Result Demonstration Report

Efficacy of Various Homeowner Pesticides against Cabbage Loopers on Cabbage

Molly Keck, Extension Program Specialist – IPM

David Rodriguez, Extension Agent - Horticulture

Cabbage loopers (*Trichoplusiani*) are a major pest of cole crops, especially in home gardens. Many homeowners treat for cabbage loopers only after significant damage has occurred or do not follow a schedule that will suppress the cabbage looper populations throughout the plant's development.

This trial evaluated the efficacy of various pesticides and treatment regimens on cabbage loopers during the fall.

Materials and Methods

Eleven beds, 3.5 x 28ft, at the San Antonio Botanical Garden were designated for this trial. Beds were divided into two equal sections allowing for the use of 21 total plots. The beds were raked and leveled, pre-irrigated and weed free, as well as fertilized with 19-5-9 granulated, slow release fertilizer prior to planting.

On 6 October 252 'Cheers' cabbage plants approximately 4 weeks old were transplanted into the beds. Early October planting was chosen because it is the best time in the South Central Texas area to plant cole crops, due to cooler weather as opposed to an early September planting.

Twelve plants were planted in two rows per bed with an off center spacing of 12 inches. The cabbage was immediately irrigated and watered in with a water soluble 6-12-6 analysis liquid fertilizer after planting.

Upon establishment, cabbages were watered twice a week with a micro irrigation system which did not wet the foliage. At week 3 and 6, the plants were side dressed with 19-5-9 granulated fertilizer at a rate of 1 lb per 100sqft.

At one week post planting, each cabbage plant was checked to be sure they were established. Once it was determined that they were growing and had rooted, each plant was checked for the presence of loopers. Then the beds were randomly assigned into one of seven treatment groups using a random number generator without repeating numbers.

Treatment groups were:

1. Untreated Control
2. Molasses
3. *Bacillius thuringiensis kurstaki* (*Bt*)
4. Spinosad
5. *Bt* and Spinosad (alternating treatments)
6. *Bt* and Spinosad with molasses (alternating treatments)
7. Carbaryl

All treatments were liquid formulations and all plants in treatment groups 2-7 were drenched with their respective pesticide.

Cabbage plants were monitored every week for 10 weeks. The presence or absence of cabbage loopers was recorded (**Figure 1**). The percent of leaves that were damaged was recorded using a Lickert Scale in which 1 = no leaves with damage, 2 = 1-25% of leaves have damage, 3 = 26-50% of leaves have damage, 4 = 51-75% of leaves have damage and 5 = 76-100% of leaves have damage. The percent damage on leaves was also measured using a Lickert Scale in which 1 = 1-25% of the leaf had chewing damage, 2 = 26-50% of the leaf had damage, 3 = 51-75% of the leaf had damage, and 4 = 76-100% of the leaf had damage. Percent damage on leaves was determined by looking at the leaf with the most damage. Presence of cabbage loopers, percent of leaves damaged and percent damage of leaves was recorded from weeks 1-10.

Figure 1. Cabbage loopers of varying instars on cabbage leaf.

Other notes were taken; the presence of other insects, the number of leaves or the growth rate of the plants, and beneficial insects.

Cabbage plants were retreated every two weeks for a total of 5 treatments. The cabbage was allowed to grow for 10 weeks, until they were ready to harvest. Harvest date was 17 December 2012. Upon harvest, cabbages were weighed and they were given an aesthetic value from 1-5 of aesthetic value, with 1 being the lowest and 5 being the perfect cabbage.

Analysis of Variance (SPSS, Inc. 2012) was performed to determine the efficacy of the treatments at 0.5 level of confidence.

Results and Discussion

Overall, cabbages treated with Spinosad every two weeks provided the best protection against cabbage loopers (**Figure 2**). In addition, Spinosad treated cabbage heads were more aesthetically pleasing and had the greatest average weight of 3.7 lbs. By week 2 of the experiment it was evident that there were less overall damage to the plants from cabbage loopers with the Spinosad treatment however there was no significant difference between Spinosad and the untreated groups until week 4. By week 10, the Spinosad treated groups had less than 1-25% cabbage looper damage and of those with damage, an average of 1-25% missing leaf material.

Figure 1. Week 5. Damage of cabbage plants on control cabbages (left) and Spinosad treated cabbages (right).

Plants treated with alternating treatments of *Bt* and Spinosad or *Bt* and Spinosad with Molasses (*Bt* treated at weeks 1, 5 and 9 and Spinosad treated at weeks 5 and 7) performed significantly better than control groups but not significantly better than Spinosad only or *Bt* only treated groups. At weeks 8, 9, and 10 the average percent of leaves that showed damage on the plants was less than 51-75% and of the leaves damaged an average of less than 25-50% of the damaged leaves were missing due to cabbage looper feeding. The weight of the cabbage heads of those treated with *Bt* and Spinosad were the second highest of the treatment groups, averaging 3.5lbs, which was significantly more than the untreated control. Cabbages treated with *Bt*, Spinosad, and molasses averaged 3.1lbs. The estimated aesthetic value of plants treated with *Bt* and Spinosad were rated at 3.7 out of 5, which is also significantly better than the control group. *Bt*, Spinosad and molasses treated cabbages had an aesthetic value of 3.4

Overall, alternating *Bt* and Spinosad treatments for cabbage is an effective form of control, producing aesthetically pleasing cabbage heads with little cabbage looper damage and high yielding cabbage.

The addition of molasses to the *Bt* treatment and Bt to the Spinosad treatment did not reduce damage to the plant by cabbage loopers and there was no significant difference in aesthetic value or weight of the cabbage head. In addition, when molasses was included in *Bt* and Spinosad treatments, the aesthetic value and weight of the cabbages did not differ significantly from control groups, although they did weight approximately .8lbs more. The

addition of molasses did not reduce the damage due to cabbage loopers when treated with *Bt* and Spinosad. This is important to note, as homeowners often use liquid molasses to increase the effects of pesticides.

Cabbage treated with *Bt* had significantly less damage to the overall plant than the untreated, molasses and Carbaryl treated groups, with an average of 51-75% of the leaves showing cabbage looper damage. However, the average damage to the leaves was less than 1-25% using the Lickert Scale. Therefore, while the majority of the leaves showed damage, there was little damage to individual leaves when treated with *Bt*. *Bt* treated cabbage heads had an aesthetic value that was not significantly different than other treatment groups and the average weight of the cabbage heads was 2.8lbs.

The poorest control of cabbage loopers came from the molasses and Carbaryl treated groups. Cabbage plants treated with molasses did not significantly differ from the untreated control groups. By the end of the study, 100% of the cabbage leaves treated with molasses exhibited cabbage looper feeding and the average damage to the plants was 76-100%. The harvested cabbage heads from the molasses and Cabaryl groups were aesthetically less pleasing than Spinosad and *Bt*/Spinosad treated plants, although this was not significant. The average weight of the cabbage heads treated with molasses was 2.6lbs. While this weight was more than the untreated control by .3lbs and less than the better performing three Spinosad treatments by 0.5 to 1.1lbs, the weight is not significantly less than any treatment group.

Carbaryl treated groups did not significantly differ from either untreated control or molasses treated groups. The results from Carbaryl were expected. On the Sevin® label, it is specifically noted that loopers are not affected. However, many gardeners continue to use Sevin® for cabbage looper control.

Table 1. Percent of leaves on overall cabbage damaged by cabbage looper feeding.

Weeks after planting

Treatment	1	2	3	4	5	6	7	8	9	10
Control	0.0	1.3	2.6	3.8a	6.5a	4.4a	5.8ab	5.0b	4.8a	4.5a
Molasses	0.0	1.5	2.5	4.1a	4.5a	4.5a	4.9a	4.9b	4.9a	5.0a
Bt	0.0	1.5	2.7	3.2ab	4.1a	4.2a	3.9ab	3.8a	4.0a	4.7b
Spinosad	0.0	1.2	1.7	2.0b	1.8b	2.0b	2.5b	1.7c	1.8b	1.9b
Bt/Spinosad	0.0	1.5	2.7	3.4ab	5.6ab	2.6b	2.4b	2.3c	2.7b	2.7b
Bt/Spinosad/ molasses	0.0	1.3	2.4	2.9ab	3.2ab	2.4b	2.9b	2.2c	2.2b	2.1b
Carbaryl	0.0	1.2	2.7	3.8a	4.4a	4.7a	4.8a	5.0b	5.0a	5.0a

Table 2. Percent damage on leaves by cabbage looper feeding.

Weeks after planting

Treatment	1	2	3	4	5	6	7	8	9	10
Control	0.0	1.0	1.2	1.5	2.4a	2.2a	2.3a	3.1a	3.3a	4.0a
Molasses	0.0	1.0	1.3	1.6	2.2ac	2.4a	2.6a	2.5a	3.3a	4.2a
Bt	0.0	1.3	1.2	1.2	1.4abc	1.5a	1.4a	1.5b	1.8b	1.6b
Spinosad	0.0	1.0	1.1	1.3	1.0b	1.0b	1.0a	1.1b	1.0b	1.0b
Bt/Spinosad	0.0	1.0	1.1	1.2	1.2bc	1.2b	1.2a	1.0b	1.5b	1.5b
Bt/Spinosad/ molasses	0.0	1.0	1.3	1.4	1.3abc	1.3b	1.2a	1.1a	1.1b	1.0b
Carbaryl	0.0	1.0	1.3	1.6	2.4a	2.7a	2.4	2.7a	1.38a	4.1a

Table. 3. Average Estimated Aesthetic Value of Cabbage Plants

Treatment	Aesthetic	Weight
Control	1.9a	2.3a
Molasses	2.8ab	2.6ab
Bt	2.9ab	2.86ab
Spinosad	3.9b	3.7b
Bt/Spinosad	3.7b	3.5b
Bt/Spinosad/ molasses	3.4ab	3.1ab
Carbaryl	2.4ab	2.8ab

This study showed that cabbage heads of 2.3lbs can be produced without any chemical treatment, which is larger than the approximate size of cabbage sold in grocery stores of 1.5 to 2 lbs. Aesthetic value is significantly less than when treating with Spinosad or *Bt*/Spinosad regimens every two weeks: leaves will show damage and many leaves will be nearly eaten, however the head of the cabbage is still edible and of fairly good size and quality. These outer damaged wrapper leaves can be removed.

In this experiment we were able to show that two organic options are available for homeowners for management of cabbage loopers on cole crops. Spinosad outperformed other treatment groups; however it is priced at approximately $2.12 per ounce, retail. The retail *Bt* price is approximately $1.29 per ounce. The Spinosad treatments produced 3.7 lb cabbage heads on an average while the *Bt* treatments produced cabbage heads of 2.8lbs. Damage to the plants was not significantly different between the two groups' aesthetic value and weight. Therefore, if price is a consideration, *Bt* is an effective and economical means of managing cabbage loopers. In addition, price can be reduced by alternating between *Bt* and Spinosad treatments every two weeks.

Based on the findings of this study, we were able to provided recommendations for varying levels of economic savings and varying levels of aesthetic management of cabbage loopers.

* The authors would like to thank the Bexar County Master Gardeners for volunteering and supporting this project with special thanks to Bert Pons, John McElroy, Fred Hassel, Albert Motz and Carolyn Randall. The authors would also like to thank the San Antonio Botanical Garden and Children's Vegetable Garden Program.