



# PEST MANAGEMENT & CROP DEVELOPMENT

## BULLETIN

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## INSECTS

### Reports of Armyworm Injury in Corn and Wheat Continue

Observations of armyworm injury have begun to slow down south of Interstate 70 in Illinois. However, reports of armyworm infestations in central and northern counties are becoming more common. Stan Eden, crop systems unit educator, Ogle County, reported on May 25 that armyworms were damaging cornfields in Ogle County that had been planted in sod. We've also heard that armyworms can be found easily in wheat fields throughout much of central and east-central Illinois. Marion Shier, crop systems unit educator, Livingston County, has observed armyworm infestations in several wheat fields that are approaching economic levels. Wheat fields in Iroquois County, especially near Cissna Park, also are infested with numerous armyworms. Producers are encouraged to continue scouting efforts in wheat and be ready to apply rescue treatments as needed. Attention should be given to any head-clipping activity that is observed, and fields should be monitored regularly for any signs of this armyworm behavior. An insecticide rescue treatment should be considered when there are six or more nonparasitized armyworms (3/4 to 1-1/4 inches long) per linear foot of row and before extensive head cutting occurs. Products labeled for armyworm control in wheat include \*PennCap-M (2 to 3 pt product per acre), Sevin XLR Plus (1 to 1-1/2 qt), and \*Warrior (2.56 to 3.84 oz). Those products preceded by an asterisk are restricted-use insecticides and may be applied only by certified applicators. Please read and follow product labels for more complete application instructions.

As cornfields mature beyond the seedling stage of development, they become less susceptible to economic losses caused by armyworm defoliation. Experiments conducted in the early 1980s by entomologists (Phillip Mulder and William B. Showers, *Journal of Economic Entomology*, 1986) at Iowa State University provided the following results concerning the effects of armyworm defoliation on corn yield: "Specifically, under normal Iowa environmental conditions (1982), 7-8 leaf growth stage corn can sustain nearly 21% defoliation by armyworm larvae and somehow compensate or recover, producing yields comparable with those of undefoliated corn. During hot dry years, 9-10 leaf growth stage corn sustaining very little (<6%) or heavy (>50%) defoliation also produces yields similar to those of undefoliated plants." These results point out the need not to panic when you observe armyworm injury in corn, especially when it reaches the 7-leaf stage of development.

As we've mentioned in many previous issues of the *Bulletin*, two to three generations of armyworms occur each growing season throughout much of Illinois. Although corn is becoming less susceptible to economic losses, pastures will remain at risk to damage for much of the summer and early fall because of subsequent generations of armyworm larvae. So, producers will need to remain vigilant in their monitoring efforts of armyworm activities in pastured areas for the remaining portion of the summer. Hopefully, diseases and parasitoids will reduce populations of armyworms to below economic levels in the following generations.—Mike Gray

## Corn Rootworm Hatch Very Early This Year

As we predicted in the *Bulletin* (issue no. 8), the corn rootworm hatch is early this year, and we anticipate numerous calls in the next several weeks confirming larval feeding and injury. Larry Bledsoe, an entomologist with Purdue University, confirmed that on May 16 he was able to find “robust” first-instar larvae on corn roots in Tippecanoe County, Indiana. Larry indicated that this is the earliest confirmed hatch in Indiana since 1985. Because of the early hatch and small developing root systems, fields that support heavy infestations of corn rootworm larvae could begin to show signs of stress (leaning and wilting plants), especially in areas that have been dry. Soil insecticide performance is often compromised in dry-soil conditions. Let us know if you begin to observe fields with obvious signs of rootworm injury. We look forward to your reports.—Mike Gray

## Remember to Scout for First-Generation European Corn Borer

Kevin Steffey reported in last week’s *Bulletin* that observers already have found European corn borer (*Ostrinia nubilalis*) adults in traps throughout most of the state and people are beginning to report that they have seen quite

a few moths in “action sites,” the grassy, weedy areas around crop fields. Although the first reports of whorl-feeding injury have not been submitted, injury caused by first-generation European corn borers will occur soon. Table 1 provides projections for seasonal corn borer events based on the initial capture of spring moths and subsequent heat-unit accumulations (base 50°F). If you have records of when corn borer moths were first observed in your county, you should be able to predict with reasonable accuracy when corn borer larvae are most likely to make their presence known.

Producers who planted corn in March or early April should especially monitor fields that in essence will serve as trap crops for egg-laying corn borer moths. Corn plants that are small (less than 18 inches, extended leaf height) are less susceptible to corn borer injury. Corn borers that feed on corn less than 18 inches in height typically fail to establish. The explanation for this response is the presence of a plant compound commonly referred to as DIMBOA (2-4 dihydroxy-7-methoxy-1, 4-benzoxazin-3-one), which prevents larvae from establishing. As plants mature, the concentration of DIMBOA decreases. Larval survival is much better on corn plants that are in mid- to late-whorl stage of development. The following questions concerning European corn borer management are asked frequently.

### What are corn borer “action sites”?

Action sites are areas of dense vegetation, usually grasses, where moths spend most of their time, especially during the day. Areas that frequently serve as action sites include grassy ditch banks, fencerows, and grass waterways. As soon as moths emerge from cornfield residue during the spring, they fly to action sites because the microclimate is suitable (morning dew, necessary for drinking, is heavier). There, moths mate and rest. Female moths emit a sex attractant (pheromone) during the late evening hours (10 p.m. to 1 a.m.) to which male moths are very attracted. Due to the favorable microclimate and the emission of pheromone by females in these grassy areas, action sites provide a “home” for large numbers of moths.

*Is treating an action site with an insecticide a good idea to prevent corn borers from causing problems in my cornfields?*

Treating action sites with an insecticide is not recommended. European corn borer moths are very mobile; just because you treat the grassy areas around your cornfield doesn’t mean your neighbors are doing the same thing. Moths can easily fly for several miles during an evening, especially when assisted by mild breezes. Treating action sites on a farm-to-farm basis won’t take the place of scouting individual fields and making management decisions based on observations.

**Table 1. Accumulated degree-days (developmental threshold of 50°F) from initial capture of moths in the spring to first occurrence of life stage or activity of first-generation European corn borers. (From *European Corn Borer: Ecology and Management*, NCR Publication No. 327, Iowa State University, Ames.)**

Accumulated degree-days	First occurrence of stage or event	Days to first occurrence <sup>a</sup>	General activity
0	First spring moth		
212	Egg hatch (first instar)	16.3	Pinhole leaf feeding
318	Second instar	6.6	Shot-hole leaf feeding
435	Third instar	6.5	Mid-rib and stalk boring
567	Fourth instar	6.6	Stalk boring
792	Fifth instar	10.2	Stalk boring
1,002	Pupa	7.6	Changing to adult

<sup>a</sup>Average number of days of development to reach the first occurrence of the stage or event since initiation of the previous stage listed. For example, it takes about 16 days from first moth capture to egg hatch, first instars require about 6.6 days to develop to second instars, etc. The number of days varies if temperatures are cooler or warmer than average.

### Management Worksheet for First-Generation European Corn Borer

[ ]	Larvae found	×	[ ]	expected survival <sup>1,2</sup>	=	[ ]	surviving larvae
[ ]	Surviving larvae	÷	[ ]	plants examined	=	[ ]	larvae/plant
[ ]	Larvae/plant	×	[ ]	yield loss/larva <sup>3</sup>	=	[ ]	yield loss
[ ]	Yield loss	×	[ ]	expected yield (bu/A)	=	[ ]	loss (bu/A)
[ ]	Loss (bu/A)	×	\$ [ ]	price/bu	=	\$ [ ]	loss/A
\$ [ ]	Loss/A	×	[ ]	control <sup>4</sup>	=	\$ [ ]	preventable loss/A
\$ [ ]	Preventable loss/A	-	\$ [ ]	cost of control/A	=	\$ [ ]	gain (+) or loss (-) per acre if control applied

**NOTES:**

<sup>1</sup>Record all percentages as decimals (for example, 20% = 0.2).

<sup>2</sup>If larvae are newly hatched (first instar), it is likely that only about 20% will survive to maturity, depending on environmental stresses. If larvae are second instar (about 3/16 of an inch) or larger the survival rate may increase to 50%. Adjust this number accordingly.

<sup>3</sup>Use 0.06 for V10 corn, or 0.05 for V16 (green-tassel) corn. When borer numbers reach or exceed three per plant, the loss caused by each additional borer will decrease. Therefore, use 0.035 loss per borer for each additional borer above three per plant.

<sup>4</sup>80% control with granules (aerial or ground application) and with sprays directed over the whorls (ground application); the more effective insecticides provide comparable control when applied as broadcast sprays (aerial application).

### Sample Worksheet Completed for First-Generation European Corn Borer

225	Larvae found	×	0.4	expected survival <sup>1,2</sup>	=	90	surviving larvae
90	Surviving larvae	÷	50	plants examined	=	1.8	larvae/plant
1.8	Larvae/plant	×	0.06	yield loss/larva <sup>3</sup>	=	0.108	yield loss
0.108	Yield loss	×	140	expected yield (bu/A)	=	15.12	loss (bu/A)
15.12	Loss (bu/A)	×	\$2.00	price/bu	=	\$30.24	loss/A
\$30.24	Loss/A	×	0.8	control <sup>4</sup>	=	\$24.19	preventable loss/A
\$24.19	Preventable loss/A	-	\$14.00	cost of control/A	=	\$10.19	gain (+) or loss (-) per acre if control applied

*Figure 1. Management and sample worksheets for first-generation European corn borer.*

*What's the best approach to scout a field for first-generation corn borers?*

When corn plants have reached a height of 18 inches (extended leaf height), scouting should begin immediately. If possible, at least 20 consecutive plants should be examined in each of five random areas for every 40 to 50 acres within a field. In very large fields, it will be more practical (although less precise) to examine 25 consecutive plants in each of five random areas for every 80 acres. Walk at least 100 feet into a field before checking plants for corn borers. If more than one corn variety is being grown or if different planting dates occurred within the same field, it is important to consider each section as a separate field. Plants should be checked for fresh whorl-feeding damage, and the percentage of infested plants calculated. For every 20 to 25 plants examined, remove the whorl leaves from two plants and check for live borers. This will enable you to estimate the average number of borers per infested plant. After the field has been scouted, you should fill out a management worksheet and make the appropriate decision (Figure 1). We have an online version of the Management Worksheet for First-Generation European Corn Borer located at <http://ipm.uiuc.edu/calculator/ecbfirst.html>. If you choose to use the online calculator, we welcome your feedback on the usefulness of the automated version. If a rescue treatment is warranted, the granular formulation of an insecticide is more effective than the

liquid formulation when applied aeri-ally (Table 2).

*Many plants within my field have whorl-feeding injury, but I can't find any borers. Should I treat anyway?*

Whorl-feeding injury doesn't always mean that an economic loss will occur. Even when eggs are laid on corn plants at the optimal stage for larval survival (mid to late whorl), it's not easy being a corn borer. Twenty per-cent to 70% of newly hatched larvae fail to establish in plants due to weather-related variables, such as high temperatures and related moisture stress. Even the larvae that make it into whorls are susceptible to drown-ing following heavy downbursts of rain or to predators, parasitoids, and diseases. If corn borers aren't found even though the leaves are shot-holed, it may mean that larval survival and establishment were very poor. It may also mean that borers have already penetrated the stalk tissue of the plant and rescue treatments are no longer a viable option. So even if a good share of your plants have whorl-feeding injury, it is crucial to pull whorl leaves from infested plants to find out why borers aren't being found in your field.

*When will corn borers begin to tunnel into stalk tissue?*

By the time corn borers reach the third larval instar (there are five larval in-stars altogether), they begin boring into stalk tissue (Figure 2). At this point, rescue treatments, if needed, are no longer effective. If plants within a

field have many leaves snapped or broken over at right angles along the mid-ribs, this usually signals that larvae are beginning to burrow into stalks. The larvae tunnel up and down the mid-ribs and eventually leave an exit hole that weakens the leaf at that point. For a quick overview of corn borer biology, please refer to Table 3.

*If I find European corn borer larvae within the whorls of Bt-plants, does this mean that the Bt-corn is not work-ing?*

No. Don't jump to that conclusion. Seed corn company representatives indicate that the expression of the Bt-endotoxin may not occur within every single plant across an entire cornfield. As you scout your Bt-cornfield, find-ing a few plants with injury should not be alarming. However, if injury and live larvae are found, the seed com-pany should be contacted. Company representatives should be able to de-termine whether the plants on which borers survived are expressing the endotoxin. When we have tested plants on which borers survived in Bt-cornfields, we have found that plants were negative (not expressing the endotoxin). We urge anyone who has planted Bt-corn to scout fields to as-sess the pest-management perfor-mance of these transgenic hybrids.—  
*Sue Ratcliffe*

**Table 2. Suggested insecticides for first-generation European corn borer in field corn.**

<i>Insecticide</i>	<i>Amount of product per acre</i>	<i>Placement</i>
*Ambush	6.4 to 12.8 oz	Broadcast
Bacillus thuringiensis	See product label.	See product label.
*Capture 2EC	2.1 to 6.4 oz	Broadcast
Lorsban 4E	1.5 to 2 pt	Over whorls
Lorsban 15G	3.5 to 8 oz per 1,000 ft row	Over whorls
Lorsban 15G	5 to 6.5 lb	Broadcast
*Pennacap-M	2 pt	Over whorls
*Pennacap-M	3 to 4 pt	Broadcast
*Pounce 1.5G	6.7 to 13.3 lb	Broadcast
*Pounce 3.2EC	4 to 8 oz	Broadcast
*Warrior T or 1E	2.56 to 3.84 oz	Broadcast

\*Use restricted to certified applicators only.

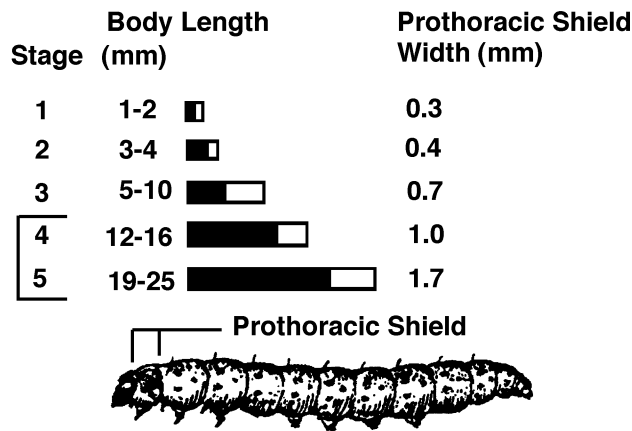


Figure 2. Body lengths and prothoracic shield widths for larval instars of the European corn borer.

Table 3. Biology of the European corn borer.

Moth longevity	1 to 2 weeks
Preoviposition period	2 to 3 days
Egg-laying period	7 to 10 days
Each moth lays ...	About 2 egg masses per night
One egg mass ...	Contains an average of 23 eggs
Eggs per female	About 400
Egg hatch ...	Takes 3 to 7 days
Larval survival ...	Varies from 10% to 20%
Number of larval instars	5

### Economic Impact of Bt-Corn Hybrids: Summary Available

A report titled *Agricultural Biotechnology: Updated Benefit Estimates* was published in January of 2001 by the National Center for Food and Agricultural Policy (<http://www.ncfap.org>) and authored by Janet Carpenter and Leonard Gianessi. The report was compiled through support provided by the Rockefeller Foundation. The aggregate costs and benefits to U.S. producers who planted Bt corn (1997-1999) were calculated. In 1997, 1998, and 1999, the net gain or loss for planting Bt hybrids was + (gain) \$89 million, - (loss) \$26 million, and - (loss) \$35 million, respectively. Aggregate losses (\$s) occurred in 1998 and 1999 in spite of production increases attributed to the use of Bt corn: 1997—11.7 bushels per acre increase, 55.8 million total bushels

increased nationally; 1998—4.2 bushels per acre increase, 60.6 million total bushels increased nationally; and 1999—3.3 bushels per acre increase, 66.4 million total bushels increased nationally. These estimates are based on the following economic variables: 1997—technology fee of \$10 per acre and a corn market price of \$2.43 per bushel, 1998—technology fee of \$10 per acre and a corn market price of \$1.95 per bushel, and 1999—technology fee of \$8 per acre and a corn market price of \$1.90 per bushel. These economic inputs resulted in a profit of \$18 per acre in 1997 and losses of \$1.81 and \$1.73 per acre in 1998 and 1999, respectively.

This report clearly elucidates that when European corn borer infestations and market prices are low, the use of Bt hybrids may not result in profits. In fact, in 1998 and 1999, aggregate

estimates for the United States showed that net losses (\$s) occurred for producers who invested in this technology. Obviously, profits can be impressive (\$18 per acre) when Bt hybrids are planted in outbreak years and commodity prices are more favorable. As we've stated many times in the *Bulletin*, the purchase of Bt hybrids is like taking out an insurance plan against European corn borers. The insurance premium will not return a dividend every year.—Mike Gray

### Soybean Aphid Regional Pest Alert Available Online

As Kevin Steffey indicated last week, David Voegtlin has confirmed identification of soybean aphids on *Rhamnus* (buckthorn) in Whiteside County. In anticipation of the soybean aphids appearing in soybean fields, we suggest you visit our IPM website and view the regional pest alert that provides information on the distribution and life cycle of the soybean aphid (<http://ipm.uiuc.edu/publications/20425.pdf>). If you are unable to download the online version of the soybean aphid regional pest alert, you may request a copy from your local University of Illinois Extension office.—Sue Ratcliffe

### Don't Forget to Scout for Stalk Borers

In the May 18, 2001, *Bulletin* (issue no. 8), we reported heat-unit accumulations that indicated stalk borers were on the move in southern Illinois. With all the attention directed at armyworms during the past 10 days, don't forget about the other lepidopteran pests, including stalk borer. Scouting is recommended when accumulated heat units are between 1,300 and 1,400, and 50% movement occurs between 1,400 to 1,700 accumulated heat units. An updated heat-accumulation map will be included in next week's *Bulletin*. For more information on the stalk borer, visit our IPM

website and view the online fact sheet (<http://www.ipm.uiuc.edu/publications/infosheets/stalkborer21/stalkborer.htm>).—*Sue Ratcliffe*

### Southwestern Corn Borer Moth Captures Common in Southern Illinois

Ron Hines, senior research specialist, Dixon Springs Agricultural Center, continues to capture southwestern corn borer moths in southern Illinois. Ron's first capture of southwestern corn borer moths occurred on May 18, 2001. According to our records, he caught his first southwestern corn borer moth last season on May 9. By keeping track of when southwestern corn borer moths have been captured in your area, you can begin to estimate important life-cycle events for this insect. After 190 heat units (base 50°F) have accumulated beyond the initial flight of southwestern corn borer moths, first instars can be found; second instars at 361 heat units; third instars at 533; fourth instars at 713; fifth instars at 902; pupation at 1,153; and emergence of adults at 1,321.

Each female southwestern corn borer moth deposits eggs in masses on the upper and lower surfaces of corn leaves. Female moths lay approximately 250 eggs over a 5- to 7-day life span. Eggs are yellow-green when first laid; however, after 36 hours they become cream colored with three orange-red lines on each egg. Economic infestations of the first generation of southwestern corn borers are not common, and most generally occur in corn planted near last season's infested and undisturbed corn residue. Yield losses caused by subsequent generations of this pest can be significant due to stalk lodging caused by the girdling of plants by larvae.

As the season progresses, we'll continue to keep you up to date regarding Ron's continued trapping efforts for southwestern corn borers in southern Illinois.—*Mike Gray*

## CROP DEVELOPMENT

### Weather Woes and Crops

The past 10 days or so, beginning about May 20, have brought us very poor weather for the young corn and soybean crops that are trying to get started growing in Illinois. While crops, especially in southern and eastern Illinois, have benefited greatly from the rainfall, continued cool and cloudy weather has slowed the growth of the crops and has given the crop a pale, unhealthy appearance. The corn, especially that with only three or four leaves, looks especially poor. Larger corn and just-emerging soybean plants have not been as affected, but they also don't look as healthy as we'd like.

In most fields, a few days of warm, sunny weather will produce rapid improvement in the appearance of the crop. Besides the unfortunate interruption of growth, which will delay future development of the crop, there will probably not be much lasting effect of these weather problems on the corn crop. Soybean problems have been mostly insects and diseases, both of which can be more damaging when growth rates are slow.

In some fields, though, especially in the Quad Cities area, where rainfall has been excessive (our Monmouth research center has had more than 8 inches of rain in May), some corn plants are showing more severe symptoms. We saw corn there this week that was twisted and lying on the ground, with what appeared to be growth regulator-type herbicide injury. Such herbicides had not been used, and I believe such injury symptoms come from weather conditions, including strong winds during storms, slow growth rates that retard recovery growth, lack of sunlight to "feed" photosynthesis, and cool temperatures that keep plants from re-forming the chlorophyll that has been lost. Most of these plants will recover, but where they remain "tied-in" too long, they might not survive, or they may not

recover sufficiently to compete with neighboring plants. Such unevenness will probably hurt yield to some extent.

On the positive side, most plant stands are good and most root systems appear to be in good shape. These factors will be important in maintaining good yield potential in fields once the weather returns to more average conditions.—*Emerson Nafziger*

## REGIONAL REPORTS

Extension center educators, unit educators, and unit assistants in northern, west-central, east-central, and southern Illinois prepare regional reports to provide more localized insight into pest situations and crop conditions in Illinois. The reports will keep you up to date on situations in field and forage crops as they develop throughout the season. The regions have been defined broadly to include the agricultural statistics districts as designated by the Illinois Agricultural Statistics Service, with slight modifications:

- North (Northwest and Northeast districts, plus Stark and Marshall counties)
- West central (West and West Southwest districts, and Peoria, Woodford, Tazewell, Mason, Menard, and Logan counties from the Central district)
- East central (East and East Southeast districts [except Marion, Clay, Richland, and Lawrence counties], McLean, DeWitt, and Macon counties from the Central district)
- South (Southwest and Southeast districts, and Marion, Clay, Richland, and Lawrence counties from the East Southeast district)

We hope these reports will provide additional benefits for staying current as the season progresses.

### East-Central Illinois

Armyworms have been the focus of attention for many area farmers, predominantly those with grass pasture or hay fields, and for wheat producers. Many fields are starting to show significant levels of natural control. Cornfields have been damaged when caterpillars have moved from original grassy sites to cornfields after the original site was defoliated.

Cutworms, grubs, wireworms, and grape colaspis have all contributed to ragged stands in some fields. This damage was compounded in some locations that were growing slowly because of temperature and moisture conditions.

### Northern Illinois

Field activity was somewhat limited as many areas received rainfall on 2 to 4 days last week. The cool temperatures have caused most of the corn crop to appear slightly chlorotic in color. Soybeans still remain to be planted in northwest Illinois.

Armyworms have reached northern Illinois, as reported in last week's issue of the *Bulletin*. However, since late last week, reports of insecticide treatments for armyworms are becoming more common. Reports on May 29 from several people indicate that they have observed larvae from 3/4 to 1-1/2 inches long. All producers are urged to scout their fields for possible infestations.

Several preemergence grass herbicide injuries have been reported in corn, but these situations should be alleviated once temperatures warm up again.

### West-Central Illinois

Showers and cool weather were predominant throughout the region last week. Most areas now have adequate moisture for good crop growth at this time.

In general, corn is growing well and getting a good dark green color. However, there are reports of brown-colored corn in Greene County. Respraying is continuing for grass control because some soil-applied herbicides were not effective owing to dry soil conditions at planting. Scouting for first-generation corn borer in earliest-planted fields should begin. Sidedressing N is almost completed. Anhydrous ammonia prices have decreased since May 1.

Soybeans look fairly good. Roundup and other postemergent herbicide applications are beginning. There have been some reports of cutworm damage and replanting because of the pest. Some replanting has occurred because of dry soil conditions. Not many disease problems have been observed.

Armyworm problems in wheat and grass pastures have decreased somewhat; however, they are still abundant in some areas. Scouting for the pest should continue well into June.

Variegated cutworm damage has been reported after first cutting of alfalfa. Scouting for potato leafhopper should begin also.

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