Time of sowing barley

***Simon Craig**, (BCG), **Ben Jones** (Mallee Focus) and **Kate Burke** (JSA Independent)*

Take home messages

- *Time of sowing was not important for yield in a wet rainfall year with a soft finish.*
- *Varietal selection was a bigger contributor to grain yield than the time of sowing in 2010. Choosing a variety well-adapted to a range of seasons will provide the greatest returns in the long term.*
- *Hindmarsh performs well in dry and wet years, consistently yielding well at all sowing times. Commander was the best of the malt varieties, yielding similarly to Hindmarsh. However, Commander may struggle in drier years.*

Background

This trial forms part of a continued GRDC funded tri-state project (DAV00138, building upon DAV00104) involving Industry & Investment NSW, South Australian Research Development Institute and BCG. Both projects have been designed to investigate the responses of new and current barley varieties to specific aspects of agronomy in a no-till farming system. These include responses to time of sowing, nitrogen and disease management (particularly scald).

The previous project investigated the interaction between row spacing (15cm, 22.5cm and 30cm) and weed competition (brome and ryegrass) and nitrogen management and tolerance to pre-emergent herbicides (Triflur X, Lexone and Boxer Gold). The results can be found in the 2007 – 2009 BCG Season Research Results Booklets.

This paper will report on the influence of sowing time on seven barley varieties. Similar studies were conducted in South Australia and New South Wales.

Aim

To evaluate the response of seven barley varieties to different sowing times.

Method

Location:	Culgoa (36km north east of Birchip)
Replicates:	4
Previous crop:	Chemical fallow
Starting soil N:	134kg N/ha
Starting Plant Available :	49mm
Water (0-100cm):	
pH – CaCl2 (0-10cm) :	7.8

Organic Carbon:	1.03%
Estimated mineralised N:	39kg N/ha
Colwell P:	32mg/kg
Target seeding density:	140 plants/m²
Fertiliser:	50kg/ha MAP (at sowing)
	50kg/ha Urea (24 June 2010, all plots)
Seeding equipment:	Knife points, press wheels (30cm spacings)
Sowing dates:	20 April, 19 May and 2 June 2010
Varieties:	Hindmarsh, Buloke, Commander, Fleet, Flagship, Gairdner and Maritime

Seven varieties (Hindmarsh, Buloke, Commander, Fleet, Flagship, Maritime and Gairdner) were sown at three times (20 April, 19 May, 2 June) on a clay loam at Culgoa. Using a split-plot design, each time of sowing (3) was randomly allocated to main plots and varieties and were randomised within each main plot.

Roundup PowerMax (2L/ha) and Striker (75ml/ha) were applied over the whole site on 20 April (2hrs prior to sowing). TriflurX (1.5L/ha) was applied in a separate application one hour prior to each sowing and incorporated by sowing.

For all sowing times, seed bed moisture at planting were sufficient to ensure germination. The site was relatively clean: no other herbicides were required post emergence during the season.

Severe locust damage occurred between 29 April and 14 May. This significantly affected the establishment of the April sown plots. Recovery from locust grazing was poor. As a result, the emergence and biomass data collected from the affected plots was removed from the analysis. Grain yields from these plots were, however, included in the analysis.

Weeds and diseases were controlled when required. The trial was harvested on 23 November (before the first harvest rainfall event). Prior to harvest, some plots experienced significant lodging.

Data recorded throughout the season included plant density after emergence, dry matter at the end of tillering, flowering and maturity, pre-harvest lodging, grain yield and quality parameters. Soil moisture at flowering was also measured for the Buloke, Hindmarsh and Gairdner treatments.

An analysis of variance was used to test for significant effects of sowing time and variety and interaction between sowing time and variety. Least significant differences were calculated at the 95% confidence rate.

Weather conditions and rainfall at Culgoa were measured using a Campbell Scientific Aust. ET107 automatic weather station.

Results

Seasonal Conditions

Contrary to previous seasons, rainfall was not limiting during 2010. Growing season rainfall (GSR) at Culgoa was 247mm (long term GSR average 235mm). Despite a very wet summer (158mm Nov 09 – Mar 10), plant available water (PAW) at sowing was 49mm. Rainfall was below average in May, June and July (19mm, 10mm and 21mm respectively). Rainfall in August (67mm) and October (71mm) was above average. Average daily temperatures were more than 2°C cooler than average during spring. This was ideal for grain filling.

Which sowing time yielded the best?

The May sown plots produced the highest yields. The mean yield of the varieties sown in May was 0.5t/ha higher than those sown in June sown. The April sowing produced very good yields, despite being severely affected by locust damage during May (Table 1).

Table 1. Grain yield (mean of 7 varieties) sown at different times at Culgoa.

Sowing time	Grain yield (t/ha)
20 April	4.86
19 May	5.66
2 June	5.24
Sig. Diff. **LSD (P<0.05)** **CV%**	**P=0.008** **0.38** **7.8**

Establishment

Varieties differed in plant establishment, with Hindmarsh having the highest plant density and Gairdner the lowest. Most varieties were below the target plant density of 140 plants/m^2, but establishment was considered adequate in all varieties except for Gairdner. The Gairdner seed was certified but considered to be less viable than expected when sowing rates were calculated. The mean plant density for the trial was 120 plants/m^2. Given the varietal differences, the emergence data was tested as a co-variate in other analyses and was found to be not significant.

Influence of time of sowing and variety on flowering date

As expected, sowing time did influence the flowering (anthesis) date. Of the seven varieties, Hindmarsh was the earliest to flower within each sowing time, initiating anthesis on the 23 September for both April and May sowing times. An earlier flowering time may have occurred in the April sowing had locust infestation not occurred. Maritime, Fleet and Gairdner all flowered on similar days for each sowing time. Gairdner reached anthesis earlier than Fleet and Maritime in the April sowing. There was a greater spread of flowering dates between varieties in the May sowing compared with the April and June sowing.

A moderate frost (-1°C) was recorded on 1 October at the Culgoa site. There was no notable frost damage in the trial, though some early-sown wheat trials on the same site were affected.

Grain yield was not related to flowering date in 2010 (Figure 1). The spread of flowering for each sowing date was due to varietal differences. Previous project findings have shown that grain yields decrease with later flowering, especially in seasons with a dry finish. However, in average to wet years, early sown crops will typically yield less because they do not grow for long enough to use all the water available throughout the season. Given water did not limit yield during this season, the reduction in grain yield for the April sowing was most likely caused by the locust damage.

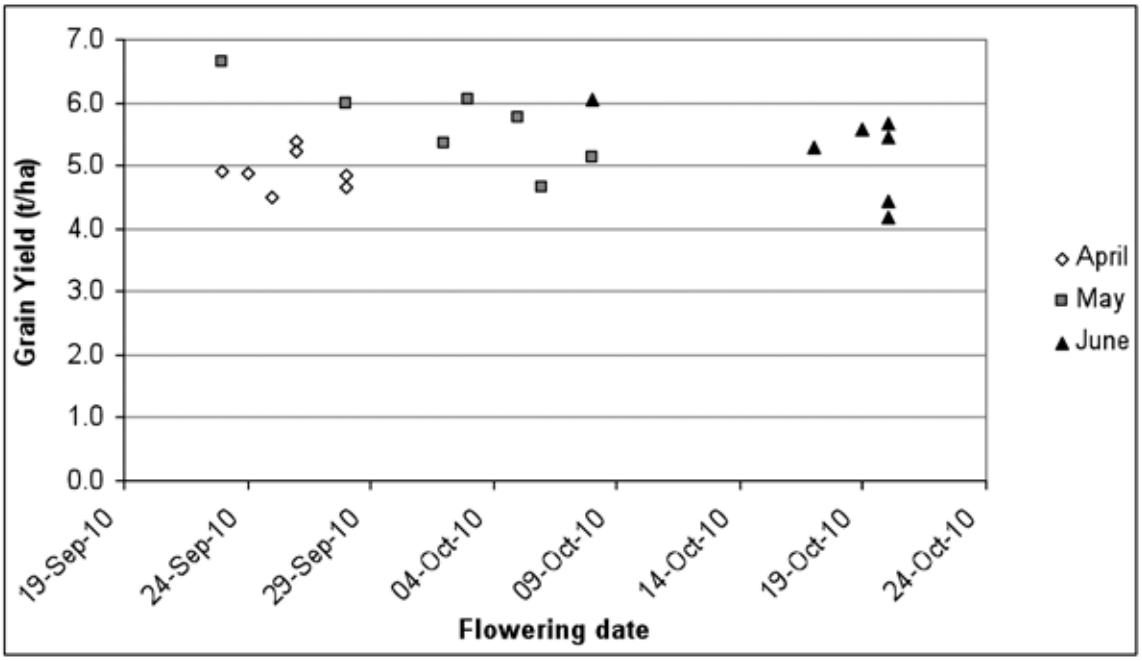

Figure 1. The relationship between the flowering date and grain yield.

Did any variety perform better at a particular sowing time?

Hindmarsh and Commander performed well at all times of sowing. Both varieties were outstanding in the May and June sowings (Figure 2). Gairdner and Maritime were the worst performing varieties, even when sown early. Both Gairdner and Maritime yields fell away at the later time of sowing. Flagship and Fleet yielded similarly to Commander, especially at the later sowing times. The differences between varieties were less pronounced in the April sowing than they were in the May and June sowings, most likely due to locust damage limiting yield.

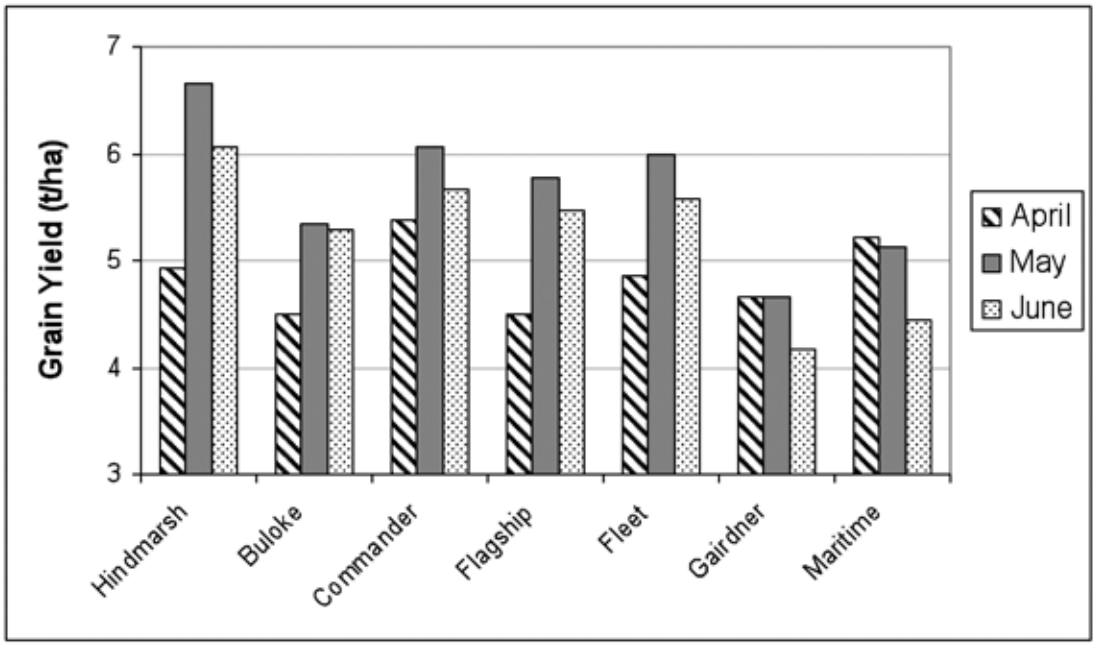

Figure 2. The effect of sowing time on grain yield at Culgoa (Variety x Sowing time: P<0.001, LSD = 0.61, CV. 7.8%).

Hindmarsh out-yielded all other varieties except Commander. Maritime and Gairdner were the lowest yielding varieties. Hindmarsh and Maritime yielded significantly higher when sown in May compared to June, whilst all varieties except Gairdner and Maritime yielded more than the April sowing. A strain of net form of net blotch (NFNB) specific to Maritime caused a complete loss of green leaf late in the season, despite fungicides being applied. No other variety was affected by the disease. This could explain why the yields of Maritime were lower than the other varieties, despite it's having been a wet year.

There was an interaction between variety and sowing time (P=0.016), for grain protein (Figure 3). Higher proteins were found in Fleet and Flagship when sown early. Buloke and Hindmarsh were not significantly higher at any of the sowing times. Protein levels in Commander and Maritime were very similar across all sowing times.

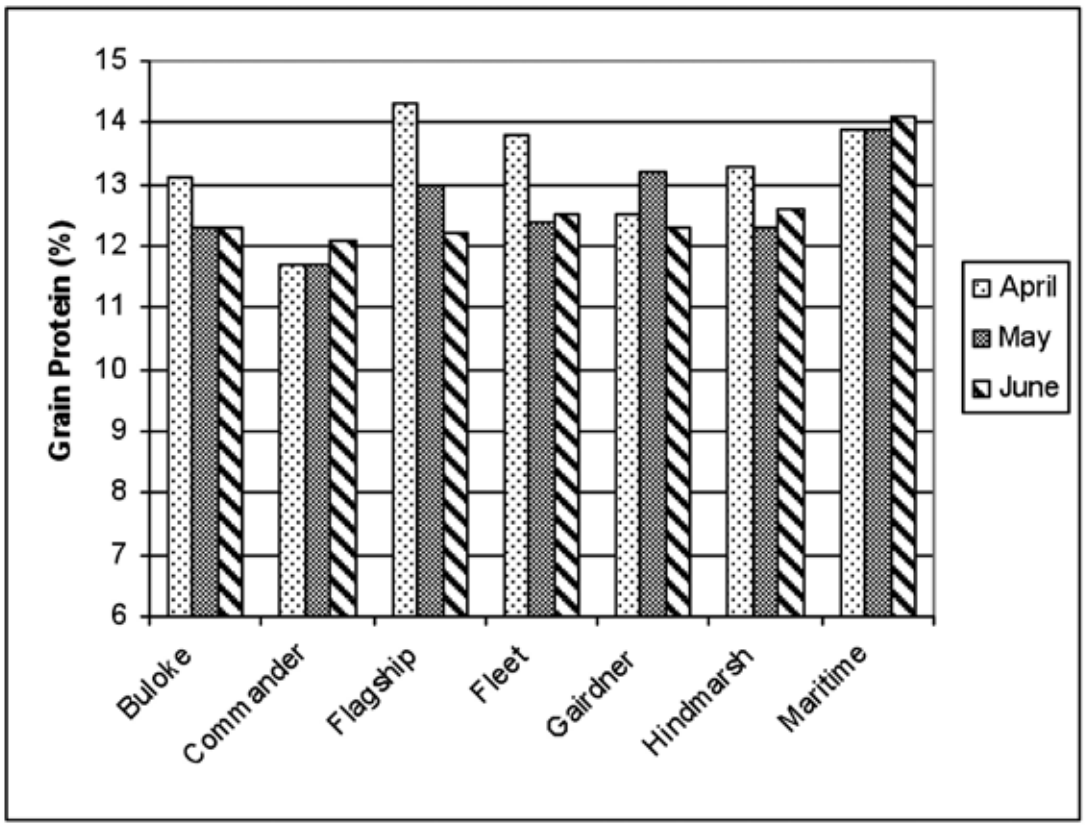

Figure 3. The effect of sowing time on grain protein at Culgoa (P=0.016, LSD=1.4%, CV4.6%).

When comparing the financial returns of growing Hindmarsh and Commander, the income from both become closer when they are sown later in the year (Table 4). Even if Hindmarsh achieved Malt, its income, compared with Commander, was lower at all sowing times. However, if both varieties made Feed, the profitability of Hindmarsh was greater than Commander at the May and June sowing.

Table 4. Theoretical gross incomes using the actual yields of Commander and Hindmarsh for malt and feed grades.

Variety (assumed grade)	Gross income ($/ha)		
	April	May	June
Commander (Malt)	1,366	1,543	1,442
Hindmarsh (Malt)	1,117	1,505	1,391
Commander (Feed)	869	982	918
Hindmarsh (Feed)	789	1,062	982

Malt 1 = $253/t, Hindmarsh Malt = 228/t, Feed $161/t

Hindmarsh yields = 4.9t/ha April, 6.6t/ha May, 6.1t/ha June

Commander yields = 5.4t/ha April, 6.1t/ha May, 5.7t/ha June

Interpretation

In wet years (with no frosts), maximising biomass at flowering will result in higher yields. Mid-maturing varieties, if sown late, will struggle to yield better than earlier maturing varieties. In drier years, later sowings are more likely to experience heat stress during grain filling in October, thus reducing yields. Higher evaporation will also occur during the season.

The results of this study showed that wet, cool seasons such as 2010 are extremely forgiving. Despite the effect of locusts on the April sowing, all varieties yielded very well. Ample PAW and nitrogen throughout the season encouraged high biomass at flowering for all sowing times (April sowing not measured). Despite biomass at flowering being similar between sowing times, differences thereafter may have occurred. Growth between flowering and maturity, though not measured, may have differed between sowing times. The May sowing possibly benefited from this, simply because the growth period during grain filling could have been extended. On the other hand, in the June sown plots, the flowering to grain filling period would have been shorter, with increasing temperatures. This could explain the yield difference found this year, as any differences that occurred after flowering (not measured) would have converted to grain yield.

Similar trends in yields between varieties were observed in the May and June sowings. Differences between varieties in the April sowing were less pronounced than in both the May and June sowings. In the absence of locusts, yield differences in the April sowing may have been greater or similar. This made it difficult to conclude much from the April sowing. Certainly, grain yields were maximised by sowing in May.

Hindmarsh proved to be an excellent variety in both wet and dry years, generally yielding the highest in all but the April sowing. Poor seed viability of Gairdner could also have affected its performance.

Ample soil nitrogen and a further in-crop application produced high protein, resulting in most varieties (with the exception of Commander) being classified as Feed quality.

A more in-depth realistic comparison of quality between varieties is presented in the following chapter in this publication entitled 'Nitrogen management in barley' page 88.

Commercial Practice

The biggest factor that affected grain yield in this trial was varietal selection. In a wet year, you would expect the varieties more suited to higher rainfall zones, such as Commander, Gairdner and Maritime, to stand out. However, the early maturing variety Hindmarsh yielded very well in 2010, but because of the price differential between Malt and Feed (~$90/t), it was more profitable to grow Commander. If the in-crop N application had not occurred and Hindmarsh had been achieved segregated Malt 1, (~$25/t difference), the profitability would have been similar. If either variety can be grown, Commander would be better suited to earlier sowing, while Hindmarsh will continue to yield well when sown later.

For the Mallee, Hindmarsh is still the variety to grow but it is limited by its feed classification. It is the best option in a dry year and at later sowing times. It can also yield well in wet years. For early sowings, Buloke or Commander will yield similarly to Hindmarsh and will open up opportunities into Malt markets. Commander will struggle in drier seasons compared with Buloke.

Acknowledgments

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