NSW GOVERNMENT Department of Primary Industries

Environment impact on grain quality

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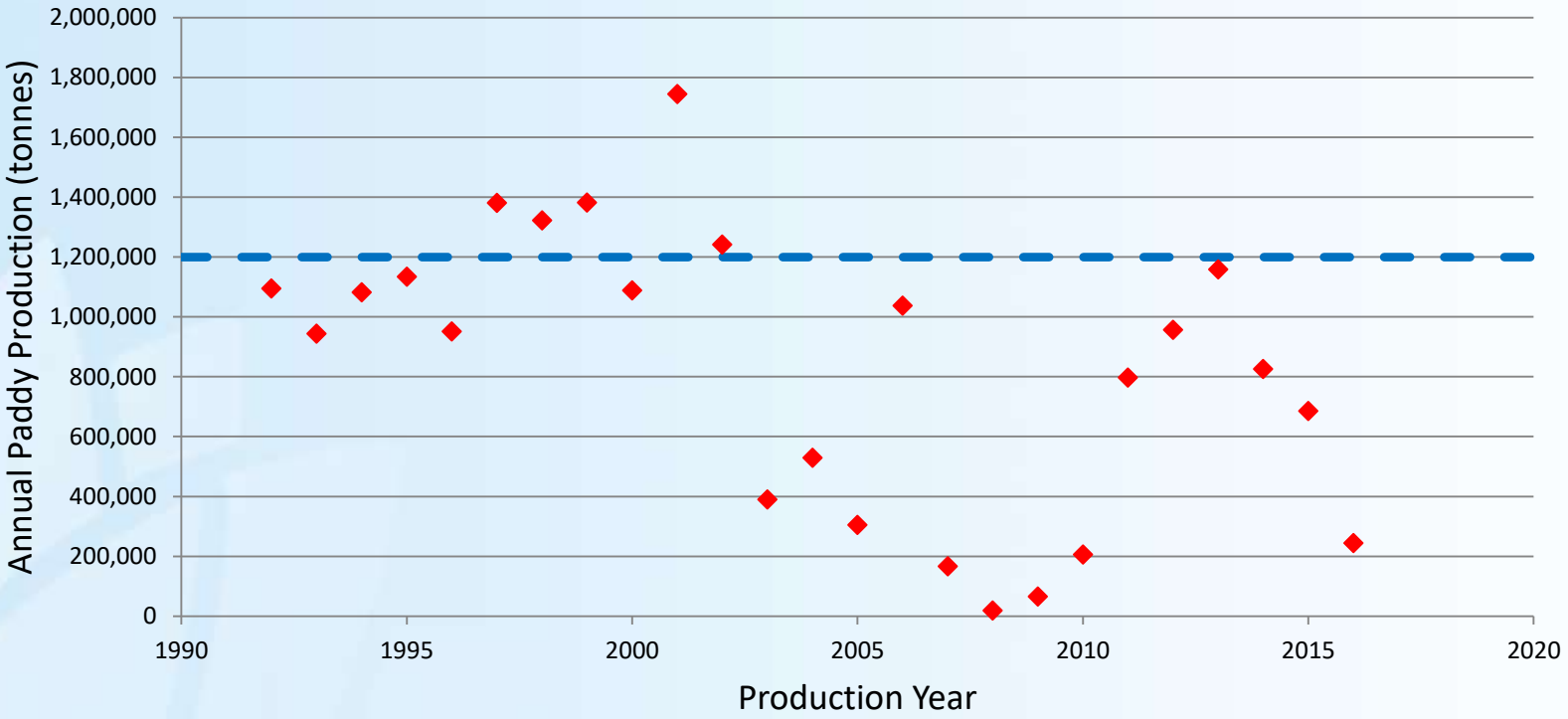
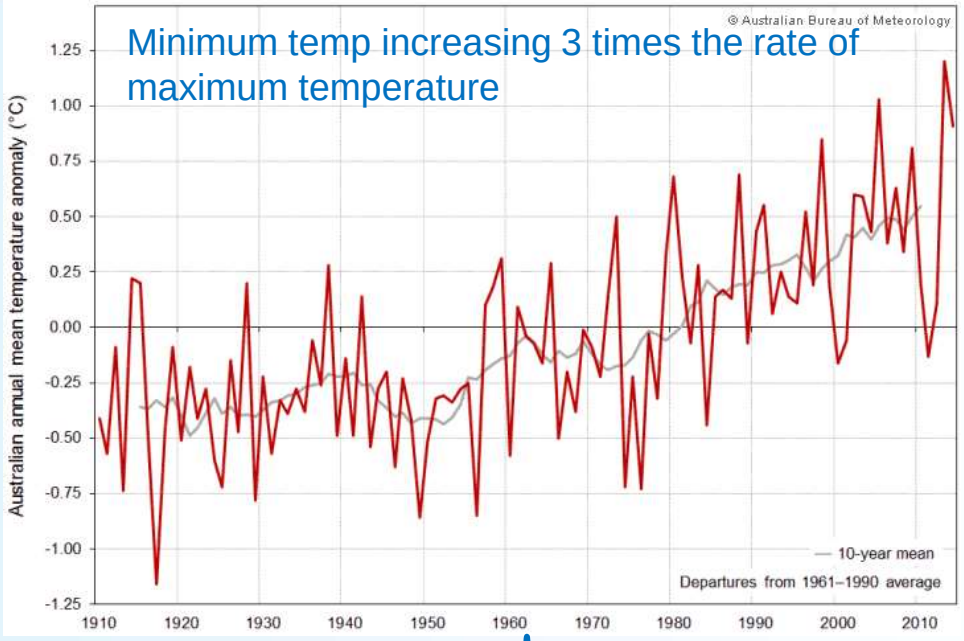
Australian Rice PARTNERSHIP

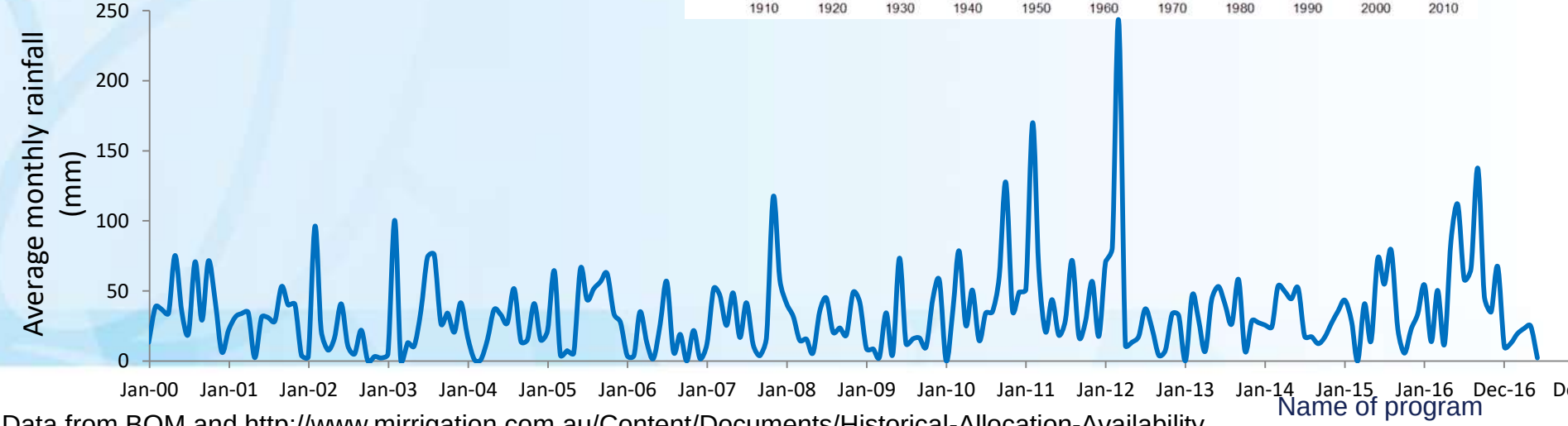
Recent production



Recent production challenges

Year	General Security	High Security
2000/01	90%	95%
2001/02	77%	95%
2002/03	38%	95%
2003/04	41%	95%
2004/05	43%	95%
2005/06	57%	95%
2006/07	15%	90%
2007/08	18%	95%
2008/09	26%	95%
2009/10	31%	95%
2010/11	105%	100%
2011/12	105%	100%
2012/13	105%	100%
2013/14	68%	95%
2014/15	53%	95%
2015/16	37%	95%
2016/17	100%	100%





Data from BOM and http://www.mirrigation.com.au/Content/Documents/Historical-Allocation-Availability

Approaches for production *and* quality

Rice must be of good, consumer accepted quality

SESSION 1 – breeding

- Varietal improvements

SESSION 2 - quality and marketing

- Agronomic advances
- Market requirements for a good industry

SESSION 3 – health qualities

- Consumer driven quality

How do we achieve these production AND quality goals under challenging production conditions?

Focus on amylose

Amylose content (and structure)

- differentiates our commodities
- drives digestibility, GI
- explains texture
- vulnerable to growing temperatures

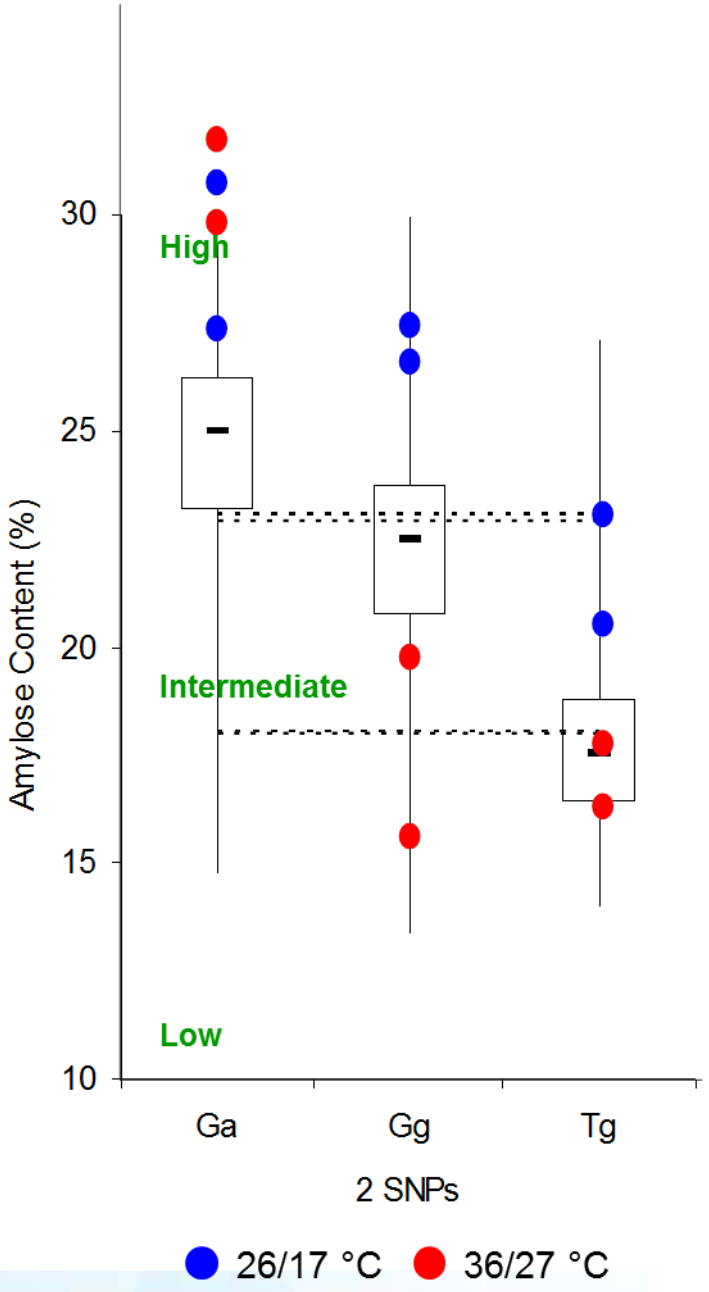
- parcel all these up into a breeding and agronomic package

Glasshouse trials

Ability to focus on one abiotic stress in isolation

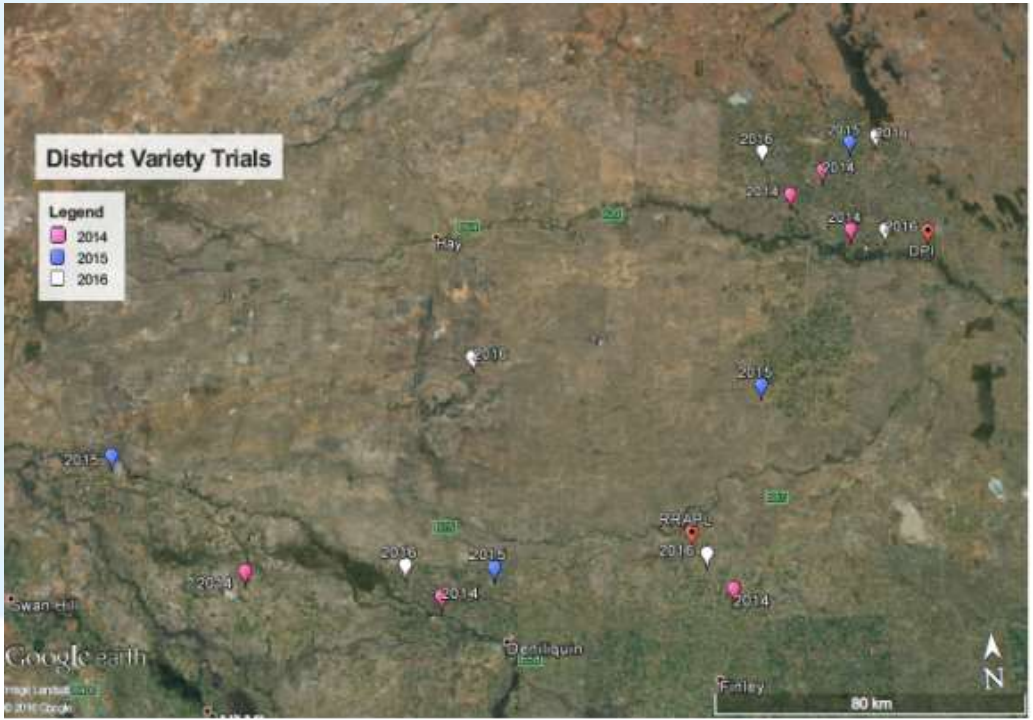
Ability to focus on one specific grain quality trait

Variety	Amylose (%) 26 / 17 °C	Amylose (%) 36 / 17 °C	Amylose (%) 36 / 27 °C
Amaroo	16.5	14.7	14.3
Langi	23.9	15.4	17.2
Doongara	27.8	17.9	15.6
IR64	24.7	20.5	18.0

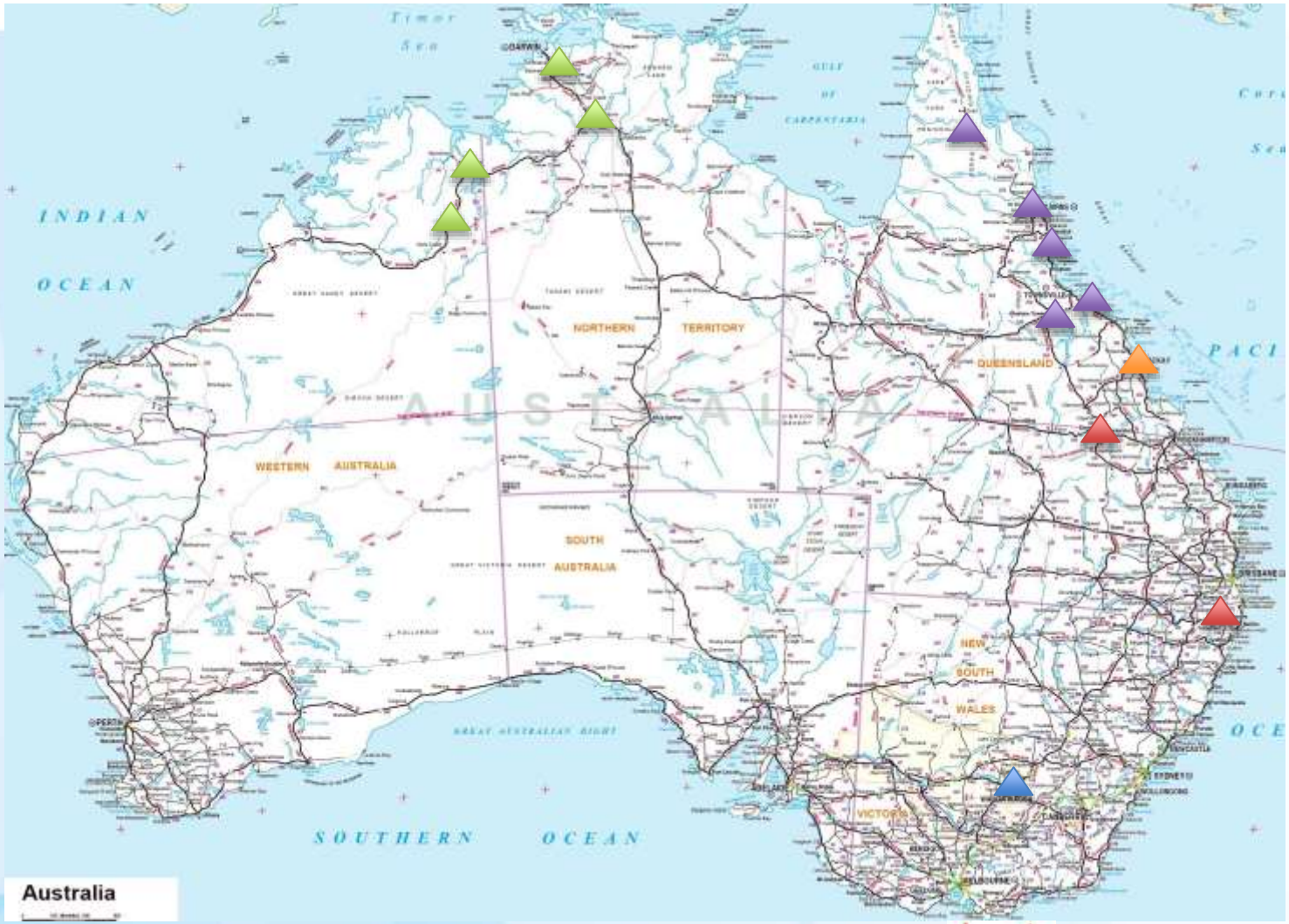


Advanced District Trials

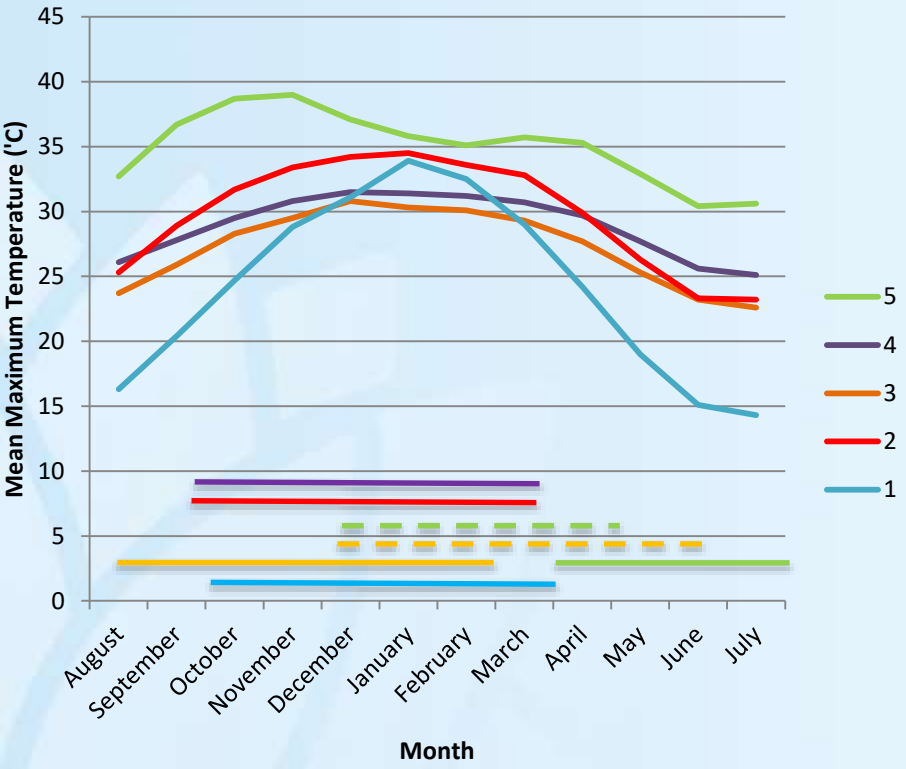
- Conducted every second year in the Rice Partnership
- Trials of Australian varieties grown across the traditional production systems
- Capture changes in quality over time and location
- Informs recommendations and used for varietal release
- Southern region only

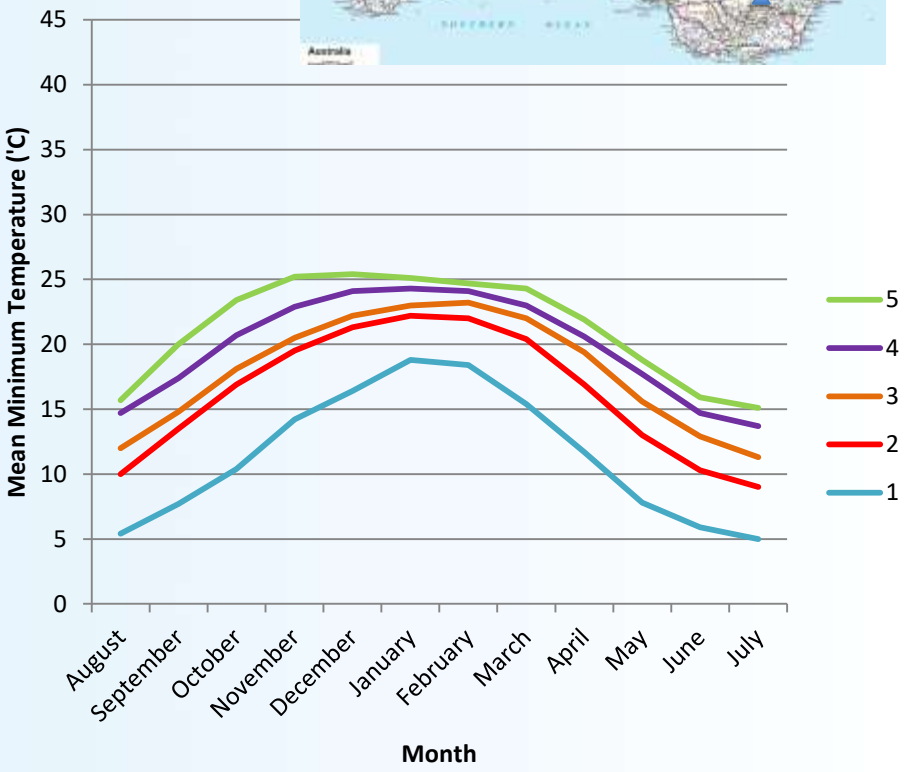


Australia – matching southern quality



Australia


Mean Maximum Temperature (°C)
45
40
35
30
25
20
15
10
5
0
August
September
October
November
December
January
February
March
April
May
June
July
Month
5
4
3
2
1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March
April
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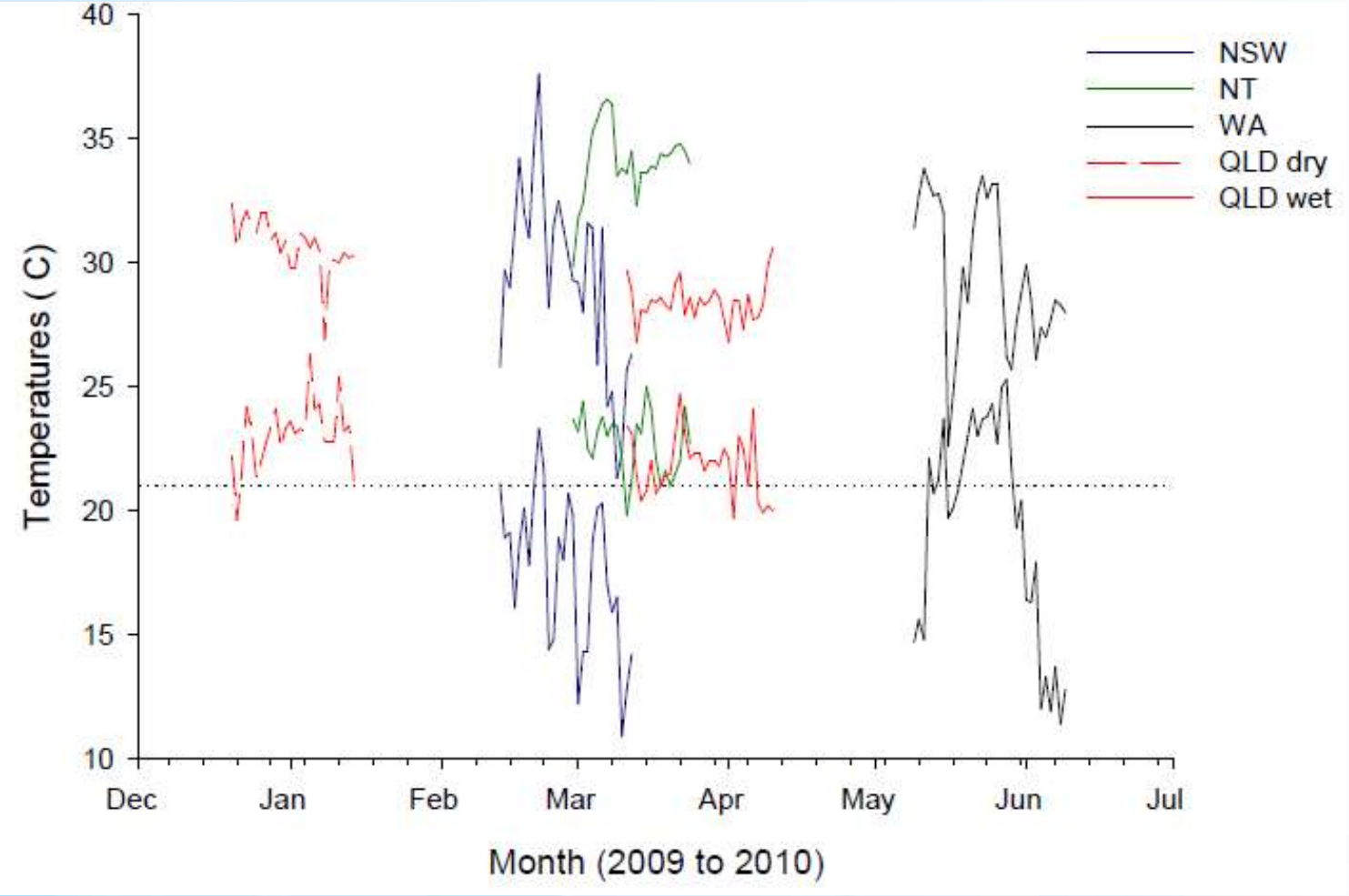
June
July
Month
5
4
3
2
1

Temperature at grain-filling



Meta-dataset

Origin of data

- Compiled from multiple ancillary projects
- Spans 8, now 9 years
- 13 locations in 5 subgroups
- 2 seasons, wet(w) and dry(d) in some years and locations

Grain quality data

- More than 200 varieties, only 66 common to 2 or more locations
- Physical, compositional and functional grain quality data
- Amylose content is central to many consumer relevant traits

			Harvest Year								
Group	Location	State	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	Yanco	NSW	d	d			d	d	d		
2	Lismore	NSW		d	d	d					
2	Emerald	Qld		d							
3	Mackay	Qld	d, w	d, w	d, w	d, w	d	w	d, w	d, w	d
4	Ayr	Qld								d	
4	Burdekin	Qld								d	
4	Tully	Qld								d	
4	Mareeba	Qld		d							
4	FNQ	Qld								d	d
5	Ord River	WA		d							
5	Kununurra	WA			w						
5	Katherine	NT			d						
5	Tortilla Flats	NT				d, w			w	d	

Meta-analysis – seasonal variation

Wet v dry season in Group 3 (Mackay only)

Variety	Amylose (%) ± s.e. dry season (n)	Amylose (%) ± s.e. wet season (n)	Protein (%) ± s.e. dry season (n)	Protein (%) ± s.e. wet season (n)
Kyeema	17.9 ± 0.2 (30)	17.7 ± 0.1 (9)	9.6 ± 0.3 (30)	9.3 ± 0.2 (9)
Topaz	16.2 ± 0.1 (14)	16.4 ± 0.2 (4)	10.4 ± 0.2 (14)	9.3 ± 0.5 (4)
Quest	15.5 ± 0.1 (9)	15.6 ± 0.21 (7)	8.2 ± 0.3 (9)	10.4 ± 0.2 (7)
Langi	16.7 ± 0.1 (18)	15.6 ± 0.2 (13)	8.9 ± 0.3 (18)	10.1 ± 0.2 (13)
Doongara	24.8 ± 0.2 (18)	23.9 ± 0.2 (18)	8.4 ± 0.2 (18)	8.5 ± 0.2 (18)

Note: Data averaged across all years of available data

Meta-analysis – locational variation

Apparent amylose content (%)

Variety	Group 1	Group 2	Group 3	Group 4	Group 5
Kyeema	18.6 ± 0.2 (2)	NA	17.3 ± 0.1 (77)	19.3 ± 0.3 (3)	17.2 ± 0.3 (19)
Topaz	NA	NA	15.2 ± 0.2 (37)	17.4 ± 0.3 (3)	14.7 ± 0.5 (3)
Quest	NA	19.4 ± 0.2 (8)	15.8 ± 0.2 (27)	NA	15.6 ± 0.6 (16)
Langi	19.7 ± 0.3 (7)	17.4 ± 0.2 (2)	15.9 ± 0.1 (45)	19.7 ± 0.2 (3)	13.7 ± 0.4 (10)
Doongara	23.1± 0.3 (2)	26.3 ± 0.1 (2)	24.0 ± 0.1 (61)	25.3 ± 0.2 (3)	23.8 ± 0.3 (27)

Are changes in amylose content reflected in textural and digestibility properties?

Is amylose content sufficient to explain functional properties?

Meta-analysis – locational variation

Protein content (%)

Variety	Group 1	Group 2	Group 3	Group 4	Group 5
Kyeema	7.4 ± 0.1 (2)	9.6 ± (1)	9.5± 0.2 (77)	7.7± 0.3 (3)	7.7 ± 0.2 (19)
Topaz	NA	NA	10.5 ± 0.2 (37)	8.5 ± 0.6 (3)	9.8 ± 0.3 (3)
Quest	6.3 ± 0.0 (2)	9.3 ± 0.2 (8)	9.5 ± 0.2 (27)	NA	8.9 ± 0.4 (16)
Langi	7.0 ± 0.2 (7)	7.0 ± 0.1 (2)	9.3 ± 0.2 (45)	11.5 ± 0.1 (3)	8.0 ± 0.3 (10)
Doongara	6.8 ± 0.3 (2)	7.0 ± 0.1 (2)	8.6 ± 0.1 (61)	6.9 ± 0.6 (3)	8.3± 0.3 (27)

Where to next…..

- Meta-datasets are valuable and will be added with each project
- Amylose content is a surrogate for many consumer recognizable traits

  …….but many other quality traits offer advantageous benefits
- Season by variety opportunities to capitalise on high-end quality
- Edible whole grain that seamlessly blends with Riverina material
- At least two fresh crops annually to supply market
- Market success through consistent product delivery

Acknowledgements

Growers at each location

YAI – cereal chemistry team for lab work

NSW DPI biometricians

Various projects that generated the samples