Southern barley agronomy - optimising time of sowing to maximise performance

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Take home messages

- Sowing barley varieties at the optimal time for each cultivar can significantly increase performance.
- Sowing barley on 21st May (TOS 1) increased yield when compared to later sowing on 26th June (TOS 2).
- Some malting varieties sown at TOS 1 had low test weights which failed the malting standard .
- Oxford had the highest yield of all varieties, at 9.0 t/ha, when sown at TOS 1.

Introduction

The project was conducted as a component of the GRDC "Southern Barley Agronomy" initiative, in order to identify key agronomic practices for new and existing barley varieties. This report aims to determine whether sowing date can influence the yield and quality of malt and feed barley varieties.

Choosing the optimum time of sowing for each crop and crop variety is an important management decision for growers, as the timing can affect when the plant reaches key growth stages in relation to soil moisture, temperature and day length. This timing can greatly impact upon yield and grain quality. Research by Southern Farming Systems in 2012 recommended that slower maturing wheat varieties be sown earlier than is traditional, in order to maximise yield advantages and avoid a dry finish. Therefore, traditional sowing dates may limit the potential of selected crop varieties, and it is clear that an optimal time of sowing for barley varieties should be identified in order to maximise their performance.

Although prior research has identified a link between early sowing and increased yields, there are also concerns that early sowing could impact negatively on the quality of the grain produced, in terms of higher screenings, and potentially lower protein levels. Therefore, these trials were conducted to determine the optimum sowing time for both popular, and newly released malting and feed quality barley varieties.

Method

The barley trials had two treatment variables: variety and time of sowing. The barley trials were sown at Tarrington, near Hamilton, following canola, on 21st May 2013 (TOS 1) and 26th June (TOS 2). Fifteen barley varieties were sown on each date, with 4 replicates of each variety. At sowing, all varieties were fertilised with 80 kg/ha of MAP, and 142 L/ha of UAN (supplying 121.6 k N/ha) was applied at stem elongation.

Table 1. Summary of the agronomic and disease ratings for each variety studied in this trial.

	Barley variety	Maturity	Leaf scald	Spot form net blotch	Net form net blotch	Powdery mildew	Leaf rust	BYDV
Malt	Bass	ML	MSS	MSS	MS-S	S	MR#	MRMSp
	Commander	M	S	MS	MSS	MRMS	S	MS
	Fairview	ML	SVS	MSS	S	RMR	R#	-
	Gairdner	M	SVS	S	MR-MS	S	S	MR
	Navigator	ML	MR#	MRMS	MRMS	R	VS	Sp
	GrangeR	M	MSS	S	MRMS	R	MR	Sp
	Henley	ME	S	S	MS	R	MR#	MS
	Westminster	ML	MR#	S	MRMS	RMR	MR	MSp
	Scope	ME	MSS	MS	MR	MR	SVS	MR
Feed	Fathom	VE	MR#	MR	MSS	MRMS	MSS	MS
	Hindmarsh	VE	SVS	S	MRMS	MS	MSS	MS
	Oxford	L	MSS#	S	MRMS#	R	MR	MS
Varieties undergoing classification	Skipper	ME	S	MRMS	MR	MR	SVS	MR
	La Trobe	VE	R/VS	SP	MRP	MRP	MR-MS/S	-
	Compass	ME	MR-SVSP	MSP	MRMS-MSP	MRP	MRMS-SP	-

Maturity; VE = very early, ME = moderately early, M = mid season, L = late
Leaf scald; MSS = moderately susceptible - susceptible, S = susceptible, SVS = susceptible - very susceptible, MR = moderately resistant, MRMS = moderately resistant - moderately susceptible
P = these ratings are less reliable and should be treated with caution
# = varieties marked may be more susceptible if alternative strains are present

Results:

The figure below shows the yield of each barley variety averaged across both sowing dates. It can be seen that Westminster and Oxford varieties were the highest yielding at 8.52 t/ha and 8.53 t/ha respectively, and that there is no significant difference between these two varieties. Across both sowing dates, they are significantly (P = <0.05) higher yielding than all other varieties, except Fairview and Navigator.

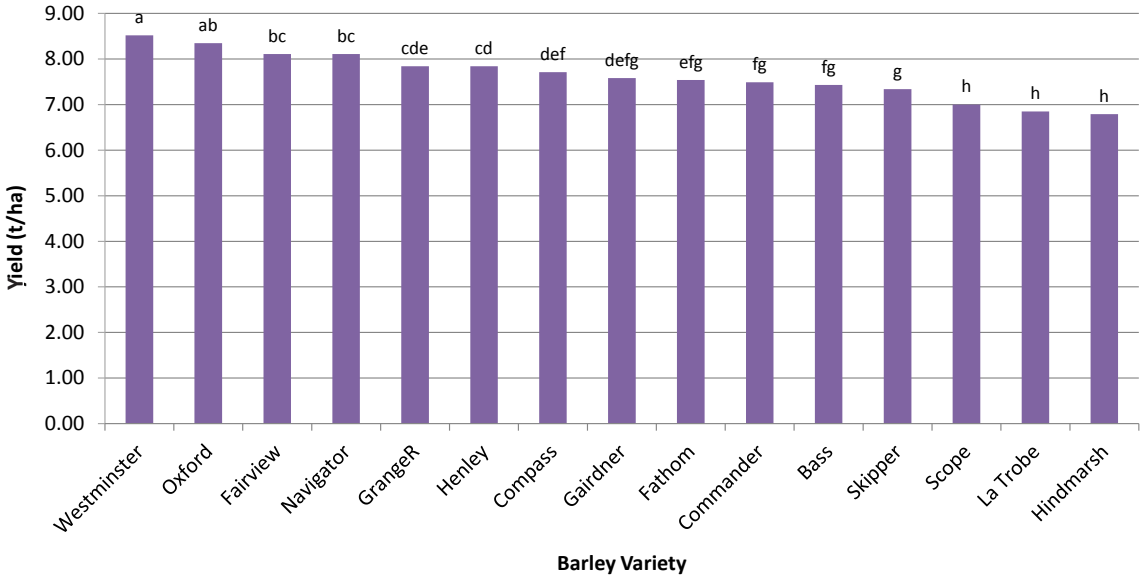

Figure 1. Yield result means of barley varieties at both times of sowing. Error bars represent the standard error of the means. Significant differences are represented by differing letters at a P<0.001 level. LSD = 0.29 t/ha.

The following table outlines the significant yield differences identified within the trial. Of the fifteen varieties sown, eleven varieties had a statistically significant (P=<0.05) higher yield when sown in May rather than June. However, while yield increased significantly in the varieties listed below, no significant yield differences were shown for Gairdner, Bass, Scope or Compass when comparing the two sowing dates.

Table 2. The effect of sowing date on the mean yield of 11 barley varieties.

Variety	Yield (t/ha) at TOS 1	Yield (t/ha) at TOS 2	Difference (t/ha)
Oxford	9.00	7.69	1.31
Navigator	8.95	7.27	1.68
Westminster	8.73	8.32	0.41
Fairview	8.60	7.61	0.99
GrangeR	8.24	7.44	0.80
Henley	8.05	7.64	0.41
Fathom	7.84	7.24	0.60
Commander	7.76	7.22	0.54
Skipper	7.73	6.95	0.78
Hindmarsh	7.61	5.97	1.64
La Trobe	7.59	6.00	1.49

Sig diff: P <0.001; LSD < 0.05: 0.41 t/ha

The effect of sowing date upon the mean yield and quality characteristics of the barley varieties is outlined in Table 2. Sowing the varieties in May increased the average yield by 0.73 t/ha when compared to sowing in June. While yield was improved, average grain protein was reduced when varieties were sown in May, although this outcome is expected when yields increase and no additional nitrogen was supplied. All protein, screening and retention values were within acceptable ranges for feed or malt quality, with minimal differences occurring between times of sowing for most varieties. GrangeR, Bass, Henley, Navigator and Westminster achieved > 95% retention, while La Trobe and Hindmarsh had the lowest retention rates with 78.5% and 80.4% respectively in TOS 1. All screenings were within the acceptable range, although Hindmarsh and La Trobe averaged the highest screenings, with 5.75% and 5.8% respectively. All other screenings were < 3%.

Table 2. The influence of time of sowing on the average grain yield and grain quality of the barley varieties.

Time of Sowing	Yield (t/ha)	Test Weight (kg/hl)	Moisture (%)	Protein (%)	Retention (%)	Screenings (%)
TOS 1: 21/5/2013	8.00 a	64.8 b	10.77 a	10.5 b	91.4 b	2.3 -
TOS 2: 26/6/2013	7.27 b	67.7 a	10.22 b	10.8 a	93.6 a	2.5 -

Statistically significant differences at P = 0.05 are indicated by differing letters.

Test weights were consistently lower when TOS 1 was compared to TOS 2, and in this instance, the grade of four varieties was negatively affected (see figure 2). The malting barley varieties Navigator, Henley and Scope narrowly missed the minimum malting standard test weight of 65 kg/hl as depicted by the line in Figure 2. Fathom achieved a feed 2 standard with a test weight of 61.2 kg/hl.

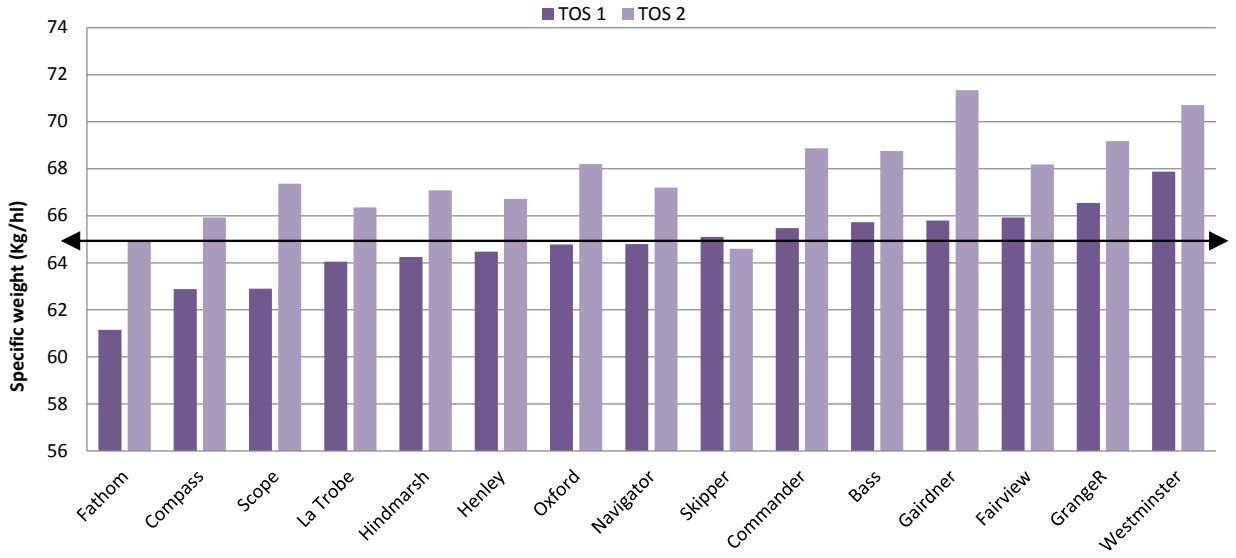

Figure 2. Specific weights of varieties comparing both times of sowing in May and June.

The figure below depicts the relationship between the maturity and yield of barley varieties. There is a very strong positive relationship between these two factors, with an R^2 value of 0.8. This relationship shows that as the maturity of the variety increases before the crop is harvested, the yield also increases. Of the six varieties which were classified as moderately long or long season varieties, four (Westminster, Oxford, Fairview and Navigator) were the four top yielding varieties overall, and all yielded significantly higher when sown at TOS 1 rather than TOS 2. In comparison, only three varieties of the fifteen (Scope, La Trobe and Compass) increased in yield when sown at TOS 2 rather than TOS 1 and all were moderately early or very early maturing varieties.

With the exception of these three varieties, all other varieties yielded best when sown at TOS 1, indicating that there is a benefit in sowing barley varieties earlier than traditional in this trial. Therefore, sowing mid and late maturing varieties earlier in the season can produce significant yield benefits such as were seen in this trial. In comparison, sowing early maturing varieties earlier than is traditional can result in either yield increases or decreases depending on the variety chosen. Therefore, caution must be exercised when choosing early maturing varieties if sowing in May.

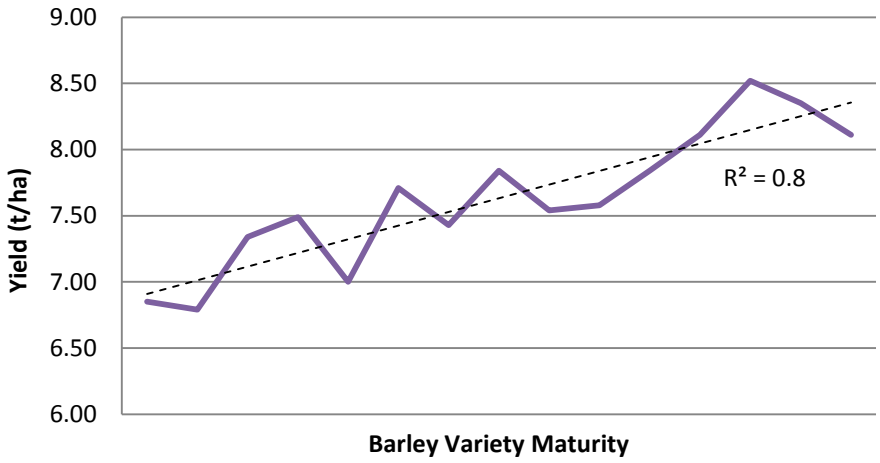

Figure 4. Relationship between grain yield and barley variety maturity.

Discussion/ Commercial application

Formulating an optimal time of sowing for each individual barley variety within the southern high rainfall zones will allow farmers to maximise the performance of their chosen variety, and allow the capture of the highest grain quality and yield possible.

Comparing barley varieties in this manner will also identify varieties which perform well regardless of sowing date. Westminster showed small differences in yield when comparing sowing dates, with yield increasing by 0.41 t/ha when sown at TOS 1. Varieties which perform in this manner indicated their ability to yield highly regardless of sowing time. In contrast, varieties such as Navigator, Oxford, and Hindmarsh were more sensitive to changes in sowing date, showing yield reductions of approximately 1.5 t/ha in response to changing sowing dates.

In addition, the results from this trial in terms of grain yield and quality also give the farmer a guide to the higher performing malt and feed varieties at each sowing date.

Conclusion

The results of this trial clearly show that each variety performs differently at varied sowing dates, with the magnitude of this difference depending upon the individual variety. Therefore, knowing these differences in variety performance will enable growers to make more informed management decisions based on the season, and enable suitable and lucrative varieties to be selected.

Acknowledgements

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