GROWING COTTON IN A WARMING WORLD

ROBERT EVELEIGH
IS CLIMATE CHANGE REAL?

- I was a sceptic but ..........
ACRI – Degree days

Extra 100 degree days every 10 years
ACRI - Day Degrees

Last 5 years above average
(2018 record year)
WHAT CAN WE DO ABOUT IT?

• Nothing?
• Inconvenient choices
• Get someone else to solve the problem
• Agronomic solutions
COTTON IS ALREADY ADAPTED TO HOT CLIMATES

- Yields maybe reduced but cotton can handle hot conditions
- Indeterminacy and its desert heritage gives cotton the ability to survive very hot temperatures.
- But ideally a constant leaf temperature of 28°C is the sweet spot.
- 2018 was a hot season in most regions but yields were quite good where the crop had at least a week or two of optimal temperatures compensate for the heat.
- More CO² may allow plants to compensate for the rising temperatures?
The big players in the wine industry are moving to cooler climates.

Climate change will threaten wine production, study shows

Global warming will make it difficult to raise grapes in traditional wine country, but will shift production to other regions.
COTTON YIELDS IN THE SOUTH AND EAST CONTINUE TO IMPROVE
BREEDING MUST PLAY ITS PART

• Current breeding program
  • Has been breeding for heat tolerance before global warming was identified as a problem.
  • CSIRO breeders have a very successful history of developing cultivars that can overcome production constraints but....
  • Is this keeping up with the rate of global warming?

• Specific breeding for heat tolerance
  • Active programs to develop cultivars that can yield better as the world heats up.
BREEDING USING ASSAYS

• Hot water bath

Warren Conaty and Susan Jaconis (CSIRO)
ASSAYS FOR POLLEN VIABILITY

• TTC – 2-3-5-triphenyl tetrazolium chloride
• FDA – fluoresceine diacetate
• CAA – carmino acetic acid
• X Gal - 5-bromo-4-chloro-3-indolye-β-galactoside
• PG - in vitro pollen germination
BIOTECHNOLOGY

• Stress genes?

• CBA - Currently no new research on heat tolerance!
AGRONOMIC SOLUTIONS

- Planting date
- Hormones/chemical solutions
AGRONOMIC SOLUTIONS

• Planting date
• 3 scenario’s
  • irrigation full water
  • Irrigation limited water
  • dryland

In full season areas, later sowing may avoid heat waves during January

Bange 2008
AGRONOMIC SOLUTIONS

- Planting date
- 3 scenario’s
  - irrigation full water
  - Irrigation limited water
  - dryland

Planted late – more bales/MI by avoiding hot days

![Water use efficiency graph](chart.png)

Water use efficiency (kg/mm/ha)

- 16 Oct 2007
- 13 Nov 2007
- 28 Nov 2007
AGRONOMIC SOLUTIONS

- Planting date
- 3 scenario’s
  - irrigation full water
  - Irrigation limited water
- dryland

How can you go past a planting opportunity?
CAN YOU PLANT EARLY AND DELAY DEVELOPMENT?

CRDC PROJECT BY DR MIKE BANGE AND CLAIRE WELSH (CRDC)

• Application of specific plant hormones may effectively slow crop growth and development – delay peak flowering to receive more desirable temperatures.

• Anti-ethylene agents (eg. aminoethoxyvinylglycine) to reduce fruit abscission – help the crop get through limited heat waves.

• Cytokynins and gibberellins to promote effective exploration of roots under limited water situations.

• Some promising early results from this project.
WAYS TO INCREASE PLANTING OPPORTUNITIES

• A dense cover of cereal stubble

• But what if we could manage the stubble better
  • Stripper fronts leave more standing stubble than conventional header fronts (David Ricardo)
  • Is there a way we can concentrate stubble on the plant line (dry scenario) and have an adjacent zone with less stubble (wet scenario)
All 3 plasma treatments significantly increased hydrophilicity (reduced water absorption time). The effect persisted for up to 19 weeks. → Seed treatment can be performed months before planting.
OTHER WAYS TO PLANT INTO MARGINAL CONDITIONS

• Seed soaking
• Moisture attractants
• Water injection - AccuShot

Figure 20. AccuShot synchronised liquid injection (Accushot, 2016).

AUSTRALIAN COTTON CONFERENCE 2018
Geoffrey Phelps
IN SUMMARY

• There is no silver bullet to solve all the challenges of cotton growing (or other crops) in a warming environment.

• Technology and management changes will help but we need to increase our research into adapting to climate change.

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