# Screening for sugarcane smut in Australia – smut to SmutBuster

**Shamsul A Bhuiyan, Barry J Croft, Mike C Cox, Rob C Magarey**

Australian Government
Sugar Research and Development Corporation

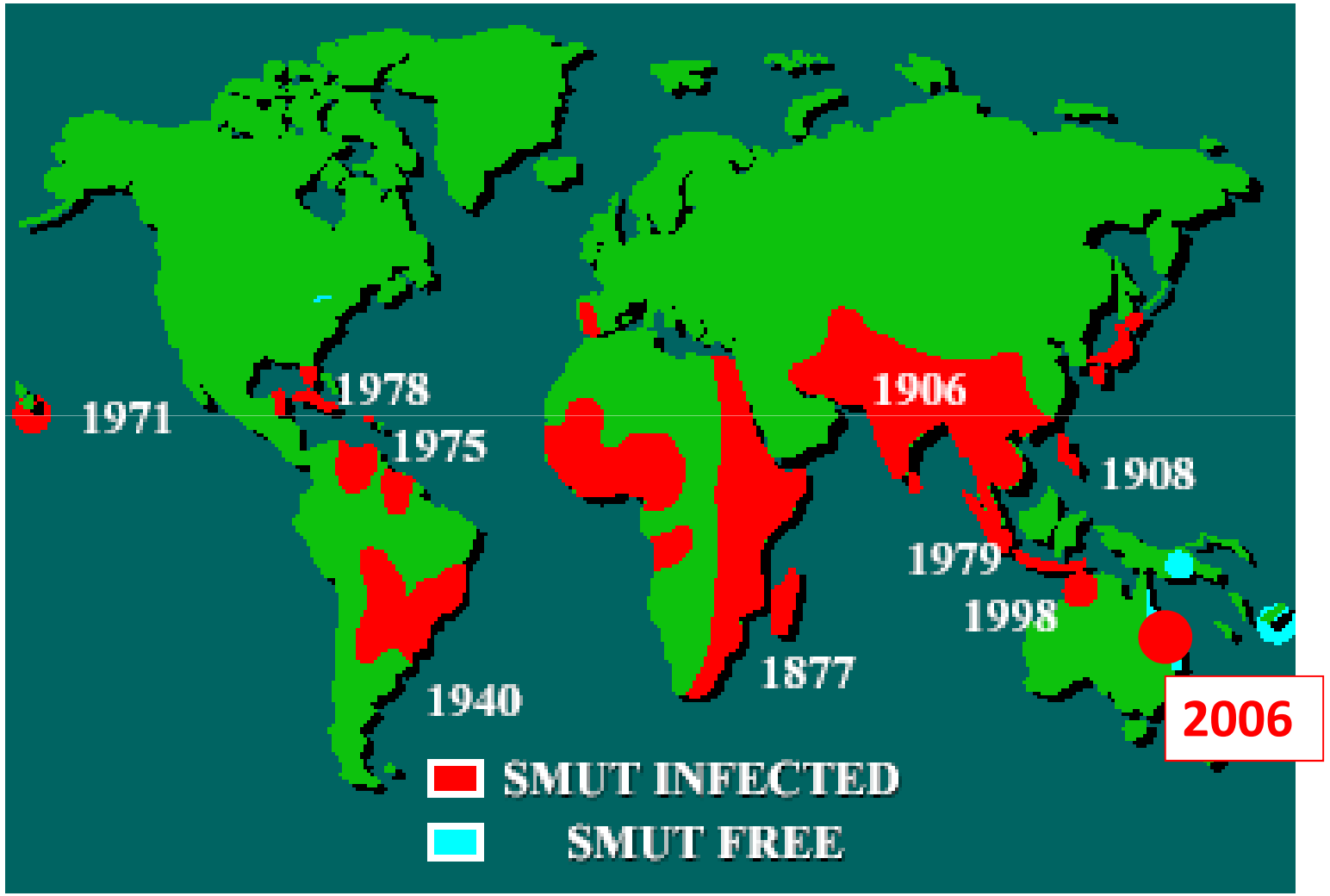
CSIRO PLANT INDUSTRY

BSES Limited

# Outline of the talk

- Sugarcane smut world distribution
- Incursion and spread in Australia
- Impact of smut on breeding program
- Screening for smut resistance
- SmutBuster program
- SmutBuster program and core program
- Summary

# Sugarcane Smut–world distribution



# Incursion and spread in Australia

- Sugarcane smut was identified on a farm near Childers on Friday 9 June 2006

Bundaberg/Childers

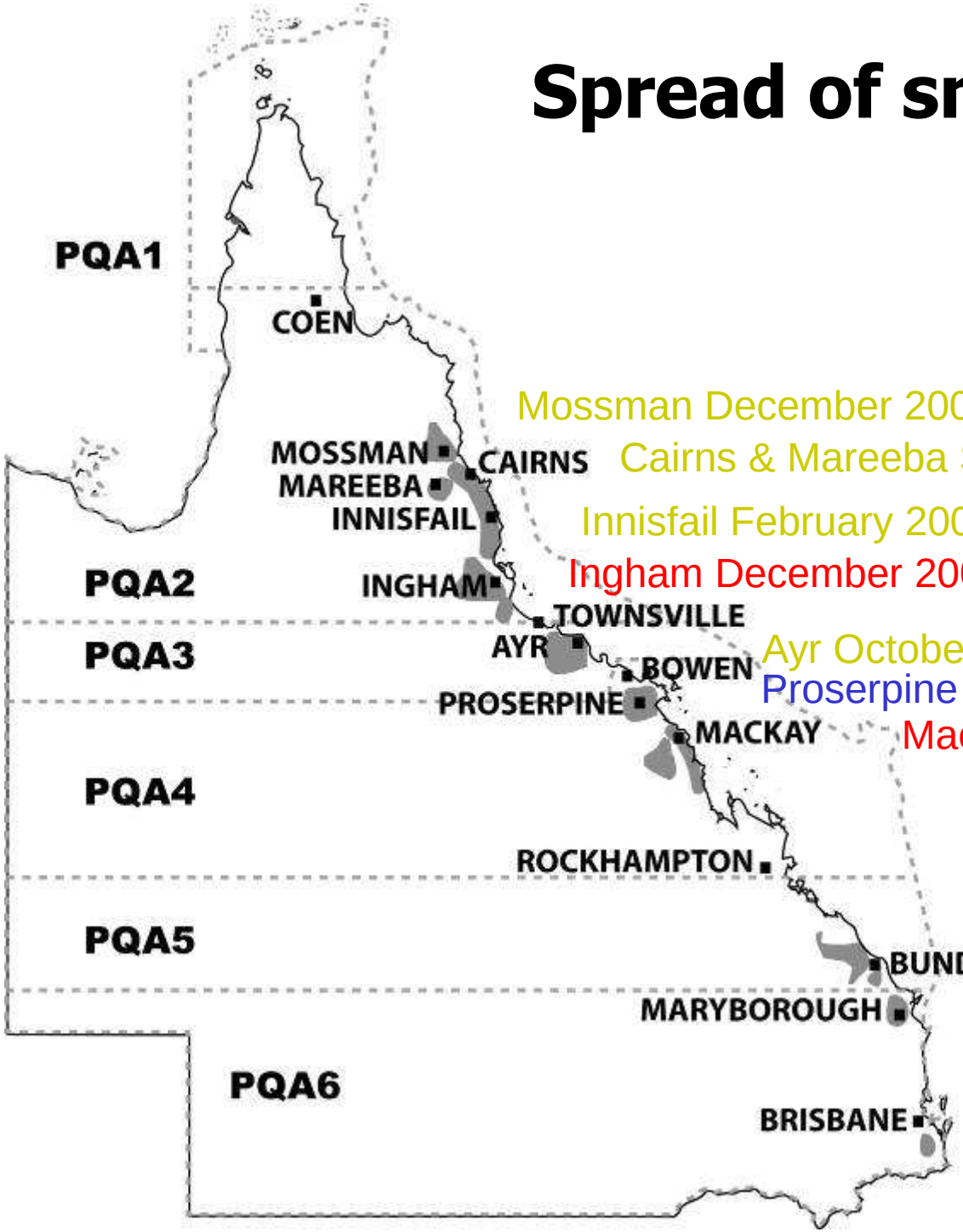
- Subsequent trace back suggests the disease was present in the region in 2003/04



***Whip found at Childers***

# Spread of smut






Mossman December 2008

Cairns & Mareeba September 2008

Innisfail February 2008

Tully October 2008

Ingham December 2006

Ayr October 2008

Proserpine December 2007

Mackay November 2006



Bundaberg June 2006

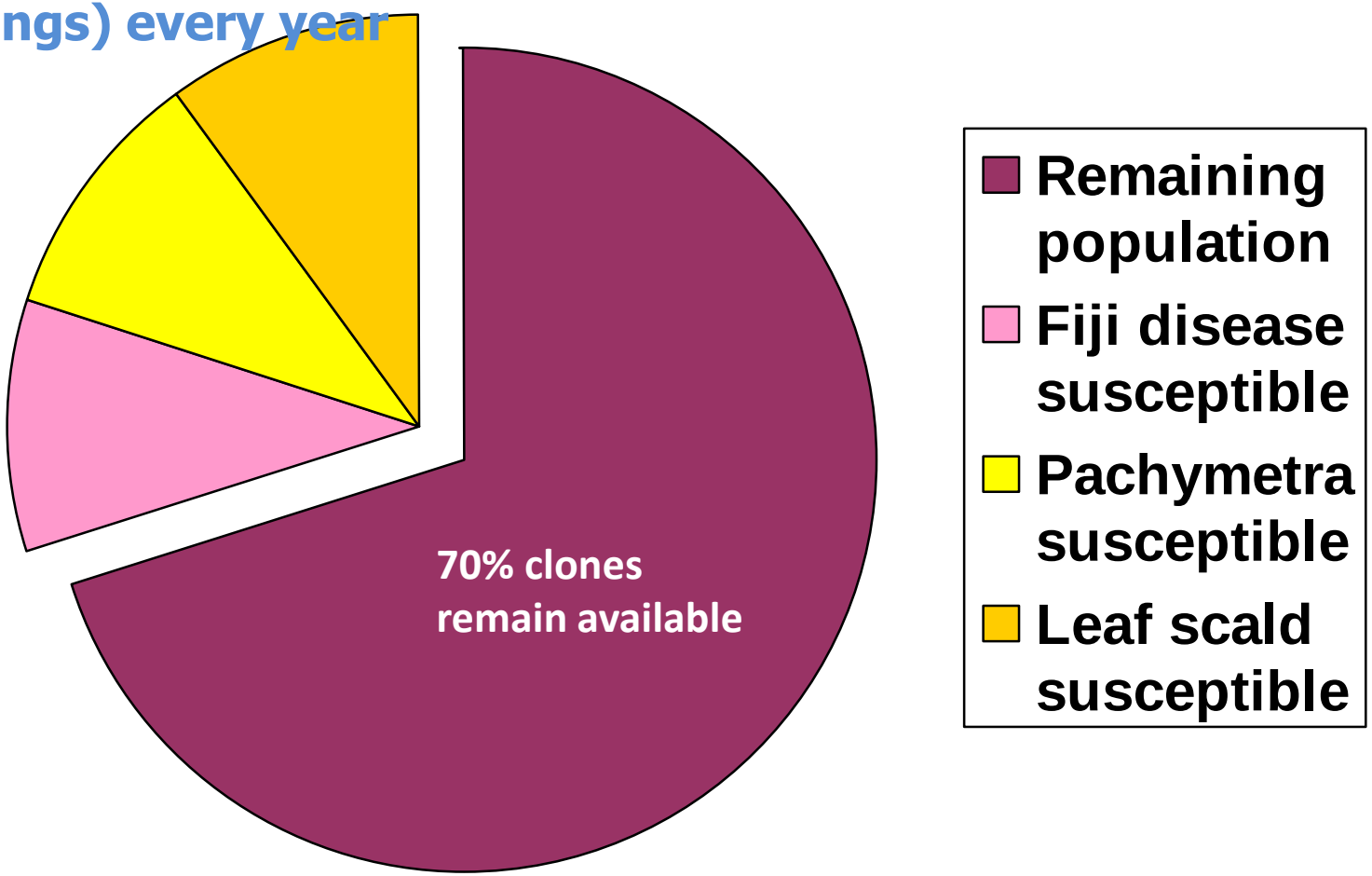
Maryborough November 2007

Rocky Point November 2009

Condong (NSW) November 2009

# Impact of smut on breeding program

**Plant breeders start with 120,000 potential new varieties (seedlings) every year**

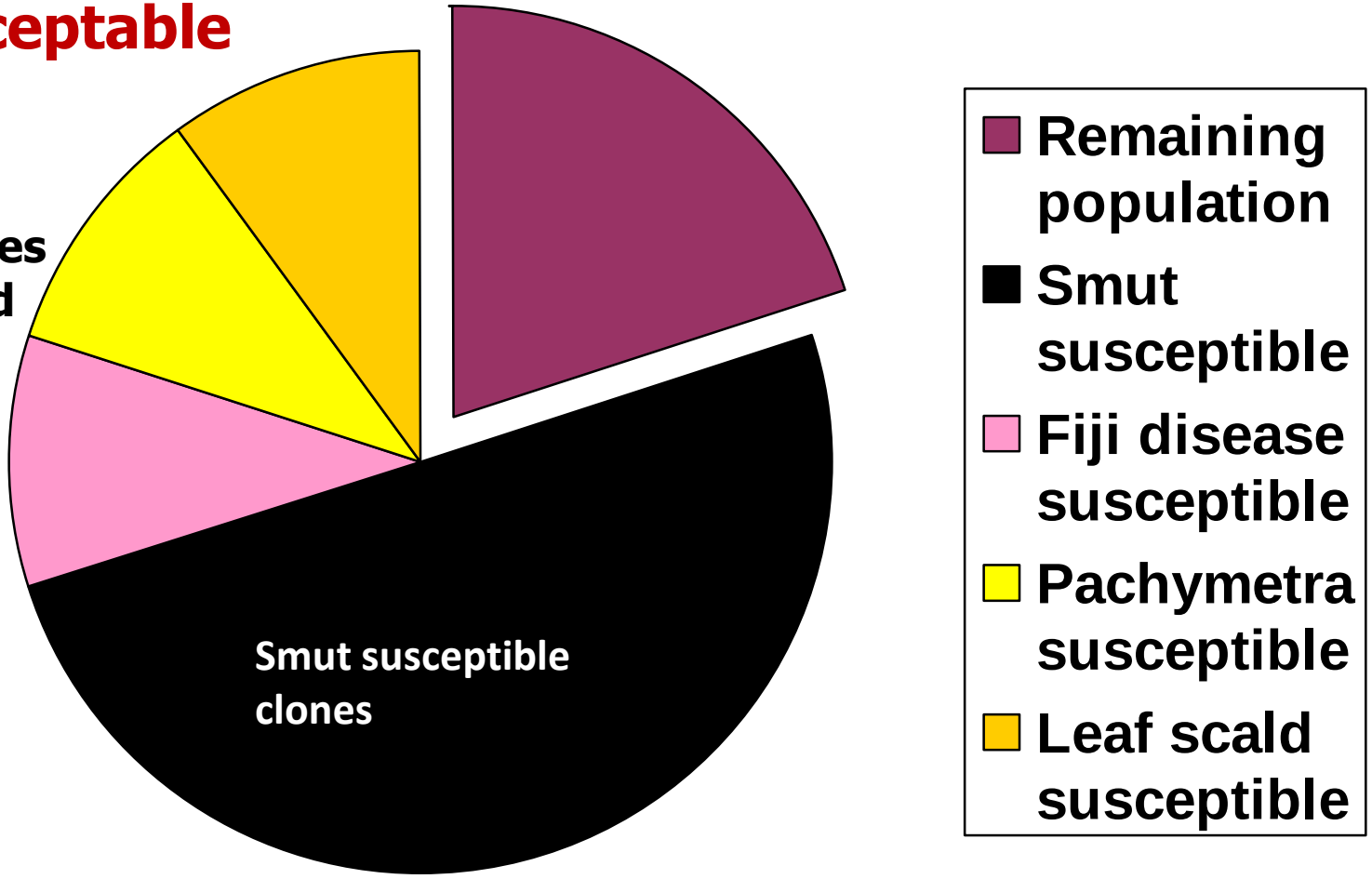



**The situation before smut - Parents selected for resistance to diseases. An acceptable loss of disease susceptible clones**

# Impact of smut on breeding program

**After smut the loss of disease susceptible clones is unacceptable**

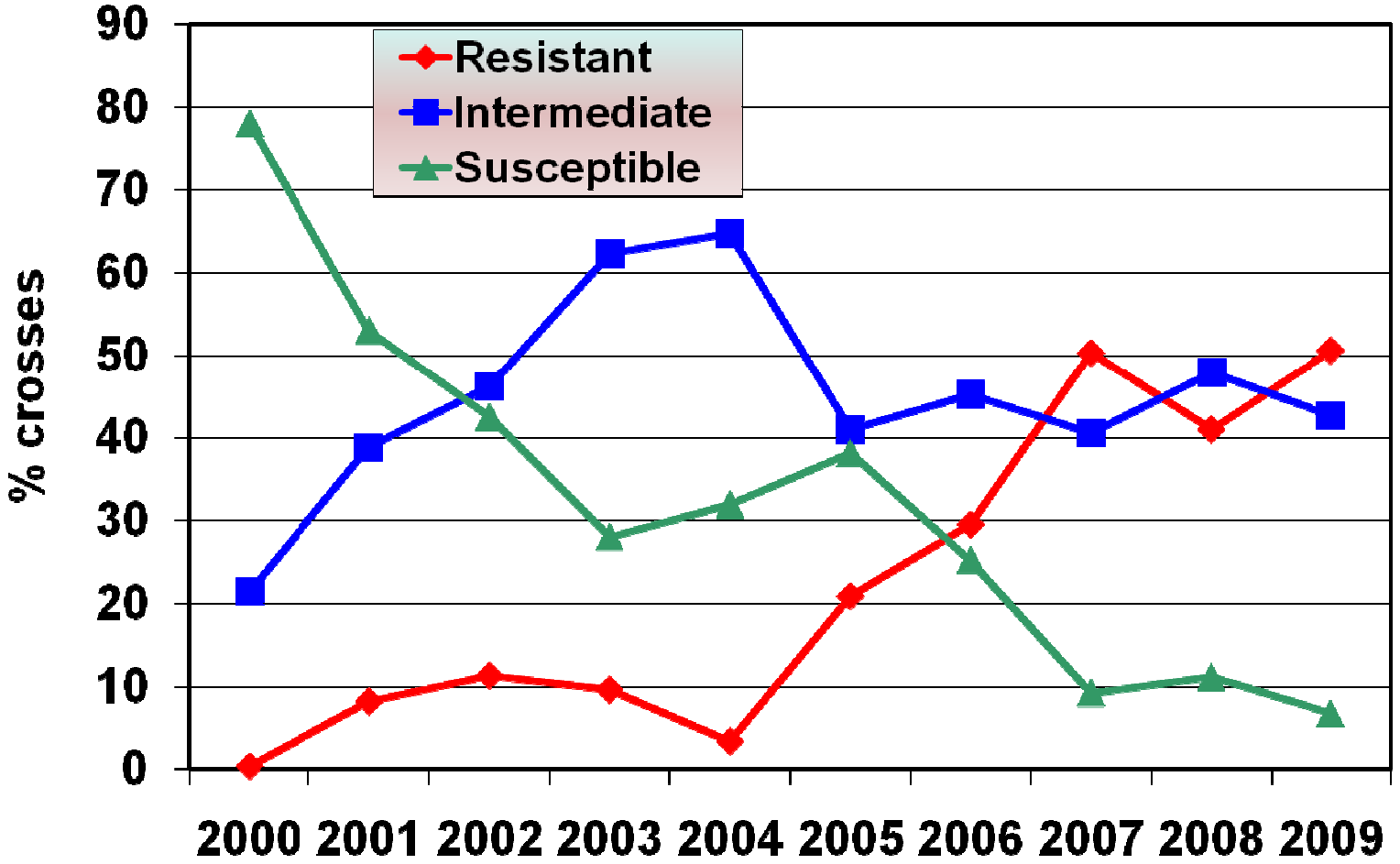
**Many high yielding clones are discarded**




**Smut will require a major shift in the starting population to maintain advances in productivity**

# Screening for smut resistance

## Pre-incursion strategy – breeding



# Screening for smut resistance

## Pre-incursion strategy – smut screening

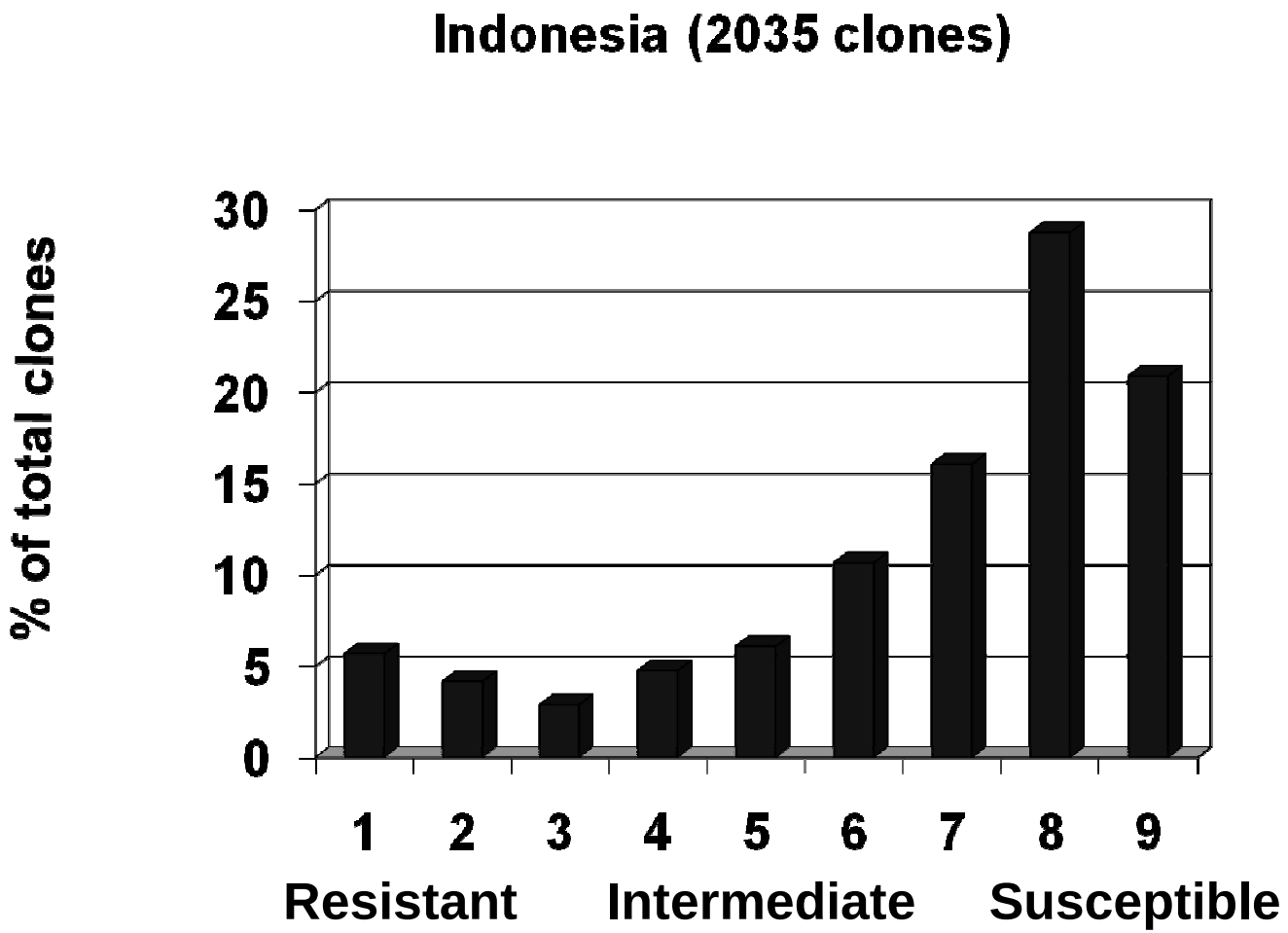
- BSES negotiated a contract with the Indonesian Sugar Research Institute to conduct smut resistance screening of Australian clones in 1997
- BSES commenced screening varieties for smut resistance in Indonesia in 1998
- 10 year program finished in 2008, >2000 clones screened for resistance
- Smut resistant varieties identified in Indonesia have been basis of response to smut epidemic





# Screening for smut resistance

## Pre-incursion strategy – smut screening



# Screening for smut resistance

## Post-incursion strategy

**BSES adopted a strategy to:**

- increase resistance of crosses in breeding program
- increased importation of smut resistant varieties from overseas
- Resistant commercial varieties were identified and propagated in all areas

# Screening for smut resistance

## Post incursion strategy – screening for resistance in Australia

- BSES has been conducting smut screening trial in Australia since 2006
- Whips are collected and dried in a chamber at 12% RH and 12°C
- Spore viability is >90%
- One-eye setts of the test clones are dipped in the spore suspension





# Screening for smut resistance

## Smut screening method for sugarcane



Receive canes



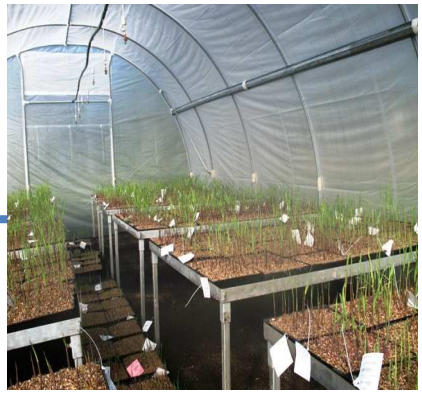
Processing



Inoculation



Incubation at 30°C



In polytunnel



On bench



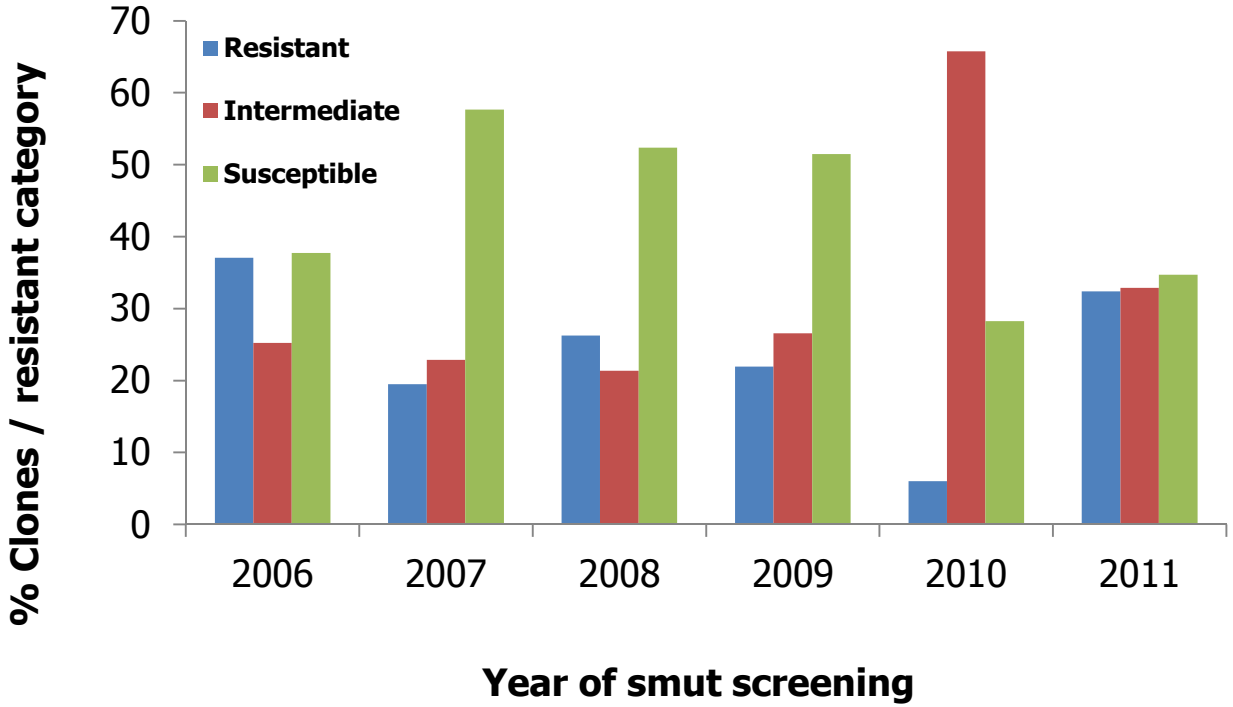
Planting



Rating

# Screening for smut resistance

Smut screening, Australia, 2006-2011
10,800 Clones



# SmutBuster program

- Research suggested that **6-20% of clones from crosses between smut susceptible parents are resistant (Chao *et al.,* 1990; Wu *et al.,* 1983)**

- SmutBuster project commenced to identify low percentage of resistant progeny from high breeding value SxS, SxI and RxS crosses by rapidly screening of clones from these crosses in stage 1

# SmutBuster program

- 5 week old seedlings (30,000) are inoculated by dipping whole seedling in smut spore suspension
- After 12 months any infected seedlings are discarded
- One 3 eye sett is selected from each disease-free seedling of good appearance and is dip inoculated for a second smut screen (10,000)
- Only clones disease-free after 2 years are selected for yield trials





# SmutBuster program and core program

## Core program

- Based on smut-resistant parents (R*R/I)
- Stage 1 – family and within family selection (4 regions)
- Stage 2 – clonal assessment trials (2500 x 4 regions*)

* Different clones

Double

## SmutBuster program

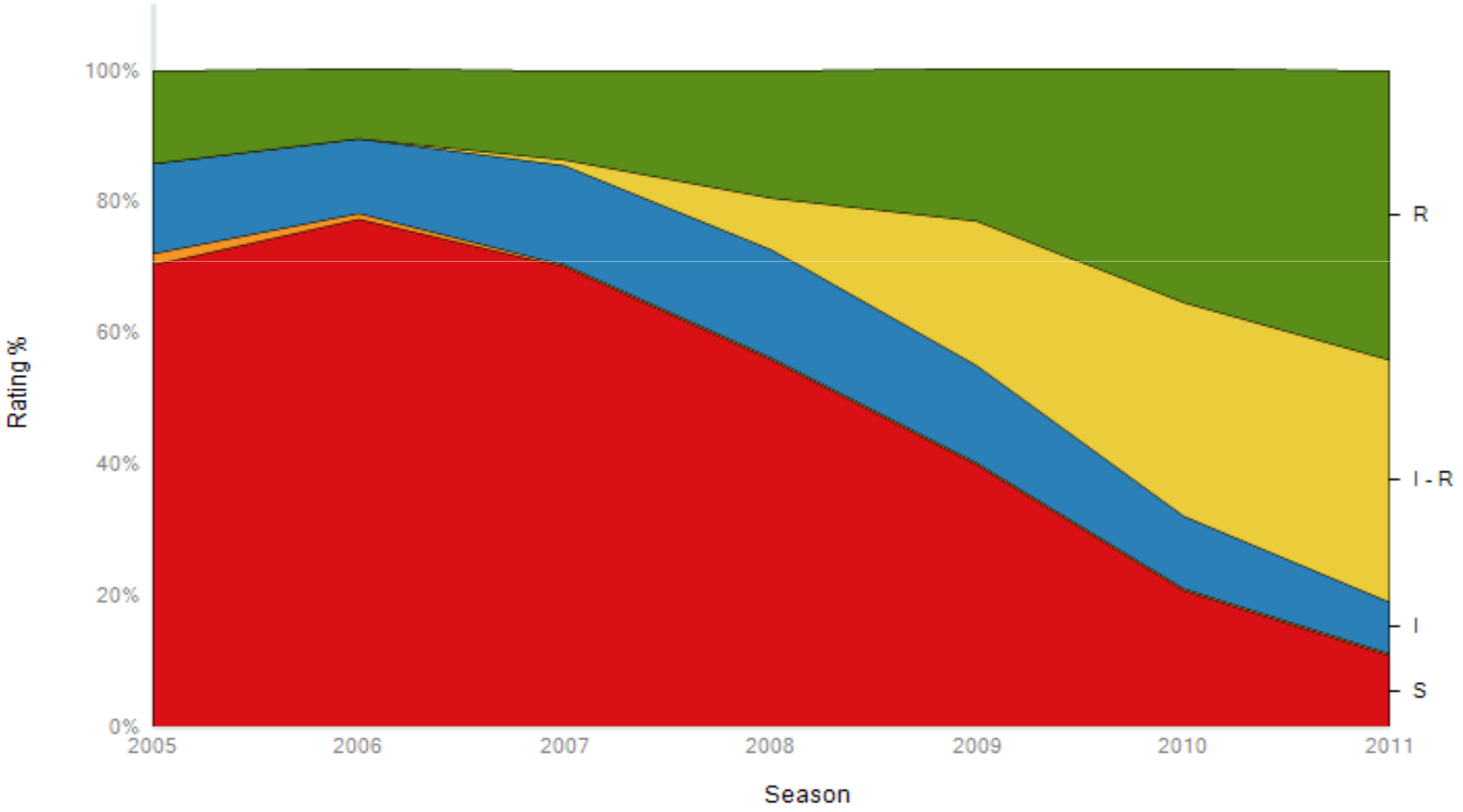
- Based on high BV smut-susceptible parents (S*S/I)
- Stage 1 – seedling and clonal screens for smut (30,000 x 1)
- Stage 2 – clonal assessment trials (2500 x 4 regions**)

** Common clones

- 400 tentative selections (x4) screened for smut
- Stage 3 final assessment trials (150 x 4 regions)


A$2M provided by SRDC and A$1M provided by DPI$F

# Current variety situation – An example: Bundaberg-Isis



# In summary

- Sugarcane smut has a huge impact on Australian sugar industry
- The size of the BSES's breeding program doubled
- Screened over 11,000 clones and 120,000 true seedlings for smut during 2006 - 2011
- A number of good smut resistant varieties are delivered to the Industry
- Most of the mill areas are replacing smut susceptible varieties with resistant ones

# Acknowledgements


- SRDC partly funding this work

- BSES staff: Thanks to Vicki Barden, George Bade, Simon Manson, Dennis Taylor, Alison Findlay, Rebecca James, Richard Cervellin, Peter Hansen, James Geizler, Gilbert Permalloo, Brendan Rae, Rod Fletcher, Catherine Kettle, Greg McGrath and  all staff at Bundaberg experimental station