Barley agronomy: time of sowing

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Take home messages

- **whilst the time of sowing can strongly influence yield, the advantages of early sowing may be reduced if establishment is compromised.**
- **later sowing (23 June) reduced yield in all varieties except Wimmera, the average reduction being 0.8t/ha compared with sowing on either 26 April or 17 May**
- **avoid dry sowing into paddocks with known weed burdens**

Background

Determining the optimum time to sow is challenging enough, but understanding where new varieties should fit within that sowing window is difficult. The risks of frost, heat stress and more recently, sprouting add to the complexity. By targeting the optimal sowing date, seasonal risks can be minimised. Crops are particularly sensitive to stresses in the period from three to four weeks prior to flowering through to the start of grain fill, as this is when grain number is determined and stem reserves are accumulated.

The advantages of sowing early have been evident over the past decade, especially those years with dry finishes. Though early sowing reduces the risk of heat stress during grain filling, it increases the frost risk during flowering. As all paddocks cannot be sown on the optimum date, other paddocks may be compromised. In these circumstances, choosing other varieties better suited to either early sowing or late sowing may be advantageous. The classic example is that of Hindmarsh versus Gairdner. Gairdner must be sown early; Hindmarsh can be sown later. However, the challenge is to avoid simultaneous flowering of both varieties with the aim of minimising the effects of one frost event.

This project aims to investigate the responses of new and current barley varieties to specific aspects of agronomy in no-till farming systems. Three different times of sowing (early, mid and late) were compared to determine how the varieties performed at different sowing times.

Aim

To evaluate the responses of seven barley cultivars to three times of sowing (TOS): early, mid and late and assess their suitability to the Wimmera Mallee.

Method

Location:	Corack	
Replicates:	4	
Target Plant Density:	150plants/m^2	
Sowing date:	26 April	TOS 1 (early) (harvested 15 November)
17 May		TOS 2 (mid)(harvested 15 November)
23 June		TOS 3 (late) (harvested 24 November)
Crop type/s:	barley	

Variety:	Commander, Hindmarsh, Buloke, Gairdner, Fleet, Scope and Wimmera	
Fertiliser:	at sowing	50kg/ha MAP (10% N, 21.9% P)
	17 June	90kg/ha SOA (TOS 1 & 2)
	2 August	90KG/ha Urea
Herbicide:	at sowing	Roundup PowerMax® (2L/ha) + Goal® (75ml/ha) + Triflur X® (2L/ha) + Avadex Xtra® (2L/ha) – All plots
	22 July	Velocity® (670ml/ha) – Early & Mid TOS MCPA LVE® (350ml/ha) – Early & Mid TOS
	31 August	Velocity® (670ml/ha) + Uptake® (0.25%) – Late TOS
Fungicide:	26 August	Prosaro® (300ml/ha) & BS1000 (0.25%) – Early and Mid TOS
	3 October	Prosaro® (300ml/ha) & BS1000 (0.25%) – Late TOS
Seeding equipment:	BCG Parallelogram seeder (knife point, press wheels, 30cm row spacings)	

Seven varieties of barley (Commander, Hindmarsh, Buloke, Gairdner, Fleet, Scope and Wimmera) were sown at three separate times (26 April, 17 May, 23 June) on a Mallee clay loam soil in Corack. A split-plot design, in which each time of sowing was randomly allocated to main plots, was used and varieties were randomised within each of the main plots.

Throughout the season, various assessments were carried out, including plant density after emergence, flowering and maturity biomass cuts, grain yield and quality.

The early and mid TOS were harvested on 15 November and the late time of sowing was harvested on 24 November.

Results

Which time of sowing yielded the best?

Even though the site had a full profile of stored soil water, there was insufficient moisture in the topsoil to stimulate germination of the early sown plots. The seeds were sown slightly deeper (2.5-3cm) to chase a bit of moisture and reduce the risk of mouse damage. Only the odd plant in each plot germinated and mouse activity still occurred. As a result, the early sown plots remained un-germinated in the ground until the next rainfall event of 4mm on the 12 May. This was still not enough to stimulate germination and it wasn't until 17mm fell on the 20 May that germination occurred. Given that mid sowing occurred three days prior to this rainfall event, there was no difference in the time the plots emerged. There was no significant difference between the early and mid-sown plots, though there was a significant penalty amongst all the varieties in those that were late-sown. The mean of the varieties within each TOS showed that, generally, there was more than 0.5t/ha yield penalty in the late time of sowing (Table 1).

Table 1. The mean grain yields (t/ha) of seven varieties sown at three different times

Time of sowing	Grain yield (t/ha)
Early	3.9
Mid	4.1
Late	3.2
Sig. Diff. **LSD (P=<0.05)** **CV%**	**P < 0.001** **0.5** **5.1**

Fleet and Commander were the two highest-yielding varieties overall, followed closely by Wimmera. Fleet and Commander did particularly well in the early and mid sowing times. Fleet topped the yields, with the mid-sown plots achieving 4.6t/ha. There was a strong interaction between variety and the time of sowing (Figure 1). Wimmera yields were very similar across the three sowing times, with a mean of 3.9t/ha. All other varieties had a significant yield penalty when sown late.

Hindmarsh, though initially included as part of this trial, was excluded from yield analysis because of a low germination percentage. The seed was found to be poor as a result of the late harvest rain in 2010, despite its having been sourced from a certified supplier. The low germination percentage, in addition to the mouse activity, resulted in Hindmarsh performing poorly across all three TOS compared with the other varieties. This was a direct result of the lack of establishment, not the variety itself.

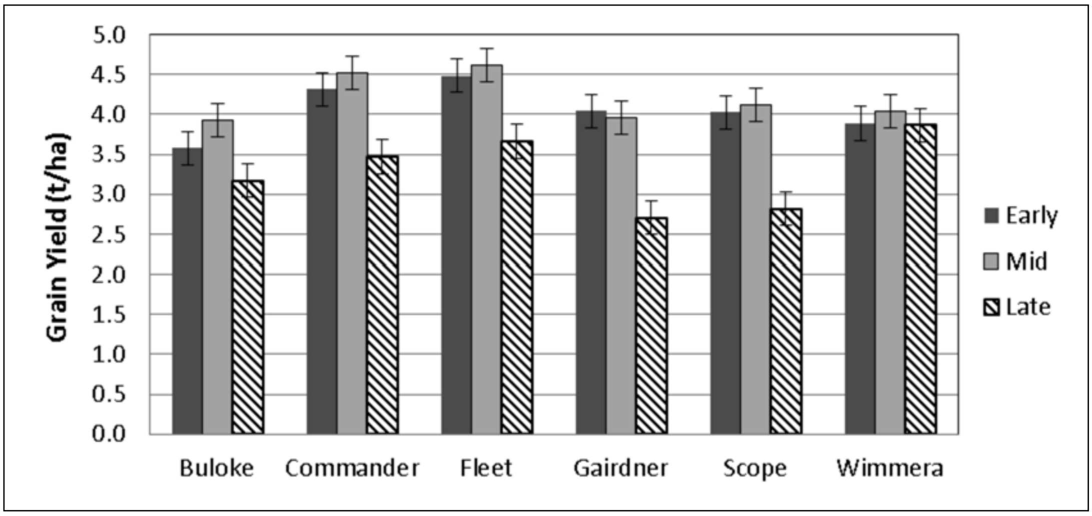

Figure 1. The effect of sowing time on grain yield (t/ha) at Corack (TOS: P=0.003, LSD= 0.41. Variety: P<0.001, 0.12. TOS x variety: P<0.001, LSD = 0.45, CV 5.1%)

There was no significant difference in yield between the early and mid time of sowing. The best yielding variety was Fleet, mid sowing time; the worst performing was the late-sown Gairdner. There was a significant difference between the mid and late-sowing times in all varieties except for Wimmera. There was also a significant difference between the early and mid compared with the late sown in Commander, Fleet, Gairdner and Scope. Wimmera yielded fairly similarly across the three sowing times, not presenting a signficant difference.

The dry conditions in April and May meant there was little germination of weeds at the early time of sowing. The dry start also meant that greater reliance was placed on the pre-emergent herbicides to work in the absence of moist conditions. With lower plant densities in the early sown plots, barley grass and brome grass proved difficult to manage, especially in the early time of sowing, even though robust rates of Triflur X and Avadex Xtra were applied. Moderate plant numbers were still observed in the mid-sown plots. The knockdown application in the late-sown plots was very effective, especially in combination with the pre-emergent herbicides. At harvest, the number of brome grass heads was notably worse in most of the early sown plots.

In the same experiment in 2010 at Culgoa, it was assumed that there was more post anthesis growth in the early and midsowing times compared with the late sowing, given the soft wet finish to the season (BCG Season Research Results 2010, pg 49). Though not measured in that experiment, biomass at flowering and maturity for each variety was measured in 2011. There was no correlation between the amount of biomass growth post anthesis and grain yield in 2011. It should be noted that the seasons were vastly different.

How is flowering date influenced by sowing time and variety?

The time of sowing influenced flowering (anthesis) date, as expected. Across the seven varieties, Buloke was the first variety to flower; the last were Gairdner and Wimmera in each of the three sowing times. Hindmarsh and Fleet flowered at almost exactly the same date in all sowing times. In previous trials, Hindmarsh was the first to flower at all times of sowing.

Variations in the flowering times of each variety were interesting, especially between the mid and late-time of sowing. In the mid, there was more noticeable differences between varieties than at the later sowing time. In the late-time of sowing, all the varieties flowered at the same time, or very closely together, with the exception of Gairdner and Wimmera. The early sowing time had three different flowering dates between varieties, ranging over a four day period. Due to the timing of emergence, those dates were similar to the mid time of sowing. Conversely, the late time of sowing had the largest difference in flowering dates, with fifteen days between the first and last to reach flowering.

The flowering date did not influence the grain yield in this trial, and the spread of flowering dates was due to varietal differences.

In 2011, a phenology trial was established at the BCG system site with eight barley varieties, two sowing times (30 May and 28 June) and three replicates, forming a total of 48 plots. On a weekly basis, each plot's growth stage was assessed using the Zadock Decimal Code. The weekly assessments created the opportunity to establish the number of days between sowing and flowering.

Table 2 shows that the number of days to flowering and maturity for each variety was about thirty days faster for TOS 2 compared with TOS 1. With the exception of Keel and Hindmarsh (Very-Early) the phenology of the barley varieties was very similar. The remaining varieties reached flowering and maturity within a few days of each other for TOS 1. It was apparent that the early varieties (Buloke and Fleet) and the later varieties (Oxford, Commander and Capstan) did not follow their maturity classifications. The TOS 2 barley varieties reached flowering within a few days of each other, with the exception of Oxford (Mid-Late). Maturity was reached consistently across all varieties.

Again we have a situation in which a number of the varieties did not follow their maturity classifications.

Table 2. Days to flowering and maturity for barley varieties assessed over time of sowing 1 (13 May) and 2 (28 June) at the BCG systems site in Birchip

Variety	Maturity Classification	Time of sowing 1		Time of sowing 2	
		Days to Flowering	Days to Maturity	Days to Flowering	Days to Maturity
Keel	Very-Early	139	174	109	150
Hindmarsh	Very-Early	140	181	111	157
Buloke	Early	144	189	111	157
Fleet	Early	147	189	110	150
Baudin	Mid	147	181	108	150
Oxford	Mid-Late	149	181	120	157
Commander	Mid-Late	148	189	110	150
Capstan	Late	148	189	111	150

Commercial practice: what this means for the farmer

The last two seasons have highlighted some of the unpredictable risks of early sowing, with mice and locusts having significant impact on establishment and yield. The benefit in both these years was that the early-sown plots had longer to compensate for the damage.

Late-sown crops are always behind the eight ball unless there is a favourable finish such as occurred in 2010. The influence of flowering time on grain yield is more pronounced in tough dry finishes, and less in wetter soft ones, as occurred in 2010 and to a certain extent 2011. Protecting your crop against those harsher seasons is the lowest risk strategy.

Problems with establishment were widespread in commercial paddocks in 2010 and 2011, with locusts, lack of seedbed moisture and mice the culprits. Having the ability to manage these issues promptly reduces any effects of establishment on subsequent yield.

This study demonstrated that the advantages of early sowing exist only if establishment occurs at an adequate plant density and within ten days of sowing. If emergence does not occur, is there an advantage to sowing into a dry soil?

As a grower, you are locked into the investment and are committed to battling unforeseen events such as locusts or mice to protect that investment. Early sowing can also put the pre-emergent herbicides under a lot of pressure in the presence of a high weed burden, as was the case in this trial, especially if conditions are dry at and after sowing.

The message of this trial is to demonstrate that early sowing does not always work due to a dry seedbed and problems with establishment and weed burden. However, it can be used as part of a risk management strategy to ensure that as many paddocks as possible on the farm are sown on time. For example start sowing early so you don't finish late, as has been shown in the past two years, the penalty is much greater for sowing later than the problems faced with earlier sowing.

Paddock selection is critical to the success of early sowing. Avoid weedy paddocks or paddocks that may have elevated risks such as the presence of mice.

Acknowledgments

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