Preparations to help protect the Australian sugarcane industry from exotic diseases and pests

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The issues

- Australian sugarcane industry is relatively free of some major pests – e.g. moth borers
- In addition, a number of important diseases are present in PNG and Indonesia
- 'Shut the gate' before the horse bolts. We need to be pro-active to minimise probability of an incursion
- Two projects preparing our industry for the 'next incursion':
  - one in PNG, the other in Indonesia



PNG project objectives

- Develop/refine resistance screening tests for *Sesamia grisescens*, downy mildew and Ramu stunt
  - particularly rapid testing
- Refine diagnostic tests for downy mildew and Ramu stunt
- Examine pathogen variation with these diseases
- Update incursion management plans



Indonesia project objectives

Similar objectives



Main targets

Moth borers:

- *Chilo sacchariphagus*
- *Chilo auricilius*
- *Scirpophaga excerptalis*

Sugarcane streak mosaic virus

Sesamia grisescens

- A serious threat and the most important moth borer in PNG
- Australia is one of just a couple of countries without a serious borer problem
- Management of *Sesamia* in PNG includes use of resistant varieties, natural enemies, cultural control and insecticides
- Of these, resistant varieties most applicable to Australia



Sesamia

- Field trials planted were planted at Ramu Agri-Industries in 2010/2011
- Significant differences in damage among clones, for all borers
- Varietal ratings correlated among trials – more work needed
- Artificial infestation in pots being investigated as alternative to field screening



Preliminary results

Variety	% bored internodes	Variety	% bored internodes
Q183[A]	3.9	Q230[A]	9.1
Q219[A]	4.3	Q113	9.2
Q215[A]	4.8	Q124	10.0
Q136	5.1	Q203[A]	10.4
Q220[A]	5.6	Q231[A]	10.7
Q127	6.6	Q198[A]	11.3
Q224[A]	7.4	Q121	13.0
Q190[A]	7.7	Q213[A]	14.8
Q209[A]	7.9	Q182[A]	17.7
Q87	8.0	Q135	18.6
Q107	8.6		

Rapid pot tests



Ramu stunt



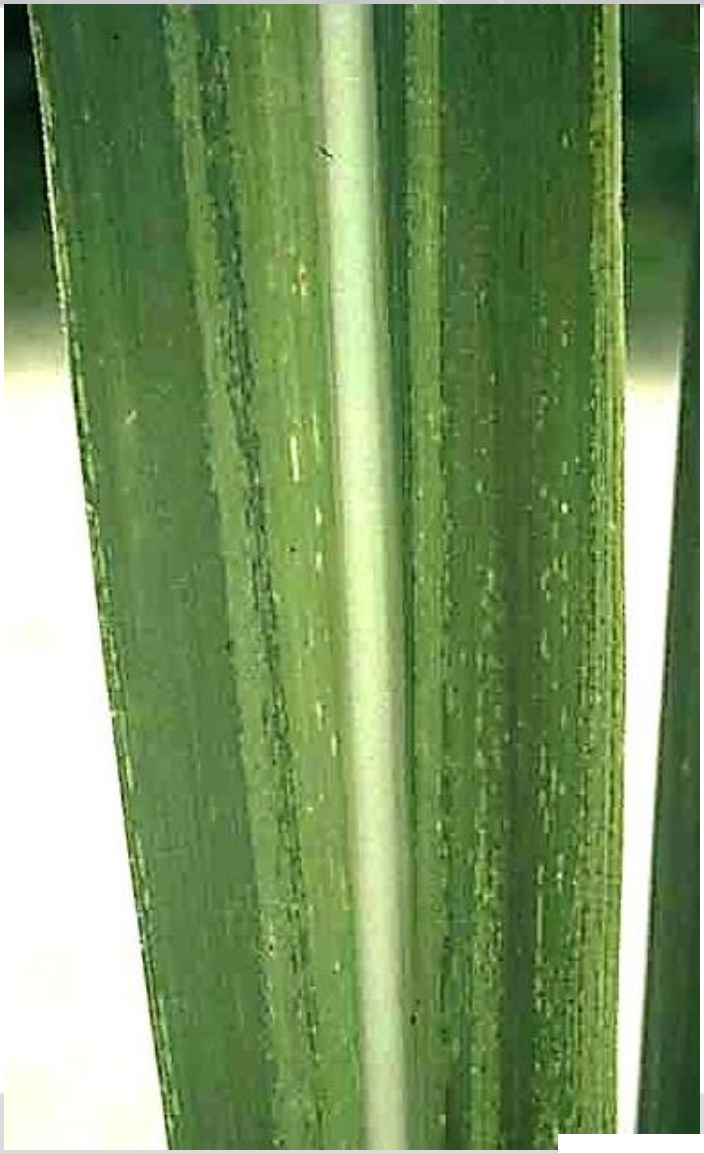


- Symptoms include chlorotic stripes, streaks, stunting and ratoon failure
- Transmitted by *Eumetopina flavipes*
  - Occurs in Torres Strait / tip of Cape York
- BSES research has shown the disease is caused by a virus
- Test validated during the project



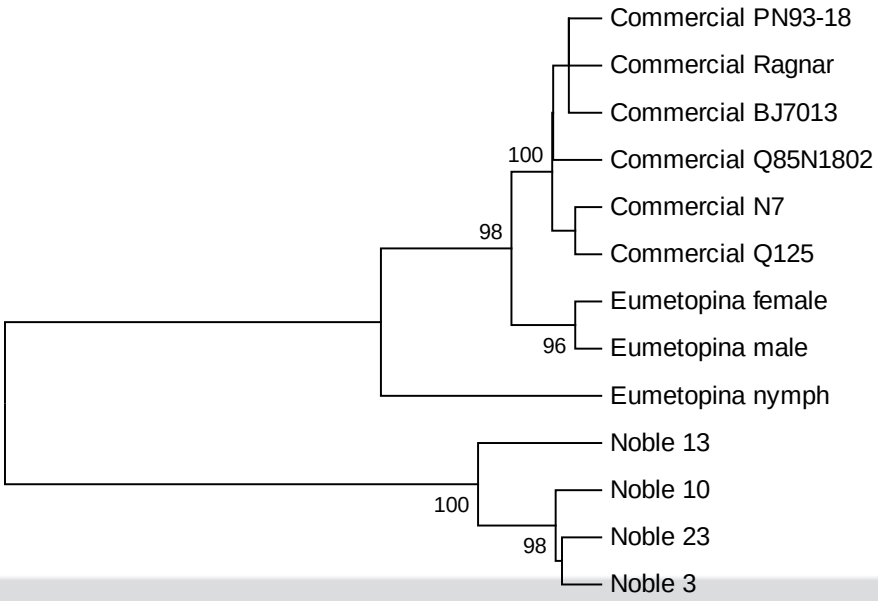
Further research

- Testing where and when plants may be assayed
  - Growth stage / time of year
- Testing variation in pathogen in PNG
- Confirming transmission – Koch's postulates



- Ramu stunt found *S. officinarum* in the Ramu valley survey
- Some variation detected in viral isolates
  - from commercial canes, noble canes and *E. flavipes*





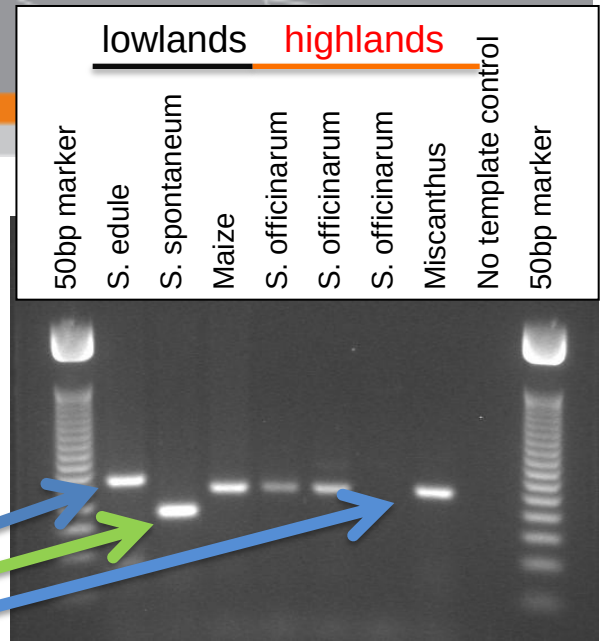
Downy mildew

- Caused by *Peronosclerospora* genus
  - *P. sacchari*, and *P. philippinensis* known sugarcane pathogens
- Symptoms: leaf stripes / leaf shredding
  - white ‘down’ on underside of leaves
  - early in morning
- Infects other crops / wild species
  - e.g. corn (maize) and *Miscanthus*



DM pathogen research

- PCR test developed to test for differences in strains / species in PNG
- At least 2-3 variants
  - Appears to be based on location, not symptom or the host plant
- Diagnostic test – for ID with disease incursion





Indonesia research

Sugarcane streak mosaic (SSMV)

- **Vectors tested potential insects**
  - **2 definite aphid vectors:**
    - ***Toxoptera melanaphis***
    - ***Melanaphis sacchari*.**
- **Evidence of cane knife transmission**
  - ***Very important in etiology***
- **General incidence in fields**
  - **SSMV > 85% of mosaic samples**
    - **Important virus to Australia**
    - **Now recorded in West Papua**
    - **Don't yet know how our varieties react**



Disease resistance

- Tests for downy mildew and Ramu stunt conducted since mid-1980s
- Urgent need to refine / speed tests
- Aim to have ratings for 100+ Australian commercial varieties by project end
- Considering field plus shade-house tests for downy mildew



Resistance - progress

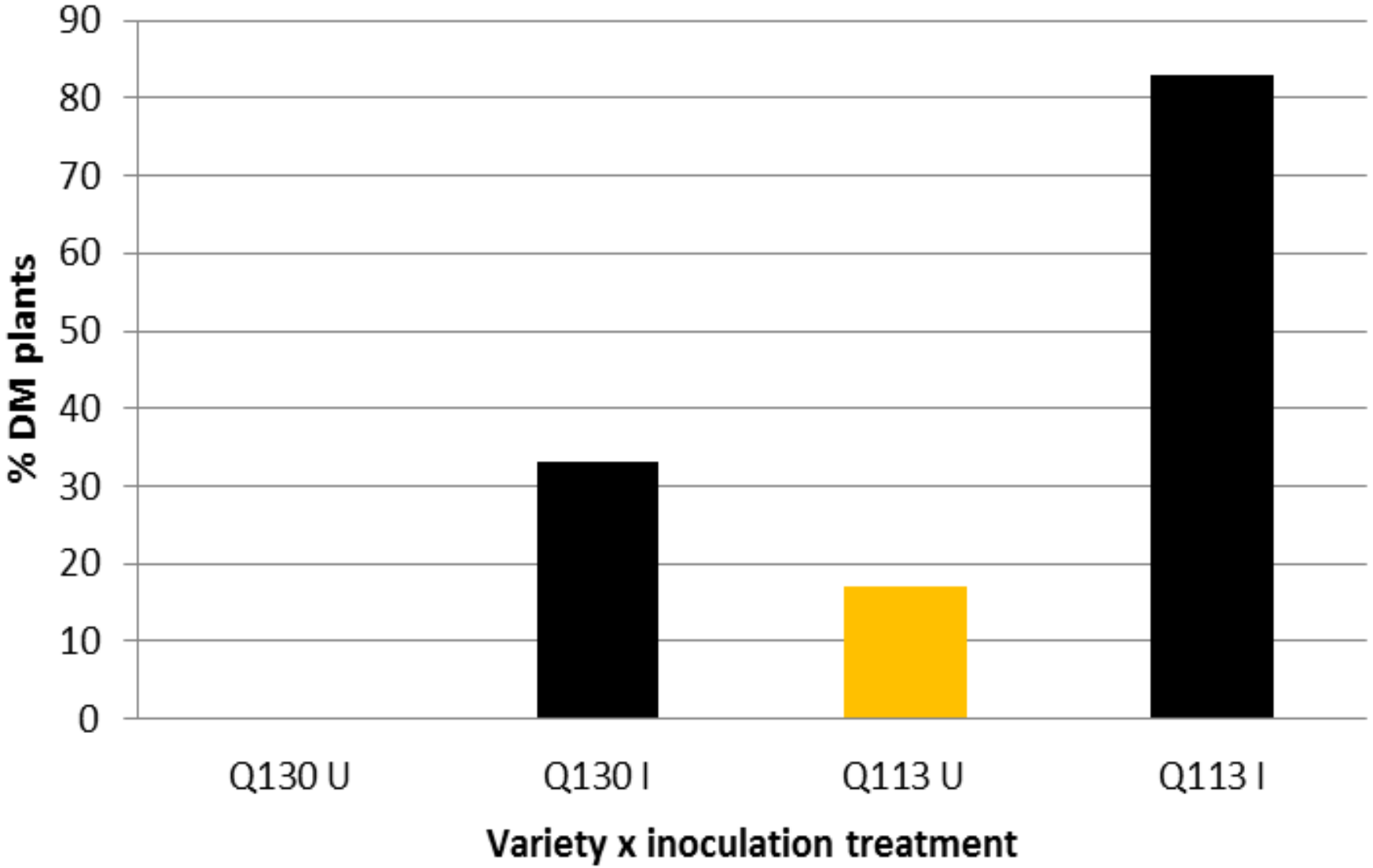
- Difficulty making field tests more reliable
  - but adjusting infection sources, timing of planting, trial designs
- Downy mildew rapid screen: two shade-house methods offer promise
  - One uses asexual spores showering onto test plants
  - The other is a first-time use of oospores (sexual spores) in soil
    - **both look promising**



Resistance (field) - progress

	%DM stools			%DM stools	
Standards	**Plant**	**First ratoon**	**Test**	**Plant**	**First ratoon**
H58-5301	0.0	9.3	Q127	4.2	25.1
RQ117	4.3	6.4	Q135	5.4	9.0
Q121	5.3	35.2	Q136	2.9	12.0
S17	4.7	10.7	$Q182^{A}$	31.7	42.0
Cadmus	0.0	23.9	$Q183^{A}$	18.8	29.9
Q107	10.0	6.8	$Q190^{A}$	7.8	23.5
Q130	12.5	23.7	$Q198^{A}$	5.6	22.8
Q88	15.9	32.3	$Q203^{A}$	0.0	5.7
Q82	10.7	20.9	$Q209^{A}$	6.3	10.7
Q113	14.6	23.5	$Q215^{A}$	26.7	42.8
Q87	13.1	35.4	Q219	15.8	40.0
			$Q220^{A}$	6.8	13.2
			$Q224^{A}$	6.8	22.0
			$Q230^{A}$	1.9	4.0
			$Q231^{A}$	6.2	19.4

Rapid test – oospores



Future work

- Refining field trials
  - Sesamia
  - DM
  - Ramu stunt
- Researching shade-house trials with Sesamia
  - Inoculation techniques
  - Shade house conditions
- Rapid test for DM
  - Assessing oospore inoculations
  - Conidia showers on test plants
- Assessing pathogen variation



General goals

- Refining field trials
- BSES staff gaining valuable experience with exotic pests/diseases
- Control measures being researched / refined
- Resistance ratings being generated for Australian commercial varieties
- Most important exotic threats identified

