2013

Diseases of Australian sugarcane: field guide

BSES Limited

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## AUSTRALIAN WHOLE-PLANT DISEASES

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## EXOTIC WHOLE-PLANT DISEASES

- **Downy mildew** 52
- **Grassy shoot** 53
- **Green grassy shoot** 54
- **Gumming** 55
Introduction

This guide has been designed for practical ‘in-field’ use.

Text is kept to a minimum and symbols are used to convey information.

General information is at the end of the guide.

To use the guide, follow the procedure below:

Understand the layout

• The disease layout is illustrated on page 16

Symptoms

• Determine the main symptom you have seen on page 6
• Matching page numbers will lead you to the disease

Confirmation

• Specific comparison pages on where, when and how common the diseases are will help confirm your diagnosis
### Key

<table>
<thead>
<tr>
<th>Main symptom</th>
<th>Page number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crop is brown</td>
<td>21, 22, 23, 24, 25, 26, 27, 30, 31, 32, 33, 34, 35</td>
</tr>
<tr>
<td>Crop or stalks are dead</td>
<td>37, 43, 48, 51, 55</td>
</tr>
<tr>
<td>Reduced crop growth</td>
<td></td>
</tr>
<tr>
<td>• Whole crop</td>
<td>46, 47, 50, 52, 53, 54, 55, 56, 57, 59, 60</td>
</tr>
<tr>
<td>• Patch</td>
<td>40, 41, 42, 43, 49, 51, 52, 53, 55, 56, 57, 58, 60</td>
</tr>
<tr>
<td>Uneven plant growth</td>
<td>40, 41, 42, 43, 49, 51, 52, 53, 55, 56, 57, 58, 60</td>
</tr>
<tr>
<td>Twisted, deformed shoot</td>
<td>42, 45</td>
</tr>
<tr>
<td>Bent stalks</td>
<td>45</td>
</tr>
<tr>
<td>Dead spindle leaf</td>
<td>45, 48</td>
</tr>
<tr>
<td>Leaf spots</td>
<td>21, 22, 23, 24, 25, 26, 27</td>
</tr>
<tr>
<td>Leaf stripes</td>
<td>40, 41, 43, 48, 52, 55, 58</td>
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<tr>
<td>Leaf galls</td>
<td>42</td>
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<tr>
<td>Poor germination</td>
<td>36, 37</td>
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<tr>
<td>Poor root growth</td>
<td>58, 59, 60, 61</td>
</tr>
<tr>
<td>Side-shooting</td>
<td>43, 49</td>
</tr>
</tbody>
</table>

Similar symptoms may be caused by more than one disease or by other factors such as pests, nutrition, herbicides and physical damage.
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p 21

Brown stripe
p 22

Eye spot
p 23

Orange rust
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Photo index

Red leaf spot
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Ring spot
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Yellow spot
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Brown spot
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Photo index

Leaf scorch
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Target blotch
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Mosaic
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Red stripe/Top rot
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Sclerophthora  
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Smut  
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Grassy shoot
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Green grassy shoot
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Gumming
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Ramu stunt
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Photo index

White leaf
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Basal stem rot
p 58

Nematodes
p 59

Pachymetra root rot
p 60

Pythium root rot
p 61
**Disease name**

**Important points about the disease**

**How to distinguish it from other diseases**

**How the disease is transmitted**

**Section name**

**Close-up of disease**

**Whole crop appearance**

**Need for clean planting material**

**Where it occurs**

**Months when it occurs**

**Economic importance**

**Extra information**
Five types of icons are used:

- How the disease is transmitted
- Where it occurs
- When it occurs
- Economic importance
- Need for clean planting material

**Transmission icon**

- Harvesters
- Planters
- Cane knives & mechanical equipment used to cut cane
- Wind-blown rain
- Wind
- Insects
- Planting material
- Drainage water
- Soil-borne

A coloured icon suggests disease transmission

A grey icon suggests no transmission
Icons

**Distribution icon**

Where the disease occurs (coloured font).

<table>
<thead>
<tr>
<th>Region</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>New South Wales</td>
</tr>
<tr>
<td>S</td>
<td>Southern region</td>
</tr>
<tr>
<td>C</td>
<td>Central region</td>
</tr>
</tbody>
</table>

**Where?**

Occurs here → **NSW**  **S**  **C**  **B**  **H**  **N** ← not here

**Occurrence icon**

Months when the disease occurs (coloured font).

Occurs in these months → **J F M A M J J A S O N D** ← not usually seen in these

**Economic value icon**

This has three levels, based on:

- The historical economic effect in Australia
- The potential effect (exotic disease)

$$$

Very significant

$$

Significant

$%

Insignificant

**Planting material icon**

Coloured font means it is essential to use disease-free planting material.

**Clean Planting Material**

Disease-free planting material is essential for control
Brown rust
Eye spot
Red leaf spot
Yellow spot
Brown stripe
Orange rust
Ring spot
Brown rust

Description
- Caused by *Puccinia melanocephala* (fungus)
- Favoured by cool nights (dew), warm sunny days
- Lesions elongated 5-10 mm x 1-2 mm
- Control by resistant varieties

Brown rust differs from:

**Yellow spot**
- Brown rust occurs in dry season, not wet
- Has elongated lesions (not round)
- Brown spores on underside of leaf

**Orange rust**
- Brown rust has brown, not orange spores
- Occurs in dry season, not wet
- Lesions longer than orange rust

Trans. | Where? | When? | Clean planting material
--- | --- | --- | ---
[diagram] | NSW S C B H N | J F M A M J J A S O N D | $$

Cool nights and sunny days · Brown canopy · Dry season
Brown stripe

Description

- Caused by Bipolaris stenospila (fungus)
- Favoured by poor nutrition
- Lesions elongated 5-7.5 mm x 2-4 mm
- Control by resistant varieties and better soil nutrition (P, K)

Brown stripe differs from:

Eye spot

- Brown stripe is linked to soil nutrition
- Has no ‘runner’ associated with the stripe

Ring spot

- Brown stripe has a dark coloured centre to the lesion
- Has a halo around the edge of the lesion
- Lesions are elongated not round

Trans. Where? When?

NSW S C B H N J F M A M J J A S O N D $

Nutrient-deficient soils · Brown canopy · Mature cane
Eye spot

Description
• Caused by Bipolaris sacchari (fungus)
• Favoured by cool, wet weather
• Lesions elongated 0.5-4 mm x 0.5-2 mm
• Dark centre with lighter halo
• Control by resistant varieties

Eye spot differs from:
Brown stripe
• Eye spot has a runner associated with the lesion
• Lesions more round than elongated

Ring spot
• Eye spot lesions are smaller
• Has a runner associated with the lesion
• Eye spot has a coloured centre to the lesion
• Not as common as ring spot

Trans.  Where?  When?  Clean planting material

NSW  S  C  B  H  N  J  F  M  A  M  J  J  A  S  O  N  D  $$

Cool, wet weather  •  Brown canopy  •  Winter
Orange rust

Description
- Caused by *Puccinia kuehnii* (fungus)
- Favoured by warm, humid weather (summer or early autumn)
- Lesions elongated 3-8 mm x 1-2 mm
- Control by resistant varieties

Orange rust differs from:

Yellow spot
- Orange rust has elongated lesions (not round)
- Orange spores on underside of leaf

Brown rust
- Orange rust spores are orange, not brown
- Occurs in wet season, not dry
- Lesions shorter than brown rust

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
<td></td>
</tr>
</tbody>
</table>

Warm, humid weather · Brown canopy · Wet season
Red leaf spot

Description
- Caused by *Dimeriella sacchari* (fungus)
- Favoured by warm, humid weather
- Lesions round, up to 12 mm
- Control by resistant varieties (not normally an issue)

Red leaf spot differs from:

**Yellow spot**
- Red leaf spot lesions seen only on upper side of leaf blade
- Lesions more red than yellow

**Ring spot**
- Red leaf spot lesions seen in upper section of canopy
- Lesions seen on upper leaf surface only
- Lesions lack dead tissue as seen with ring spot

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Clean planting material</th>
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</thead>
<tbody>
<tr>
<td>Where?</td>
<td>NSW S C B H N</td>
</tr>
<tr>
<td>When?</td>
<td>J F M A M J J A S O N D</td>
</tr>
</tbody>
</table>

Warm, humid weather  ·  Red-brown canopy  ·  Wet season
Ring spot

Description

- Caused by *Leptosphaeria sacchari* (fungus)
- Favoured by warm, humid weather
- Lesions oval elongated 1-5 mm x 4-18 mm
- Straw-coloured centre to lesions

*Ring spot differs from:*

**Eye spot**

- Ring spot has no ‘runner’
- Has larger lesions
- Occurs lower in crop canopy

**Yellow spot**

- Ring spot occurs lower in canopy
- Has dead tissue in the central part of lesion
- Has minimal effect on crop yield
- No specific controls required

<table>
<thead>
<tr>
<th>Where?</th>
<th>When?</th>
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<tbody>
<tr>
<td><strong>NSW S C B H N J F M A M J J A S O N D</strong></td>
<td>$</td>
</tr>
</tbody>
</table>

- Warm, moist conditions
- Dead lower leaves
- End of wet season
- Clean planting material
Yellow spot

Description

- Caused by *Mycovellosiella koepkei* (fungus)
- Favoured by warm, humid weather
- Lesions irregular (roundish) up to 10 mm in diameter
- Lesions initially yellow but turn brick red
- Control by resistant varieties

Yellow spot differs from:

Red leaf spot

- Yellow spot lesions seen on both sides of the leaf
- Lesions yellow or brick red, not red

<table>
<thead>
<tr>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
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</thead>
<tbody>
<tr>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
</tr>
</tbody>
</table>

- Wet, humid weather · Brown canopy · Wet season
Brown spot  Leaf scorch
Target blotch  Veneer blotch
White speck  Zonate leaf spot
EXOTIC LEAF DISEASES

Brown spot

Target blotch

White speck

Leaf scorch

Veneer blotch

Zonate leaf spot
Brown spot

Description

- Caused by *Cercospora longipes* (fungus)
- Favoured by heavy rain and humid conditions
- Lesions oval shaped and reddish brown with yellow halo 3-15 mm
- Control by resistant varieties

**Brown spot differs from:**

**Eye spot**

- Brown spot has no ‘runners’
- There is no link to cool, wet conditions

**Brown stripe**

- Brown spot lesions are rounder than brown stripe lesions
- No link to poor soil nutrition

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy rain / humid</td>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$</td>
</tr>
<tr>
<td>‘Fired’ canopy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Leaf scorch

Description
- Caused by *Stagonospora sacchari* (fungus)
- Favoured by rain and warm conditions
- Lesions spindle-shaped with dead tissue in centre, 50-200 mm x 5-10 mm
- Control by resistant varieties

**Leaf scorch differs from:**

**Other diseases**
- Leaf scorch has characteristic spindle-shaped lesions
- Ramu scorch looks very similar, but caused by an insect
- Pathogen spores are found within the lesion with leaf scorch, but not Ramu scorch

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
<td>Warm, rainy weather · ‘Fired’ canopy · Wet season/early dry</td>
</tr>
</tbody>
</table>
Target blotch

Description

• Caused by *Helminthosporium* sp. (fungus)

• Occurs principally on mature cane in winter

• Lesions straw-coloured to brown, necrotic areas with concentric rings (some similarity to ring spot)

**Target blotch differs from:**

Ring spot

• Target blotch lesions are similar, except target blotch has concentric margins to the lesions
Veneer blotch

Description

• Caused by Deightoniella papuana (fungus)

• Lesions straw-coloured with a pattern like wood veneer

• Lesions up to 10-15 mm wide x 600 mm long

Veneer blotch differs from:

Ring spot

• Veneer blotch differs by having much larger, more elongated ‘winged’ lesions

Target blotch

• Veneer blotch lesions are much larger and more elongated

• Veneer blotch has ‘winged’ lesions

Trans. Where? When? Clean planting material

| NSW | S | C | B | H | N | J | F | M | A | M | J | J | A | S | O | N | D | $ |
| Humid weather | • | Winged lesions | • | Wet season |
White speck

Description

- Caused by *Elsinoe sacchari* (fungus)
- Little is known of favourable conditions
- Lesions are whitish-grey, sometimes with a red margin, 1-4 mm x 0.4-1 mm

**White speck differs from:**

**Other leaf diseases**

- White speck lesions are small and whitish-grey, and not readily confused with other leaf diseases

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW S C B H N J F M A M J J A S O N D</td>
<td>$</td>
<td>Little known information · White speckled leaves · Older cane</td>
</tr>
</tbody>
</table>
Zonate leaf spot

Description

• Caused by *Gloeocercospora sorghi* (fungus)
• Favoured by hot, humid weather
• Lesions are a series of concentric rings of alternating dark and light brown tissue, up to 60 mm in diameter

**Zonate leaf spot differs from:**

Yellow spot

• Zonate leaf spot has less affected tissue within the lesion and more reddening
• Lesions have a concentric pattern with zonate leaf spot

---

Trans.  
Where?  
When?

<table>
<thead>
<tr>
<th>NSW</th>
<th>S</th>
<th>C</th>
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<th>N</th>
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<td>J</td>
<td>F</td>
<td>M</td>
<td>A</td>
<td>M</td>
<td>J</td>
</tr>
</tbody>
</table>

$\text{Clean planting material}$

- Hot, humid weather
- Red leaf lesions
- Wet season
Fusarium sett rot

Description

- Caused by *Fusarium sacchari* (fungus)
- Favoured by damaged planting material or cold/wet soil conditions
- No chemicals registered for control
- Activity of chemicals unknown

Fusarium sett rot differs from:

Pineapple sett rot

- Fusarium sett rot lacks the blackening of the central internal sett tissues and the fruity pineapple smell of freshly split setts
- Fusarium sett rot has a more purple colouration

<table>
<thead>
<tr>
<th>Trans.</th>
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<tbody>
<tr>
<td></td>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$</td>
</tr>
<tr>
<td></td>
<td>Cold, dry or wet soils</td>
<td>Purple sett tissue</td>
<td>Young plant cane</td>
</tr>
</tbody>
</table>
Pineapple sett rot

Description

- Caused by *Ceratocystis paradoxa* (fungus)
- Favoured by damaged planting material or cold, dry or wet soil conditions
- Reddening of internal sett tissues, black in the centre (spores)
- Fungicide control

**Pineapple sett rot differs from:**

**Fusarium sett rot**

- Pineapple has a central blackening of internal sett tissues (spores)
- PSR also has a pineapple smell in freshly split affected setts

**Other sett rots**

- Lack the red/black symptoms

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<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
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<tbody>
<tr>
<td></td>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
</tr>
<tr>
<td></td>
<td>Cold, dry or wet soils</td>
<td>Red/black sett tissue</td>
<td>Young plant cane</td>
</tr>
</tbody>
</table>
Leaf scald

Ratoon stunting disease

Chlorotic streak

RSD – young symptoms
Quick Comparison - Leaf Streaks

Leaf scald

Chlorotic streak

Chimera (genetic)

Chlorotic streak

Chimera
Bacterial mottle

Description

- Caused by *Pectobacterium chrysanthemi* (bacterium)
- Favoured by flooding during growing season
- Symptoms: creamy-white regular stripes (1-2 mm wide) or a general chlorotic mottle
- Stunting, excessive tillering
- Control by resistant varieties

**Bacterial mottle differs from:**

**Sclerophthora**

- Sclerophthora has a wavy leaf margin
- Sclerophthora causes leaf shredding/drying out of leaf tips, giving the canopy a ragged appearance

---

**Trans.**

Where?

NSW  S  C  B  H  N

When?

J  F  M  A  M  J  J  A  S  O  N  D

Clean planting material

Flooding · Chlorotic stripes/excessive tillering · All year
Chlorotic streak (CSD)

Description

- Unknown cause
- Favoured by wet soil conditions/flooding
- Symptoms are irregular chlorotic streaks and internal stalk reddening
- Control is by improved drainage/disease-free planting material/resistant varieties

Chlorotic streak differs from:

Leaf scald

- With CSD, leaf stripes are irregular, no ‘pencil line’ and less reddening of internal stalk tissues
- Leaf scald causes a general chlorosis in the acute stage, chlorotic streak does not

Where? NSW S C B H N

When? J F M A M J J A S O N D $$$

Clean planting material

Flooding/planting material · Leaf stripes · All year
Fiji leaf gall

Description
- Caused by Fiji disease virus
- Transmitted by planthoppers (Perkinsiella saccharicida)
- Characteristic symptom is a gall on the back of the leaf
- Causes stunting, dead spindle, distorted tops and short, erect, dark green leaves
- Control by resistant varieties and clean planting material

Fiji leaf gall differs from:

Pokkah boeng
- In many ways Fiji is similar to pokkah boeng, but the latter has no associated leaf galls
- Affected crops grow away from pokkah boeng but not Fiji
Leaf scald

Description

- Caused by *Xanthomonas albilineans* (bacterium)
- Favoured by water stress
- Leaf stripes, pencil line, tissue chlorosis and stalk death are common symptoms
- Control by resistant varieties and clean planting material

Leaf scald differs from:

Chlorotic streak

- Leaf scald has more regular leaf stripes, and stalk death is not unusual
- Transmitted by machinery
- Favoured by dry conditions, not flooding

Trans. | Where? | When? | Clean planting material
--- | --- | --- | ---
[Image] | NSW S C B H N | J F M A M J J A S O N D | $$
Stress favours expression | Stalk death/leaf stripes | All year
Mosaic

Description

• Caused by Poty (mosaic) viruses and spread by aphids

• Seen most easily in young cane/young leaves

• Symptoms are a mosaic leaf pattern and stripes on the young stalk

• Control by resistant varieties

Mosaic differs from:

Striate mosaic

• Striate mosaic has very fine striations on the leaf

• Striate mosaic occurs only in the Burdekin, while mosaic is normally seen in south Queensland
Pokkah boeng

Description

• Caused by *Fusarium sacchari* (fungus)

• Favoured by fast cane growth

• Leaf twisting/distortion and ‘knife cuts’ are common

• Control not usually required

**Pokkah boeng differs from:**

**Fiji leaf gall**

• Fiji leaf gall causes galls on the back of the leaf

• Pokkah boeng is mainly seen in the peak of the growing season

• Cane will usually recover from pokkah boeng

**Trans.**

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$</td>
<td>soil</td>
</tr>
</tbody>
</table>

- Fast growth  ·  Twisted/stunted leaves  ·  Wet season
Ratoon stunting disease (RSD)

Description

• Caused by *Leifsonia xyli* subsp. *xyli* (bacterium)
• Losses increased by drought
• No external symptoms besides stunting
• Diagnosis by ‘ELISA’ or phase contrast microscopy assays
• Up and down growth characteristic in diseased crop
• Control by machinery sanitation, clean planting material

RSD differs from:

All other diseases

• There are no external diagnostic symptoms with RSD

Trans. Where? When? 

| NSW | S | C | B | H | N | J | F | M | A | M | J | J | A | S | O | N | D | $$$ |
| Drought | · | Stunted crop | · | All year | Clean planting material |
Red rot

Description

- Caused by *Glomerella tucumanensis* (fungus)
- Favoured by crop stress
- Symptoms are internal stalk reddening with transverse white patches (internal) and stalk death
- Control by resistant varieties

Red rot differs from:

Fusarium sett rot

- Red rot does not cause a purpling of tissues but a reddening, with transverse white patches
- Red rot has a starchy smell, not sour
Red stripe/Top rot

Description

- Caused by *Acidovorax avenae* subsp. *avenae* (bacterium)
- Favoured by warm, moist weather
- Symptoms include red leaf stripes and/or a top rot
- Foul odour associated with the base of dead spindle
- Control by resistant varieties

**Red stripe/Top rot differs from:**

**Leaf scald**

- Red stripe has red leaf symptoms
- Top rot is also associated with the disease
- Pathogen not primarily spread by mechanical equipment

**Where?**

- NSW
- S
- C
- B
- H
- N

**When?**

- J F M A M J J A S O N D
- $ (Clean planting material)

- Warm, moist weather
- Red stripes/Top rot
- Early/mid wet season
Sclerophthora

Description

• Caused by *Sclerophthora macrospora* (fungus)

• Favoured by flooding, poorly drained soils

• Symptoms include excessive tillering, multiple budding, stunted growth, wavy leaf margins and leaf mottling

• No control usually needed

*Sclerophthora differs from:*

**Bacterial mottle**

• Sclerophthora has wavy leaf margins and less leaf striping

• The disease is caused by a fungus – oospores can been seen in affected leaves
Smut

Description

• Caused by *Ustilago scitaminea* (fungus)

• Favoured by hot, dry conditions

• Symptoms include terminal growth ending in a ‘whip’, grassy growth habit

• Whips sometimes on side shoots

• Control by resistant varieties

*Smut differs from:*

**All other diseases**

• Smut produces a very characteristic black whip structure from the apical growing point

---

Trans. | Where? | When? | Clean planting material
---|---|---|---
 ![plant icon] | NSW S C B H N | J F M A M J J A S O N D | $$

Hot, dry conditions | Grassy habit and a whip | All year
Striate mosaic

Description

- Caused by a virus
- Limited to patches in affected fields
- Symptoms include fine striations in the leaf blade that are difficult to see
- Stunting and stalk death are common in susceptible varieties
- Control by resistant varieties

Striate mosaic differs from:

Mosaic

- Striate is limited to soil-associated patches, the vector is unknown and has far less-obvious leaf symptoms
- Stool death occurs
- Striate is limited to the Burdekin

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSW S C B H N</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
</tr>
<tr>
<td>soil</td>
<td>Soil-limited patches</td>
<td>Stunting and death</td>
<td>All year</td>
</tr>
</tbody>
</table>
Downy mildew

Description

- Caused by *Peronosclerospora sacchari* (fungus)
- Favoured by warm, humid weather
- Symptoms include leaf stripes, leaf shredding and stunting
- Spread by air-borne, fragile spores
- Control by resistant varieties

**Downy mildew differs from:**

**Bacterial mottle**

- Downy mildew has more definite leaf striping
- There is down production with downy mildew on hot, humid nights

---

**Trans.**

<table>
<thead>
<tr>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
</table>
| NSW S C B H N | J F M A M J J A S O N D $$ | $$
| Warm, humid weather | • Stunting/leaf stripes | • All year |
Grassy shoot

Description

• Caused by a phytoplasma

• Symptoms are excessive tillering with white chlorotic shoots and severe stunting

• Spread is by diseased planting material

• Control by resistant varieties

Grassy shoot differs from:

White leaf

• Grassy shoot is characterised by excessive tillering

• No insect vector has been identified with grassy shoot

Trans.  Where?  When?  Clean planting material

| NSW | S | C | B | H | N | J | F | M | A | M | J | J | A | S | O | N | D | $$ |
|     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   | All year

Clean planting material

Warm weather  •  Grassy growth, stunting  •  All year
Green grassy shoot

Description

- Caused by a phytoplasma
- Symptoms are excessive tillering (without chlorotic shoots) and stunting
- Spread by diseased planting material (also suspected spread by insect vector)
- Control by resistant varieties and disease-free planting material

Green grassy shoot differs from:

White leaf

- Green grassy shoot has no white leaf symptoms

Grassy shoot

- Green grassy shoot does not exhibit leaf chlorosis
Gumming

Description

• Caused by *Xanthomonas axonpodis pv. vasculorum* (bacterium)

• Favoured by high winds, high humidity, wind-blown rain

• Symptoms include leaf stripes, chlorosis and gum pockets within stalks

• Control by resistant varieties

Gumming differs from:

Leaf scald

• Leaf stripes caused by gumming are yellow to orange, with non-systemic disease development occurring in older leaves only

• Gumming causes gum pockets within stalks

Trans.  Where?  When?  Clean planting material

Warm, humid, windy weather · Leaf stripes · Wet season
Ramu stunt

Description

• Caused by a virus
• Transmitted by the planthopper *Eumetopina flavipes*
• Symptoms include severe stunting and stool death, a trashy appearance and various leaf stripes and mottling

**Ramu stunt differs from:**

**White leaf**

• Obvious white leaves are seen with white leaf

**Grassy shoot**

• Grassy shoot does not cause leaf patterns such as seen with Ramu stunt

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Where?</th>
<th>When?</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil</td>
<td>NSW</td>
<td>J F M A M J J A S O N D</td>
<td>$$$</td>
</tr>
</tbody>
</table>

Good growth · Stunting/stool death/trashy · All year
**White leaf**

**Description**
- Caused by a phytoplasma
- Favoured by high populations of the vector (leafhopper *Matsumuratettix hiroglyphicus*) in summer
- Main symptom is a chlorosis (whitening) of the leaves
- Reduced yield and stalk death also result
- Control by resistant varieties

**White leaf differs from:**

**Grassy shoot**
- White leaf has leaf chlorosis as the main symptom
- White leaf is transmitted by a leafhopper
- Both are transmitted in planting material
Basal stem rot (BSR)

Description
- Caused by a basidiomycete (fungus)
- Favoured by dry conditions
- Occurs in patches in young plant cane
- Symptoms include stunted growth, poor tillering and sunken brown lesions around the base of shoots
- White stripes on leaves
- Crop recovery favoured by hilling up

**Basal stem rot differs from:**

**Striate mosaic**
- BSR also occurs outside the Burdekin
- BSR affects the base of shoots
- BSR leads to a strong mushroom-like smell

<table>
<thead>
<tr>
<th>Trans.</th>
<th>Clean planting material</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where?</td>
<td>NSW S C B H N</td>
</tr>
<tr>
<td>When?</td>
<td>J F M A M J J A S O N D</td>
</tr>
<tr>
<td>Dry conditions</td>
<td>Poor patch in young cane</td>
</tr>
</tbody>
</table>
Nematodes

**Description**

- Caused by various species (*Pratylenchus*/*Meloidogyne*).
- Favoured by light soils.
- Lesions and poor fine-root growth (*Pratylenchus*) or knots on roots (*Meloidogyne*).
- Control by crop rotation/nematicides.

**Nematodes differ from:**

**Pachymetra root rot**

- Nematodes don’t produce a soft rot of primary roots.
- Nematodes are not controlled through resistant varieties.

**Pythium root rot**

- *Pythium* lesions are more oval shaped and have a more red-black appearance.

---

**Trans.**

**Where?**

NSW  S  C  B  H  N  J  F  M  A  M  J  J  A  S  O  N  D  $$

**When?**

Light soils  · Unthrifty growth/poor root growth  · All year

Clean planting material
Pachymetra root rot

Description
- Caused by *Pachymetra chaunorhiza*
- Favoured by high rainfall/light soils (some districts)
- Main symptom is a rot of the thicker roots
- Control by resistant varieties
- More important in Queensland than *Pythium*

Pachymetra root rot differs from:

Nematodes
- *Pachymetra* causes a rot of the root system
- Controlled by resistant varieties

Pythium root rot
- *Pachymetra* is favoured by high soil temperatures
- Mainly affects the primary (thick) roots

---

Trans. | Soil | Clean planting material
--- | --- | ---
When? | High rainfall/warm conditions | Root rot | All year
Pythium root rot

Description

- Caused by *Pythium arrhenomanes* (fungus)
- Favoured by low soil temperatures
- Main symptoms are red lesions on roots and poor fine-root growth
- Not a major disease in Queensland
- No controls necessary

Pythium root rot differs from:

Pachymetra root rot

- *Pythium* causes red root lesions and poor fine-root growth

Nematodes

- *Pythium* lesions are more oval shaped and have a more red-black appearance

---

Trans.  
Clean planting material

Where?  
NSW S C B H N

When?  
J F M A M J J A S O N D

Low soil temperatures  •  Poor fine roots  •  Winter
Diagnosis

Keep the following in mind:

1. **Other causes?**
   - Not all symptoms are caused by disease

2. **Diversity of symptoms**
   
   Examine:
   - Whole crop, individual stalk, inside the stalk and a hand lens view (mites may be identified with a hand lens, for instance)

   *Make a summary of your observations.*

3. **Investigate other possibilities**
   
   This may involve:
   - Slicing stalks
   - Finding out what chemicals have been applied to the crop
   - Checking what unusual weather conditions have occurred (for instance, lightning)
   - Determining what fertiliser has been applied

4. **Look for other reasons why the symptoms may be present**
   
   - Relate appearance to the timing of other events, e.g. lightning, severe heat or cold

5. **Distribution patterns**
   
   Are there any patterns that may link the symptoms with:
   - Out-of-field activities, e.g. spray application in an adjoining paddock
   - Soil type within the field
   - Traffic paths of machinery, e.g. multiple row symptom expression patterns
Diagnosis

• Previous variety history

Attempt to link symptoms with field patterns.

6. When did the symptoms first occur?

Find out how long the symptoms have been present.

This may link the symptoms with an event, either the weather or a farming operation.

7. Is the cane ‘growing out’ of the symptoms?

If it is:

• The disease may be a minor one, or
• Symptoms may not be caused by a disease

8. See if the symptoms match a disease

Using the guide, consider:

• Whether symptoms fit with any known diseases
• The consistency of when and where the disease is usually found

The presence of atypical symptoms and occurrence may be enough to suggest a ‘no-match’.

Seek expert advice, if needed.

How to distinguish:

1. Genetic mutations (chimeras)

• Thin, white streaks, sometimes similar to leaf scald
• Have very definite, very sharp boundaries between the white streak and the green leaf tissue
• Most diseases have a ‘fuzzy’, diffuse boundary
Diagnosis

2. *Nutritional symptoms*

Experience is needed to expertly diagnose nutritional disorders. Clues of nutritional causes include:

- Symptoms only expressing in either younger or the older leaves
- Potential relationship with soil type and fertiliser application dose
- Symptoms linked to leaf structures (for instance, an inter-vein yellowing)

3. *Lightning*

Damage can be very spectacular and difficult to determine. Clues are:

- **Timing**: symptoms occur during the storm season
- **Patch occurrence**: symptoms are seen as a round patch with more-severe symptoms in the centre grading out to healthy cane; patches may be about 10 m in diameter
- **Purple leaf symptoms** coupled with stalk death near the centre of the patch

4. *Below-ground causation*

- Often there are no above-ground symptoms besides general unthrifty growth
- Growth limitations may occur either in patches or a whole field
- Dig up a few stools and look for shortened discoloured roots and the presence of very limited root growth

5. *Cold or heat chlorosis*

- Spectacular white bands running across the leaf blade; there
Diagnosis

may be a number of bands across a single leaf

- Occurrence is linked to either:
  
  - Unusually cold conditions, or rain, immediately followed by a hot, sunny period
  
  - Susceptible varieties (chlorosis usually occurs in only one or two per district)

**Equipment to assist diagnosis**

The following equipment will assist in collecting the information you need to make a diagnosis:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand lens</td>
<td>For close-up examination of symptoms on leaves</td>
</tr>
<tr>
<td>Knife</td>
<td>For slicing open stalks to view internal stalk symptoms</td>
</tr>
<tr>
<td>Felt pen</td>
<td>For labelling bags/labels</td>
</tr>
<tr>
<td>Sealable plastic bags</td>
<td>For collecting specimens to send to relevant experts</td>
</tr>
<tr>
<td>Shovel</td>
<td>To dig up stools to examine root systems and to collect soil samples</td>
</tr>
<tr>
<td>Camera</td>
<td>To photograph symptoms</td>
</tr>
</tbody>
</table>
When diseases occur

What time of year do you see it?

Brown rust

North .................................................. J F M A M J J A S O N D
South .................................................. J F M A M J J A S O N D

Brown stripe .................................................. J F M A M J J A S O N D

Eye spot .................................................. J F M A M J J A S O N D

Orange rust .................................................. J F M A M J J A S O N D

Red leaf spot .................................................. J F M A M J J A S O N D

Ring spot .................................................. J F M A M J J A S O N D

Yellow spot .................................................. J F M A M J J A S O N D

Bacterial mottle .................................................. J F M A M J J A S O N D

Chlorotic streak .................................................. J F M A M J J A S O N D

Fiji leaf gall .................................................. J F M A M J J A S O N D

Leaf scald .................................................. J F M A M J J A S O N D

Mosaic .................................................. J F M A M J J A S O N D

Pokkah boeng .................................................. J F M A M J J A S O N D

Ratoon stunting disease .................................................. J F M A M J J A S O N D

Red rot .................................................. J F M A M J J A S O N D

Red stripe/Top rot .................................................. J F M A M J J A S O N D

Sclerophthora .................................................. J F M A M J J A S O N D

Striate mosaic .................................................. J F M A M J J A S O N D
**Leaf diseases**

**Area affected by Australian leaf diseases**

Average annual incidence data (1980-2003) in Queensland

![Bar chart showing area affected by various leaf diseases in Queensland](chart)

- **Brown stripe** is associated only with poor soils.
- **Eye spot** is associated with a small number of susceptible varieties.
- **Yellow spot** is consistently found only in northern and Herbert districts.
- **Brown rust** and **orange rust** are found throughout the Queensland industry.
- **Ring spot** is commonly seen in every district but because it affects the lower canopy, only minor yield losses occur.
Leaf diseases

Distribution and importance of exotic leaf diseases

- There are a number we don’t yet have in Australia
- Some are close by in PNG
- Listed below is the likely economic effect if any are introduced (however, it should be remembered that extreme susceptibility in a commercial variety may make any one of major significance to our industry)
- Each has characteristic symptoms – especially lesion shape

<table>
<thead>
<tr>
<th>Disease</th>
<th>Country</th>
<th>Major/Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown spot</td>
<td>Widely distributed</td>
<td>Minor</td>
</tr>
<tr>
<td>Leaf scorch</td>
<td>S &amp; SE Asia, South America, Africa</td>
<td>Major</td>
</tr>
<tr>
<td>Target blotch</td>
<td>Widely distributed</td>
<td>Minor</td>
</tr>
<tr>
<td>Veneer blotch</td>
<td>SE Asia</td>
<td>Minor</td>
</tr>
<tr>
<td>White speck</td>
<td>Widely distributed</td>
<td>Minor</td>
</tr>
<tr>
<td>Zonate leaf spot</td>
<td>PNG, USA, Solomon Islands, Samoa</td>
<td>Minor</td>
</tr>
</tbody>
</table>
Leaf diseases

Severity

Affected by:

1. Weather

Has a huge influence on occurrence and severity of leaf diseases. Temperature and relative humidity (illustrated below) are the most important factors for spore germination.

Spore germination requirements (optimum)

<table>
<thead>
<tr>
<th></th>
<th>Relative humidity (%)</th>
<th>Temperature (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown rust</td>
<td>&gt; 99</td>
<td>11-27</td>
</tr>
<tr>
<td>Orange rust</td>
<td>&gt; 97</td>
<td>17-23</td>
</tr>
<tr>
<td>Yellow spot</td>
<td>100</td>
<td>20-30</td>
</tr>
</tbody>
</table>

2. Where in the canopy

Greatest yield effects occur when the younger 2-4 green leaves in a shoot show obvious disease.

Severity Examples

Minor: Ring spot principally affects the senescing (old) leaves in the canopy. Although visually spectacular, yield effects are small.
Leaf diseases

Major: On the other hand, the rusts and yellow spot may affect the younger leaves and they have a very significant yield effect.

3. Varietal resistance

Has a very large effect; control for most diseases is via varietal resistance.

4. Soil parameters

Such as soil texture and nutritional content.

- Poor nutrition influences brown stripe
- Lighter soils favour the rusts

5. Time of year

Leaf diseases have greater yield effects when present in the growing crop (tonnes cane). Commercial cane sugar (CCS) drops if the disease persists into, or occurs in, the harvest season.

Lesion shapes

Lesion shape gives a substantial clue to the identity of the disease.

Looking carefully (close-up) at the lesion shape will greatly assist in identification.
Leaf diseases

Lesion distribution upper and lower leaf surface

Some lesions appear equally on both upper and lower leaf surfaces, some only on the upper surface.

Red leaf spot (upper)  
Red leaf spot (lower)

Yellow spot (upper)  
Yellow spot (lower)
Severity assessment

Leaf area affected

The scale above provides a guide to the percentage leaf area affected in diseased sugarcane leaves.

A computer simulation program can be obtained from SRA, Tully, to assist in improving estimation accuracy.
Severity assessment

Estimating leaf area affected

A uniform objective measure of the leaf area affected by a disease is useful in:

- Estimating areas affected by a disease over several districts
- Estimating yield losses caused by a disease

Research has shown that even 10% leaf area affected in the 5th leaf from the spindle in a crop canopy may be enough to significantly reduce sugarcane yields (orange rust).

Individual ability to estimate leaf area affected

Studies in the USA have shown that:

- Some people are unsuitable as leaf disease estimators
- Others may routinely over- or under-estimate disease levels, and this bias varies with disease severity

Tip for area estimation

- First estimate the % leaf area diseased (dark tissue), then check
- By estimating % leaf area healthy (green tissue)
## Planting-material diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pathogen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusarium sett rot</td>
<td><em>Fusarium sacchari</em></td>
</tr>
<tr>
<td>Pineapple sett rot</td>
<td><em>Ceratocystis paradoxa</em></td>
</tr>
</tbody>
</table>

### 1. Control

Pineapple sett rot control is principally through fungicide application at planting.

*Mercurial fungicides*

- Are more commonly used
- These stimulate germination (physiological)

*Fungicide costs*

- About $1 m annually in Queensland

### 2. Factors increasing severity

- Dry or wet and cold soil
- Poor-quality planting material (split/cracked/piping)
- Poor fungicide coverage of cut billet ends

### 3. Importance of early diagnosis

Early digging of planting material (2-4 weeks after planting):

- Provides for reliable diagnosis because sett tissues have not excessively deteriorated (few other organisms are there)
- May allow replanting of the crop if pineapple sett rot is diagnosed
Planting-material diseases

Pineapple sett rot fungicides

<table>
<thead>
<tr>
<th>Commercial Products</th>
<th>Active Ingredient</th>
<th>Dose/100 L water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shirtan®</td>
<td>Methoxy ethyl mercuric chloride</td>
<td>125 mL</td>
</tr>
<tr>
<td>Cane sett treatment®</td>
<td>Propiconazole</td>
<td>20 mL</td>
</tr>
<tr>
<td>Cane Strike®</td>
<td>Flusilazole</td>
<td>125 mL</td>
</tr>
<tr>
<td>Bumper®</td>
<td>Propiconazole</td>
<td>20 mL</td>
</tr>
<tr>
<td>Tilt®</td>
<td>Propiconazole</td>
<td>20 mL</td>
</tr>
<tr>
<td>Sportak®</td>
<td>Prochloraz</td>
<td>20 mL</td>
</tr>
<tr>
<td>Sinker®</td>
<td>Flutriafol</td>
<td>100 mL</td>
</tr>
<tr>
<td>Bayleton®</td>
<td>Triadimefon</td>
<td>100 mL</td>
</tr>
</tbody>
</table>

Note: Check with supplier regarding dosage.

Sett coverage
It is imperative to completely cover the cut ends of setts with fungicide.

Testing coverage
- Sprays on whole-stick planters can be tested using vegetable dyes (for instance, ‘marker dye’ from Nufarm)
- Dips in billet planters should also provide coverage of all cut ends
- **Failure to test these systems may lead to germination failure**

Recommended change times for solutions
Solutions should be changed weekly in most cases.
Whole-plant diseases

Area affected by Australian whole-plant diseases

Viral diseases

Average annual data (1980-2003) in Queensland

The cause of chlorotic streak is still unknown; the disease is included here as it is likely to have a viral causal agent.
Whole-plant diseases

**Fungal diseases**
Average annual data (1980-2003) in Queensland

![Bar graph showing area affected by different fungal diseases]

**Bacterial diseases**
Average annual data (1980-2003) in Queensland

![Bar graph showing area affected by different bacterial diseases]
Whole-plant diseases

Pathogen and importance

- Are those where the pathogen invades the whole plant
- Often cause greater yield loss than other diseases
- Most of our major diseases are whole-plant
- Carryover from one crop to the next

Pathogens

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pathogen</th>
<th>Major/Minor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial mottle</td>
<td><em>Pectobacterium crysanthermi</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Chlorotic streak</td>
<td>Unknown</td>
<td>Major</td>
</tr>
<tr>
<td>Fiji leaf gall</td>
<td><em>Fiji disease virus</em></td>
<td>Major</td>
</tr>
<tr>
<td>Leaf scald</td>
<td><em>Xanthomonas albilineans</em></td>
<td>Major</td>
</tr>
<tr>
<td>Pokkah boeng</td>
<td><em>Fusarium sacchari</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Ratoon stunting disease</td>
<td><em>Leifsonia xyli</em></td>
<td>Major</td>
</tr>
<tr>
<td>Red rot</td>
<td><em>Glomerella tucumanensis</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Red stripe/Top rot</td>
<td><em>Acidovorax avenae</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Sclerophthora</td>
<td><em>Sclerophthora macrospora</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Striate mosaic</td>
<td><em>Sugarcane striate mosaic associated virus</em></td>
<td>Minor</td>
</tr>
<tr>
<td>Mosaic</td>
<td><em>Sugarcane mosaic virus</em></td>
<td>Major</td>
</tr>
</tbody>
</table>
Whole-plant diseases

Control measures

1. **Resistant varieties**
   - The most important control measure
   - Resistance screening of new clones is a major SRA activity
   - Appropriate levels of resistance in commercial varieties is critical to maximise profitability

2. **Disease-free planting material**
   - Normally also very important, since the pathogen lives inside the cane stalk
   - Approved seed plots in each mill area supply disease-free planting material

3. **Sanitation**
   - Important for controlling diseases that spread in cane juice (RSD and leaf scald)

4. **Drainage**
   - Diseases such as chlorotic streak are favoured by wet soils
   - Improved drainage can reduce disease levels
Whole-plant diseases

Distribution and importance of exotic whole-plant diseases

- Are those not recorded in Australia
- Some would lead to a significant drop in productivity and profitability
- Some of our best varieties are susceptible to exotic diseases
- Below are major exotic diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pathogen</th>
<th>Current distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downy mildew</td>
<td><em>Peronosclerospora sacchari</em></td>
<td>SE Asia, Pacific Rim</td>
</tr>
<tr>
<td>Grassy shoot</td>
<td>Phytoplasma</td>
<td>S &amp; SE Asia</td>
</tr>
<tr>
<td>Green grassy shoot</td>
<td>Phytoplasma</td>
<td>S &amp; SE Asia</td>
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<tr>
<td>Gumming</td>
<td><em>Xanthomonas axonpodis pv vasculorum</em></td>
<td>Africa, South America, India</td>
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<tr>
<td>Ramu stunt</td>
<td>Unknown</td>
<td>PNG</td>
</tr>
<tr>
<td>White leaf</td>
<td>Phytoplasma</td>
<td>Thailand, Laos, Taiwan</td>
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Contingency plans

Developed:

- To maximise the possibility of disease eradication, or to minimise yield losses if eradication is not possible
- For the highest risk diseases
Whole-plant diseases

The smut plan was used in 1998 when smut reached Western Australia, and in 2006 when it reached eastern Australia.

**National sugar industry biosecurity plan**

Plant Health Australia together with sugar industry groups have developed a national plan for responding to incursions of exotic pests and diseases. Copies of the plan can be obtained from www.planthealthaustralia.com.au.

Outline of plant pest emergency response

1. **Investigation**
   - Detection of new pest, investigation by SRA or state agency, samples collected and identified

2. **Alert**
   - Australia’s Chief Plant Protection Officer notified
   - Quarantine restrictions imposed
   - Impact evaluated and decision made on response

3. **Operational**
   - State agency manages operational responses, e.g. eradication, surveys, trace back, quarantine
   - Local pest control command established

4. **Stand down**
   - Eradication successful or decision made to move to containment and control
   - Containment – quarantine to limit spread to other districts
   - Control – resistant varieties, fungicides, hygiene, plough-out
Queensland minor diseases

Yellow leaf syndrome (YLS)
- Caused by a virus
- Main symptoms: a strong yellowing of the mid-rib
- Symptoms are expressed when the crop is stressed

Sugarcane bacilliform virus (SCBV)
- Caused by a virus
- Main symptoms: a flecking seen on all leaves
- Chewing canes are more susceptible to the disease

Banded sclerotial disease
- Caused by a fungus
- Main symptoms: large round lesions on affected leaves
- The disease is rarely seen and has only minor yield effects
Soil-borne diseases

Hidden

Often soil-borne diseases are unrecognised because they can’t be seen without digging up root systems.

In Queensland, they cause the largest economic losses of any type of disease.

Need for a soil assay

Unless soil or root systems are assessed for disease, there is no way of telling how severe the situation is.

Assay laboratory

A soil-assay laboratory at SRA can conduct assays for:

- Pachymetra root rot
- Nematodes
- Mycorrhizae
- Soil-health indicators

Recommendations are sent with the results to guide the farm disease-control program.

Type of diseases

There are two groups of well-recognised causes for soil-borne diseases:

- Fungi
- Nematodes
# Soil-borne diseases

**Nematode count thresholds (per 200 g soil)**

<table>
<thead>
<tr>
<th>Species</th>
<th>Plant/1 ratoon</th>
<th>2 ratoon</th>
</tr>
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<tbody>
<tr>
<td><strong>Root lesion</strong> <em>(Pratylenchus)</em></td>
<td>300</td>
<td>900-1 000</td>
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<tr>
<td><strong>Root knot</strong> <em>(Meloidogyne)</em></td>
<td>200</td>
<td>400</td>
</tr>
<tr>
<td><strong>Spiral</strong> <em>(Helicotylenchus)</em></td>
<td>500</td>
<td>1 500-2 000</td>
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<tr>
<td><strong>Stubby root</strong> <em>(Paratrichodorus)</em></td>
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<td>500</td>
</tr>
<tr>
<td><strong>Stunt</strong> <em>(Tylenchorhynchus)</em></td>
<td>500</td>
<td>1 500-2 000</td>
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<tr>
<td><strong>Dagger</strong> <em>(Xiphinema)</em></td>
<td>N/A</td>
<td>400</td>
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</tbody>
</table>

**Note:**

- Sub-critical populations may cause problems, particularly on sandy soils
- Soil fertility and water availability are critical factors governing yield losses
- Ideal nutrient and water supply may reduce yield losses
- Keep grasses out of fallow rotations and plant legumes to control most nematode species
Soil-borne diseases

Pachymetra root rot spore count thresholds (,000 per kg soil)

Standing crops

Susceptible varieties (ratings 7-9)

<table>
<thead>
<tr>
<th>Spore Count</th>
<th>Yield Loss</th>
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<tbody>
<tr>
<td>0-30</td>
<td>Nil-low</td>
</tr>
<tr>
<td>30-50</td>
<td>Medium</td>
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<tr>
<td>&gt; 50</td>
<td>High</td>
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Intermediate resistance (ratings 4-6)

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<td>0-40</td>
<td>Nil-low</td>
</tr>
<tr>
<td>40-70</td>
<td>Medium</td>
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<tr>
<td>&gt; 70</td>
<td>High</td>
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High resistance (ratings 1-3)

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<tr>
<td>0-45</td>
<td>Nil yield</td>
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<tr>
<td>45-80</td>
<td>Very low</td>
</tr>
<tr>
<td>&gt; 80</td>
<td>Low</td>
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</table>

Fallow ground

<table>
<thead>
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<td>0-30</td>
<td>Low</td>
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<tr>
<td>30-50</td>
<td>Moderate</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>High</td>
</tr>
</tbody>
</table>
Soil-borne diseases

Soil-assay laboratory: SRA Tully

1. Location

SRA, Dallachy Rd, Hewitt via Tully

Costs

A commercial service is available

*Check current costs with SRA*

2. Forms

Need to be filled in. Information is used to:

- Guide recommendations
- Deliver results
- Populate a database to better understand the disease

3. Transport

Nematodes

Transport conditions are critical for nematode assay samples, as temperatures of 40°C can kill nematodes. Place nematode samples in a cool esky (do not refrigerate) and transport them quickly to the assay laboratory. Ensure forms are fully completed.

Pachymetra root rot

Temperature is not critical and samples can be sent without cooling.

Contact: SRA, Tully. Ph: 07 4088 0704.
Quarantine – State

Boundaries

- Aim to maintain area freedom from pests and diseases
- There are seven pest quarantine areas in Queensland (Queensland Plant Protection Act 1989)
  - These have prevented the spread of some major diseases over an 80-year period
  - Cane movement from Queensland and New South Wales to the Ord River District is strictly controlled
Quarantine – State

*Plant Protection Act (Queensland)*

**Shifting sugarcane**

- No sugarcane stalks, leaves, mulch or unprocessed product may be moved across a quarantine boundary without a permit.
- No cane can enter Queensland without a permit.

**Shifting machinery**

- Any machinery used on a cane farm must be cleaned and inspected before crossing a quarantine boundary.

**New South Wales**

- Movement of sugarcane/machinery from New South Wales to Queensland has the same regulations as for intra-Queensland movement.
- We recommend the same strict regulations for shifting machinery into New South Wales from Queensland.
- Consult a SRA entomologist or pathologist to discuss this.
General

Background

Sugarcane diseases affect thousands of hectares of Australian sugarcane crops each year. Varietal resistance, rather than chemicals, is the main control measure.

What is resistance and tolerance?

• **Resistant varieties** are able to resist infection and/or colonisation by the pathogen

• **Tolerant varieties** are able to yield well even though infected by the pathogen (i.e. there are some tolerant susceptible varieties)

Resistance ratings

1-9 sliding scale:

*There are 3 categories:*

1-3: Resistant

4-6: Intermediate

7-9: Susceptible

All commercial varieties are assessed for resistance to major diseases in specifically designed trials.

Major diseases in Australia

**Viral:** Fiji leaf gall, mosaic

**Bacterial:** Leaf scald, ratoon stunting

**Fungal:** Orange and brown rusts, yellow spot, Pachymetra root rot, pineapple sett rot and sugarcane smut

Minor diseases

Some may become major with the widespread commercial cultivation of a susceptible variety. Details are included in this guide.
General

**Economic effects**

Diseases are generally well controlled in Queensland. Some leaf diseases, and a couple of easily transmitted endemic diseases, still cause significant yield losses each year.

**Abbreviations**

<table>
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<th>Description</th>
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<tr>
<td>SHWT</td>
<td>Short Hot-Water Treatment</td>
</tr>
<tr>
<td>LHWT</td>
<td>Long Hot-Water Treatment</td>
</tr>
<tr>
<td>CSLHWT</td>
<td>Cold-Soak Long Hot-Water Treatment</td>
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**Hot water treatment**

<table>
<thead>
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<th>Treatment Details</th>
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<td>SHWT</td>
<td>50°C for 30 minutes (controls chlorotic streak)</td>
</tr>
<tr>
<td>LHWT</td>
<td>50°C for 3 hours (RSD control)</td>
</tr>
<tr>
<td>CSLHWT</td>
<td>40+ hours in cold water plus 3 hours at 50°C (controls leaf scald)</td>
</tr>
</tbody>
</table>

**RSD**

**RSD transmission capability:** One (1) diseased stick going through a whole-stalk planter may lead to disease in the next 100 planted setts.

**RSD survival time on knives:** Less than 12 days.

**Sanitation**

**Cane knife steriliser** (quaternary-ammonium compounds):

- Clean all metal surfaces thoroughly before applying sterilant at recommended dose
- Allow five (5) minutes contact with the solution to ensure sterilisation
- Supplier: Agricrop Pty Ltd (www.agricrop.com.au)
General

**Methylated spirits** (for rapid sterilisation):

Mix 70 parts ‘metho’ with 30 parts water. This concentration is more effective than stronger solutions.

It provides instant sterilisation (on clean surfaces). The solution does not break down in the short term (period of weeks). It is very suitable for cane knives and other exposed surfaces.

Be cautious regarding the fire hazard. Consider application with a household trigger-pack (spray bottle). Cleaning is still essential.

**Pachymetra root rot**

1. **Spore life**

   Spores (formed in diseased roots) are the main survival structure. These last for up to five years in soil. Keeping spore levels low is important in management. Exposing the soil to the sun will have minimal impact on disease levels.

2. **Distribution**

   Spore levels are much higher in the cane row (up to 20 times higher than in the inter-row).

3. **Transmission**

   The disease has no swimming spore. Transmission into disease-free fields probably occurs through mud on machinery.

4. **Favourable conditions for disease**

   Susceptible varieties, high rainfall, lighter soils (central and southern Queensland more particularly).

**Soil test**

Available through SRA, Tully (commercial service. Recommendations are attached to the results. Turnaround time for the assay is 2 weeks.)
General

Nematodes

1. Populations

Vary greatly through the season and with growth conditions. Growth effects need to be interpreted in the light of plant growth conditions. Can be high even on heavier textured soils.

2. Species

A range of species is found in canefields. Pratylenchus zeae (lesion nematode) occurs in almost all canefields and is the most important. Meloidogyne species (root knot nematodes) are relatively common and are also important.

3. Resistance

Highly resistant varieties have not yet been identified.

4. Control

Is through cultural means (rotation cropping).

5. Soil test

Available through SRA. Samples must be kept cool (less than 35°C) in transit but do not refrigerate. Advise SRA by fax (07 4068 1907) of samples sent. Recommendations are included with the results.

Approved seed plots

These are propagation plots in each mill area comprising the main commercial varieties that have been subject to:

- Hot-water treatment (to eliminate systemic diseases such as RSD and leaf scald)
- Inspections for other diseases and correct identity

It is very important for farmers to regularly access approved seed plot material to minimise disease incidence and yield losses.
resulting from RSD (and other systemic diseases). Plots are usually organised for each mill area by Cane Productivity Service staff.

**Disease inspections**

Critical in propagation plots to avoid widespread infection in a whole region.

**RSD**

The following is a guide to sampling for RSD in approved seed plots.

- Sample 50-100 stalks/variety
- Bulk extracts into 12-25 samples
- Plots of varieties less than 200 m require 10-50 samples

Vascular extracts are normally assayed using the ELISA-based assay. Either add a preservative (a drop of formalin, or savlon) or freeze the samples. Send samples to the assay laboratory at SRA Indooroopilly.

**Other diseases**

Inspect for other diseases, and impure varieties, by walking each plot at least 3 times each year (young cane/advanced tillering/10-12 months of age).
**Chimera**
Genetic variation with thin white streaks and very definite, sharp margins

**Chlorosis**
Absence (partial or complete) of normal green colour

**Gall**
A localised proliferation of tissue producing a swelling

**Halo**
Ring of chlorotic tissue around a lesion
Glossary

**Lesion**
A localised area of diseased tissue

**Necrotic tissue**
Dead tissue

**Pencil line**
Discoloured single vascular bundle in a leaf (leaf scald)

**Root knot**
Knobby growth on roots
Glossary

Runner
Chlorotic or necrotic tissue extending away toward the leaf tip from a lesion

Spore
Fungal reproductive structure (equivalent to seed)

Systemic
Occurring throughout the plant (photo is example only)

Whip
A black whip structure arising from the apical growing point
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Yellow leaf syndrome (YLS) ................................................................. 82, 105
Yellow spot ......................... 8, 19-21, 24-26, 27, 35, 66-67, 69-71, 89

Z

Zonate leaf spot ...................................................................................... 10, 28-29, 35, 68, 105
SRA would like to thank the following people for use of photographs from their collection:

<table>
<thead>
<tr>
<th>Scientist</th>
<th>State/Country</th>
<th>Disease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jack Comstock</td>
<td>Florida, USA</td>
<td>Brown rust</td>
</tr>
<tr>
<td>Salem Saumtally</td>
<td>Mauritius</td>
<td>Brown spot</td>
</tr>
<tr>
<td>Philippe Rott</td>
<td>France</td>
<td>Zonate leaf spot</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Veneer blotch</td>
</tr>
<tr>
<td>Brenden Blair</td>
<td>Australia</td>
<td>Nematodes</td>
</tr>
<tr>
<td>Anusorn Kusalwong</td>
<td>Thailand</td>
<td>White leaf</td>
</tr>
<tr>
<td>Jeff Hoy</td>
<td>Louisiana, USA</td>
<td>Pythium root rot</td>
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<tr>
<td>Mike Grisham</td>
<td>Louisiana, USA</td>
<td>Mosaic</td>
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<tr>
<td>Ben Lockhart</td>
<td>Wisconsin, USA</td>
<td>Yellow leaf syndrome</td>
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<tr>
<td>Hideo Koike</td>
<td>Louisiana, USA</td>
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<td></td>
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<td>Veneer blotch</td>
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<tr>
<td>CT Chen</td>
<td>Taiwan</td>
<td>White leaf</td>
</tr>
<tr>
<td>R Viswanathan</td>
<td>India</td>
<td>Grassy shoot</td>
</tr>
<tr>
<td>John Randles</td>
<td>Australia</td>
<td>Striate mosaic</td>
</tr>
</tbody>
</table>

We would also like to thank CIRAD and ISSCT for the supply of photographs from their collections, and the Queensland Government for their support of RD&E into endemic and exotic sugarcane diseases.
Further information


**Website**

Sugar Research Australia

www.sugarresearch.com.au
## Metric conversion table

<table>
<thead>
<tr>
<th>Metric</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>25.4 mm</td>
</tr>
<tr>
<td>1 foot</td>
<td>0.305 m</td>
</tr>
<tr>
<td>1 chain</td>
<td>20.117 m</td>
</tr>
<tr>
<td>1 chain/acre</td>
<td>49.709 m/ha</td>
</tr>
<tr>
<td>1 mile</td>
<td>1.609 km</td>
</tr>
<tr>
<td>1 mile/gallon</td>
<td>0.354 km/L</td>
</tr>
<tr>
<td>1 pound</td>
<td>0.454 kg</td>
</tr>
<tr>
<td>1 hundredweight</td>
<td>50.803 kg</td>
</tr>
<tr>
<td>1 ton</td>
<td>1.016 t</td>
</tr>
<tr>
<td>1 ton/acre</td>
<td>2.511 t/ha</td>
</tr>
<tr>
<td>1 bag/acre</td>
<td>123.550 kg/ha</td>
</tr>
<tr>
<td>1 acre</td>
<td>0.405 ha</td>
</tr>
<tr>
<td>1 fluid ounce</td>
<td>28.410 mL</td>
</tr>
<tr>
<td>1 gallon</td>
<td>4.546 L</td>
</tr>
<tr>
<td>1 gallon/acre</td>
<td>11.233 L/ha</td>
</tr>
<tr>
<td>1 mile/hour</td>
<td>1.609 km/h</td>
</tr>
<tr>
<td>1 horsepower</td>
<td>0.746 kw</td>
</tr>
<tr>
<td>1 pound/square inch</td>
<td>6.897 kPa</td>
</tr>
</tbody>
</table>

**Poisons information**  
13 11 26  
Material Safety Data Sheets  
msdsonline.com
The *Diseases of Australian Sugarcane Field Guide* contains simply presented information and photos on the sugarcane diseases in Australia. All Australian diseases of importance are included, along with major exotic diseases in neighbouring countries.

The guide is designed for researchers, extension and quarantine staff, as well as farmers, harvester operators, consultants, private contractors and agribusiness personnel.