



*Planting Refuges, Preserving Technology*

**Insect Resistance Management Grower  
Survey for  
Corn Borer-Resistant Bt Field Corn  
2004 Growing Season**

Submitted by:  
The IRM Stewardship Subcommittee of the  
Agricultural Biotechnology Stewardship  
Technical Committee

January 31, 2005

The *2004 Insect Resistance Management Grower Survey for Corn Borer-Resistant Bt Field Corn* is the property of the IRM Stewardship Subcommittee of the Agricultural Biotechnology Stewardship Technical Committee (ABSTC), whose members are Dow AgroSciences LLC; Pioneer Hi-Bred International, Inc., A DuPont Company; Monsanto Company; and Syngenta Seeds, Inc. Member companies may submit or refer to this document in their individual communications with the US Environmental Protection Agency. On behalf of the Subcommittee and the members of ABSTC, we hereby waive the rights to compensation and exclusivity under the Federal Insecticide, Fungicide, and Rodenticide Act with respect to the *2004 Insect Resistance Management Grower Survey for Corn Borer-Resistant Bt Field Corn*, and further, waive the right to claim this document as trade secret or commercial or financial information protected from disclosure under federal law.

## Summary of 2004 Compliance Assurance Program Activities

The Agricultural Biotechnology Stewardship Technical Committee (ABSTC) has developed and implemented a wide array of activities to meet the conditions of the Compliance Assurance Program for corn borer protected products since the US Environmental Protection Agency approved it in September 2002. At the core of the CAP is a multi-faceted, comprehensive insect resistance management (IRM) education program targeted at corn growers, seed dealers, and seed company representatives. The education program is delivered by the registrants using a diverse set of materials, venues and stakeholders. New for 2004 was a web-based IRM training module developed in collaboration with the National Corn Growers Association.

A second important component of the CAP is assessing grower compliance with the IRM requirements. The registrants use a number of EPA-specified techniques to measure IRM compliance. These techniques include the annual IRM telephone survey, which targets corn growers with at least 200 acres of corn (100 acres in the South) and 25 acres of Bt corn. The results show that adherence to IRM requirements has been at high levels and has continued to improve over the five years of the survey. A second assessment technique involves conducting on-farm IRM assessments of randomly selected Bt corn growers. The on-farm IRM assessment program does not have any corn acreage restrictions, thus enabling the evaluation of compliance among individual growers with a wide range of corn acreage. In 2004, 95.4% of growers assessed were found to be in full compliance. Approximately 30% of the growers assessed on-farm had fewer than 250 acres of corn, and these “smaller growers” had a level of compliance (97.4%) similar to that of larger growers (94.9%).

A third component of the CAP is the Phased Compliance Approach, which specifies the actions that registrants take with non-compliant growers. In 2003, 172 growers were found to be out of compliance with the IRM requirements. Consistent with the Phased Compliance Approach, these growers were informed of their compliance deviation(s) and provided instructional guidance on how to comply with the requirements. These growers also received a compliance assistance visit and were reminded that their future access to the technology could be denied if a significant deviation occurred in 2004. None of the 172 non-compliant growers reassessed in 2004 was found to be significantly out of compliance and consequently, those growers are permitted to purchase Bt corn in 2005. These results confirm that implementation of the Phased Compliance Approach by the registrants and their seed partners has been effective in bringing growers back into compliance with IRM requirements as intended.

As in previous years, no legitimate tips and complaints related to compliance with Bt corn IRM requirements were reported, despite enhanced efforts to publicize this program.

## **2004 Telephone Survey of IRM Practices**

The ABSTC, consistent with the industry IRM Program and EPA requirements, has commissioned an annual telephone survey of Bt corn growers every year since 2000. The objectives of the surveys have been i) to determine the level of adherence to the IRM requirements, ii) to measure changes in awareness of IRM requirements versus the baseline established in 2000, iii) to obtain grower feedback for improvement of educational and compliance programs, and iv) to evaluate the potential biological significance of non-adherence to the requirements. The surveys have been designed and conducted each year by the independent marketing research firm, Marketing Horizons, Inc., of St. Louis, MO, based on input from ABSTC, NCGA, EPA, and the NC-205 Regional Committee for the Control of European Corn Borer.

### *2004 Telephone Survey Methodology*

The 2004 survey instrument and respondent qualification criteria were unchanged from 2003, and included clarification that the subject Bt corn products included those for control of corn borers only, not corn rootworm. The geographic regions surveyed represented i) areas with significant grower adoption of Bt corn (150 samples in Eastern IA/Northern IL and 200 samples in SD/MN/NE/Western IA), ii) areas where insecticides historically have been sprayed for control of Lepidopteran pests (100 samples in KS/OK/TX Panhandle), and iii) areas where both Bt corn and Bt cotton may be grown simultaneously (100 samples in NC/SC/Southeast MO/TN/MS). Results were weighted to reflect the actual distribution of corn acres in each region. The consistency of methodology since 2000 has allowed for and enhanced the value of year-on-year comparisons.

The telephone survey was conducted by Marketing Horizons, Inc. between August 18<sup>th</sup> and August 31<sup>st</sup> 2004, and reached a total of 554 Bt corn growers stratified across the four regions. An incentive payment of \$10 was used to increase participation in NC/SC/Southeast MO/TN/MS according to standard practice in the region.

Respondents were identified as decision-makers who farmed a minimum of 200 total acres of corn (100 acres in the South) and 25 acres of Bt corn in 2004, and were not employed in the ag-chemical or seed industries. The minimum acreage parameters were established to ensure a representative sample of farmers who plant the vast majority of Bt corn acres. USDA-NASS statistics have shown that nearly 88% of all Bt corn in the 10 states sampled in 2002 was planted on farms with greater than 200 total acres of corn (<http://www.usda.gov/nass/pubs/bioc0703.pdf>).

The survey questionnaire sequentially assessed the grower's actual refuge implementation practices, recall of specific refuge requirements on an unaided basis,

aided awareness of the requirements with prompting, and feedback on information sources. The survey was professionally designed to provide an unbiased and statistically valid evaluation of adherence by Bt corn growers to the IRM requirements. The researchers conducting the survey provided no up-front indication that it was related to IRM, and assessment of whether the grower had planted an appropriate refuge was obtained prior to the term “IRM” being mentioned or implied. All respondents remained anonymous.

### *2004 Telephone Survey Results*

#### *Farming Operations*

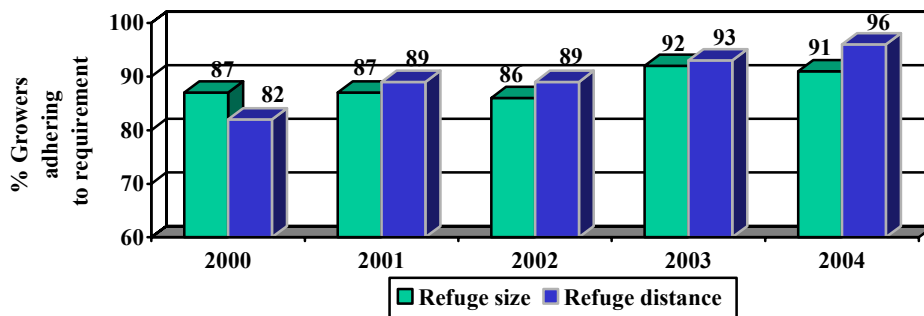
Participants in the study reported planting an average of 589 acres of corn in 2004, down slightly from 614 acres in 2003. The average penetration of Bt corn on these farms remained relatively constant at 57% in 2004, compared to 54% in 2003 and 57% in 2002. The average numbers of total corn fields and Bt corn fields across all regions were 8.9 and 6.2, respectively (little changed from 9.4 and 5.9 in 2003). Cotton Belt corn growers, despite having the lowest total corn acreage, once again reported the highest average number of corn fields, at 16.5 (same as 2003).

#### *Refuge Requirements*

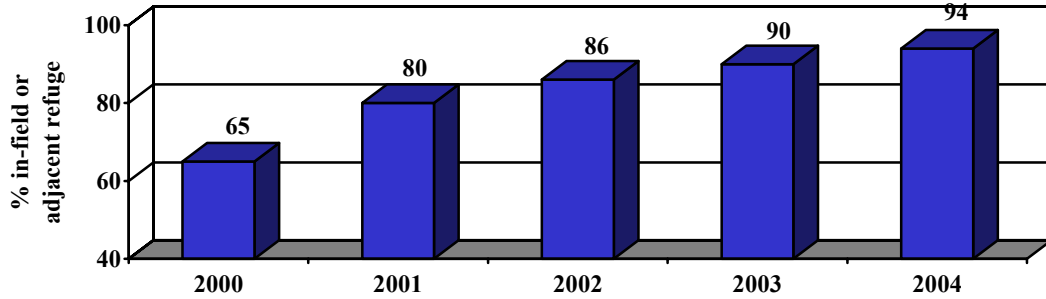
Adherence to both the refuge size requirement (91%) and the refuge distance requirement (96%) remained high in 2004. Neither value represented a statistically significant difference compared to 2003, yet the overall trend toward higher compliance since 2000 is evident in

Figure 1. The improvement in compliance with the refuge distance requirement has been particularly apparent over years, and largely is a result of greater percentages of non-Bt refuge fields being planted within or adjacent to Bt corn fields rather than being separated by some distance (Figure 2).

**Figure 1. Adherence to Refuge Size and Distance Requirements, 2000-2004**

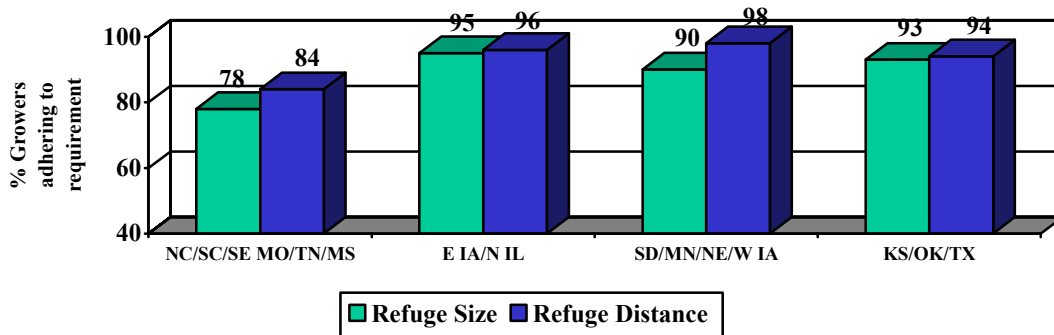


**Figure 2. Percentage of non-Bt refuge fields planted within or adjacent to Bt corn fields**



A look at refuge implementation on a regional basis shows exceptional levels of adherence in the Corn Belt and High Plains (Figure 3). Adherence in the Cotton Belt remained lower, despite improvement since 2000. There are several reasons why adherence to the requirements may be lower in the corn/cotton region, including: 1) the 50% refuge requirement as opposed to 20% in the Corn Belt (economic pressure on the size requirement), 2) some residual confusion over the regional distinction, and 3) the complexity of farming operations as a result of numerous, smaller fields, making separation by distance more likely (36% in the corn/cotton region, compared to just 6% overall).

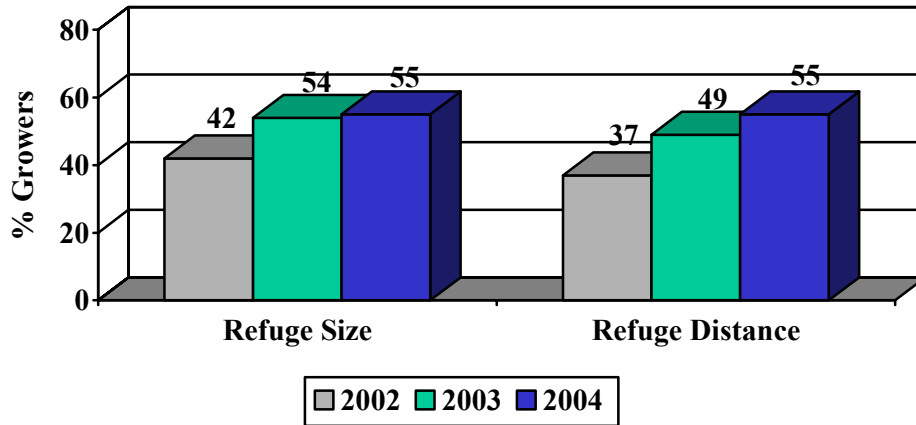
**Figure 3. Adherence to IRM Refuge Size and Distance by Region, 2004**



*Grower Awareness and Attitudes toward IRM*

Ninety-two percent (92%) of Bt corn growers surveyed in 2004 responded that they were aware of requirements for managing insect resistance, and 88% knew on an unaided basis (without prompting) that a refuge was needed and could recall at least one of the requirements. Fifty-five percent were able to correctly provide the required refuge size for their region when asked (Figure 4). Likewise, 55% of the growers surveyed knew that the refuge must be planted with ½ mile of Bt corn, which represented a statistically-significant increase ( $P=.05$ ) from 49% in 2003.

**Figure 4. "Unaided" Awareness of IRM Requirements**

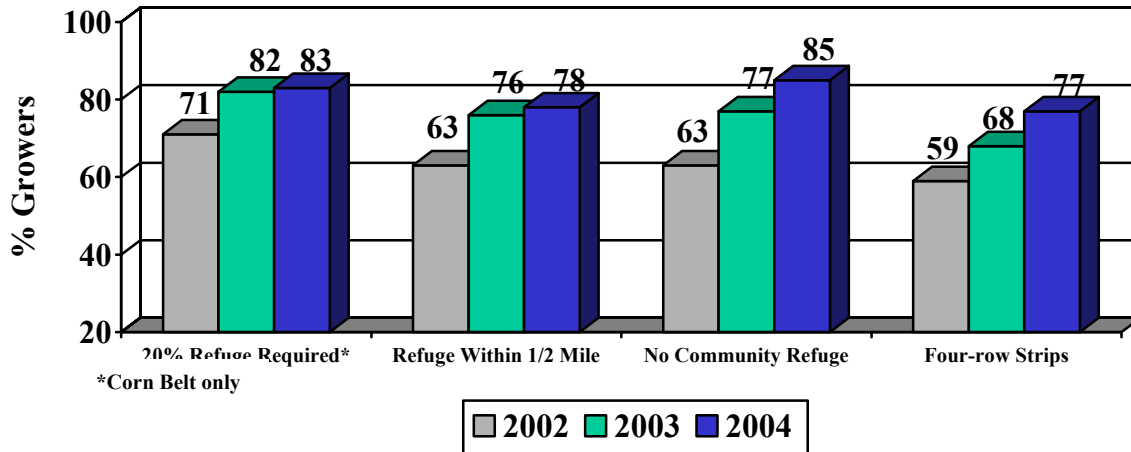


Aided awareness, i.e., when respondents received specific cues for information, also showed improvement. The percentage of respondents from the Corn Belt who knew upon prompting that 20% refuge was required (83%), and the overall percentage who knew upon prompting that ½ mile distance was required (78%) were relatively flat compared to 2003 (Figure 5). However, the percentage of growers knowing that a neighbor's non-Bt corn does not qualify as a (community) refuge, as well as the percentage of respondents aware that refuge strips must be at least four rows wide (preferably six), have shown statistically significant improvement in each of the past two seasons, standing at 85% and 77%, respectively.

*IRM Education*

Seed companies and their dealers continue to be regarded as the most important sources of information on IRM. Both were ranked as "very important" or "somewhat important" by 96% of the Bt corn growers surveyed. Respondents also mentioned grower/technology use guides (86%), cooperative extension or university (85%), farm publications (83%), ag-chem retailers (83%), and crop consultants (81%) as being somewhat or very important.

Figure 5. "Aided" Awareness of IRM Requirements

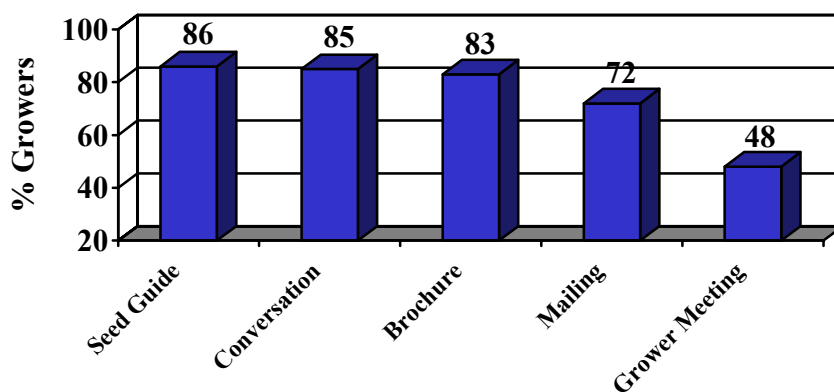


Bt corn growers once again recalled receiving multiple IRM communications throughout the year, and the actual sources tracked very well with the level of importance the growers placed on them. Communications with seed companies or dealers included production or IRM-specific seed guides (86%), an individual conversation (85%), an IRM brochure (83%), mailings (72%), or grower meetings (48%) (Figure 6). The registrants have continued to emphasize direct communication of IRM information to growers through company representatives and dealers, and the percentage of growers reporting having had an individual conversation about IRM increased significantly for the second consecutive year (Figure 7).

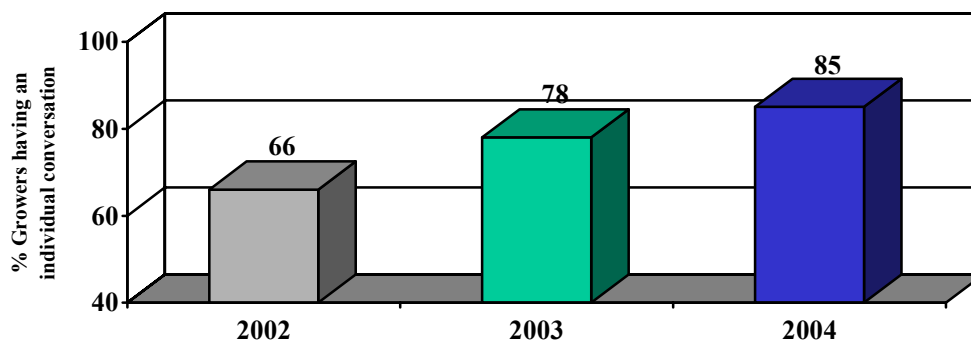
*Additional Findings*

The overall attitude of growers toward IRM remains decidedly positive, with 94% saying it is important (64% very important, 30% somewhat important). Nearly all growers said they were well informed about IRM, with 96% indicating they have sufficient information to properly implement a refuge.

**Figure 6. Grower Recall of IRM Information from Seed Companies**



**Figure 7. Conversations with Seed Company Reps about IRM**



As noted consistently in previous surveys, participants continue to report that their use of insecticide sprays to control corn borers has decreased since the introduction of Bt corn. Among growers who used insecticides regularly (four or five of the previous five years), 77% reported having decreased their insecticide use, 60% describing the reduction as significant.

*Telephone Survey Conclusions*

The results of the 2004 Insect Resistance Management Grower Survey for Corn Borer-Resistant Bt Field Corn overall were positive and consistent with previous years. All statistically significant differences compared to 2003 were favorable, as is the five-year trend in overall adherence to the IRM requirements. The ABSTC is pleased with the maintenance of very high levels of adherence to both size and distance refuge requirements. The results confirmed that farmers who plant the vast majority of the Bt

corn acres are well informed about IRM, adhering to the requirements, and helping to preserve this valuable technology.

Continued improvement in unaided recall of the requirements was observed, indicating that Bt corn growers have become increasingly familiar with the specifics of the requirements over time. The significant improvements in aided recall of the need for an on-farm non-Bt refuge and for non-Bt strip refuges to be at least four rows wide are notable. The ABSTC is particularly encouraged by the continued improvement in the number of individual conversations about IRM, which put a “face” on the requirements, reinforce comprehension, and enable immediate feedback.

Adherence to the IRM requirements in the Cotton Belt continues to lag the outstanding levels observed in the primary corn production areas. The ABSTC, in cooperation with NCGA, National Cotton Council (NCC), and regional stakeholders, are re-examining and addressing the factors associated with this difference, including the technical rationale and economic impact of the 50% non-Bt refuge.

The results of the 2004 telephone survey validate that the existing CAP, including education efforts, on-farm assessments, and the Phased Compliance Approach, is working. Going forward, the ABSTC would consider success to be measured as maintenance of the high levels of adherence, awareness, perceived importance, and information dissemination that have been achieved during the first five years of the IRM telephone survey.