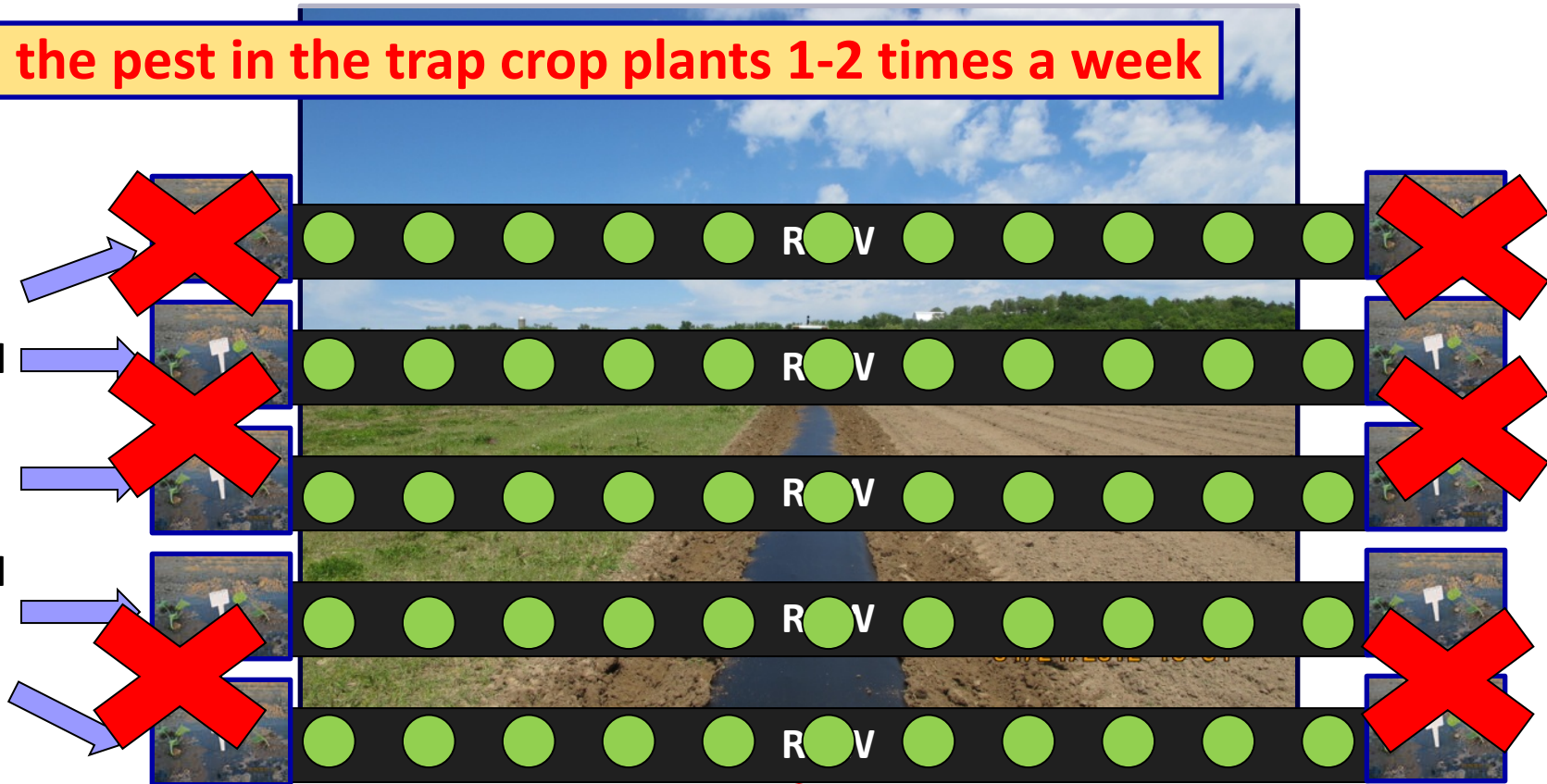
2. Plow field, prepare your rows whenever you feel is convenient

3. Plant the trap crop plants at the row ends 2 weeks before planting cash crop

4. Plant your cash crop

5. Kill the pest in the trap crop plants 1-2 times a week

Red Kuri  
Hubbard  
squash  
OR  
Blue  
Hubbard  
squash



**PESTICIDE-FREE  
VEGETABLES**

- **Non-organic:** Imidacloprid applied to trap crop plants only
- **Organic:**
  - **Flaming**
  - **OMRI approved insecticides:** Pyganic , AZERA, Entrust (spinosad).  
Scout again to determine if repeat sprays are needed in the border.  
Several sprays may be needed as bugs continue to colonize
  - **Suction:** A reverse leaf blower or motorized insect vacuum can be used (at least twice weekly) to suction beetles off the trap crop plants
    - In Massachusetts: Some growers tried this and were pleased with the results. *“The blower chopped up the beetles nicely and though it did some damage to the border plants it kept beetles out of the main crop”.*

# On-farm Trap Crop Studies



- Mr. Jose Fonseca (St. Peters, MO)
- 13 acres, mostly tomatoes (9 acres), cucurbits (3), cole crops (1)
- Very interested in IPM



# Adoption of Trap Cropping as an IPM tool

***"I became convinced that trap cropping is effective, very simple, and cheap"***

Jose Fonseca (Home-Grown Produce, St. Charles, MO)

- Jose Fonseca has fully adopted the trap cropping approach (2011, 2012, 2013)
- 2012 and 2013: Jose seed-planted zucchinis and transplanted 2-week old Blue Hubbard squash plants (trap crops) in the corners
- Very few insect pests observed in zucchinis, saw good number of beneficial insects (predators)
- Did not apply any insecticide to his zucchinis in 2012, 2013 (had a 90% reduction in 2011)



**Phone call made on 10.30.13**

***"It worked great in 2013; proof that it works is that in one plot I forgot to plant Blue Hubbard squash and squash bugs killed all my plants"***



# What about profits?

## Jose Fonseca's example:

By not spraying the cucurbit cash crops, Jose's estimates that his cost-savings are around \$ 400 per acre (cost of insecticide, time and fuel savings), resulting in increased profits and insecticide residue-free produce.

**His estimated savings in 10 acres using trap crops: \$ 4,000**

# Rocky Creek

## Welcome !! to Rocky Creek Valley Farm (RCV Farm)

**Oct, 2013:**

Elizabeth was recently featured in [Living Without Magazine](#) a very good article about the Alpha-gal disease she contracted in 2012.

For May we are featuring links to two of our friends, Well one is our grandson, which makes it even better. [Get Outside with Henry on YouTube](#) The hunting and fishing exploits of our grandson, future star! He lives to fish. You can also follow him on Facebook [Get Outside with Henry on FB](#)

[Lone Aspen on YouTube](#) Our new friend Jeff at Lone Aspen Outdoors, Jeff teaches survival in the Colorado Rockies. Also follow him on Facebook [Lone Aspen on FB](#)



**SARE Research Study** A research project in coordination with Lincoln University. This years project is the use of chicken tractors and trap crops to control pest without pesticides. Details and progress log at the link. Project completed view the findings - [Final report](#)

**EQUIP High Tunnel Program** - erection, production statistics and cost analysis on a 30 x 72 high tunnel.



**Photo Gallery** Check it out - lots more photos added, see all our critters.

**Milk Comparison Chart PDF** Compare raw goat's milk to cow's milk and mother's milk in our handy nutritional comparison chart.

**Recipes:** Fall canning is just around the corner. [Recipe of the Month.](#)

**Rocky Creek Valley Farm on Facebook:** Our goal here is to keep you up-to-date with food and nutrition related studies and news. As well as legislation that effects you as a consumer. Conferences, studies and

grants from the federal government, state of Missouri, Lincoln University and all of our other sources we follow. Join us for all the latest farm news.... [facebook](#)



# 2013 SARE IPM Study Summary

## Synopsis of IPM Study - grant # FNC13-938 [Back to Study Page](#)

Jump to: [★ First quarter](#) [★ July Interim Assessment](#) [★ September Interim Assessment](#) [★ Final IPM Analysis](#)

### Final IPM Analysis:

Bottom line - it was a great success. After a number of issues including the weather, a steep learning curve and a complete reevaluation we were able to prove this method will work to control squash bugs in a vegetable produce business. In conclusion this is what we learned and how we will set up next years program:

1. Winter Rye - Works great for weed control, the growing rate and allopathic effects delay the planting time too much to be effective for vegetable production. Unless you alternate two plots crimping the rye in the spring and waiting to plant that plot the following spring. It does add a massive amount of organic matter and is highly beneficial for fallow sections.
2. Millet - An absolute must as a perimeter beneficial insect attraction crop. Brought parasitic wasp and lady bugs to the farm for the first time, and in large quantities.
3. Buckwheat - As a perimeter beneficial insect crop. Also attracted beneficial insects and kept stink bugs out of the garden.
4. Sorghum - Originally planted as a dust control barrier. No quantifiable effects determined other than the perimeter IPM total system was very effective. The whole system brought in lady bugs, lacewing, hover flies, parasitic mini-wasps and tachinid flies.
5. Red Kuri Squash - Although it works to attract pest away from the cucurbits the pest much prefer the blue hubbards.
6. Blue Hubbard Squash - Absolutely will pull the pest away from the cucurbits. Place a minimum of two plots on the outside corners of the garden area. One on each corner would be better. Kill your pest there with whatever method you prefer. Keep a ready supply of replacement plants in the greenhouse. It is better not to mulch under the hubberds, it makes monitoring the bugs much easier if they have less area to hide.
7. Chickens - They will devour the bugs once they settle down in the hubbard area. They must be in the area at dawn and dusk to catch the bugs when they come out of the ground to feed and lay eggs. Next year we will place an electric chicken wire mesh around the plots to protect the chickens from predators at night. Two to four chickens per plot is more than enough to control the bugs.

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9. **Chicken Tractors** - This design worked very well and is easily moveable. Construction **details** and **cost** are included in our program. The only issues was the wheel brackets need to be metal as wood will just not support the weight. Next year we will encircle the chicken tractor with electric chicken wire to protect the chickens at night.
10. IPM - A 3 or 4 foot wide strip of millet and buckwheat around the entire perimeter of the vegetable production area worked very well. next year we will incorporate it with a farm scaping program to include marigolds, tansy and nasturtium to attract lady bugs, lacewing, hover flies, parasitic mini-wasps and tachinid flies.
11. Winter rye can be easily and effectively crimped using a rotary tiller with the PTO disconnected so that it can free wheel. See our video

We would be happy to discuss our project and findings at any time [contact us](#).



Department of Agriculture

This project and all associated reports and support materials were supported by the Sustainable Agriculture Research and Education (SARE) program, which is funded by the U.S. Department of Agriculture- National Institute of Food and Agriculture (USDA-NIFA). Any opinions, findings, conclusions or recommendations expressed within do not necessarily reflect the view of the SARE program or the U.S.



# Field Day at Rocky Creek Valley farm



06/06/2013 20:08





Nymphs

Adult

09/12/2012 16:37