

Sugarcane Ratoon Stunting Disease¹

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Ratoon stunting disease (RSD) is considered by many to be the most important disease affecting sugarcane production worldwide. It can cause a 5 to 15% loss in crop yield without growers realizing their fields were infected. The disease is caused by a bacterium. RSD has no easily recognized external symptoms, only stunting of growth that may not always be apparent in the field. Furthermore, even when stunting of growth is noticeable, other factors could be the cause of stunting, including poor cultural practices, inadequate moisture or nutrient deficiencies. During dry weather, the diseased cane will often show signs of drought stress earlier than healthy cane, but with adequate moisture, visual detection of differences may be difficult or impossible.

Partial RSD resistance is present in several cultivars, but no cultivar is completely immune to infection. In Florida, CP 88-1762 is susceptible and CP 89-2143 moderately susceptible, and a clean seed cane program is recommended. Yield losses in Florida during the 1988-89 growing season were estimated at 5%, resulting in estimated losses in; raw

sugar value of \$92 per acre or \$36.8 million in losses over the entire south Florida sugarcane industry. More recent experiments indicate that most cultivars would suffer yield losses if RSD incidence was high.

SYMPTOMS

Although there may be no externally conspicuous symptoms of the disease, internally there is usually an orange-red discoloration of the vascular bundles containing the water-conducting tissues (xylem) at the basal nodes of the stalk (Figure 1). Similar discoloration is also associated with other sugarcane diseases so it is not a totally reliable indicator of RSD. The discoloration of RSD, however, does not extend into the internodes as it does with some other diseases. Adjacent nodes in mature stalks will usually show similar discoloration if it is RSD infection.

In some clones, very young shoots may have a pink discoloration in the immature nodes near the apical meristem. Again, this symptom is not a reliable indicator of RSD but may serve as an aid in detection of the disease at an early stage.

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Figure 1. Discoloration of sugarcane vascular bundles caused by ratoon stunting disease.

In diseased fields where stunting is apparent, the shortening of stalks is not usually uniform from stool to stool. Such fields may show an "up and down" growth appearance across the canopy.

CAUSAL AGENT

The organism that causes RSD is, *Leifsonia xyli* subsp. *xyli*, a small aerobic bacterium. The genus of the pathogen was previously called *Clavibacter*. Although it can be isolated from diseased cane, isolation of the pathogen is very difficult since it is slow-growing and must be grown on specialized culture media.

Historically, diagnosis of RSD has been difficult because there are no definitive external symptoms, and internal symptoms do not develop adequately in all varieties. Reliable diagnosis of the disease can be performed using microscopic and/or serological techniques. Phase contrast microscopic techniques have proven to be rapid but are not as sensitive as serology for RSD detection. Serological techniques include direct fluorescent-antibody staining, dot blot

immunoassay and the Enzyme-Linked Immunosorbant Assay (ELISA). Recently a variation of the dot blot immunoassay technique was developed to diagnose RSD and to assess its severity. The technique is called the Tissue Blot Immunoassay (TBIA) and can rapidly test large numbers of sugarcane samples for RSD. This technique has been used to screen clones for RSD resistance in the USDA Canal Point (CP) sugarcane cultivar development program and is used to determine disease incidence within seed cane fields.

SPREAD OF THE DISEASE

The RSD bacterium is transmitted through seed cane taken from diseased plants. Because symptoms of the disease are not readily visible, the bacterium may be spread unwittingly from one area to another. Stalks in potential seedfields can be randomly sampled and serologically assayed to determine RSD incidence.

RSD can be readily transmitted by knives and mechanical harvesting machines that become contaminated with pathogen that is contained in juice from diseased stalks. Transmission by harvesting machinery is very significant.

Cane chewing animals may be capable of transmitting the disease when they gnaw on a diseased stalk and then a healthy one. Not much is known about this means of transmission or its significance.

There are new reports that the pathogen survives in the soil after harvest to re-infect healthy plants. The extent of infection by the pathogen surviving in the soil is not known.

The effects of the disease are usually more severe in ratoon crops than in plant-cane crops. This is especially true following a drought, or other stressful crop condition, which usually increases losses due to RSD.

PREVENTION AND CONTROL

Since RSD bacteria are easily transmitted mechanically, sanitation is important in preventing healthy cane from becoming infected. All cane cutting

implements should be protected from contamination from diseased cane or be disinfected before use on healthy cane. Disinfection can be achieved by heat or chemicals.

Chemical disinfectants that may be used on cane cutting knives include Lysol, Dettol, ethanol, Mirrol and Roccal. At least 5 minutes of contact with the cutting surface is needed to assure disinfection, but a shorter disinfection time will be partially helpful.

Heat treatment of seed cane before planting can be used to eliminate bacteria prior to the establishment of seed cane nurseries. Hot-water treatment (50°C / 122°F for 2-3 hours) is the method most commonly used to control RSD. A meristem tip tissue culture technique also eliminates the pathogen. Commercially available clean-seed nursery stock is available in both Florida and Louisiana. A serological assay can be used to monitor the effectiveness of the heat therapy and tissue culture procedures. Due to the likelihood of reinfection, both heat therapy and disease-free plants produced from tissue culture must continually be produced to ensure disease-free seed cane for planting.

The use of resistant clones has been shown to control RSD. CP 72-2086 has been grown in Florida in the absence of both hot-water treatment and sanitation measures with less than 2% disease incidence in sampled fields. CP 72-2086 is an exception since no other commercial varieties have been found with this level of resistance to RSD. The USDA-ARS Sugarcane Field Station at Canal Point, Florida screens for RSD resistance and the level of resistance available slows the spread of RSD. However, disease-free seed cane is necessary to completely control the disease.