

**Bt Corn Insect Resistance  
Management Survey**

**2000 Growing Season**

Agricultural Biotechnology Stewardship  
Technical Committee

January 31, 2001

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## Executive Summary

### Introduction

On January 31, 2000, the EPA accepted the Bt Corn Industry Insect Resistance Management (IRM) plan (the "unified plan") for the 2000 planting season. The plan, developed by many of the member companies of the Agricultural Biotechnology Stewardship Technical Committee (ABSTC) in cooperation with the National Corn Growers Association (NCGA), features a 20% refuge requirement in the corn belt and a 50% refuge requirement in areas of overlapping corn and cotton production<sup>1</sup>. The plan provides a practical, science-based approach to IRM. The creation and implementation of the unified plan sought to reverse the confusion in the grower community caused by inconsistencies in IRM recommendations from Bt corn registrants, universities and other sources during previous seasons. In addition to a common refuge size, the unified plan establishes for the first time that growers locate the refuge within a specified distance from Bt cornfields.

Consistent with previous efforts put forth by the Bt seed corn industry, the unified plan includes a strong commitment to IRM education. The plan's education program, while focused on the grower, also is aimed at stakeholders who influence the grower community and are able to reinforce the messages put forth by the seed industry.

Since the first introduction of Bt corn in the marketplace, the Bt seed corn industry has supported surveys done by Iowa State University aimed at measuring grower practices with Bt corn. ABSTC expanded and refined the survey effort for the 2000 growing season, specifically to: (1) gauge awareness and the degree of adoption of IRM requirements, (2) identify regions with lower than expected IRM implementation, and (3) improve its understanding of the sources of IRM information used by growers. There currently remain significant opportunities to educate growers and influence IRM practices while Bt technology is new and has relatively low market penetration nationwide. The Bt corn registrants will use the results of this and future surveys to more successfully design and target education programs in subsequent seasons. The ultimate aim is to ensure that growers are aware of the most current IRM requirements and are implementing them to preserve the benefits of this technology for years to come.

The education component of the unified plan was implemented by all Bt corn registrants as soon as the program was approved by the EPA at the end of January, 2000. However, it is important to note that most growers had already made their seed purchasing decisions and developed their planting programs by that time. Therefore, this survey was designed to establish a baseline of grower awareness and adoption of the most recent IRM refuge guidelines and to provide information for future improvements to the industry's IRM education efforts.

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<sup>1</sup> Aventis CropScience independently developed the IRM plan for Cry9C-expressing plant protectants. This plan was accepted by EPA on April 7, 2000, and features a uniform 20% refuge requirement across all corn growing regions. With the exception of the reduced refuge percentage in the areas of overlapping corn and cotton production, the Aventis and 'unified' IRM plan are similar. For the purpose of this document, both IRM plans will be referred to collectively as either 'the plan' or 'unified plan.'

## **Survey Development**

Consistent with the unified plan and a letter to registrants from the EPA (dated January 31, 2000) requiring a survey of growers, the ABSTC commissioned Marketing Horizons, Inc. of St. Louis, MO, an independent marketing research firm, to design and conduct a survey of Bt corn grower awareness and implementation of the IRM requirements approved for 2000. A wide range of stakeholders including members of the academic community (NC-205), the NCGA, and the Bt corn industry provided input on the questions and geographic regions to be included in the survey. The survey was conducted and analyzed solely by Marketing Horizons, Inc.

Four distinct geographic regions were included in this study, representing areas with significant grower adoption of Bt corn (Southern IA/Northern IL and SD/MN/NE), areas where insecticides are traditionally sprayed for control of lepidopteran pests (KS/OK/TX), and areas where both Bt corn and Bt cotton may be grown simultaneously (MO Bootheel/ TN/KY/MS). A total of 501 Bt corn growers stratified across these four regions were surveyed via telephone during the period from September 14 through September 27, 2000. Respondents were identified as decision-makers who farmed a minimum of 200 acres of corn in 2000 (average of 553 acres), and were not employed in the farm chemical or seed industries.

In order to obtain the most rigorous evaluation possible, the survey assessed both aided and unaided grower recall of the IRM requirements. Aided measures indicate general familiarity with the subject matter and are particularly useful when a significant amount of time has elapsed between exposure to the information and conduction of the survey. Unaided awareness is a more stringent measure, as it relies more heavily on memory recall and generally reflects a person's command of the subject matter. Thus, significant differences between aided and unaided awareness measures are common and to be expected.

## **Survey Results**

The results of the survey demonstrate Bt corn growers' strong recognition of the need for IRM efforts to preserve the benefits of this technology (91% of the respondents agreed that IRM plans for Bt corn are somewhat to very important).

For the 2000 growing season, 92% of all growers surveyed believed that they had an acceptable refuge in place: 87% planted at least 20% of their corn to non-Bt while an additional 5% apparently followed refuge guidelines from previous years that differed from the current size requirement. These numbers represent a very high degree of refuge implementation given the range of refuge requirements communicated since the introduction of this technology.

Growers reported having an average of 4.4 separate fields of Bt corn. Overall, 82% reported planting their refuge less than ½ mile from their Bt corn. Some growers may have planted their refuge ½ mile from their Bt field and met the distance requirement, but this could not be determined due to the manner in which the question was asked (refuge planted *½ mile or more* from Bt corn - see page 12). This question will be edited accordingly for future surveys. A grower was defined in this survey as outside the proximity guidelines if at least one of his fields was ½ mile or more from the non-Bt refuge, although some of his fields may have been within

the distance requirement. Furthermore, there is a reasonable probability, given current penetration levels, that non-Bt corn will be located within ½ mile of any Bt corn field.

When considering overall implementation of the current refuge requirements, 71% of growers reported that they had followed both the 20% non-Bt refuge size and proximity options in place for the 2000 season.

A series of questions were asked to assess growers' aided and unaided recall of the current IRM requirements. Most growers (80%) claimed to be aware that requirements exist, however unaided recall of the specific requirements was limited: 29% were aware on an unaided basis that they must plant a minimum 20% refuge in non cotton-growing regions. An additional 26% of growers felt a refuge size of 5-15% was required (reflecting recall of elements of past refuge requirements). With respect to proximity requirements, 31% were aware on an unaided basis that the refuge must be placed within ½ mile. Assessment of the reasons why growers did not plant an appropriate refuge indicate a lack of up-to-date information rather than a conscious effort on the part of growers to violate the guidelines, highlighting the need for consistency and focused education efforts.

Aided recall of the IRM guidelines was significantly greater: seven out of ten growers in the non-cotton growing regions indicated that they were aware that a 20% non-Bt refuge is required. Awareness of distance requirements was lower (39%), possibly due to different requirements based on whether the refuge is treated with an insecticide.

Finally, growers were asked to identify their key sources of IRM information for Bt corn. By a wide margin, seed dealers and seed companies were most often identified as the primary sources. As a requirement of Bt registrations, companies provided the purchasers of Bt corn products with use guides that included the current IRM guidelines. At the time of purchase or prior to seed delivery, growers are required to sign a document stipulating that they agree to incorporate the guidelines delineated in these guides into their farming practices. The use guides, however, are just one of several sources of IRM information, and were not cited as a primary source by most growers (although the "seed dealer" and "seed company" responses may have referred to the guides). This information confirms the importance of multiple avenues of education communication, and will be critical in helping Bt registrants improve their education efforts.

### **Conclusions and Next Steps**

The ABSTC is very encouraged by the results of this survey, particularly given that this was the first year of the unified plan and that education programs were not initiated until the seed purchasing season had largely passed. The overwhelming majority of growers understand that IRM is important and are within the recommended IRM options. As indicated in the industry plan and by academic experts, a simple and consistent message is key to promoting awareness and adoption of IRM guidelines, and the ABSTC is committed to comprehensive education programs to communicate the IRM message.

The biotechnology provider companies participating in ABSTC are committed to Bt crop stewardship, including continuing efforts to provide grower education and raise awareness and

understanding of the current IRM guidelines. Pursuant to this goal, ABSTC, in conjunction with NCGA and members of NC-205, has developed educational materials to reinforce and augment grower guides/technical use guides. These materials include videos, brochures, and slide presentations, as well as a graphic logo to be used in multiple communications media. Details for deployment of these materials were supplied to the EPA by the Bt corn registrants in March 2000, and will be updated for 2001.

Results of this baseline survey were particularly valuable in highlighting seed companies and dealers as the most effective vehicles for grower communication, and ABSTC members will utilize this information to improve their education programs. Bt registrants intend to develop improved IRM educational materials, including point of sale brochures and other items, that will help ensure both the dealers of Bt corn seed and individual seed companies are better equipped to provide the most current IRM information to growers.

Crop consultants and farm publications were also recognized as significant sources of IRM information, particularly in the Plains, where 37% of Bt corn growers relied on consultants as their primary source of IRM information. To take full advantage of this important resource, outreach opportunities will be identified to ensure consultants have the information they need to better advise client Bt corn growers of IRM requirements and to help them implement an appropriate structured refuge.

The Bt corn registrants will also work in collaboration with the NCGA, the Cooperative Extension Service, USDA, the American Crop Protection Association, the Biotechnology Industry Organization, crop consultants and other crop professionals to identify opportunities to promote grower awareness through publications in farm journals, newsletters and websites.

Paramount to maintaining a high level of grower adoption of IRM is maintaining consistency in the requirements. Establishing a high level of recall of specific refuge guidelines will require time as ABSTC members continue to communicate and reinforce the IRM message. Current IRM requirements are practical, flexible and sufficient to ensure the durability of Bt in corn for the foreseeable future, and therefore must be maintained.

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**2000 Growing Season**

**Prepared For:**

**Agricultural Biotechnology Stewardship  
Technical Committee**

**Marketing Horizons, Inc.  
St. Louis, Missouri  
December 2000**

## ***INTRODUCTION***

### **PURPOSE:**

- **To determine to what degree growers are aware of and implementing insect resistance management and/or refuge requirements pertaining to Bt corn. Additionally, current cropping practices relative to Bt corn were examined.**

### **METHODOLOGY:**

- **A total of 501 telephone interviews were conducted between September 14 and September 27, 2000.**
- **Four separate regions were selected to be included in the study. The sample size for each region is shown below:**

<b>Bootheel/TN/KY/MS.....</b>	<b>50</b>
<b>Southern IA/Northern IL.....</b>	<b>151</b>
<b>SD/MN/NE.....</b>	<b>200</b>
<b>KS/OK/TX .....</b>	<b><u>100</u></b>
<b>Total .....</b>	<b>501</b>

- **Respondents were screened to ensure that they were:**
  - **Actively involved in farming**
  - **Decision-maker concerning the purchase of insecticides.**
  - **A minimum of 200 corn acres in 2000.**
  - **Not a member of a household where anyone was employed by a farm chemical manufacturer, distributor, or dealer.**
  - **Not a member of a household where anyone was employed by a seed company in a position other than being a farmer/dealer.**
  
- **On average, the Bt corn growers surveyed planted 553 acres of corn in 2000, of which 47% was planted in Bt corn. Users of Bt corn also reported having on average 4.4 separate cornfields planted in Bt corn.**

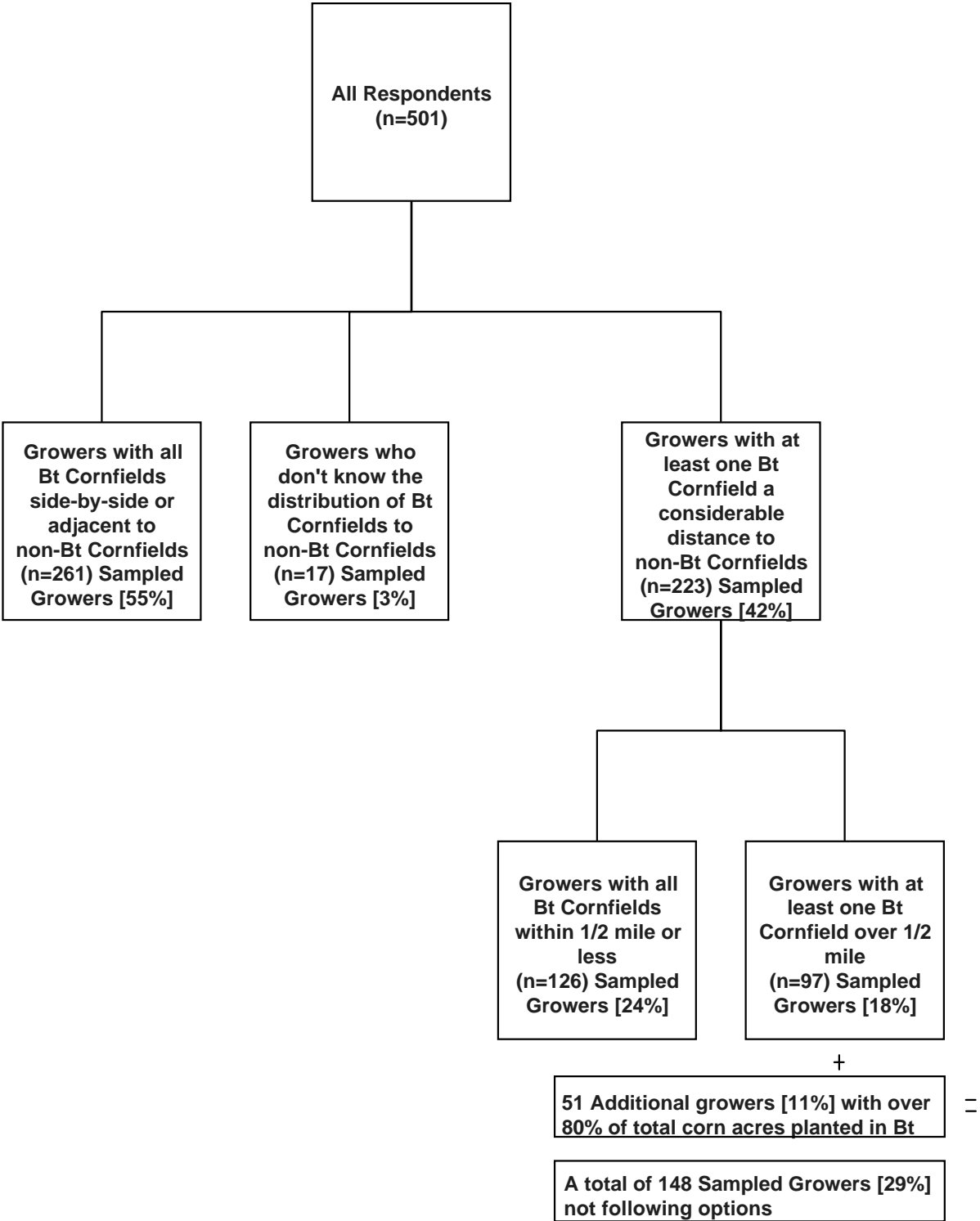
**NOTE:** *The total column has been weighted to reflect the actual distribution of corn acres across the sample region.*

## ***I. REFUGE PLANTING PRACTICES***

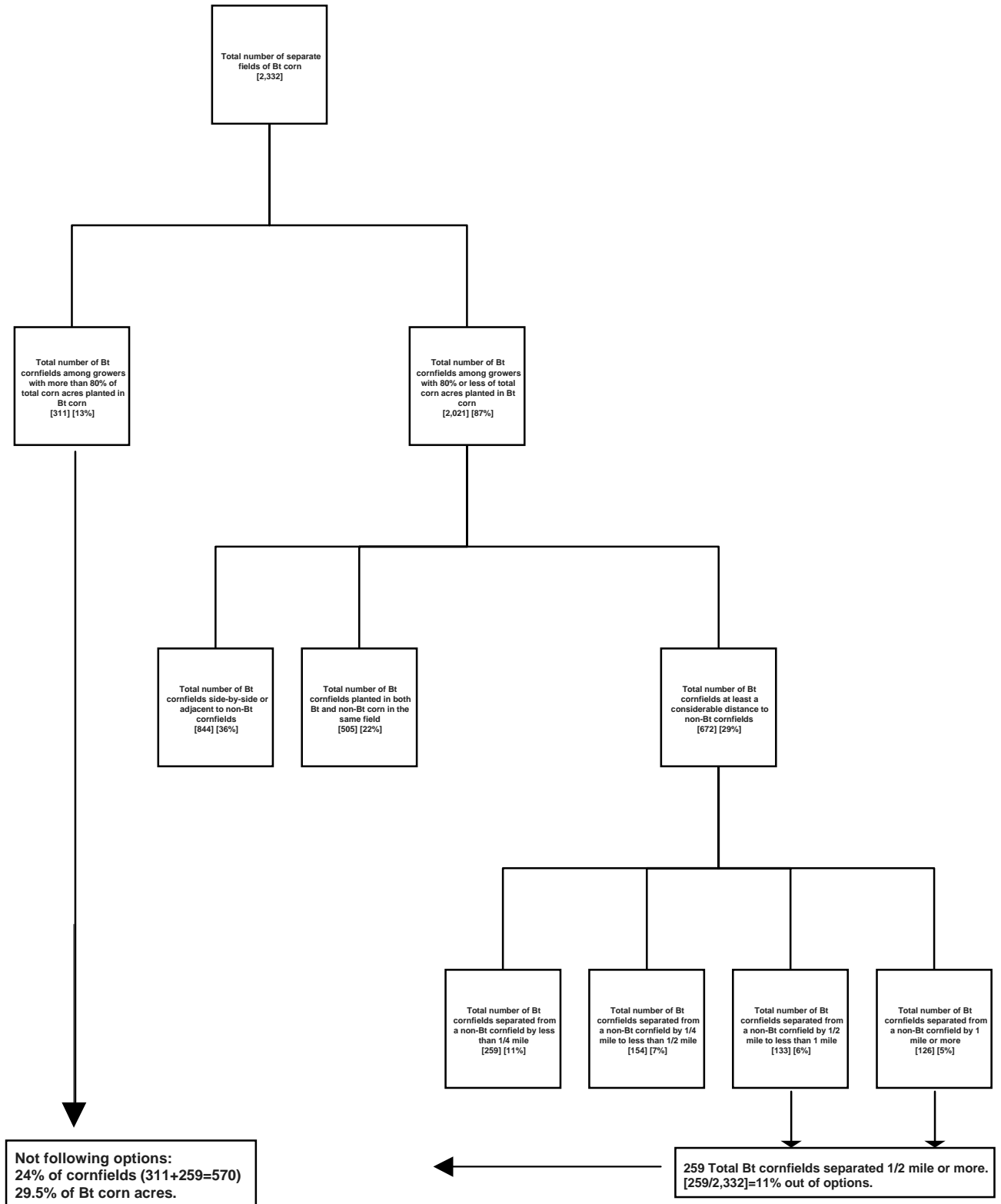
- **Most growers (91%) agree that insect resistance management plans for Bt corn are very or somewhat important; thus, it is reasonable to assume that they would be committed to doing their part to preserve the technology.**
- **Most growers (92%) believed they had an acceptable refuge in place, and 71% were within both the size and proximity guidelines for the 2000 season.**
- **Individually, neither the 20% non-Bt refuge nor the proximity options were particularly problematic. That is, 87% of growers had planted less than 80% of their corn acres in Bt and 82% reported planting a refuge less than 1/2 mile from their Bt corn. When taken together, the results show that 71% of growers apparently followed the complete refuge requirements outlined for the 2000 season. (Approximately 76% of Bt fields were estimated to have been consistent with established refuge options.)**
- **To a large extent, growers not following established refuge planting options did so as a result of lack of knowledge or incorrect knowledge, as opposed to a conscious effort to go against these options.**
  - **41% of growers planting more than 80% of their corn acres in Bt corn this year were under the impression that they were maintaining an acceptable refuge. This equates to 5% of all growers. Thus, 92% of all growers surveyed either planted less than 80% of their corn acres in Bt (87%) or were under the impression that they were planting an acceptable refuge (5%).**
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- **64% of growers with at least one Bt cornfield separated from a non-Bt cornfield by a distance of 1/2-mile or more explained their action by suggesting “*just the way it worked out*”/“*way farm is set up.*”**
- **Growers planting over 80% of their corn acres in Bt corn tended to be smaller growers (432 average corn acres), while those with at least one Bt field 1/2-mile from a non-Bt field tended to be larger growers (672 average corn acres).**

# ***Distribution Of Sample In Regards To Distance Between Bt And Non-Bt Cornfields***

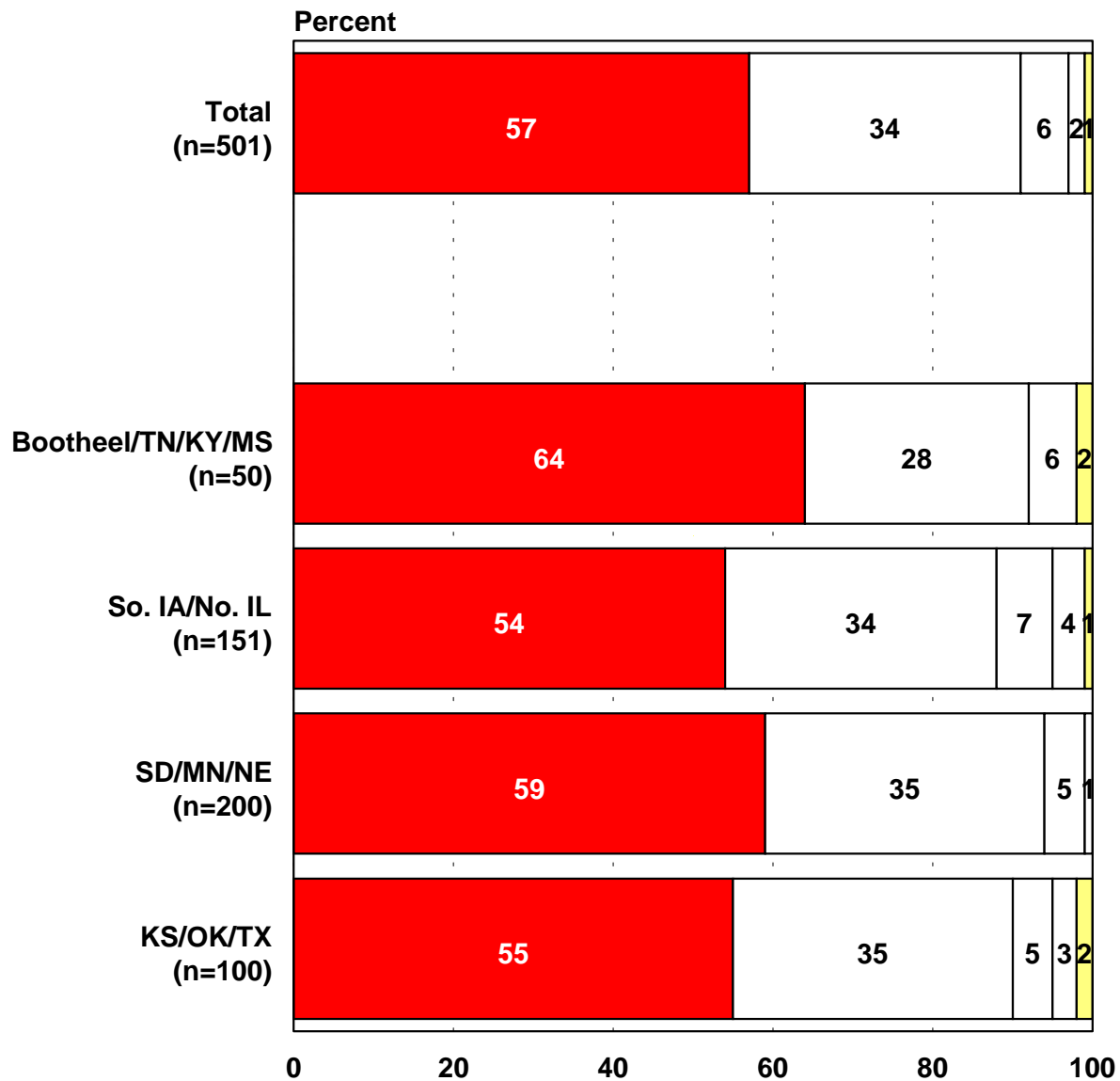


# Distribution Of Bt Cornfields Among Sample



# Importance Of Insect Resistance Management Plans For Bt Corn

(Base=All Growers)



Q.5 In your opinion, how important do you consider insect resistance management plans for Bt corn to be? Would you say:

## **II. AWARENESS OF IRM REQUIREMENTS FOR Bt CORN**

*Note: The current study featured both unaided and aided measures of grower awareness and understanding of the IRM guidelines for Bt corn. Unaided awareness is a more stringent measure, as it relies more heavily on memory recall and is thus generally viewed as a more reliable measure of having a “working knowledge” of the subject matter. In contrast, aided measures are subject to respondents agreeing with a statement or position that “sounds right.” Thus, significant differences between unaided and aided awareness measures are common and to be expected.*

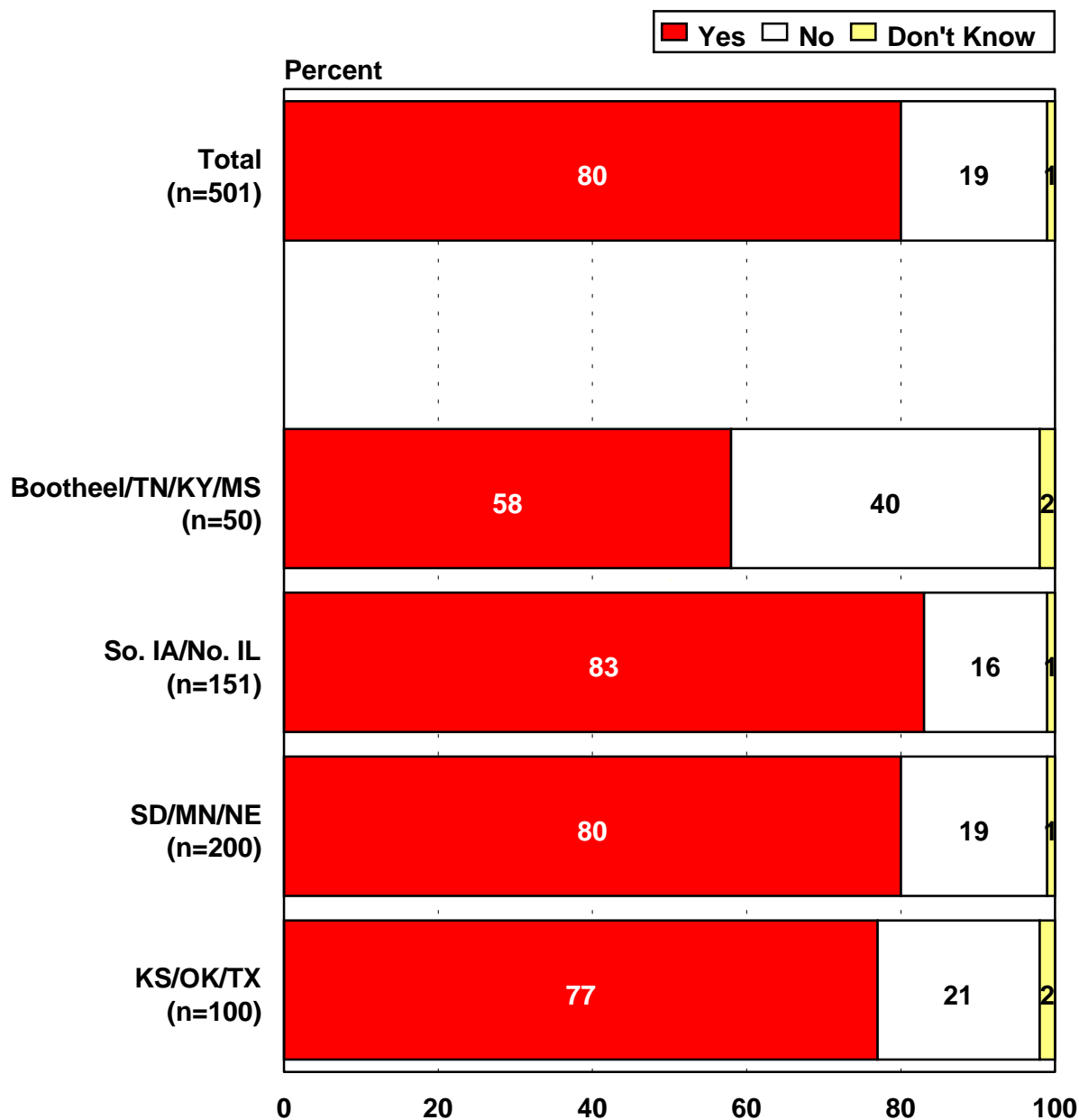
### **A. Unaided Awareness**

- **Most growers (80%) claimed to be aware of 2000 requirements for managing insect resistance for Bt corn.**
  - **Growers in the corn/cotton growing areas tended to be less aware of these requirements.**  
*[Caution: small sample size]*
- **Unaided recall of specific requirements regarding the management of insect resistance for Bt corn was limited and primarily reflected a general understanding that a refuge planted in non-Bt corn must be maintained.**

- **A significant percent of growers do not appear to be aware that changes have occurred in planting options regarding the minimum size of non-Bt corn refuge.**
  - **26% feel that a refuge of 5%-15% of corn acres must be established**
  - **29% feel that a refuge of 20% of corn acres must be established**
  - **39% didn't know the minimum size of a non-Bt refuge.**
  
- **Most growers (61%) didn't know how close, in terms of miles or fractions of miles, the non-Bt refuge must be to a Bt cornfield.**
  
- **One out of two growers (49%) were aware that a non-Bt corn refuge could be treated for cornborer (28% didn't know). Most of those claiming to be aware of the treatment option didn't know what conditions had to be met to treat, or what, if any, insecticide restrictions existed.**

# Awareness Of Requirements For Managing Insect Resistance For Bt Corn

(Base=All Growers)



Q.2a For the 2000 season, were you aware of requirements for managing insect resistance for Bt corn?

## Recall Of Requirements Pertaining To The Management Of Insect Resistance For Bt Corn

(Base = Respondents aware of requirements for managing insect resistance for Bt corn)

- Multiple mentions accepted -

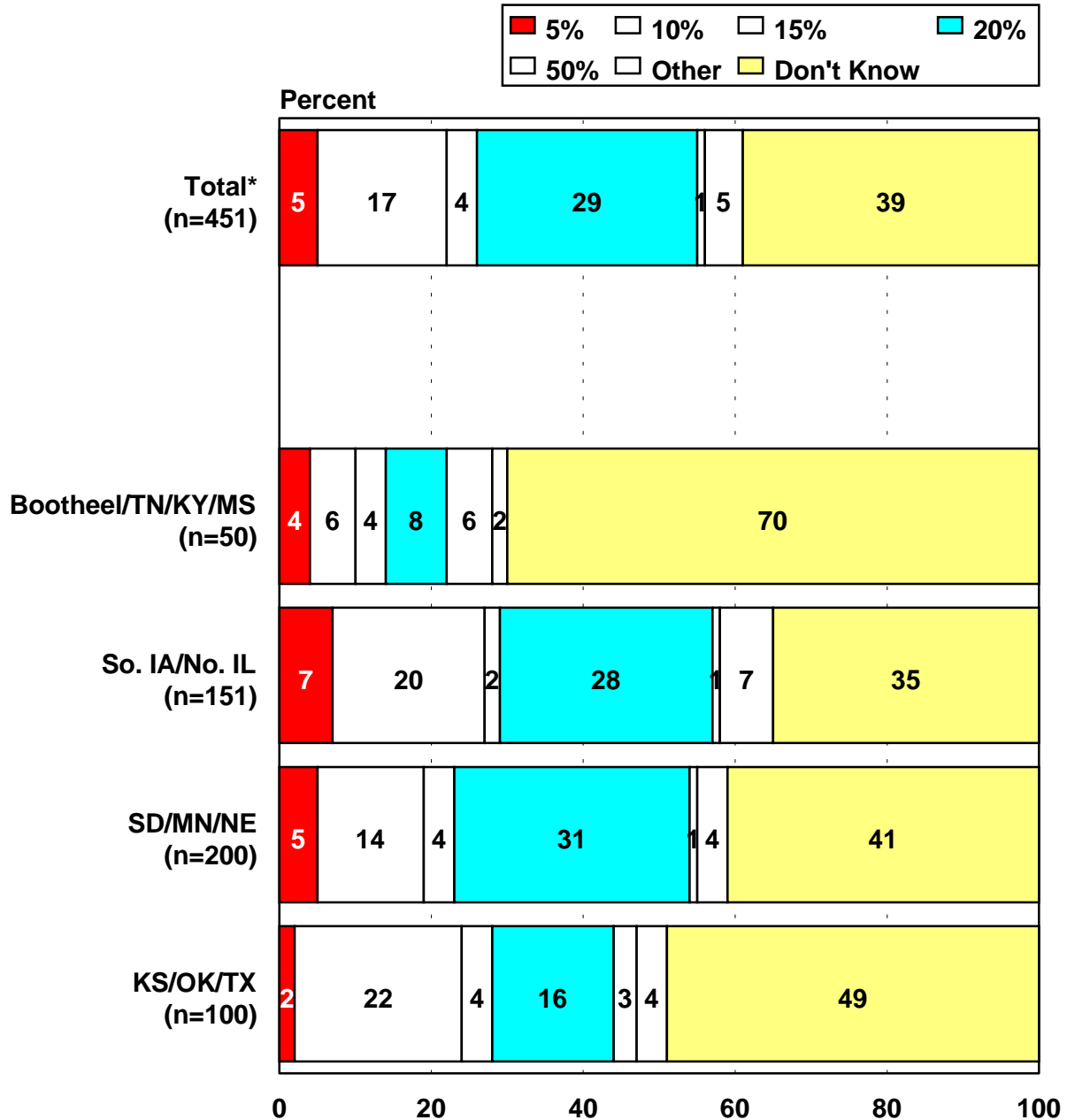
	*				
	Total	Bootheel/ TN/ KY/MS	So.IA/ No.IL	SD/ MN/NEOK/TX	KS/
	(n=501)	(n=50)	(n=151)	(n=200)	(n=100)
Plant 20% non Bt.....	25%	2%	26%	27%	16%
Have to have a refuge .....	12%	16%	11%	13%	12%
Plant non-Bt on a certain percentage of acres	11%	10%	11%	12%	11%
Strips of non-Bt in same field as Bt.....	8%	10%	9%	8%	7%
Plant 10% non Bt.....	5%	--	5%	5%	9%
Plant 25% non Bt.....	4%	2%	6%	4%	3%
Plant a non-Bt field next to Bt field.....	4%	--	5%	4%	2%
Plant 30% non-Bt.....	2%	--	2%	1%	--
Plant 50% non-Bt.....	1%	10%	--	--	8%
Plant 15% non-Bt.....	1%	--	1%	1%	2%
None.....	1%	6%	--	1%	1%
Don't know.....	24%	46%	22%	24%	27%

\* *Caution: Small sample size*

**Q.2b What do you recall about these requirements?**

# Minimum Size Of The Non-Bt Corn Refuge That Must Be Planted

(Base=All Growers)

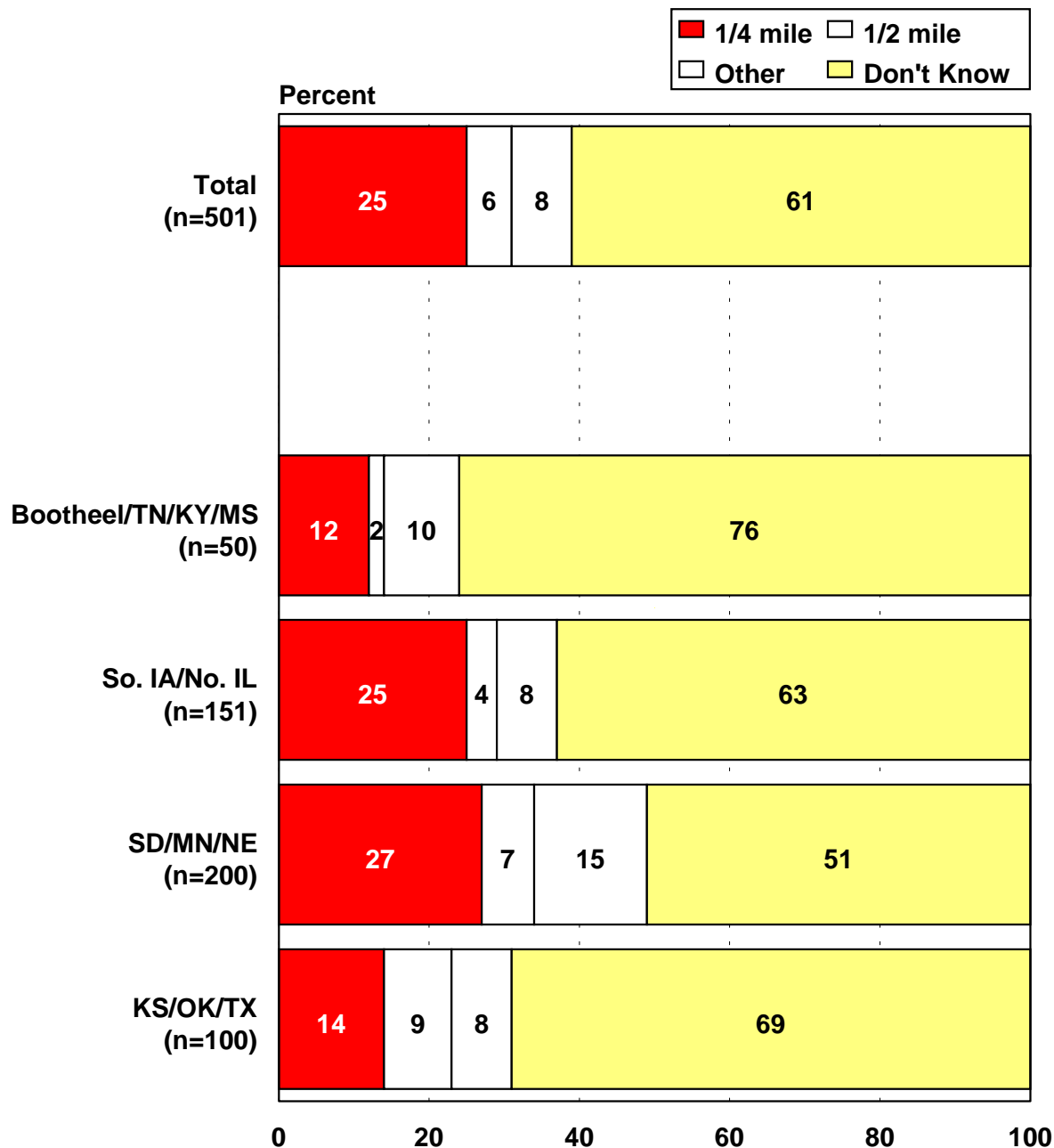


\* Excluding Bootheel/TN/KY/MS region

Q.2c To your knowledge, what is the minimum size of the non-Bt corn refuge that must be planted on a farm?

# Distance The Non-Bt Corn Refuge Must Be To The Bt Cornfield

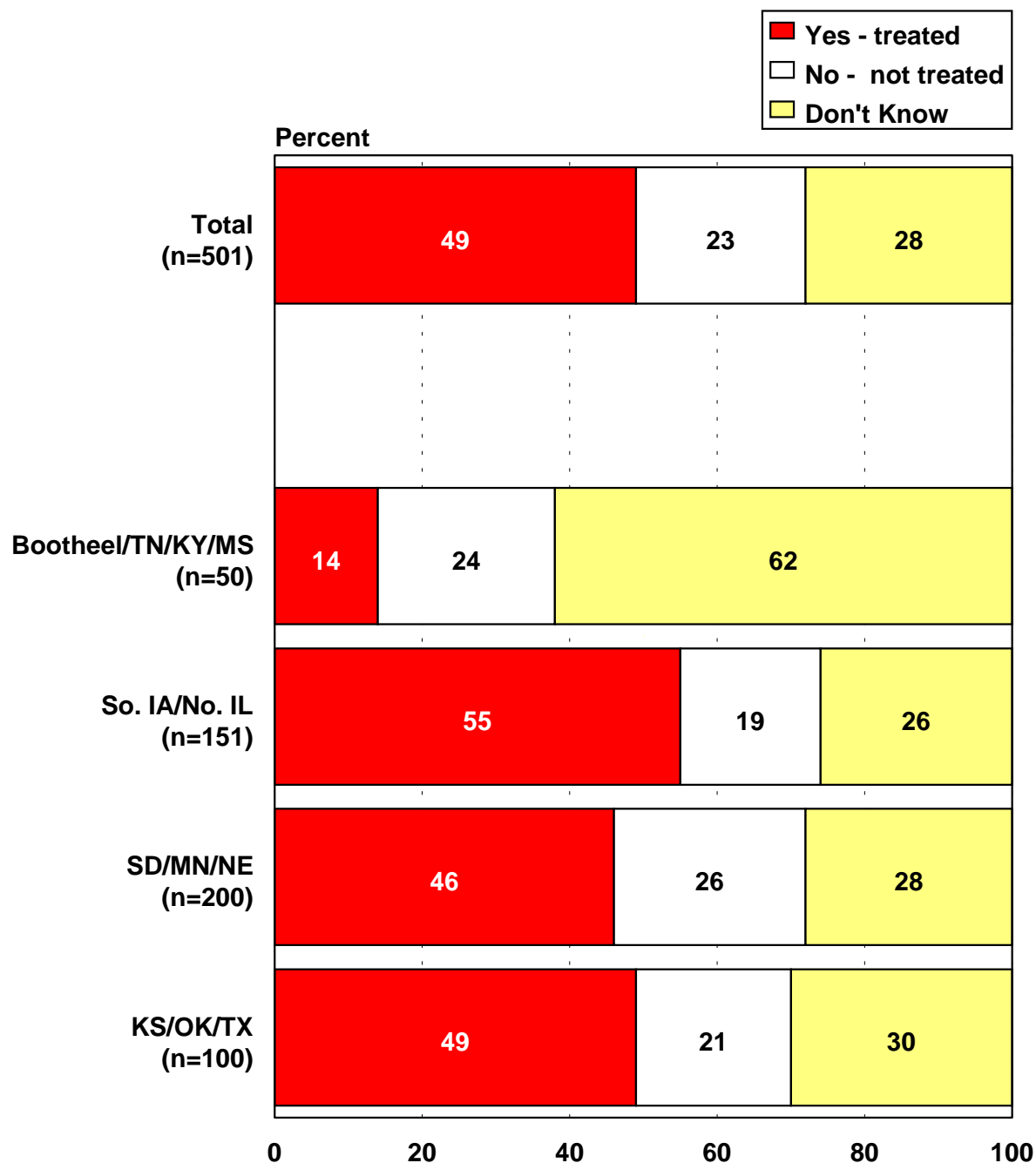
(Base=All Growers)



Q.2d How close, in terms of miles or fraction of miles, must the non-Bt corn refuge be to the Bt cornfield?

# Incidence Of Believing That The Non-Bt Corn Refuge Can/Cannot Be Treated For Cornborer

(Base=All Growers)



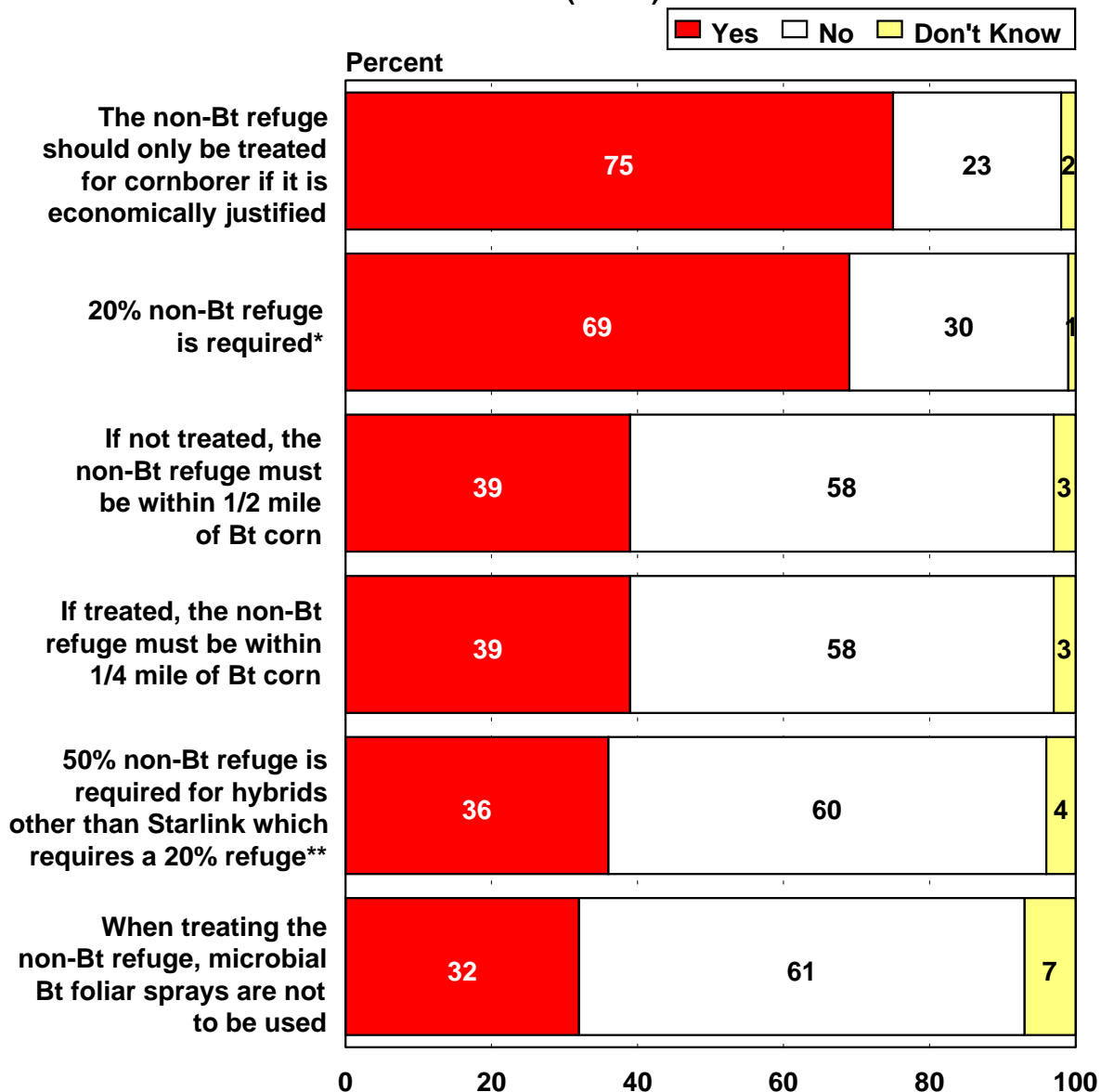
Q.2e As you understand it, can the non-Bt corn refuge be treated for cornborer or not?

**B. Aided Awareness**

- **Aided awareness of refuge size guidelines was considerably higher. Seven out of ten (69%) growers in non-cotton/corn regions indicated that they were aware that a 20% non-Bt refuge is required.**
- **There was considerably less awareness that:**
  - **If not treated, the non-Bt refuge must be within 1/2-mile of Bt corn (39% awareness)**
  - **If treated, the non-Bt refuge must be within 1/4-mile of Bt corn (39% awareness).**
- **Most growers (75%) reported that they were aware that non-Bt refuge should only be treated for corn borer if it is economically justified.**
  - **Only 32% were, however, aware that when treating the non-Bt refuge, microbial Bt foliar sprays are not to be used.**

# Awareness Of Various Aspects Of Insect Resistance Management Or Refuge Requirements For Bt Corn

(Base=All Growers)  
(n=501)



\* Not asked of MO/TN/KY/MS cotton region

\*\* Asked of MO/TN/KY/MS cotton region only

Q.3 Just to review, as it relates to insect resistance management plans or refuge requirements, for Bt corn, are you aware:

### ***III. SOURCES OF INFORMATION***

- **By a wide margin, seed dealers (37%) and seed companies (23%) were most often identified as the primary sources of awareness regarding information on insect resistance management plans for Bt corn. Farm publications were another major source, and crop consultants were an important source for the Kansas/Oklahoma/ Texas region.**
- **The Grower Guide/Technology Use Guide provided to each grower from Bt corn manufacturers was not identified as a significant source of IRM information.**

**Primary Source Of Information Regarding Insect Resistance  
Management Or Refuge Requirements For Bt Corn**

(Base = All growers)

	<u>Total</u> (n=501)	<u>Bootheel/ TN/ KY/MS</u> (n=50)	<u>So.IA/ No.IL</u> (n=151)	<u>SD/ MN/NEOK/TX</u> (n=200)	<u>KS/</u> (n=100)
Seed dealer.....	37%	38%	35%	40%	31%
Seed company.....	23%	14%	25%	23%	19%
Crop consultant.....	13%	10%	9%	13%	37%
Farm publications.....	13%	10%	19%	10%	9%
Grower/technology guide or use agreement.....	2%	4%	1%	4%	--
Extension.....	2%	--	3%	2%	1%
Internet.....	1%	--	--	2%	1%
National Corn Growers.....	1%	--	1%	--	1%
Don't know.....	4%	8%	3%	5%	1%

**Q.4a** What is your **PRIMARY** source of awareness regarding information on insect resistance management plans or refuge requirements for Bt corn?

#### ***IV. ACTION ITEMS***

- **Growers generally consider insect resistance management plans for Bt corn to be important. Therefore, in communicating IRM plans to growers, the long-term benefits of retaining a valuable tool/technology should be weighed against any short-term inconvenience.**
- **Efforts to inform growers of IRM guidelines for Bt corn must continue, as repeated reinforcement will be necessary to establish a working knowledge of these requirements.**
  - **Communications should occur throughout the seed planning, purchasing, and planting stages to help ensure that growers are actively considering available refuge options when developing their crop plans.**
- **The dual nature of Bt refuge requirements must be continually stressed, as growers need to understand that they must plant at least 20% of their corn acres in non-Bt corn, and must locate a non-Bt field within 1/2- or 1/4-mile of Bt fields.**
- **Seed companies and seed dealers in all areas, and crop consultants in the Plains, will need to be the focal point for informing growers of insect resistance management plans for Bt corn.**
- **For the foreseeable future, it will be important to maintain consistency in Bt refuge planting options. It is evident that some growers are unaware that the options have changed and “*think they are doing the right thing.*”**