Sugarcane smut in Queensland

Research outcomes

Rob Magarey, Darryl Denney, Tanya Sheahan, Kathy Braithwaite and Kim Lonie

BSES Limited
Disease epidemics

Chronology

- incursion / first disease detection
  - panic!
- hard work / regulation / rapid research
- variety transition
- plough-out heavily-diseased crops
- ‘comfortable continuing actions’
- industry loses interest
- Virtually forgotten!

Different diseases – same elements!
Smut presentations x time

Number of presentations

Year

- June
- July
- August
- September
- October
- November
- December
- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December

2006 2007 2008 2009 2010
Smut presentations x time

Number of presentations

Panic!

Year

2006 2007 2008 2009 2010
Smut presentations x time

Research – extension!

Year

Number of presentations

2006 2007 2008 2009 2010
Smut presentations x time

Year

Number of presentations

Comfortable implementation
Smut research

Four main areas

- Disease detection: spore trapping
- Assessment of speed of spread / escalation
- Accelerated variety resistance selection and adoption
- Industry yield loss assessment
1. Spore trapping

**Early warning**

**Principle:** filtering of spores from atmosphere for remote detection

- Symptoms difficult to see
- Commercial traps available
- Molecular test developed
How much early warning?

<table>
<thead>
<tr>
<th>District</th>
<th>Spores detected</th>
<th>Crop symptoms identified</th>
<th>Warning time (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mossman</td>
<td>July 2007</td>
<td>December 2008</td>
<td>18</td>
</tr>
<tr>
<td>Tableland</td>
<td>July 2008</td>
<td>September 2008</td>
<td>0-2</td>
</tr>
<tr>
<td>Mulgrave</td>
<td>July 2008</td>
<td>September 2008</td>
<td>1-2</td>
</tr>
<tr>
<td>Burdekin</td>
<td>April 2007</td>
<td>October 2008</td>
<td>18</td>
</tr>
<tr>
<td>Proserpine</td>
<td>July 2007</td>
<td>December 2007</td>
<td>6</td>
</tr>
<tr>
<td>Maryborough</td>
<td>March 2007</td>
<td>January 2008</td>
<td>9</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
<td>&gt; 24</td>
</tr>
</tbody>
</table>
Spore trapping conclusions

- Successfully predicted smut presence

- Trapping - more sensitive than finding symptoms

- Extra time for farmers to prepare for smut
  - opportunity to fast-track to resistant canes
2. Smut epidemiology

Drivers of the epidemic

- How fast it spreads (new farms)
- How quickly it builds up (highly susceptible crops)

Key parameters of interest for farmers!
Herbert:
March 2007
• Around 800 farms
• Over 60,000 ha
Herbert:
February 2008
Smut progress

- < 2 years after first detection to reach all farms

- 2-3 years (highly susceptible crop) to infest all stools
  - *varies with district*
    - slower - high rainfall (wet tropics)
    - also affected by resistance!
Smut spread
Different districts

Tully vs Herbert

Number of farms

Time (days)
Modeling the epidemic
3. Resistance screening

Started before smut reached Australia
- Indonesia (1999)
- Limited Australian varieties
- Harder to screen large numbers off-shore

High percentage S commercial canes in Australia

- Rapid screening in Bundaberg (after first detection)
Smut resistance screening

‘Smutbuster’ program

- Led by other BSES scientists

- 2x original program
  - Used selected resistant parents
  - Screened progeny in rapid screen trials

- Also used S x S crosses
  - To recover high-yielding genes!
4. Yield loss studies (Herbert)

3 smut severity x yield loss estimates
1. On individual plants (stools)
2. On whole plots within the same commercial crop
3. On the whole crop (mean severity x yield loss)
Effect of smut severity (0-4 scale) on individual plants

\[ y = -0.7593x^2 + 0.8742x + 10.167 \]
2. Effect on whole plot yield

\[ y = -15.567x + 99.657 \]
3. Average yield loss - whole crop

• Assessed average severity across whole crop
  ▫ 20 representative plots
  ▫ average smut severity score: 1.6

• Related this to yield
  • the average smut-induced yield loss for the whole crop = 26%.
Predicted yield losses

Herbert region losses:

• **2009 crop losses:** estimated at 250,000 tonnes

• **2010 losses:** estimated at >300,000 tonnes cane.
  - *In 2010:* > 30% of Herbert crop supplied by HS varieties, and
  - smut severe in these crops.
Modelled annual losses

Annual losses from smut ($) at tippler

$\text{m lost revenue}

Year

Variety solution
No variety solution
Smut conclusions

As an industry

• Strategy has done well! Losses limited

• Good management strategy adopted by industry

• Favoured by good replacement varieties (Q208, KQ228 and Q200)

• With on-going sensible strategy, sugarcane industry will emerge well!