Corn Borers and Corn Earworm Problems in Sweet Corn

Over the past couple of years sweet corn growers across Saskatchewan have reported more problems with "worms" in their corn. There has been considerable confusion as to whether the problem is Corn Earworm (*Helicoverpa zea*), European Corn Borer (*Ostrinia nubilalis*) or perhaps both. The objective of this article is help growers to identify the problem and to take appropriate control measures.

Corn Earworm – actually feed on a wide range of crops and weeds – including many vegetable crops (tomatoes, peppers, and lettuce) but corn is the preferred food source. **Damaging populations of Corn Earworm are sporadic both in time and space in Saskatchewan.** This reflects the fact that **this pest cannot successfully overwinter north of the Canada/USA border – instead the adult moths blow into Saskatchewan on storm winds out of the southeast.** The moths typically begin to arrive in Saskatchewan in July and new flights continue to arrive through until fall. Upon arrival the moths lay their eggs on the freshly **emerged silks of the corn crop.** The eggs are small and difficult to detect on the silks. The eggs hatch within a few days (depending on the temperature) and the small caterpillar larvae begin to migrate down the silk into the developing ear of corn. The caterpillars initially feed on the silks but then move onto the developing kernels – especially towards the tip of the cob. The larvae feed heavily, developing into a 2.5 cm long grub with about 3 weeks. The larvae are cannibalistic and for that reason it is unusual to find more than one larva in an ear of corn. **The presence of the earworm caterpillars, along with their feeding damage and associated waste, renders the ear unmarketable unless the husk can be opened and the damaged area of the cob trimmed off.** In the short growing season available in Saskatchewan very few of the caterpillars manage to reach maturity and are instead killed off when the first frost strikes. In more southern regions, caterpillars do reach maturity, at which time they emerge from the cobs and drop into the soil where they pupate. The pupae overwinter and the adult moths emerge the next spring.

Identification – Corn Earworm moths (Fig. A) are buff brown, about 2.5 cm long, with a wing span of 2.5 cm. The forewings have a distinctive brown dot at their center. The dot is best seen from the top side of the moth. Corn Earworm caterpillars (Fig. B) can range in color from green, through brown to pink – but all have darker longitudinal stripes – whereas the European Corn Borer larvae have spots (Fig. C). The pair of fine longitudinal stripes down the dorsal (upper) surface of the Corn Earworm is distinctive. Corn Earworm larvae also have distinctive spines whereas the European Corn Borer larvae do not.

Control – **as the Corn Earworm blow into Saskatchewan each year from more southerly regions, they cannot be controlled by crop rotation or tillage practices.** Growers need to carefully monitor their fields for the arrival of the adult moths - **as employing any control measures prior to their arrival is a waste of effort … and any delay in the implementation of control measures after arrival of the moths can spell disaster.** As mentioned above, the moths usually arrive at about the time the crop begins to silk. The arrival of the moths is most efficiently detected by positioning Heliothis traps (Fig. E) at the edge of the corn fields just as the crop begins to silk. These traps contain a pheromone that is highly attractive to the male Corn Earworm moths. Once moths are detected in the traps on several consecutive nights egg laying has likely commenced.

Controlling corn earworms using insecticides is challenging. The spray window is very brief – as insecticides applied prior to egg-laying are not effective and once the larvae hatch out they quickly migrate down the silk and into the ear where they are protected from any sprays the grower might subsequently apply. **As the larvae do not feed much during the 1-2 day period they are exposed on the silks they are difficult to control using pesticides that must be ingested to be effective.** Fast acting contact and stomach poison-type insecticides such as the synthetic pyrethroids (Pounce, Ripcord, and Matador) have proven to be effective. **New classes of insecticide such as Coragen which acts as a paralytic or Rimon which disrupts development of the larvae may also be useful**. **Biologicals such as Spinosad (Success and Entrust) are also effective.** All of the products listed are relatively soft on the environment and the applicator and have a relatively short pre-harvest interval. However several of these products are hard on bees so growers should carefully read the label and only spray in the evenings or early mornings. **All sprays should be directed towards the silks and away from the tassels where the bees congregate to gather pollen.** Thorough coverage of the silks is crucial so the sprays should be applied at 30 psi in in large volumes of water (100 L/a) using drop nozzles positioned within the canopy to target the developing cobs. The insecticides will need to be re-applied weekly until the silks start to dry down.

Attempts to control earworms using Bacillus thuringiensis (B.t. var. Kurstaki) sprays have produced inconsistent results. Much more consistent control of earworms can be achieved by planting corn varieties that have been genetically engineered to express the B.t. toxin. This toxin kills any Earworm (or European Corn Borer) that feeds anywhere on the corn plant. Extensive studies have shown that the B.t. toxin is harmless to humans and its use likely represents a more consumer and environmentally safe approach to earworm control than the repeated application of standard pesticides. Although genetically engineered canola, soy and field corn are widely grown and consumed in North America, consumer acceptance of genetically engineered vegetable crops such as sweet corn is less certain. The University of Saskatchewan has tested the field performance and quality of most of the insect resistant genetically engineered varieties of sweet corn available in Canada. While these GM varieties generally performed well and were completely free of insect damage, they tended to be a little too late to be recommended for growers in Saskatchewan. If GM sweet corn achieves widespread market acceptance it is likely that the insect resistance trait will be introduced into a wider selection of varieties – including varieties better suited to Saskatchewan growing conditions.

Some varieties of corn appear to be naturally less prone to invasion by Earworms than others. **These varieties may be producing compounds that suppress feeding and growth of the Earworms or the husks may simply be so tight that the larvae crawling down the silks cannot gain access to the cob.** Susceptibility to invasion by earworms is one of the quality characteristics evaluated in the sweet corn variety trials conducted each year by the Vegetable Crops Research Program at the University of Saskatchewan.

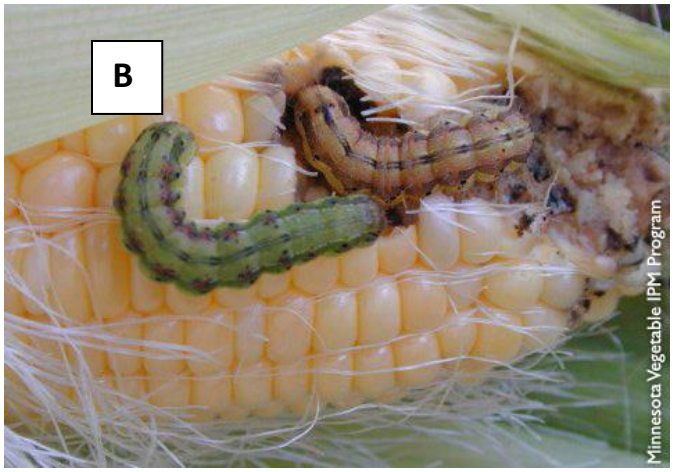
European Corn Borers – also feed on a wide range of crop and wild plants in addition to corn. Unlike the Corn Earworm, European Corn Borers most commonly feed on the leaves and stems of its host plant – only occasionally venturing into the ears of the corn crop. **European Corn Borers can survive typical Canadian winter conditions – therefore they can be present in fields from the start of the growing**

season. Mature Corn Borer larvae overwinter in the stalks of the plants remaining from the previous year. In spring, the larvae chew an exit hole in the stalks – but then return to stalks to pupate – exiting from this hole several weeks later as a mature moth. On warm calm evenings in late June to early July the moths begin to disperse, looking for new host plants – including emerging corn crops. Eggs are laid on the undersides of the leaves. Within a few weeks the eggs hatch and the caterpillar larvae disperse – typically heading for dark moist locations such as the whorl of leaves at the center of a developing corn plant. As the corn plants begin tassel out the caterpillars seek a new sheltered place to hide - typically by boring into the stem or the developing ear of corn. In the short growing season available in Saskatchewan there is only time for a single generation of Corn Borers each year.

Identification – European Corn Borer moths (Fig. D)are similar in shape and color but smaller than Corn Earworm moths. Corn Borer caterpillars are white to tan colored, with dark spots. Their body is smaller and their head capsule is darker than that of the Corn Earworm. Corn Borer caterpillars also lack the distinctive spines seen on Corn Earworms. **While Corn Earworms tend to cluster at the tip of the ears of corn, Corn Borers can be found anywhere in the cob.** While the eggs of the Corn Earworm are small and laid individually on the silks of the corn plant, the white eggs of the European Corn Borer are laid in overlapping groups on the undersides of the leaves near the mid-rib. These egg masses are relatively easy to detect and provide a good scouting tool. While the larvae are usually hidden within the developing leaf whorl, their feeding damage becomes obvious are the leaves emerge – showing up as a series of shot holes running longitudinally down the leaf. Any Corn Borers feeding within the ear render the cob unmarketable – especially as their feeding is not a restricted to the tip as is typically seen with the Earworm. Extremely high Borer populations may weaken the stems of the corn plant to point where they break.

Control – **effective management of the crop residues that harbor the overwintering larvae is crucial to managing European Corn Borers.** Over 80% of the larvae can be eliminated by shredding and then ploughing under the residual corn stalks in the fall. By contrast, disking under the crop residues does not provide adequate control. Crop residue management also cannot protect against any larvae that overwinter in the stalks of weeds growing in the head lands or other adjacent uncultivated areas. The moths can also travel from other nearby corn fields. Growers should therefore still monitor their crop for signs of invasion by Corn Borers. Phermone traps should be placed on the edges of emerging corn fields in late June. Growers should also scout the lower leaves of the crop, looking for the obvious egg masses. The Borer moths tend to lay their eggs on the biggest plants available – therefore growers should pay particular attention to early planted crops or large, fast growing cultivars. Early plantings around the edge of a field can potentially serve as a trap crop for Corn Borers. The larvae of the Corn Borer are only susceptible to control using standard contact insecticides during the time they are feeding in the relatively open leaf whorl of the developing corn plant. The same range of standard pesticides recommended for control of Corn Earworms also work on Corn Borers. This includes the biological control products such as Spinosad and the Bacillus thuringiensis var. Kurstaki. Thorough coverage of the target tissues is again crucial in getting acceptable control of Corn Borers using any of these pesticides. Multiple applications of these pesticides will again be required to protect the growing corn plant from multiple flights of moths. Growers should rotate between classes of pesticide to slow

the development of pesticide tolerance. Once the Borers move inside the stem or ears they are no longer susceptible to standard contact pesticides. They are however still susceptible to control via the B.t toxin that is expressed in genetically engineered lines of corn. See the Corn Earworm section for more information on genetic engineering of sweet corn for insect pest resistance.



A – Corn Earworm moth. Note the dark spots on the forewings

B – Larvae of Corn Earworm. Note the stripes, especially long the dorsal side

C- European Corn Borer moths

D- Larvae of the European Corn Borer. Note the spots and the dark head capsule

E – Heliothis trap