European Corn Borer Management in North Dakota

*Ostrinia nubilalis* (Hubner)

Managing corn borer in North Dakota is a challenge due to the lengthy emergence interval of the moths from overwintering. In ND, borers have the potential for one or two generations during the season. The two generation borers are present in the southeast quarter and Missouri River basin areas of the state. They begin emerging in early June and represent the first flush of larval feeding. The single generation borer is present throughout ND, emerging from mid June, possibly until late July. The challenge of the crop manager is to distinguish when egg laying and larval populations can be tolerated or they need to be controlled.

**Description**

Full-grown larvae of the European corn borer vary in color from gray to creamy white. The body is covered with numerous dark spots. The head is black. They range in length from 3/4 to 1 inch.

Adult are straw-colored with a 1 inch wingspread. Males are slightly smaller and darker. Females lay eggs on the underside of the leaves, near the midvein.

The egg masses are 1/8 to 3/16 inches long and contain about 20 to 30 eggs. The eggs, when laid, overlap like fish scales. As the eggs develop, they change from white to a creamy color. Just prior to hatching, the black heads of the larvae become visible through the shell; this stage is referred to as the "black-head" stage.
Life Cycle

European corn borers pass the winter as full-grown larvae in corn stalks, corn cobs, weed stems, or in other cornfield debris. Spring development resumes when temperatures exceed 50F. The larvae pupate in late May and June, and moths begin to emerge in June and continue to emerge well into July. Cool weather can delay the development of borers; warm weather can accelerate borer development.

After emerging, moths spend the daylight hours in weeds and grasses bordering or within the cornfields. Vegetation in these sites collects rain or dew droplets more effectively than the corn plants. The moths drink this available water. Also, in these sites, mating occurs as the females attract large numbers of males to where they are resting.

The females deposit their eggs on the undersides of the leaves near the midvein. It takes 3 to 7 days for eggs to hatch, depending on temperatures.

After hatching, larvae move quickly into the whorl and begin to feed. Their feeding results in shot-holing of the leaves. This damage becomes more apparent as the leaves lengthen and emerge further from the whorl.

When larvae are about 10 days old, they reach a length about equal to the diameter of a dime and begin to tunnel into the midvein of the leaf, then burrow into the stalk.

Bivoltine versus Univoltine

**Bivoltine** - two generations per year

**Univoltine** - one generation per year

Management of European corn borer in North Dakota is complicated by the presence of two biological types of corn borer. The bivoltine corn borer
develops quicker in the spring, allowing it to emerge earlier, usually early June to July. The univoltine develops slower and the moths emerge in mid-June to mid-July. The result of this staggered emergence is a moth flight that can extend over a five week period. When this flight winds down, the bivoltine moths are emerging to lay eggs for a second generation. When the bivoltine members of the population are abundant, infestations are observed in whorl stage corn. When the univoltine members are most abundant, infestations develop later in pre-tassel or older corn.

The proportion of bi- and univoltine members within the corn borer population can shift from season to season. Following a season with a warm spring and an open fall, a shift to more bivoltine borers would be expected. A cool spring with an early fall season, should shift the population to more univoltine borers. Because of this fluctuation from year to year, field scouting during the first flight period to detect moth activity is critical.

**Using Degree Days for Scheduling Scouting Activities**

A degree day model was developed to predict occurrence of the univoltine flight of corn borer moths. As with other degree day models, it should help identify priority times for field scouting. The models pinpoint the occurrence of key biological events. In this case, the model is indicating the proportion of moths that have emerged based on accumulated degree days from April 1 when using a Max-Min, modified base 50°F (this is the same method used for monitoring corn growth with Growing Degree Days).

### Degree Day (Modified Base 50°F) Model for Moth emergence of Univoltine-type European Corn Borer

<table>
<thead>
<tr>
<th>Accumulated Degree Days</th>
<th>Proportion of Emerged Moths</th>
</tr>
</thead>
<tbody>
<tr>
<td>911</td>
<td>10 %</td>
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<tr>
<td>986</td>
<td>25 %</td>
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<tr>
<td>1078</td>
<td>50 %</td>
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<tr>
<td>1177</td>
<td>75 %</td>
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<tr>
<td>1274</td>
<td>90 %</td>
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</table>
To determine current degree day accumulations for monitoring corn borer emergence, visit the North Dakota Agricultural Weather Network (NDAWN), select Applications, and then select Corn Degree Days for the nearest town. Future plans are to include a graph for illustrating degree day accumulations superimposed on a corn borer developmental chart.

**Damage**

Yield losses due to European corn borer infestations are primarily due to stalk tunneling that results in physiological stress. The later in the development of the crop that larvae begin to tunnel, the less direct impact on yield occurs and risk of loss shifts to other potential problems. With persistent autumn winds and dry conditions, tunneling in stalks and ear shanks increases the risk of stalk breakage and dropped ears.

**Management**

**Natural Control**

Heavy rains that occur before borers are able to burrow into the plant may kill borers by drowning them or through physically removing them from the plant.

**Cultural Control**

European corn borers pass the winter as larvae in corn stalk residue. Corn harvested for silage results in high borer mortality. Stalk shredding and deep plowing may reduce winter survival in individual fields, but seldom has significant impact region wide because of the mobility of moths moving from neighboring overwintering sites.

**Field Scouting**

Corn should be monitored weekly for at least five weeks once plants exceed an extended leaf height of 17 inches. At this point, corn borer larvae will be able to survive on the plant. Inspect plants for the presence of egg masses, whorl feeding, and active larvae. Observing moth activity around field margins or within the field may alert you to developing infestations. Recent corn borer infestations in ND developed in mid to late July as a result of the late emergence of the numerous single generation type borers. In other years, the two generation borers emerging first may contribute more to significant infestations.
Field Scouting and Treatment Decisions for European Corn Borer by Crop Stage

In North Dakota, chemical treatments are not always warranted for controlling corn borer damage. Scout fields for determining the levels of corn borer present and use the management worksheets to assess the economic necessity of treating with an insecticide.

**Whorl stage corn** . . . Pull the whorls from 10 plants at 5 locations across the field. Select whorls at random, avoiding damaged plants. Unwrap the whorl leaves; count and record the number of live larvae found. *Click here to use an interactive spreadsheet on the internet.*

You fill in the blanks

1. __% of plant infested   x ___Avg. no. borers/plant
2. ___ borers per plant   x ___ percent yield loss per borer*
3. ___ percent yield loss   x ___ expected yield (bu. per acre)
4. ___ bushel loss per acre   x ___ price per bushel
5. ___ loss per acre      x ___ percent control**
6. ___ preventable loss/acre    x ___ cost of control per acre

= ___ Borers per plant
= ___ percent yield loss
= ___ bushels per acre loss
= $___ loss per acre
= $___ preventable loss/acre
= $___ profit (loss)/acre

*5% for corn in the early whorl stage; 4% for late whorl; 6% for pre-tassel
**80% for granules; 80% for sprays.

**Tassel stage or older corn** . . . Examine the underside of the middle 7 leaves (3 leaves above and 3 leaves below the ear leaf) on 20 plants from 5 locations in the field. Multiply the number of egg masses found by 1.1 (correction factor for eggs on other leaves). Complete worksheet to determine the need for treatment. *Click here to use an interactive spreadsheet on the internet.*

You fill in the blanks

1. ___ egg masses/plant*   x 4.5 borers per egg mass
2. ___ borers per plant   x ___ percent yield loss per borer*
3. ___ percent yield loss   x ___ expected yield (bu. per acre)
4. ___ bushel loss per acre

= ___ borers per plant
= ___ percent yield loss
= ___ bushels per acre loss
= $___ loss per acre
= $___ preventable loss/acre
= $___ profit (loss)/acre
5. __loss per acre  x __ price per bushel  =__$ __ profit (loss)/acre
6. __preventable  x 80 percent control**
   loss/acre               -__ cost of control per acre

*Cumulative counts taken five to seven days later can be added here
**Use 4% for pollen-shedding corn, 3% if kernels are initiated

### Economic Threshold (Corn borer/plant) when factoring Crop Value and Control Costs

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<tr>
<th>Control Costs(^2) (($/acre))</th>
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<th>250</th>
<th>300</th>
<th>350</th>
<th>400</th>
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\(^1\) **Crop value** = expected yield \((bu/acre)\) X projected price \(($/bu)\)

\(^2\) **Control costs** = insecticide price \(($/acre)\) + application costs \(($/acre)\)