

MU Guide

Corn Earworm in Missouri

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The corn earworm, *Helicoverpa zea* (Boddie), is a generalist feeder with at least 16 cultivated and numerous (more than 100) wild host plants. Other names given to this pest include cotton bollworm, soybean podworm, tomato fruitworm and vetchworm. This insect has a global distribution and is found throughout the continental United States.

Description and life cycle

The corn earworm overwinters as a pupa within an earthen cell two to four inches deep in the soil. Resident moths [buff-colored with irregular wing markings (Figure 1)] emerge in April and are later joined by migratory moths in June (see timeline). First-generation moths mate and the females lay their eggs on both cultivated and wild host plants. Each female can produce 500 to 3,000 eggs, but the average is around 1,000. The white to cream-colored, dome-shaped eggs are individually laid near the terminals and fruit of its host plants. Reddish brown bands appear on the eggs before the larvae hatch (within 2 to 10 days). Small larvae are cream-colored but larger ones have variable coloration (pale green to rose to brown) and pale lateral stripes. Unlike other striped larvae with four abdominal prolegs, corn earworm larvae have numerous small, black spines along their back and sides. The larval stage of the corn earworm and the tobacco budworm, *Heliothis virescens* (F.), look very similar; however, corn earworm larvae lack an extra tooth on the inside of their mandibles. For the tobacco budworm, the extra tooth is at a right angle to the other teeth, like the thumb folded across the palm of the hand. A 10x hand lens is necessary to distinguish both the black spines on the corn earworm larvae and the presence or absence of the extra mandible tooth. Corn earworm larvae feed for two to four weeks and molt four to five times. Once a larva is full-grown, it crawls down the host plant and pupates in the soil. The next generation of moths emerges within the next 10 to 25 days.

Facts at a Glance

- This insect attacks various crops (e.g., corn, cotton, grain sorghum, soybeans).
- It feeds primarily on the fruit of its cultivated hosts: corn ears, cotton squares and bolls, grain sorghum seed heads, and soybean pods and seeds.
- Because of its cannibalistic nature, there is usually just one larva per fruiting structure.
- There are two to three generations per year in Missouri.



Figure 1. Corn earworm moth.

Damage

Corn

Corn is the preferred host of the corn earworm; annual corn yield losses range from 5–7 percent for field corn and 10–15 percent for corn canned for human consumption. First-generation larvae may feed within the tightly rolled leaves of whorl-stage corn. This damage causes numerous ragged holes to appear after the leaves unfurl. The larvae also deposit wet, tan to brown waste droppings (or frass) between the whorl and the base of the leaves. The feeding damage and frass are similar to that of the fall armyworm, *Spodoptera*

Approximate timing for corn earworm infestations in Missouri.

	1st generation	2nd generation	3rd generation	
January – March	April – June	July	August – September	October – December

frugiperda (Smith). Damage from second-generation larvae is more economically important because the larvae feed on corn kernels around the tip of the ear (Figure 2); whereas, both the European corn borer, *Ostrinia nubilalis* (Hübner), and fall armyworm feed along the sides of the ear below the tip. Both the ear damage and larval frass also permit secondary disease pathogens to infect corn kernels and further reduce grain quality and yield. One of these pathogens, *Aspergillus flavus* Link, produces aflatoxin that is poisonous to both humans and livestock. Third-generation corn earworms may attack late-planted corn, but these larvae are usually found on other host plants.

Cotton

Since 1990, Missouri cotton growers have annually lost more than 11,000 bales (approximately 5 million pounds) of cotton to the cotton bollworm (same as corn earworm) and tobacco budworm complex. The cotton bollworm primarily attacks the terminals, squares, blooms and bolls of cotton. A female moth typically

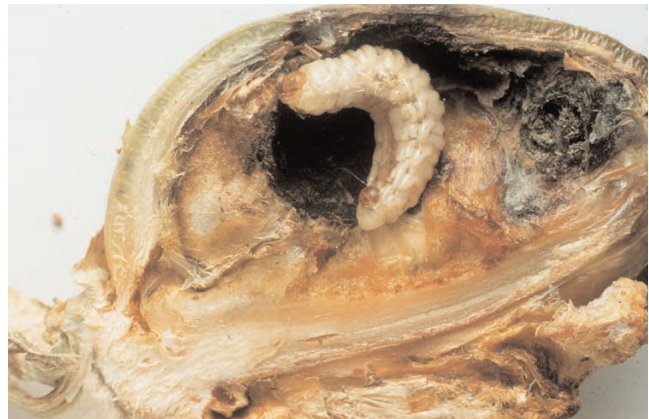


Figure 3. Cotton bollworm larva and boll damage.

deposits her eggs on young terminals, square bracts and flowers (inside or outside). Initially, the small larvae tunnel into young terminal growth and squares. Terminal damage by small larvae can lead to excessive branching by the plant. Later, the larger larvae tunnel into squares and feed on the developing floral structures. These squares eventually turn yellow and fall to the ground. Larvae also can damage bolls and consume the entire contents of the boll (Figure 3). This damage is generally accompanied by semisolid, moist frass deposited by the larvae around the irregular-shaped entrance hole. Frequently, secondary pathogens infect damaged bolls and cause additional boll rot. During times of limited fruit supply and high larval populations, bollworm larvae may feed on older leaves. Overall, a single larva also may consume six to seven squares and two to three bolls before completing its growth.

Grain sorghum

Late in the growing season, corn earworm larvae can be found feeding on the seeds and flower stems of sorghum. Plants are most vulnerable to injury during the bloom to milk stages, and corn earworm larvae can heavily damage seed heads (Figure 4). An average of one larva per seed head can reduce yields by 5 percent and two larvae per seed head can cause a 9–10 percent yield loss.

Soybeans

In southern Missouri, late-planted or double-cropped soybeans are most vulnerable to attack by the soybean podworm (same as corn earworm). Leaves, stems, flowers but especially pods and seeds (Figure 5) can be damaged by the third generation larvae. When soybean podworm infestations coincide with prebloom



Figure 2. Corn earworm larva and corn ear damage.



Figure 4. Corn earworm damage to grain sorghum seedhead.

soybeans, damage is limited to the foliage and is of little economic importance; however, infestations during peak flowering to early pod fill stages can delay seed production and lower yields. In university research field trials, an average of one large larva per row foot was found to reduce yields by approximately 1.9 bushels per acre.

Scouting procedures and techniques

Corn

Corn earworm larvae usually feed at the ear tip. When disturbed they will either fight or curl into a C-shape.

Cotton

Closely examine the entire plant (terminal, squares, blooms, bolls) for cotton bollworm eggs and larvae. Cotton adjacent to corn fields or those with weedy field margins often receive the most intense egg-laying pressure. Generally, the biggest threat from bollworm infestations occurs when corn stops silking and begins to mature. Carefully examine 50 plants (five plants in each of 10 locations) and their fruiting structures (particularly underneath the bloom tags) per field for bollworm eggs, larvae, and feeding damage. Fields must be scouted one to two times each week until the last effective boll population matures.

Grain sorghum

Once sorghum begins to bloom, check fields every five days until the hard dough stage. Randomly sample five plants at each of 10 locations per field for corn earworm larvae by vigorously shaking the seed heads



Figure 5. Soybean seedpod damage by corn earworms.

over a beat sheet or 5-gallon plastic bucket. This method helps to detect the smaller larvae (less than ¼ inch in length) that are easily overlooked with visual examinations of the seed heads.

Soybeans

Fields should be scouted for soybean podworms once plants begin to flower. A beat sheet for detecting the larvae and visual examinations for pod damage are recommended sampling methods. At each of 10 locations per field, sample 6 row-feet with a beat sheet and visually examine five plants.

Economic thresholds

Corn

For field corn there is no recommended threshold in Missouri. Rescue insecticide treatments are economically impractical because of the numerous applications required to obtain effective control and prevent ear damage. Insecticide applications can be economically justified for sweet corn or late-maturing seed production fields. The threshold is an average of five corn earworm moths per night in pheromone traps when green silks are present in the field. Stop insecticide applications when 90 percent of the silks turn brown.

Cotton

The University of Missouri's insecticide recommendations for cotton are when square or boll damage reaches 5–10 percent, or when 10 or more cotton bollworm eggs or larvae per 100 plants are present.

Grain sorghum

Insecticide application is recommended for sorghum when more than 75 percent of the plants are infested with corn earworm larvae (one or more larvae per seed head).

Soybeans

Once soybean plants start to flower, rescue insecticide applications are recommended when soybean podworm populations are more than one per row foot and 5 percent or more of the pods are damaged.

Management

Corn

Because insecticide use is economically impractical for field corn, growers must rely on other management options to limit corn earworm damage. Plant high-quality hybrids noted for their “husk-tightness.” In most cases, early-planted corn can escape damage if silking is completed before the corn earworm populations peak. Maximize the use of beneficial arthropod populations (e.g., parasitic wasps, *Trichogramma* spp.). Fall plowing also helps to disturb and kill any overwintering pupae present in the soil. For sweet corn, select resistant varieties that will help to reduce the number of insecticide applications. **Precaution:** Before you select and apply an insecticide, review the manufacturer’s label for information on the safe use of the material.

Cotton

Maintain beneficial insect (e.g., big-eyed bugs, *Geocoris* spp.; minute pirate bugs, *Orius* spp.) and spider populations by limiting the number of early-season insecticide applications. Both natural enemies and disease organisms (e.g., *Nosema heliothidis*) help suppress cotton bollworm larval populations and eliminate or reduce the need for insecticide applications. Cotton should be managed to obtain an early cutout and thus shorten the window that the larval stage can damage cotton. If an insecticide application becomes necessary,

thorough canopy coverage, timely applications, and targeting small larvae will increase the effectiveness of the rescue treatments.

Another management option is planting Bt-transgenic varieties. These varieties are recommended for areas with a high risk for tobacco budworm and cotton bollworm infestations. Do not trigger insecticide treatments for tobacco budworm and cotton bollworm infestations based on egg counts because larvae must first ingest a toxic dose of the Bt protein. Fields should still be monitored weekly because the current commercial varieties have a lower expression of the Bt toxin in the flower pollen. Larvae that feed on flowers are less likely to die and can damage the bolls from beneath the bloom tags. Non-Bt cotton should be planted in close proximity to the Bt fields to maintain susceptible moth populations. There are two refuge options (5% or 20%) for these non-Bt fields. With the 5 percent refuge option, do not control cotton bollworms with any product specially targeted at this insect. With the 20 percent acreage refuge option, do not apply foliar Bt sprays.

Grain sorghum

Early planting helps the crop mature sooner and avoid late-season corn earworm infestations. Plant open-headed varieties that increase corn earworm larval exposure to the weather, natural enemies and insecticides. Maximize and maintain healthy beneficial arthropod populations.

Soybeans

Early planting and use of early-maturing varieties decrease the crop’s risk to late-season soybean podworm feeding damage. Manage the crop so that a full canopy quickly develops, and this will help to discourage the moth’s egg-laying activities. Maximize the use of beneficial arthropod populations. When insecticide use becomes necessary, target the midsize larvae. Smaller ones are more difficult to control because they hide within protective areas of the plant canopy, and larger ones are more difficult to kill with insecticides.

