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Southwestern Corn Borers in the North?

Last year we had a larger than normal extension of the area infested by southwestern corn borers. A few corn fields in some parts of NC Kansas (from Hays east and north through Cloud and Republic Counties) experienced notable SWCB infestation. The risk of second generation problems during the year 2000 from this stalk-boring insect is unknown at this time. However, pheromone traps placed by Larry Buschman and cooperators have confirmed that at least small numbers of SWCB larvae successfully overwintered and emerged as adults in some of these areas. The population is not crop threatening but is something to watch as corn enters reproductive stages. Corn borer problems during the following year do not relate well to previously overwintering populations because environmental conditions during the first generation through egg laying of the second generation can cause substantial mortality to both European and southwestern corn borers.

SWCB is a much more serious pest of corn than European corn borer. It tunnels much more extensively, 30 or more inches per larva vs. 3 to 5 inches per insect for a typical European corn borer. It also deliberately weakens the plant by internally girdling it so the stalk will break over and may drop completely free of the stalk base, making harvest difficult or impossible.

We suggest scouting for southwestern corn borer egg masses in the coming weeks. Eggs per SWCB egg mass are fewer in number than laid by Europeans. SWCB egg masses often have only 3 to 6 or so eggs per mass, laid in a chain-like fashion rather than 15 to 25 laid in a fish-scale like cluster (characteristic of ECBs). Also, as SWCB eggs mature there is a distinctive wavy redline appearance on the surface of the eggs, whereas Europeans lack the redline with only the developing dark head capsules giving much differentiation as the eggs mature.

BT CORN AND NON-BT CORN REFUGES: HOW DO THE ECONOMICS PENCIL OUT? Read over the following report for information on this subject, based on data from SC and SW Kansas.

ECONOMIC COMPARISON OF BT-CORN REFUGE-PLANTING STRATEGIES FOR SOUTH CENTRAL AND SOUTHWESTERN KANSAS

Phil Sloderbeck, Larry Buschman, Troy Dumler and Randy Higgins

SUMMARY

Data from Bt corn trials at Garden City and St. John were analyzed to compare the potential economic returns of various Bt corn refuge-planting strategies. The results of this analysis indicate that the costs of various refuge planting strategies are relatively small in comparison with the increased returns associated with Bt corn.

INTRODUCTION

The EPA is now requiring producers who plant Bt-corn to plant a 20% refuge as a resistance management practice. This paper is an attempt to determine the economic cost to producers of various refuge strategies. The analysis is based on selected data from Bt-corn efficacy trials conducted in St. John and Garden City, KS during 1997 and 1998 comparing corn hybrids under both insecticide sprayed and unsprayed conditions. Costs associated with the inconvenience of having to plant the refuge are not included.

METHODS & PROCEDURES

Five pairs of non-Bt and Bt corn hybrids were selected from these trials to obtain representative yield information for four corn growing strategies; unsprayed non-Bt corn, insecticide-sprayed non-Bt corn, unsprayed Bt corn and insecticide-sprayed Bt corn. The insecticide treatment used in the trials was Capture at 0.08 lb ai/A applied in one application for corn borer control (note that Capture at this rate would also reduce spider mites and corn rootworm adults if present). The ten hybrids selected for this comparison are listed in Table 1. These hybrids were present in all four studies and in the case of the Bt hybrids, having either event MON810 or Bt11. The events MON810 or Bt11 (sold under the Trademark YieldGard) were chosen for this comparison because they provide very good control of southwestern corn borer and are available in corn hybrids that are well-adapted for this area. In these trials, both standing yield and fallen yields were recorded. The corn in these trials was harvested in October so there was a reasonable chance of lodging due to corn borer damage. Standing yield denotes the yield from plants that did not lodge from corn borer damage and represented yields that could be expected, if fields were harvested late and there was extensive lodging. Total yield was the sum of the standing yield plus the hand harvested yield from any lodged plants or dropped ears. Total yield represents the overall physiological yield and would be representative of corn borer losses associated with early harvest.

RESULTS AND DISCUSSION

Yield data for the four corn growing strategies are summarized in Table 2. There was a significant difference (DMRT at 0.05) between standing yield of the unsprayed non-Bt corn and the sprayed non-Bt corn. In addition, both the unsprayed and sprayed Bt corn yielded significantly more than the sprayed non-Bt corn. Similar significant differences also were observed in total yield among the four treatments.

To determine economic returns selected in corn production systems, the effects of seed costs, insecticide plus application costs, and yields were considered. The cost of Bt corn seed was \$1.53/1000 seeds versus \$1.21/1000 seeds for non-Bt corn seed, for a technology fee of \$0.32/1000 seeds. On a per acre basis, the cost of Bt-corn was \$10.24 higher than non-Bt corn. The total cost of applying 0.08 lbs of Capture at \$429/gal was \$21.20 per acre, when an application cost of $4.04 per acre is added. The price of grain was set at $2.40/bu, which was the average harvest price paid in southwest Kansas during 1997-98. The differences in yields and returns for the different corn production strategies are shown in Table 3. Significant differences in yields resulted in higher returns for most corn production strategies. However, the small increase in yield gained from spraying Bt-corn versus not spraying Bt-corn was offset by the cost of spraying. Thus, there was actually a small loss in returns where Bt-corn was sprayed with Capture.

These data were employed to estimate potential returns for several recommended non-Bt corn refuge strategies (Table 4). Two conclusions stand out. First, corn growers in southwest and south central Kansas can experience significant losses when nothing is done to control corn borers. Based on standing yields, returns were increased by 15% when timely applications of Capture were made and by from 22 to 27 percent when various Bt corn strategies were employed. The other interesting observation is that the economic cost of including a 20% or a 40% non-Bt corn refuge planting was fairly low. The difference in returns for the refuge strategies ranged from only 2 to 4 percent. Trends were similar when total yields (standing + lodged) were analyzed. Assessing total yields rather than standing yields may be more representative of expected losses if corn is harvested prior to any lodging is caused by corn borers. All of the various Bt corn and non-Bt corn refuge combinations exhibited higher returns than either unsprayed or sprayed non-Bt corn. Returns obviously vary as the cost of inputs and price paid for corn grain changes. As the price of corn increases or as the costs of control become less expensive, the returns for the sprayed options improve in relative terms. If the technology fees decline and other factors remain constant, then the returns for Bt corn grow even higher. However, the percentage differences in economic returns appear to remain fairly stable among a fairly wide range of economic inputs.

This analysis highlights the importance of controlling corn borer and potential advantages of using Bt corn hybrids as part of a corn borer management system. These data also indicate that refuge plantings should not cause a significant reduction in economic returns. The refuge planting systems were within 1 to 4% of returns expected for field wide (100% plantings) of Bt corn (using data from either standing or total yields) and were still 4 to 6% above the standard practice of using an insecticide to protect non-Bt hybrids from corn borers (using the total yield data which is a more conservative estimate of corn borer injury).

A significant portion of the data used to develop this report originated from studies sponsored in part by K-State Research and Extension and the Kansas Corn Commission.

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Table 1. Corn hybrids selected from Bt corn trials conducted near St. John and Garden City, Kansas during 1997 and 1998.

Company	Bt Hybrid — Event	Comparison Non-Bt Hybrid
Novartis	7590Bt — Bt11	7590
Novartis	7639Bt — Bt11	4494
Golden Harvest	H-2530Bt – MON810	H-2530
Cargill	8021BT – MON810	7997
Pioneer	31A14 – MON810	3162

Table 2. Average corn yields for 5 YieldGard corn hybrids and 5 non-Bt corn hybrids under insecticide sprayed or unsprayed conditions near Garden City and St. John during 97 and 98.

	Standing Yield (Bu/A)		Total Yield (Bu/A)	
	Unsprayed	Sprayed	Unsprayed	Sprayed
Non-Bt	138.8 a	168.1 b	163.4 a	175.3 b
YieldGard	180.5 c	189.2 c	183.0 c	190.4 c

Table 3. Selected comparisons of corn productions strategies showing yield differences and resulting dollar differences on a per acre basis.

Standing Yield Advantage of Strategy Listed Below	Vs.		
	Unsprayed Non-Bt	Sprayed Non-Bt	Unsprayed Bt
Sprayed Non-Bt	29.3 ($49.12)	—	—
Unsprayed Bt	41.7 ($89.84)	12.4 ($40.72)	—
Sprayed Bt	50.4 ($89.52)	21.1 ($40.40)	8.7 (-$0.32)

Total Yield Advantage of Strategy Listed Below	Vs.		
	Unsprayed Non-Bt	Sprayed Non-Bt	Unsprayed Bt
Sprayed Non-Bt	11.9 ($7.36)	—	—
Unsprayed Bt	19.6 ($36.80)	7.7 ($29.44)	—
Sprayed Bt	27.0 ($33.36)	15.1 ($26.00)	7.4 (-$3.44)

Table 4. Comparison of returns to different corn production systems based on data from trials conducted near St. John and Garden City, Kansas during 1997 and 1998.

Comparison Based on Standing Yields

Production System [a]	Total Returns	Increase in returns [b]	% Increase [b]	% Decrease [c]
100 acres of unsprayed non-Bt Corn	$33,312.00	—	—	—
100 acres of sprayed non-Bt Corn	$38,224.00	$4,912.00	14.75%	—
20 acres of unsprayed non-Bt corn plus 80 acres of unsprayed Bt corn	$40,499.20	$7,187.20	21.58%	4.25%
20 acres of sprayed non-Bt corn plus 80 acres of unsprayed Bt corn	$41,481.60	$8,169.60	24.52%	1.93%
40 acres of sprayed non-Bt corn plus 60 acres of unsprayed Bt corn	$40,667.20	$7,355.20	22.08%	3.85%
20 acres of sprayed non-Bt corn plus 80 acres of sprayed Bt corn	$41,456.00	$8,144.00	24.45%	1.99%
100 acres of unsprayed Bt corn	$42,296.00	$8,984.00	26.97%	—
100 acres of sprayed Bt corn.	$42,264.00	$8,952.00	26.87%	—

Comparison Based on Total Yield

Production System [a]	Total Returns	Increase in returns [b]	% Increase [b]	% Decrease [c]
100 acres of unsprayed non-Bt Corn	$40,850.00	—	—	—
100 acres of sprayed non-Bt Corn	$41,725.00	$736.00	1.88%	—
20 acres of unsprayed non-Bt corn plus 80 acres of unsprayed Bt corn	$43,970.00	$2,944.00	7.51%	1.72%
20 acres of sprayed non-Bt corn plus 80 acres of unsprayed Bt corn	$44,145.00	$3,091.20	7.88%	1.37%
40 acres of sprayed non-Bt corn plus 60 acres of unsprayed Bt corn	$43,540.00	$2,502.40	6.38%	2.75%
20 acres of sprayed non-Bt corn plus 80 acres of sprayed Bt corn	$43,945.00	$2,816.00	7.18%	2.01%
100 acres of unsprayed Bt corn	$44,750.00	$3,680.00	9.38%	—
100 acres of sprayed Bt corn.	$44,500.00	$3,336.00	8.51%	—

[a] These production systems include either 0%, 20% or 40% refuge planting of non-Bt corn (The EPA is currently requiring a 20% refuge planting).
[b] Relative to 100% unsprayed non-Bt corn.

[c] Relative to 100% unsprayed Bt corn.**Randall A. Higgins, Extension State Leader, Entomology**