

## Managing Western Bean Cutworm in Corn

by Steve Butzen, Herb Eichenseer and Paula Davis

### Summary

- Western bean cutworm (WBC) was once primarily a pest of dry beans in the western U.S., but is now considered a threat to corn in some of the largest corn-producing states.
- WBC has gradually migrated eastward through Iowa and into parts of Illinois and Missouri. Many fields have been damaged in these states because growers were unaware of the problem.
- WBC larvae damage corn primarily by feeding on developing kernels. This causes direct yield losses and also allows secondary insects and diseases to invade the ear.
- Because scouting is time-consuming, application timing is critical, and multiple treatments may be needed, insecticides are not a good solution to the WBC problem.
- Pioneer hybrids with the Herculex® I (HX1) and Herculex XTRA (HXX) traits provide in-plant protection against WBC. These technologies eliminate the need for intensive scouting and work regardless of infestation level.
- The HX1 and HXX traits also provide full-season protection against corn borer, black cutworm and some other insects. The HXX stacked trait includes protection against western, northern and Mexican corn rootworm.
- This *Crop Insights* discusses western bean cutworm identification, life cycle, feeding behavior, damage to corn and management options.

Once known mainly as a pest of dry beans in the western U.S., western bean cutworm (*Richia albicosta*) is now considered a serious threat to corn in at least 10 states. WBC is a late-season pest that begins to damage corn just prior to pollination as larvae feed on developing tassels and ears. When infestation levels average several larvae per ear, yield reductions can be as high as 30 to 40%. In addition to consuming developing kernels, WBC feeding also allows entry of other insect feeders as well as ear rot pathogens.

### Western Bean Cutworm Extends Range

Historically, the primary corn-growing regions affected by WBC have included Colorado, South Dakota, Nebraska, western Kansas and the panhandles of Texas and Oklahoma. By 2002, this destructive insect could be found in most

northwest Iowa counties, and observations of moths, larvae, and damage confirmed that WBC had advanced eastward to Interstate 35 (Figure 2). By 2004, WBC had expanded its range eastward across Iowa and southern Minnesota. After initial detections in 2004 in several western Illinois and northern Missouri counties, pheromone and light traps confirmed that WBC had extended its range to include counties across the northern half of Illinois and many counties in Wisconsin in 2005.

Although it is unclear why this rapid range expansion has occurred during the last five years, several factors may be involved including mild winters, reduced use of foliar insecticides, and increased use of no-till systems.

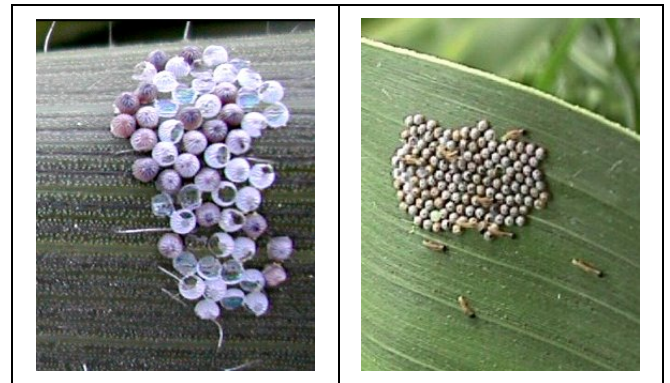
### Identification



Western bean cutworm adult.

**Adults:** The adult western bean cutworm is a dark brown moth about  $\frac{3}{4}$  inch long with a wingspan of  $1\frac{1}{2}$  inches. Wings have distinct markings and a white stripe on the leading edge of the upper wing. This very distinct looking moth is easily identified.

**Eggs:** The adult WBC lays eggs in masses of 5 to 200 with an average of about 50 (Figure 1). Initially, eggs are pearly white, but turn to tan within two days. By the fifth day of development, the eggs turn a dark purple. From this point, egg hatch is only a day or two away.



**Figure 1.** (L) WBC egg mass with some eggs hatched.<sup>1</sup>  
(R) WBC larvae crawling away from egg  
mass.<sup>3</sup>

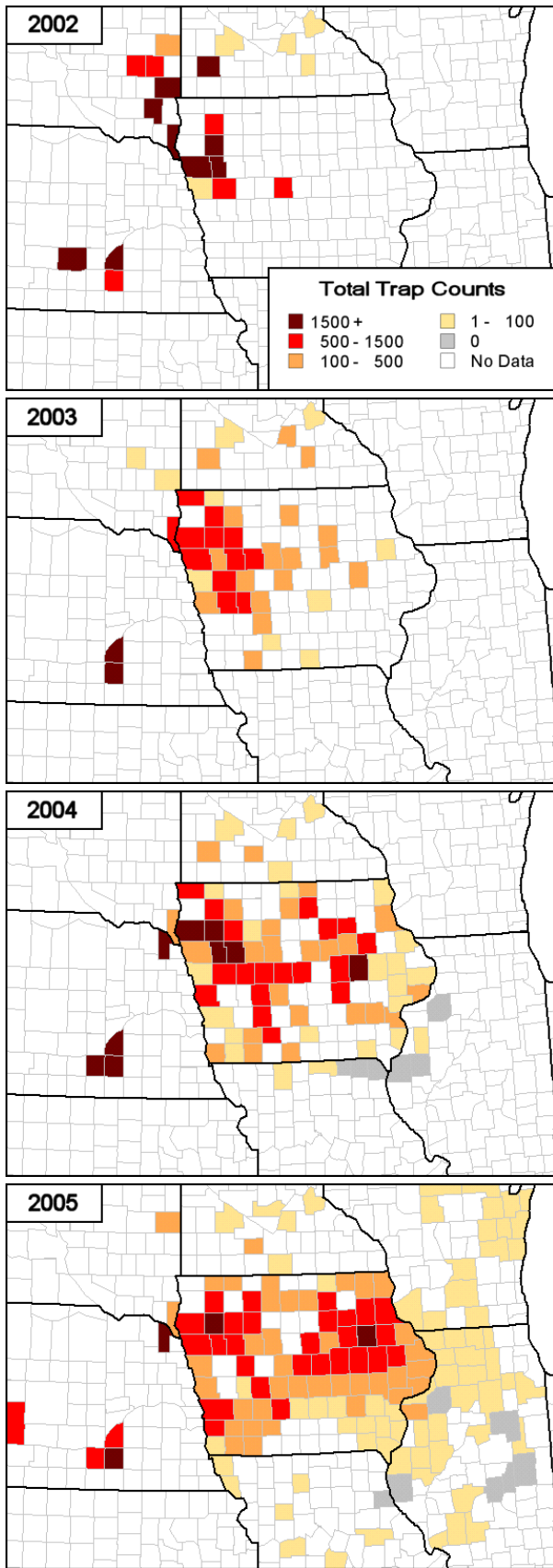


Figure 2. Spread of WBC in the midwestern US<sup>a</sup>.

**Larvae:** First- through fourth-instar larvae are dark brown with faint cross-hatched (diamond-shaped) markings on their backs (Figure 3).

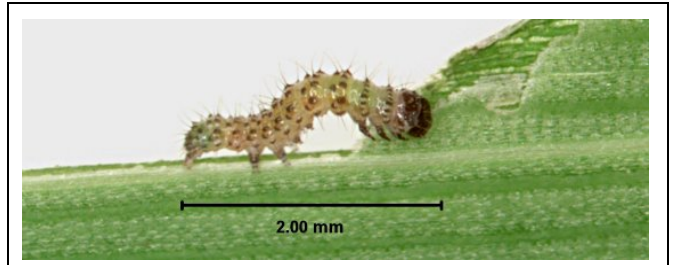


Figure 3. First-instar WBC larva on corn leaf<sup>2</sup>.

Older larvae have three dark brown stripes immediately behind their heads (Figure 4). These characteristic markings distinguish them from other cutworms and caterpillars that may be found on corn. As larvae mature, they become light tan or gray to pink in color.



Figure 4. Fifth-instar<sup>4</sup> WBC larvae.

To further distinguish WBC from corn earworm, note that corn earworm larvae have longitudinal stripes on the side of the body, and WBC larvae do not (Figure 5). Corn earworm larvae also have small dark “microspines” covering their body, whereas WBC larvae are smooth-bodied. (See Appendix 1 for tips on distinguishing WBC from other caterpillars on corn based on larval characteristics, feeding behavior and geographic range.)



Figure 5. Corn earworms showing variation in color<sup>5,1</sup>.

---

## Life Cycle

---

Western bean cutworms complete one generation of egg, larva, pre-pupa, pupa and adult per year. WBC overwinter as full-grown, non-feeding larvae in earthen cells about 4 to 10 inches beneath the soil surface. This pre-pupa stage pupates in late-May or early June, and adults emerge in early to mid-July. Degree-day accumulations from May 1 can be used to predict moth emergence. Using a base temperature of 50°F, 25%, 50% and 75% of the WBC adults have emerged after 1319, 1422, and 1536 degree days, respectively.

WBC adults (moths) are strong fliers, and are known to travel several miles. Female moths emit a pheromone that attracts males. After mating, females deposit their eggs on the top surface of corn leaves in the upper one-third of the plant. In very erect-leaf hybrids, eggs may also be deposited on the lower surface of leaves.

Eggs hatch in 5 to 7 days, and larvae feed for 3 to 5 weeks as they develop through five instar stages. In early to mid-September, larvae complete their growth, stop feeding, and drop from the ear to the ground. They then burrow into the soil and construct an earthen cell for overwintering.

---

## Feeding Behavior and Damage to Corn

---

Because young larvae feed on tassels and silks, WBC moths target corn fields in the late whorl stage of development for egg laying. In pre-tassel corn, hatched larvae move up the plant to feed on pollen in the developing tassel. However, if the tassel and ear shoot have emerged when larvae hatch, larvae move to the ear as their preferred feeding site. Plant-to-plant movement is very common with WBC larvae, which may move up to 10 feet away from their egg mass in any direction.



**Figure 7.** Several WBC larvae per ear cause severe losses<sup>6</sup>.

Once the ear has formed on a plant, it becomes the major focal point of feeding by WBC larvae. Early-instar larvae

tunnel through the silk channel to reach the developing kernels. As larvae grow, they feed on the ear tip and often move further into the ear, especially if several larvae infest the same ear. Unlike corn earworms, WBC larvae are not cannibalistic, so several larvae are often found on one ear (Figure 7).

Direct yield loss occurs as WBC larvae consume all or parts of developing kernels (Figures 7 and 8). Those partially consumed may be further attacked by ear molds or secondary insect feeders that enter the ear through the WBC feeding channel. The result is lower yield and lower quality grain. When fields average several WBC larvae per plant, yield losses may be as high as 30 to 40 percent.



**Figure 8.** WBC larva and damage in ear tip of corn<sup>7</sup>.

---

## Management of Western Bean Cutworm

---

Management of western bean cutworm was historically limited to careful scouting and timely application of insecticides. But growers now have access to in-plant solutions for this hard-to-control pest – Pioneer<sup>®</sup> brand hybrids with the Herculex<sup>®</sup> I and Herculex XTRA Insect Protection traits.

### Scouting and Insecticide Application

Most broad-spectrum corn insecticides are labeled to control western bean cutworm. However, insecticide timing is critical to achieve acceptable control. Once larvae enter the ear for feeding, it is almost impossible to reach them with insecticide sprays. Because larvae begin to tunnel through the silk channel at a very young age, the window for effective insecticide application is limited.

Entomologists suggest using light or pheromone traps to monitor for WBC moths in early July. When the first moths appear, growers should immediately begin to scout their fields. Look for eggs and larvae on the upper leaf surface in the upper part of the plant. Sample 100 plants by checking 20 consecutive plants in 5 areas of the field, or 10 consecutive

plants in 10 areas of the field. The more variable the field, or the more hybrids planted, the more areas that should be sampled.

If 8% of the plants have an egg mass or young larva in the tassel, an insecticide application should be considered. This low threshold is made necessary by the ability of the larvae to move to other plants.

Should an insecticide treatment be deemed necessary, its timing is critical. If tassels are not yet emerged, wait to apply until 90 to 95% of tassels have emerged. If tassels have already emerged, apply when 70 to 90% of the eggs have hatched. Note that hatch will occur in about 24 hours once eggs have reached the dark purple stage.

Before treating, corn fields should also be checked for the presence of spider mites. If spider mites are found, use an insecticide product that won't stimulate mite reproduction.

### Herculex® I and Herculex XTRA Traits

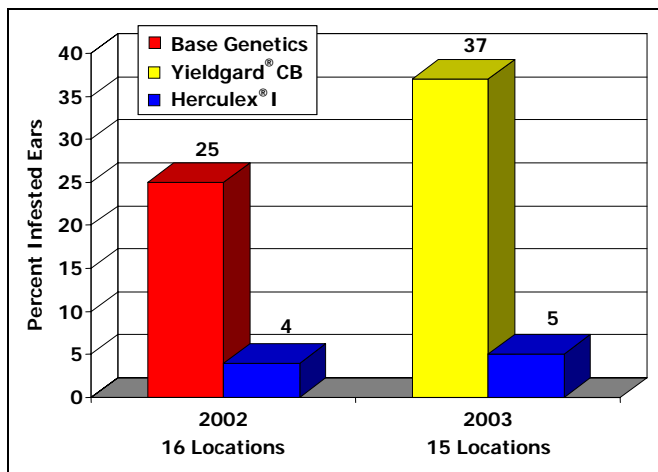
In 2003, the EPA approved a registration amendment to include western bean cutworm on the Herculex I (HX1) Insect Protection label. Hybrids with the Herculex XTRA stacked trait, a combination of the HX1 and Herculex RW traits in the same plant, are now approved for 2006 planting.

In addition to controlling WBC, these products also provides full-season protection against European corn borer, southwestern corn borer, black cutworm and fall armyworm, and intermediate suppression of corn earworm. Hybrids with Herculex XTRA also provide control of western, northern and Mexican corn rootworm to create the broadest spectrum of in-plant insect protection available today. Hybrids with the YieldGard® Corn Borer or YieldGard Plus traits, on the other hand, do not provide protection against WBC.

### 2002-2003 Pioneer Research

In 2002 and 2003, Pioneer researchers conducted field-sized side-by-side studies to evaluate the performance of Pioneer hybrids with the Herculex I trait in the presence of natural infestations of WBC. In 2002, hybrids with the Herculex I trait were compared to hybrids with similar base genetics but without the Herculex I trait in 16 Product Advancement Trial (PAT) locations. In 2003, hybrids with the Herculex I trait were compared to hybrids with similar base genetics and the YieldGard Corn Borer (YGCB) gene in 15 Product Knowledge Plot (PKP) locations. Results are shown in Figure 9.

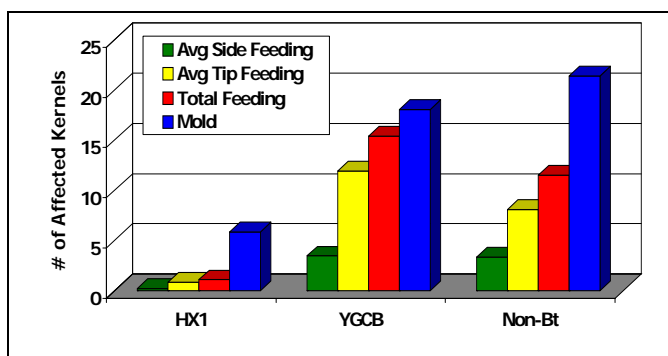
As the graph clearly shows, the Herculex I trait was very effective in protecting hybrids from ear feeding by WBC. In 2002, unprotected hybrids had 25% of ears infested by WBC, but Pioneer hybrids with Herculex I Insect Protection had only 4% of ears infested. In 2003, 37% of ears with the YGCB gene were infested with WBC, while hybrids with Herculex I Insect Protection had only 5% of ears infested.



**Figure 9.** Percent ears infested by WBC, Herculex I vs. base genetics (2002 PAT, 16 locations) and Herculex I vs. YieldGard Corn Borer (2003 PKP, 15 locations).

### 2004 Pioneer Research

In 2004, Pioneer conducted research to determine if hybrids with Herculex I Insect Protection have reduced mold levels compared to their non-Bt counterparts in areas with heavy western bean cutworm infestation. Locations included in the study were Audubon, Carroll, Harlan, Manilla, and New Providence, Iowa and Riversdale, Nebraska. The researchers sampled 10 random ears from a HX1 variety and a non-Bt and/or YGCB at each location. They then counted the number of kernels fed on by WBC on the side and tip of each ear and the number of kernels affected by mold. Results are shown in Figure 10.



**Figure 10.** Number of kernels affected by WBC feeding and mold on HX1, YGCB and non-bt isolines. Six locations, 2004.

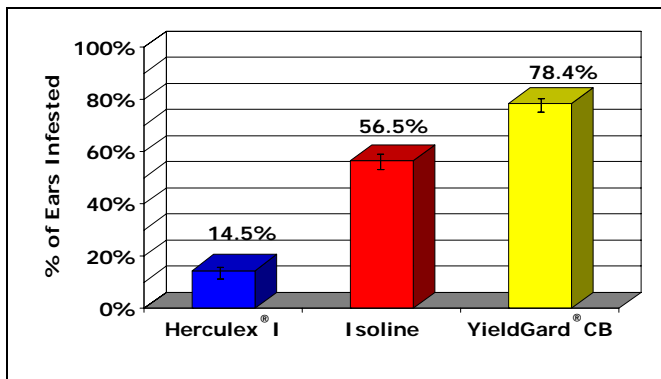
As the graph shows, hybrids with the HX1 trait greatly reduced the occurrence of WBC feeding and mold. No such reduction is seen by hybrids with the YGCB trait. As a result of these and other studies, Pioneer researchers rate hybrids with the HX1 trait a 7 on a scale of 1 to 9 for resisting WBC feeding, indicating very good protection against this insect.



**Figure 11.** (Left) Pioneer hybrid with Herculex I trait, and (Right) competitive YieldGard® Corn Borer hybrid, from field with western bean cutworm feeding (Pioneer image.)

### 2005 University Research

In 2005, Iowa State University scientists conducted research with hybrids with HX1 at four locations in two Iowa counties – Hardin and Buchanan. The researchers counted the number of ears infested with WBC in hybrids with HX1 or YGCB traits compared to their isolines. Results are shown in figure 11. This research demonstrates that the HX1 trait in corn hybrids significantly reduces risk of WBC damage.



**Figure 11.** Number of ears infested by WBC on HX1 and YGCB hybrids and non-bt isolines. Four Iowa locations, 2005. Source: Iowa State University<sup>b</sup>.

### Conclusion

Because of the labor intensive nature of scouting, the critical timing needed for insecticide applications, and the possibility that multiple treatments may be necessary, insecticides may not be an economical or effective solution to the WBC problem. In-plant Herculex® I and Herculex XTRA Insect Protection, on the other hand, eliminates the need for intensive scouting, works regardless of infestation level, and controls a number of other damaging pests. This technology could provide an excellent management solution for growers

facing WBC infestations, and insurance for many growers in the path of this spreading problem.

### References

Seymour, R.C., G.L. Hein, R.J. Wright, and J.B. Campbell. 2002. Western bean cutworm in corn and dry beans. University of Nebraska Extension publication G1359. Lincoln, NE.

<http://www.ianr.unl.edu/pubs/insects/g1359.htm>

Peairs, F.B. 2002. Western bean cutworm: characteristics and management in corn and dry beans. Colorado State Extension publication 5.538. Fort Collins, CO.

<http://www.ext.colostate.edu/pubs/insect/05538.html>

### Acknowledgements

The authors gratefully acknowledge the following individuals and institutions for the images used in this article:

<sup>1</sup> Scott Dickey, <sup>2</sup> Herb Eichenseer, <sup>3</sup> Kevin Branick, <sup>4</sup> Chuck Bremer, <sup>5</sup> Jim Boersma, <sup>7</sup> Paula Davis -- Pioneer Hi-Bred.

<sup>6</sup> Mike Catangui, South Dakota State University.

<sup>a</sup> Data compiled by Pioneer Marketing Department from the following university sources:

<http://www.plantmanagementnetwork.org/cm/element/cmsum.asp?id=4491&photo=2240>

[www.ent.iastate.edu/trap/westernbeancutworm](http://www.ent.iastate.edu/trap/westernbeancutworm)

<http://nerec.unl.edu/ipm/lighttrap2005.htm>

[http://entomology.unl.edu/scal/Lighttrap/2005\\_lighttrapdata.htm](http://entomology.unl.edu/scal/Lighttrap/2005_lighttrapdata.htm) (also see 2003\_lighttrapdata.htm and 2004\_lighttrapdata.htm)

<http://hamilton.unl.edu/2004.htm> (also see 2003.htm and 2002.htm)

[http://plantsci.sdstate.edu/ent/entpubs/wbc2005\\_broo.htm](http://plantsci.sdstate.edu/ent/entpubs/wbc2005_broo.htm) (also see other locations and years.)

[www.vegedge.umn.edu/2005/wblist.htm](http://www.vegedge.umn.edu/2005/wblist.htm)

<http://westcentral.unl.edu/entomology/lighttrap.htm>

<http://pestbulletin.wi.gov> (issues 45-52)

<sup>b</sup> Data from research by Dave Dorhout and Marlin Rice, Iowa State University. Four locations in Hardin and Buchanan counties, Iowa, 2005.

Herculex Insect Protection technologies by Dow AgroSciences and Pioneer Hi-Bred. ®Herculex is a registered trademark of Dow AgroSciences LLC.

®YieldGard is a registered trademark used under license from Monsanto Company.

**Appendix 1.** Larval characteristics, feeding behavior, geographic range and hybrid response of several caterpillars found on corn.

	<b>Western bean cutworm</b>	<b>Corn earworm</b>	<b>European corn borer</b>	<b>Fall armyworm</b>
	<i>Richia albicosta</i>	<i>Helicoverpa zea</i>	<i>Ostrinia nubilalis</i>	<i>Spodoptera frugiperda</i>
<b>Early instars</b>	Alternating stripes, upper surface has diamond-shaped variegations.	Uniformly brown with tubercles and spines.	Dark head, body dull-white with several rows of brown spots.	Dark to light larva, distinct spines.
<b>Late instars</b>	Dorsal shield (pronotum or “neck”) behind head is black with three faint white lines. Head capsule is light brown often with darker stripes along midline of head. Body is uniformly tan or brown. Skin (cuticle) is smooth without microspines.	Dorsal shield (pronotum or “neck”) behind head is tan. No dark marks on head capsule. Body color varies from pink, green or brown with alternating light & dark stripes. Skin (cuticle) is covered with ‘microspines’ and looks coarse. Larger spines are visible.	Medium to dark brown head, creamy white to gray body with slightly darkened tubercles on every body segment. Body is uniformly tan, with darker spots. One-half size of other insects.	Head capsule is black or dark brown, with light/white inverted ‘Y’ marking along the midline of the head. Body is uniformly dark brown with evenly spaced spines on each segment. Near the last segments are four prominent dark spots (tubercles) that form a square.
<b>Feeding behavior</b>	Tends to move among several plants. Damage tends to be restricted to a limited part of the ear. Often enters ear through the husk in the sides of the ear. May be more than one caterpillar per ear, not cannibalistic.	Tends to stay in same ear during entire larval development. Usually only one insect per ear, as they are cannibalistic. Most often enters ear through the silk channel. Damage can be distributed along full length of ear.	Feeding in shanks, stalks and ears. Feeding in ear shanks, cobs and between kernels. Frass (excrement) tends to be finer, drier and more like sawdust.	Feeds on green leaves and can feed on many parts of the ear.
<b>Geographic range</b>	Formerly confined to western Corn Belt and southern plains states, but has extended its range eastward. Now WBC is also found throughout IA and across northern IL, as well as counties in WI, MN and MO (see maps on page 2.).	Infests corn wherever it is grown.	Infests corn wherever it is grown.	Mostly southeastern U.S. In the Corn Belt, late-planted corn is most susceptible.
<b>Hybrid response</b>	HX1 hybrids show very good resistance, no observed resistance in YGCB hybrids.	HX1 and YGCB hybrids demonstrate intermediate resistance.	HX1 and YGCB hybrids both demonstrate excellent resistance.	HX1 hybrids show excellent resistance. YGCB hybrids show good to very good resistance.

HX1 = Herculex® I Insect Protection YGCB – YieldGard® Corn Borer