Queensland Government

Sugar Research Australia

Introgression:

Exploiting New Sources of Genetic Variability for the Australian Sugar Industry

ISSCT workshop

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Outline

- Introgression in Australia
- Results from Introgression projects
- Current status
- Future plan
- Questions

Introgression in Australia – Early History

- 1960's
  - Mandalay (*S. spontaneum*) used in crossing
  - resulted in a BC2 clone (QN66-2008) that is a parent of 25 released varieties (effectively BC3)
  - Some of these BC3s are parents of 18 other released varieties (BC4s)
  - Approximately 25% of the varieties released in Australia over the last 40 years trace back to Mandalay

Introgression in Australia - History

- 1980's
  - Many attempts to use *Erianthus arundinaceus*
    - Very few genuine hybrids produced
    - Hybrids were sterile

Introgression in Australia – Recent History

- From 2002 Australian Centre for International Agriculture Research funded a project to make new crosses with wild sugarcane relatives in China (Joint project CSIRO, BSES/SRA, Yunnan & Guangzhou Sugar Research Institutes)

  - Clones and seeds from crosses with *Erianthus* and *S. spontaneum* made in China imported to Australia (2003 - 2006), F1, BC1, BC2
  - Evaluated in small plots (2004-2007)
  - Crosses made with selected clones (2007 - 2009), BC1, BC2, BC3
  - Evaluated in small plots (2008 - 2010)
  - Crosses made with some selections (2012 - 2014), BC2, BC3, BC4
  - Evaluations in core program (2013 onwards…)

Introgression in Australia – Present

Build on the considerable effort made over the last decade to develop germplasm from wild relatives (particularly *Erianthus* spp and *Saccharum spontaneum*).

➢ Project 2011344

- Select and evaluate introgression clones for cane yield, CCS, fibre and resistance to nematodes (*Meloidogyne* (RKN) and *Pratylenchu*s (RLN)), Pachymetra root rot and smut
- Develop new methods of rating large numbers of clones for nematode resistance
- Make crosses and evaluate families to estimate breeding values of new germplasm

➢ Project 2014053

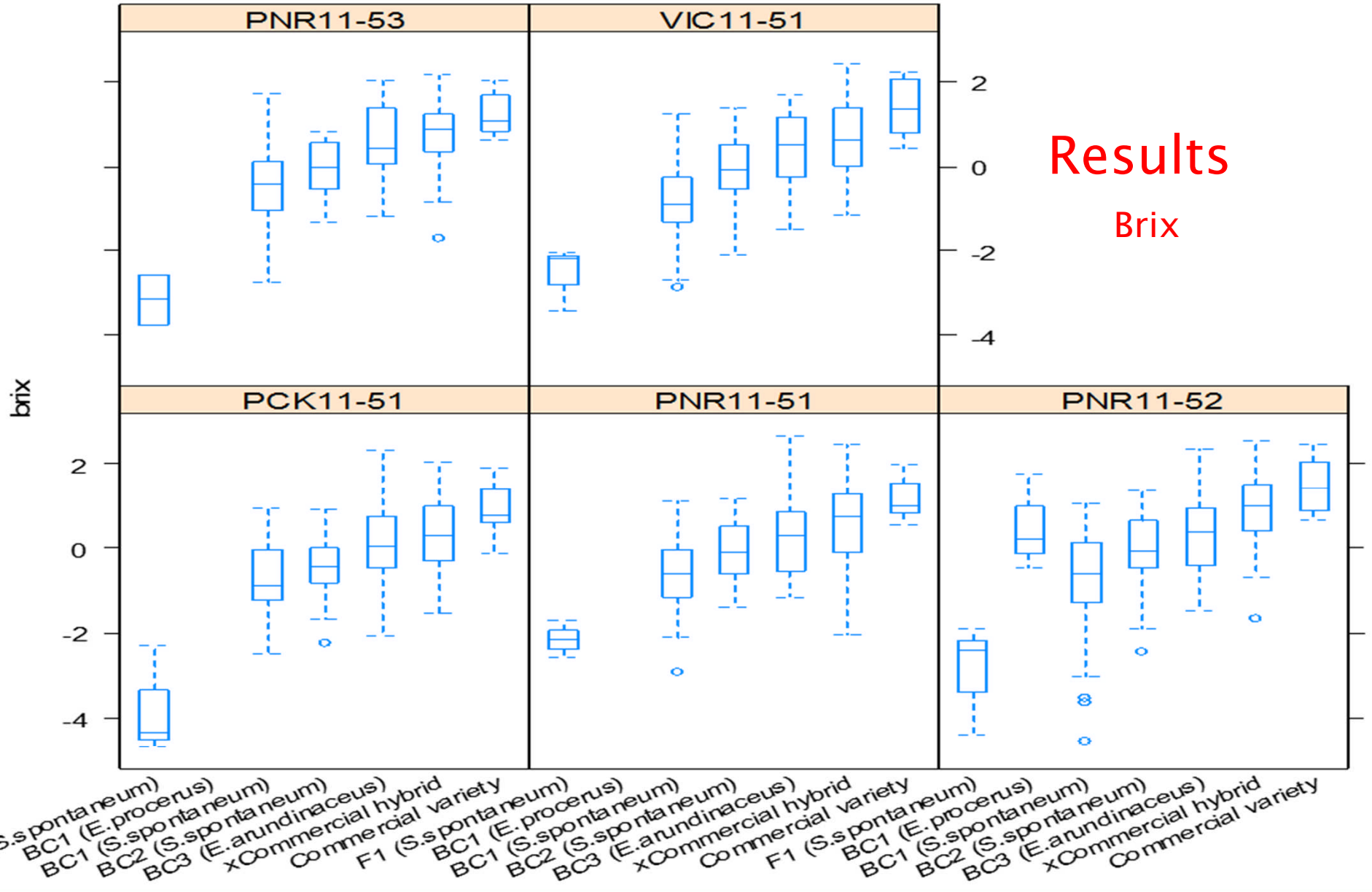
- Identify and exploit new sources of genes (ratooning, nematode and pachymetra resistance)
- Select clones under harsh environment (yield and ratooning)
- Ground-truth nematode ratings (from glasshouse) in field (RKN and RLN)
- Establish a clear pathway for future direction and investment in introgression breeding

Results from Introgression projects



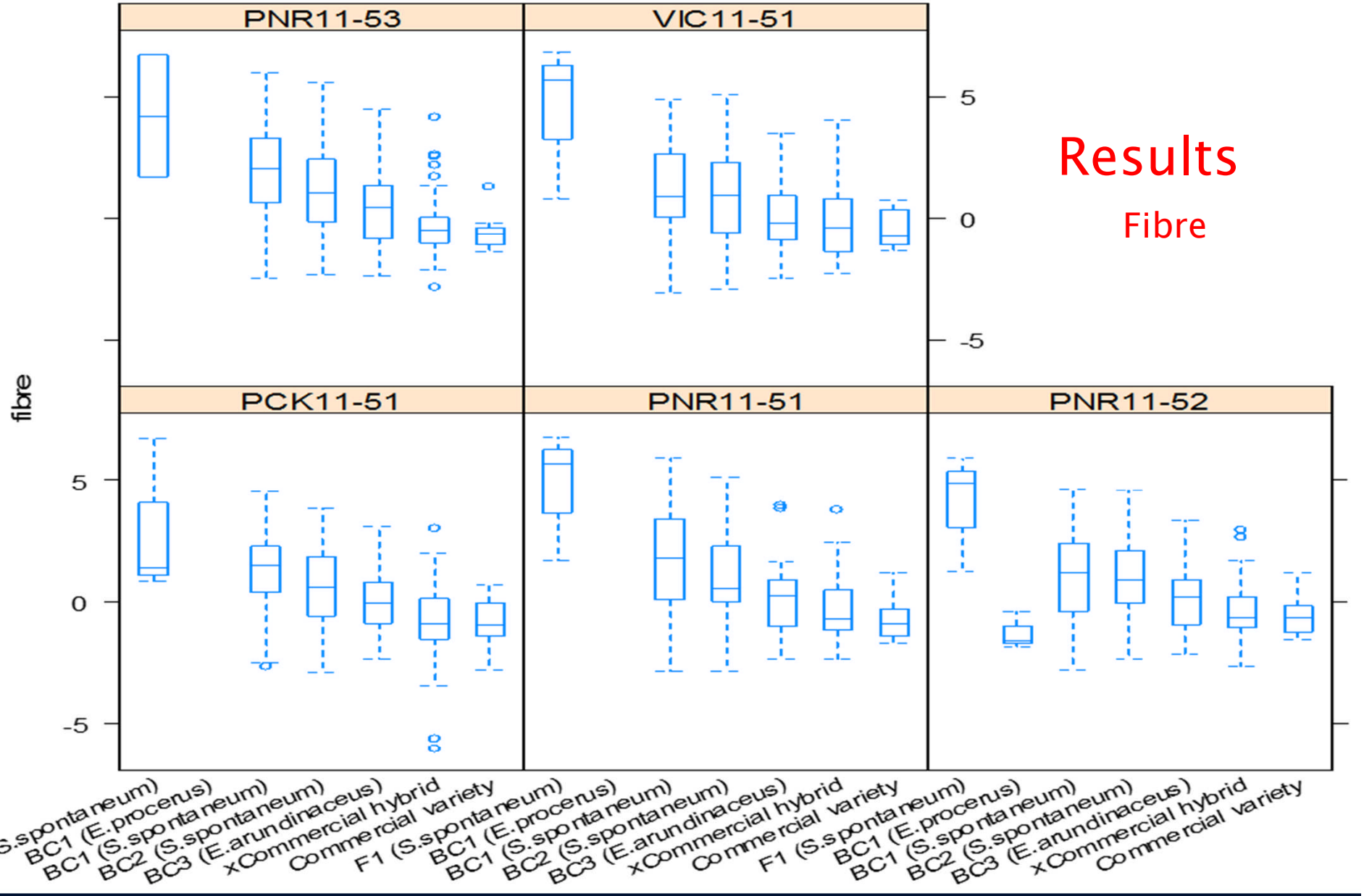
Results

Brix



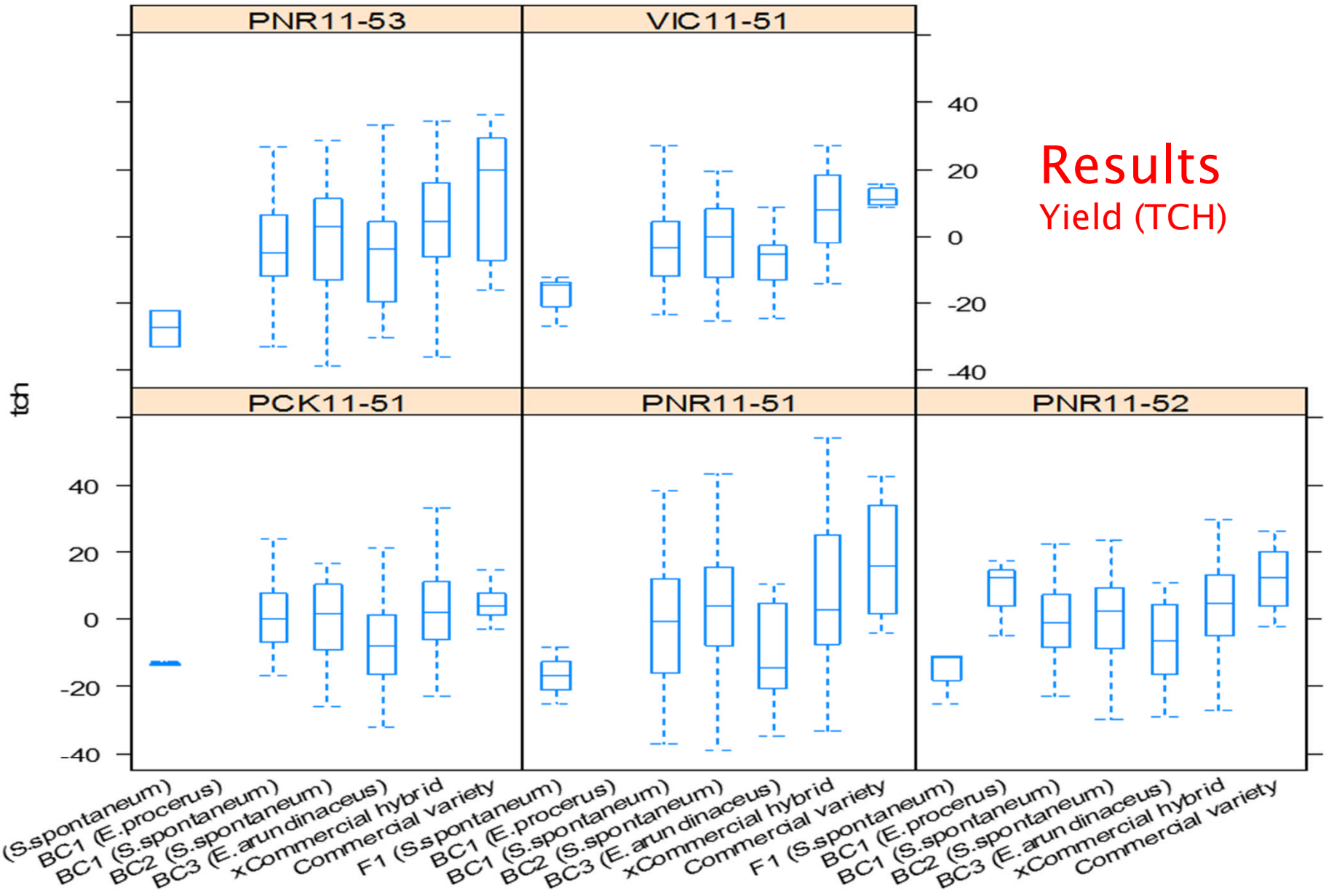
Results

Fibre

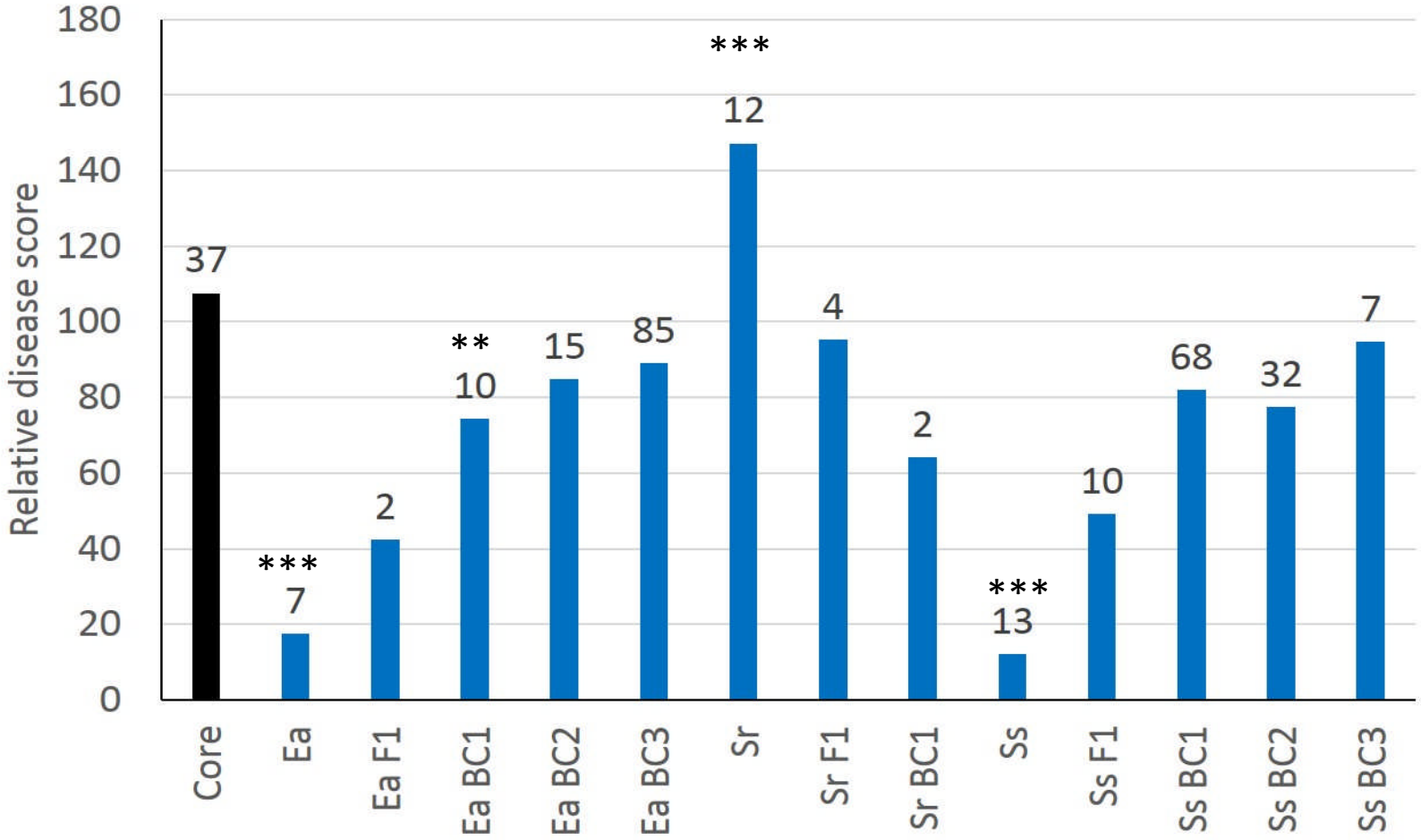


Results

Yield (TCH)

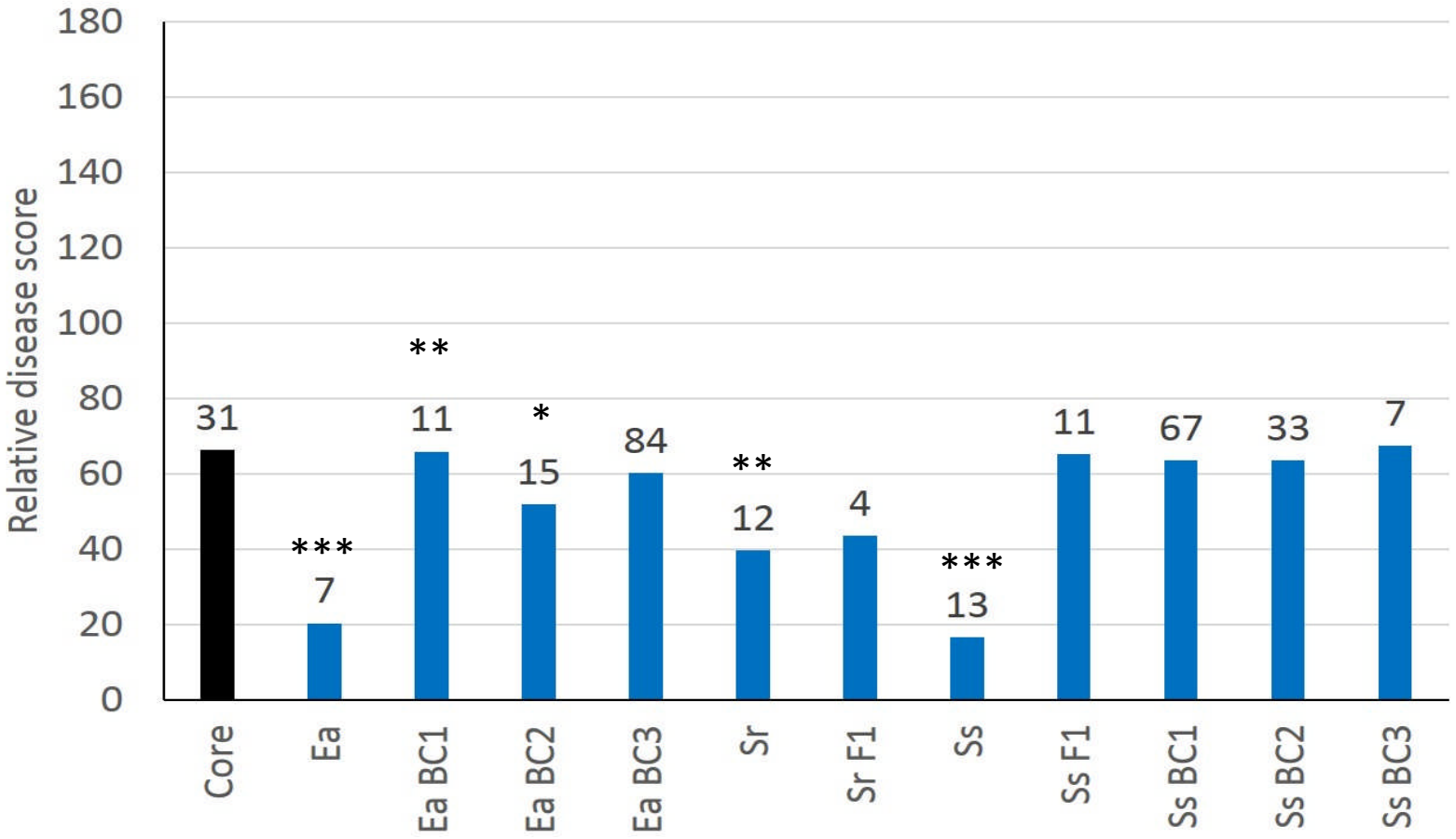


Results - Root Knot Nematode



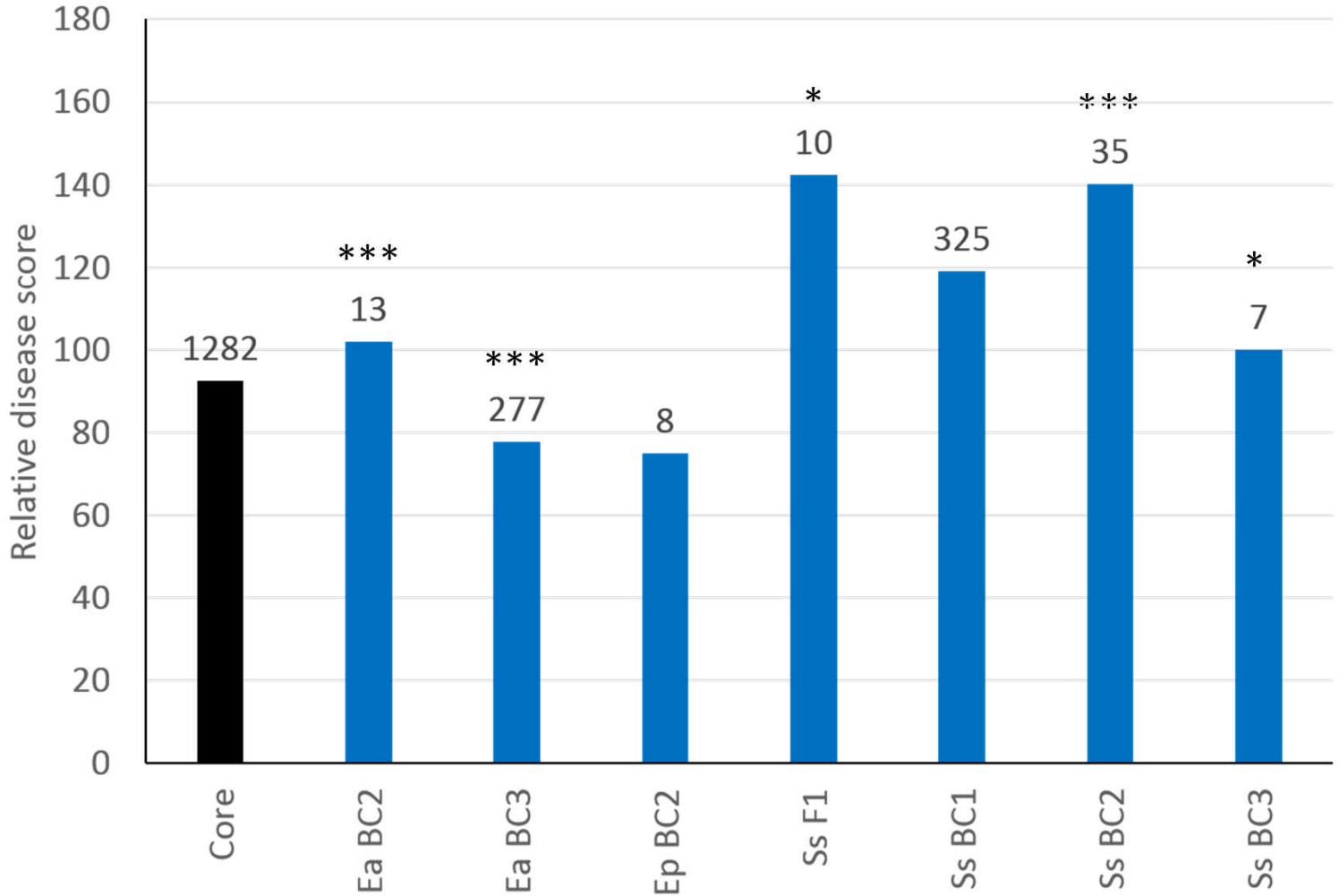
Disease score relative to average standards Q208 and Q135 = 100 (B. Croft)

Results - Root Lesion Nematode



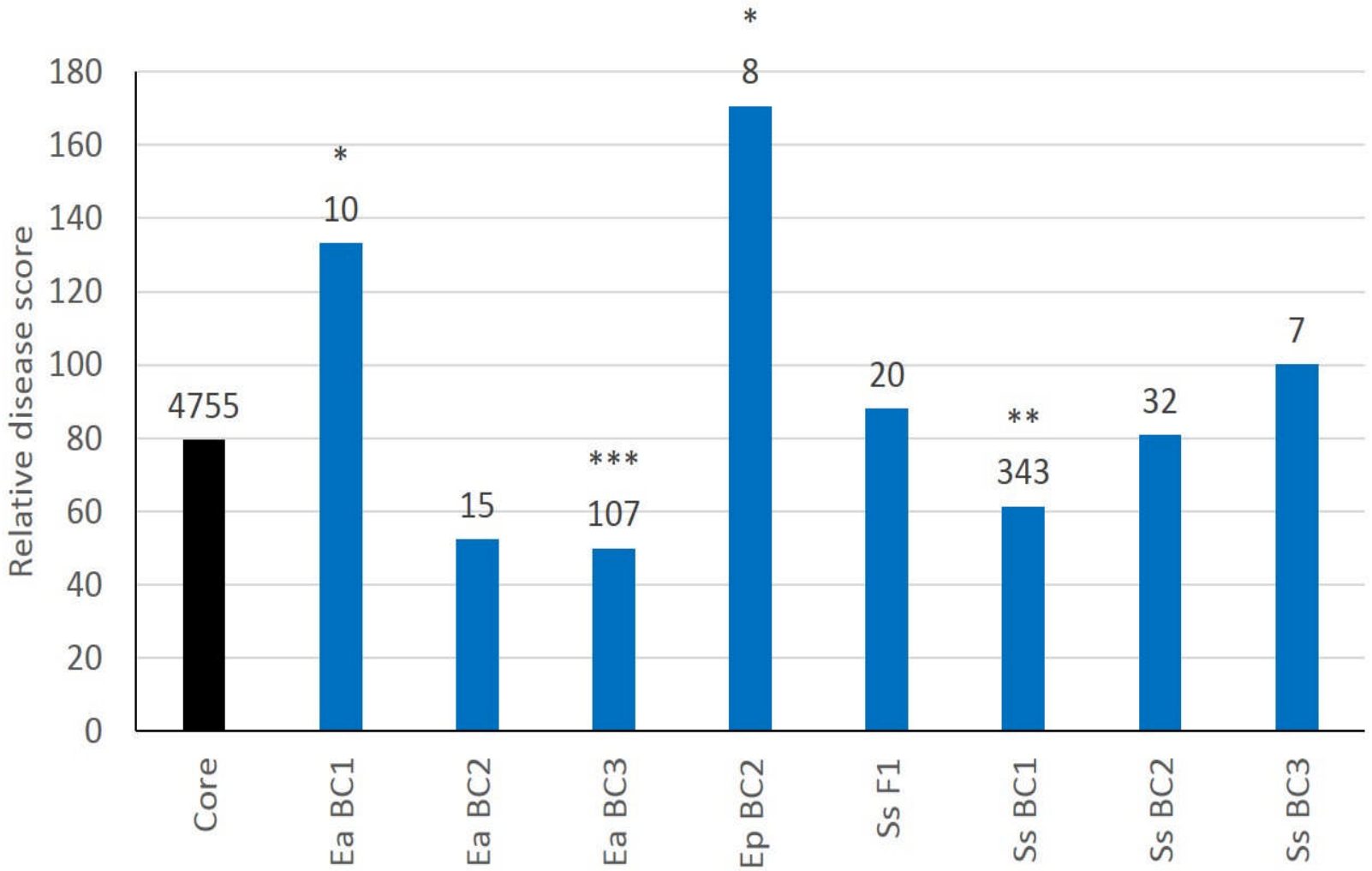
Disease score relative to average standards Q208 and Q135 = 100 (B. Croft)

Results - Pachymetra



Disease score relative to average 10 standard varieties = 100 (B. Croft)

Results - Smut



Disease score relative to average 10 standards varieties = 100 (B. Croft)

Current status

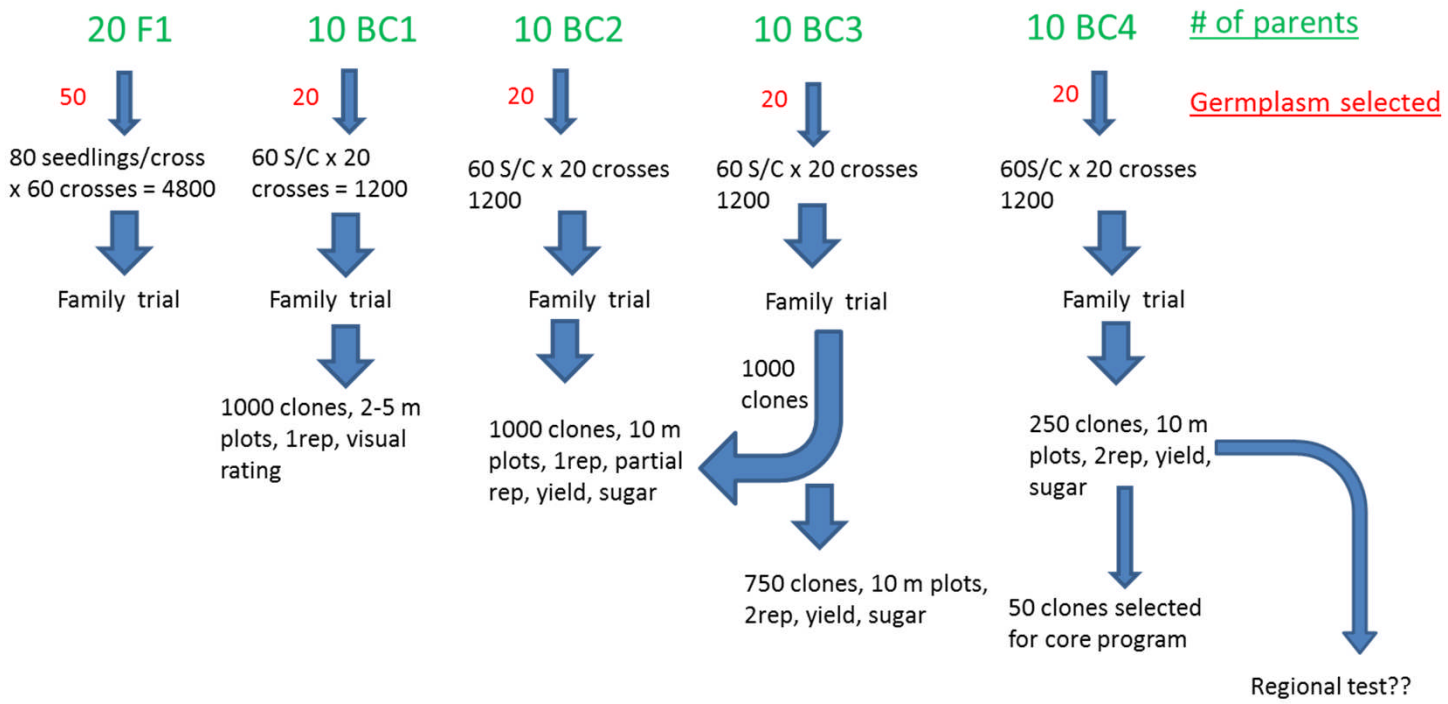
- Introgression clones are being tested for yield and CCS, best clones in 2014 Final Assessment Trials
- Best clones have been used as parents to increase disease resistance levels in selection program, further crossing is planned
- Research to determine if nematode resistance in glasshouse trials is correlated with field resistance is in progress
- In complementary projects DNA markers are being identified to assist with introgression breeding for disease resistance
- New crosses made with introgression clones and the progenies (including Ea BC4, Ep BC3) are going to be evaluated in 2015-2016
- Lack of long term strategy for introgression breeding

Future plan

- Introgression seed exchange
- Introgression clonal exchange
- Collaboration
- Pre-breeding program

Questions

1) How many basic crosses (S. officinarum x S. spontaneum) are needed for each year?
2) How many crosses (S. spontaneum x commercial) are needed for each year?
3) Are BC3 or BC4 clones going to regional Final Assessment Trials?
4) Who is going to fund this long term (high cost) pre breeding program?



Thank you