GREEN GRASSY SHOOT DISEASE (GGSD)

Sugar Research Australia

INTRODUCTION

Green grassy shoot disease (GGSD) was recognized for the first time in Thailand in the mid-1990s. Caused by a phytoplasma – a very small organism that lives in the phloem of the vascular bundles, the disease has caused serious yield losses in Thailand and Vietnam. GGSD is very similar to Grassy shoot disease (GSD), first seen in India in the 1940s. In 2006, GGSD was recognized for the first time in Vietnam and is currently causing a major disease epidemic in that country, particularly in Nghe An Province.

If GGSD was introduced to Australia, it could cause major yield losses to the sugar industry. Issues such as diagnostic techniques, resistant varieties and alternative hosts require research.

CAUSAL ORGANISM

The disease is caused by a phytoplasma. These organisms infest the phloem tissues in the sugarcane vascular bundles. Phytoplasmas are difficult to detect, not only because of their small size (requiring an electron microscope) but because of the limited occurrence of the phytoplasma within the tissues.

SYMPTOMS

The main symptom of GGSD is small, green, and profuse tillering at the base of the mature sugarcane stool. These tillers do not exhibit any white leaves, in contrast to White Leaf Disease (WLD).

When the crop is ratooned, emerging shoots (if there are any) consist of very small, green profuse tillers which fail to develop into mature stalks. Advanced infestations are characterised by very gappy ratoons and greatly reduced yields. Crops in Vietnam have decreased from 80 tonnes/ha in plant cane to 15 tonnes cane/ha in the first ratoon.

The differences between GGSD, GSD and WLD can be summarized as: GGSD does not show any white leaves, GSD has white leaves and grassy tillering, while WLD has white leaves but not grassy tillering.

(Above) Green grassy tiller at the base of a mature stool of cane.

(Above) Emerging shoots after ratooning showing severe GGSD.

YIELD LOSS

GGSD is capable of causing major yield losses in susceptible varieties. The production of very small multiple tillers, and the lack of mature harvestable stalks, means the disease has very serious consequences. Crop production at the NAT&L Quy Hop Sugar factory in Nghe An Province, Vietnam decreased from 1.2 m tonnes in 2007-2008 to 0.6m tonnes in 2008-2009 and a significant proportion of this decrease was due to severe GGSD. Failed ratoons mean very severe financial losses for cane farmers and GGSD is a major disease.

DIAGNOSIS

Phytoplasma diseases may be diagnosed using molecular tools such as PCR and LAMP. General assays for phytoplasmas have been developed and primers for GGSD. However, more research is needed to ensure molecular assays are specific to GGSD. In the field, the disease is diagnosed by profuse grassy tillering with no leaf chlorosis i.e. no white leaves.

SPREAD

GGSD is spread principally through the planting of infested planting material. However, rapid spread in Vietnam indicates a potential insect vector. Similar phytoplasma diseases are spread by leafhoppers. The presence of a vector for GGSD has yet to be confirmed. The disease is not spread by cane juice, so machinery and knives do not spread the infection. Soil transmission of GGSD is also unknown.

ALTERNATIVE HOSTS

Little is know of alternative hosts for GGSD. If there are any, they are likely to be closely related grasses. Further research on GGSD hosts is required.

CONTROL

Planting of disease-free planting material is of prime importance. GSD and WLD can be eliminated from diseased planting material by hot water treatments (50°C for two to three hours) and early work with GGSD suggests a similar result. However, there is a low level of 'escapes' – stalks where the pathogen is not completely eliminated, so care in the selection of disease-free, or minimally diseased planting material for treatment is important.

There appears to be a very limited source of resistance in commercial varieties in either Thailand or Vietnam. Further work into resistance in commercial varieties is needed. The most important management options therefore are to eliminate badly diseased crops, replanting with disease-free planting material into fallow ground (no volunteers) and the selection of the most resistant varieties available.

(Top) GGSD affected plants in a heavily infected field. Note the grassy shoots.

(Bottom) Profuse grassy tillering at base of a mature stool.

If you suspect you may have seen any of these disease symptoms please contact the exotic pest hotline on 1800 084 881, SRA, or your local Productivity Service.