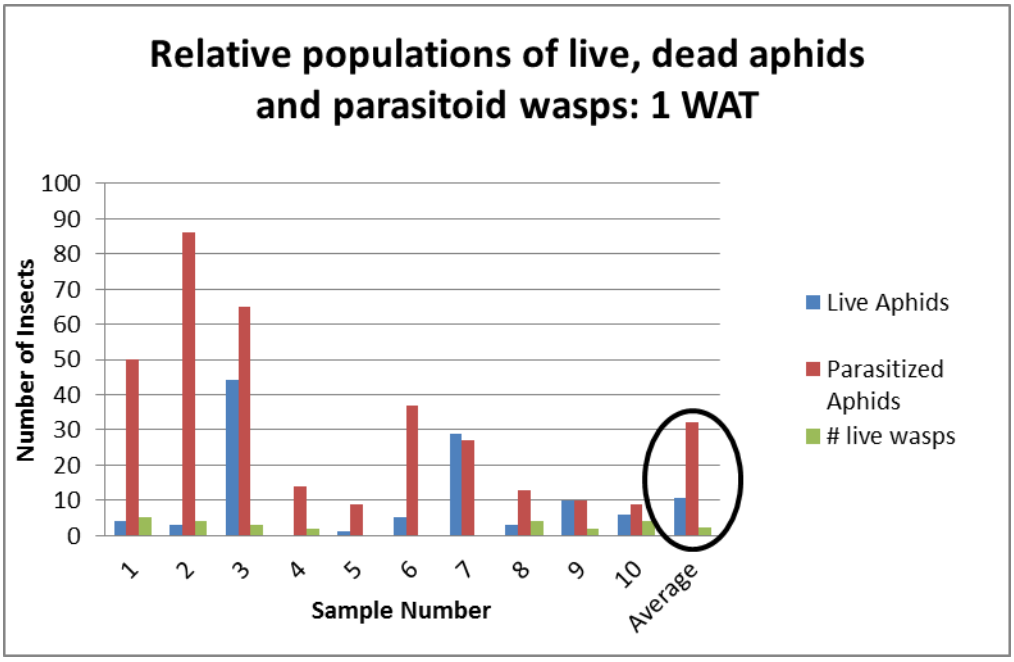
Preliminary Farm Summaries, Fall 2013
Project Title: Sustainable Pest Management in High Tunnel Winter Greens Production

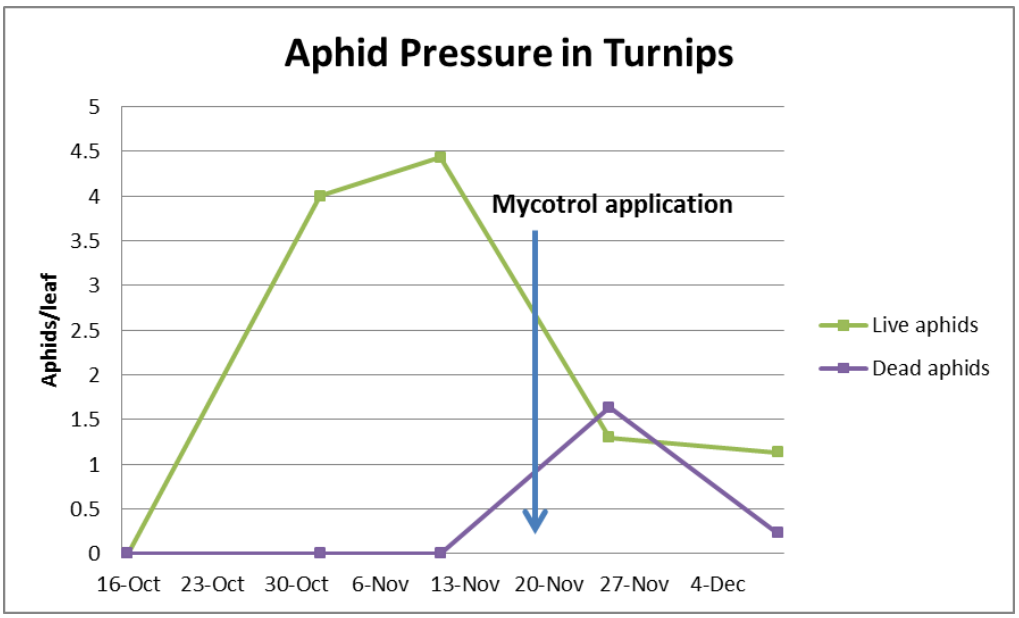
Farm 1: Phelps, NY
Scouting began: September 4
Crops: Onions, Spinach, Arugula, Tatsoi, Leaf Lettuce
Pests: Thrips, Caterpillars, Slugs, Aphids, Leaf Minor, Flea Beetles
Controls:ACE Mix (500 count) parasitoid wasps from Syngenta, Mycotrol O (1.5 tsp for 1 gallon of spray volume)

Scouting began at Andy's farm on September 4, 2013. Initially, a fall planting of onions, spinach, arugula, tatsoi, and leaf lettuce was in place. Flea beetles were causing damage to the spinach and **there was a large aphid population in the tatsoi, which was under floating row cover**. No controls were implemented for the flea beetles. To control the aphid population parasitoid wasps (ACE Mix from Syngenta, 500 count: *Aphidius colemani, Aphidius ervi, Aphelinus abdominalis*) were ordered and released under the floating row cover. 1 week after the release, the number of parasitized aphids was on average 3 times greater than that of living aphids per plant. Wasps were present at an average of 2.4 per plant.



No aphids we detected in the tunnel on October 1st, at which point the house contained onions, 2 plantings of spinach, and two rows of leaf lettuce. The floating row cover was shaken out in the house, to encourage wasps to go elsewhere in the house. However in mid-October, there was a reappearance of aphids in the house. One lettuce plot showed an average of .47 aphids per plant. By early November, the hakurei turnips (now under the floating row cover in place of the tatsoi) had 4 aphids per leaf. Mycotrol-O (*Beauveria bassiana* Strain GHA) was recommended and applied to the entire house at a rate of 1.5 tsp per gallon of spray volume (75% of maximum label recommendation) on Nov 20. Scouting

on the 25th of November showed decreased numbers of live aphids and an increase in the number of dead aphids scouted. A second application of Mycotrol has not been made.



In early October there was some light caterpillar feeding in one spinach plot and light slug feeding in another spinach plot, but the low level of damage, combined with a rapidly approaching harvest date, did not necessitate treatment. There has been no significant slug or caterpillar feeding since then. Thrips counts in the onions steadily declined from the beginning of October through mid-November, at which point they were no longer present. Some leaf miner damage was present in the spinach at the beginning of November, but the problem did not intensify and reach a level that required treatment.

Farm 2: Ontario, NY
Began Scouting: September 4
Crops: Lettuce Mix, Spinach
Pests: Caterpillars

Scouting for this site began in early September, at which point the only pests were a few aphids on tomatoes, lambsquarters, and sowthistle. The houses (House 1 and House 2) were scouted again on September 16 and October 16 and only a few aphids were found in House 1 on lambsquarters in September. The first scouting of greens occurred on November 12. House 1 was seeded with a lettuce mix in 3 separate plantings. 3 of the plots had areas of poor emergence. One of those plots (labeled SMO3) was caused by damping off pathogens, which continued to cause losses on November 25 and December 9. Some caterpillar frass was noted in one plot on November 12 and November 25 but there has been no feeding. The youngest planting of the lettuce mix has a few cold spots where the seedlings won't survive. In general, it was noted that it was wet and cold in House 1 on December 9. There was standing water in the house on this date.

House 2 has not been scouted yet, though it was being planted with spinach transplants on December 9. It was noted that slugs were present in the transplant house. The grower sorted through the transplants

and discarded any that were overly damaged. The grower also plans to use iron phosphate bait at the time of planting to prevent carryover of slugs from the transplant house to House 2. No controls have been implemented.

Farm 3: Alden, NY
Scouting Began: October 21
Crops: Spinach, Swiss Chard, Hakurei Turnips, Kale, Pak Choi, Mixed Brassicas, Arugula
Pests: Caterpillars, Slugs

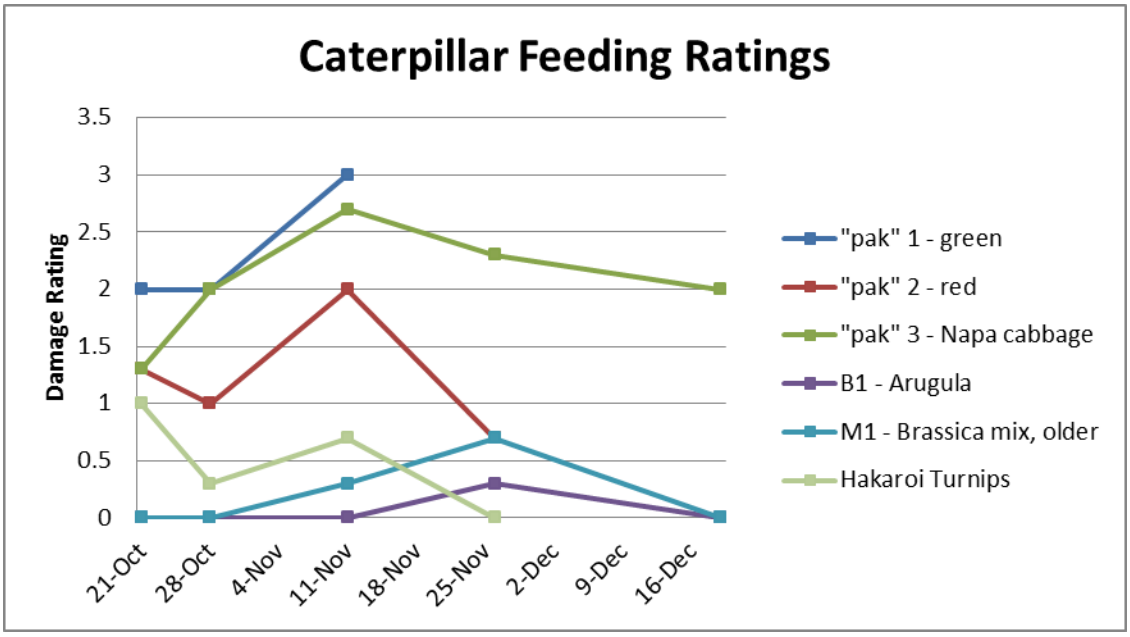
This is a brand new house and the crops scouted this fall were the first crops it has ever seen. When scouting began on October 21 there was some very light slug feeding on the kale, spinach, turnips, and pak choi. The feeding in all crops appeared to be old and well-healed. The damage occurred in the transplant house. In the pak choi, occasionally one head would have new caterpillar damage and caterpillar frass.

On October 28 the pak choi showed more signs of feeding by caterpillars and slugs. The damage rating in plot 3 increased from 1.3 (very light) to 2 (light). The other plots on this date had damage ratings of 1 (plot 2) and 2 (plot 1). Only one caterpillar was found across the pak choi plots (30 plants) on October 28, but on November 11, a total of 11 caterpillars were found across 30 plants. Damage ratings were highest at this site on November 11, coming in at 3 (plot 1), 2 (plot 2), and 2.7 (plot 3). The pak choi was showing signs of yellowing at this point, and in plot 3 70% of the heads had caterpillar frass on them. 2 weeks later on November 26, plot 1had been harvested, plot 2 had only 4 plants remaining, and plot 3 had caterpillar frass on 100% of the plants. On December 19, plot 2 had been harvested completely and plot 3 received a damage rating of 2, with some very wilted Napa cabbages. Nothing has been done to control the caterpillar population in the pak choi, though it should be noted that the damage was on the whole, less severe than the rating. There were a few heads in each plot with severe damage and the rest of the heads still marketable. The beds next door to the pak choi plots also showed slight signs of caterpillar feeding. The arugula, older planting of the brassica mix, and hakurei turnips all had very low, varying caterpillar and slug feeding ratings through the month of November. These ratings will be something to keep an eye on.

Aside from caterpillar and slug pressure, cold temperatures and high moisture were the most damaging to the crops in this house. On November 11 the kale had a little cold damage. On November 26 a few leaves in the arugula were rotting. Plot 1 in the spinach had rot on a few stems. Again, cold damage in the kale was noted. On December 19 it was noted that the floating row cover was quite wet underneath on the shaded side of each bed. The arugula had been harvested and showed some decay in leaves that were injured by cutting and the cold temperatures. Also on this day, several of the crops were wilted from being dry and cold. The Napa cabbages in the Pak choi, as mentioned before, as well as the mixed brassicas, kale and swiss chard were wilted because the grower chose to use low turgor in the plants to reduce freezing damage potential.

The spinach has been showing feeding damage since scouting began. Initially, it was believed to be slugs. By November 11, slugs were suspected but it was difficult to be sure who the culprit was. On November 26 it was suspected that crown mite was doing the damage, but by December 19 it was again

unclear. The damage seems to occur when leaves are young, but not as early as a crown mite would. A small grey worm was found in the midst of a leaf that was fed upon.

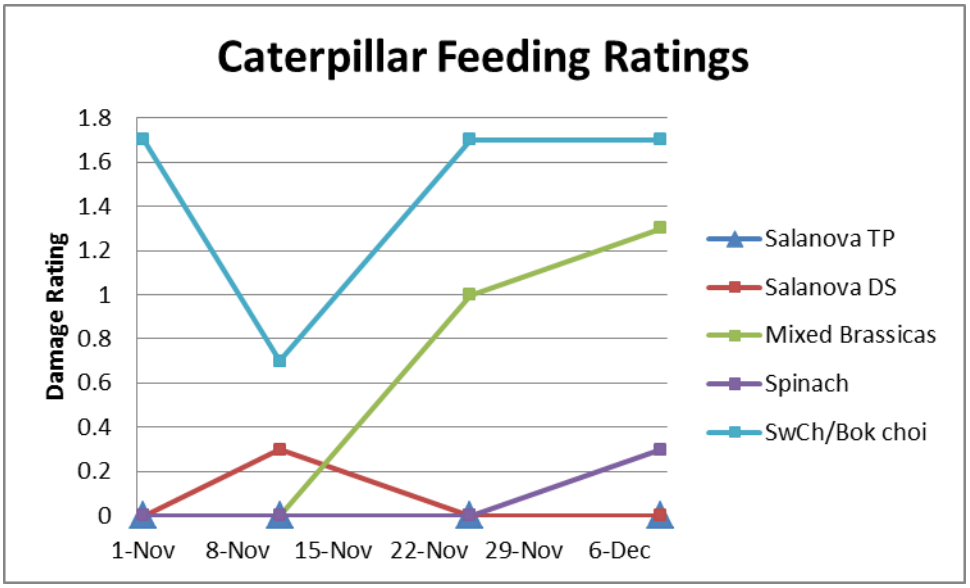


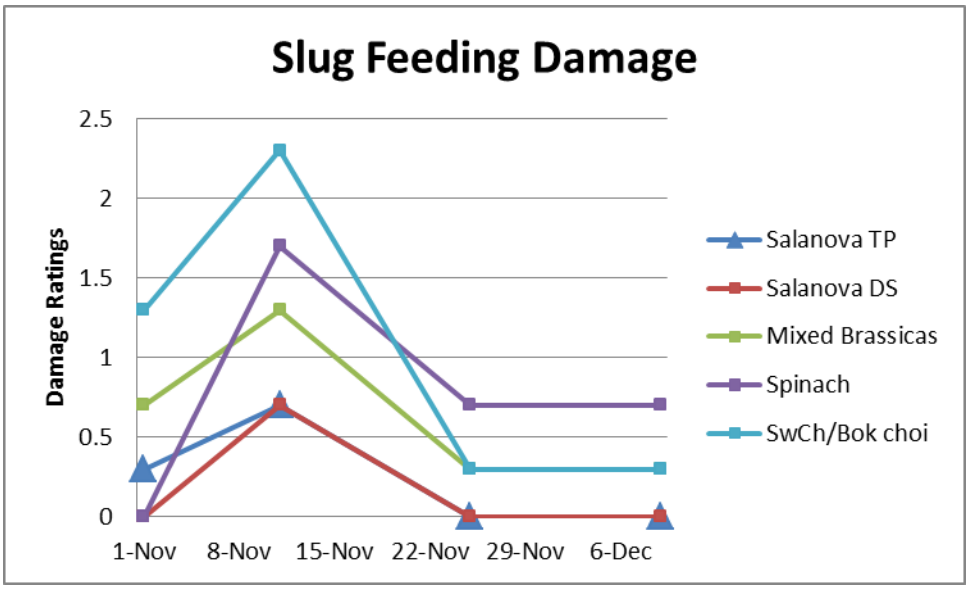
Farm 4:Canandaigua, NY
Scouting Began: September 4
Crops:Salanova Lettuce, Spinach, Mixed Brassicas, Swiss Chard, Pak Choi
Pests**:** Aphids, Caterpillars, Slugs
Controls:Sluggo

When scouting began on September 4, a few aphids were noted as being in the house. On September 16, no aphids were noticed. The Salanova transplants were in place on the 16th, but they were free of any pests or disease. The house was not scouted again until October 15, at which point there was a little slug activity on the planting of Swiss chard and Pak choi, which were in the same bed. The house was clean otherwise. Sluggo (iron phosphate) was applied to the house on October 29. The grower used two 1lb bags for his entire house.

The Swiss chard/pak choi bed really received the worst of the caterpillar and slug damage. On November 1st this bed received a damage rating for caterpillars of 1.7 and it has mostly remained consistent. The same date this bed also received a slug damage rating of 1.3, which went up to 2.3 by November 11, and went down to .3 on November 25 and December 9. The Swiss chard has consistently been more damaged than the pak choi. There have been no aphids in this plot.

All of the crops other than Swiss chard/pak choi mix, which includes Salanova transplants, Salanova direct seeded, mixed brassicas, and spinach, have not received slug or caterpillar feeding damage ratings which cumulatively exceed 2 (light feeding). Slugs, caterpillars, and aphids do not seem to be big concerns this year. There was, however, a markedly high slug count in the Salanova transplants on December 9, coming in at 4 slugs. It is something to keep a watchful eye on.





Some exposure to the cold is making some of the Salanova lettuce rot. On November 25 it was noted that there was snow along the edges of the house and there was some frost on the tips of many crops' foliage as well as on the underside of Salanova transplants. On December 9, 30% of the Salanova transplants scouted had bottom rot and there was a little rot present in the direct seeded Salanova. The grower is heating this house to keep it at about 31^0-32^0F and is not using floating row covers to cover the crops.

Farm 5: Canandaigua, NY

When Scouting began: September 4

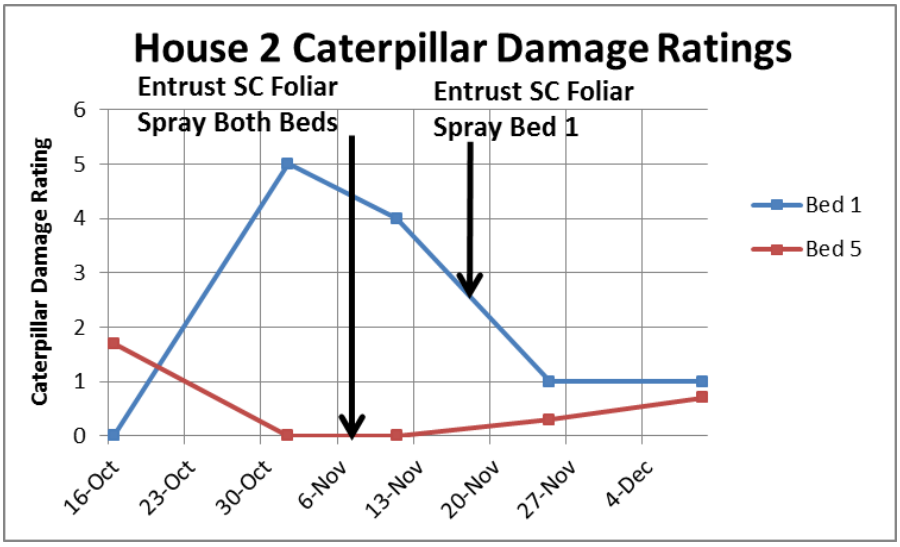
Crops: HOUSE 6- Tomatoes, Peppers, Green Kale, Red Russian Kale, Lettuce Mix, Spinach, Radishes
HOUSE 2- Carrots, Bok Choi, Radishes, Lettuce Mix

Pests: Caterpillars, Slugs, Aphids

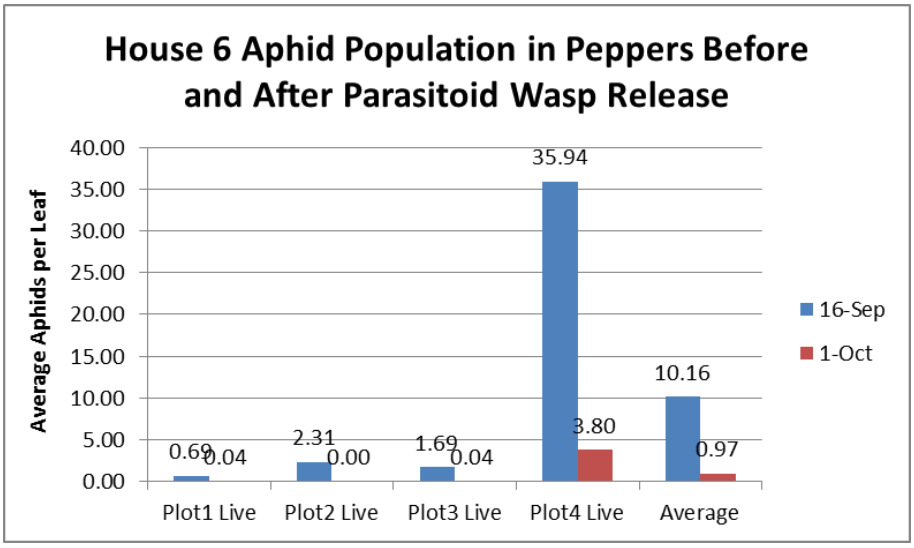
Controls: ACE Mix Parasitoid Wasps (Syngenta), Entrust SC Foliar Spray

House 2 was initially planted with lettuce, kale, and radishes and was free of any pests when it was first scouted on September 4. It was free of pests again on September 16th, though it was noted that there were 3 very wet beds on the west side of the house. Uneven watering has been present in this house every time it has been scouted, with a tendency toward heavier watering on the two outermost beds and in the center. On October 1 it was noted that the tunnel was particularly wet at the North end and in the isles. On this date it was clean of pests again.

Caterpillars and subsequent damage were recorded on October 16. The damage was particularly bad in bed 5 on October 16 and in bed 1 on November 1. Entrust SC (spinosad) was applied at a rate of 3g per 4 gallons of spray to help control the population. Bed 5 received 1 spray on November 7 and bed 1 received 2 sprays on November 7 and November 18. The amount of new caterpillar damage sustained by each plot went down. It is important to note that these damage ratings are based on cumulative caterpillar damage, so the fact that ratings dropped indicates that the plants grew out of their damage and put on new foliage. In bed 1 the rating was dropped from 5 (heavy/severe) to 4 (significant/substantial) within a week of application on November 11 and was down to 1 (very light) by November 25 The damage rating has remained at 1 in bed 1 through December 9. In the case of bed 5 the damage rating was actually lowered from 1.7 (lightly damaged) to 0 (no damage) a week prior to the application of the Entrust on November 1. Bed 5's rating remained at 0 for the week following its only Entrust application but began to increase when it didn't receive another application. On November 25 bed 5 saw a rating of .3 and on December 9 a rating of .7. Aside from caterpillars, House 2 has seen no significant damage from any other pest. There was one area of severe rot in the lettuce mix noticed on December 9.

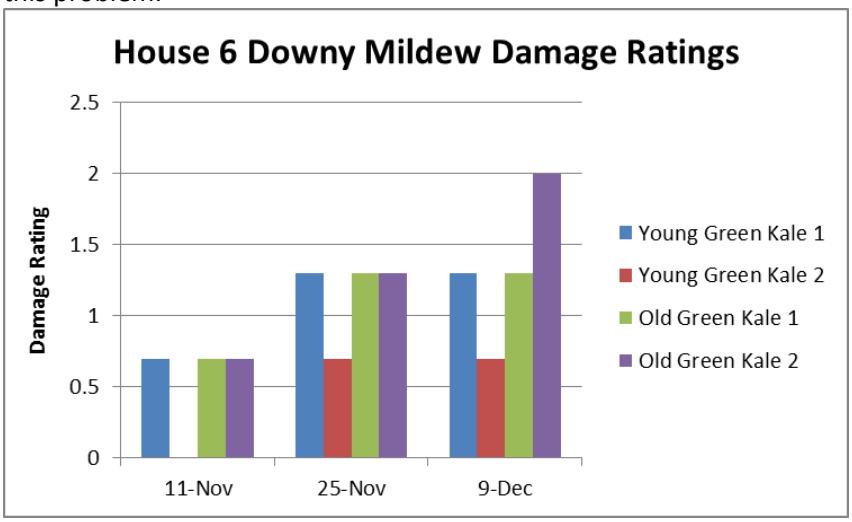


House 6 was initially planted with peppers, tomatoes, lettuce, kale, and radishes. There were aphids present in the peppers and parasitoid wasps (ACE Mix from Syngenta, 500 count: *Aphidius colemani, Aphidius ervi, Aphelinus abdominalis)* were ordered to help control the population. On September 10th the wasps were released. On September 16 the average number of aphids per leaf was recorded at 10.16, and on October 1 that number was .97 per leaf. It should be noted that ladybeetles and larvae were present on the peppers on September 16 and that they likely played a role in the reduction of aphid numbers in this tunnel, as there were also many aphid mummies present on September 16.



By the 1st of November, House 6 was planted with two plantings of green kale, two plantings of red Russian kale, spinach, radishes, and two rows of a lettuce mix. This house has been relatively free of pests and there was no carryover of aphids from the peppers into subsequent winter plantings. There are a few issues to note, however, as they will impact the profitability of the crops in this house. The row containing the radishes and spinach is affected by high moisture and cold temperatures. It was noted that some of the spinach had very poor stand on November 1. On December 9 it was noted that some of the spinach was very wet and chlorotic, and that the radishes were stunted and chlorotic from the moisture and temperature. Nothing has yet been done to remedy this problem. There are a few spots in the lettuce where damping off was a problem (noted November 1) which has led to rot (noted until November 25).

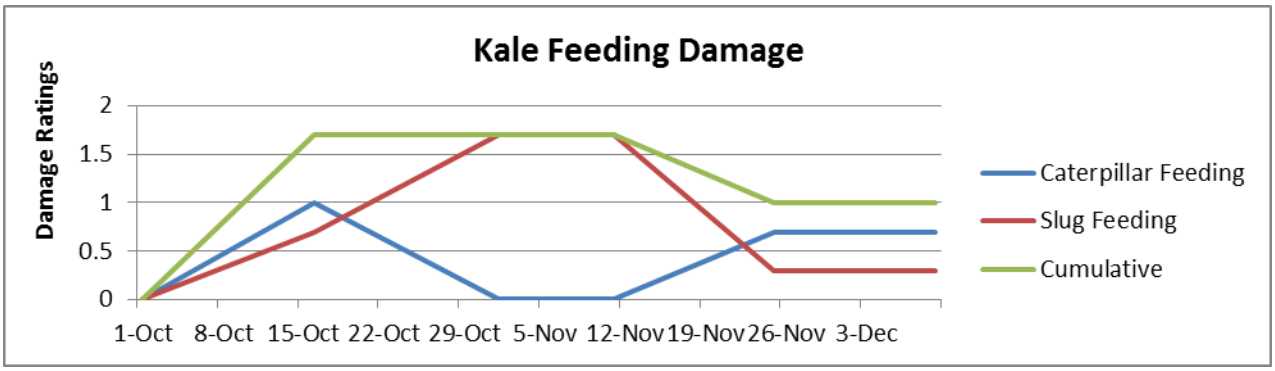
The major concern in House 6 this fall is downy mildew. It was first noted on November 11 in both the younger and older plantings of green kale. The downy mildew symptoms were most pronounced on senescing cotyledons, but were also present on some canopy leaves. Since November 11 the downy has stayed only in the green kale, but the damage level has increased. Nothing has been done to remedy this problem.

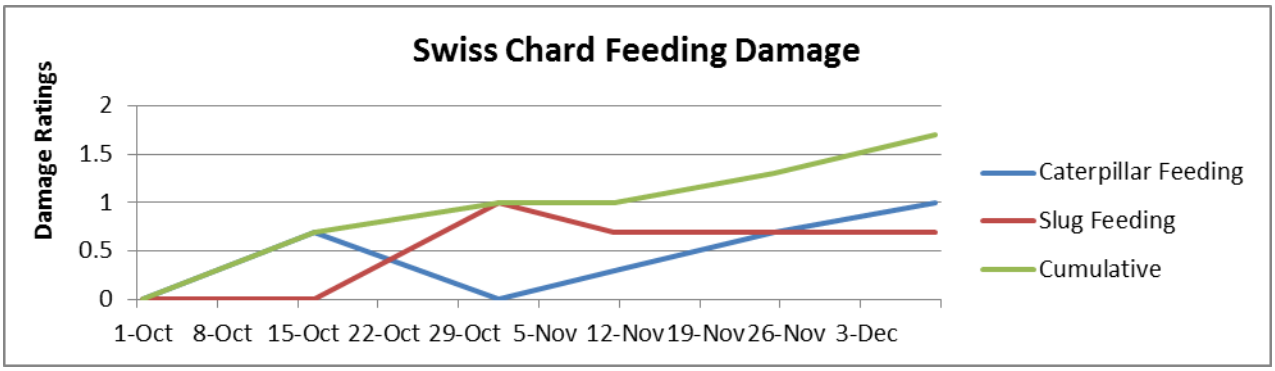


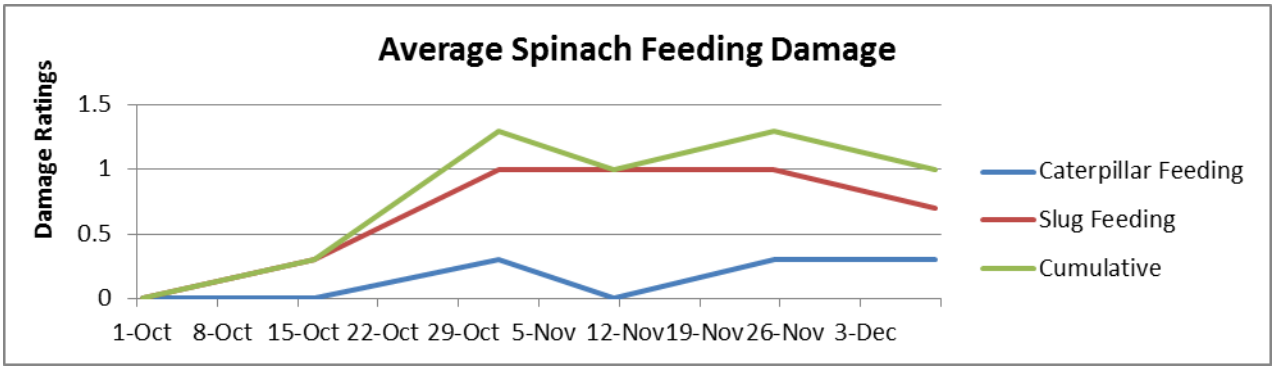
Farm 6: Clyde, NY
Began Scouting: September 16
Crops: Spinach, Kale, Leaf Lettuce, Swiss Chard, Beets
Pests: Aphids, Caterpillars, Slugs
Controls: DiPel

Scouting at this farm began on September 16. The tomatoes had just been taken out of the house and were generally pest-free save a few aphids. Chickweed has been present in the house since November 1. It has noticeably hindered growth of the spinach, where it is most prevalent. The grower is selling the chickweed as an edible, so no action has been taken to control its growth. There is cercospora in the beets and swiss chard, but it is not so severe that it necessitates treatment.

On October 1, 9 of 10 plants in the kale plot had cabbage worm complex, imported cabbage worm, diamondback moth, or cabbage looper, which increased the caterpillar damage rating on October 16 from 0 to 1. DiPel (Bacillus thuringiensis, subsp. Kurstaki, strain ABTS-351) was applied to the entire house once between October 1 and October 16. The caterpillar damage for crops throughout the whole house has not exceeded a rating of very light. On November 25, 7 out of 7 scouting plot showed signs of caterpillar feeding, which was an increase from November 11 when only 3 of 8 plots showed signs of caterpillar damage. On December 9, 4 of 7 plots showed caterpillar feeding. Slug feeding ratings in the house have been a bit more severe. In the kale, the slug feeding reached a high of 1.7 on November 1 and 11. This was the highest in the whole tunnel. The cumulative damage ratings (slug and caterpillar) have not exceeded 2 (light) in any of the crops.

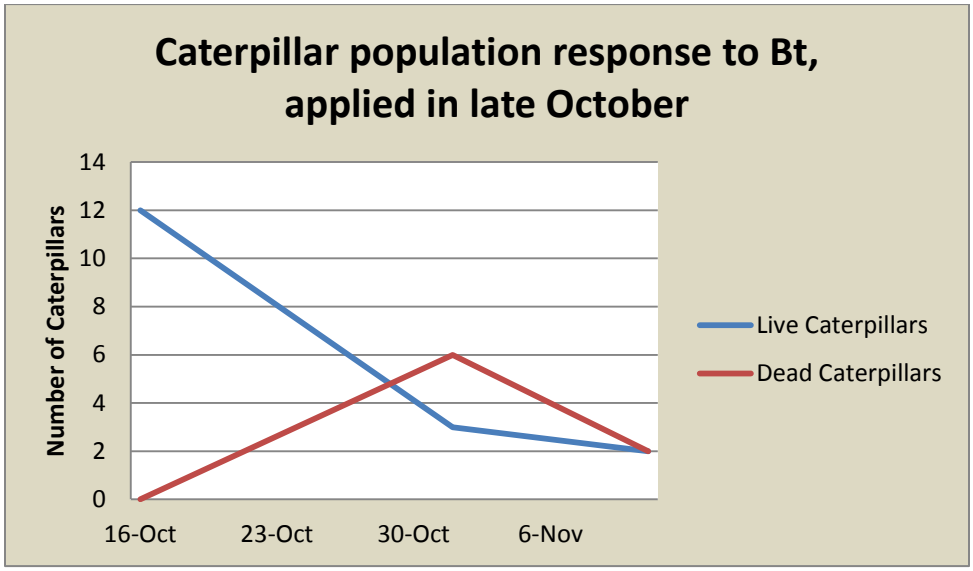




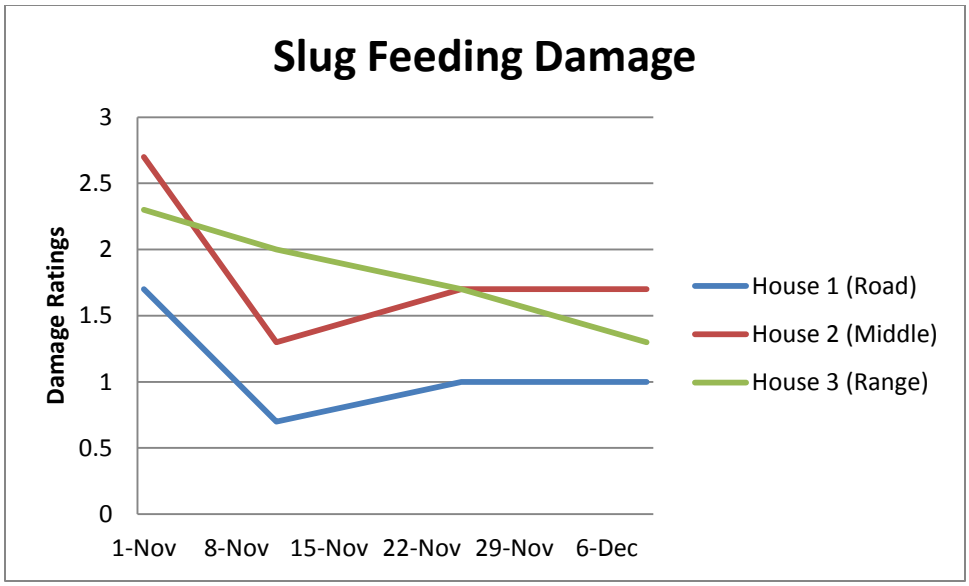


Farm 6: Bellona, NY
Began Scouting: Late August
Crops: Kale
Pests: Caterpillars, Slugs
Controls: DiPel (Bt), sluggo (iron phosphate bait)

Three small high tunnels ('Road', 'Middle', and 'Range') are being scouted at this farm, with each tunnel serving as one plot. Caterpillars and slugs were present in all three tunnels this fall. Cabbage attacking caterpillars (Imported cabbage worm, diamondback moth, cabbage looper) were the worst in the 'Road' tunnel, with many caterpillars found on plants in mid-October. The grower treated with Bt in late October, and the caterpillar population decreased. However, pupating caterpillars were present on Nov. 1, and caterpillars were still found on Dec 23, indicating that lepidopterans can continue to complete their life cycles in cool fall conditions.



Slugs are the major problem in the other two houses. The grower applied iron phosphate bait to address slug feeding in early November. Slugs concentrated underneath the weedmat, which provided ideal habitat. Management of slugs may be difficult because of the weedmat refuge.


Slug Feeding Damage
Damage Ratings
3
2.5
2
1.5
1
0.5
0
1-Nov
8-Nov
15-Nov
22-Nov
29-Nov
6-Dec
House 1 (Road)
House 2 (Middle)
House 3 (Range)