in focus: leaf scald

Leaf scald, a serious disease that occurs in all regions of the Australian sugarcane industry, can cause extensive yield losses in highly susceptible varieties through death of stalks and poor ratooning. Major epidemics of leaf scald have occurred in the Central and Burdekin regions, but it is rare in the Bundaberg region. Leaf scald symptoms often appear when cane is placed under stress such as dry weather.

The presence of leaf scald can cause major disruption to disease-free seed schemes. In some cases, plots may need relocation to areas isolated from known sources of disease. Approximately 20% of clones in the BSES/CSIRO selection programs are discarded due to leaf scald susceptibility. The disease restricts the use of parent clones.

CAUSAL ORGANISM

The disease is caused by a rod-shaped bacterium, *Xanthomonas albilineans* (Ashby) Dowson, which infects the xylem (water transport) vessels of the sugarcane plant.

SYMPTOMS

Leaf scald has three stages of symptom development:

- ***Latent phase***

  Leaf scald can remain latent in some varieties for long periods (>12 months) while showing no symptoms. Stress can trigger an outbreak that shifts the infected plant from the latent phase into the chronic or acute phases.

- ***Chronic phase***

  Leaf scald in the chronic phase exhibits a range of symptoms including chlorotic (white) stripes and patches of chlorotic tissue on leaves, side shooting beginning at the base of stalks and burning of the leaf tips. When stalks are sliced open, the vascular bundles are red in the nodes. Image 1 shows the white stripes on leaves – a well-defined white pencil-line that runs along the vein. This pencil-line is specific to leaf scald.

- ***Acute phase***

  In some susceptible varieties, leaf scald will cause sudden death of whole stools. Usually, the dead stalks will show some chronic stage symptoms, particularly on side shoots or suckers (Image 2).

YIELD LOSS

Leaf scald can cause complete crop loss, though this is rare. Losses depend on the percentage of stools affected. When the number of affected stools is low, surrounding stools can compensate, but as the percentage of diseased stools increases, losses will also increase. Ratoons can fail. Large numbers of dead stalks can affect sugar quality.

Losses in Australia have been negligible in recent years because highly susceptible varieties are not released to growers. The loss of potentially high-yielding susceptible varieties is a hidden cost of the disease.

Management of the disease through approved seed schemes and hot water treatment is another significant cost to the industry.

DIAGNOSIS

Diagnosis of leaf scald is by visual inspection for the specific pencil-line symptom and the other characteristic symptoms. This diagnosis can be confirmed by isolation of the causal bacterium and identification of the isolated bacteria by ELISA or polymerase chain reaction (PCR) assays.

SPREAD

The disease spreads primarily by planting infected cuttings, by using contaminated cutting implements and by wind-blown rain.

Because leaf scald has a latent phase, the disease can be spread in planting material, even if the plant source is inspected for symptoms. It is believed that this is how leaf scald was unknowingly spread around the world.

Any implement that cuts the stalk or comes in contact with the freshly cut end of the sett or billet can spread leaf scald readily. Implements typically include cane knives, whole stalk and billet planters, and harvesters.

IMAGE 1 | Chronic phase. White stripes on leaves.

IMAGE 2 | Acute phase. Leaf scald has caused sudden death of stalks.

The following guidelines must be followed to minimise spread of infection:

- Remove all soil and plant material with water and detergent under high pressure.
- Spray cutting surfaces and parts that come in contact with cut surfaces with a registered product containing 0.1% benzalkonium chloride or didecyldimethyl ammonium chloride (with the disinfectant left in contact with the implement for 5 minutes before use).
- Disinfect harvesters – the base-cutter, butt-lifter roller, chopper box and extractor fans – when cutting cane to be sent to the mill.
- Disinfect the whole feed chain as well as the base-cutter, chopper box and extractor fans when cutting billets for planting.

Leaf scald can be spread by wind-blown rain, especially during severe weather events. The bacteria can only survive for a few days away from a plant. The disease naturally infects a number of grasses, including paspalum, blady grass, *Brachiaria*, guinea grass and itch grass, and outbreaks are often associated with river or creek systems, which may harbour infected grasses.

CONTROL

Control of leaf scald involves a combination of deploying resistant varieties, disease-free or approved seed schemes, and hygiene. Some level of varietal resistance is required to control the disease.

Disease-free seed is produced for distribution to farmers by repeated cold-soak long hot-water treatment (40 hour soak in water at ambient temperature followed by 50°C for 3 hours) of nucleus or mother plot cane. If leaf scald is common in an area, the mother plot and approved seed plot may have to be located in a low risk area.

RESISTANT VARIETIES

All clones in the BSES CSIRO selection program are screened for resistance. Crosses between susceptible parent clones are not made to reduce the numbers of susceptible clones coming through the program.

CURRENT RESEARCH

Each year at the Pathology Farm at Woodford, two leaf scald trials are conducted – a two-replicate trial and a four-replicate trial. The two-replicate trial includes tentative selections from the 1st ratoon final assessment trials from all breeding programs, a selection of parent clones and some foreign introductions. Up to 250 clones are screened in the two-replicate trial each year.

The four-replicate trial includes advanced selections from each of the breeding programs; these clones should have been in a previous two-replicate trial in past years. Approximately 50-60 clones are screened in the four-replicate trial each year.

These trials are planted at Woodford in September/October each year, and are then grown for 5 to 6 months before they are inoculated in early to mid-February. The inoculation of these trials is best performed in showery/overcast conditions to maximise inoculum virulence, as the inoculum can be killed by long exposure to direct intense sunlight (ultra violet light).

On the morning of inoculation 8-10 stalks of infected cane showing good leaf scald symptoms are cut from the field and put through the small mill. The process of crushing the stalks extracts the juice which contains large numbers of the bacteria, this juice is collected, and is used as the inoculum.

The inoculation is performed by decapitating the cane above the growing point with a cane-knife and applying the inoculum onto this cut surface with a paint brush. The cane stalks are usually decapitated between the 3rd and 4th dewlaps, with the growing point generally present between the 4th and 5th dewlaps. Every stalk in each plot is inoculated.

After inoculation, the trials are grown for a further 9-10 months before they are inspected. At inspection, all stalks that were inoculated are counted in each plot, and then inspected for the presence of disease symptoms. Resistant clones rarely display any symptoms, susceptible clones can show a range of symptoms including white pencil lines on the leaves, leaf chlorosis, side-shooting, wilting of the tops and even complete death of the stalk.

The results of the test clones are compared with results of the trial standards in the trials, to give each clone a rating on the scale of 1 to 9.

FOR FURTHER INFORMATION

Your nearest BSES extension officer can provide further information on the control of leaf scald.

IMAGE 3 AND 4 | Trial 2 weeks post-inoculation.