Field Corn XI-5

European Corn Borer

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European Corn Borer

Identification (and life cycle/seasonal history)

European corn borer (ECB) larvae are cream colored to pinkish caterpillars, which are marked with small, round brown spots. The head capsule is dark or reddish brown. Fully developed larvae are 25 millimeters (one inch) in length. Male moths are distinctly darker and slightly smaller than the pale yellow female moth. The average adult wing-span is about 25 millimeters (one inch). The forewings are buff colored with darker bands running in wavy lines across the wings.

First generation. In early spring, overwintered larvae pupate and emerge as moths during late May or early June. On warm, calm, humid evenings in June, female moths fly from weedy or grassy margins into cornfields and lay eggs. Eggs are laid in masses of 15 to 30 on the underside of corn leaves, usually near the midrib. The egg masses have a scaly, glossy white appearance. As the egg masses mature, the black head capsules of the developing larvae become visible, and the egg mass is described as being in the "blackhead stage." Once an egg mass reaches the blackhead stage, hatching will generally occur within 36 hours. Larvae require from four to six weeks to complete development. Mature larvae, fifth instar first generation, change into pupae within the corn stalk. Adult moths emerge in mid-July to early August to form the second generation. Adults fly at night but do not cause damage. ECB usually go through two generations each year.

Second generation. The female summer moth prefers to lay eggs in corn that is tasseling and in the green silk stage. Later-maturing fields are more attractive to egg-laying moths than fields approaching maturity. Second generation larvae bore into the tassels, ear shanks, ears, and stalks. These larvae usually overwinter and do not pupate until the following spring.

Plant Response and Damage

ECB usually go through two generations each year. The young larvae feed first on the leaf near where they hatched. As the larvae grow, they move to the whorl or leaf sheath area, and feed. When leaves emerge, the "shot hole" feeding signs in the leaves can be seen. Most of the mature larvae will bore into the stalks, feed, and finish development there. Second generation larvae cause ear damage, tunneling in the shank and feeding on silks, kernels and cobs. Signs of infestation include: dropped ears, broken shanks, stalk breakage, sawdust-like castings on leaves, and holes in the stalks.

Management Approaches

Resistant Varieties

Some hybrids have useful resistance to the first brood of European corn borer, which feeds in the whorls and later enters the stalk. Control can be expected with Bt corn hybrids, except those containing just the YieldGuard Rootworm event. See ?Managing Corn Pests with Bt Corn?, http://www.ext.colostate.edu/pubs/crops/00708.html, for details on the use of Bt corn hybrids to control corn pests.

Biological Control

Beauveria bassaina is a fungus that attacks and eventually kills ECB larvae. Nosema pyraustae is a protozoan organism that infects eggs, larvae, pupae, and adults. Ladybird beetle larvae and adults and lacewing larvae feed on eggs and newly hatched larvae. Two parasitic wasps, Eriborus terebrans and Sympiesis viridula, are known to parasitize ECB larvae.

Cultural Control

Planting date may affect infestations since egg-laying females are attracted to taller corn.

Chemical Control

Granules applied by ground and air, as well as some center-pivot applied liquids, have given the best results in university tests. The second brood feeds in leaf axils and the ear tip, and later enters the stalk or the ear. Second brood damage increases the possibility of lodging and ear drop losses, so heavily infested fields should be harvested early. Aerially applied and center-pivot applied liquids have performed better than granules for control of second-generation larvae in university tests. Monitor treated fields for spider mites as applications for control of second generation are often associated with mite outbreaks.

The need to treat European corn borer can be determined by a simple method based on average Colorado conditions, or by a more complex method which takes into account treatment costs, individual field yields and current market conditions (Table XI 2). Incorrect treatment decisions, by either method, are much more likely with second-generation infestations. This is partly due to the second-generation egg-laying period, which can last up to four weeks making proper treatment timing very difficult.

By the simple method chemical control of the first generation is economical when 25 percent of the plants have feeding damage and larvae are present in the whorls. Once larvae have entered the stalk, control is impossible. Survival of second-generation larvae is highest during pollination, so treatments should be considered when weekly scouting has an accumulated total of 25 percent of plants with egg masses. This percentage should be raised to at least 50 percent after pollination. If egg laying continues after the treatment, a second application may be justified under some circumstances.

A more complex method allows you to take into account control costs and yield expectations.

First Generation Procedures

Visit fields weekly after moth flight activity is reported. Earlier planted, larger corn will be more likely to have eggs.

1. For each 25 acres per field, sample one location.

2. At each location examine 20 plants for leaf feeding and record the number in the worksheet below (Table XI - 2).

3. Dissect two of the damaged plants and record the total number of ECB larvae present.

4. After sampling, calculate the proportion of plants damaged and average borers per plant. Multiply these together to calculate average borers per plant.

5. Compare your observed borers per plant figure to the figure in Table XI - 3 corresponding to your expected control costs and crop value. The table figures are break-even figures. If you want more return per control dollar, multiply the figure by the desired return before comparing it to the observed value. For example, multiply by 1.5 to get a 150% return for each dollar of control costs.

6. If your observed borers per plant figure is greater than the one in the table (or the one from the table multiplied by the desired return factor) then an insecticide treatment should be cost effective.

7. If not then resample if (1) the moth flight is still underway; (2) mostly small larvae were present; and (3) little stalk tunneling had been initiated. If most of the larvae have already entered the stalk, a treatment will not be effective.

Second Generation Procedures

1. Visit fields weekly after moth flight activity is reported. Later corn is more likely to have eggs.

2. For each 25 acres per field, sample one location.

3. At each location dissect 10 plants, paying close attention to silks and leaf axils. Record the number of larvae present. If scouting for eggs, strip leaves from each of the 10 plants, examining each for eggs. Record the number of egg masses present.

4. After sampling, calculate average borers per plant or egg masses per 100 plants.

5. Compare your observed borers per plant figure to the figure in Table XI - 4 corresponding to your expected control costs and crop value or use the values in the footnotes to convert the borers per plant to the action threshold in egg masses per 100 plants. The ECB counts in the table are break-even figures. If you want more return per control dollar, multiply the borers per plant or egg masses per 100 plants figure by the desired return before comparing it to your observed value. For example, multiply by 1.5 to get a 150% return for each dollar of control costs.

6. If your observed borers per plant or egg masses per 100 plants figure is greater than the table value (or the table value multiplied by the desired return factor) then an insecticide treatment should be cost effective.

7. If not then resample if (1) the moth flight is still underway; (2) mostly small larvae were present; and (3) little tunneling had been initiated.

Table XI - 2. European corn borer field scouting form.

Date: Field ID:
Acres: Location:

	First Generation		Second Generation	
Sample #	**Damaged plants per 20 plants**	**Borers per 2 damaged plants**	**Borers in 10 dissected plants**	**Egg masses in 10 plants**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Total				
Average				

Estimated larvae per plant

(Damaged plants in 20) x (borers per plant)

x =

Action threshold (see Table XII-3)

Table value x desired economic return (see Step 6)

x _____ =

(Ave. ECB/10 plants)/10 =

Or

(Ave. egg masses/10 plants) x 100 =

Action threshold (see Table XII-4) Table value x desired economic return (see Step 5)

x _____ =

Decision:

TREAT DON?T TREAT RESAMPLE

Table XI - 3. Action threshold values for first generation European corn borer larvae expressed as larvae per plant.

Expected crop value (expected bushels per acre x expected market price)

250	275	300	325	350	375	400	425	450	475	500

		Action threshold (European corn borer larvae per plant)1										
	6	0.60	0.55	0.46	0.43	0.40	0.38	0.35	0.33	0.32	0.32	0.30
	7	0.70	0.64	0.54	0.5	0.47	0.44	0.41	0.39	0.37	0.37	0.35
	8	0.80	0.73	0.62	0.57	0.54	0.50	0.47	0.45	0.42	0.42	0.40
	9	0.90	0.82	0.70	0.64	0.61	0.56	0.53	0.51	0.47	0.47	0.45
	10	1.00	0.91	0.78	0.71	0.68	0.62	0.59	0.57	0.52	0.52	0.50
	11	1.10	1.00	0.86	0.78	0.75	0.68	0.65	0.63	0.57	0.57	0.55
Control Costs per Acre ($)	12	1.20	1.09	0.94	0.85	0.82	0.74	0.71	0.69	0.62	0.62	0.60
	13	1.30	1.18	1.02	0.92	0.89	0.80	0.77	0.75	0.67	0.67	0.65
	14	1.40	1.27	1.10	0.99	0.96	0.86	0.83	0.81	0.72	0.72	0.70
	15	1.50	1.36	1.18	1.06	1.03	0.92	0.89	0.87	0.77	0.77	0.75
	16	1.60	1.45	1.26	1.13	1.10	0.98	0.95	0.93	0.82	0.82	0.80
	17	1.70	1.54	1.34	1.20	1.17	1.04	1.01	0.99	0.87	0.87	0.85
	18	1.80	1.63	1.42	1.27	1.24	1.10	1.07	1.05	0.92	0.92	0.90

1Assumes (1) 100% efficient scouting; (2) 5% yield loss per plant; and (3) 80% control.

Table XI-4. Second generation European corn borer action threshold values expressed as larvae per plant2.

		Expected crop value (expected bushels per acre x expected market price)										
		250	275	300	325	350	375	400	425	450	475	500
		Action threshold (European corn borer larvae per plant)1										
	6	1.23	1.12	1.03	0.95	0.88	0.82	0.77	0.72	0.68	0.65	0.62
	7	1.44	1.31	1.20	1.10	1.03	0.96	0.90	0.84	0.80	0.76	0.72
	8	1.64	1.49	1.37	1.25	1.17	1.09	1.03	0.97	0.91	0.86	0.82
	9	1.85	1.68	1.54	1.40	1.32	1.23	1.16	1.09	1.03	0.97	0.92
	10	2.06	1.87	1.71	1.55	1.47	1.37	1.29	1.21	1.15	1.08	1.02
	11	2.26	2.05	1.88	1.70	1.61	1.50	1.42	1.34	1.26	1.18	1.12
	12	2.47	2.24	2.05	1.85	1.76	1.64	1.55	1.46	1.38	1.29	1.22
Control Costs per Acre ($)	13	2.68	2.43	2.22	2.00	1.91	1.78	1.68	1.58	1.50	1.40	1.32
	14	2.88	2.61	2.39	2.15	2.05	1.91	1.81	1.71	1.61	1.50	1.42
	15	3.09	2.80	2.56	2.30	2.20	2.05	1.94	1.83	1.73	1.61	1.52
	16	3.30	2.99	2.73	2.45	2.35	2.19	2.07	1.95	1.85	1.72	1.62
	17	3.50	3.17	2.90	2.60	2.49	2.32	2.20	2.08	1.96	1.82	1.72
	18	3.71	3.36	3.07	2.75	2.64	2.46	2.33	2.20	2.08	1.93	1.82

1Assumes (1) 100% efficient scouting; (2) 5% yield loss per plant; and (3) 65% control.

2Multiply larvae per plant by 22 to convert to action threshold in egg masses per 100 plants (assuming 20% survival from egg to larvae boring in plant and 23 eggs per mass). Multiply by 44 for 10% survival, 15 (30%), 11 (40%), or 9 (50%) if one of these survival rates better represents your situation.

Product list for European corn borer

Pesticide	**Product/Acre (Fl oz. or oz. product)**	**Preharvest Interval, remarks**
Asana XL**R**,**1**	5.8 - 9.6	21 days. Spray when eggs are in the blackhead stage or starting to hatch**. Extremely Hazardous to Bees!**
Bacillus thuringiensis**1**,**2**	See labels	0 days. Time application when young larvae are present for first or second generation. Cool weather may cause ECB to seek protected areas. This will hamper effectiveness of Bt insecticides.
Baythroid XL**R**,**1**	1.6 - 2.8	21 days. See label. **Extremely Hazardous to Bees!**
bifenthrin 2E**R**,**1,2**	2.1 - 6.4	30 days. Use rates below 5.12 fl. oz. only if spider mites are **NOT** a concern. **Extremely Hazardous to Bees!**
chlorpyrifos 15G	6 - 8 oz/1000 row ft	35 days to harvest. Treat when 25 to 50 percent of the plants show pinhole feeding or leaf feeding scars. Applications should be directed into the corn leaf whorls. Not for use on popcorn. **Extremely Hazardous to Bees!**
chlorpyrifos 4ER**1,2**	16 - 32	

Cobalt**R**1	19 - 38	21 days grain. 14 days graze or silage. **Extremely Hazardous to Bees!**
Delta Gold **R**,**1**	1.5 - 1.9	21 days to harvest grain or fodder. 12 days to forage. Do not apply more than 0.095 lb ai/acre/crop. **Extremely Hazardous to Bees!**
Furadan 4F**R**	24 - 32	30 days. DO NOT APPLY MORE THAN 2 PT/ACRE AS FOLIAR SPRAY. Use a sticker. Do not apply within 14 days of detasseling or rogueing seed corn. **Extremely Hazardous to Bees!**
Hero**R**,**1**	4.0 - 10.3	30 days to harvest grain or fodder. 60 days to forage. Do not apply more than 0.4 lb ai/acre/crop. **Extremely Hazardous to Bees!**
Intrepid 2F	4 - 8	21 days. 64 oz per season maximum. See label for timing information and crop rotation restrictions.
lambda cyhalothrin**R**,**1,2**	2.56 - 3.84	21 days. For control before the larva bores into the plant stalk or ear. Do not apply more than 0.12 lb ai/A/season. **Extremely Hazardous to Bees!**
Mustang Max**R**,**1**	2.72 - 4.00	30 days. See label. **Extremely Hazardous to Bees!**
Penncap M**R**,**1**	32 - 64	12 days. **Extremely Hazardous to Bees**. Do not apply when bees are foraging in the field.
permethrin**R**,**1,2**	See labels	30 days. **Extremely Hazardous to Bees!**
Proaxis**R**,**1**	2.56 - 3.84	21 days. For control before the larva bores into the plant stalk or ear. Do not apply more than 0.06 lb ai/A/season. **Extremely Hazardous to Bees!**
Radiant SC1	3 - 6	28 days grain. 3 days fodder or forage. **Highly toxic to bees!**
Tracer1	1 - 3	28 days. See label. **Extremely Hazardous to Bees!**

RRestricted use pesticide. **1**Labeled for chemigation. **2**Generic active ingredient, may be additional formulations.

Categories: Field corn, Insects, European corn borer

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