PRACTICAL farmers of Iowa

Healthy Food, Diverse Farms, Vibrant Communities

Cooperator
Ben Saunders, Turtle Farm, Granger

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http://tinyurl.com/fleabeetle

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Non-toxic, physical flea beetle controls, year 2

Written by Sally Worley

Abstract

Flea beetles can cause significant damage to eggplants and reduce harvest yields. In 2010, Ben Saunders compared kaolin clay and row covers as physical barriers to reduce flea beetle damage on eggplants. Yields were higher in both kaolin clay and row cover treatments than the control, but statistical significance was not found between the treatments and control. Ben replicated the trial in 2011, and kaolin clay and row covers both resulted in yields significantly greater than the control. Cull eggplants were significantly greater in the kaolin clay treatment but still comparatively low. Ben plans to utilize kaolin clay as his flea beetle control for future eggplant plots; applying kaolin clay worked better with Ben's skills than row covers.

About the Cooperator

Ben Saunders manages Turtle Farm near Granger. Turtle Farm is owned and operated by Angela Tedesco. This certified-organic-fruit-and-vegetable operation supplies food to 185 families through their community supported agriculture (CSA) program, which has been in operation since 1996, one of the first CSAs in Iowa. Turtle Farm also sells food to restaurants, through an on-farm stand and at a farmer's market.

Background

Flea beetles feed heavily on eggplant leaves from transplant until flower set, affecting fruit development and even killing the plant. Last year PFI cooperator Ben Saunders trialed kaolin clay and row covers to measure their effectiveness at reducing flea beetle presence and damage. Ben began this study in 2010 because he was interested in finding effective non-toxic physical controls. Ben has had success with the organically-approved pesticide Spinosad to control flea beetles, and there are other organically-approved pesticides available on the market to control flea beetles (Kuepper, 2003). However, Ben was interested in looking for a control method that did not harm beneficial insects on the farm. Kaolin clay is a physical barrier that does not contain toxins that harm beneficial insects or humans. Kaolin clay has been tested as a method to control flea beetles and potential impact in the early season prior to fruit set. Kaolin clay was effective at controlling flea beetle populations, but adversely impacted fruit quality because it is difficult to wash off mature fruit (Kuepper, 2003).

Ben Saunders manages Turtle Farm, located near Granger.

In 2010, no statistical analysis was conducted on the treatments' effect on eggplant yield and quality. Total yields from the kaolin clay (34.3 lb) and row cover (28.9 lb) treatments were higher than the control (19.3 lb) (see last year's report for details, http://practicalfarmers.org/assets/files/horticulture/on-farm/2010_Flea_Beetle_report.pdf). Considering the response from the 2010 project, Ben felt the time and money to implement the treatments warranted increasing his understanding of non-toxic or physical controls of flea beetles. He repeated the trial in 2011.

Method

This research project measured the difference in effect on harvested fruit quality and weight between three treatments: a spray-applied barrier of kaolin clay (Surround WP), row covers (ReemayTM) and a control. Eggplant variety 'Black Beauty' was used for this project.

Ben planted three plots (replications) of ten plants within each treatment (see ***Photos 1 and 2,*** *page 4). Data were collected from the eight center plants in each plot. One guard row of peppers was planted on each side of the experiment. The eggplants were planted 18 inches apart, with four feet between rows. Ben placed landscape fabric under all plots before transplanting to reduce weed pressure. Eggplants were seeded March 28 and transplanted to the field May 19 when the plants were approximately eight inches tall with three to four true leaves. Eggplant harvest period was July 29, 2011 to September 23, 2011. Row covers were placed on eggplants at the time of transplant and removed at flower formation. Kaolin clay was applied at transplant and weekly thereafter until flower formation (see* ***Photo 3,*** *page 4). Kaolin clay was intended to be a physical barrier and needed to be reapplied when washed off so it was reapplied if the farm received more than 0.25 inches of rain in a 24-hour period.*

Ben irrigated his eggplants after transplanting as well as four additional times during the growing season with drip tape. The eggplants were fertilized with Sustain immediately before planting. He did not use any form of pest control other than the treatments. Ripe fruit was collected and sorted into two categories, marketable and cull, based on exterior quality. The number of fruit and harvest weight was determined for both categories for each plot. Ben recorded the harvest window and plant health notes throughout the research project.

On September 23 a frost occurred that killed the eggplants; all replications had been fruiting at that time. When the plants were removed from the field, heavy pest damage was present on all treatments.

An additional site was planned for replication of this trial, but the wet spring prevented the replicating farm from following through with the project.

Table 1

Date	Control	Kaolin Clay	Row cover
19-May	flea beetles present at planting	flea beetles present at planting	flea beetles present at planting
26-May	minor flea beetle feeding	No flea beetles present	
2-Jun	minor flea beetle feeding	flea beetles on plants, but no damage noticed	
9-Jun	heavy flea beetle damage	minor flea beetle feeding	
16-Jun	heavy flea beetle damage	No flea beetles present. Blossoms observed (stopped applying Surround)	row cover removed. Very minor flea beetle feeding observed
23-Jun	heavy flea beetle damage. Blossoms beginning to emerge	flea beetles on plants	more flea beetle damage observed
30-Jun	heavy flea beetle feeding observed	no beetles present, minor feeding observed	flea beetles and feeding observed
7-Jul	many blossoms forming. Plant leaves are a little pale in color	blossoms beginning to form on side branches	heavy populations of flea beetles and feeding observed. Leaves are beginning to pale
14-Jul	eggplant beginning to form	eggplant forming	eggplant forming
21-Jul	plants showing signs of stress. Blossoms and tiny eggplant dropping off plants	plants showing stress. Plants dropping blossoms	plants showing signs of stress. Blossoms and tiny eggplant dropping
28-Jul	plants still showing stress. Flea beetle damaged observed. A couple ripe fruit observed	plants showing stress. Some ripe fruit	plants showing stress. Flea beetle feeding observed. Couple ripe fruit observed
4-Aug	plants still showing stress. Flea beetle damaged observed. A couple ripe fruit observed	plants showing stress. Some ripe fruit	plants showing stress. Flea beetle feeding observed. Couple ripe fruit observed
11-Aug	plants still showing stress. Flea beetle damage observed. A couple ripe fruit observed	plants showing stress. Some ripe fruit	plants showing stress. Flea beetle feeding observed. Couple ripe fruit observed
18-Aug	hot temps seem to be slowing growth	hot temps seems to be slowing growth	hot temps seem to be stalling growth
25-Aug	few flea beetles observed	few flea beetles observed	few flea beetles observed
1-Sep	Plants seem to be recovering from stress, probably from heat	Plants seem to be recovering from stress, probably from heat	Plants seem to be recovering from stress, probably from heat
8-Sep	cooler temps. Plants seem to be slowing down	cooler temps. Plants seem to be slowing down	cooler temps. Plants seem to be slowing down
15-Sep	cooler temps. Plants seem to be slowing down	cooler temps. Plants seem to be slowing down	cooler temps. Plants seem to be slowing down
23-Sep	last harvest. Plants killed by two frosts	last harvest. Plants killed by two frosts	last harvest. Plants killed by two frosts

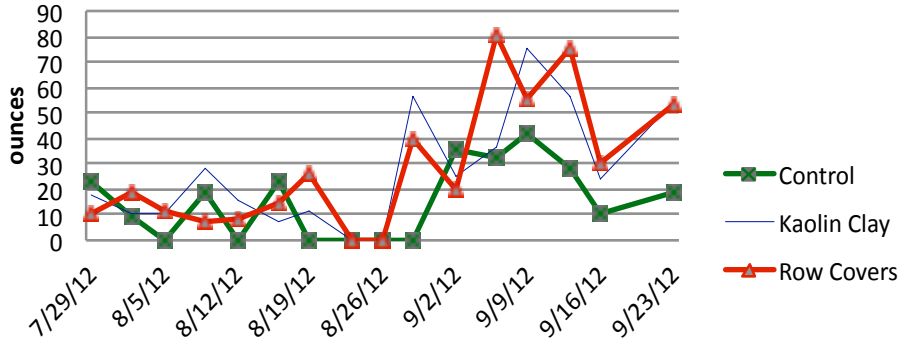
Table 1. *Ben's field notes: Description of the activities carried out with each of three different flea beetle treatments.*

Results and Discussion

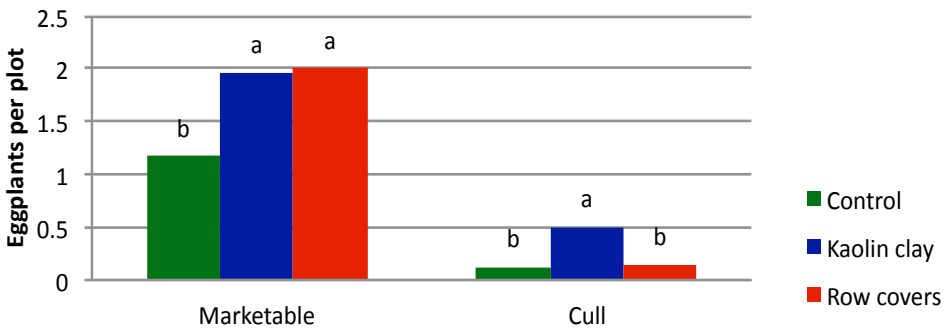
Table 1 *(on the previous page) documents the presence of flea beetles and damage across the trial. Flea beetle damage was not observed in the row cover treatment, because removing the row cover could allow flea beetles to move into this treatment area.*

Graph 1 *illustrates the average yield (oz/plot) for each treatment during the harvest period. As illustrated in the chart, high daytime temperatures in late August, paired with warm overnight temperatures caused the eggplants to stall in fruiting.*

Graph 1



Graph 2



Graph 2 *illustrates the mean weights for marketable and cull eggplants for each harvest date from each treatment, and*

Graph 3 *illustrates the mean number of marketable and cull eggplants for each harvest date from each treatment.*

Both flea beetle control methods, kaolin clay and row cover, out yielded the control in marketable fruit (ounces per row). Kaolin clay (26.9 oz/row) and row cover (26.6 oz/row) were not statistically different but yielded statistically higher than the control (14.9 oz/row). However the kaolin clay (6.02 oz/row) did result in a statistically greater amount of cull fruit compared to the control (1.79 oz/row) and row cover (2.06 oz/row) treatments.

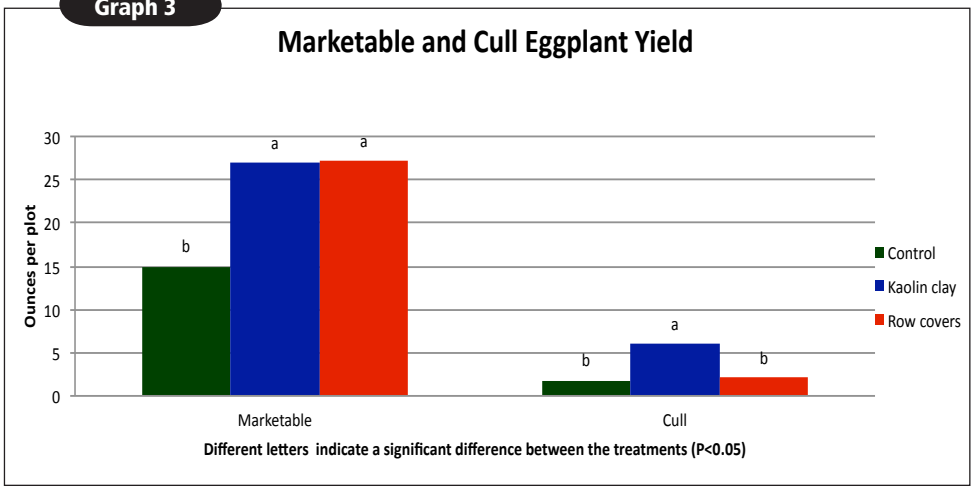
Similar results were measured in the numbers of marketable and cull fruit. The kaolin clay (1.95) and row cover (2.00) out numbered the control (1.17) in marketable fruits; however, more cull fruits were counted in the kaolin clay (0.50) treatment as compared to the control (0.13) or row cover (0.15).

It took Ben approximately 45 minutes to mix and apply kaolin clay each application, and he applied kaolin clay seven times, for a total of 5.25 hours of labor. The row cover took approximately two hours to install and 45 minutes to remove for a total of 2.75 hours of labor.

Conclusion

After two years of participating in this research trial, Ben plans to apply kaolin clay (Surround WP) to his eggplants until flower set to improve management of flea beetles. Ben plans to trial kaolin clay as a physical barrier for cucurbit crops as well. "Some people may be more proficient with

Graph 3



row covers than I am, but for me, there is less room for error with Surround. Row covers have the potential to blow off, rip, and they don't stay taut. Plus, one bag of Surround takes up a lot less space than a roll of row cover." Ben has used the same 50-pound bag of Surround WP throughout the experiment. He had supplies on hand for both the kaolin clay and row cover treatments so didn't calculate the costs.

There were clear data in 2011 that illustrated that the yield of both non-toxic, physical treatments were very similar and significantly greater than the control, and that kaolin clay and row covers as described are an effective method for reducing flea beetle damage in eggplants.

Ben is satisfied with his findings but feels it would be beneficial for the project to be replicated on a different farm.

Data Analysis

Data were analyzed using a fit model one-way analysis of variance (ANOVA) to determine treatment effects. Comparisons of means were analyzed using the Student's t-test. All data analyses were performed using the JMP9 software (SAS Institute Inc., Cary, NC).

References

Dufour, 2001. Reduced-Risk Pest Control Factsheet, http://www.agrisk.umn.edu/cache/ARL02953.htm (What is kaolin and how does it work? Surround WP presents a unique form of pest control: a non-toxic particle film that places a barrier between the pest and its host plant. The active ingredient is kaolin clay, an edible mineral long used as an anti-caking agent in processed foods, and in such products as toothpaste and Kaopectate. There appears to be no mammalian toxicity or any danger to the environment posed by the use of kaolin in pest control.)

Kuepper, 2003. Flea Beetle: Organic Control Options, http://attra.ncat.org/attra-pub/fleabeetle.html

Photo 1

Photo 1. *Replications of kaolin clay, row cover and control shortly after planting.*

Photo 2

Photo 2. *Replications of kaolin clay, row cover and control just before fruit set.*

Photo 3

Photo 3. *Eggplant treated with kaolin clay.*