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Sugarcane Yellow Leaf Disease[1]

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Sugarcane Yellow Leaf disease was first recognized as Yellow Leaf Syndrome during the 1980s in Hawaii. Later it was reportedly associated with yield losses of 25% or more in the cultivar SP 71-6163 in Brazil. Subsequently the virus sugarcane Yellow Leaf Virus (SCYLV) was discovered to be associated with the disease. Yellow leaf has been found in numerous countries of the world. However, somewhat confusedly, another disease, "leaf yellows", has been found in other areas. Although it has similar symptoms, it is caused by a phytoplasm rather than a virus. To date, this phytoplasm pathogen has not been identified on sugarcane in Florida.

Symptoms

Symptoms of SCYLV are a yellowing of the leaf midrib on the underside of the leaf. The yellowing first appears on leaves 3 to 6 counting down from the top expanding spindle leaf (Figure 1). Yellowing is most prevalent and noticeable in mature cane from October until the end of harvest in March. The yellowing expands out from the leaf midrib into the leaf blade as the season progresses until a general yellowing of the leaves can be observed from a distance (Figure 2). Eventually, almost all leaves of the plant turn yellowish. Cold and nutrient stress appear to intensify the symptoms.

The Pathogen

Taxonomically, SCYLV is a member of the Luteoviridae family that contains barley yellow dwarf virus, soybean dwarf virus, potato leaf roll virus, and pea enation mosaic virus-1. Its classification within the family has not been fully resolved. The virus is transmitted by aphids, *Melanaphis sacchari* and *Rhopalosiphum maidis*, in a semi-persistent manner. The virus is also spread by planting infected seedcane. The virus is localized within the phloem cells of the plant and can be diagnosed by either reverse transcription-polymerase chain reaction (RT-PCR) or tissue blot immunoassays using an antibody specific for the virus (Figure 3). There is no thermal treatment effective for eliminating SCYLV in infected sugarcane.

1. This document is SS-AGR-256, one of a series of the Agronomy Department, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. This publication is also a part of the Florida Sugarcane Handbook, an electronic publication of the Agronomy Department. For more information you may contact the editor of the Sugarcane Handbook, R.A. Gilbert (ragilbert@ifas.ufl.edu). Original publication date: September 2005. Visit the EDIS Web Site at http://edis.ifas.ufl.edu.

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Figure 1. Initial symptoms of yellow leaf, with a yellowing of the lower surface of the leaf midrib of leaves 3 to 6 counting from the top expanding spindle leaf.

Figure 2. More general leaf yellowing is shown on mature sugarcane plants.

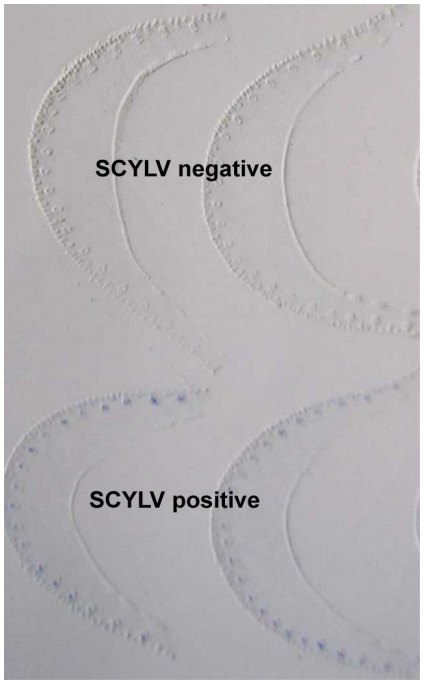

Figure 3. Tissue blot serological assays results of imprinted leaf midribs of healthy (top) and infected (bottom) leaves. The light blue areas are stained phloem cells where the virus is located.

Effect of SCYLV and its Incidence

SCYLV reduces both cane and sugar yield. In a yield trial conducted on a grower's field in Florida, hot-water-treated seedcane had 95% SCYLV incidence compared to an initial 0% incidence on commercial tissue-culture based seedcane. There was a 7 and 4% overall increase in cane and sugar yield respectively in the tissue-culture based over the heat-treated seedcane. There was no difference in sucrose content in plants between these two seedcane sources. Another yield test was conducted using seedcane derived from tissue-culture and long hot-water-treated seedcane planted in one-meter plots. The numbers of stalks, cane weight and sucrose were significantly higher in tissue-culture seedcane plots in plant cane for all five cultivars (CP 72-1210, CP 80-1827, CP 84-1198, CP 85-1382 and CP 89-2143). In addition, the tissue-culture plots were SCYLV-free. In the first ratoon crop, the results were less dramatic and not all the differences were statistically significant. Generally yields were higher in the tissue-culture plots free of SCYLV. Cultivar CP 80-1827 was the exception, with higher yields in the heat-treated plots that were SCYLV infected. In a third experiment, seedcane was obtained from plots

of tissue-culture derived seedcane that was either SCYLV-free or had become infected during the growing season. The plot weight and sucrose per plot of the SCYLV-free plots of all cultivars combined were higher than the plots with infected plants. The overall results indicate a yield loss due to SCYLV in Florida. Losses have also been reported Louisiana and in Brazil.

SCYLV is widespread in the CP cultivars grown commercially in Florida. Commercial fields planted with regular seedcane usually have at least 85% of the plants infected with SCYLV. Currently, no CP cultivar grown commercially in Florida is free of the virus. Unfortunately, the heat therapy treatments used to control ratoon stunt do not eliminate SCYLV from sugarcane stalks. Thus, using infected seedcane transmits the virus to the emerging plants. The only way to eliminate the virus from the plant is to use meristem tissue culture techniques. Even this technique is not 100% effective and plants derived using this technique must be tested to ensure the virus was eliminated. In Florida, a commercial seedcane company sells disease-free seedcane where SCYLV along with the ratoon stunt and other pathogens have been eliminated. Fields established with SCYLV-free seedcane will initially be virus-free. However in time, plants in these fields will become infected with SCYLV because the virus is aphid-transmitted. The rate at which the plants become infected is cultivar dependent. However, in most cultivars the incidence of SCYLV infection is typically 30-40% after three years. An exception is the former commercial cultivar CP 72-1210 that becomes infected very rapidly.

Since SCYLV-infected plants have a 4 to 10% yield loss of both cane weight and sucrose, yellow leaf is a major economic threat. Actual field losses will depend on the loss per plant and the incidence of yellow leaf in the field. Unfortunately, the incidence of yellow leaf is 85% or more in almost all commercial fields planted with regular seedcane of CP cultivars in Florida. Assuming a yield loss of 10% per plant and an 85% incidence level, there would be a 8.5% loss for the field in each crop. Those fields planted with tissue-culture based seedcane have zero or low incidences of yellow leaf, depending on the number of years since it was purchased as clean seedcane. Data indicates that the incidence of SCYLV in plants in the second ratoon in fields established with tissue culture based seedcane is around 30% depending on cultivar, location and other factors. Thus, using these figures there would be only a 3% loss for the tissue-culture field in the second ratoon crop. The use of the tissue-culture based seedcane would also be free of the ratoon stunt pathogen and would prevent losses from this disease too. In summary, control of yellow leaf in the field is extremely important for Florida growers because its high incidence leads to greater economic losses to the industry than many other diseases.

Control

Until resistant cultivars can be developed, only the use of SCYLV-free seedcane can moderate SCYLV yield losses.