Sugar Research Australia



Strategy for importing and assessing foreign varieties in the SRA breeding and selection program

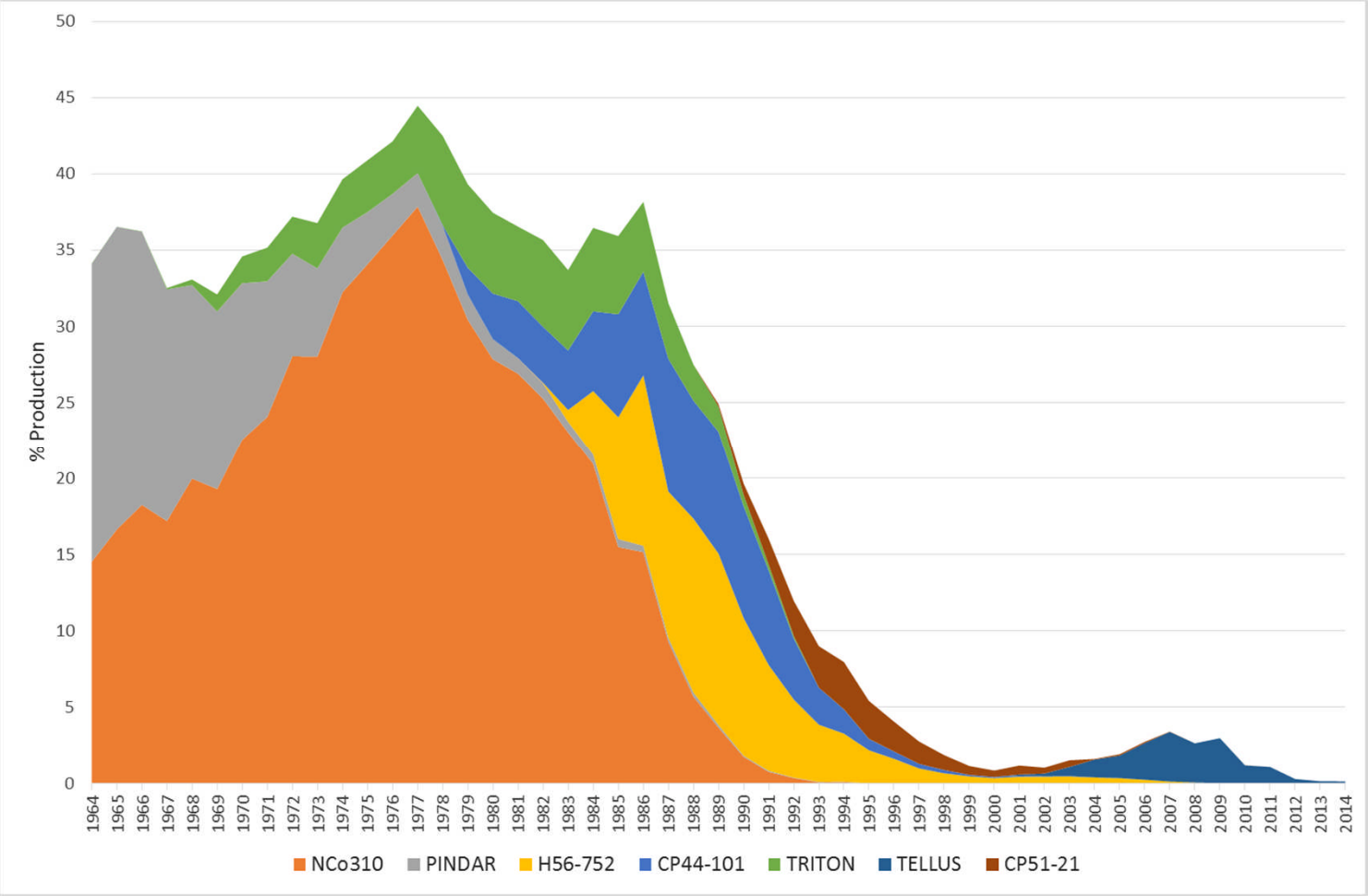
June 2015

Outline

- History of foreign varieties in Australia
- Not so distant past
  - SRA program
  - Foreign strategy
  - Trial / crossing data
- Future
  - Reason for change
  - New strategy
- Conclusion

History

Contribution of Foreign Varieties to Qld Production



History

Summary of foreign varieties imported into Australia

1973 – 1990

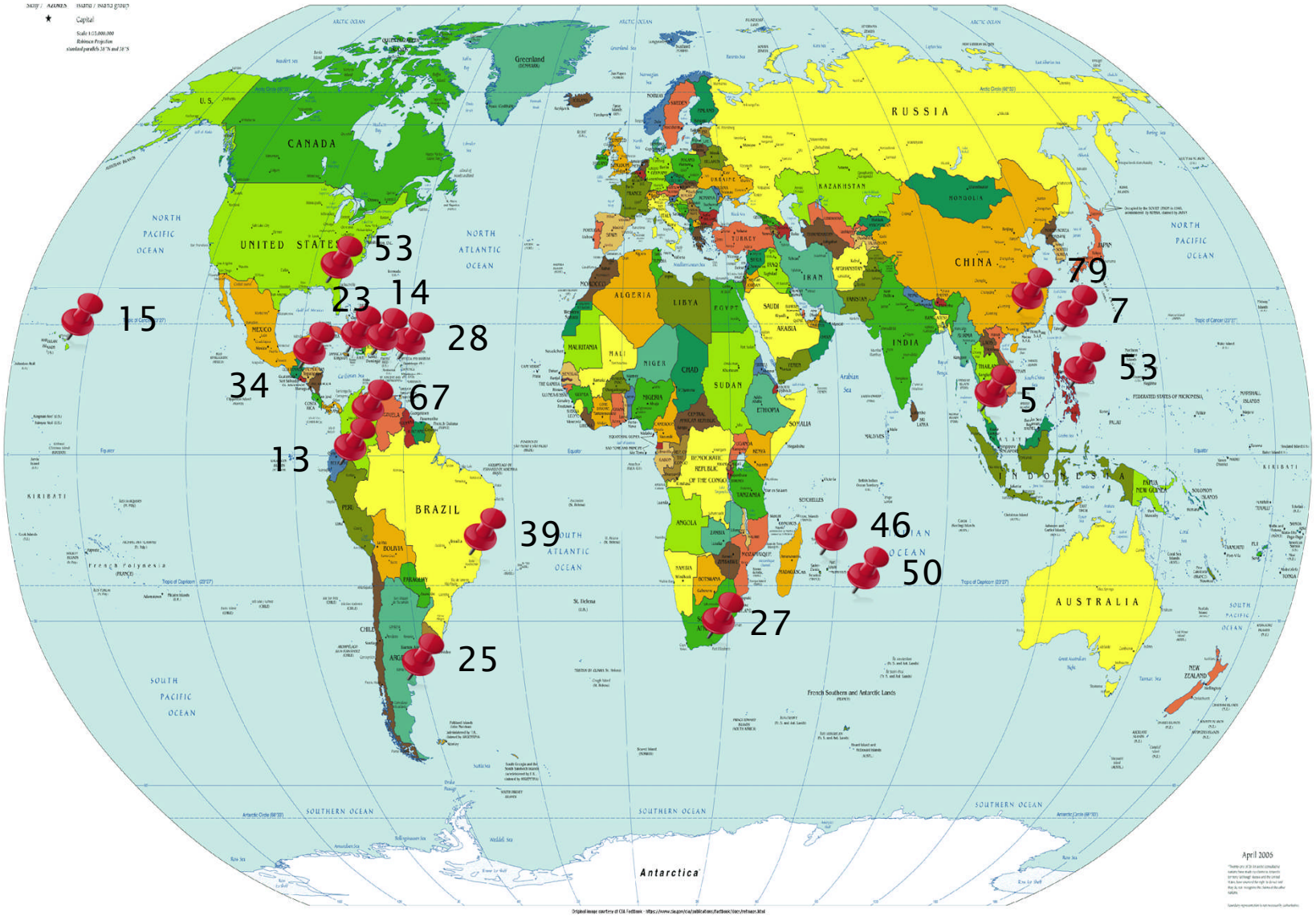
- 689 varieties
- 22 countries: USA, Brazil, Hawaii
- 38 varieties/year

1999 – 2014

- 657 varieties
- 19 countries: China, Colombia, Philippines, Mauritius
- 41 varieties/year (max 74)

Foreign varieties imported per year

Year	Count of Variety
1999	66
2000	57
2001	32
2002	25
2003	59
2004	37
2005	37
2006	8
2007	36
2008	74
2009	42
2010	60
2011	39
2012	26
2013	28
2014	31
Grand Total	657


53
15
23
14
28
34
67
13
39
46
50
27
25
79
7
53
5
Sugar Research
Australia

Overview : SRA Breeding Program

- 4 regional selection programs
  - 4 regional breeders
  - Differ in climate, soil type, pests & diseases
- Crossing is done at Meringa
  - Regional breeders select parents
  - Approximately 1500 crosses / year
- Three selection stages
  - 25, 000 seedlings / region
  - ~12 years to release a variety



Overview : SRA Breeding Program

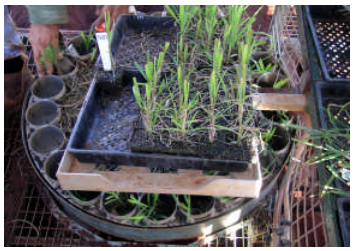


Stage 1
Seedlings
(P + 1R)

Crosses made using parents with high productivity and good smut resistance

25,000 seedlings planted into Progeny Assessment Trials (PATs)

2,500 seedlings selected from best families



Clonal Assessment Trials (CATs)

Varieties from other sources

Cane yield and CCS

Stage 2
Clonal Assessment Trials
(P+1R)

Screened for smut and Fiji



4 locations
150 new clones + **25 repeat clones**
(1 rep) (2 reps)

Assess cane yield and CCS

Stage 3 / 4
Final Assessment Trials
(P+1R+2R)

25 best performing varieties repeated into FAT series

Promising varieties to productivity boards for LHWT & maximum propagation

Further disease screening

PBR trial

Varieties approved by Variety Adoption Committee/DAF and given SRA number

Advanced Variety Program



Release

Foreign strategy

Year 1	2015	Enter quarantine in Australia
Year 3	2017	Released from quarantine and propagated (N & S)
Year 4	2018	Propagated in other regions (H & A)(C & W)
Year 5	2019	Plant preliminary trials (CATs)
Years 6-7	2020-21	Harvest P, 1R crops Smut screening
Year 8	2022	Plant into arrowing block / Plant FATs
Year 9	2023	Crossing (x5) / Harvest P crop Disease screening
Year 10	2024	Plant progeny trials (PATs) / Harvest 1R crop
Year 11	2025	Harvest PAT (P) / Harvest 2R crop
Year 12	2026	Re-cycle top clones / Propagate for release

Foreign varieties use in crossing

Year imported	# of crosses
1999	2542
2000	839
2001	457
2002	606
2003	398
2004	345
2005	30
2006	2
2007	113
2008	63
2009	58
2010	166
2011	25

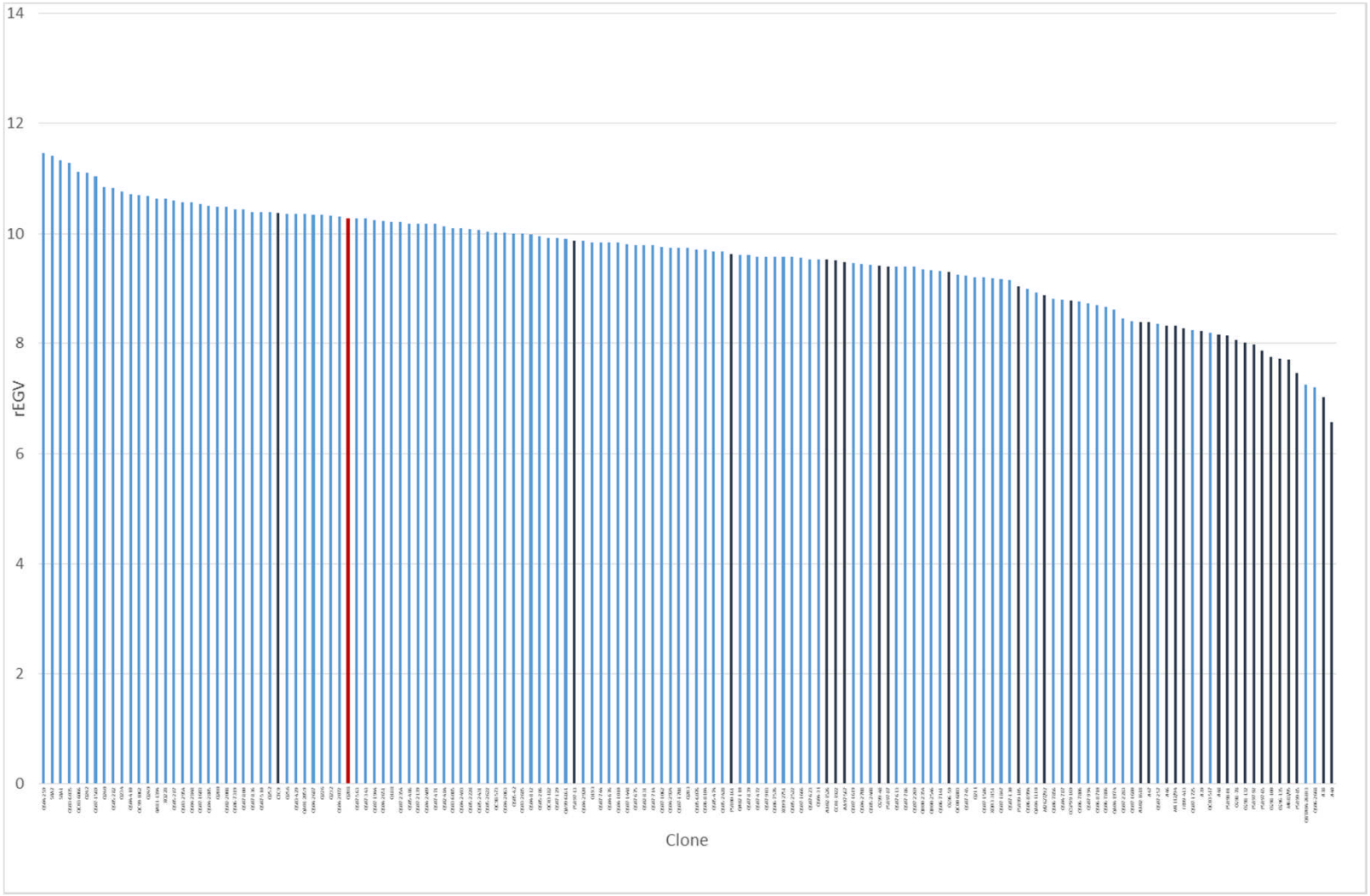
Foreign varieties use in crossing

Country	# of crosses
Argentina	256
Barbados	46
Brazil	1256
China	150
Colombia	279
Ecuador	3
Guadeloupe	154
Guatemala	51
Hawaii	133
Malaysia	60
Mauritius	246
Philippines	337
Reunion	291
South Africa	628
Taiwan	135
USA	1474

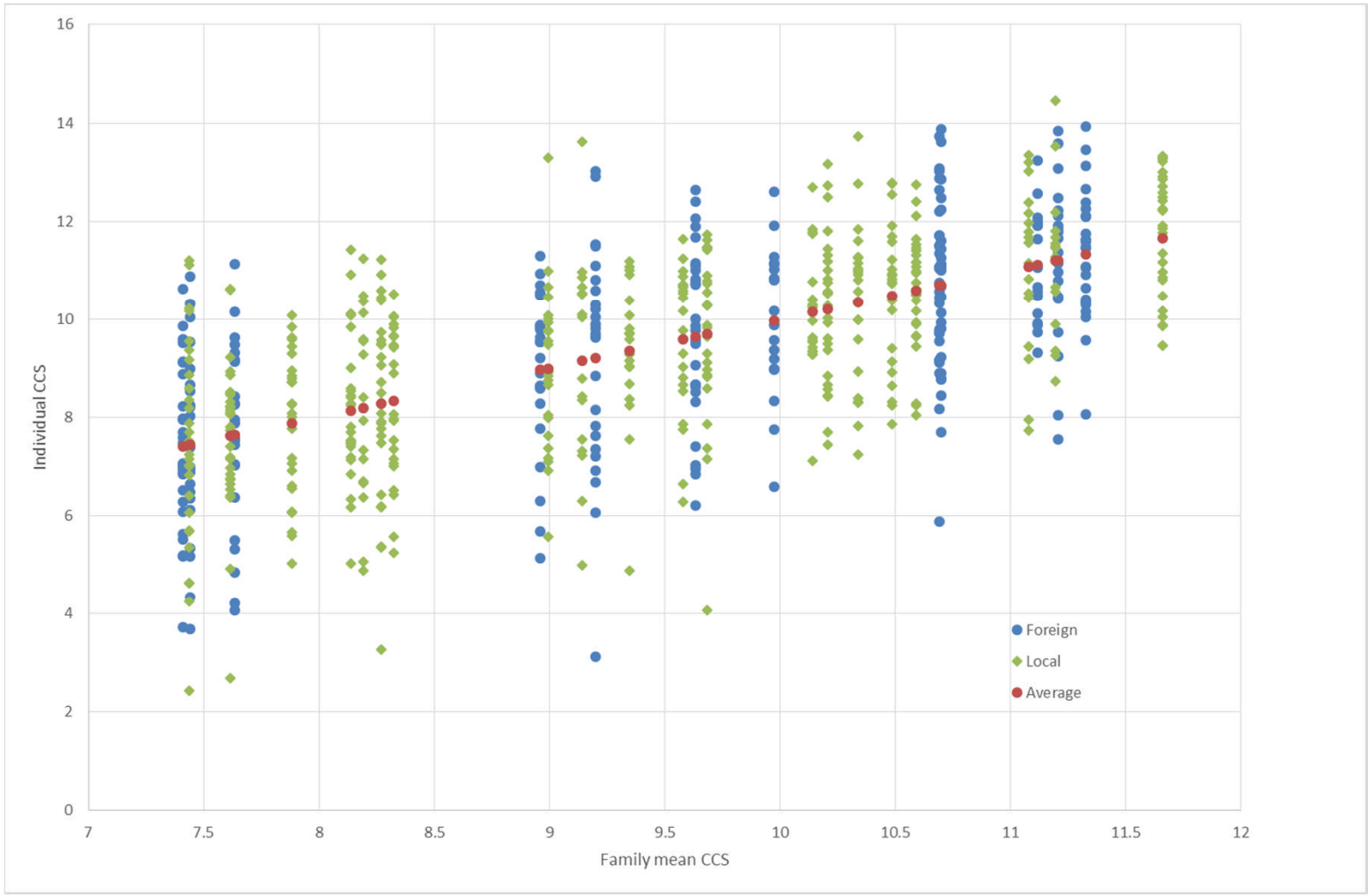
Foreign varieties use in crossing

Year	Imported	Parents
1999	66	49
2000	57	24
2001	32	18
2002	25	19
2003	59	37
2004	37	23
2005	37	9
2006	8	1
2007	36	14
2008	74	11
2009	42	12
2010	60	22
2011	39	1
2012	26	
2013	28	
2014	31	
Grand Total	657	240

Foreign varieties performance



Foreign varieties performance



Foreign varieties in release

Cross type	Varieties released 1996-2005 (60)	Varieties released 2006-2015 (34)
Local x Local	58.3%	67.6%
Foreign x Local	38.3%	29.4%
Foreign x Foreign	3.3%	0%

Overview : SRA Breeding Program

- Stage 1- Family Selection (Progeny Assessment Trial: PAT)

  25000 seedlings/region; ~350 families; 20 seedlings/plot; 3-5 replicates/family



family selection - sugar content, cane yield + individual selection - visual

- Stage 2- First Clonal Selection (Clonal Assessment Trial: CAT)

  2500 clones/region; single-row/plot x 6m full or 10m partially replicated



competition model selection: sugar content, yield, fibre & diseases

- Stage 3- Second Clonal Selection (Final Assessment Trial: FAT)

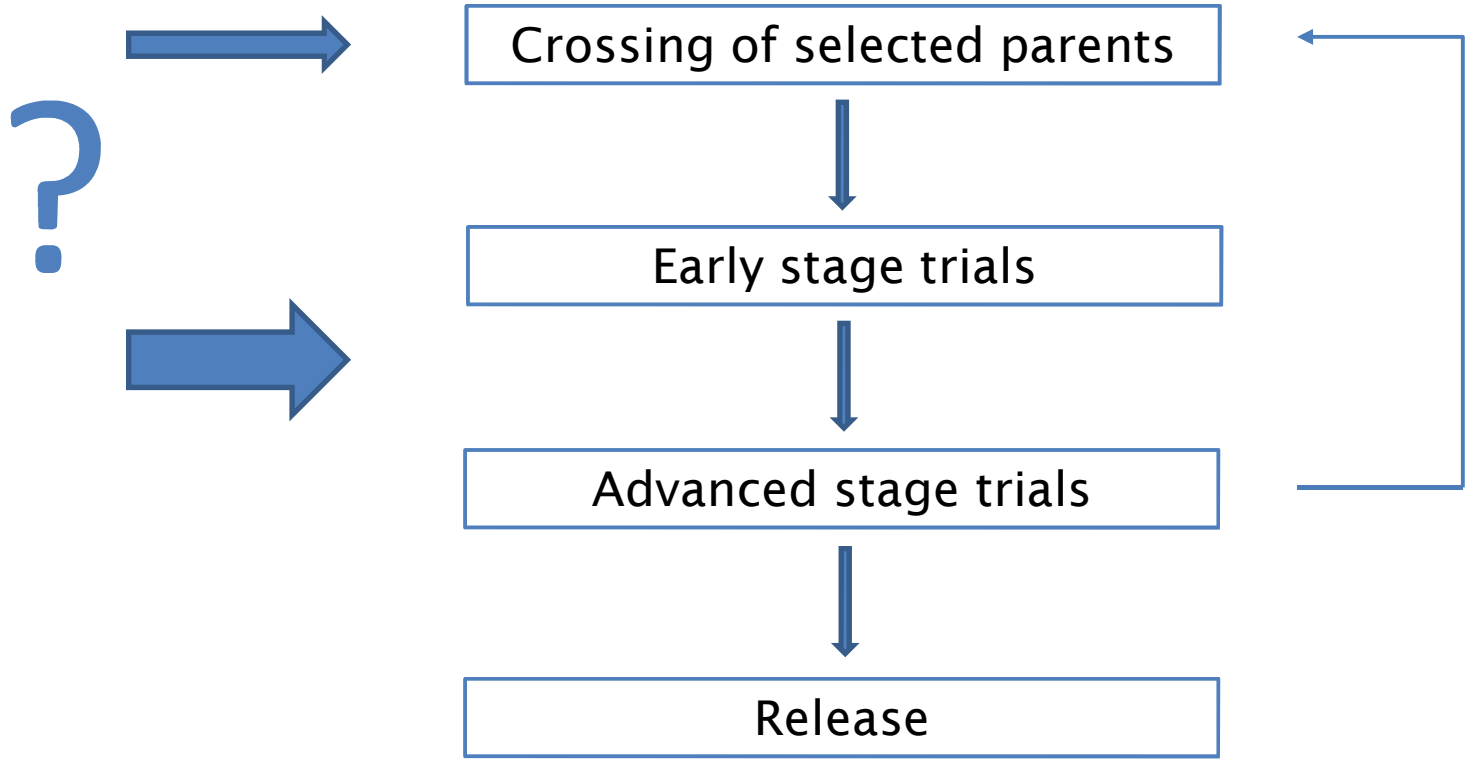
  175 clones/region; Inter Station exchange; 4-row/plot x10m partially replicated



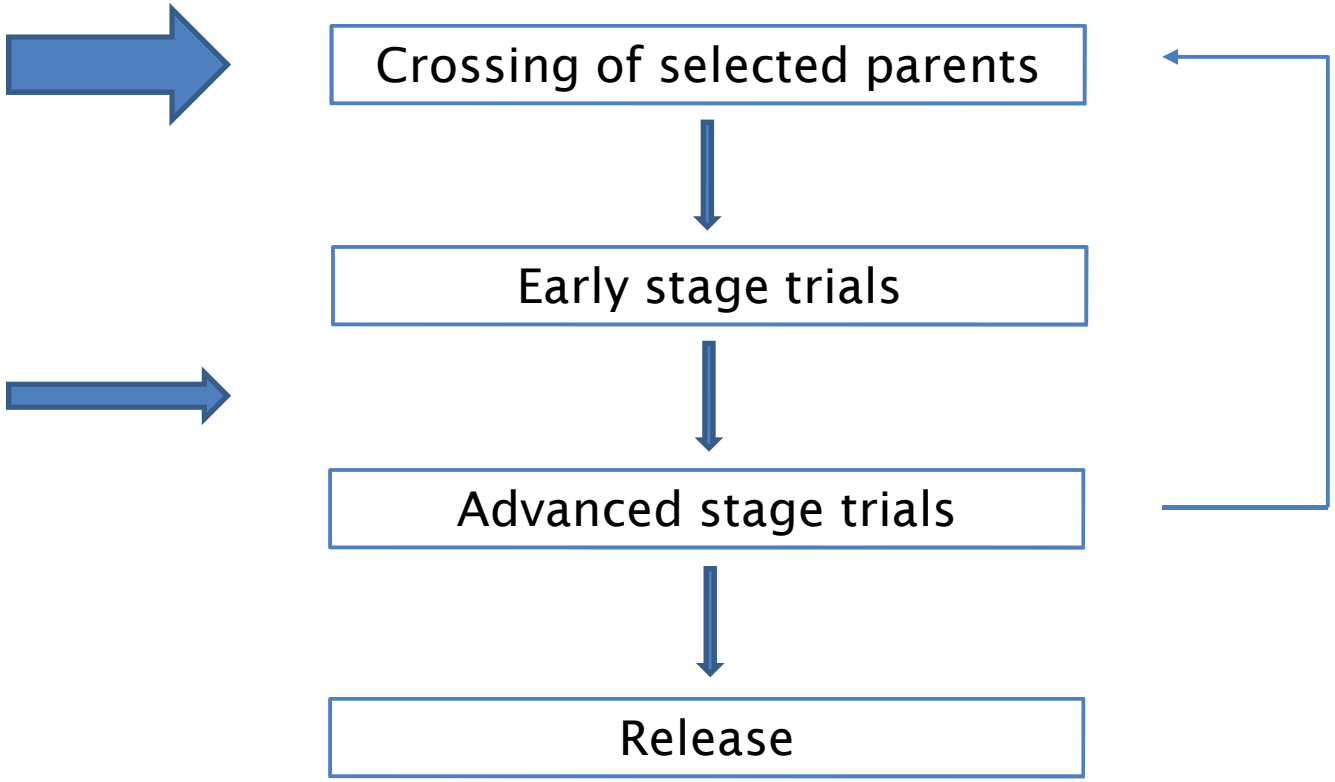
index selection: sugar content, yield, fibre & diseases

Release variety

Changes to foreign strategy



Changes to foreign strategy



Foreign strategy

Year 1	Enter quarantine in Australia	Enter quarantine in Australia
Year 3	Released from quarantine and propagated (N & S)	Released from quarantine and propagated (N) / (N, A, C or S)(x2)
Year 4	Propagated in other regions (H & A)(C & W)	Plant arrowing blocks & PF / Plant FAT
Year 5	Plant preliminary trials (CATs)	Crossing #1 (x5) / Harvest P crop
Years 6-7	Harvest P, 1R crops Smut screening	Plant progeny trial # 1 / Harvest 1R crop Harvest PAT #1 / Estimate BV (ind)
Year 8	Plant into arrowing block / Plant FATs	Estimate BV #1 / Propagate for release
Year 9	Crossing (x5) / Harvest P crop Disease screening	
Year 10	Plant progeny trials (PATs) / Harvest 1R crop	
Year 11	Harvest PAT (P) / Harvest 2R crop	
Year 12	Re-cycle top clones / Propagate for release	

Conclusion

- Disease screening / Tissue culture
- More coordinated / structured approach within SRA
  - Schedule of exchange
  - Involve all breeders in selection
  - Target clones to regions
  - Allocation of crosses to regions
- Shift emphasis to crossing rather than field testing
- Decrease the time to crossing and field testing
- Exchange agreements

Thank you