# Survey of Pests and Beneficial Insects in Conventional and Transgenic Cotton

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A survey was conducted on a cotton patch that was divided into two sections, one half containing conventional cotton and the other, transgenic cotton.. The cotton was transgenic for *Bacillus thuringiensis* (Bt), a naturally occurring bacterium in the soil that is toxic to Lepidoptera larvae, which is one of the most common pests in cotton crops. The collected arthropods were identified and sorted into the categories "beneficial" and "non-beneficial" with relation to the cotton crop. . There were more pests on the transgenic cotton than on the conventional cotton but there were more beneficial insects in the transgenic cotton than in the conventional cotton. . If Bt cotton had the most promising effect on reducing pests, then there were more pests on the transgenic cotton. Results showed that there were more pests on conventional cotton than on Bt cotton. This information is important for the implementation of integrated pest management strategies.

### Keywords: Cotton, Bacillus thuringiensis, Pests

In order for the world to safely feed and clothe its increasing population, new agricultural techniques are needed. Integrated pest management has proven to be an invaluable asset in the mass production of crops without the need of spending money and labor on chemicals that are hazardous to the environment and potentially to the consumer. There are many ways in which integrated pest management can be applied. One method is the introduction of natural enemies to the field so that pests are continuously being managed by their predator. One could also plant different types of crops close to each other at the same time to increase natural enemy diversity. The planting of genetically modified crops can also prevent pest from attacking crops; the crop can be modified to produce a natural toxin that is lethal to some of its major pests. Genetically modified crops eliminate the use of broad-spectrum insecticides and spares the natural enemies in the environment. The transgenic cotton crops are modified with genetic information incorporated into the crops' genetic make-up for the production of Bacillus thuringiensis (Bt), a naturally occurring soil bacterium. Bt is toxic to Lepidoptera larvae, beetles, cotton bollworms, and flies, which are main pests in cotton. Yang et al (2008) concluded that the amount of Lepidoptera larvae is significantly reduced with the use of Bt genetically modified crops, but does not have the same effects on other pests that attack crops like the potato beetle (Alyokhin & Ferro 1999).Due to Bt's very target specific nature, there are fewer cotton pests effected by Bt than not.. It is supposed that there will be fewer pests on the transgenic cotton than on the conventional cotton due to the advantages offered by Bt production.

### **Materials and Methods**

A tract of land planted with both transgenic and conventional cotton was surveyed and the arthropods collected were identified and sorted into two groups. Group one consisted of arthropods that were beneficial to the cotton plants while group 2 contained the arthropods considered to be pests of mature cotton.

The transgenic and conventional cotton were in the same location but separated by a 15 foot wide break. Coordinates of the field are N40.52253 W96.40128. Using an aspirator (BioQuip, Rancho Dominguez, CA) and a sweep net (BioQuip, Rancho Dominguez, CA) one member collected insects in the transgenic cotton while the second member went through the conventional cotton with a sweep net. The sweep net was used to sample 20 plants while the aspirators were used to sample the transgenic cotton for a total of fifteen minutes . The samples were placed in their appropriate jars then (BioQuip, Rancho Dominguez, CA) filled with ethyl acetate..Once the samples had been divided into the correct containers, the two collectors traded fields and the process was repeated. The time aspirated and plants swept were unchanged.

Once all the collecting was done, the insects were identified as pests or beneficial insects to the crop. They were placed into sorting trays, identified under the microscope ,counted andseparated into the two categories.

The number of pests and beneficial insects were compared using *t*-tests. A chi-squared test was used to establish whether or not the observed distribution differed from the theoretical distribution.

**Results**A total of 140 insects were collected, 98 of them were pests and 42 were beneficial insects, with a t-statistic of 1.20. Statistically, the two populations are not different. (P> 0.05) (Figure 1).



**Figure 1.** The total amount of insects collected separated by location, whether from transgenic cotton or conventional cotton.

There was an average of 16.8 pests in the transgenic cotton and there was an average of 2.8 pests in the conventional cotton, with a t-statistic of 1.11. Statistically, the two populations are not different (P > 0.05). (Figure 2)



**Figure 2.** Number pests found in transgenic cotton and conventional cotton.

There was an average of 5.2 beneficial insects in the transgenic cotton and an average of 3.2 beneficial insects in conventional cotton, with a t-statistic of 1.14. Statistically, the two populations are not different (P> 0.05). (Figure 3)



**Figure 3.** Number of beneficial insects found in transgenic cotton and conventional cotton.

## Discussion

The transgenic cotton plants surveyed were modified with *Bacillus thuringiensis* and were used mostly to attack Lepidoptera larvae. These plants help toprevent pesticide resistance, thus decreasing the amount of chemicals used on crops, making it cheaper for farmers to maintain cotton by not purchasing as much insecticides. Using transgenic crops also lowers pesticide residue that can be harmful to consumers and reduces environmental hazards that can occur. , No Lepidoptera larvae were found in this survey, suggesting that Bt is affective against this pest. Other pests, like aphids, grasshoppers, and tarnished plant bugs were found however these insects can also be very harmful to the cotton crops. Since no Lepidopteran larvae were seen and other pests were present, this means that Bt is very host specific and there seems to be no non-target effects. What scientists should be worrying about is the pressure for larvae to become Bt resistant.

Integrated pest management (IPM) requires a lot of research in order to be successful. This experiment was performed to judge if there is any difference in the populations of pests and beneficial insects found in genetically modified cotton plants and conventional cotton plants. From our

results, it was concluded that, by using a ttest, there were not any differences, thus disproving our hypothesis. These results mean that even with the use of Bt cotton, there is still the same amount of pests as beneficial arthropods. there are This suggests that, even though it is keeping away Lepidoptera larvae, there are still other pests that are attacking cotton. These insects will need to be managed using a different method. Establishing trap crops or planting a different crop around the cotton to create a polyculture of plants could be a potential solution..

If this experiment were to recreated, one possible improvement to the protocol would be an improved method of collection. The original team used a variety of mesh grades and many of the team members were less than experienced. A more prepared and more experienced team would likely find a better representative example of the arthropods in a field of cotton.

#### References

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