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Insect Management in Sugarcane[1]

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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 differences in insect preferences, 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. Chemicals available for insect control in Florida are listed in Table 1.

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, bacterial, and viral 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. 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. Detecting 2 to 3 live larvae per 100 sampled stalks is generally

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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, no chemical control is recommended.

Lesser Cornstalk Borer

Lesser Cornstalk Borer (LCB), *Elasmopalpus lignosellus,* has become 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 gray to brown 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 young shoots near the soil. 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 17 to 42 days and can kill several young shoots before pupating in the soil.

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 usually produce additional tillers, so the plants can potentially compensate for this type of early damage. 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.

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, there is little opportunity to control the damaging stages with post-emergence pesticides. While a pesticide formulation is registered for use against this pest, insecticidal control is difficult to achieve because larvae live within the plant tissue and are protected by their silken burrows. Applications in association with cultivation have achieved some limited success. Pesticides applied to the plant tissue or banded over the rows and mixed or covered lightly with soil during cultivation place these toxins in the path of the larvae as they move up the soil profile to reestablish feeding sites within 3/8 inch of the soil surface.

Application of pesticides with enough water to wet the top 3/8 inch of soil around the plants will also place them where they will have the greatest effect against LCB larvae. Adults are sensitive to broadcast insecticide applications and treatments should be timed to coincide with their most active periods.

White Grubs

White grubs that have been found in Florida sugarcane fields are of the genera *Ligyrus*, *Cyclocephala*, *Phyllophaga,* and *Anomala*. Of these grub pests, the species *Ligyrus subtropicus* is the most important. It is the most abundant of the grubs affecting Florida sugarcane and causes, by a wide margin, the most damage. *Ligyrus subtropicus* tends

to infest sugarcane in muck soils. *Ligyrus subtropicus* is the white grub of primary economic importance.

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.

Ligyrus 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. Since, there are no insecticides labelled for grub control in Florida sugarcane, growers must use cultural control practices for sugarcane grubs.

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 *L*igyrus *subtropicus* in sugarcane grown on muck soil.

1. Positive identification of *Ligyrus 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. 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. *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. 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 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. Growing a ratoon rice crop may offer slightly increased control during years when click beetle activity extends into July and August.

Yellow Sugarcane Aphid

Yellow sugarcane aphid (YSA), *Sipha flava*, is a fairly small, 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 aphids are reduced to 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. Natural enemies, including 10 species of ladybird beetles, several species of flower flies, and rain can greatly reduce populations, but this may not occur before the aphids have caused plant damage.

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.

Aphid numbers quickly 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 shows a preference for certain cultivars, including CP80-1827, so resistance appears to be a viable control strategy.

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 1970's. 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.

Table 1. Insecticides available for use in Florida sugarcane.

Active Ingredient	(hours) REI	(days) PHI	Trade Name & Formulation	Rate Per Acre
SUGARCANE BORER				
*Carbofuran	48	17	Furadan 4F	1 1/2 pt
*Cyfluthrin	12	15	Baythroid 2 (2EC)	2.1 oz
*Esfenvalerate	12	21	Asana XL (0.66EC)	5.8-9.6 oz
Tebufenozide	4	14	Confirm 2F	6.0-8.0 oz
LESSER CORNSTALK BORER				
*Carbofuran	48	17	Furadan 4F	1.0-1 1/2 pt
WIREWORMS				
Ethoprop	48	at planting	Mocap 10G	20-40 lb
*Ethoprop	48	at planting	Mocap 20G	19.5 lb
*Phorate	48	at planting	Phorate 20G Thimet 20G	19.5 lb 19.5 lb
APHIDS				
*Carbofuran	48	17	Furadan 4F	1.0-1 1/2 pt

* Denotes a restricted-use compound.