



Adapting Canola to Changing Agricultural Systems

GCIRC Technical Meeting, Cambridge

Dr Matthew Nelson and the CSIRO team | 9 April 2025

Australia's National Science Agency





Agricultural systems are changing



~50%



\$\$\$!!

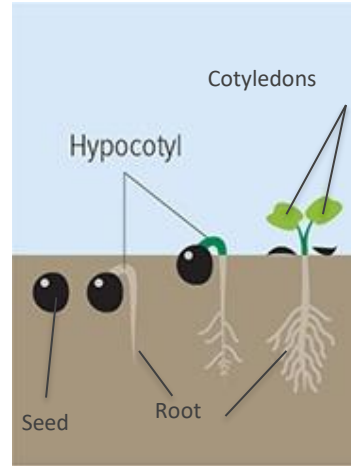


Poor establishment is a serious problem *globally?*



It isn't easy being a canola seedling...

	Canola	Wheat
Seed size	2-4 mg	35-50 mg
Seed composition	Mostly oil	Mostly starch
Germination	Epigeal	Hypogeal



Canola

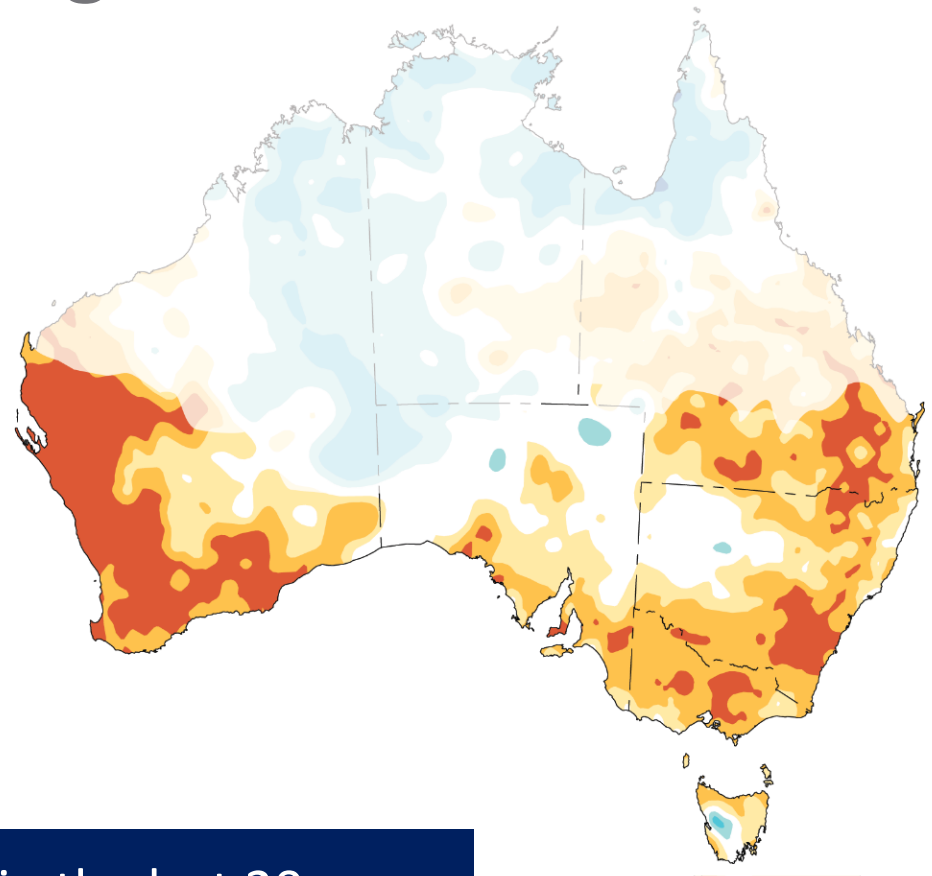
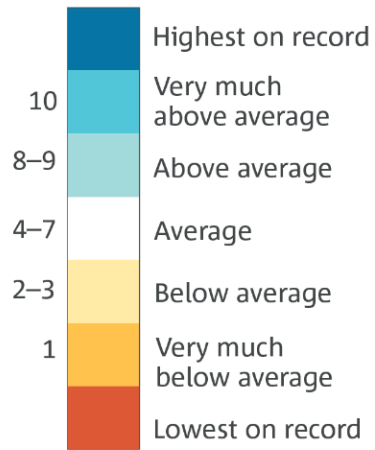


Wheat



And it is getting harder

Rainfall decile ranges

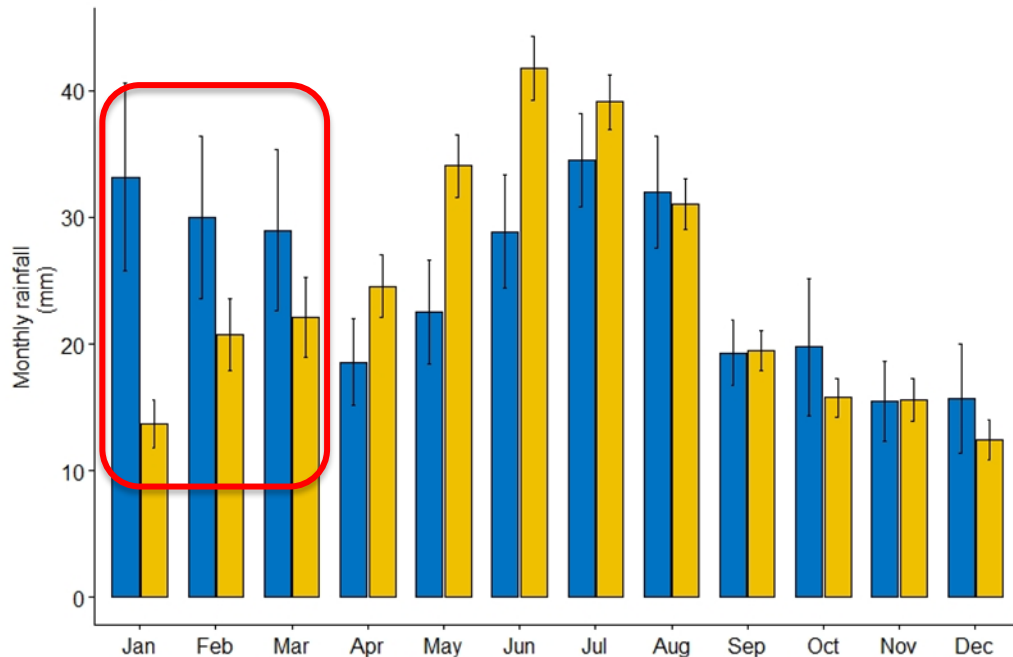


Source: Bureau of Meteorology

Reduced in-season rainfall in the last 20 years



But there are new opportunities

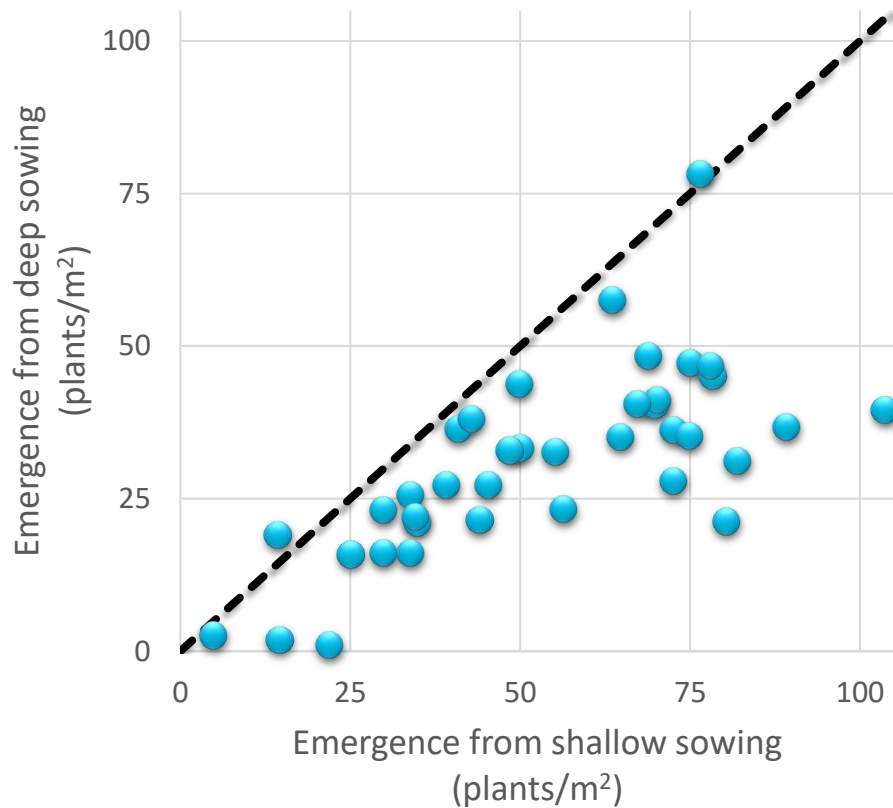


Southern Cross, WA
(pre-2000 and post-2000)

More stored soil moisture at depth in some years



Current varieties are unsuited to deep sowing



Credit: Andrew Fletcher, CSIRO





Does hypocotyl length limit deep sowing?

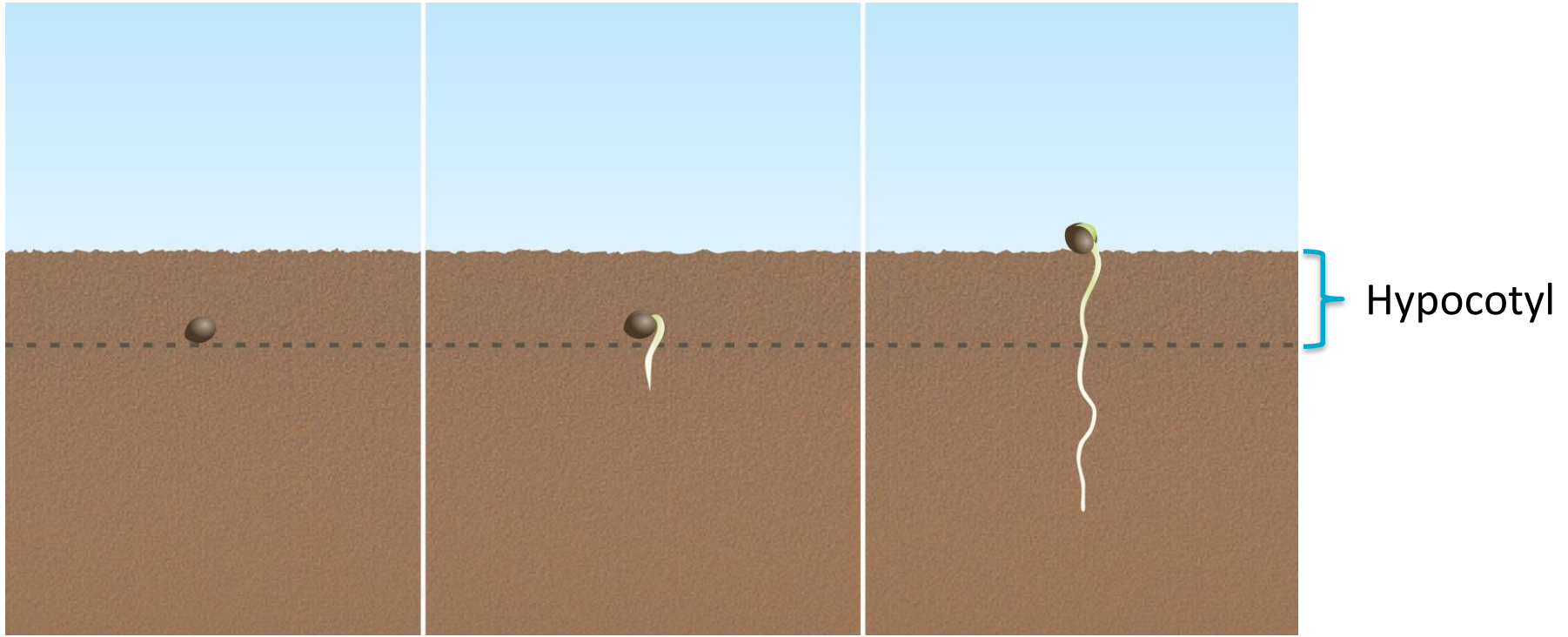
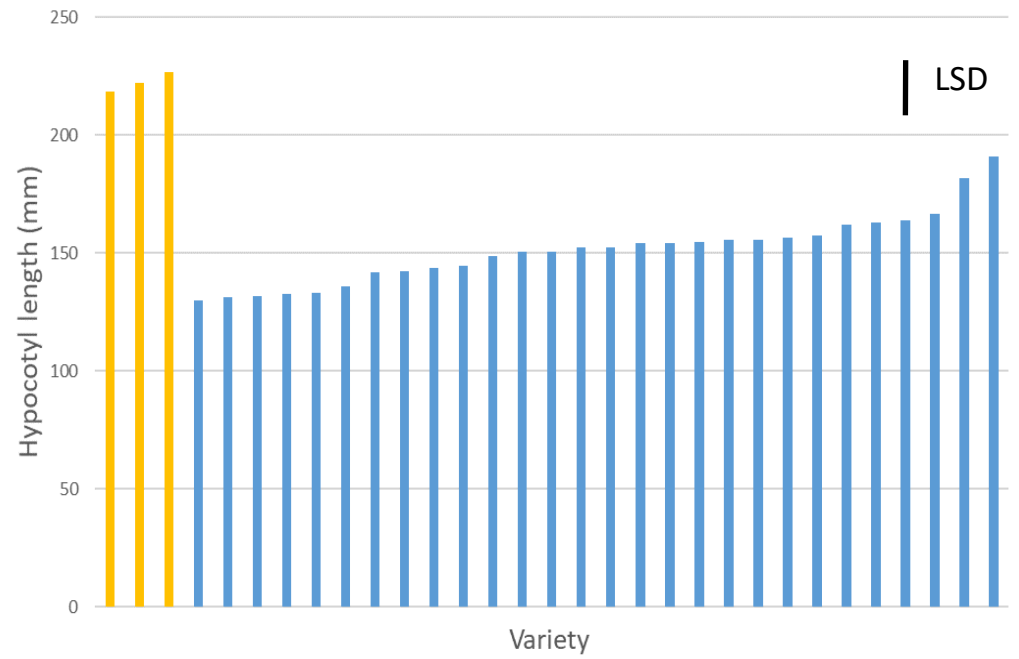
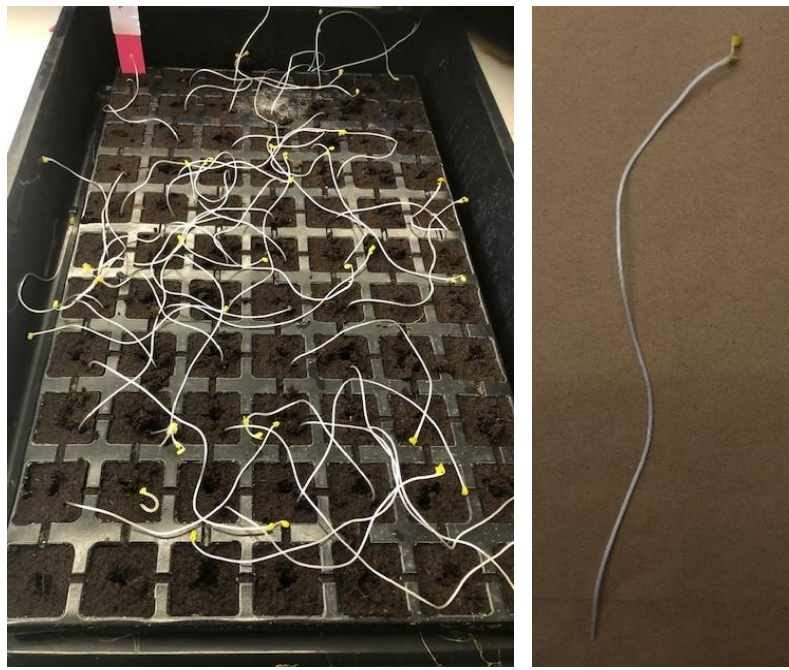


Figure credit: Carl Davies



International OP varieties

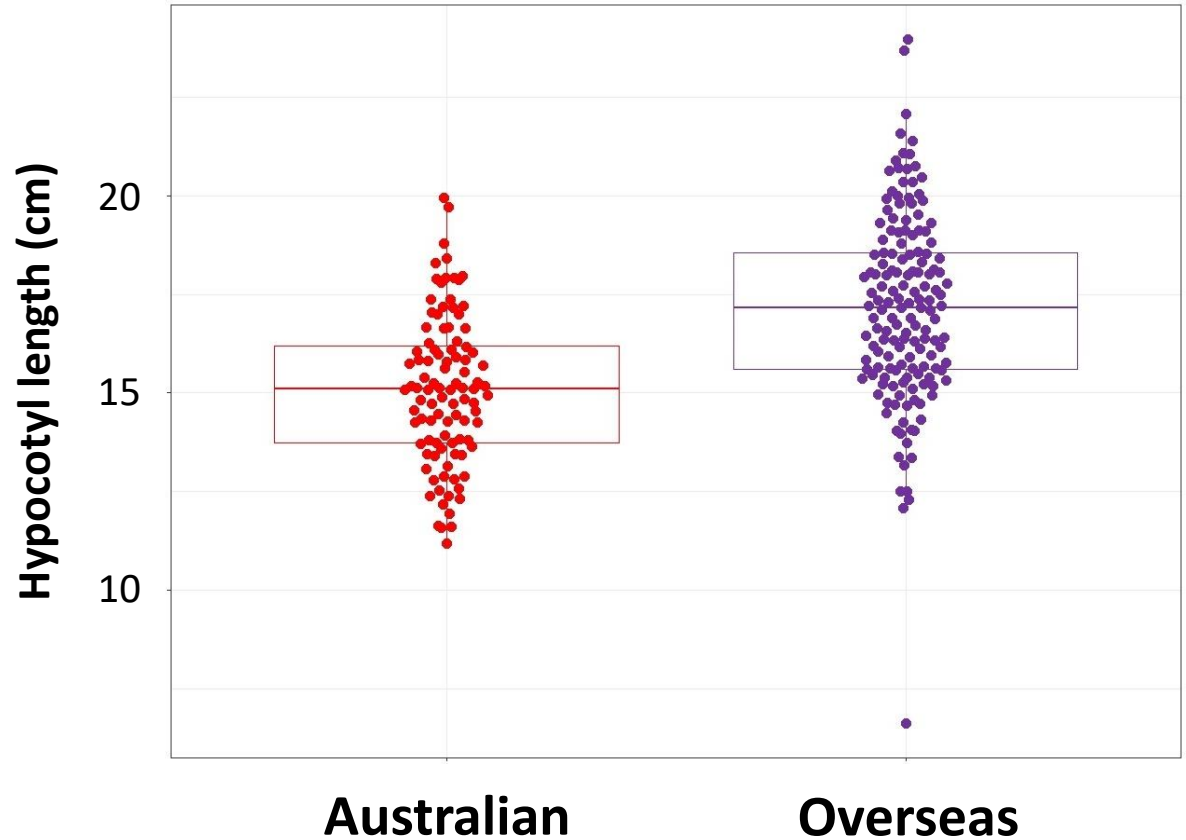
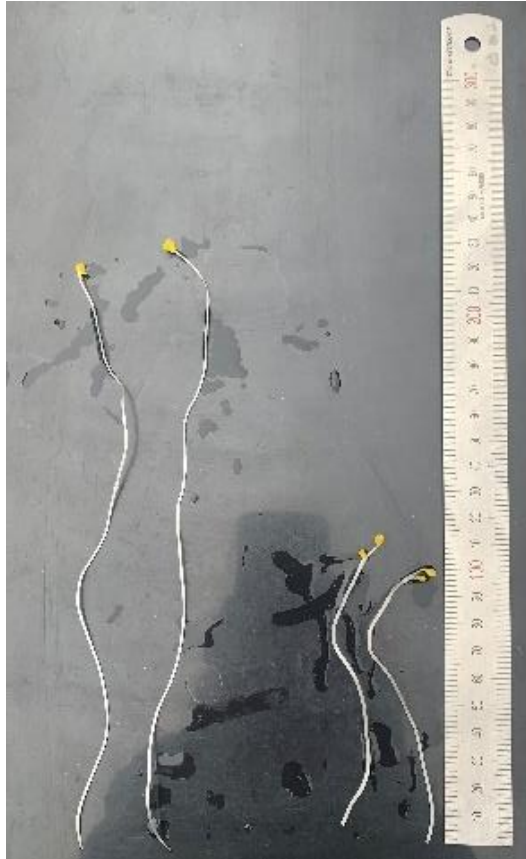
Current Australian varieties

- Individual seeds weighed
- 15 or 22 °C in dark for 230 °Cd

Heritability = 0.86



Australian varieties have short hypocotyls



Eight field sites in Australia in 2021 and 2022



- 3000 seeds per site hand-sown at 2 cm and 5 cm depths
- 20 international varieties (same seed source, same size)
- 5 current Australian varieties
- Regular emergence counts
- Final biomass at 4-leaf stage

Best
Australian
variety



2 cm

5 cm



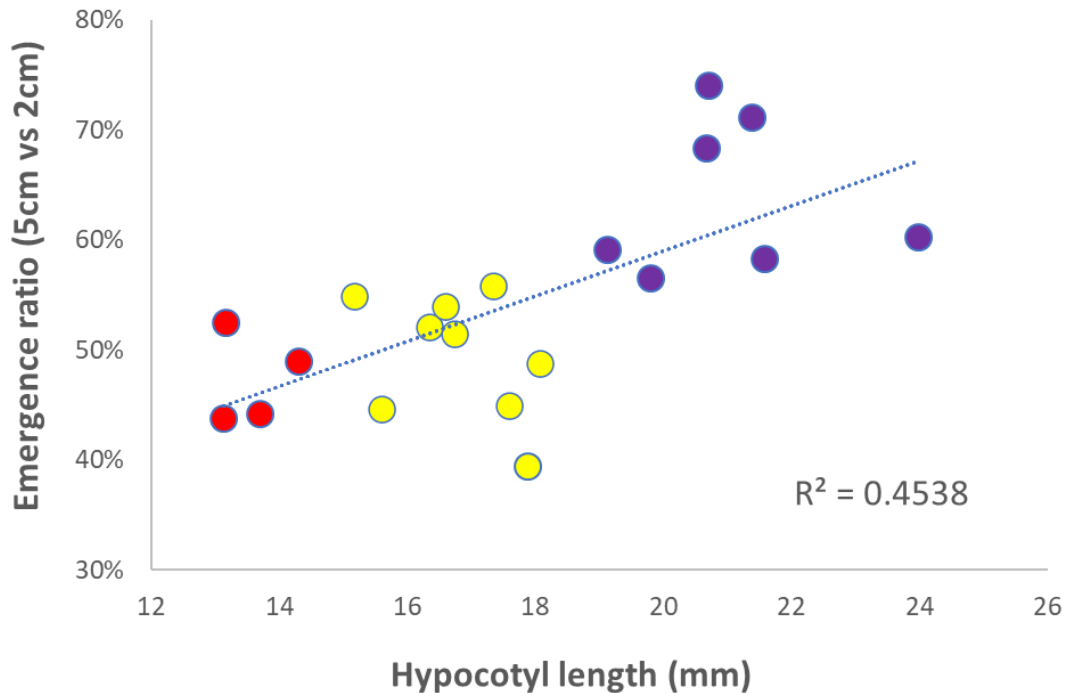
2 cm

5 cm

Best
international
variety



All the best emergers had long hypocotyls

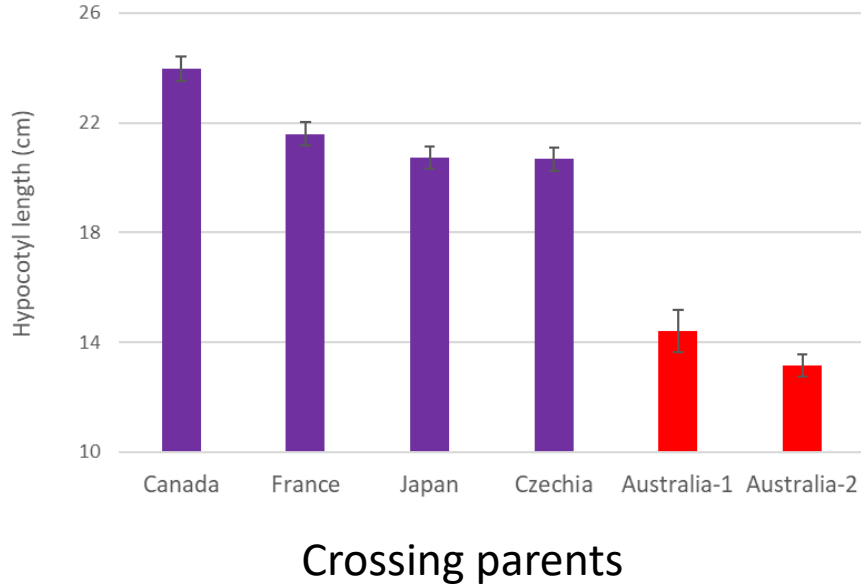


- Longest hypocotyl varieties were all from overseas
- Shortest hypocotyl varieties were all historic Australian

We need to bring long hypocotyl genes from overseas into Australia

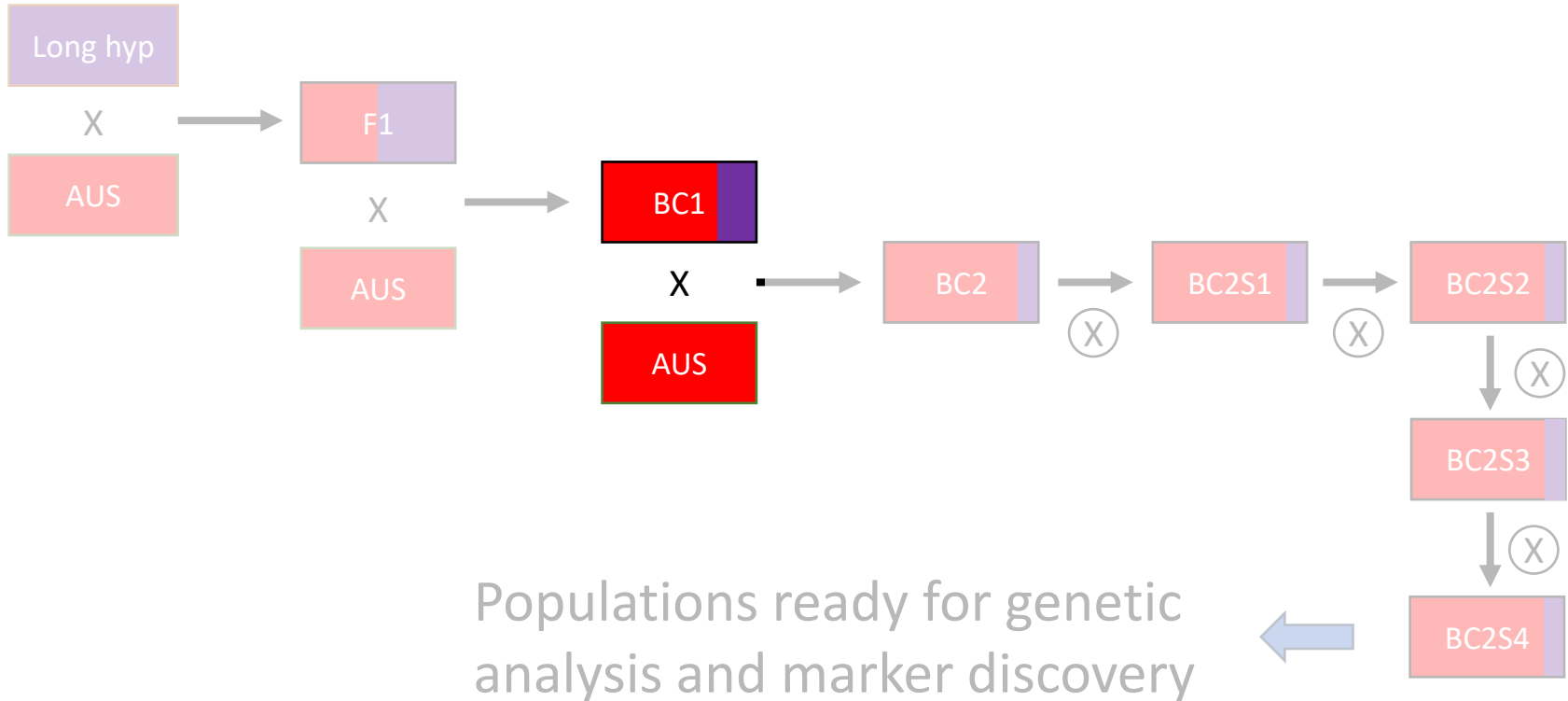


Long Hypocotyl Canola project: Aims

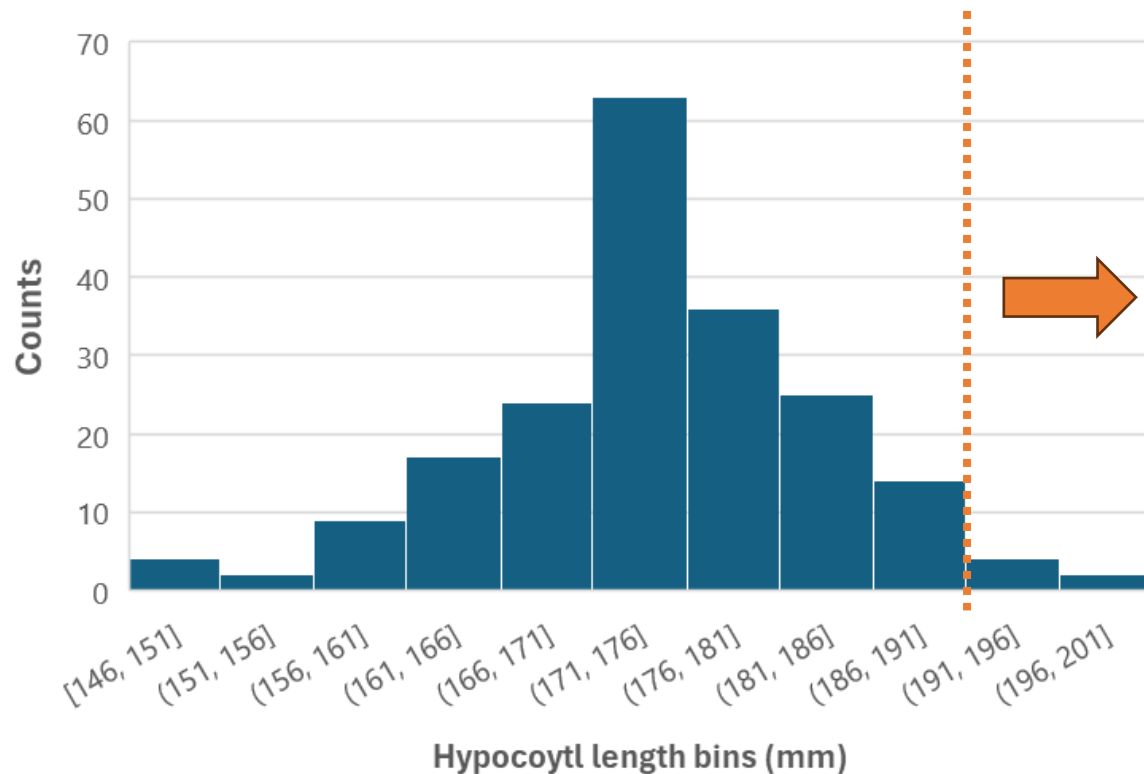


1. Transfer long hypocotyl genes into Australian background
2. Confirm the value of long hypocotyls in field experiments
3. Understand how hypocotyl length interacts with temperature, moisture, etc
4. Provide Australian-adapted, long hypocotyl germplasm & marker tools to breeders

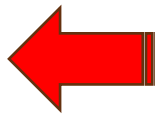
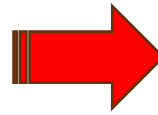
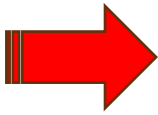
Crossing strategy



Selecting long hypocotyl BC1 plants



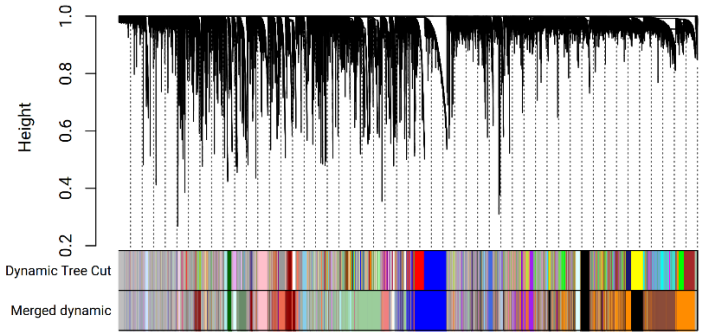
Top 5 crossed,
BC2 + BC1S1
obtained





Identifying long hypocotyl genes

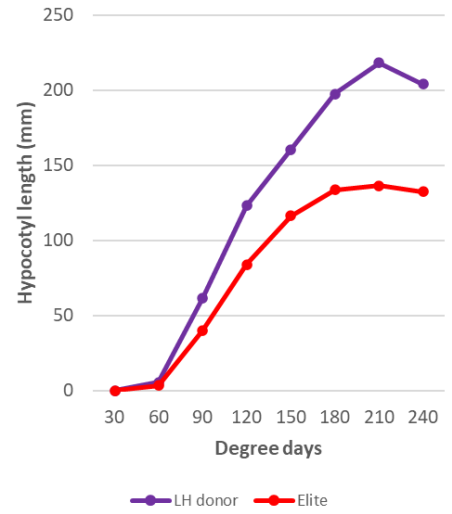
Cluster Dendrogram



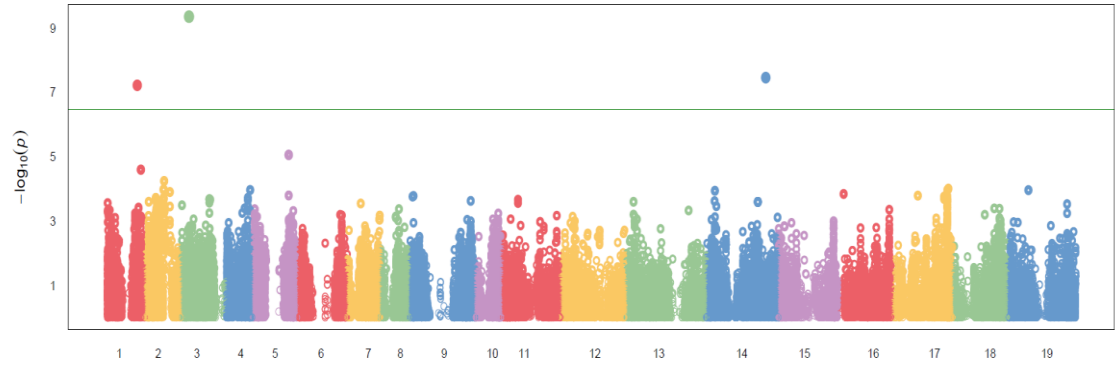
Virginia Wainaina



Angelia Tanu



Trijntje Hughes



Beata Sznajder



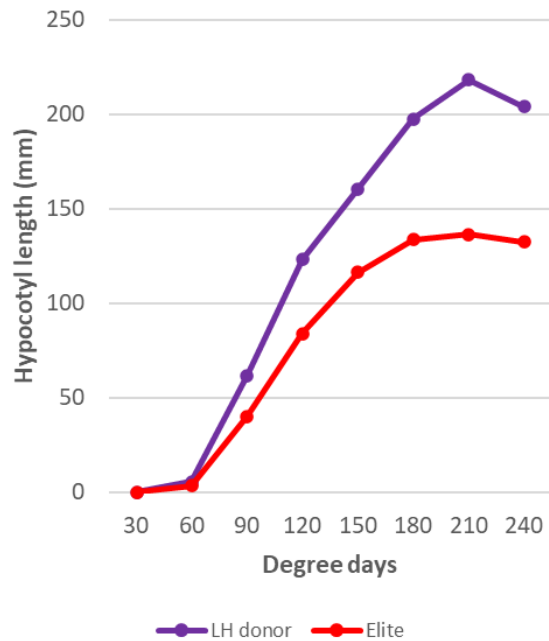
Candy Taylor



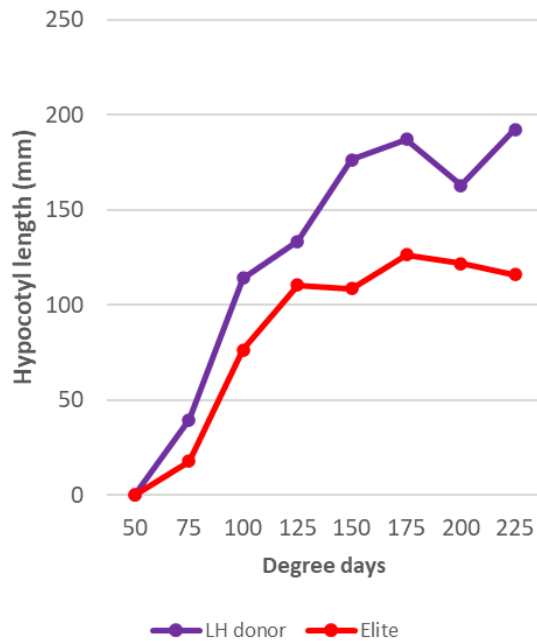
Impact of temperature on hypocotyl growth



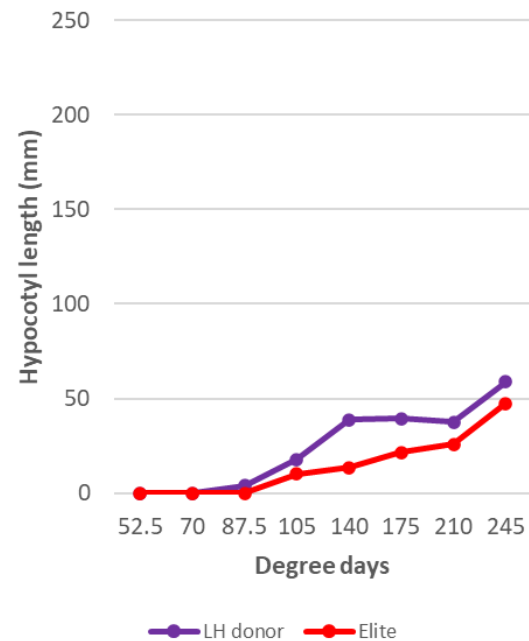
15 °C



25 °C



35 °C





Harnessing wild Brassica diversity



Candy Taylor

Identifying gaps in seed collections



Collaborators: Makenzie Mabry, Alex McAlvay

Epicuticular wax



Collaborators: Mark Smith, Fred Beaudoin



Flowering time calculator



Canola Flowering Calculator

Helping you optimise your canola program

[Learn more about this tool >](#)

Choose your scenario below to get started



Which variety should I sow?

(I know my intended sowing date)

Go



When should I sow?

(I know my variety)

Go



Shannon
Dillon



Chris
Helliwell



GRDC
GRAINS RESEARCH
& DEVELOPMENT
CORPORATION



next generation



Acknowledgements

- The organisers of this meeting
- Allison Pearson (GRDC)
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- Australian Grains Genebank for historic Australian varieties
- Breeding companies for current Australian varieties
- Nathalie Nesi, Anne Laperche, Mathieu Gueutin-Rousseau, Rod Snowdon, Steve Penfield, Rachel Wells, Jun Zou & Sally Vail for their collaboration



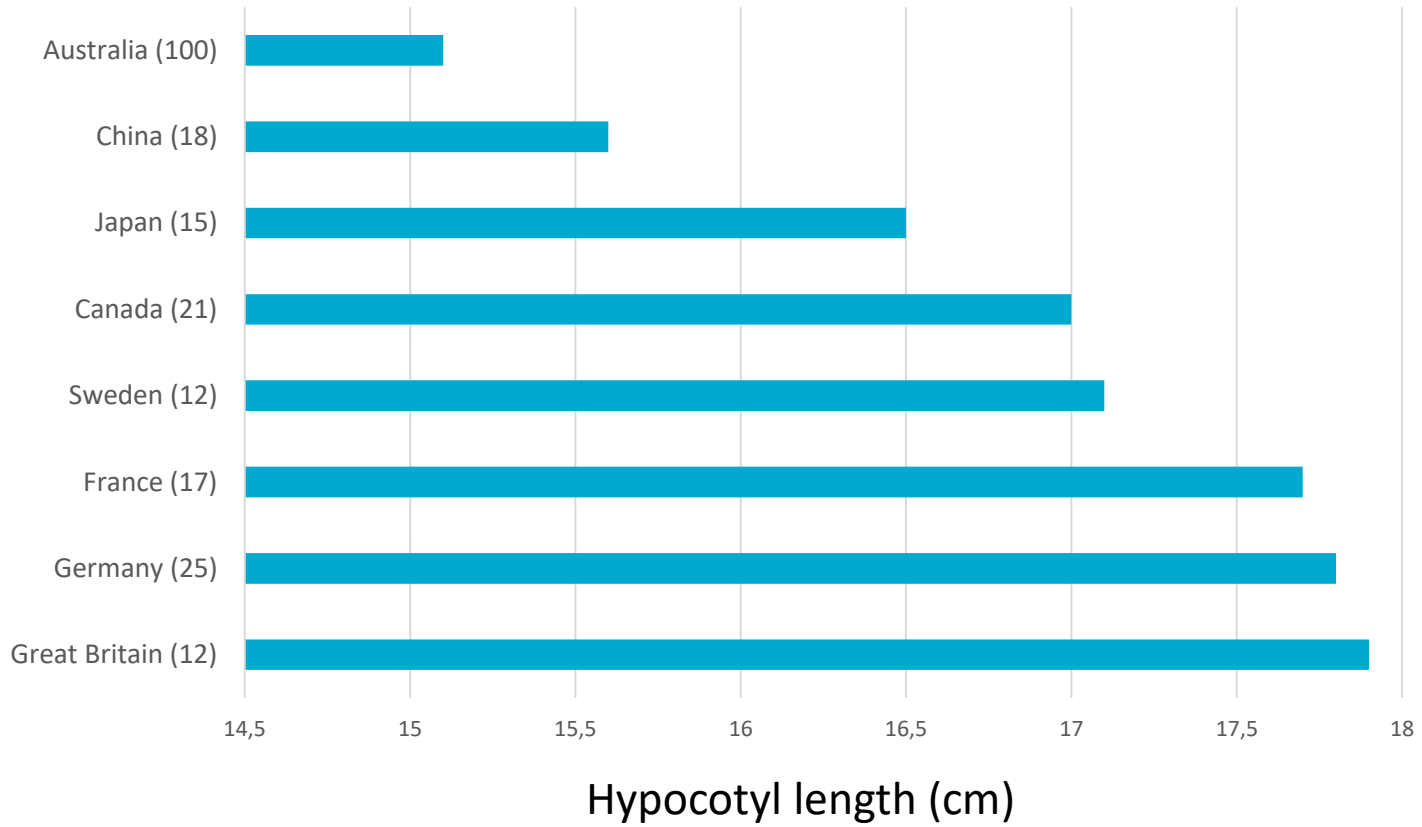
THE UNIVERSITY
of ADELAIDE





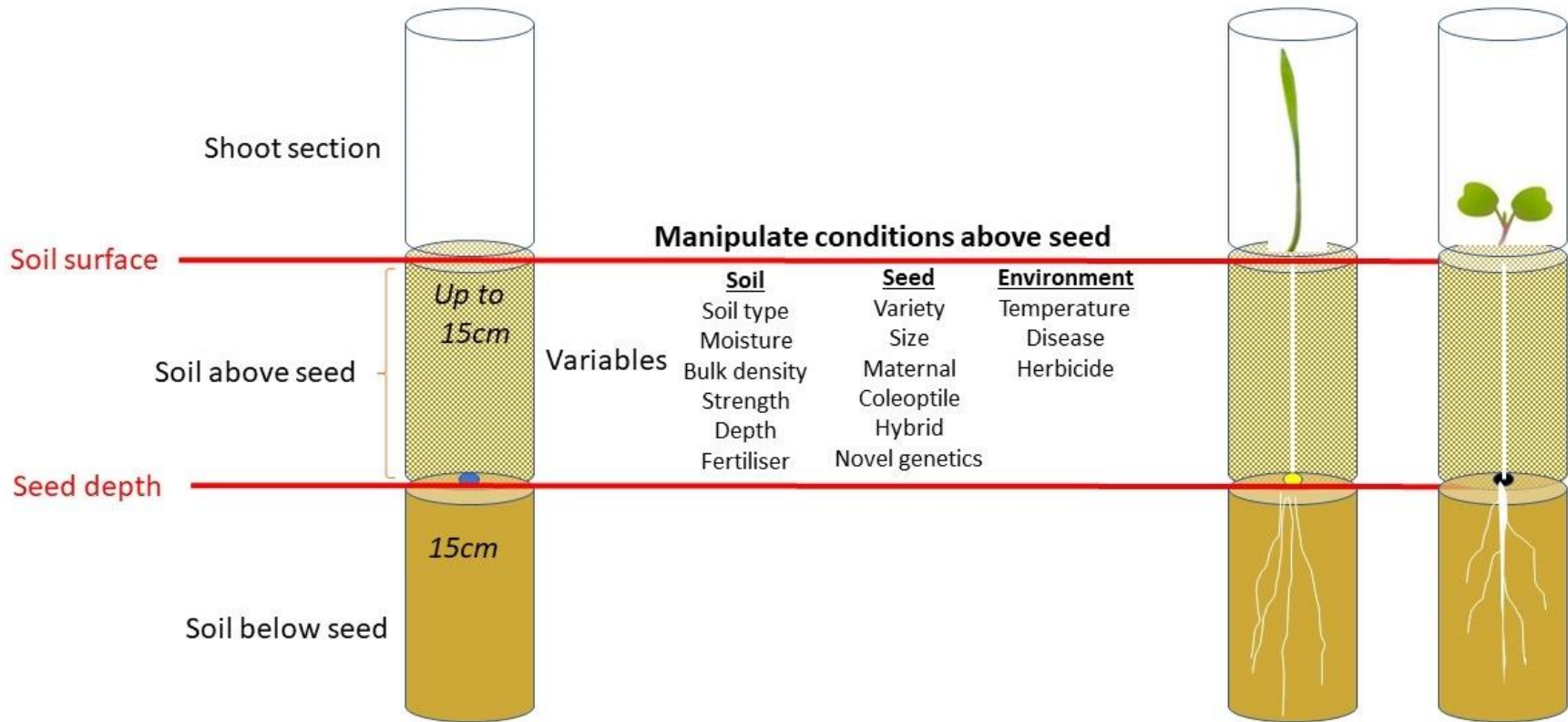


Average hypocotyl length by country (# accessions)





Simulating field conditions in the lab



0.5
kg/cm²



1.5
kg/cm²



2.5
kg/cm²



3.5
kg/cm²



4.5
kg/cm²



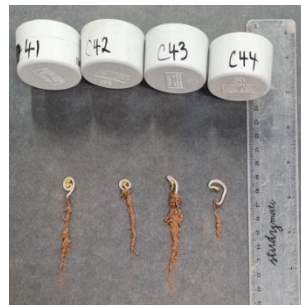
5.5
kg/cm²



2cm →



5cm →



- Regiment XC sown in 3.8cm diameter PVC tubes in Geraldton sand
- 2cm & 5cm depths
- Emergence scored 21 DAS

What influences hypocotyl growth?



- Long vs short hypocotyl varieties
- Sandy vs loamy soils
- Light vs medium soil strengths
- Large vs small seeds