# FARMERS' EXPECTATIONS IN THE PRODUCTION OF TRANSGENIC *Bt* COTTON: RESULTS FROM A PRELIMINARY SURVEY IN SOUTH CAROLINA

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## Abstract

Potential savings associated with reduced chemical insecticide application was the main factor considered by South Carolina farmers in their decision to adopt *Bt* cotton technology. Farmers surveyed expect no change in management practices used in planting *Bt* cotton, except for insect control practices. They do not expect to apply any pyrethroids for *Bt* cotton, although they anticipate spraying methyl parathion at least once. Most farmers expect to have the same yield and to receive the same price for *Bt* cotton as compared to non-*Bt* cotton. Both the farmers' yield and insect control expectations must be satisfied if they are to plant *Bt* cotton next season. In general, the farmers were satisfied with the performance of *Bt* cotton up to the time of the survey, although concerns about its efficacy and pricing structure were expressed.

## Introduction

Much have been said about the opportunities and challenges farmers face in the production of *Bt* cotton (Bradley, 1995; Phillips, 1995; Benedict, 1996). However, only a few articles have examined growers' perspectives in the production of this new variety (See Mitchener, 1996). The 1996 release of Monsanto's *Bt* (Bollgard®) cotton variety provides the opportunity to investigate what farmers think about this new technology. As part of a 1996 economic evaluation of *Bt* cotton in South Carolina, a survey of cotton farmers was undertaken in mid-July to ask their opinions about their production of *Bt* cotton. when surveyed, they had about two months experience in growing the new variety which, in addition to industry interaction, allows them to shape their own preliminary expectations.

Expectations embody the information set that farmers have at a particular time. Hence, this survey can serve as a measure of the degree of information dissemination by Monsanto, in particular, and the cotton research community, in general. The survey results showed that dissemination was effective since the farmers' main reason in adopting the technology was the potential savings in insecticide spraying. Second, they expected to eliminate the need for pyrethroids to control for lepidopterans, but expected at least one application of methyl parathion to control for stinkbugs. Third, most farmers also expected no change in pre-insecticide management practices for *Bt* cotton. All these are consistent with the information released by Monsanto as well as recent research results. The survey also indicated that farmers' yield and insect control expectations must be met for them to plant more of *Bt* cotton next season.

The next section describes the data collection process and survey representation. The following sections present the survey results organized by topic, including reasons for adoption, management expectations, insect control expectations, yield and price expectations, minimum acceptable results, and other concerns. Principal findings are presented in the last section.

## Data and Farmer Profile

In mid-July 1996, a survey of South Carolina farmers was undertaken in coordination with Clemson University's Edisto Research and Education Center in Blackville, SC. A non-statistical sample of 14 cotton growers in the southwestern part of the state were selected for preliminary interviews. The small number of producers surveyed was due to time and logistical constraints. However, the respondents represent key informants which were selected based on the recommendations of Clemson scientists at the Edisto Research and Education Center.

The respondents represent 6 major cotton growing counties in the state (see Table 1) with nearly half from Barnwell county. On average, the respondents have been farming cotton for about 25 years with an average of 827 acres planted to cotton in 1996. Roughly 502 acres (61 percent) of the mean cotton acres were planted to non-*Bt* cotton, while around 325 acres (29 percent) were planted to *Bt* cotton. The farmers surveyed also have an average of 4 other agricultural enterprises in addition to cotton. They use 4 cotton varieties, on average, including the *Bt* cotton variety -- Bollgard®. The most popular varieties used was from DeltaPine Land (i.e. 5415, 90, etc.) with around 86 percent of the respondents using it.

## Results and Discussions

### Reasons for Adoption

Farmers were asked to discuss several factors they considered in the decision to adopt the *Bt* cotton technology. Potential savings in insecticide application turned out to be the most popular reason. Seventy nine percent of respondents mentioned insecticide savings as the most important factor in their adoption decision. Surprisingly, only 7 percent considered the potential increase in yield as a factor in their decision and only 29 percent considered the health and environmental benefits of the technology. Other reasons, such as earliness to harvest and "just to try", were also factors in the adoption decision of 57 percent of the respondents.

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**Management Expectations**

Where to plant the *Bt* cotton was a major decision made by farmers. Fifty percent of the respondents indicated they allocated varieties planted according to characteristics of the fields. The other half allocated land randomly. The factors they considered in the decision include: distance of the fields, type of soil, and whether the land is irrigated. Distance was a factor because the farther away a field is, the greater the savings in the machinery cost associated with fewer insecticide sprayings. Farmers avoided soil types which easily turns muddy because it would be difficult to spray using a hiboy during wet weather. Hence, *Bt* cotton technology potentially allows them to plant in these types of soil because they expect that insecticide spraying will be less critical to their making a crop. Following this reasoning, *Bt* cotton allows the growers to plant in irrigated lands which also get muddy. Furthermore, they do not have to worry about the insecticides being washed away by irrigation since the *Bt* gene is inside the plant.

All pre-insecticide management practices for the farmers surveyed were the same in *Bt* cotton as in non-*Bt* cotton. All respondents revealed that they did not change any of the planting, tilling, boron applying, and fertilizing practices. They also did not change the way they decide when to apply growth regulators. That is, they apply whenever they think its necessary. However, some farmers changed how they apply the growth regulators. Two of the respondents always applied growth regulators mixed with the lepidopteran insecticides in non-*Bt* cotton. This means that they have to apply their growth regulators separately in *Bt* cotton. Another two never mix growth regulators and insecticides. This means that they always do it separately and hence there is no change in the method of growth regulator application for *Bt* cotton. The majority of the farmers, however, usually mix growth regulators with insecticides *only* when the timing and need of both chemicals coincide. Moreover, if the growth is not uniform in the fields, they usually do spot application of growth regulators only rather than mix it with insecticides.

**Insect Control Expectations**

The main difference in expectation between growing *Bt* and non-*Bt* cotton is in the insect control practices. The number of applications and type of insecticides used vary widely in *Bt* cotton and non-*Bt* cotton. Pyrethroids are the most common insecticide used for bollworms and budworm in cotton. All the farmers surveyed used pyrethroids in non-*Bt* cotton, but the majority of the respondents (64.3 percent) only use the pyrethroid brand Karate®. About one-third of them use Karate® plus other pyrethroid brands, such as Scout X-tra®, Asana®, and Baythroid®. The remaining 7.1 percent do not use the Karate® brand at all. To control for other pests, like stinkbugs, methyl parathion is the most commonly used by the respondents (71.4 percent). Assuming "normal" weather about 93 percent of the farmers spray these insecticides using hiboy and 7 percent use airplane application.

The majority of the farmers surveyed did not expect to apply any pyrethroid in *Bt* cotton (Table 2). However, about one-third of them have already applied or are planning to apply pyrethroids once or twice. All of them remain vigilant and extra careful in their scouting for worms. On the other hand, the majority of the farmers do expect to apply methyl parathion once or twice to control for stinkbugs. This belief stems from the recommendations by cotton entomologists and extension workers in the area. On average they expect to apply once for stinkbugs throughout the season.

In contrast, the farmers surveyed intended to apply an average of 6 applications of pyrethroids for their non-*Bt* cotton (Table 2), which is the normal average in the state. Around 70 percent of the respondents expect to apply 6 applications of pyrethroids. Approximately 21 percent expect to spray less than six times, while 7 percent expected that more than six sprayings will be needed. Farmers surveyed most frequently expect to apply methyl parathion once in non-*Bt* cotton (Table 2). Forty-two percent expects to spray methyl parathion once, 29 percent expects to spray twice, and the remaining 29 percent does not expect to spray any methyl parathion at all.

Since the pyrethroid brand Karate® and methyl parathion were the most commonly used insecticides, only the application rates for these two are presented here. The application rate of Karate® in *Bt* cotton was slightly less than the rate in non-*Bt* cotton. Approximately 0.027 gallons per acre was the expected rate to be used in *Bt* cotton, while 0.03 gallons per acre was expected to be applied for non-*Bt* cotton. Methyl parathion is expected consistently to be applied at 0.125 gallons per acre for both *Bt* and non-*Bt* cotton.

Consultants were hired by all farmers to scout their fields. All farmers expect no changes in the scouting frequency for *Bt* cotton. Around, 80 percent of the farmers have both their *Bt* and non-*Bt* fields scouted once every week, while the remainder have their fields scouted twice a week. Although scouting frequency remains the same, scouting effort in *Bt* is different from non-*Bt*. In non-*Bt* cotton, scouts look for eggs as the threshold indicator, but in *Bt* cotton they must allow the worm to grow a bit (around 1/4 inch) to serve as an indication of potential control problems. This is a drastic change in techniques that makes most of the farmers a bit uneasy. However, they anticipate that they will get used to this scouting method as they grow more *Bt* cotton in the future.

**Yield and Price Expectations**

Farmers' yield and price expectations on *Bt* cotton were also elicited. Approximately 40 percent of the farmers believe that *Bt* cotton yields will be the same as non-*Bt* cotton yields (Figure 2). Thirty-six percent anticipate a higher *Bt* cotton yield, while 21 percent expect the yield to be the same or higher. This is a surprising result because

although it has been noted that *Bt* might yield more than conventional cotton (Benedict, 1996), farmers have a very conservative expectation of yield.

Ninety-three percent of the respondents anticipate no difference in the price they will receive for *Bt* cotton and non-*Bt* cotton. This indicates that most of them believe that lint quality of *Bt* cotton will be the same as non-*Bt* cotton, although some expressed the concern that there is a probability of *Bt* cotton having a lower quality.

**Minimum Acceptable Results**

The farmers were also asked what kind of results this year would make them plant more *Bt* cotton next year. Fifty percent of the farmers revealed that they will plant more if their yield expectations are met and there are obvious cost savings due to reduced insecticide application. Only when these two factors are satisfied will they use more *Bt* cotton. Roughly 30 percent said that aside from the two factors above their expectations on quality and mill acceptance must also be met for them to plant more. The remaining 21 percent will plant more even if their quality and yield expectations are not met, as long as the savings from insecticide spraying are there. All of the respondents also revealed that if only their yield expectations are met, with no reasonable cost savings in insecticides, they will not plant *Bt* cotton anymore.

**Other Concerns**

At the time of the survey most farmers (93 percent) expressed satisfaction with the way the *Bt* cotton was performing. For example, one farmer observed higher numbers of squares in his crop. Some of them also revealed that the stand and vigor of the *Bt* cotton plant was better than conventional ones. Overall, most of the respondents have positive comments. In contrast, however, one farmer noted that there was already some boll damage in his *Bt* cotton fields and was extremely disappointed at its performance.

Opinions about the seed pricing structure for the *Bt* cotton vary widely among the farmers interviewed. Prices paid by the respondents for the actual *Bt* cotton seed was approximately eight cents per pound more than conventional cotton. In addition farmers had to pay a technology charge of $32.88, on average. Some farmers were displeased with this pricing structure, while others are satisfied with the structure. One farmer, for example, commented that the technology charge should not be billed per acre. He suggested that it should be incorporated in the actual seed cost instead. Around half of the farmers believe that the charge is too high, while the other half believes it is just right.

The farmers were also asked how much they value the "convenience" that *Bt* cotton provides in terms of avoiding wet weather losses. The *Bt* gene is inside the plant and cannot be washed away, so there is no need to worry about applying insecticides when it rains and the losses from insecticides being washed away. In a scale of 1 to 5, five being the highest, farmers value this convenience at approximately 3.5. This indicates that this characteristic is relatively important to farmers, although not extremely important.

Some farmers also expressed satisfaction with the job the research community has done in developing *Bt* cotton technology. An economically feasible technology like *Bt* cotton which is consistent with the health and environmental concerns of society is a step in the right direction for agriculture, they said. It is not often that they see this kind of environment-friendly technology that has a high economic potential.

## Summary and Conclusions

The main factor that South Carolina farmers considered in their decision to adopt *Bt* cotton was the potential savings associated with reduced chemical insecticide application. Health and environmental benefits, yield potential, and other factors, such as earliness of planting, were also usually considered by the cotton growers.

They anticipate no substantial changes in the management practices used in planting *Bt* cotton as compared to conventional cotton, except for insect control. The farmers, on average, do not expect to apply any pyrethroids for *Bt* cotton, compared to averaging 6 applications in conventional cotton. Methyl parathion, on the other hand, is anticipated to be applied at least once for both *Bt* and non-*Bt* cotton. The average application rate of the most common pyrethroid Karate is slightly lower for *Bt* cotton (0.027 gal/acre) than non-*Bt* cotton (0.03 gal/acre). The average application rate for methyl parathion is the same for both *Bt* and conventional cotton (0.125 gal/acre).

The survey revealed that most farmers expect to have the same yield in *Bt* cotton as in non-*Bt* cotton. They also expect that the same price will be received for *Bt* and non-*Bt* cotton. Most growers also indicated that both their yield and insect control expectations should be met for them to plant more *Bt* cotton next season.

Overall, most of the farmers were satisfied by the performance of *Bt* cotton up to the time of the survey. Some concerns were expressed about a variety of topics but overall they agree that this technology is good for the cotton industry --- just as long as the *Bt* cotton technology does indeed give them savings from reduced insecticide application. As the survey showed, this is the most important reason for their adoption and this is what they expect *Bt* cotton will do for them. This is the key issue that the farmers are looking at this year.

## Follow-up

In December the same farmers were contacted to find out how well their expectations were realized. Almost all were satisfied with the results they obtained. The major factor influencing their sense of satisfaction was the reduced number of sprays required. The farmers interviewed sprayed their conventional cotton an average of 5.3 times, but their Bt cotton was sprayed only 1.3 times. All but two farmers sprayed once or twice for stinkbugs, and half had to use one or two pyrethroid applications for bollworm on their Bt cotton. Yields of Bt cotton were about the same as conventional cotton for most farmers in the survey. Almost all farmers reported that production costs were lower for Bt cotton because of reduced sprays required, though some argued that the reduced cost was offset by the technology charge.

Most of the farmers interviewed stated that they used Bt cotton in fields that were logistically difficult to spray; either because of the configuration of the field or distance required to move equipment. This was pointed out as a major advantage of the Bt cotton. All except one said he would continue to use Bt cotton and would recommend that other farmers use it too.

## References


Benedict, J.H. 1996. "*Bt* cotton: Opportunities and Challenges." *In* Proc. Beltwide Cotton Production Research Conf., National Cotton Council, Nashville TN. pp. 25-28.

Bradley, J.R., Jr. 1995. "Expectations for transgenic *Bt* cotton: are they realistic?" *In* Proc. Beltwide Cotton Production Research Conf., National Cotton Council, Memphis TN. pp. 763-765.

Mitchener, F. 1995. "A Grower's Perspective." *In* Proc. Beltwide Cotton Production Research Conf., National Cotton Council, Nashville TN. pp. 163-164.

Phillips, J.R. 1995. "Insect management considerations in a *Bt* cotton production system." *In* Proc. Beltwide Cotton Production Research Conf., National Cotton Council, Memphis, TN. pp. 175-177.


Table 1. Distribution of respondents by county.

| County | No. of respondents | Percent of respondents |
|---|---|---|
| Bamberg | 1 | 7.1 |
| Barnwell | 6 | 42.9 |
| Hampton | 3 | 21.5 |
| Allendale | 1 | 7.1 |
| Aiken | 2 | 14.3 |
| Orangeburg | 1 | 7.1 |
| **Total** | **14** | **100.0** |

Data Source: Primary survey for *Bt* cotton evaluation in South Carolina.

Table 2. Mode of the number of expected application and average application rates, South Carolina, 1996.

| | *Bt* cotton | Non-*Bt* cotton |
|---|---|---|
| **Number of applications** | | |
| Pyrethroids | 0 | 6 |
| Methyl parathion | 1 | 1 |
| **Total** | **1** | **7** |
| **Application rate** | | |
| Pyrethroids (Karate®) | 0.027 | 0.030 |
| Methyl parathion | 0.125 | 0.125 |

Data Source: Primary survey for *Bt* cotton evaluation in South Carolina.