

# Sugarcane

## Integrated Disease Management of Sugarcane

Sugarcane productivity and profitability depend on effective disease management, particularly in Louisiana, where varietal resistance and a healthy seed cane program are key strategies. Since sugarcane is vegetatively propagated, obtaining and planting healthy seed cane is essential to manage systemic diseases such as ratoon stunt, leaf scald, smut, mosaic and yellow leaf. These diseases can spread through infected stalks, so using disease-free seed cane is critical.

Historically, the sugarcane industry has faced significant disease challenges, such as the mosaic epidemic of the 1920s, which nearly devastated the industry due to the susceptibility of the most popular cultivar at the time. In response, breeding programs have focused on developing resistant varieties to prevent such catastrophic impacts. Varietal resistance remains the top management strategy, but the adoption of propagative material with undetectable levels of pathogens, verified through testing, is also essential, particularly for systemic diseases.

In Louisiana, tissue-cultured sugarcane material is routinely tested for key pathogens, benefiting the industry through the breeding program and the clean seed program. However, continued monitoring and a deeper understanding of the impact of diseases on current cultivars are necessary. While varietal resistance and clean seed cane are the primary management approaches, other methods, such as heat treatment and chemical control, are also employed. Heat treatment can eliminate pathogenic bacteria like *Leifsonia xyli* subsp. *xyli* and reduce fungal spores' viability, while chemical control is commonly used to manage brown rust, particularly in susceptible varieties during the spring. This overview highlights the common diseases found in Louisiana and the management tactics used to mitigate their effects.

## Disease

Symptoms, source of inoculum and management of sugarcane diseases.

Disease	Symptoms	Source of Inoculum	Management
Leaf Scald ( <i>Xanthomonas albilineans</i> )	Leaves of young plants may show bleaching or yellowing and dead tissue. The characteristic symptom of leaf scald is the presence of one or more narrow, white “pencil lines” running longitudinally along a vein from the leaf margin down the blade into the sheath. Bands of dead tissue then develop along pencil lines starting at the leaf margin and may expand until the entire leaf is dead. Young shoots may be killed. Mature stalks may show leaf symptoms and develop side shoots with symptoms. Under severe disease conditions, entire plants may die. Drought stress, water logging and low temperatures can increase symptom expression and severity. This may occur in different ways – the chronic phase of leaf scald is characterized by a progressive increment in disease severity; the acute phase is defined by sudden disease outbreaks that can rapidly lead to the death of mature sugarcane plants.	The bacteria that cause leaf scald live from year to year in infected plants. Many times, although the bacterium is present in the plant, symptoms won't manifest due to the lengthy latent period of the disease. It is spread by harvesters and farm equipment, and possibly by other cultivation practices that cause plant wounding. The disease can be spread aerially in windblown rain.	Varietal resistance is the best means of control. The current varieties have adequate levels of resistance, particularly when produced with progeny from a tissue-culture based seed cane program. Avoid planting seed cane from fields with obvious disease. Regular planting of healthy seed cane produced through tissue-culture has kept the incidence of leaf scald low. Sanitize equipment, especially after working in fields where leaf scald was observed. Sanitation can be performed with suitable sanitizer products, such as disinfectant sprays, alcohol and bleach solutions. The heat treatment previously used to control ratoon stunting disease is not effective against leaf scald.

Disease	Symptoms	Source of Inoculum	Management
<p>Mosaic (Species <i>Potyvirus sacchari</i> and <i>Potyvirus sorghitessellati</i>, former virus names Sugarcane mosaic virus and Sorghum mosaic virus, respectively)</p>	<p>The mosaic pattern of irregular, interspersed, pale green, yellowish and green areas on leaves varies with cane variety, stage of growth, temperature and the strain of the virus involved. The mosaic symptom is most evident in the youngest emerging leaves and is most easily seen in young plants, therefore, scouting in Louisiana is recommended during the spring, when plants are recovering from the winter freezes.</p>	<p>The virus persists from year to year in infected plants. Mosaic in Louisiana is transmitted by various aphid species such as, <i>Rhopalosiphum maidis</i> (Fitch), <i>Hysterononeura setariae</i> (Thomas) and <i>Schizaphis graminum</i> (Rondani). Infected seed cane also spreads the disease.</p>	<p>Mosaic is controlled primarily with host plant resistance. Historically, mosaic was a major disease adversely affecting sugarcane production in Louisiana. However, basic breeding and development of sources of resistance have greatly reduced the impact of this disease. Currently grown varieties have adequate levels of resistance to mosaic with the exception of three recently released varieties, HoCP 09-804, L 11-183 and HoL 15-508. Planting seed cane produced through tissue-culture can help keep disease incidence low in susceptible varieties.</p>
<p>Ratoon Stunt (<i>Leifsonia xyli</i> subsp. <i>xyli</i>)</p>	<p>Ratoon stunting disease has no obvious external symptoms, but can cause important yield losses if spread is not under control. It is among the most important sugarcane diseases worldwide, but it is currently under control in Louisiana due to the adoption of resistant cultivars and clean seed. Infected plants may be shorter but with little or no decrease in diameter of the stalk. Stunting severity is associated with adverse environmental conditions, particularly drought stress, and it is more severe in ratoon crops. Affected plants, when split, may or may not show a pinkish color in the growing point of young shoots and orange to brownish discoloration of vascular bundles at the nodes in the lower portion of mature stalks.</p>	<p>The bacteria live from year to year in infected plants. It is spread mechanically by the cane harvester and by planting infected seed cane.</p>	<p>A healthy seed cane program is the primary method for RSD control. Seed cane produced from tissue-culture free of RSD is commercially available. Heat treatment of seed cane in hot water at 50 C (122 F) for two hours can provide control of most RSD bacteria. A regular annual heat treatment program can provide good RSD control. Sanitation of farm machinery and tools is a form of prevention. Cleaning machinery and farm equipment with bleach, water and other sanitizers able to kill bacterial cells is recommended, especially if they are shared among different farmers or used in areas affected by the disease. Monitoring of RSD infection levels and the success of a healthy seed cane program can be provided by collecting stalk samples and having them tested at the LSU Ag Center’s Sugarcane Disease Detection Lab (<a href="https://lsu.edu/agriculture/ppcp/outreach/sugarcane-disease-detection-lab.php">https://lsu.edu/agriculture/ppcp/outreach/sugarcane-disease-detection-lab.php</a>). The level of RSD resistance varies among varieties. High levels of resistance are uncommon, so a healthy seed cane program is essential for successful RSD control.</p>
<p>Red Rot (<i>Colletotrichum falcatum</i>)</p>	<p>Red rot adversely affects stand establishment by rotting planted seed cane. Splitting stalks dug up from portions of row without living plants reveals red discoloration of the internode tissue and rotted nodes. Within the red areas, white spots usually elongated at right angles to the long axis of the stalk, are diagnostic of red rot infection. Red rot is more severe when planted stalks are exposed to drought stress or waterlogging, especially on plant cane. The disease is highly associated to sugarcane borer infestations.</p>	<p>The fungal pathogen survives from season to season in infected cane tissues. Fungal inoculum is present on most planted stalks and in the soil.</p>	<p>Avoid using stalks with sugarcane borer damage as propagative material, as those are usually affected by red rot. Sharper blades in harvesters are recommended, as dull blades lead to greater physical damage to billets, increasing susceptibility. Avoid planting under drought, wet or cooler soil conditions that may hamper bud germination. This is especially the case when planting billets (stalk sections). The use of seed treatment chemicals to improve stand establishment and yield obtained from billet planting is under investigation. Labels have been obtained for application of three fungicide combination products to billets at planting: azoxystrobin + propiconazole (Quilt Xcel), fluxapyroxad + pyraclostrobin (Priaxor), and pyraclostrobin + mefentrifluconazole + fluxapyroxad (Revytek).</p>

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Brown Rust ( <i>Puccinia melanocephala</i> )	Small chlorotic areas appear on the leaves at first as flecks. Later, the flecks elongate and become reddish-brown. The spots continue to enlarge with a slight yellow halo surrounding the lesion on some varieties. The lesion takes on a pustular appearance on the lower surface of the leaf. The pustules erupt, releasing a reddish-brown mass of spores. On susceptible varieties, heavily infected leaves dry out and die prematurely.	Rust survives the winter in living green leaf tissue usually in southern areas of the industry. Spores are then produced and aerially dispersed to spread the disease over short and long distances.	Host plant resistance is the primary control method. However, the rust pathogen has the capability to adapt and overcome varietal resistance. Once a variety becomes susceptible, rust can be controlled with the application of fungicide. Avoiding excess fertilization is another way to prevent the disease – excessive levels of nutrients may lead to brown rust development. Detailed information on varietal resistance ratings, fungicide labels and use recommendations, and other brown rust management strategies can be found through the LSU Ag Center website in “Best Management Practices for Minimizing the Impact of Brown Rust in Sugarcane” at <a href="https://www.lsuagcenter.com/profiles/lblack/articles/page1553195579511">https://www.lsuagcenter.com/profiles/lblack/articles/page1553195579511</a>
Smut ( <i>Sporisorium scitamineum</i> )	Smut is characterized by the production of a black, whip-like structure at the apex of stalks with smaller than normal diameter that can grow more rapidly and extend above the crop canopy. The whip often elongates to a length of 2-3 feet and curls downward. The whip is covered by a layer of dark brown fungal spores. Prior to the emergence of whips, smut-infected plants can have a grassy appearance with many small-diameter shoots.	Tremendous numbers of smut spores are released over time from whips and dispersed in air currents to spread the disease over short and long distances.	To control smut, grow resistant varieties and plant healthy seed cane. Current varieties have adequate resistance to smut with the exception on L 01-299 that is moderately susceptible under field conditions. Cultivar HoCP96-540 is resistant to smut. High rates of disease increase do not occur under Louisiana climatic conditions, so it is possible to grow varieties with moderate smut susceptibility, if a rigorous healthy seed cane program is followed. Tissue-culture produced seed cane will have little or no smut infection. On-farm roguing of smut-infected plants with glyphosate is only feasible in seed cane sources with low levels of infection. Avoid planting seed cane sources of smut susceptible varieties next to smut infected cane. Do not plant seed cane with more than 2% smut infection.
Yellow Leaf ( <i>Polerovirus</i> SCYLV, common name Sugarcane Yellow Leaf Virus)	The underside of the mid-vein on young leaves at the apex of mature plants turns bright yellow in SCYLV-infected plants. The yellowing can spread into the leaf blade, and mid-veins can turn pink in severely infected plants. Due to the short growing season in Louisiana, symptoms are not seen most years because of ripener applications and/or frosts. Despite the lack of visible symptoms, infected plants may exhibit reduced growth and juice quality.	The sugarcane aphid acquires the virus during feeding on an infected plant. The aphid retains the virus for life and can transmit SCYLV during feeding to healthy plants within the same field or in other fields. Infected propagative material can also introduce the disease to new fields.	Certified seed cane produced through tissue-culture is tested for SCYLV. Continuous planting of seed cane with little or no virus infection will keep the incidence of yellow leaf low. Information is lacking on the disease resistance levels of commercial varieties. Epidemiological information is lacking on whether vector management is effective to prevent yield losses related to yellow leaf disease.

Disease	Symptoms	Source of Inoculum	Management
<p>Red Stripe and Top Rot (<i>Acidovorax avenae</i> subsp. <i>avenae</i>)</p>	<p>Narrow, dark red stripes of variable length run longitudinally along veins. Symptoms are often seen in 4- to 6-month-old cane. The leaf spindle at the shoot apex can become infected in susceptible varieties, particularly under warm, wet conditions. The infection can then spread into the shoot apex and cause a top rot. Reddish brown discoloration and cavities may form in stalk internodes. An unpleasant odor is associated with the rotting spindle that may be detected outside the field.</p>	<p>Bacterial exudates form that are readily spread from plant to plant by wind-blown rain. The bacteria infect through wounds and stomates.</p>	<p>Red stripe is usually a minor disease. Most commercial varieties are resistant and never exhibit top rot. HoCP 00-950 is a current variety that may develop top rot during wet growing seasons.</p>
<p>Brown Stripe (<i>Bipolaris stenospila</i>)</p>	<p>In leaves, elongate, reddish-brown lesions with an obvious yellow “halo” develop parallel to veins. During severe infection, lesions may coalesce, and entire leaves may be killed. Disease is more severe when plants are under nutritional stress or injured by herbicides. Brown stripe may be severe in fields cut the previous season for seed cane.</p>	<p>Spores produced by the fungus are spread by the wind to cause new infections.</p>	<p>Brown stripe is usually a minor disease. Severe disease symptoms have been observed in L 01-299, L 03-371, HoCP 04-838 and HoCP 09-804 during early spring following mild winters and frequent rainfall events. Disease development is minimal when conditions are favorable for growth. Symptoms usually diminish after fertilization.</p>
<p>Pokkah Boeng (<i>Gibberella fujikuroi</i>)</p>	<p>Malformed or twisted leaves occur near the shoot apex. Young leaves may exhibit pronounced wrinkling, twisting and shortening. Chlorosis (yellowing) is often evident at the leaf base, and necrosis may develop. Spindle infection can spread into the stalk. In severe cases, dark red streaks and ladder-like lesions form inside the stalk and the rind. A “knife-cut” lesion may form in the rind.</p>	<p>Spores of the fungus are spread by wind and rain.</p>	<p>Grow resistant varieties. All the current varieties have adequate resistance. Pokkah boeng may become evident during warm, wet periods when rapid plant growth is occurring. However, plants recover, and the effect on yield is minimal.</p>
<p>Orange Rust (<i>Puccinia kuehni</i>)</p>	<p>Leaf lesions are very similar to brown rust except that young lesions and the spores produced in pustular lesions on the underside of the leaf are orange, lighter than brown rust spores. It is easier to distinguish orange rust lesions from brown rust on younger leaves in the upper section of sugarcane plants. Symptoms will persist into the summer months, whereas few brown rust symptoms are evident in young leaves during summer.</p>	<p>Same as for brown rust. The fungus overwinters in green leaf tissue, and spores produced during late spring spread the disease over short and long distances.</p>	<p>Orange rust was first observed in 2012. Varietal resistance has provided good control. One variety, Ho 05-961, has shown moderate susceptibility to orange rust. Avoiding excessive fertilizer applications may avoid orange rust outbreaks.</p>
<p>White Stripe (Physiological disorder)</p>	<p>Characterized by variable amounts of longitudinal, white striping on leaves of some plants, usually occurring during spring. The white stripes extend the full length of the leaf. Striping is not considered infectious but rather a growth response to environmental conditions.</p>		<p>None. Plants will recover after fertilizer uptake in the presence of adequate rainfall.</p>

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