CENTRE FOR CROP AND DISEASE MANAGEMENT

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GRDC Grains Research & Development Corporation | Curtin University

School of Molecular and Life Sciences, Curtin University

Sclerotinia resistance in Australian germplasm and genomic selection as a tool for expediting Sclerotinia resistance breeding

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THE UNIVERSITY OF WESTERN AUSTRALIA

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Current status of Sclerotinia resistance

- ‘New generation’ AAF Canada lines (Lone Buchwaldt):
  - PAK54
  - PAK93
  - DC21
  - K22

  (Gyawali et al., 2016. *Molecular Breeding*)

- International Rapeseed Congress 15:
  - Crossed with elite Canadian varieties
  - Backcrossing and QTL-based selection
  - Ongoing
  - Some not ‘double low’ status

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PIONEER PROTECTOR SCLEROTINIA

Released 2009 in Canada

Can we find any varieties suitable to Australian conditions?

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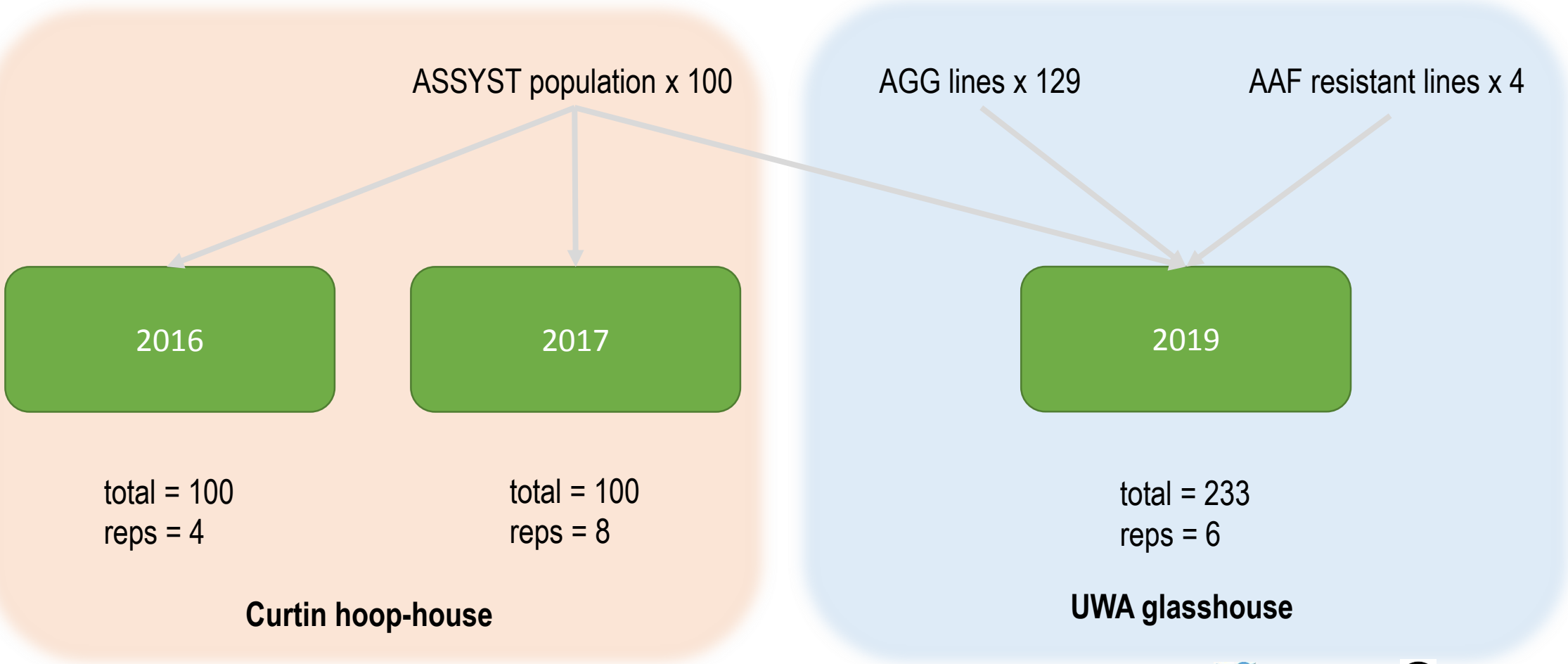
Pot trials 2016 - present | spring varieties



Stem inoculation method

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‘academic standard’

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Two different kinds of screen

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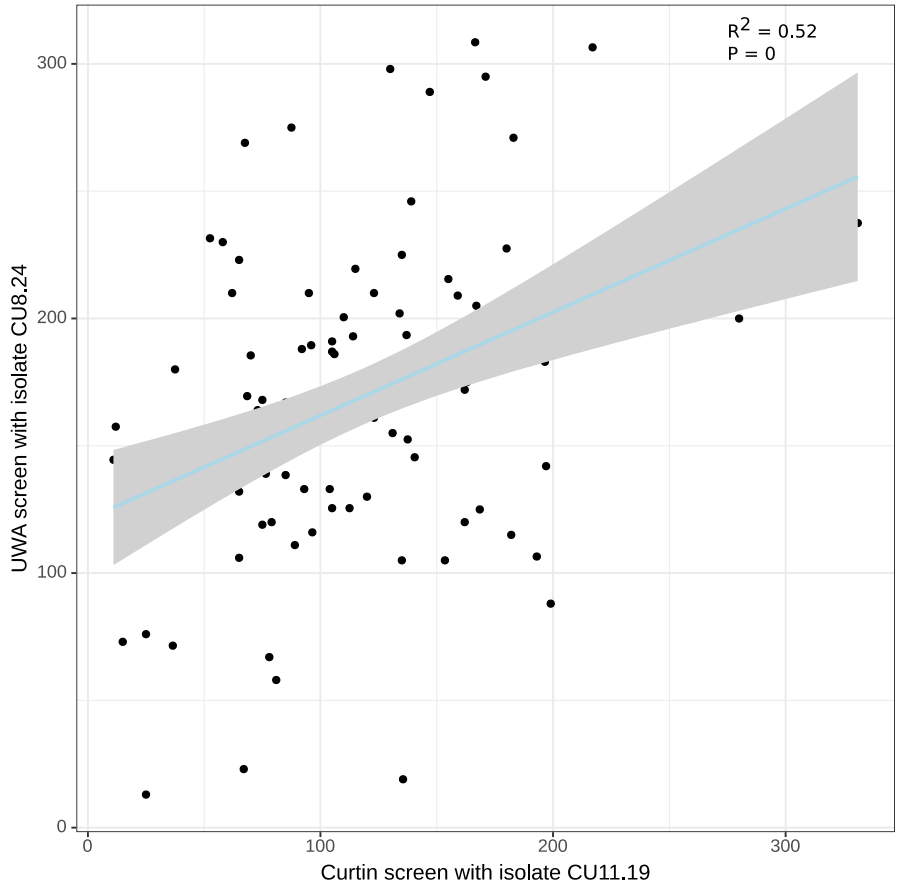
no temperature regulation
isolate CU11.19
inoculated same time

temperature regulation
isolate CU8.24
inoculated 50 % flowering

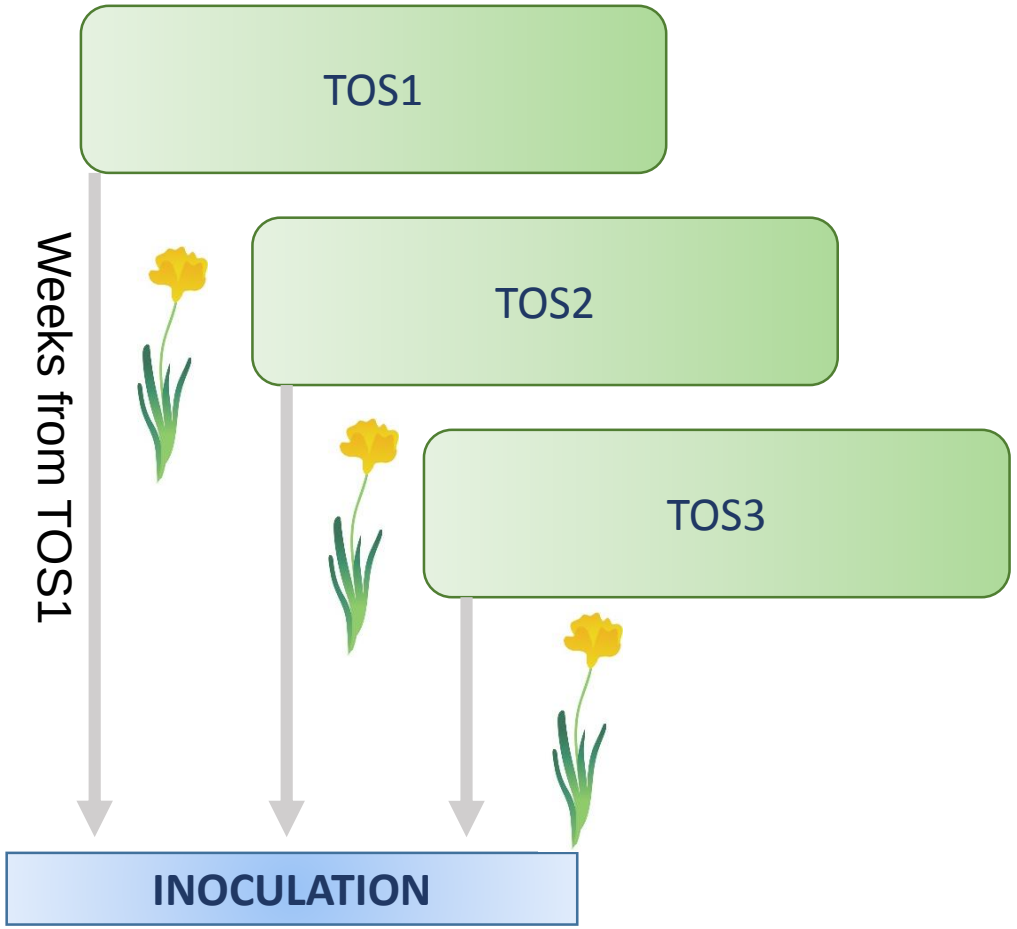
Why test a different isolate?

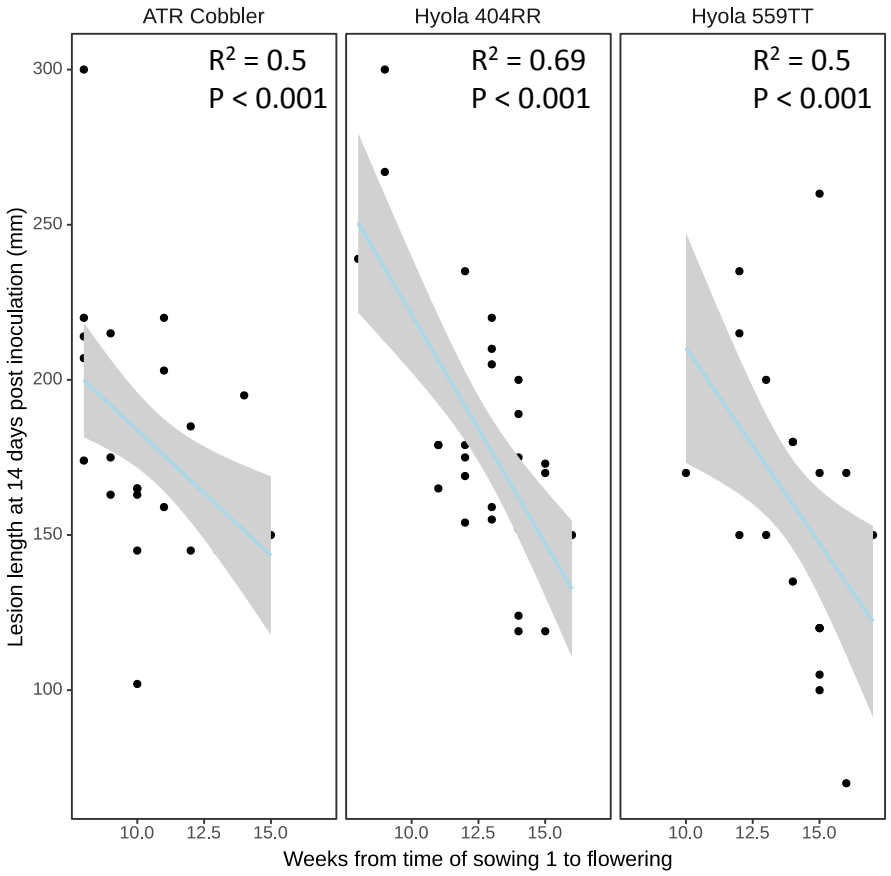


‘academic standard’ assumes same response to all isolates

seems more-or-less the case

Why control for time of inoculation relative to flowering?





Correlation goes away when inoculation timing controlled

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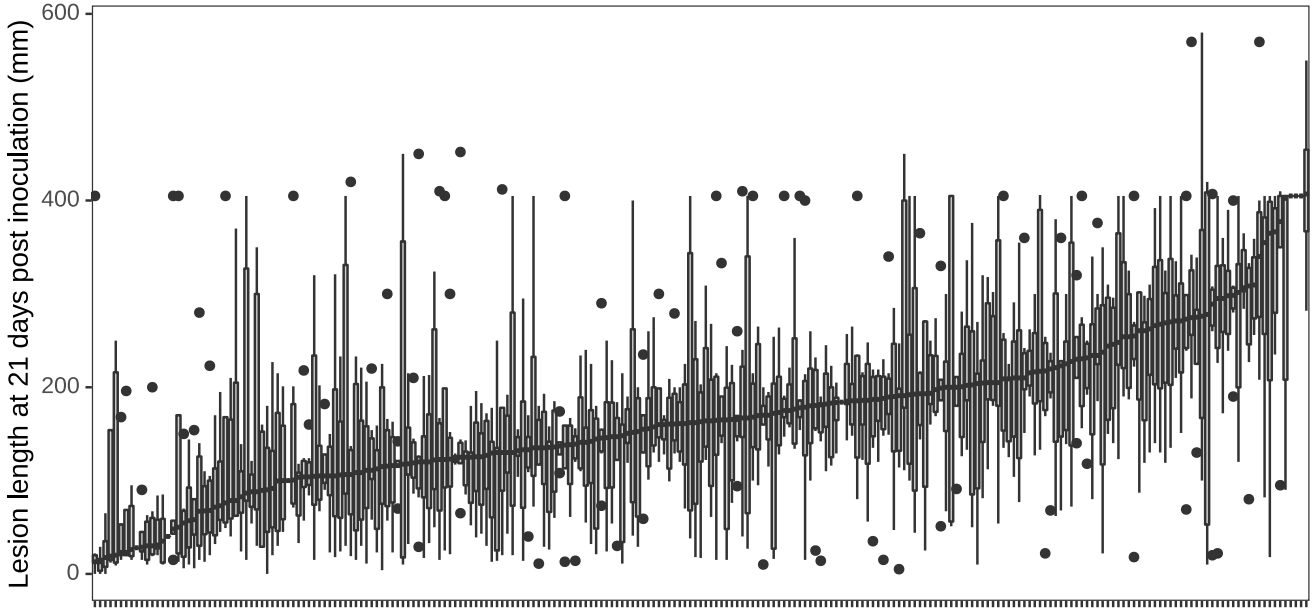
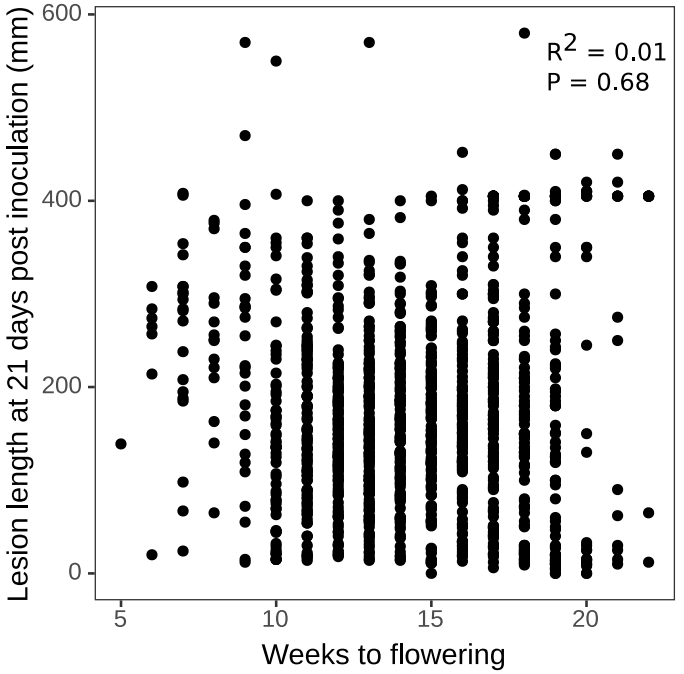
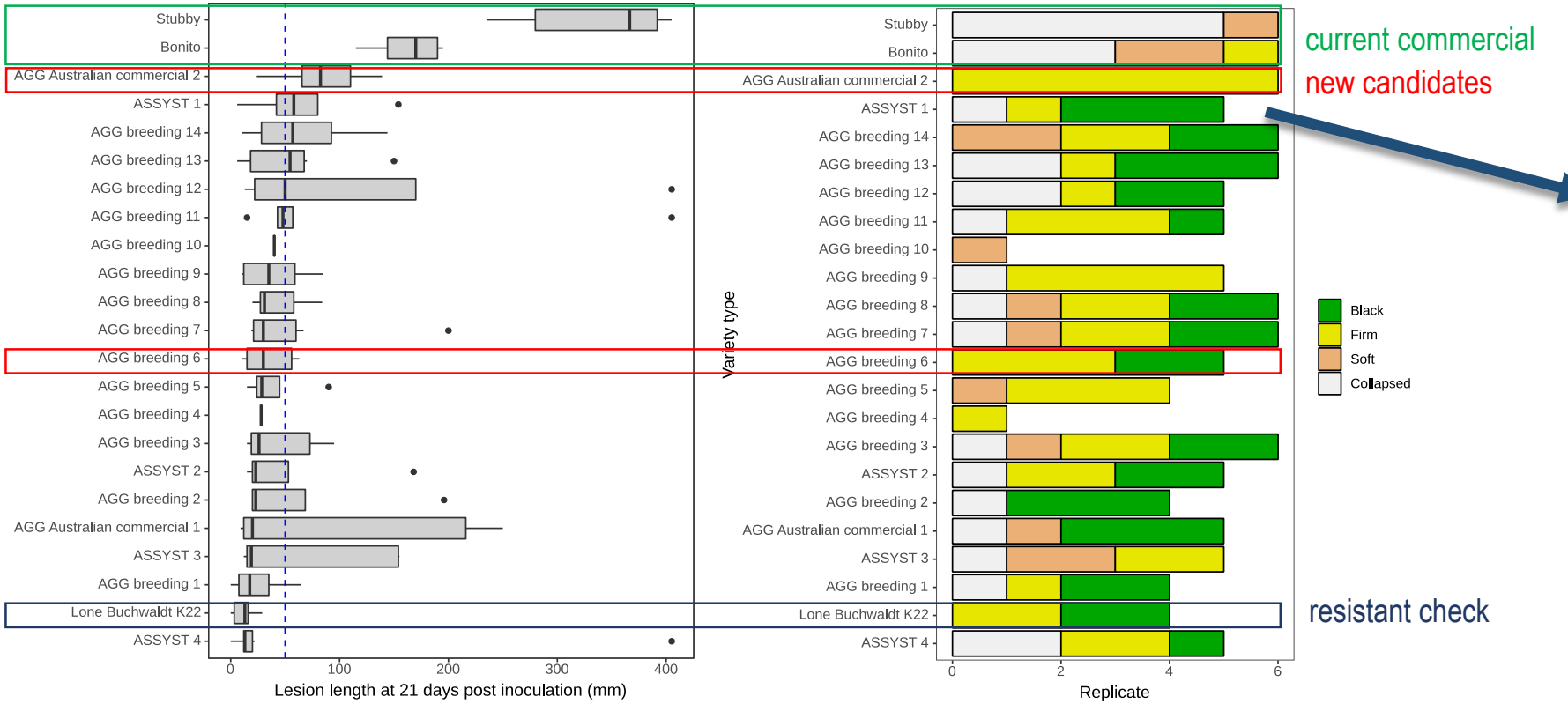




Several candidates in existing Australian germplasm and commercial lines

black firm soft collapsed



current commercial

new candidates

resistant check

Aus. com. Bonito

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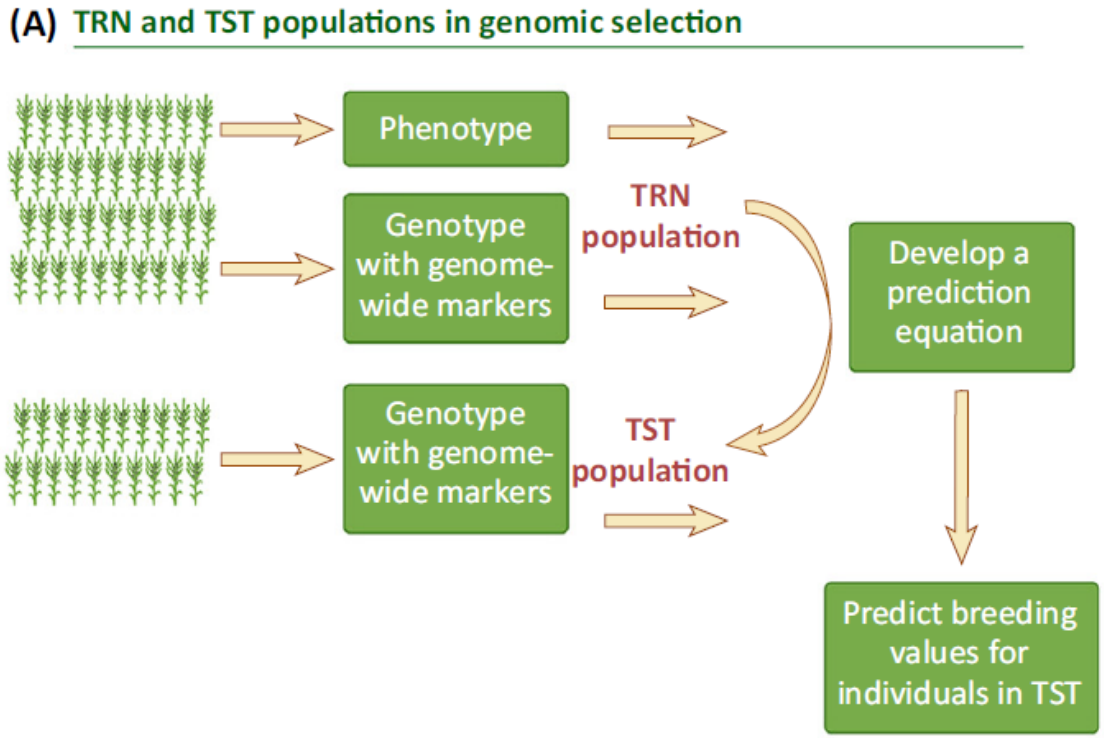
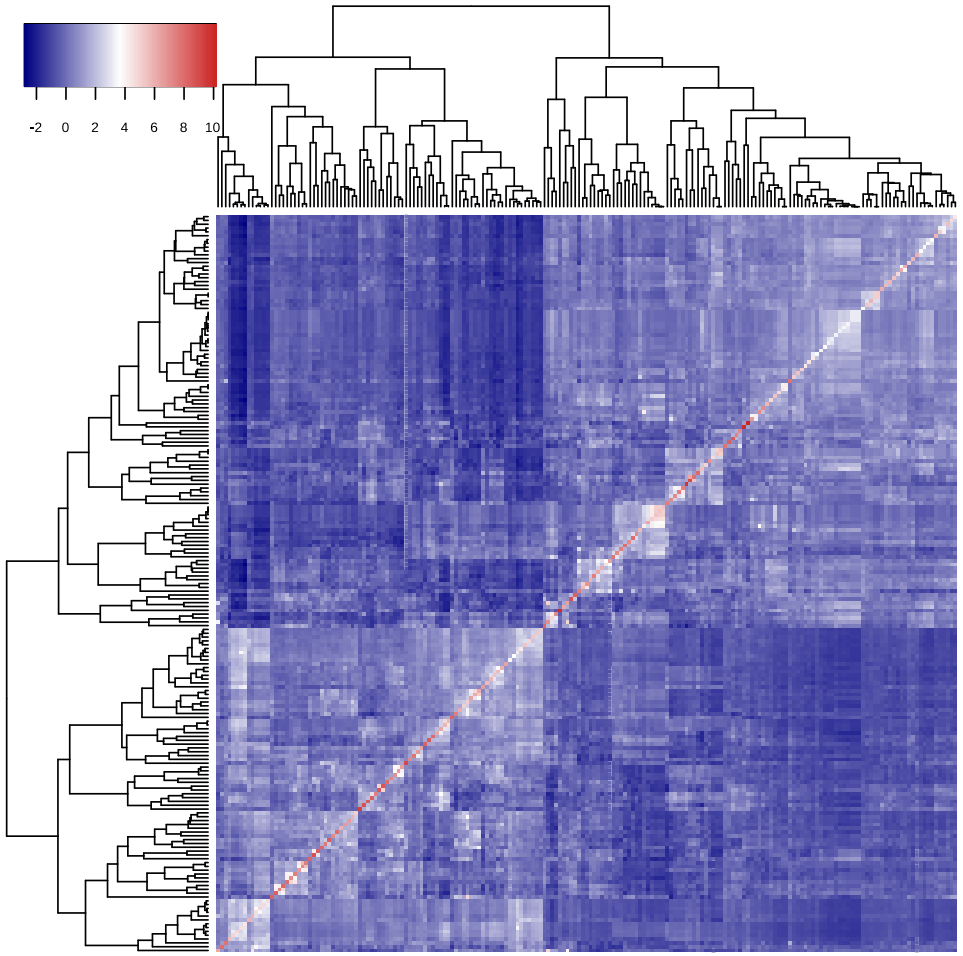
Expediting breeding with genomic selection



Crossa et al., 2016.*Trends in Plant Science*.

Population structure of varieties genotyped so far



- 233 variety genotypes to obtain (incl. 100 ASSYST).
- 193 so far – 93 new from UWA collaboration.
- 40 to be downloaded / provided by Batley lab.

Larger population shows improvement in accuracy over last meeting's presentation

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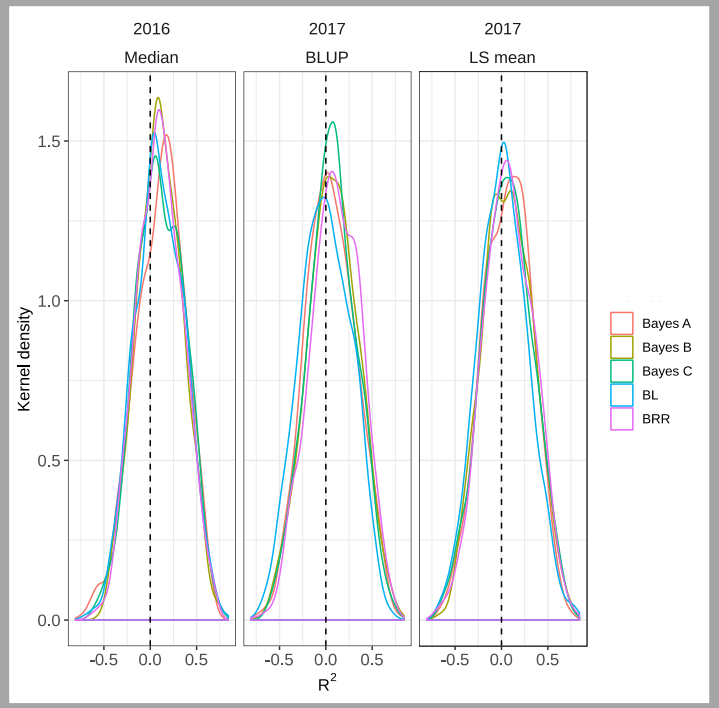
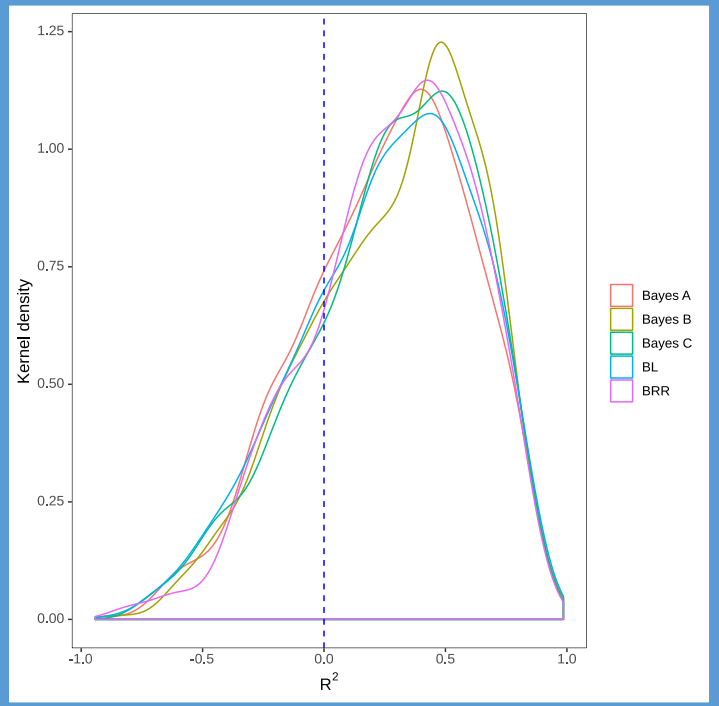
2016-2017



All models ~ 0.1 – 0.15 R^2
100 ASSYST varieties

2019



All models ~ 0.3-0.35 R^2
193 ASSYST + AGG varieties

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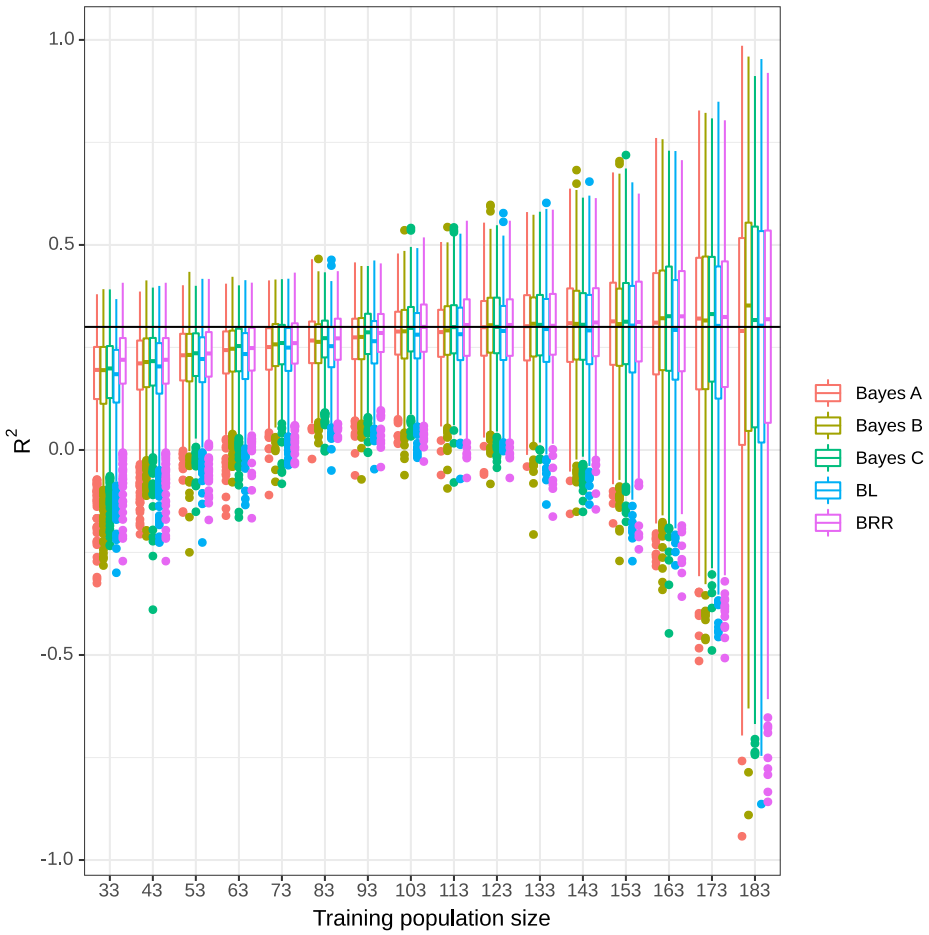
Increasing training population size increases accuracy



Improvement from 33-183 training population size.

Larger population = further improvements?

(233 varieties total)

Conclusions and future directions

- Conclusions:
  - Several varieties, presumably suitable to Australian conditions, with Sclerotinia resistance.
  - Resistance not correlated with late flowering.
  - Different isolates produce similar results.
  - Genomic prediction has good potential.
  - Larger training population = increased accuracy.

- Future directions:
  - Confirmation of new resistance sources – multiple isolates.
  - Genomic prediction accuracy between isolates.
  - Correlation with field data such as disease nursery.
  - QTL priors to increase genomic prediction accuracy.

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THANK YOU

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