Using perimeter trap cropping and a flaming unit to control for squash bugs and cucumber beetles in cucurbits, FNE07-615

Goals of the Project

In this project we want to research the potential of reducing the impact of Squash bugs (SB) and Striped Cucumber beetle (CB) in organic squash production using Perimeter Trap Cropping (PTC) in combination with flaming.

Current Farm Status

In 2007, we harvested the first crops of our new farm and in the same season, we made the last harvests at our old farm, , which we had been renting for the last three seasons.

We had 5 acres in diverse vegetables (approximately 40 different vegetables, totaling 100 different varieties), and 6 acres in cover crops. Produce was marketed through our 20 week, 120 member Community Supported Agriculture program, some direct marketing and a limited number of wholesale accounts.

The farm provided employment for 2 full time farmers and 2 part-time farm hands. Additionally, we hosted 1 farm intern for half our growing season through MESA, Multicultural Exchange for Sustainable Agriculture.

For 2008, we expect to expand our farming operation to provide vegetables for 160 CSA members, keeping our direct marketing and wholesale activities the same as 2007. We are planning to expand our harvest season by 1 week (to 21 weeks), on approximately 6 acres under cultivation. The farm will employ 2 full time farmers and 1 full time farm hand. In the peak of the season, part time help may be hired. We will start introducing a program of conservation tillage on our gently sloping farm lands, using a chisel plow. Additionally, we will start experimenting with season extension/acceleration structures by optimizing the use of our 26' x 48' high tunnel and the addition of a new 15' x 200' "caterpillar" tunnel.

Project Cooperators

Raymond Luhrman, (PL). Project coordination, data collection (scouting) and recording, field experiment lay-out

Sara Luhrman. Seedling production, scouting, planting, general field records (harvest notes)

Farm help. Planting, scouting, harvesting.

Charles Bornt (advisor). Extension Educator, Cornell Cooperative Extension, Capital District Vegetable Program. Assistance with experiment design, reporting.

2007 Project activities

For our flaming experiment, we grew sufficient amounts of Blue Hubbard (Johnny's Selected Seeds) transplants in our greenhouse. Trays were seeded April 28, and plants reached the 3 true leave stage June 5, 2007. On June 8, we planted six hubbard transplants in our greenhouse for the flaming experiment. On June 9, we flamed the plants with a Red Dragon backpack flamer. We hypothised in our project proposal that regrowth would occur, but it did not (see pictures, appendix 1). Observing the destruction to the plant tissue caused by the heat of the flamer, we discontinued our proposed experimentation with bigger transplants (6 and 9 leave stage).

Field transplants were started in the greenhouse on June 6 in 50 count transplant trays (2"cells), 100 Blue Hubbard and 100 Burgess Buttercup. Avalon variety butternut were planted on the same date. Because of poor initial germination, we replanted the Blue Hubbard and Burgess on June 16. We planted one experimental field and on control field according to the methods described in our project proposal, but only on our new farm. Due to unforeseen logistic constraints, we could not plant at our old farm.

Our experimental planting consisted of two rows of 16 Acorn plants, surrounded by one row of Burgess, which was surrounded by Blue Hubbard. The control consisted of four rows of 16 acorn plants, in the same field at the farm. Planting was done using a waterwheel transplanter on July 2nd. All plants were planted into black plastic mulch on 24" in row spacing, in beds 64" on-center. Drip irrigation was also applied under the mulch and plants were irrigated as needed. In order to assist with insect monitoring, we set out trap boards between the Blue Hubbard and Burgess, and Burgess and Acorn plantings. Both control and experimental plantings were scouted biweekly, starting July 5, 2007, ending August 9, 2007. Results, including time, were recorded. Trap boards were lifted biweekly in either early morning or early evening, and squash bug and cucumber beetle populations were recorded.

We harvested our crop starting October 5, ending October12. We harvested 56 Blue Hubbards, 76 Burgess Buttercup and 311 Avalon fruits. Due to an oversight in our records, we did not discriminate between the different Avalon planting yields.

Results and Accomplishments

Based on our observations of our flaming experiment, the use of the backpack flamer will be an effective tool to control squash bug and cucumber beetle populations in the perimeter trap crop. Flaming however will also kill the trap crop. When flamed, no further growth of the trap crop should be expected.

We scouted for SB and CB on a biweekly schedule, starting 7/5/07 and ending 8/9/07, according to the strategy described in our project proposal. In this period, no SB or CB populations exceeded the intervention threshold of 1 egg mass per plant for the SB, or more than 5 CB per plant, or heavy feeding damage. The results of our scouting efforts are tabulated in appendix 3. At the time of our last scouting, the Blue Hubbard started to set fruit, and the runners of the winter squash varieties started to intertwine in our experimental field. This unexpected effect resulted in a situation where flaming of the trap crop would also result in the severe damage of the cash crop. Therefore, during the 2007 growing season we did not perform any flaming in the field.

Our limited data might indicate that CB prefer Burgess Buttercup over Blue Hubbard. In fact, at our last scouting we noted more CB in the Burgess planting compared to the Hubbard planting. This was surprising due to the fact that most research information indicates that Hubbard are preferred before Burgess in SB and CB feeding preference. It appears that Burgess Buttercup would be worth considering as a trap crop for CB. We did not note any SB under the trap boards, nor did we find any in the plants before August 9.

During our flaming experiment we noted that the high heat output of the backpack flamer (80,000 Btu). It is therefore not a good idea to flame plants that are planted in plastic mulch for the risk of igniting the mulch and related effects (fire, environmental pollution). With the rapid horizontal growth of the winter squash canopy, we are doubtful if the use of plastic mulch has significant effects on the control of weeds and retention of moisture. Interseeding a living mulch of Dutch White clover after the last mechanical cultivation may control additional weed growth, while providing organic matter and fixating N.

We harvested all squash varieties. The size of most of the harvested Blue Hubbard winter squash was impressive. When given the choice between the Blue Hubbard and the more manageable size of the Burgess Buttercup or Avalon butternut varieties, our CSA members preferred to take home the buttercup or butternut.

Site conditions affecting findings

This was our first year growing vegetable crops on our new farm. Rotating out of pasture (through a fall cover crop of winter rye) may have affected the historic

populations of CB and SB present on the farm (i.e. hibernating in hedgerows, plant debris).

Economic findings

1. Scouting takes time, but is restricted to a 5-6 week period after transplanting before the runners become intertwined. At that time it becomes impossible to distinquish between the different winter squash varieties. We scouted 8 times, with an average time of 10 minutes per session.

2. Blue Hubbard as a trap crop takes a lot of space in a field and is a non-preferred variety with our customers compared to butternut or buttercup types. While we do not have clear data on this, it appeared that the full vining nature of the blue Hubbard into the acorn squash reduced the light exposure for the desired crop, limiting the yields (fruit size and count). .

3. Blue Hubbard is a variety in which you may not want to consider growing in a CSA system that works with off-farm distribution sites due to the large size of the fruit and the potential for the use of lots of space in the distribution truck.

4. Given the availability of land resources, crop rotations may offer a better and less labor intensive method to control SB and CB than the use of PTC and other control strategies (ie. flaming, or spraying).

New ideas

1. Crop rotation is likely one of the 'best practices' to control SB and CB in winter squash. It would be nice to find out what kind of rotation would be most effective (i.e. distance from previous planting, and prior insect pressure the previous season).

2. Using PTC strategies may be effective in the control of SB and CB; however, more information may be necessary to carefully select the trap crop. For example, Burgess Buttercup, which in our original design was the 'intermediary' PTC, was actually the preferred crop by CB over Blue Hubbard in this particular trial.

3. It would be advantageous for organic vegetable growers if a reliable organically approved method existed that to control SB and CB in the PTC system – this truly would be a win win situation for all involved, since the cash crop remains unsprayed, and the PTC crop would still yield marketable fruits. At this time, however, the so-called 'botanicals' have limited residual effects, and need to be applied frequently (personal communication, Jude Boucher).

4. The planting of two PTC crops is probably unnecessary in situations with low insect pressure. To trap a first release of SB and CB in one (to be flamed) planting may be sufficient to temporary reduce the population at the time when the squash plants are most vulnerable. Additionally, with the use of two PTC circles around the market crop, preference of the pest for the inner circle PTC may result in an unnecessary planting of the outer PTC, as happened in our situation.

For 2008 we will evaluate our PTC project again, with the following changes in our study design:

1. Direct planted crop, 3 seeds per hill, on bare ground with drip tape irrigation, covered with row cover until flower stage. One planting will be our control (planted Avalon), the other planting will be experimental (Avalon surrounded by PTC). Plantings on same field, one side of the field experimental, other side control. Mechanical cultivation will be used until squash starts to vine out. After last cultivation, we will interseed with Dutch White clover.

2. One PTC crop – Burgess buttercup.

3. Trap boards will be placed between the PTC and desired crop after removal of the row cover.

4. Scouting will start upon removal of the row cover, weekly, either early AM or late PM.

5. The PTC crop will be flamed when thresholds of SB and/or CB are met.

6. Harvest yields will be expressed in pounds per row foot, comparing the Avalon experimental planting with the Avalon control planting. Yields will be separated in two groups: “culls” and “marketable for distribution”.

Appendix 1: Flaming experiment

Picture 1: Blue Hubbard immediately after flaming

Picture 2: Blue Hubbard one day after flaming

Picture 3: Blue Hubbard 3 days after flaming

Appendix 2: Planting of winter squash transplants for experiment, July 2, 2007

Appendix 3: Scouting results

	PTC						Control	
	Hubbard		Burgess		Avalon		Avalon	
Date	SB	CB	SB	CB	SB	CB	SB	CB
7/5/07	0	0	0	0	0	0	0	0
7/10/07	0	0	0	0	0	0	0	0
7/16/07	0	0	0	0	0	0	0	0
7/20/07	0	0	0	0	0	0	0	0
7/29/07	0	0	0	0	0	0	0	0
8/3/07	0	0	0	1/5	0	0	0	0
8/9/07	0	1	0	3	0	0	0	0

PTC: Perimeter Trap Crop
SB: Squash bug egg masses (average per 5 scouted plants)
CB: Cucumber beetles (average per 5 scouted plants)