

Conclusions

This report offers insight into a few of the major issues surrounding the farm-level adoption of GE crops since their recent introduction. As new technologies continue to be introduced and the issues concerning GE crops evolve, ERS is committed to providing information about how these technologies affect farmers, consumers, and the environment. Further producer surveys are being designed and implemented to monitor GE crop adoption and its impacts. The principal findings of this report are:

- The adoption of most GE crops has been rapid since these crops first became available to farmers in 1996. Adoption of herbicide-tolerant soybeans and cotton was particularly rapid, reaching 68 and 56 percent of their respective acreage in 2001. The adoption of these herbicide-tolerant crops is expected to continue growing, unless there is a radical change in consumer sentiment concerning GE crops. In contrast, the use of Bt corn peaked at about 26 percent in 1999, and retreated to below 20 percent in 2000 and 2001. Use of Bt cotton expanded to 35 percent of cotton acreage in 2000 and increased to 37 percent in 2001. Future adoption rates for Bt corn and Bt cotton are expected to increase little or possibly decrease, mainly limited by the infestation levels of their respective Bt target pests.
- The economic impact of GE crops varies by crop and type of technology. Adoption of herbicide-tolerant cotton and herbicide-tolerant corn had a positive economic impact on farms. However, adoption of herbicide-tolerant soybeans did not have a significant impact on farm financial performance. These findings were obtained from marginal analyses, meaning that the estimated financial impacts are associated with changes in adoption around the aggregate level of adoption. For example, the finding that the adoption of herbicide-tolerant soybeans did not have a significant impact on farm net returns in 1998 implies that an increase from the average adoption rate (45 percent of acreage) in 1998 would not have a significant impact on net returns.
- The use of herbicide-tolerant soybeans was quite profitable for some farms, but the profitability depended specifically on the types of weed pressures faced on the farm (Bullock and Nitsi, 2001). Farms for which the GE technology provides the highest relative prof-

itability are likely to be the first adopters; farms for which factors other than profitability (such as the simplicity and flexibility of the herbicide-tolerant crops) are driving adoption tend to be later adopters. However, these factors are not quantified in our analysis (nor in other analyses using standard measures of profitability) of net returns to management.

- Adoption of Bt cotton had a positive economic impact on farms, but Bt corn had a negative impact. Bt corn may have been used on some acreage where the value of protection against the European corn borer (ECB) was less than the Bt seed premium. This seeming “overadoption” of Bt corn may be due to annual variations in ECB infestations as well as poor forecasts of infestation levels, corn prices, and yield losses due to infestations. In addition, some risk-averse farmers may have desired to insure against losses due to the ECB.
- The adoption of GE crops has been associated with a small but statistically significant reduction in aggregate pesticide use. While the substitution induced by the use of herbicide-tolerant soybeans results in a small overall change in pounds of herbicides, glyphosate replaces other synthetic herbicides that are at least three times as toxic to humans and that persist in the environment nearly twice as long as glyphosate.

As in all studies, the results presented in this report should be interpreted carefully, especially since the impact studies are based on just 2 years of survey data (1997 and 1998). The impacts of GE crops vary with several factors, most notably annual pest infestations, seed premiums, prices of alternative pest control programs, and any premiums paid for segregated crops. These factors will continue to change over time as technology, marketing strategies for GE and conventional crops, and consumer perceptions of GE crops evolve and new technologies are introduced. Also, the results are heavily dependent on the quality of the survey data. Survey data are influenced by nonsampling errors introduced by enumerators, respondents, and questionnaire design. While nonsampling errors are not measurable, efforts were made throughout the survey design and implementation to minimize these errors.

All in all, we conclude that there are tangible benefits to farmers adopting first-generation GE crops. Not all of the benefits are reflected in standard measures of net returns. But in looking at farm-level impacts, it appears that farmers are, at least, not being disadvantaged by the advent of GE pest and herbicide-resistant seed.