



Research Report: Managing Cabbage Aphid in Brussels Sprout, 2016

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Background & Objectives

From 2013 to 2015, we performed experiments comparing different varieties of brussels sprouts as well as different topping practices. For a full description of that work, visit https://extension.unh.edu/resources/files/Resource003914_Rep5563.pdf. During these trials, we experienced severe infestations of cabbage aphids. Although our research did not focus on the aphids, they were quite a nuisance and rendered most sprouts unmarketable. From conversations with growers in the region, we came to realize that many growers, especially organic growers, were struggling with cabbage aphid management. We decided to conduct a study to compare two different methods of managing cabbage aphids: **intercropping with beneficial flowers** and using a rotation between **two organic insecticides**.

The goals of this study were to:

- 1) Compare the **percent marketable sprouts** using these two control methods
- 2) Observe and compare **insect visitation** of both control methods, focusing on insects that are **predators or parasites of cabbage aphids**.
- 3) Create a **timeline of cabbage aphid levels** throughout the growing season.

Though not specifically tested, we were also able to document the effectiveness of **scouting with economic thresholds** to determine when to apply pesticides.

What we did

In 2016, we evaluated three different strategies to manage cabbage aphid in Brussels sprouts: 1) nothing, 2) organic insecticides, and 3) interplanting with a mix of flowers. We hypothesized that mixing flowers in with the Brussels sprouts would provide some control of cabbage aphid levels on the sprouts by attracting insect enemies of the aphid. We also hypothesized that scouting and spraying the sprouts would provide some control. Each treatment was repeated four times throughout the field, which was a field of solid Brussels sprouts (cv. Diablo) slightly greater than ¼ acre. Each plot was 13 plants long and 3 rows wide. The treatments were laid out as follows:

	flowers		organic		flowers		control
	organic		control		control		flowers
	control		flowers		organic		organic



Layout of the Brussels field on August 5th, showing the 12 total rows.

The first treatment was the control, where no form of aphid control was applied. The second treatment was a rotation of two organic insecticides, insecticidal soap M-pede (Gowan Company, Yuma AZ) and Azera (Valent, Walnut Creek CA). These insecticides were applied when thresholds were met through the scouting protocol put forth by the University of California's Statewide Integrated Pest Management Program, found at <http://ipm.ucanr.edu/PMG/r108300811.html>.

The third treatment was polycropping the Brussels sprouts with a variety of flowers: alyssum, borage, marigold, phacelia, and cilantro. These flowers were planted in random formation in the middle row of each of the four flower treatments.



Flowers on August 5th, showing the marigold, alyssum, phacelia, and borage.

Planting Dates. The Brussels sprouts (cv. Diablo), were seeded on 5/20/2016 and kept in the UNH MacFarlane greenhouses until transplanted into the field on 6/21/2016. The alyssum, borage, and dill were also seeded on 5/20/2016. The phacelia and cilantro were seeded on 6/2/2016, and all flowers were transplanted on 6/27/2016.



Cultural Details. The field was fertilized prior to planting based on soil test recommendations, with 120 lbs/acre of N and 150 lbs/acre of K₂O using a combination of 27-0-0 and 0-0-22. The Brussels sprouts were planted 18 in apart in single rows into 1 mm embossed black plastic mulch. Beds were laid with 6 feet between bed centers. We irrigated via drip irrigation for approximately two hours based on feel of the soil, which typically resulted in irrigation 2X per week. We scouted for caterpillars and controlled them with Bt (Dipel DF, Valent USA) when necessary. For scouting protocol, see <https://nevegetable.org/crops/insect-control-3>. This resulted in 6 applications of Bt during the season at a rate of 0.5 lbs/acre.

Organic Spray Treatment: We scouted for aphids weekly and sprayed when the aphid levels met the economic thresholds described by University of California’s IPM resources. Below is a table of our history of pesticide applications to control cabbage aphid:

Insecticide	Date	Amount Sprayed (Dilution)
Azera	7/19/16	2.5 oz (2 oz/gal)
M-pede	9/13/16	7.5 oz (2.5 oz/gal)
Azera	9/28/16	8 oz (2 oz/gal)
M-pede	10/7/16	10 oz (2.5 oz/gal)
Azera	10/12/16	10 oz (2 oz/gal)
M-pede	10/20/16	10 oz (2.5 oz/gal)
Azera	11/2/16	10 oz (2 oz/gal)

Data Collection. We collected data every other week beginning on Aug 3rd, until Nov 4th on the number of aphids and all other insects observed on the Brussels sprouts as well as on the flowers. We sampled 6 leaves (2 lower, 2 middle, 2 upper) on 6 plants per plot. We also rated the health of the Brussels sprout plants and the flowers during this data collection. On Nov 11th we sampled 6 plants per plot and, for each plant, recorded the percentage of sprouts that were infested by aphids, had a few aphids that could be wiped off, or were free of aphids.

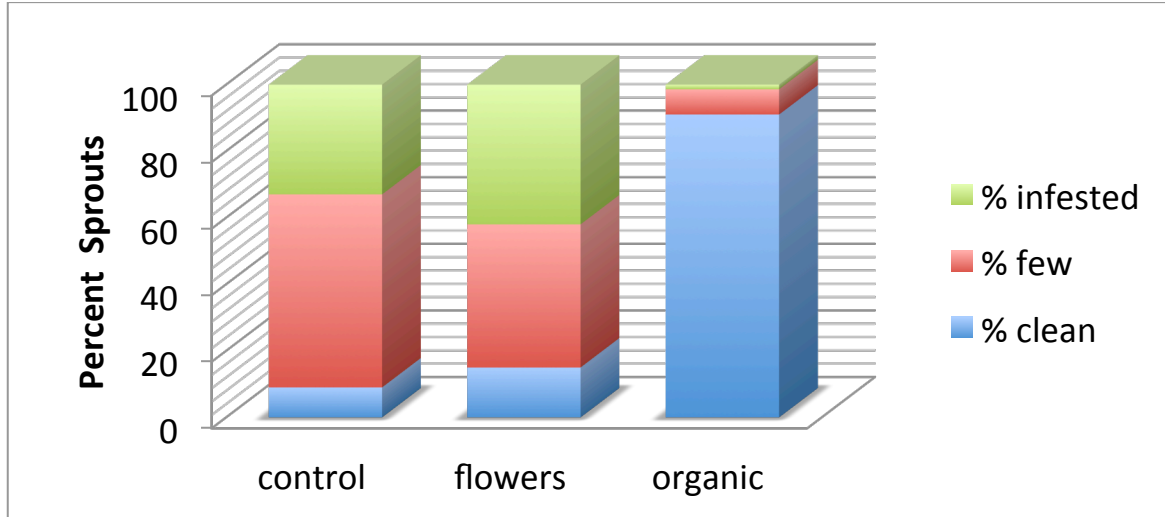


The above photo shows extremely infested sprouts. Photo credit: Alan Eaton, IPM Extension Specialist and professor at UNH.



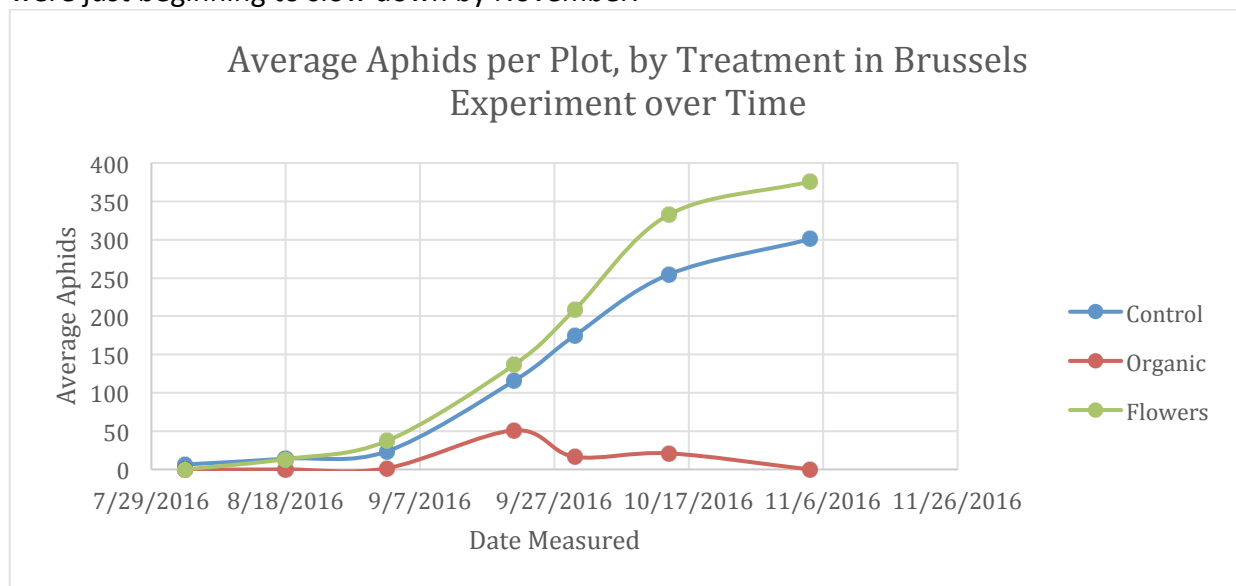
Results and conclusions

The plots controlled by a rotation of organic insecticides showed very good control of aphids, while the plots with beneficial flowers or no pest control were very infested by aphids by harvest time in November.



This graph shows that the plots controlled by organic insecticide had greater than 80% clean sprouts at harvest time. Both the flower plots and the control plots had fewer than 10% clean sprouts. It also shows that with light cleaning, about 90% of the sprouts in the organic insecticide plots were marketable. The control plot yielded 58% of the sprouts marketable with light cleaning, and the flower plot yielded about 43% of the sprouts marketable with light cleaning. Unfortunately, the plots with flowers actually attracted slightly more very infested sprouts than plots without the flowers. However, the difference was not statistically significant.

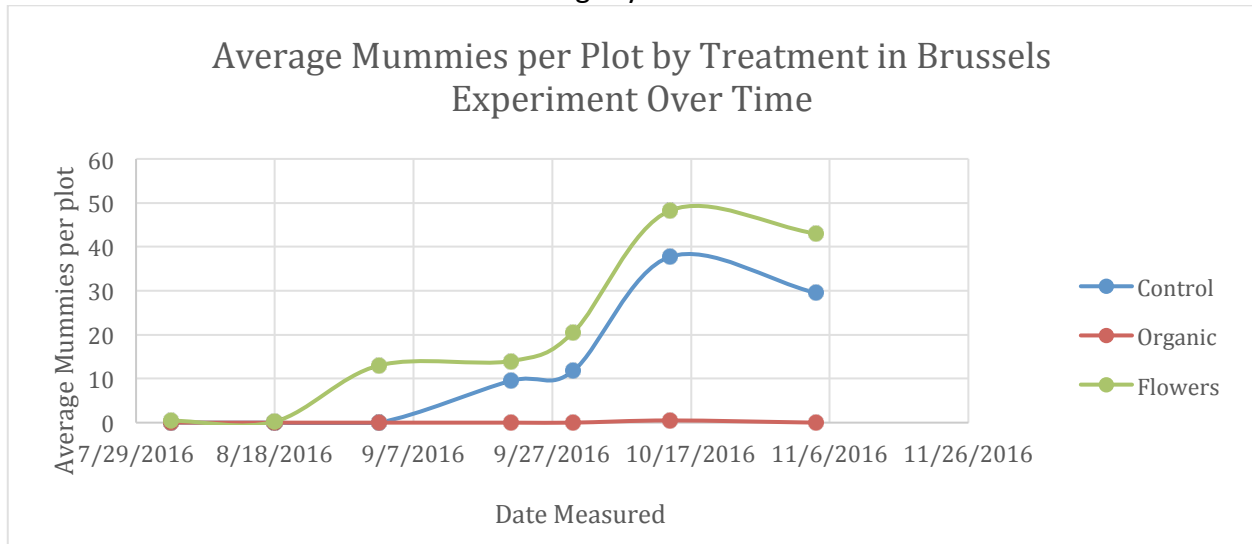
Cabbage aphid numbers increased quickly starting around the beginning of September, and were just beginning to slow down by November.





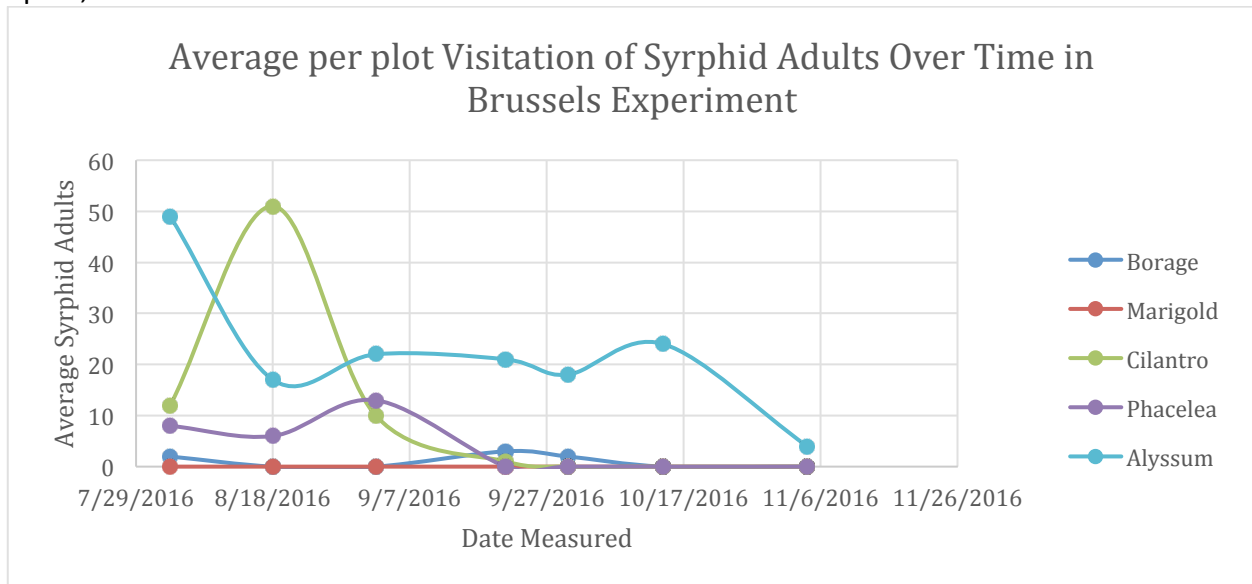
The graph above shows how much of a difference the organic insecticides made on the number of aphids found in each plot. Especially by the middle of September onwards, the insecticides were really working. As the graph shows, the plots with the flowers actually had slightly more aphids than the plots with no method of aphid control.

Although the flowers did not lower the number of aphids on the brussels sprouts, they did increase the number of beneficial insects slightly.



The above graph shows that the flower plots consistently had more parasitized aphids, or “mummies”, which are caused by the parasitic wasp *Diaratiella rapae*.

Out of the five species of flowers that were planted to attract insect enemies of the cabbage aphid, three were much more effective than the other two.



The above graph shows that the alyssum flowers attracted the most syrphid flies, a predator of cabbage aphids. The cilantro and phacelia also attracted a decent number, but stopped flowering then died early in the season.



Take home messages

Rotating organic insecticides Azera and M-pede controlled cabbage aphids on Brussels sprouts very well. Scouting once a week and spraying when threshold levels were reached based on University of California's chart (<http://ipm.ucanr.edu/PMG/r108300811.html>) appears to be key to controlling aphids. Scouting only took us about 30 minutes every week.

Flowers did not reduce the amount of infestation of Brussels sprouts, and did not seem to be a good method of aphid control. However, the flowers did attract more insect enemies of aphids, notably parasitic wasps and syrphid flies. The most effective flowers were the alyssum, cilantro, and phacelia. The alyssum attracted the most syrphid flies. If the cilantro and phacelia had been planted multiple times in sequence plantings, they may have kept flowering and attracted more insect enemies.

Cabbage aphids seemed to really start multiplying at the beginning of September. The aphids multiplied very quickly from early September until mid-October. Although growth rates slowed in mid-October, aphid numbers continued to rise into November.

Future Research Questions

Our research raises several questions for future research:

1. Would different arrangements of the flowers in relation to the Brussels sprouts (within, or even outside the plots) provide higher rates of parasitism of aphids?
2. Would different combinations or larger numbers of flowers provide better control?
3. Would different planting times for the flowers provide better control?
4. Is a rotation of insecticides necessary for control?
5. Which insecticides are most effective at controlling cabbage aphid?

For additional information, please contact Becky Sideman (becky.sideman@unh.edu, 603-862-3203) or Talia Levy (talia.h.levy@gmail.com).



Sizeable, clean brussels sprouts.



Many of our brussels sprouts were donated to the Cornucopia Food Pantry in Durham, NH.

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