

Multi-year Performance of Pioneer® brand Hybrids with Herculex® XTRA Insect Protection

by Murt McLeod and Steve Butzen

Summary

- Pioneer Agronomy Sciences researchers conducted studies from 2006 to 2007 to evaluate efficacy, standability, and yield associated with various corn rootworm (CRW) management systems.
- At 10 locations with the highest CRW pressure, Pioneer® brand hybrids with Herculex® XTRA (HXX) technology provided protection that was better than or equivalent to every other CRW management system tested.
- The consistency rating of HXX hybrids at these locations was 93%, which was significantly higher than the consistency rating of 79% for YieldGard® Plus (YGPL) hybrids.
- Herculex XTRA hybrids had significantly higher grain yields than Aztec®, Poncho® 1250 or untreated check hybrids, and numerically higher grain yields than YGPL.
- Even under very low CRW pressure, yields of Herculex XTRA hybrids were at least equal to yields obtained in all of the other CRW management systems.
- All CRW management systems evaluated in this study prevented any appreciable root lodging as a result of CRW larval feeding.
- Growers' choices for CRW management should be based on efficacy, cost, ease of use, and availability of the best hybrid genetics for each management system

Introduction

Corn rootworm (CRW) causes yield loss and increased production costs for North American corn growers estimated at about one billion dollars annually. CRW larvae feed on corn roots from early June through late July, reducing the plants' ability to extract and transport water and nutrients from the soil, thereby causing physiological yield loss. In addition, root pruning by CRW larvae predisposes corn plants to lodging, which contributes to both physiological and harvest yield losses.

Corn rootworms have traditionally been managed by crop rotation or application of soil-applied granular or liquid insecticides at planting. New technologies such as high rate

seed treatments and transgenic hybrids have recently been commercialized to help growers reduce losses from CRW.



Left: Western corn rootworm beetle on corn silks¹.

Right: Western corn rootworm larvae tunneling in the brace roots of an untreated check hybrid².

One such technology is Herculex XTRA (HXX) Insect Protection in Pioneer hybrids. HXX is a stack of the Herculex I (HX1) trait with the Herculex RW (HXRW) trait for control of several important above-ground insects and western, northern, and Mexican corn rootworm. YieldGard Plus (YGPL) is another stacked technology combining YieldGard Corn Borer and YieldGard Rootworm traits. Poncho 1250 is a high-rate seed-applied insecticide for management of CRW and several other soil insects. These technologies offer growers the convenience of insect protection in or on the seed without the need for application equipment and handling of insecticides during planting.

Although growers now have many choices for CRW management, their decision should be based on efficacy, cost, ease of use, and availability of the best hybrid genetics for each management system. For this reason, Pioneer Agronomy Sciences researchers conducted studies to evaluate efficacy, standability, and yield associated with various CRW management systems.

Study Description

Corn rootworm management systems were evaluated for efficacy against CRW larval feeding, plant standability, and grain yield at 32 locations from 2006 to 2007 in small-plot replicated field trials. Each treatment was replicated four times per location and one to two hybrid platforms were evaluated in each treatment at a given location. Hybrids with the appropriate comparative relative maturity (CRM) were selected for each growing environment. Individual plots

were four rows wide by 17.4 feet in length. Management systems evaluated were Herculex XTRA Insect Protection, Aztec granular soil insecticide, Poncho 1250 insecticide seed treatment, and an untreated check. In addition, competitive hybrids were chosen to represent YieldGard® Plus technology (Table 1).

Table 1. CRW management systems and Pioneer® brand or Dekalb® brand hybrids tested at 32 locations, 2006-2007.

Mgmt System	Hybrid CRM Group / Year			
	108-110 2006	108-110 2007	96-98 2006	96-98 2007
Herculex® XTRA	34A20	34A20 33D14	38B87 38H72	37Y14 38F35
Aztec® 2.1G	34A16	34A17 33D12	38B85 38H67	37Y13 38F34
Poncho® 1250	34A16	34A17 33D12	38B85 38H67	37Y13 38F34
Check	34A16	34A17 33D12	38B85 38H67	37Y13 38F34
DeKalb® YGPL	DKC 58-73 DKC 60-14	DKC 58-73 DKC 63-74	DKC 46-22 DKC 52-40	DKC 46-22 DKC 52-40

Technologies for Pioneer hybrids in Table 1:
 (HXX, LL, RR): 33D14, 34A20, 37Y14, 38B87, 38F35, 38H72
 (HX1, LL, RR): 33D12, 34A17, 37Y13, 38F34
 (HX1, LL): 34A16

In mid-July, five plants were randomly selected from row 1 or 4 of the 4-row plot; plants were dug, washed, and roots were evaluated for CRW larval injury using the 0.0 to 3.0 node injury scale developed at Iowa State University (Oleson et. al, 2005).

Consistency ratings were also calculated for each treatment. Consistency ratings are derived by calculating the percentage of dug roots that have a node injury score below a defined economic injury level, such as 0.25. (Several university entomologists use this level as the cutoff when calculating consistency ratings.) For example, if 96 out of 100 roots evaluated for a given treatment had a node injury score equal to or less than 0.25, the consistency rating for that treatment would be 96%. Percent root lodging and corn grain yield were recorded at harvest from the center two rows of the four-row plots.

Applied Questions

Did testing locations in this study have adequate corn rootworm feeding pressure to evaluate CRW management technologies?

Yes. There were 20 of 32 testing locations from 2006-2007 that had moderate to high levels of CRW feeding, with an average node injury score in the untreated check of about 0.5 to 3.0 (Table 2). This gave researchers an excellent opportunity for evaluation of the various CRW management systems under a range of insect pressure that brackets most Corn Belt fields. The other twelve locations had low infestation levels with an average node injury score of less than 0.5 (Table 2).

Table 2. Summary of CRW injury level, range of injury scores*, total locations, and locations per state for 32 test sites, 2006-2007.

CRW Injury Level	Range of Injury Scores*	Total Locs	State (No. of Sites)
High	1.13 to 2.90	10	IN (3), IL (1), WI (2), IA (3), MN (1)
Moderate	0.46 to 0.99	10	IL (3), IA(3), MN (2), NE (2)
Low	0.06 to 0.31	12	IN (1), MI (1), IL (2), MN (5), NE (2), CO (1)

*Root node injury score of check hybrid at location.

Data are grouped by these **high, moderate** and **low** CRW feeding pressure categories in the subsequent graphs and analysis comparing the performance of CRW management technologies under these various levels of CRW injury.

How did efficacy of Herculex XTRA technology compare to other CRW management systems evaluated?

Herculex XTRA technology provided excellent protection from larval CRW feeding. When data were averaged across ten locations with the highest CRW pressure (node injury score greater than 1.0 in the untreated check), Herculex XTRA hybrids provided protection that was better or equivalent to every other available CRW management system tested (Figure 1).

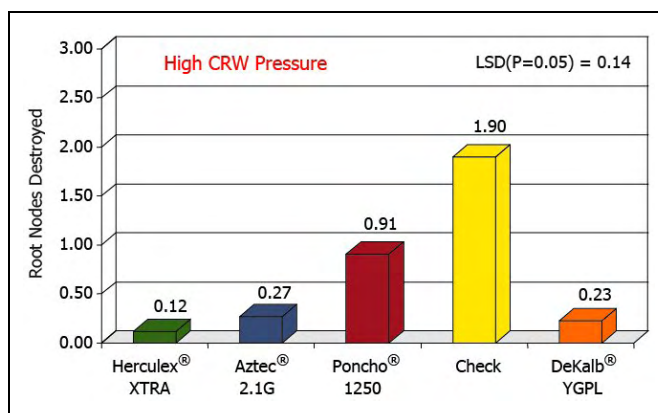


Figure 1. Node injury scores of CRW management systems averaged across **10** test locations with **high** CRW feeding pressure, 2006 to 2007.

(See Table 2 for summary of test locations.)

Node injury scores for Herculex® XTRA hybrids were lower compared to those of YieldGard® Plus hybrids and were statistically lower than those of Aztec® and Poncho® 1250 insecticide-treated hybrids.

Did Herculex XTRA hybrids have higher consistency ratings compared to other CRW management systems available to producers?

Yes. The consistency rating of Herculex XTRA hybrids at the ten high pressure locations was 93%, which was significantly higher than the consistency rating of 79% for YieldGard Plus hybrids at these same locations (Figure 2). In fact, the consistency rating of Herculex XTRA hybrids at the ten high pressure locations was highest of all CRW management systems.

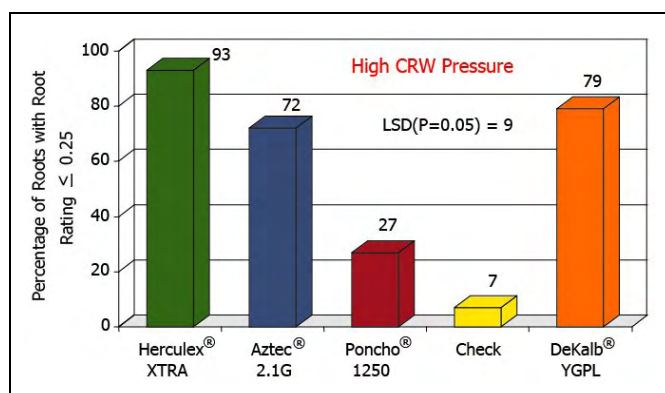


Figure 2. Consistency ratings for CRW management systems averaged across **10** testing locations with **high** CRW feeding pressure, 2006 to 2007.

(See Table 2 for summary of test locations.)

Did the various CRW management systems prevent root lodging due to CRW larval feeding?

Yes. All CRW management systems evaluated in this study prevented any appreciable root lodging as a result of CRW larval feeding. All management systems resulted in 4 percent or less root lodging whereas the untreated check plots had 18 percent root lodging. Each management system had significantly less root lodging than the untreated check, but there were not significant differences between management systems.

How did grain yield compare across the various CRW management systems evaluated in this study?

When data were averaged across all testing locations and years, under high pressure, and under moderate pressure, Herculex XTRA hybrids had significantly higher grain yields compared to Aztec-treated, Poncho-treated, or untreated check hybrids, and numerically but not statistically higher grain yields compared to YieldGard Plus hybrids (Figures 3 - 5).

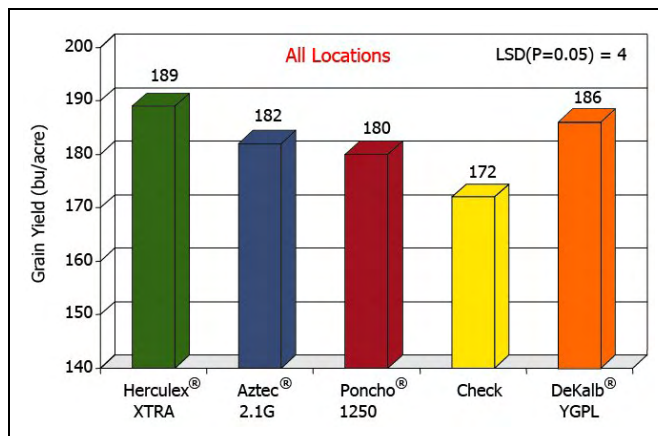


Figure 3. Grain yield of CRW management systems averaged across **32** testing locations, 2006 to 2007.

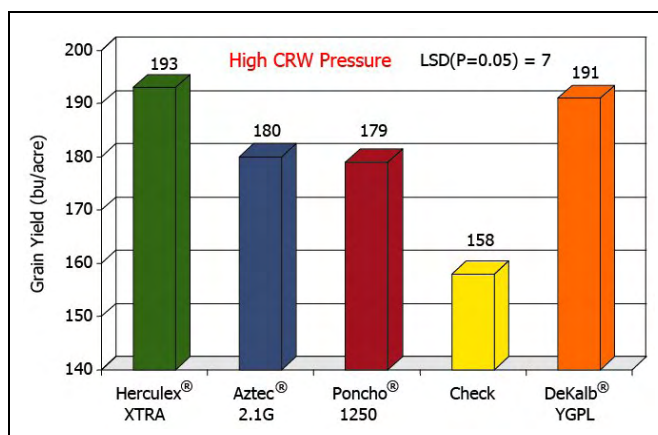


Figure 4. Grain yield of CRW management systems averaged across **10** testing locations with **high** CRW feeding pressure, 2006 to 2007.

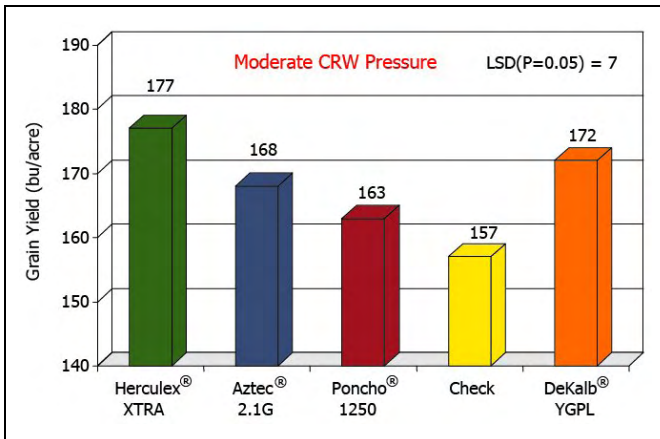


Figure 5. Grain yield of CRW management systems averaged across 10 testing locations with moderate CRW feeding pressure, 2006 to 2007.

(See Table 2 for summary of test locations for Figures 3-5.)



Differences in root protection of CRW technologies are evident in this picture showing root of YieldGard[®] Plus hybrid (left) and Herculex[®] XTRA hybrid (right) grown in same field³.

Did Herculex[®] XTRA hybrids have lower grain yields when CRW damage levels were low?

No. Even under very low CRW pressure, yields of Herculex XTRA hybrids in this study were not significantly different from yields obtained in all of the other CRW management systems (Figure 6).

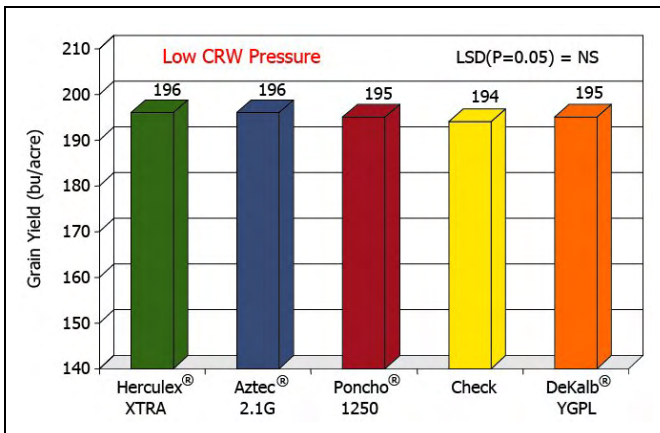


Figure 6. Grain yield of CRW management systems averaged across 12 testing locations with low CRW feeding pressure, 2006 to 2007.

(See Table 2 for summary of test locations)

Credits

- ¹ Corn rootworm beetle image courtesy of Donald Specker, Pioneer Area Agronomist.
- ² Corn rootworm larvae image courtesy of Steve Thompson, Pioneer Research Associate.
- ³ Corn root images courtesy of Gary Lowry, Pioneer Sales Representative.

Reference

Oleson, J.D., Y. Park, T.M. Nowatzki, and J.J. Tollefson. 2005. Node-injury scale to evaluate root injury by corn rootworms (Coleoptera: Chrysomelidae) *J. Econ Entomol.* 98(1): 1-8).

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