

Implemented Organic Methods

At the Lafayette Organic Garden

Introduction

The one acre Lafayette Student Garden grows vegetables to be served on campus in the Lafayette dining halls. The one acre Lafayette Community Garden is split up into multiple plots for individuals to manage and grow. One challenge to both the student and community gardens are how to deal with pests. In the first two summers at the garden, there were very little problems with pests. However, in the third summer, the summer of 2011, pests appeared. The purpose of this study was to examine how best to manage pests in the student and community garden for future summers.

The main problems for the summer of 2011 were cucumber beetles, vine borers, and squash bugs. These attacked squash and related plants.

There were multiple strategies used for combating these pests. Cucumber beetles and squash bug eggs were first noticed in the garden on July 11th in the cucumber and crookneck summer squash. This is around the time that flowers first appeared on the plants. The methods of pest control tested in this study are described and analyzed below. The most effective methods are described first and the least effective are described last.

Cucumber Beetles

1. Remove by hand

This method is most effective when there are only a few cucumber beetles or when there are only a few plants that the cucumber beetles are on. Cucumber and squash plants should be checked once a week for signs of the beetle. They are most often found in the yellow blossoms and on the stem of the plant. Sometimes they are found feeding on the leaves. If the plants are on bare ground, without mulching, the beetles can sometimes be found on the ground.

Analysis: This is the best method. It is simple and costs nothing other than time. And even that is not much of a commitment in a small garden. Check the plants at least once a week for signs of the cucumber beetles. If they are found, do hand squishing twice a week. If this is done, the problem will most likely not get out of hand.

2. Floating row covers

Floating row covers create a physical barrier between the beetles and the plant. This is assembled, when the cucumber or squash plant is still young, from lightweight summer

garden fabric and wire. The wire is bent into a half circle and placed in the ground over the plant. The fabric is placed over the wire and secured to the ground with rocks or garden staples. It is important that there are no gaps between the fabric and the ground so the beetles cannot sneak in. Mulch, such as newspaper and hay or grass, should be placed around the plant to prevent weeds since it will be difficult to weed with the row cover on. Once the plant begins flowering, the row covers must be removed or the flowers must be hand pollinated. The plants in the row cover should be checked once a week for signs of leaf feeding damage in case some beetles got into the row cover.

Analysis: When done properly and started early, this will keep the cucumber beetles off the plants. It will also keep the plant and soil more moist than plants without the row cover. However, it would be difficult to put row covers on more than a few plants. Even for a few plants, it is initially a labor intensive process. Once the plant begins to flower, the row cover has to be removed or the plant needs hand pollination. Also, this works best on cucumber plants because squash plants get very big and will outgrow the row cover. Cucumber plants tend to be smaller and will do a better job sustaining in the row cover.

3. Neem Oil

Neem oil is a natural chemical made from the neem tree. It kills cucumber beetles on contact and will repel more from arriving. Neem oil concentrate is mixed with water following the instructions on the bottle. It can be sprayed all over the plant or just sprayed where the cucumber beetles are seen. This should be done in the morning when the blossoms are open. If there are still cucumber beetles a week after spraying, it can be sprayed again.

Analysis: Cucumber plants sprayed with neem have less cucumber beetle feeding than plants not sprayed and plants just sprayed with soap. Few dead beetles were found, but the lack of feeding damage is evidence to neem's repellent power.

4. Soap

Soap combined with water is an organic alternative to chemical sprays. The soap works by dehydrating the bug which causes it to die. The ratio should be about 1 tablespoon of soap to a quart of water. The soap used needs to be natural soap, like Dr Bronner's, I used peppermint soap because strong smelling plants like peppermint are supposed to keep pests away. Or, a soap mixture specifically made for pests can be bought. The soap and water mixture is applied either to the entire plant, or just to spots where cucumber beetles are, about once a week. This should be done in the morning when the blossoms are still open. The soap to water ratio can be altered as needed.

Analysis: This method only works if the mixture is sprayed on the cucumber beetles. If there are only a few beetles, it saves a lot of trouble to just hand squish them. This method is best used when there are a lot of beetles or too many plants to check. Its actual effectiveness has been hard to determine. The soap does not eliminate all feeding because it will not necessarily kill all the beetles. But I did find some dead beetles that looked like they could have been killed by the soap.

5. Timings of plantings

Cucumber beetles decline in population as the summer progresses, so planting cucumber and squash plants later in the summer should make the plants less susceptible to attacks.

Analysis: Timings of plantings did not make much of a difference. Cucumber and squash plants sowed in early and late June were being eaten by the beetles. Through August, cucumber beetles are still present in the garden. For the timing method to be effective, the plants need to be sprouting and growing when the cucumber beetles have stopped feeding to overwinter. This might be possible later in the summer, but it would also mean getting cucumbers very late in the summer and growing them in less ideal weather.

6. Garrett Juice

Garrett Juice is organic plant fortifier and insect controller made from compost tea, liquid seaweed, molasses, natural apple cider vinegar and other natural ingredients. The concentrated juice should be mixed with water according to the bottle. It is sprayed on all parts of the plant.

Analysis: Plants sprayed with Garrett Juice have grown better than nearby plants without Garrett Juice. It is unclear whether the Garrett Juice repels cucumber beetles because neither the Garrett Juice plants or the control plants were attacked in that plot.

7. Red dye #28

This dye is phototoxic so the cucumbers that ingest it will die when exposed to the sun. Soak a cucurbit that cucumber beetles like, such as Caserta squash (but I used a cucumber because I didn't have a Caserta squash), in water with a drop of red dye. The red cucumber is put out in the garden near the plants infested with the beetles.

Analysis: This was ineffective. The problem with this test is that I am not sure if I was using the correct dye, but I tried it anyways. No bugs were attracted to eat the cucumber and this was not even necessarily the right dye to kill the bugs. Further testing would have to be done to determine if this works with the proper materials.

Squash Bugs

1. Remove by hand

This method is most effective when there are only a few squash bugs or when there are only a few plants that the squash bugs are on. Cucumber and squash plants should be checked once a week for signs of the bug. The egg masses are most often found underneath the leaves, though they can also be on the tops. Nymphs are found underneath the leaves where they hatched or they might have moved to be feeding on the stem of that leaf. Adults are usually hiding under the low lying leaves or around the base of the plant but can also be found feeding somewhere on the plant.

Analysis: This is the best method. It is simple and costs nothing other than time. And even that is not much of a commitment in a small garden. Check the plants at least once a week for squash bugs. If they are found, do hand squishing twice a week. If this is done, the problem will most likely not get out of hand.

2. Pyrethrin

Pyrethrin is an organic chemical made from the chrysanthemum flower that when applied to the main stem will kill eggs and adults. Pyrethrin was added to water to be used as a spray. It was applied sparingly only to the areas that had eggs and adults.

Analysis: This method is effective, but is a strong chemical and potentially dangerous. It should only be used when all other methods have failed.

3. Timings of plantings

Planting cucumber and squash plants later in the summer should make the plants less susceptible to attacks. Plants in the test plots were planted in early June, late June and late July. The student garden squash were planted throughout June.

Analysis: Many of the early and late June plantings, as well as the student squash plantings, have had squash bugs on them. But they generally had less, so this was moderately effective.

4. Mulching

Mulching around the cucurbit plants with newspaper and hay or grass clippings will make it harder for squash bugs to spread around the garden. In other instances, the mulch actually helps the squash bugs by giving them a place to hide

Analysis: The mulching has not affected squash bugs much. Mulched and unmulched plants have both had squash bug adults and egg clusters on them. However, the mulching is very effective at preventing weeds and keeping the soil moist.

5. Soap

Soap combined with water is an organic alternative to chemical sprays. The soap works by dehydrating the bug and egg clusters which causes it to die. The ratio should be about 1 tablespoon of soap to a quart of water. The soap used needs to be natural soap, like Dr Bronner's, I used peppermint soap because strong smelling plants like peppermint are supposed to keep pests away. Or, a soap mixture specifically made for pests can be bought. The soap and water mixture is applied to the entire plant, or just to spots where egg clusters are, about once a week. The soap to water ratio can be altered as needed.

Analysis: This method only works if the mixture is sprayed on the squash bugs or egg clusters. If there are only a few bugs and eggs, it saves a lot of trouble to just hand squish them. The soap method is best used when there are a lot of bugs or too many plants to check. Its actual effectiveness has been hard to determine. The soap does not eliminate all feeding because it will not necessarily kill all the bugs. But I did find some dead bugs that looked like they could have been killed by the soap. It is not yet determined if the soap actually dries out the egg clusters.

6. Neem Oil

Neem oil is a natural chemical made from the neem tree. It kills bugs on contact and will repel more from arriving. Neem oil concentrate is mixed with water following the instructions on the bottle. It can be sprayed all over the plant or just sprayed where the bugs are seen. This should be done in the morning when the blossoms are open. If there are still bugs and eggs a week after spraying, neem can be sprayed again.

Analysis: Neem has not eliminated squash bugs or their eggs, but it seems to have been controlling them from getting out of hand. It is hard to determine if the neem kills the squash bug eggs or adults however.

7. Companion planting

Cucurbit plants can be interplanted with repellant plants to keep bugs away. Some options for this are catnip, tansy, radishes, nasturtiums, marigolds, beebalm and mints. I tested mint in my plots.

Analysis: The repellant plants might reduce bugs in the garden, but it will not eliminate them. I found the mint to be not very effective, but other plants might do a better job. Squash bugs have

been found on plants near where the mint was planted. A cucumber beetle was once found crawling around the base of the mint plant. I would recommend experimenting with other repellant plants. Even if they are not fully effective at pest control, they are nice additions to a garden.

8. Planting buckwheat

Buckwheat provides a habitat for the parasitic fly, *Trichopoda pennipes*, which will live in the buckwheat and attack squash bug adults and eggs. It should be planted near the squash plants.

Analysis: This method was unsuccessful for me probably because I did not plant enough buckwheat. I planted buckwheat in the square foot area between some of the squash plants. For this method to be successful, much more buckwheat should be planted. This might only be possible in the student garden and not in individual community gardens.

Squash Vine Borers

1. Hand removal

Squash vine borer larva feed inside the stem of the squash, so it is not as easy as hand picking them off the plant. They start feeding at the bottom of the stem and make their way up the stem. To remove the larvae, estimate where they have been feeding and cut lengthwise along the stem with a knife. When the larvae are found, remove them and squish them. Cover the stems where they were cut with moist soil.

Analysis: This works at getting rid of squash vine borers and the plants I tested this are still alive and doing moderately well. They don't look as good as the perfectly healthy plants but they are still producing squash. The best time to do this method is as soon as there is evidence for the larvae in the stem. If it is caught too late, and the stem has started to die and turn brown and lifeless, it might be too late to save the plant.

2. *Bacillus thuringiensis* (Bt)

Bt is a bacteria that kills worms and larva when they have ingested it. To get to the squash vine borer larva, the Bt is injected into the infected squash plant. Each vine should be injected with about 1cc of Bt. Make a whole in the stem where it looks like the larva has been feeding and use a syringe to inject the Bt. A spray bottle aimed into the hole will also work.

Analysis: Bt somewhat worked. On a group of four squash being attacked by borers, three were sprayed with Bt and one was left as a control. The three with Bt were doing well and producing fruits while the control plant was dying. Now all the plants are dying. So Bt keeps the plant alive but does not save it.

3. Timings of plantings

Planting cucumber and squash plants later in the summer should make the plants less susceptible to squash vine borer attacks. Plants in the test plots were planted in early June, late June and late July. The student garden squash were planted throughout June.

Analysis: Later planting is the best time to plant. Generally, the only plants that have been affected by squash vine borers are ones planting in early June.

4. Resistant crops

Planting resistant crops will mean that the squash vine borers will be more likely to not attack. Butternut squash is a variety that is considered resistant. The squash vine borers will attack other varieties before the butternut or will leave the butternut completely alone.

Analysis: No butternut squash have been attacked by squash vine borers. This method is very effective for someone who just wants butternut. But for someone who wants other varieties of squash, other methods should be implemented to control the squash vine borers.