Optimising cultivar and time of sowing in wheat

Sarah Noack and Peter Hooper, Hart Field-Site Group
James Hunt, CSIRO Agriculture

Key Findings

- Despite damage from frosts, the highest wheat yield in this trial came from Trojan sown in late April at Hart.
- Based on two years of trial data across SA, Trojan complements Mace in a cropping program and allows growers to sow earlier and achieve higher yields (0.7 t/ha) than could be achieved with Mace alone.
- Across nine trials in SA (2014 and 2015) there was an average yield penalty of 28 kg/ha per day for every day sowing is delayed past the end of the first week of May.

Why do the trial?

The majority of our current wheat varieties need to be sown in the first half of May to flower during the optimal period for grain yield. Recent research in southern NSW has shown they have well adapted winter and slow maturing spring cultivars that when sown in mid-late April will out-yield fast maturing cultivars sown in May. However, the same cannot be said for SA where no cultivar x ToS options have been shown to out-yield Mace sown in its optimal window.

Currently options for growers in SA who wish to sow early are not well known. The aim of this trial was to investigate time of sowing for individual wheat cultivars with different maturities.

How was it done?

Plot size	1.75 m x 10.0 m	**Fertiliser**	DAP (18:20) + 2% Zn @ 100 kg/ha @ seeding
Seeding date	ToS 1 – 10th April ToS 2 – 30th April ToS 3 – 15th May		Urea @ 70 kg/ha split application @ GS30 and GS32 for each ToS

The trial was a split block design with three replicates, five bread wheat and one durum wheat cultivar (Table 1). Fungicides were applied as necessary to keep the crop canopy free of disease (ie. stripe rust). Crop growth stages were recorded between 12th of June and 8th of October to identify the flowering time for each treatment. All plots were assessed for grain yield, protein, test weight and screenings with a 2.0 mm screen.

Table 1. Wheat cultivars and their maturity used in this experiment

Variety	Maturity	Comments
Cobra	Fast maturing (moderate vernalisation, weak photoperiod)	High yielding AH quality variety similar maturity to Mace
EGA_Wedgetail	Mid-maturing winter (strong vernalisation, moderate photoperiod)	The early sowing and dual purpose standard in SNSW and an excellent grain-only option. May be too slow in most of SA, only has APW quality and can be quite intolerant of problems associated with alkaline soils (CCN, boron, aluminium)
Emu Rock	Very fast maturing (weak vernalisation, weak photoperiod)	High yielding AH quality variety suited to a broad range of environments in SA
Mace	Fast-maturing spring (moderate vernalisation, weak photoperiod)	No introduction necessary! SA main-season benchmark and in the trial as a control from a mid-late May sowing
Trojan	Mid-fast maturing spring (weak vernalisation, moderate photoperiod)	Has demonstrated good adaption to SA and has an unusual photoperiod gene which may allow it to be sown in late April and flower at the optimal period
DBA-Aurora		Released in 2014 this variety has shown a good disease resistance profile, improved grain size and grass weed competitiveness

Results and discussion

The area around Hart is not generally considered a frost prone district however, in both seasons of this trial frost damage has been evident in some treatments (variety and ToS dependent).

Trojan sown on 30th of April was the highest yielding treatment, out yielding Mace sown at the same time by 0.5 t/ha (Table 2). This result is similar to 2014 and reflects the results seen in a number of experiments across SA at Minnipa, Cummins, Pt Germein and Tarlee (Figure 1).

The optimal flowering time to maximise grain yield in the Hart area is considered to be mid-September. The optimal flowering time is a product of temperature, radiation, water availability and frost and heat risk. The highest yielding treatment Trojan sown at ToS 1 and ToS 2 was at mid-flowering or start of flowering growth stage, respectively at the optimal flowering time (Figure 2).

Cultivars Mace, Cobra and Emu Rock all yielded highest when sown on 30th April (ToS 2). At this ToS Mace and Cobra were mid-flowering at the optimal time (Figure 2). Emu Rock had almost finished flowering by the first week of September however, at the later ToS it was likely to have been impacted by heat stress in early October (>35°C for 3 days), reducing grain yield.

Slow maturing cultivars such as Wedgetail have shown poor adaptation across SA. In 2015 at Hart, Wedgetail sown early matched the yield of Mace sown in its optimal window. The growth stage assessments show Wedgetail sown on 10th April was able to reach flowering in mid-late September.

Protein did not vary across ToS however, there were significant differences between cultivars (Table 2). Similarly, there was no significant difference in test weight and all varieties were above 76 kg/hL the minimum required for maximum grade. Screening levels across the trial were generally low with all varieties below 5% (maximum level for maximum grade). Higher screening levels were measured in Emu Rock, which can be attribute to frost damage and also in DBA-Aurora.

Table 2. Grain yield and quality for all wheat varieties trialed at Hart, 2015.

	Yield (t/ha)			Protein (%)		
	10th April	30th April	15th May	10th April	30th April	15th May
Wedgetail	3.5	3.4	2.7	11.0	12.6	11.5
Trojan	3.7	4.0	3.4	10.0	10.3	11.0
Mace	2.9	3.5	3.5	11.2	9.8	10.1
DBA-Aurora	1.6	3.0	2.5	11.2	11.6	12.1
Emu Rock	3.1	3.4	3.1	12.6	11.7	11.9
Cobra	3.2	3.6	3.1	12.6	13.3	11.1
LSD (P≤0.005)		0.3			ns	
	Test weight (kg/hL)			Screenings (%)		
	10th April	30th April	15th May	10th April	30th April	15th May
Wedgetail	79.6	78.8	79.0	3.2	1.7	1.6
Trojan	79.3	80.1	78.6	2.0	2.0	3.5
Mace	79.3	80.0	80.4	1.3	1.6	2.6
DBA-Aurora	78.8	77.6	77.7	1.8	4.5	4.5
Emu Rock	78.3	79.8	78.2	4.8	4.5	2.4
Cobra	77.5	77.1	80.3	1.4	2.9	2.4
LSD (P≤0.005)		ns			1.6	

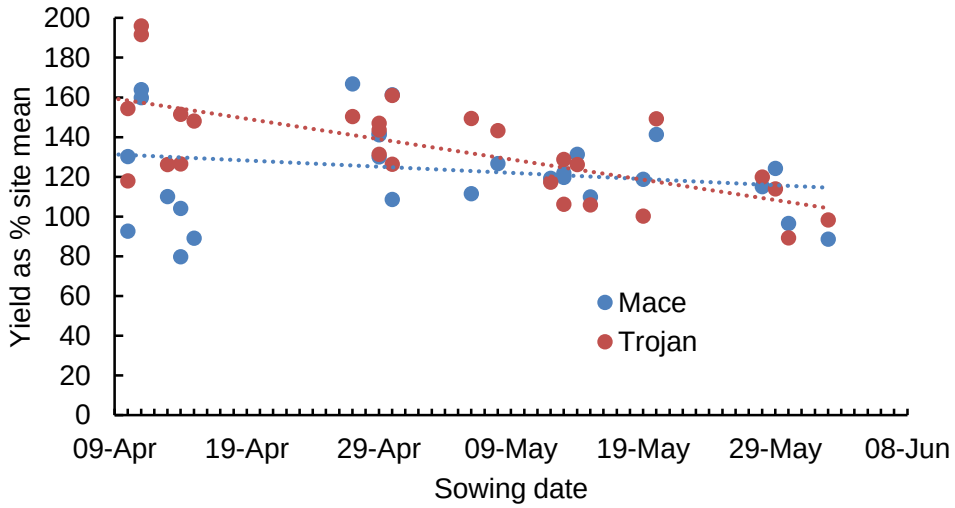

Figure 1. Mean yield (% of site mean) of Mace and Trojan at nine SA sites across 2014 and 2015 seasons (Minnipa 14 & 15, Cummins 14 & 15, Pt Germein 14 & 15, Hart 14 & 15, Tarlee 14). Linear regression for both Mace and Trojan are significant (P≤0.001) and are significantly different from each other in gradient (P=0.045) and intercept (P=0.025).

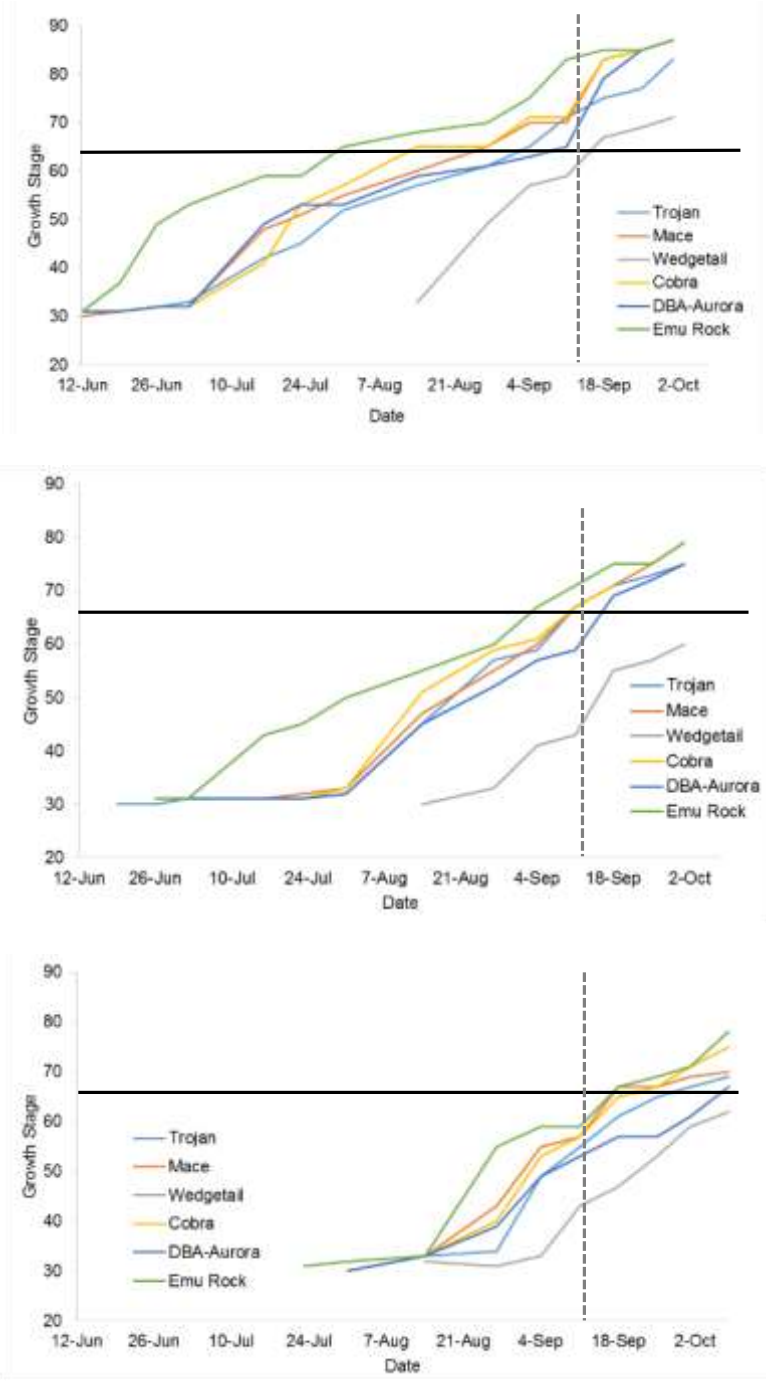

Figure 2. Growth stage assessment for all varieties and times of sowing 10th April (top), 30th April (middle) and 15th May (bottom) between 12th of June and 8th of October at Hart, 2015. The horizontal black line represents mid-flowering (GS65) and the vertical dashed line displays optimal flowering time (approximately 15th September).

Implications

Trials across multiple environments in SA over the past two years have shown that yields decline at a rate of 28 kg/ha per day once sowing extends past the end of the first week in May. In order to maximise average yields, growers should aim to finish seeding wheat by mid-May. Growers with longer wheat sowing programs will require multiple cultivars of different development types in order to allow them to start early enough. An example of how this might be achieved is presented in Table 3. In years with a late break where seed bed moisture isn't available to establish slow developing cultivars in their optimal window, yields will be maximised by dry sowing only a fast developing cultivar (e.g. Mace or equivalent) starting from the opening of its optimal window.

Table 3. An example of how slow developing cultivars and early sowing can be used to maximise farm wheat yield depending on the duration of wheat sowing program. In years where there is no seed bed moisture available and sowing starts 'dry', yield will be maximised by planting Mace (or equivalent fast developing cultivar) from 1 May onward.

Duration of wheat sowing program	Cultivars (or equivalent maturity types) required to maximise average yield	Sowing window if seed bed moisture available
10 days or less	Mace	5-15 May
10-20 days	Trojan, Mace	25 April-15 May
20-25 days	Cutlass, Trojan, Mace	20 April-15 May
25 days or more	Wedgetail, Cutlass, Trojan, Mace	10 April-15 May

Remember early sown crops require different management in order to get the most out of them;

- Don't dry-sow slow developing varieties (EGA Wedgetail, Cutlass), they will flower too late if not established early. There needs to be seed-bed moisture and ideally some stored soil water to get them through to winter.
- If growing winter wheat (EGA Wedgetail) and not grazing defer N inputs until after GS30, stem elongation.
- Pick clean paddocks – winter wheat is not competitive with ryegrass and common root diseases are exacerbated by early sowing.
- Protect against diseases associated with early sowing – barley yellow dwarf virus (imidicloprid on seed backed up with in-crop insecticides at the start of tillering if aphid pressure high), *Zymoseptoria tritici* in some areas (flutriafol on fertiliser and timely foliar epoxyconazole applications at GS30 & GS39). Many slow developing cultivars also have poor resistance to stripe rust (flutriafol on fertiliser and timely foliar fungicide application at GS39, flag leaf emerged).

Acknowledgements

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