NCR-SARE Farmer Rancher Grant Program

Final Report

PROJECT IDENTIFICATION

- Name: Rusty Lee
- Address: 39358 Pin Oak Church Road
- City, State, Zip Code: Truxton, MO 63381-3028
- Phone: home: 636-597-9921 cell: 314-954-0551
- Website:
- Project Title: Scaling Up the use of Trap Crops for Insect Control in Mechanized Squash Production
- Project Number: FNC12-873
- Project Duration: 2012-2013
- Date of Report: 4/23/14

PROJECT BACKGROUND

Lee Farms, LLC is owned and operated by Rusty and Teresa Lee. We represent the 3rd generation to cultivate crops and raise livestock on our Warren County Missouri farm. We select the best varieties of vegetables for both regional growing conditions and fresh picked flavor.
Our produce is carefully hand harvested to allow for peak quality, ripeness and taste. Our family is passionate about what we grow, how we grow it, and making it available fresh for customers. We deliver twice a week. We are concerned about the use of insecticides because of cost and concerns by customers.

My family is involved with University of Missouri's 4-H club program in our county. We have served as project leaders and club leaders. I am currently serving on the Warren County University of Missouri Extension Council. I am active with Extension projects such as the Old North Project in the City of St. Louis. I serve on the MO SARE advisory board. This project is focused on bring fresh locally produced foods to a "Food Desert" by the establishment of a food store cooperative. In addition I speak at many community and extension sponsored events concerning local food production and sustainable vegetable production.
2. Before receiving this grant, did you carry out any sustainable practices? If so, briefly describe what they were and how long you had been practicing them.

The farm has been terraced for soil sheet and rill erosion control. Cover crop use to improve soil health began in 2011. Crop rotation is used to manage insect and disease complexes with the vegetable portion of the farm. Row crops and forage crops are also used in the rotation when possible.

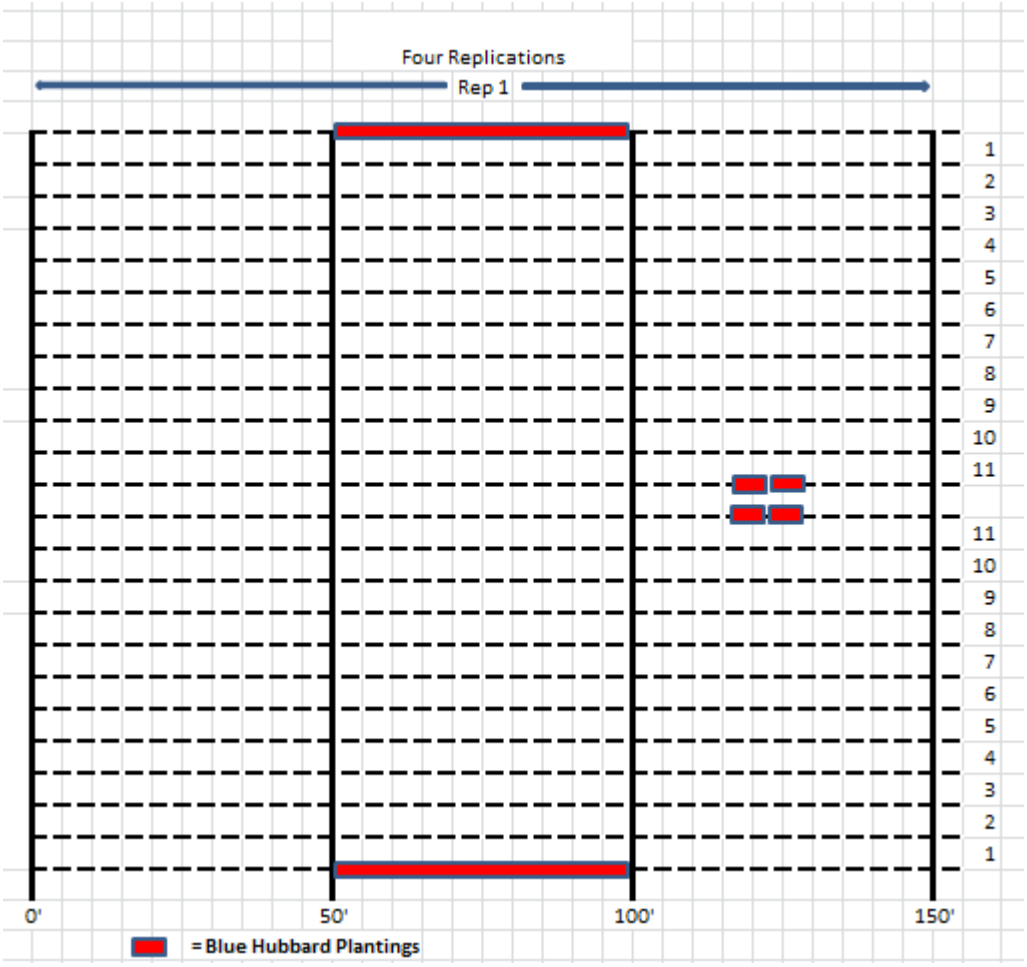
PROJECT DESCRIPTION

GOALS: This study will determine:
1) the extent of the "sphere of control" by Blue Hubbard as a trap crop,
2) if I can reduce insecticide use (with all that entails),
3) if I can increase production acreage (eliminate travel lane for applicator), and
4) alleviate customers concerns about insecticide use in my squash production.

A two year effort is needed to confirm the viability of the sustainable concept and as the spring pest pressure can differ considerably form fall production insect pressure, I feel it is necessary to research both time periods. I read that two years of data is the norm for confirming statistically valid cause and effect in farming systems.

PROCESS

In 2012 a late season direct planting was made of squash with three treatments replicated four times. The plot was 600 feet long and 24 rows wide (5' width). Each treatment was 24 rows wide and 50 feet long. The treatments were: 1) control with no Blue Hubbard, 2) perimeter of Blue Hubbard, 3) center of the treatment Blue Hubbard. See the table below.



The plot was scouted three times a week until late harvest.

PEOPLE

Dr. Jamie Pinero, State IPM Specialist, Lincoln University frequently visited during the project and offered insights into the scouting process. Rich Hoormann, MUEXT Agronomist assisted in various parts of the project including planting, data collection, and field days for school children and local farmers. The site was used as part of a SARE Professional Development Program (PDP) for cover crops and the insect scouting project was discussed. Staff from the Montgomery and Warren County SWCD and NRCS offices assisted with advertisement of the field days. They also participated in the field days.

RESULTS
2012 Observations

1) Early in season of first planting there was heavy insect pressure from spotted cucumber beetle and squash bug. Squash vines from 2011 in an adjacent plot on south side of 2012 plot with field corn on the north may have served as a reservoir for insect to over winter and as an early season host for spotted cucumber beetles.
2) The spring plots lost some plants due to delay in over the top insecticide applications and very heavy spotted cucumber beetle pressure. First application of an insecticide was with Artic (5-7 days after transplant) at 9 oz. /acre with 17 gallons of carrier in an airblast applicator.
3) Set first plants into black plastic cover raised beds with yellow squash and green zucchini. We transplanted Blue Hubbard squash (BH) at same time grown in size 72 packs. The BH's were not flowering at the time of transplant.
4) Trap boards were used in the spring plots (16" x 6") beside every BH planting. The idea was the boards would attract the squash bugs and make scouting counts easier. However, the spring planting was cool enough that the squash bugs (SB) were attracted to the heat under the black plastic and not attracted to the cooling shade under the boards. No SB's were ever found under the boards. Further review of the literature indicates the board width was too narrow to be effective.
5) The fall squash planting was done with direct seeding into plots with a Monosem planter and BH's were transplanted the day of seeding. The cell pack size was 72. Again, the BH's were not flowering.
6) Scouting began at transplant in the spring plots and at transplant of BH in the fall planting. The plots were scouted three times a week. A Monday-Wednesday-Saturday scouting schedule was used during the project. The scouting was found to take on average 4.5 hours of labor. Most scouting sessions used two people trained in scouting techniques. Hired scouts were Alex, Clint and Paige.

Midseason to late season there was heavy insect pressure from striped and spotted cucumber beetles. Early in the season squash bugs were more of a problem. In the spring planting the SBs were most often found under the plastic near the squash stem. In the fall planting the SB were found on the lower stem and as the plants grew they remained within 6-8" of the soil on the main stem.

Spray application
Spray application was made late on Saturday afternoon to protect foraging pollinators and to comply with PHI on label. One application only on trap crop, but they were dying and used field broadcast application of insecticide to try and save the BHs. On black plastic sprayed everything.
Early on direct seed thought trap crop was working, but as the season progressed pressure caused us to switch to spaying entire field. Back sprayed direct seeded plots. Early in the season only sprayed trap crop, but moved to broadcast of all plants due to insect pressure.
Artic insecticide applications were rotated with Asana XL applications.

Summary of Scouting Counts

The tables below summarize the counts taken by week, by species from the scouts. The tables list the counts for the four treatment replications.

The count information for the striped cucumber beetle reflects early season pressure that declined over the course of the harvest life of the crop. The treatments show a clear trend that the perimeter treatment placement of the Blue Hubbard trap crop attracted a significantly greater number of striped cucumber beetles

than did the cash crop plants in the perimeter. The control treatment did not have a trap crop and counts were not significantly different between the perimeter counts and the center of the treatment. The treatment with the Blue Hubbard trap crop plants located in the center of the plot were not effective in attracting striped cucumber beetles and protecting the cash crop plants.

Clearly the perimeter placement for mechanized production of squash was superior in attracting striped cucumber beetles versus center of the plot placement. The center of the plot placement was ineffective in preventing feeding damage as insects moved into the squash planting. In addition the control had significantly greater insect counts and both in the perimeter and center of the plots.

Table 1

Striped Cucumber Beetle Counts

Summary of counts by Treatment

	Perimeter		Control		Center	
Date	BH	cash crop	edge row	center row	BH	cash crop
06/26/12	2	0	2	0	1	1
06/28/12	3	0	1	0	0	0
06/30/12	9	0	1	0	0	0
07/03/12	7	1	12	1	2	12
07/05/12	18	2	23	1	0	86
07/07/12	35	28	105	20	15	127
07/10/12	190	25	161	150	25	205
07/12/12	0	0	0	0	0	1
07/14/12	0	0	0	0	0	3
07/17/12	0	2	1	8	1	1
07/19/12	0	4	1	2	0	8
07/20/12	4	7	6	11	2	32
07/24/12	0	15	0	13	8	5
07/26/12	0	2	3	0	2	6
07/28/12	3	0	8	0	1	22
total	271	86	324	206	57	509

The summary of spotted cucumber beetles follows a similar pattern to the striped cucumber beetle, as seen in Table 2.

Table 2

Spotted Cucumber Beetle Counts

Summary of counts by Treatment

	Perimeter		Control		Center	
Date	BH	cash crop	edge row	center row	BH	cash crop
06/26/12	0	0	0	0	2	1
06/28/12	4	0	2	0	0	0
06/30/12	6	0	1	0	0	0
07/03/12	9	2	20	0	0	13
07/05/12	8	4	10	2	0	10
07/07/12	13	0	12	7	5	8
07/10/12	26	8	42	6	30	121
07/12/12	0	1	0	0	0	0
07/14/12	1	1	0	1	0	0
07/17/12	0	2	0	7	1	3
07/19/12	2	10	0	12	0	4
07/20/12	8	4	0	4	11	18
07/24/12	0	19	1	17	11	26
07/26/12	7	5	0	9	9	3
07/28/12	40	0	11	0	0	31
total	124	56	99	65	69	238

The summary of counts for the squash bug is very different in numbers and the difficulty in scouting technique once the squash plants reached a stage of growth where moving vines was difficult without damaging individual stems. In addition as the plants aged the squash bugs remained within a short distance of the main stem and its entry into the soil. While the summary shows few squash bug numbers, their damage was great, often leading to plant death.

The trend noticed in the other species counts held true for the squash bug. The perimeter placement of the Blue Hubbard trap crop species had the highest number count, the control treatment showed no significant difference in number found in the perimeter versus the center of the plots, and the center placement of the Blue Hubbard trap crop gave no protection to the cash crops between the perimeter and the center of the plots.

In conclusion of the 2012 scouting year, the perimeter treatment of placement of the Blue Hubbard trap crop species did attract the greatest number of scouted pests. The center treatment of the trap crop offered no pest management advantage, and the special logging of the row in which the scouted pests were found indicated no significance to a radius or sphere of protection of cash crops around the Blue Hubbard trap crop. The control treatment of no Blue Hubbard plants confirms this as the distribution of insect pest counts does not show a pattern. Only the perimeter placement of the Blue Hubbard trap crop intercepted insect pests moving into the plantings, showed significant differences reducing cash crop insect pest counts. Table 4 illustrates the special relationship in counts.

Table 3

2012 Squash bug Counts

Summary of counts by Treatment

	Perimeter		Control		Center	
Date	BH	cash crop	edge row	center row	BH	cash crop
06/26/12	0	0	1	0	0	1
06/28/12	2	0	0	0	1	0
06/30/12	4	0	2	0	0	2
07/03/12	2	1	0	0	0	0
07/05/12	1	0	1	0	0	0
07/07/12	7	1	1	0	0	0
07/10/12	0	0	0	0	0	1
07/12/12	4	0	1	0	0	1
07/14/12	1	0	0	0	0	0
07/17/12	0	0	0	2	0	0
07/19/12	1	0	0	0	0	0
07/20/12	0	0	1	0	0	0
07/24/12	0	1	0	0	0	0
07/26/12	0	0	1	0	0	1
07/28/12	1	0	0	0	0	1
Total	**23**	**3**	**8**	**2**	**1**	**7**

Table 4 Map of Distribution of Striped Cucumber Beetle Counts

Date													Blue										
7/28	rep	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	Hubbard	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
	1			1						1	1		0	1	2		2		8				6	
	2	1				1	1						0							1	1			
	3			2		5	2			3			0	2				2						
	4			1			1											1				3		
7/26																								
	1																							
	2																2					3		
	3									3												2		
	4										1	1					1							
7/24																								
	1					5	5	5																
	2						1	2	2							5	5	5	5			2		
	3								3															
	4															1								
7/20																								
	1					2		1	2	7		2		3	1	2	2		2				2	
	2					1				3									1		2			
	3							1		1				1					3	1	1			
	4	1				1	1	1		1		1						2						
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	1													1	1			1						
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	2																									
	3																									
	4																									
6/26																										
	1																									
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	3										1			1	1	1										
	4																									
totals		2	2	6	3	17	11	11	9	21	3	13	0	26	10	14	17	17	27	11	32	34	54	0		

2013

During the off season customer concerns about the use of insecticides, even when shown that an IPM scouting program was being used, led to changes in the pest management system. An insecticide soil transplant treatment of imidacloprid to flats prior to setting plants in the field was instituted in 2013. This change was made to augment the use of trap crops, with the potential to further reduce insecticide applications.

Blue Hubbard squash were grown to flowering stage of growth prior and transplanted with non-flowering squash. Dr. Pinero recommended the change based on his work and his observations of the first year of the project in 2012.

The plants were put in black plastic culture and the scouting program started upon transplant. The plots were scouted three times a week. However, after three weeks of intense scouting, the scouting program was reduced to observation status, due to the low insect pressure in the 2012 growing season (unlike 2013) and the fact that counts found dead insect pests, but no live insect pests.

DISCUSSION

The project showed that advanced squash plants with flowers set into the field prior to transplant or direct seeding of the main cash crop is useful in a mechanized vegetable production system early in the growing season.

The use of imidacloprid as a plant treatment prior to transplant was observed to control insect pests such as spotted cucumber beetles, stripped cucumber beetle and the squash bug during the early part of the season. Originally meant to augment the trap crop system, it effectively changed the early season need for intense three times a week scouting to an observation system, until late in the harvest season.

Our operation intends to make use of the imidacloprid treatment of transplants to replace the trap crop system of scouting. However, if we were not using imadacloprid as a treatment, we would be using a trap crop scouting system to target early season insecticide applications with the goal to reduce overall insecticide use.

PROJECT IMPACTS

The use of trap crops in the first year resulted in an economic benefit due to two less insecticide applications in the first year. In addition the reduction in pesticide use had business and social impact. The customer base continues to question the use of pesticides, while at the same time demanding high quality product. By collecting data as part of an IPM scouting program the customers are more accepting of insecticide applications that are determined by economic thresholds. The reduced use of insecticides is consistent with EPA goals of reducing pesticide use to minimize environmental impact.

The use of imidacloprid to supplement the use of the Blue Hubbard squash as a trap crop significantly reduced the need for insecticide applications. With the potential for six to seven applications in a typical year, the 2013 season need only three insecticide applications, which was a 50 percent reduction in foliar applications. Essentially the only applications were late in the season as the plants were productive late into the harvest season.

OUTREACH

There were three field days held in 2012. The Wentzville public school district had the farm as a tour for

fourth and fifth grade students. The children were shown information on planting, with discussion on pest management to produce quality vegetables. Special emphasis was placed on the use of scouting with trap crops as part of an IPM approach to vegetable farming.

The other field days were part of soil conservation tours on cover crops. Our farm participated in a cover crop planting effort to improve the soil physical properties for production of vegetables. Local row crop, livestock and vegetable farmers participated in the MUEXT and NRCS sponsored tours. During these field days we had the opportunity to discuss the trap crop project.

Dr. Pinero also had a tour with Lincoln University small farmers.

In addition Rich Hoormann used information from the project at a small farm meeting at the Carver Farm, which is part of Lincoln University.

In 2013 a presentation was made at the Great Plains Vegetable Conference in St. Joseph Missouri. This conference attracts vegetable growers from Nebraska, Kansas, Iowa, Nebraska, Missouri and other North Central States.