**1.** **Project name and contact information**

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

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1. **Goals**

In the past, we spent significant amounts of time handpicking squash bugs and cucumber beetles at our farm. In this project, we are looking at the possibilities of using a backpack flamer to control squash bugs and cucumber beetles in cucurbits, using perimeter trap cropping to concentrate the bug population.

1. **Farm profile**

Fox Creek Farm is located in Gallupville, New York, approximately 30 miles west of Albany. We are marketing the majority of our diverse crops through our Community Supported Agriculture (CSA) project. For the past year (2008), approximately 95% of our gross sales were through the 160 member, 21 week CSA. We grow 40 different vegetables, totaling 100 different varieties.

We are farming 12 acres in a bi-annual rotation (producing vegetables one year / cover cropping the other year). Through the continued growth of the CSA, our farm has evolved to be one of the bigger seasonal employers in our locality, employing 2 full time farmers and 6 part-time farm hands (working between 1 and 3 days/week).

Over the duration of this project, we increased our CSA membership by 25%, and added some acreage to our production. We also found that in relatively easy in this area of upstate New York to find hard working, local farm help. In 2008, we moved most of our tomatoes inside our high tunnel and ‘caterpillars’. Compared to the one, 200’ row of tomatoes grown outside, the results of ‘growing under cover’ are very impressive, not so much as for the earliness of the crop, but mostly for the quality of the harvested produce.

Our farm is off-grid, and generates it’s electricity for the walk-in cooler (CoolBot system), well pump and other electric needs with a 1kW solar array (manufactured by Evergreen, in Massachusetts, USA) and 1kW wind generator on a 100’ tower (Bergey XL1).

**4. Participants**

Our technical advisor was Charles Bornt, Extension Educator, Cornell Cooperative Extension, Capital District Vegetable Program. Chuck helped us with the grant proposal, especially with literature regarding the trap cropping methodology. He made various farm visits, and thought us our scouting skills for squash bugs and cucumber beetles.

Other participants were Sara Luhrman, farmer, who was responsible for the growth of the transplants for our first experimental year, planting, and farm notes. In addition, our farm hands helped with field preparation, planting and harvesting.

**5. Project activities**

**5.1 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 was 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 October 12. 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.

Our 2007 project results were previously reported in our interim report, submitted January 31, 2008 to SARE.

**5.2 2008 Project activities**

During the winter of 2007-2008, we evaluated our experiment and submitted an interim project report to SARE, describing the results of our 2007 work on the project (see paragraph 6 in this report, “results”). We proposed the following modifications to 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”.

We prepared our fields for the winter squash planting 5 days before actual planting. We blind cultivated the beds, and applied drip tape with biodegradable mulch (MatterBi, Biotello, a corn-starch based mulch) using a Holland Transplanter mulch and drip-tape layer. We seeded the winter squash using a Rainflo waterwheel transplanter with 24” water wheel, single row on 5’4” on center. The experimental field was 5 rows wide, perimeter planted with Burgess Buttercup (40’ long bed, 48 hills in total), with 3 rows of Avalon Butternut inside (18 hills per row). The control planting consisted of 5 rows of Avalon Butternut.

We decided to use the biodegradable mulch vs. mechanical cultivation – the biodegradable mulch ‘shrinks’ over the soil, and would probably allow flaming when needed. We also liked to try the biodegradable mulch. Some of the farmers in our network reported very good results (for matter of weed control, as well as bio-degradability), and we liked to verify their findings on our farm.

Since the historic SB and CB pressure on our farm is quite low, we decided not to put row cover on the planting. Not using row cover saved us approximately 2 man-hours per bed, and verified by our first scouting July 21 (see results, table 2, appendix), no bug pressures would have been deterred. In addition, we planted later in the season to reduce storage time (the time between harvest and distribution to our CSA), and we were concerned that the row cover would result in temperatures not conductive to the germination of winter squash.

Because no SB or CB was found under the trap boards in 2007, we decided not to use the trap boards during the 2008 growing season .

We started scouting July 21, 2008 after the first flowers emerged from the winter squash planting. Scouting took approximately 10 minutes per session. We did not scout enough SB or CB to exceed our pre-set threshold for flaming. We stopped scouting for SB and CB after the plants started to send out runners and it became hard, if not impossible, to distinguish between plants (see pictures in appendix).

We clipped the fruits for field curing on October 11, 2008 and harvested October 16, 2008 (see pictures in appendix). The harvest of our winter squash was initiated by a county wide frost warning, which would have adversely affected the quality of the curing winter squash. Due to the rush harvest, we were not able to weight the squash into the categories proposed.

6. **Results**

Similarly as reported in our interim report, in the 2008 experimental year we did not flame the trap crop due to a lack of bug pressure in excess of the pre-set flaming thresholds. The continued very low SB and CB pressures at our farm were unexpected – discussions with our technical advisor and others suggested that we could expect increased bug pressures in our 2nd growing year on the farm. However the 2008 scouting results indicated that SB and CB populations were similar in both years.

In low bug pressure situations, direct seeding of winter squash works excellent, and saves a tremendous amount of labor and space in the propagation greenhouse. Our main objective of planting later in the season than we used to do was to reduce the time between harvest and winter squash distribution to our CSA members, but the higher soil temperatures probably also helped the quick germination and strong growth of our winter squash planting (making the plants possibly less susceptible to SB and CB infestation).

7. **Conditions**

This was our second year growing vegetable crops on our new farm. In 2007, we grew the first cucurbits on the farm. During our 2007 experiment, we noted very small populations of CB and SB. 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).

We experienced a significant rain event during the 2nd week of July, 2008. We measured 7 inches of rain in less than 1 week (with one rainfall event of 2 inches in 1.5 hours), resulting in excessive wetness in all fields. We did not notice any adverse effects to our control and experimental planting of winter squash.

**8. Economics**

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 distinguish between the different winter squash varieties. In 2007, we scouted 8 times, with an average time of 10 minutes per session, in 2008, we scouted 6 times

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 (i.e. flaming, or spraying).

5. PTC may give you an opportunity to control a first influx of CB and SB in a winter squash crop. Our success with growing winter squash on our farm has given us the confidence add this crop to the extended CSA season we are offering our members for 2009 (to 22 weeks, from 20 weeks in 2007, and 21 weeks in 2008). With a 200 member CSA, and a ‘per week’ membership fee structure, this adds to the farm income.

6. In our grant proposal we described the hand picking we used to do on our previous farm to control for SB and CB, which took over 1 hour/day with two people in the peak of the SB and CB season. At our new farm, this activity is no longer necessary.

7. Direct planting saves labor and space in propagation greenhouse. Field germination of winter squash seems unproblematic when soil temperatures are quite high.

**9. Assessment**

In this project we attempted to control SB and CB with PTC and flaming. We anticipated similar bug pressures as historically encountered on our previous farm. While growing the same winter squash variety as our cash crop, the bug pressure on our new farm has been very low to negligible.

We think that the low bug pressure may be a result of the following:

A. We took into vegetable production haying fields, (for the 2007 experimental year), with a low or non-existent historic population of SB and CB;

B. Crop rotation may have resulted in low SB and CB pressures for the 2008 growing year on the same farm;

C. Soil health issues. Producing vegetables on marginal soils (i.e. clay type soils) results in a multitude of problems. Even if you start off with healthy transplants, marginal soils may not be conductive to maintain optimum plant health. Poor plant health may result in increased attraction of bugs – and poor quality vegetables (if any).

This experiment, as much as we didn’t have a chance to try our flaming method, demonstrated the importance of selecting the best soils reasonably available for commercial vegetable production. In combination with an emphasis on soil testing to set a benchmark for the soil chemistry on the farm (and to maintain or improve on this benchmark), and substantial crop rotations seem important factors for plant health. Creating a healthy environment for crops may help these crops use their natural defenses against bugs – how these plant defense mechanisms work remain poorly understood, but from a farm economic perspective it could be quite cost effective (considering off-farm inputs and labor) to maintain optimum growing conditions given the soils on is working with, than it is to intervene during the season with flamers, pesticides, etc.

10. **Adoption**

We are not planning on continuing the PTC experiment/growing practice at this time at our farm. The space available to crop rotation offers ample opportunity to avoid the small SB and CB populations build up from the previous growing year. We are managing our silty loam soils carefully (soil testing, cover crops, rotations) to maintain a healthy soil – which seems to deter bug infestation.

To prevent bug problems from the start is a time saver over interventions like the control of bugs in the trap crop, hand picking etc.

**11. Outreach**

Because of the unexpected circumstances surrounding our experiment (the almost non-existent bug pressure), we never had the opportunity to try the flaming on our trap crop, nor were we able to gather results comparing the trap crop experiment with the controls. We planned on an on-farm workshop in our grant proposal, and presentations at some seminars/conferences. For lack of any presentable results regarding the trap crop experiment, we did not do formal outreach. However, we informally disseminated our findings with this experiment to the farmers in our network.

**12. Report Summary**

With this project we proposed to study the effectiveness of perimeter trap cropping in winter squash using a backpack flamer to control for squash bugs and cucumber beetles. We planted our Avalon butternut market crop within the trap crop for two seasons. One season, the trap crops were Blue hubbard and Burgess buttercup, the other season, burgess buttercup only. Our control consisted of a market crop of avalon butternut. We scouted weekly for squash bugs and cucumber beetles, but in neither year the number of scouted bugs triggered flaming. The combination of prime farming soils and well maintained soil health, and historically low bug pressures may have prevented intervention. Selecting prime farm land for a vegetable operation, and maintaining healthy growing conditons through soil testing and a thorough soil health management plan may be economically advantagous compared to an interventionist approach for matters of purchased off-farm inputs and related labor expenses.

Raymond Luhrman March 12, 2009