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1-9-2004

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### Recommended Citation

Van Scharrel, Angella and Van der Sluis, Evert, "Farm Level Transgenic Crop Adoption Rates in South Dakota" (2004). *Economics Commentator*. Paper 437.  
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# ECONOMICS COMMENTATOR

South Dakota State University

No. 446

January 9, 2004



## FARM LEVEL TRANSGENIC CROP ADOPTION RATES IN SOUTH DAKOTA

by

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and

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This is the first of two articles on transgenic crop use in South Dakota. In this article, we describe determinants of transgenic crop adoption rates at the farm level in the state. In the next, we will discuss written comments associated with agricultural biotechnology made by South Dakota crop farmers.

Transgenic crops have been rapidly adopted among many farmers in the United States. However, adoption rates differ for the three major transgenic crops currently available (corn, cotton, and soybeans) among individual farmers, geographical areas, and climates.

South Dakota ranked first in the proportion of total cropland area devoted to transgenic crop varieties among the major U.S. corn and soybean producing states in each of the last three years. The popularity of these two transgenic crops in the state led us to ask what the reasons for the high adoption rates are. Although South Dakota is not representative of U.S. agriculture as a whole, attempts to answer this question for South Dakota help provide insights into farmer attitudes towards transgenic crops in the nation as a whole.

To assess attitudes towards, and to analyze factors contributing to the adoption of, transgenic crops among farmers, we conducted a survey among agricultural producers in South Dakota in spring 2002. We sent the survey to a group of 1,000 randomly selected corn and soybean farmers in the state, and received 367 usable surveys.

The article is divided in two parts. In the first part, we describe general attitudes towards agricultural biotechnology among the survey respondents, and in the second part we describe some factors important in transgenic crop adoption rates.

### General Attitudes towards Agricultural Biotechnology

The respondents were evenly divided in their views about the general benefits of agricultural biotechnology, but largely expected the technology to help local agriculture. Not surprisingly given the widespread adoption of the crops in the state, the majority of the respondents did not express principled objections against using transgenic crops, and less than one-tenth stated that growing the crops is unethical. Most survey respondents expected that South Dakota farmers would benefit from agricultural biotechnology, but many had mixed views about biotechnology's benefits to agriculture in general.

There was an almost even split among those who agreed, were not sure, or disagreed that biotechnology will help solve farm surpluses by finding new uses for crops and livestock, and also that biotechnology will hurt American farmers by increasing farm surpluses. The respondents' opinions about the benefits of biotechnology for themselves were much more positive – nearly two-thirds indicated that biotechnology would provide benefits to most South Dakota farmers. Further, greater returns from biotechnology for large farm operations than for small ones were expected.

Many producers were concerned about a shift in power away from production agriculture and towards agricultural input firms, making farmers more dependent upon large corporations. On the other hand, nearly half of the respondents expected biotechnology will enable farmers to become less dependent upon agricultural chemicals, but others were not convinced – over a quarter expected that biotechnology contributes to greater farmer dependence on agricultural chemicals.

Even though transgenic crops are widely used in the state, more than two-thirds of the respondents were particularly concerned about foreign, and slightly fewer about domestic, consumer acceptance of genetically modified crop products. Nearly half of the respondents expected biotechnology to make it harder for the United States to export its crops. Nevertheless, most respondents stated that consumer concerns about food products made from transgenic crops are generally exaggerated. Over half of the respondents stated that biotechnology would benefit consumers, but nearly one-third was uncertain about the benefits of agricultural biotechnology to consumers. Just over one-tenth stated consumer attitudes towards biotechnology would not affect their future planting decisions.

There was an even division between those expressing a need for, uncertainty about, and no necessity of segregating genetically modified (GM) from non-GM crops. Similarly, those stating they did not intend to plant GM crops if they were required to segregate crops were similar in number to those expressing uncertainty about, and those favoring, the planting of transgenic varieties. Ironically, a majority of the respondents stated that GM food at the retail level should be labeled as such, but also that segregating transgenic crops from conventional crops at the farm level is not practical.

Several factors influenced – sometimes in opposing ways – farmers' decisions about adopting transgenic crops. Over half of the respondents indicated that the costs involved with technology fees affect their planting decision, whereas nearly one-third of the respondents stated that their transgenic crop planting decisions are not affected by these fees. The respondents were evenly split between those indicating that seed companies' restrictions on saving seed affect the next year's planting decisions and those stating that they were not influenced by these restrictions. The respondents were similarly divided between those indicating that lawsuits filed by seed companies against farmers affect, and those indicating that they do not influence, their choice of growing transgenic crops. Further, although the StarLink™ case had occurred long before the survey, nearly one-third of the respondents indicated that it had reduced their motivation to grow GM crops.

Even though transgenic crops are widely used by South Dakota farmers, fewer than half of the respondents indicated being well informed, and more than one-fifth of the respondents stated not being

well informed about biotechnology. Less than one-third stated that farmers in general have sufficient knowledge, and another one-third suggested that farmers do not have sufficient and relevant knowledge of biotechnology. Nearly a third of the respondents attributed the lack of knowledge of agricultural biotechnology to the difficulty in gaining access to objective information.

Pronounced differences occur between the adoption patterns of *Bacillus thuringiensis* (Bt) corn, herbicide-tolerant (HT) corn, and HT soybeans, satisfaction with these varieties, and reasons for their adoption. The performance of Bt corn is generally viewed more favorably than that of HT corn and HT soybeans. Over half indicated that per acre profits increased as a result of growing Bt corn, while less than half of the respondents believed that profits had increased in comparison to their conventional counterparts as a result of using HT corn and HT soybeans. More than two-thirds stated that Bt corn yields were higher, but only one-third found higher yields for HT corn. Only one-fifth stated that HT soybeans provided higher yields than conventional varieties.

A large majority of respondents stated they incurred higher expenses associated with growing Bt corn over conventional corn, but the perceived expenditure increases were less pronounced among users of HT corn and HT soybeans. Nearly three-quarters experienced lower pest damage with using Bt corn, while only less than one-third and one-fifth, respectively, experienced lower pest damage growing HT corn and HT soybeans. Pesticide usage associated with Bt corn and HT corn decreased for more than half of the respondents. For farmers growing HT soybeans, more than two-thirds used fewer pesticides compared to conventional varieties.

Overall, the producers' bottom line experience with the three transgenic crops was positive. Nevertheless, approximately one-half of the respondents indicated that profits associated with each of the three transgenic crop varieties are no better or worse than those of conventional varieties. These results indicate that both market and performance factors contribute to the high adoption rates of these three transgenic varieties.

In general, improved pest control is the most important determinant of transgenic crops usage. Improved yields was also a major factor in deciding to grow Bt corn, but was not nearly as important for

farmers in deciding to grow HT corn and HT soybeans. A reduction in herbicide application and a decrease in costs were cited as major factors contributing to the choice of transgenic over conventional soybeans.

The two main reasons for non-adoption or for reverting back to conventional crops are satisfaction with current varieties and dissatisfaction with the new varieties. In the case of HT soybeans, an important reason for not adopting the crop is dissatisfaction with crop yields. Other reasons for not adopting the crops are concerns about segregation, the ability to sell the crops, the environment, and the potential for receiving a lower price.

### **Determinants of Transgenic Crop Adoption**

Based on univariate (that is, one variable at a time) analyses, improved pest (i.e., insect or weed) control was found to be a major factor in the respondents' adoption of all three of the transgenic varieties. Improved yields was also a key factor in the farmers' decision to grow Bt corn, but not nearly as important for growing HT corn or HT soybeans. Other important reasons for adopting the HT varieties were to reduce the amount of labor, costs, and herbicides. The main reason farmers chose not to grow Bt corn, HT corn, and HT soybeans was satisfaction with their current varieties.

Based on Chi-square statistical tests, farm size (measured both in crop acres and in total farm receipts) was a statistically significant determinant in the adoption of all three transgenic varieties. That is, larger farms had higher transgenic crop adoption rates than smaller farms. Further, younger respondents (less than 50 years of age) and farmers with higher levels of education (greater than trade school) also had statistically significant higher adoption rates of Bt corn than their counterparts. In addition, respondents who only worked on the farm adopted Bt corn and HT corn at higher rates than farmers who performed some off-farm work. Respondents not affected by the StarLink™ incident had a statistically significant higher adoption rate of Bt corn and HT corn than farmers stating that the StarLink™ incident had affected their transgenic crop planting decisions. Also, farmers who perceived themselves as being knowledgeable about biotechnology had higher adoption rates of transgenic corn than those who did not feel they were well informed about the technology.

Regression (that is, observing the influence of several variables at once) analysis indicated that for Bt corn, education levels and the farmers' relationship with their seed and chemical suppliers were positive determinants of adoption. On the other hand, the presence of livestock, the farmers' age, work at an off-farm job, and the StarLink™ incident were statistically significant impediments of Bt corn adoption. The latter findings are consistent with the literature, and suggest that palatability of Bt corn may be a problem.

There were no clearly identifiable determinants of HT corn and HT soybean adoption. The only statistically significant variable in the adoption of HT corn was whether the farmer was a seed dealer. For HT soybeans, no variables were found to be statistically significant in their adoption.

### **Concluding Comments**

Based on a survey conducted among a random sample of corn and soybean farmers in South Dakota in 2002, we have provided insights into the adoption of Bt corn, HT corn, and HT soybeans among the state's crop farmers. One of the most important findings of this work is that there is a need for unbiased and scientifically-sound information on agricultural biotechnology among corn and soybeans farmers in the state. This suggests an important role for public institutions, which serve in part to provide objective information to agricultural producers.

### **For Further Reading**

Van Scharrel, Angella. "Determinants of South Dakota Farmers' Adoption of Genetically Modified Corn and Soybeans." South Dakota State University, Department of Economics, Masters Thesis, 2003. <http://www.lib.umi.com/cr/sdstate/fullcit?p1415411>

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