Insect Management in Sugarcane

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Pest management in sugarcane is suited to an integrated pest management (IPM) approach since some pest damage can be tolerated. Cultivar tolerance to insect feeding, biological control agents, cultural practices, and pesticides are all used in sugarcane. An effective IPM program helps protect the environment and potentially saves money for the grower. Several Florida sugarcane growers have been using a formal IPM program for a number of years.

**Sugarcane Borer**

The sugarcane borer, *Diatraea saccharalis*, is one of the most important above-ground pests of sugarcane in Florida. Although this insect’s principal host is sugarcane, many other grasses have been reported as alternative hosts.

Significant damage results from the sugarcane borer tunneling within the stalk. This can cause a loss of stalk weight (tonnage/acre) and sucrose yield. The borer's tunneling into the stalk allows points of entry for secondary invaders including fungal and bacterial disease organisms. One investigation showed bored internodes produce 45% less sugar than undamaged ones. If the tunneling is extensive, death of the terminal growing point of the plant (“dead-heart”) may result. Weakened stalks are more subject to breaking and lodging.

The foundation of an IPM program for sugarcane borer control is regular scouting. Scouting is necessary to estimate the infestation level and beneficial borer parasites. A regular scouting program will also increase the chances of detecting other pests that may be damaging the crop.

Fields should be scouted every 2 or 3 weeks from March through November. One Florida sugarcane company scouts each 40-acre field in at least 4 locations. At each location, 5 stalks are randomly sampled from each of 5 stools spaced 10 feet apart (5 stalks/5 stools/location). It is desirable to detect borers before they tunnel into stalks so that, if necessary, control measures can be applied before any damage to stalks occurs (Figure 1). Characteristic signs that plants are infested are pinholes in leaves, tiny holes into midribs, holes into stalks, and frass (light-brown fibrous waste material) at these holes. An infestation of borers can not be positively identified until the sugarcane borers are actually observed. Examine leaves, the whorl, and behind leaf-sheaths. Split stalks to detect borers tunneling inside stalks. Larvae in late summer and fall have spotted pattern as indicated in Figure 1. Detecting 2 to 3 live larvae per 100 sampled stalks is generally thought to be enough to cause concern about economic damage. Whenever the economic injury threshold is approached, sugarcane borer larvae from a field should be dissected to determine the level of parasitism. If 50% or greater of the borers are parasitized (Figure 2), no chemical control is recommended. Insecticides containing chlorantraniliprole, flubendiamide, or insect growth regulators (e.g., novaluron) have provided the best control in sugarcane trials. Consult labels for proper application rates.
Lesser Cornstalk Borer

Lesser cornstalk borer (LCB), *Elasmopalpus lignosellus*, is a serious pest on sand soils and an occasional pest on organic soils.

Adult lesser cornstalk borers are small, slender moths about 1/2 to 5/8 in. long. They are easily disturbed by walking through the field, but these quick fliers usually move no more than 10 feet at a time. They are most active at dawn and dusk. Females are covered with mostly brown to gray, or black, and reddish shiny scales. The base color of males is much lighter, ranging from pale yellow to medium brown. Wings of males are bordered with darker brown scales and a small spot is often visible on each wing near the center of the back when the wings are folded. The base color of young larvae is white to creamy yellow. Reddish to brown patterns adorn each thoracic segment, except for the first, which is covered with a broad black shield. Older larvae develop green to turquoise blue color between the darker patterns, particularly between the head and thoracic segments.

Adults deposit their shingle-like, translucent eggs on soil or detritus near young shoots. Larvae emerge from eggs in 3 to 18 days and enter the soil to burrow into soft young tissue usually within 3/8 in. of the soil surface. They feed on tillers and older shoots from within tunnels lined with silk and usually bore-out tissue within 1 inch above or below the soil line. The soil-covered tunnels are often found attached to the entry wounds and serve as an important diagnostic trait to separate their damage from that of wireworms, which do not produce such tunnels. Development is highly dependent on soil temperature. The larvae complete development in 16 to 66 days and can kill several young shoots before pupating in the soil (Sandhu et al. 2010). The population of this insect can double in 6 to 48 days depending upon the temperature (Sandhu et al. 2013). For further information on the life cycle of this insect, please visit [https://edis.ifas.ufl.edu/sc093](https://edis.ifas.ufl.edu/sc093)

Damage to meristematic tissue presents itself as dead young tillers and older shoots with dead youngest leaves (i.e., dead heart). Shoots with dead hearts can produce additional tillers, and some cultivars can compensate for this type of early damage (e.g., ‘CP78 1628’). Evidence of feeding above the meristem later becomes visible as rows of holes on the two to three leaves present within the whorl when it was attacked. Frequently, the tips of these leaves break off at the row of holes. Fields with a high frequency of LCB damage may appear to have been mechanically mowed. Susceptibility to damage generally decreases after the shoots reach 1 foot in length. Further information on lesser cornstalk borer damage to sugarcane plants, plant response, and potential control measures is available at [https://edis.ifas.ufl.edu/sc094](https://edis.ifas.ufl.edu/sc094)

*E. lignosellus* is also an important pest of beans, corn, peanuts, and pepper. They feed on other grasses and are often found in association with nutsedges, which also exhibit the dead tiller and dead heart symptoms. Weedy fields and those bordered by other LCB host plants may experience prolonged activity associated with adult emergence from these reservoirs.

As with most insect soil-pests, it is important to initiate control strategies before first incidence of damage is visible, because damage symptoms are frequently delayed by several days to a week after the larvae reach the damaging.
Insect Management in Sugarcane

instar. Pheromone traps can be used to identify sugarcane fields with adult LCB activity. Timely follow-up scouting should look for adults flying low over the soil and early signs of larval feeding damage (i.e., rows of holes in emerging leaves, greying color of newest leaves due to damage to meristematic tissue). Insecticides are best applied when adults are common, but before or immediately following first evidence of larval feeding damage to reduce potential long-term stand and yield loss. Insecticides containing chlorantraniliprole or flubendiamide applied to sugarcane plants have shown significant control of LCB larvae in sugarcane. Application of products containing chlorpyrifos to plants and surrounding soil followed by overhead irrigation to wet the top ½ inch of soil can be effective at controlling larvae in the soil around sugarcane plants. Consult labels for rate and application directions.

Field flooding is effective at controlling larvae between crops. Rainfall and overhead irrigation can be effective at reducing egg laying in the field because adults prefer dry fields and tend to avoid wet soil. Similarly, the layer of sugarcane residue left on the soil surface after green cane harvest (i.e., no preharvest burning) retains soil moisture longer than bare soil and also blocks direct contact of adults with the soil surface, which lowers the lesser cornstalk borer damage in ratoon crops (Sandhu et al. 2011).

White Grubs

White grubs that have been found in Florida sugarcane fields are in the genera *Anomala*, *Cyclocephala*, *Dyscinetus*, *Euphoria* and *Tomarus*. Of these grub pests, *Tomarus subtropicus* has been the species of primary concern. It is mostly found in sugarcane grown on muck soils where most Florida sugarcane is grown rather than sandy soils. It has become less important as a pest in recent years for reasons not fully understood.

Larvae have soft bodies but tough heads and legs that allow them to move through the soil to find and hold on to roots and underground stalks to feed (Figure 5). Larvae tend to curl into a “c-shape” when disturbed or removed from the soil.

White grubs damage sugarcane by feeding on roots and underground stems. The first symptom is a yellowing (chlorosis) of the leaves. This is usually followed by stunted growth, dense browning, lodging, plant uprooting, and death in heavily infested areas. Symptoms may be seen as early as September. Damage is usually more severe in ratoon crops and is most evident around the edges of a field.

*Tomarus subtropicus* infestation usually starts at the edge of a field and slowly spreads, in an irregular pattern, throughout the field. Infested fields may need to be replanted because ratoon regrowth and productivity can be severely reduced. Heavily infested areas may not be worth harvesting. In the past, no insecticides were labelled for grub control in Florida sugarcane. Hence, growers have relied on cultural control methods to control grubs.

Figure 3. Lesser cornstalk borer larva.

Figure 4. Lesser cornstalk borer adult (male). Credits: Gregg Nuessly, University of Florida
Insect Management in Sugarcane

Disking infested fields, reducing the number of ratoon crops, and flooding are the most common methods of grub control in Florida. Disking kills many grubs and allows birds to kill many more. Freshly planted fields usually have little or no grub infestation. Although it is not always practical to flood, this control method can significantly reduce grub populations. The following points are to be considered if flooding is to be used to control *Tomarus subtropicus* in sugarcane grown on muck soil.

1. Positive identification of *Tomarus subtropicus* should be made and the stage found (i.e., adult, egg, larvae) should be noted.

2. Adults are essentially impossible to kill by flooding. Eggs are also very difficult to kill using this method. These stages occur from approximately May through July.

3. Larvae (grubs) and pupae, which occur mostly from August through April, are the easiest stages to kill by flooding.

4. The warmer the weather, the better the flood will kill larvae and pupae. If the water temperature in the flooded field is 77°F or higher, a continuous flood for 5 days will be sufficient for grub control.

5. The flood water level should be about 2 inches above the soil surface. Many grubs will come to the soil surface and survive if there is less than two inches of standing water. Water depth greater than 2 inches will increase grub mortality very little, if at all.

6. Given the option, the best time to kill grubs by flooding is in August. At this time, water temperatures are warm, rainfall abundant, and feeding damage by the grubs is just starting.

**Wireworms**

Wireworms, the larval stage of the click beetle, often cause severe damage to numerous crops in Florida. Larvae are dull yellow to orange with hard bodies. The rear of the larva is adorned with a symmetric array of ridges, bumps or points that can be used to identify larvae to species. At least 12 species of wireworms have been found in southern Florida, but only the “corn wireworm,” *Melanotus communis*, is abundant enough in sugarcane to cause significant economic damage to this crop (Figure 3). *Melanotus communis* has traditionally been a more important pest in Florida sugarcane grown on muck soil than on sandy soil.

Generally, wireworms are a pest of newly planted sugarcane and are rarely a pest in ratoon sugarcane. Wireworms feed on the buds and root primordia during germination of sugarcane seed pieces, and on shoots and roots after germination. Most of the injury to young shoots is near the point where the shoots join the seed piece or stubble. Larvae also feed along the seed pieces between buds (i.e., internodes) thereby introducing pathogens that can ultimately kill the bud or shoots connected with the damaged internode. Wireworm injury can generally be identified as relatively large, ragged holes into seedpieces and buds or into young shoots. The death of buds or young shoots leads to stand reductions. Wireworm injury has been reported as facilitating the entrance of the fungus that causes sugarcane red-rot disease.
Flooding for wireworm control can be effective, but it is a slow process and may not be practical in many cases. More studies are needed, but the current information suggests a minimum of 6 weeks of continuous flooding is needed during the summer to obtain wireworm control. Longer flooding durations are needed during colder months.

Flooding during late spring and summer will kill the wireworms, and will also prevent egg laying by the adult click beetles. Fallow-field flooding or growing rice as a rotation crop may eliminate the need to use a soil insecticide for wireworm control at sugarcane planting the following fall.

Soil insecticides are generally used in newly planted sugarcane for wireworm control. Insecticides are not used for wireworm control in raton sugarcane. No resistance to insecticides has been reported to occur in wireworms in Florida sugarcane.

Some Florida sugarcane growers do not use a soil insecticide at planting knowing that previous flooding of fallow fields or rice fields reduces wireworm populations. However, these fields account for only a small percent of sugarcane fields. Florida producers growing sugarcane on sandy soils sometimes do not use a soil insecticide at planting in the belief that fewer wireworms are in sand than muck soils where most sugarcane is grown. Again, these fields account for only a small percent of sugarcane fields and a study did report that high wireworm populations do occur there, although not as frequently as in muck soils. Another study concluded that label rates for phorate, a soil insecticide for wireworm control in Florida sugarcane, may be too high for effective control. These previous studies have brought into question when to use soil insecticides at sugarcane planting. However, Florida sugarcane growers have not had a useful sampling method to help them in this decision. Recently, a simple sampling method has been tested that may be of use to Florida sugarcane growers to determine the necessity of soil insecticide application at planting.

Wireworm samples are taken by digging in a transect across a field after fields have been disked and right before planting. By counting wireworms found in samples, a decision can be made to determine the necessity of a soil insecticide application to control wireworms in that field. This sampling method has been successfully applied by several Florida sugarcane growers. Details on this sampling method may be found in the Cherry et al. (2013) reference in the Selected References of this publication.

Insecticides with phorate as the active ingredient have consistently been the most effective in our trials for wireworm control on sugarcane produced on muck soils. Insecticides for wireworm are applied at planting in the furrow with the seed pieces before being covered with soil.

**Yellow Sugarcane Aphid**

Yellow sugarcane aphid (YSA), *Sipha flava*, is a fairly small, dull to bright yellow aphid with short legs, antennae and mouth parts. Its body is adorned with short stiff hairs. The pair of tubes (cornicles) that protrude from the top and end of the abdomen of most aphid species are reduced to only slightly more than pore-like openings on YSA.

This aphid takes 2 to 3 weeks to develop to the adult stage at which point it can produce 3 to 5 nymphs per day for another 2 to 3 weeks. Winged forms of the aphid are produced under crowded conditions when plant quality is beginning to be significantly affected.

Yellow sugarcane aphid feeding leads to premature yellowing and death of sugarcane leaves. Feeding on very young plants leads to reduced growth and tillering. YSA feeding results in longer, faster growing leaves and internodes, but also thinner, lighter stalks with shorter node lengths and widths. Prolonged feeding by large populations of YSA can cause plant death. Sugarcane leaf and node lengths approach sizes of uninfested plants after YSA are removed, but node diameter remains lower on previously infested stalks. Sugarcane plants do not compensate for early-season YSA damage. Such damage ultimately results in lighter stalks that contain less sugar. Severely damaged stalks that survive have narrow internodes near the soil surface that frequently break later in the season due to strong winds associated with summer and fall thunderstorms and tropical weather storms.

Rain and natural enemies, including 10 species of ladybird beetles, several species of flower flies, green lacewings and brown lacewings, can greatly reduce populations, but this may not occur before the aphids have caused plant damage. Aphids reproduce quickly and speedily build to numbers too numerous to count for sampling purposes. Leaf damage symptoms appear to be a good indicator of season-long effects on growth and yield and works without having to count aphids. Leaves with <50% green tissue can be quickly counted and averaged over an area to compare long term effects of YSA feeding with the relative size of the infestation. An infestation that leaves just four leaves beneath the top visible dewlap leaf with more than 50% green tissue is still enough to reduce sugar content at harvest. This means an average of 2 to 3 leaves with >50% damage early in the season will significantly reduce yield. Significantly greater
yield reductions occur with each additional pair of leaves showing >50% YSA damage.

YSA populations can be very spotty in fields and are frequently observed only with the use of aircraft or drones to view fields from above ground. YSA shows a preference for certain cultivars, including ‘CP80-1827’, so resistance appears to be a viable control strategy. Insecticides are only recommended if it appears that natural enemies or rainfall will not soon greatly reduce populations below levels that cause damage symptoms, because insecticides may reduce or eliminate predators and parasitoids of other arthropod pests that are currently under natural control in fields. Products with pyrethroids or natural pyrethrins can reduce YSA populations.

**Miscellaneous Insect Pests**

The sugarcane delphacid, *Perkinsiella saccharicida*, is a sugarcane pest of Australian origin. It was first discovered in Florida during 1982. Surveys quickly revealed the delphacid ranged throughout the Florida sugarcane production area. To date, little economic damage has been reported by the pest.

The sugarcane lacebug, *Leptodictya tabida*, was first discovered in Florida in 1990. Damage to sugarcane by this bug was initially noticed in Palm Beach County. This was also the first time the insect was discovered on sugarcane in the mainland U.S. To date, the pest has caused little economic damage.

Sugarcane spider mites, primarily *Oligonychus stickneyi*, have been occasional pests of importance in Florida sugarcane since the 1970s. These mites live and feed on the undersides of leaves. They form fine webs in which eggs are laid and young nymphs develop. Leaves infested by mites often develop a red-russetting similar to that associated with lacebugs. Severe damage by spider mites can result in leaf death.

The Diaprepes root weevil, *Diaprepes abbreviatus*, is invasive to Florida and is an important pest of sugarcane in Barbados and Puerto Rico. This insect is a root weevil native to the Caribbean and one of the most economically important pests there. It was first reported in Florida during the 1960s. Since then it has spread over a large area of central and southern Florida where it is damaging to citrus, ornamental plants, and some other crops. For over 40 years since its introduction into Florida, despite damage to nearby citrus orchards, damage to sugarcane had not been found. In 2010, damage in Florida sugarcane by this pest was first noted. Larvae are white and look like grubs, but have no legs. Larvae feed on roots and tunnel into the stool and below ground stalks. Damage is similar to grub damage being plants turning yellow, highly stunted, and lodging. We do not know if the damage in 2010 was rare or a sign of more damage that may occur if the pest becomes more established in sugarcane in the future.

Foliar sprays of contact insecticides against adult weevils and granular insecticides applied to kill neonatal larvae can be used for management of infestations in citrus. Furthermore, biocontrol of root weevils may be enhanced by entomopathogenic nematodes and insect parasitoids that specifically attack larvae. However, there is no information on control of the root weevil in sugarcane using insecticides or biocontrol agents. Flooding, which is a common cultural practice in Florida sugarcane, has been shown to be an effective control measure against root weevil larvae under laboratory conditions depending on temperature. However, no research on flooding has been conducted in a field situation where flood waters might not reach all larvae boring into a sugarcane stool. Disking an infested sugarcane field to kill root weevils and replanting is an expensive option. Odero et al. (2013) have shown the importance of controlling smaller herbaceous weeds in and around sugarcane fields to reduce root weevil infestation. A more recent study has shown that the most abundant larger woody invasive weed species around Florida sugarcane is Brazilian peppertree, which is an excellent host for adults. These latter two studies are consistent in showing that weed control is probably the single most important factor in preventing infestations of the root weevil in sugarcane.

![Figure 7. *Diaprepes* damage in a Florida sugarcane field. Sugarcane has not been harvested and should be 10 to 12 feet high.](image)

*Credits: Alvin Wilson, University of Florida*
Selected References


