# Increasing Farm Sustainability through the Use of Cover Crops for Weed Suppression in Non-Transgenic Conventional Cotton

**Gary L. Hawkins, Ph.D., Biological and Agricultural Engineering, UGA,**
**ghawkins@uga.edu**
**Ronnie Barentine, Pulaski County Extension, barentin@uga.edu**

## Introduction:

Increasing sustainability of farm operations will require that natural means of weed suppression be incorporated into the farming operation. One alternative is the proper use of cover crops. Cover crops not only supply nutrients (e.g. legumes fix nitrogen and cereal crops recycle nutrients), but also break pest cycles, provide needed soil organic matter, increase available water, and help suppress weeds. Proper use of cover crops may not totally eliminate the use of chemicals, but any reductions will lower the overhead and maintenance cost incurred by the farmer.

Transgenic cotton including the Round-up Ready varieties first appeared in 1997 and now occupies approximately 90% of the cotton planted in Georgia and the other southern states (Steve Brown, 2003). Within Georgia alone reduced tillage systems are used on approximately 600,000 acres. There is concern that continued reliance on RR cotton will continue to promote the spread of weed species with resistance to glyphosate (actual Round-Up chemical). Resistant weed species may require potentially more toxic herbicides to be used or growers will have to revert back to using plowing methods as a means of weed control. Either method of weed control will be detrimental in making these southern farms sustainable systems. Therefore the farmer needs an alternative method of weed control other than transgenic cotton varieties which relies or encourages over use of glyphosate.

## Objectives:

To demonstrate that a Black Oat cover crop can be used and how effective the cover is in suppressing weed pressure in a conservation tillage system. Additionally the research will compare yield and quality differences in non-GMO modified and GMO cotton.

## Materials and Methods:

The research objective as stated above was to use Black Oats as a cover crop to suppress weed pressure in conservation tillage systems. The plots were divided into seven treatments across three farms. To complete the objective stated above, the project was divided into three different parts: 1) planting Black Oats as a winter cover crop, 2) monitoring and measuring weed populations in the treatments during cotton production season, and 3) harvest and compare yields of cotton from each treatment.

### Planting of cover crop:

The black oats were planted as soon as possible after the previous commercial crop was harvested. Planting of cover crops for both study years was middle to late November. The oats were planted at a rate of approximately 1 bushel per acre across all treatments. No irrigation was used to establish the stand in that there was ample moisture both years to get a good stand of

Black Oats. Nitrogen fertilizer was used in the second growing season to try and increase the cover crop biomass.

**Monitoring and measuring weed biomass:**

Monitoring and measuring weed biomass was facilitated by dividing each treatment into three sections to be used as replications of the treatment. Weed populations were measured every other week from planting to either harvest or a point where the farmer decided that no yield was possible. To ensure that sample collection was not biased due to the amount of weeds, a random grid was established prior to the first sampling date and was maintained through out the growing season. To better accomplish this, each replication within each treatment was divided into 10 blocks and 9 sections within each block. The weeds were sampled by locating the randomly selected Block and Section, standing at the corner of the section and tossing a $1/10^{th}$ square meter square into the section. The number of weeds were then counted and noted. This was repeated in all selected Blocks and Sections. The same random numbers were used for all treatments for a given date. If the $1/10^{th}$ square meter was completely filled with a weed a value of 50 was entered, otherwise the number of weeds was entered based on the number of stems not vines.

**Harvest and compare yields from each treatment:**

During harvest of the cotton, the replications were harvested separately, weighted and a sample collected for quality analysis. The weights were measured through the use of scales placed under the wheels and tongue of a boll buggy. The analysis consisted of the standard tests (i.e. Gin turnout, mic, elongation, strength, uniformity, length, rd, b, and color grade).

**Results and Discussion:**

**Monitoring and measuring weed biomass:**

The weed population varied from treatment to treatment with a significant difference in only one treatment across years. This treatment was the no-herbicide treatment on the farm that had been using the conservation tillage system for ten plus years. In the first year of the study, the number of weeds was no different from that of the farm using round-up ready cotton, but was significantly different from the farm that had only been using conservation tillage with weeds as a cover crop. The weeds that were present in the first year on the T4 and T5 farm was mainly pigweed with some morning glory and grass. In the second year grass formed a complete mat even prior to the cotton emerging in the Treatment 5 plot. It can be seen in Figure 1 that the number of weeds is shown as 500 per $m^2$ in T5, but most of that was grass that covered the whole sampling area and the 50 per $1/10^{th}$ square meter was noted so as to not overpower the other data on the graph. Likewise, on T1, T2 and T3 for both years the weeds were hard to control and a majority of the weeds were pigweed. The farmer in year one mowed the plots once he decided he had lost the complete crop and in the second year, we stopped the test at a point that he determined the amount of pigweed specifically had reached a point that the yield from any one of the plots would be less than the cost of harvesting the cotton, so he again mowed the plots prior to us knowing he had mowed them.

Overall, the T1, T2 and T3 plots that had winter weeds as a cover crop prior to planting a commercial crop, even with the addition of black oats for two years, were hard to manage and ultimately resulted in the test being so overcome with weeds that the harvest would have cost more than the return from the sale of the cotton. The major weed in both years in the control, no

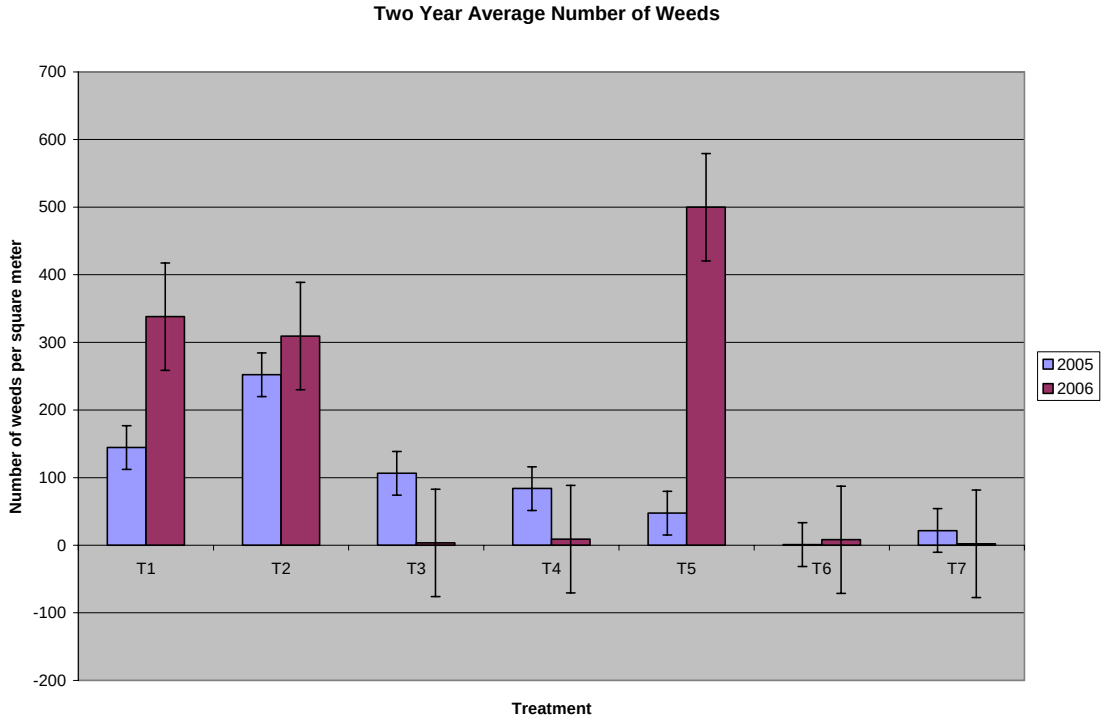


Figure 1. Weed population per square meter in given treatment. The T5 treatment had complete coverage of grass across the entire treatment area, so a count of 500 indicates complete coverage.

herbicide use and a threshold application was pigweed with some morning glory and grasses. With the reduced herbicide application, the soil system was not able to suppress the weeds and some of the pigweed reached heights of at least 6 feet and had diameters at the soil surface of approximately 3 inches. This made it impossible for the cotton to grow and the cotton picker to pass through the plots. In T4 and T5, the continual use of conservation tillage with high biomass at time of planting appears to have had some impact on the suppression of weeds. The fact that in the second year of T5 the grass overtook the plots can not be explained by the research team. However, T4 performed as well as T6 and T7, which used a cover crop and round-up ready cotton seed, on suppressing the weed population.

**Harvest and compare yields from each treatment:**

The average lint yields from each treatment can be seen in Figure 2. As can be seen, the regular use of herbicides on T4 helped the plants yield more than T5. Both treatments were planted on land that had been in conservation tillage for ten plus years and the use of herbicides, the older chemistry in this case, has a significant difference on the yield. These chemicals allow the planting of conventional non-transgenic cotton, but still require a regular spray pattern. It was also suggested by the County Extension Agent and co-project director that the use of a pre-emergence herbicide can have large benefits on controlling and suppressing weeds, thereby reducing the amount of herbicides needed in the growing season. The lint yield in the

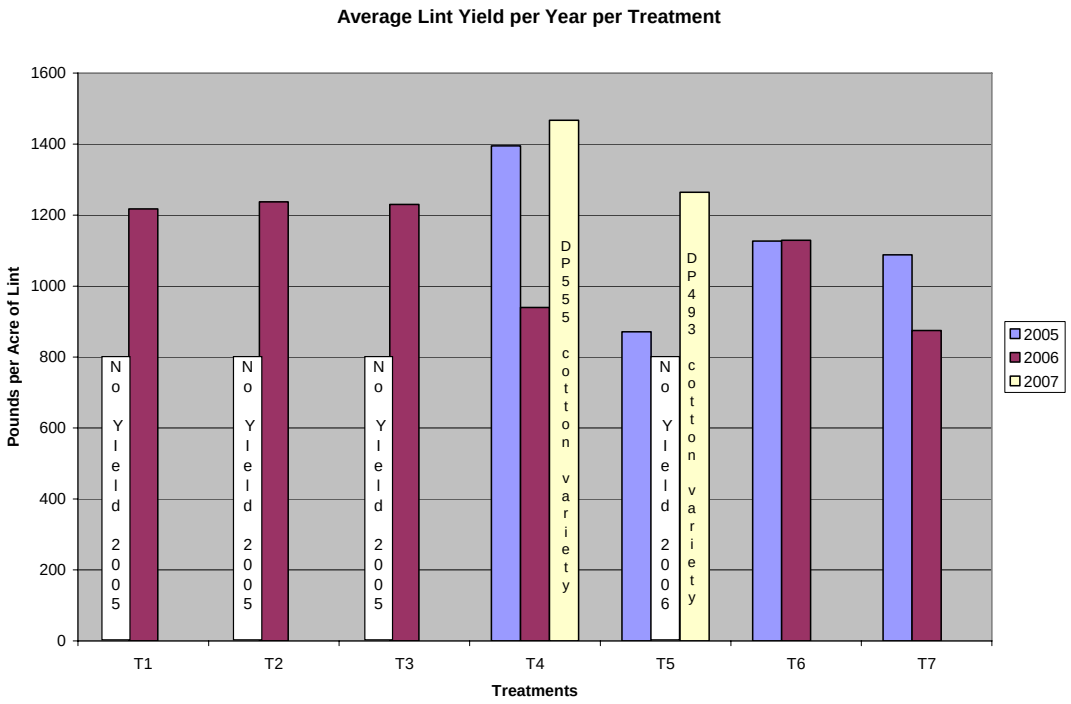


Figure 2. Lint yields from all treatments for two years of study. A third year was conducted on one of the study field s (yellow bars on T4 and T5).

conventional cotton (DP493[1]) was not significantly different from that of the genetically modified cotton (DP555[1]).

This equal or greater lint yield is good for the farmer in that the yield is just as high, the cost of the herbicide may not be different, but the seed for the genetically modified seed at the time this was written was as high as 5 times more per bag than the conventional seed. This would lead to potentially being a larger profit or less out of pocket costs for the farmer. However, our cooperating seed dealer stated that the amount of conventional seed was low to non-existent in 2007 and is expected to be that way in the future.

When comparing the cotton quality parameters there was no significant difference across any treatment for either year as can be seen in Figure 3. This shows that the farmer will and does not loose quality when planting conventional cotton verses the transgenic cotton.

[1] The use of specific cotton seed does not in any way suggest that The University of Georgia promotes or specifically endorses this specific product. The product was used in the study and the use of names is only supplied for purposes of reporting data.

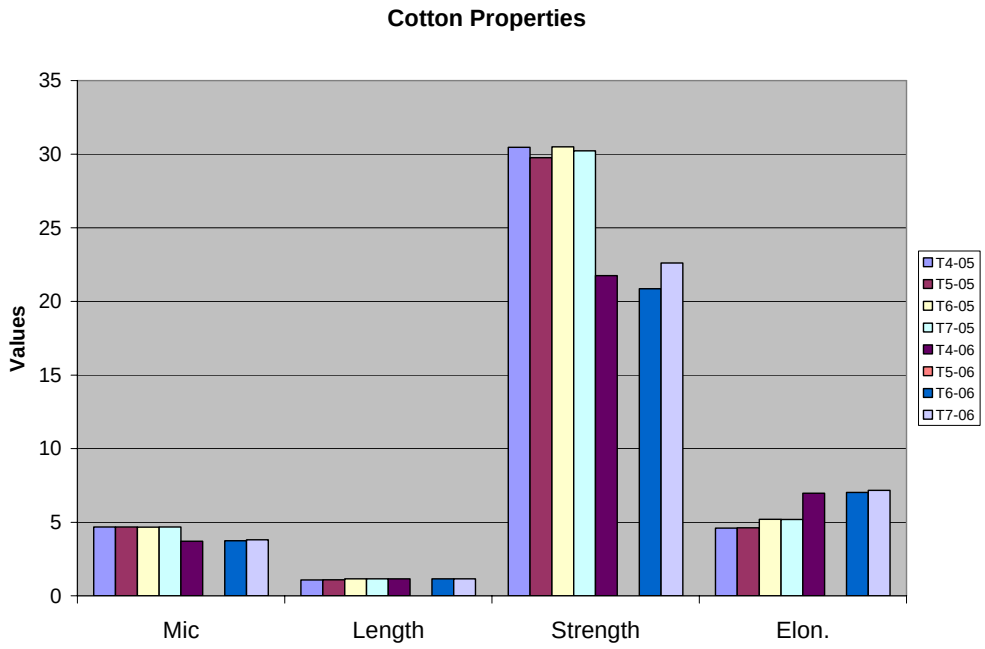


Figure 3. Cotton quality parameters of collected cotton samples from both years of study.

**Conclusions**

The data indicates that the use of cover crops in conservation tillage systems has an affect on the suppression of weed growth. The yields collected during this research were similar in plots that used conventional cotton seed as compared to Round-Up ready cotton variety seed. The cotton quality was also similar and showed no difference between seed varieties as well as across years. Therefore, to assist in reducing the potential spread of resistant weeds, the use of conventional cotton with "old chemistry' technology may need to be further explored. However, it has been suggested by some seed distributors that the availability of conventional seed are I short supply. The use of conventional seed and chemistry needs to be further researched and if the results are similar to that shown here, the use of conventional seed could prove more sustainable for the farmer in conservation tillage systems as well as provide a means to help suppress the chemical resistant weeds.

**References:**

Brown, S. 2003. Personal contact. Dr. Brown is the University of Georgia cotton specialist.

Hawkins, G.L. and R. Barentine. 2007. Increasing Farm Sustainability Through the use of Cover Crops for Weed Suppression in Non-Transgenic Conventional Cotton. Southern SARE final report for Grant number OS04-020.
http://www.sare.org/reporting/report_viewer.asp?pn=OS04-020