Wheat or barley - the best options for early sowing at Dandaragan

Brenda Shackley, Blakely Paynter and Christine Zaicou-Kunesch
DAWFA Katanning, Northam and Geraldton

Purpose:	Evaluate yield and quality response of long season wheat and barley to sowing time.				
Location:	Dandaragan				
Soil Type:	Black deep loamy duplex				
Soil Test Results:	Depth (cm)	0-10	10-20	20-30	30-40
	Gravel (%)	5	5	0	0
	pH ($CaCl_2$)	6.1	6.3	7.0	7.6
	NH_4 (ug/g)	1	<1	2	1
	NO_3 (ug/g)	16	4	2	1
Rotation:	Canola (2014), wheat (2013), oats (2012)				
Rainfall (2015):	Dandaragan (patch point data)				

Jan	Feb	March	April	May	June	July	August	Sept	Oct	Summer (Jan-Mar)	GSR
4.7	28.6	28.0	20.3	38.5	68.0	94.6	83.9	32.2	12.4	61.3	349.9

BACKGROUND SUMMARY

What are your cereal seeding options with an April sowing? The information and options for seeding in May are much easier to make, however, there is a need for information on the performance of later maturing varieties where there is the opportunity to sow early or in areas where frost management is required. Research is being conducted into the yield and quality response of long season wheat and barley varieties to a range of sowing times between mid-April and mid-May.

TRIAL DESIGN

Trials have been initiated at Dandaragan, Katanning and Gibson in 2015. Twenty-four varieties (12 wheat and 12 barley) were sown at three sowing times targeting mid-April with the first seeding date and then three weekly intervals thereafter in early May and late May.

Plot size: 7 rows (22cm row spacing) x 10m

Machinery use: small pot research equipment

Repetitions: 3

Crop type and varieties used:

Wheat (12 varieties): Whistler, Yitpi, Mace, Magenta, Harper, Trojan, Calingiri, Zen, Bremer, Cutlass (RAC2069), ADV08.0065 and LPB11-1728

Barley (12 varieties): Bass, Baudin, Compass, Flinders, Granger, La Trobe, Lockyer, Maltstar, Oxford, Rosalind, Scope CL and Urambie

Seeding dates (TOS): 16 April (TOS1, mid-April), 07 May (TOS2, early May) and 27 May (TOS3, late May) 2015

Seeding rates: Target establishment for both wheat and barley was 150 plants/m².

Fertilizer rates and dates:

- At seeding K-Till Extra drilled (100 kg/ha) and NPK Blue top-dressed (250 kg/ha)
- 9 June TOS1 and TOS2 and 23 Jun TOS3 - UAN (60L/ha)

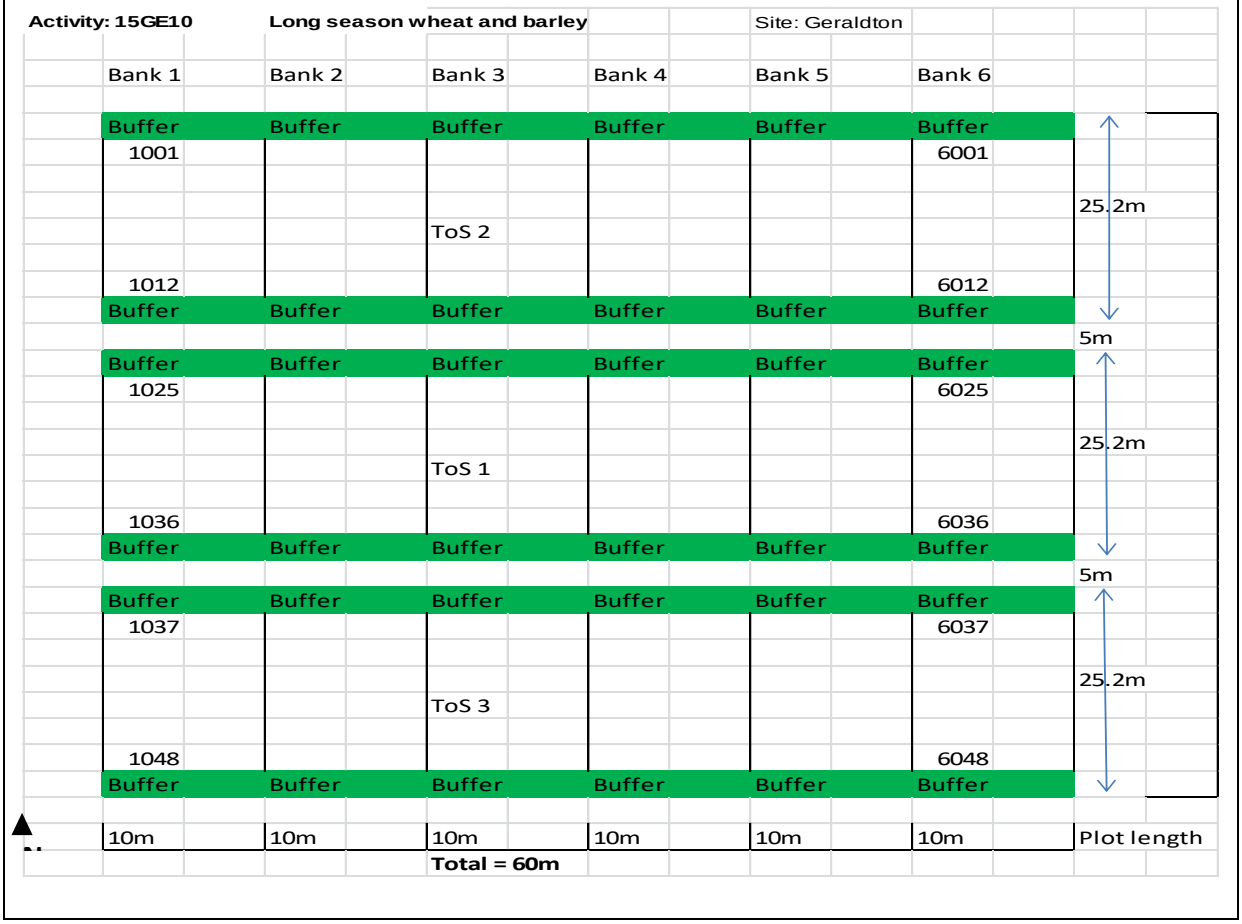
Herbicide rates and dates:

- At seeding - Lorsban (200mL/ha) + Boxer Gold (2.5L/ha) + Sprayseed (2.5L/ha) + Dominex (200mL/ha)
- 28 May TOS 1 and 9 Jun TOS 2 - Velocity (800mL/ha) + 1% Hasten
- 23 Jun TOS 1 and TOS3 - Velocity (700mL/ha) + 1% Hasten + MCPA LVE (400mL/ha)
- 15 Jul TOS 1 andTOS3 - Jaguar (1L/ha) + 1% Hasten + MCPA LVE (400mL/ha)

Other applications/treatment rates and dates:

- Uniform in furrow (400ml/ha) at seeding.
- 15 Jul TOS1 and TOS2 Prosper (600mL/ha) and TOS3 Prosaro (300mL/ha)
- 29 Jul TOS1 Prosaro (300mL/ha)

TRIAL LAYOUT



RESULTS

Many areas in the wheatbelt of WA received good levels of summer rain in 2015, including the site at Dandaragan. Rainfall at Dandaragan continued into April providing the opportunity to sow in mid-April into drying top soils. The drying topsoil (with all sowing dates) resulted in an average establishment of 115 plants/m² for wheat and 120 plants/m² for barley against a target density of 150 plants/m².

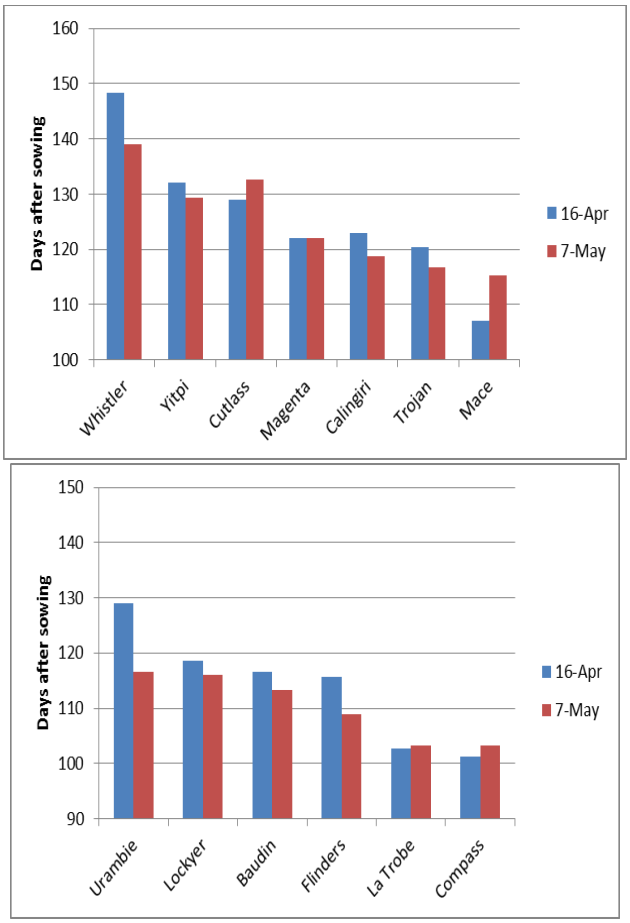
At the Dandaragan NVT wheat site, an e-Temperature logger also recorded some frost events and periods of temperature above 30°C during grain fill. This NVT site was in close proximity to this wheat and barley agronomy trial but no frost damage was clearly observed in our trial.

Flowering and awn peep observations

The spread of flowering between the wheat varieties range from just over 40 days between the spring wheat Mace and the winter wheat Whistler when sown in mid-April at Dandaragan (Figure 1). The duration to flowering for Mace was 107 days after sowing with mid-April planting and 115 days with early May sowing. Zen, the new longer season ANW had very similar flowering dates to Calingiri (data not shown). The new APW variety Cutlass appears to have a similar maturity compared to Yitpi.

The spread of awn peep between the barley varieties was slightly lower than for wheat at ~30 days between the spring barley Compass and the winter barley Urambie (Figure 1). The average duration to awn peep in the earliest barley varieties (Compass and La Trobe) was around 102 days after sowing for both the mid-April and early May planting.

Figure 1: Flowering (50%) of wheat or awn peep of barley taken as days after sowing of varieties sown mid-April and early May at Dandaragan in 2015



Grain yield – wheat

Across the three sites the average grain yield ranged from over 5.5t/ha for wheat and 7.5t/ha for barley at the early May sowings to 4.2t/ha for wheat and 3.3t/ha for barley when sown mid-April at Dandaragan (Figure 2). The average yield of barley was higher than wheat (ranging from >2t/ha to 0.25t/ha) at sowing times and sites in 2015. Most varieties obtained their highest yields at the early May sowing.

Although Mace was one of the lowest yielding wheat varieties when sown mid-April at Dandaragan, Yitpi was the only variety that achieved a significantly higher yield at that sowing date. Overall yields increased by 1.5t/ha by delaying the sowing time until early May (Figure 3). This yield response to sowing time was also observed at the RSCN trial at Yuna (https://agric.wa.gov.au/n/4552), with the exception of Forrest, a late maturing spring wheat which was included in the Yuna trial. The reason for this response was not adequately measured in the trials.
Visual observations at Dandaragan did not suggest that biomass for the mid-April sowings was lacking in comparison to early May sowings. Ear numbers were recorded to be lower for the mid-April compared to the early May sowings at an average of 341/m² to 400/m² respectively.

Figure 2: Average barley and wheat grain yields (t/ha) at the three sowing dates at Dandaragan (Dn), Katanning (Ka) and Gibson (Es) in 2015

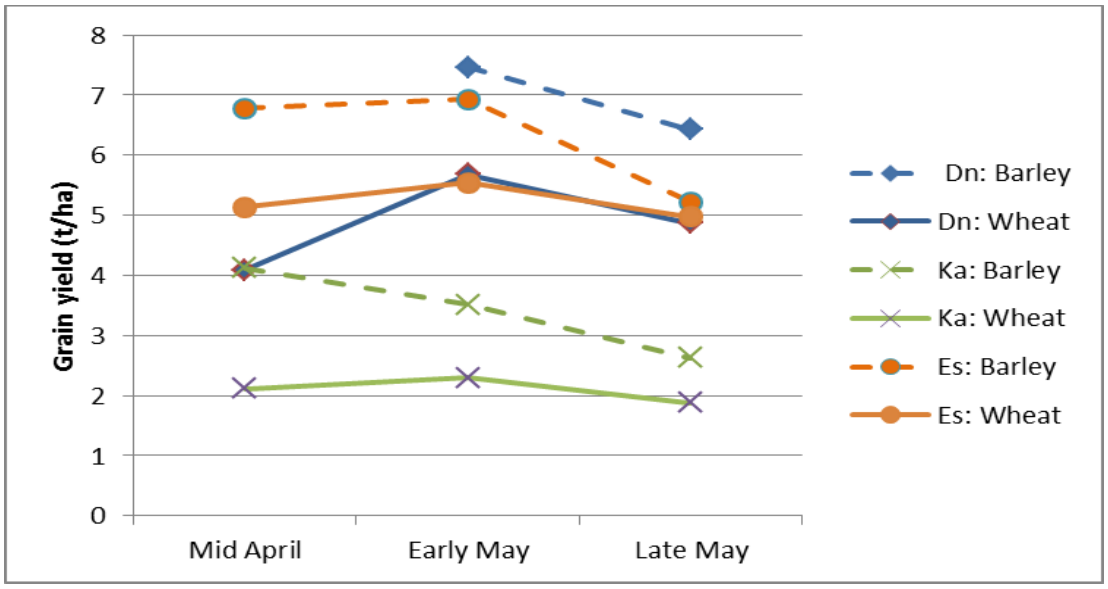
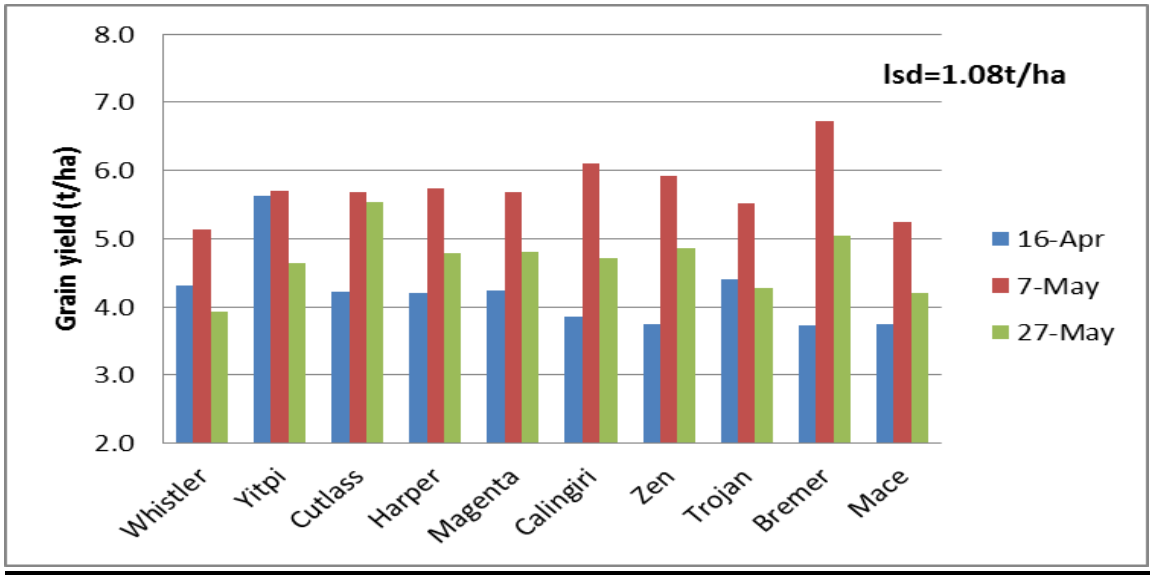


Figure 3: Grain yield (t/ha) response of wheat varieties to sowing time at Dandaragan in 2015. Varieties arranged in order of maturity



Although Bremer achieved the highest yield in the trial at Dandaragan when sown early May, it was only significantly higher than Mace, Trojan and Whistler. Mace was consistently the lowest yielding variety at Dandaragan, although it is important to note that it was not significantly different from most of the varieties examined in the trial series.

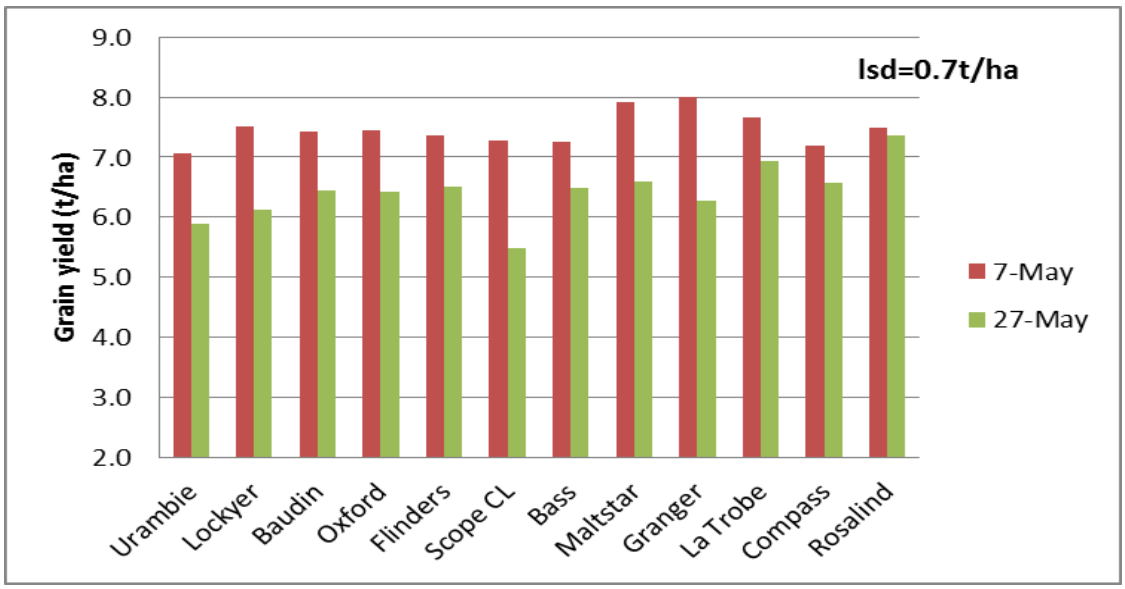
Grain yield – barley

The results of the mid-April planting have been excluded from this analysis due to problems with the sample weighing and collection at harvest affecting not only the harvest yields but the purity of the sample obtained from each plot. It is predicted that the mid-April planted would have yielded 7t/ha, mid-way between the grain yield of the early May (7.47t/ha) and

late May (6.48t/ha) plantings. This prediction is based on the mid-April sown plots having a similar tiller number as the May plantings (842 vs 891 vs 839 tillers/m^2 for TOS1, TOS2 and TOS3 respectively) and the mid-April planting having a similar kernel weight as the early May planting (41.9 vs 42.4 vs 38.4 mg for TOS1, TOS2 and TOS3 respectively). There was no indication of frosted grain in the barley samples.

There was no varietal difference in grain yield for early May sowing (Figure 4), but there was a varietal difference with late May. This was largely due to the poorer performance of Granger, Lockyer, Scope CL and Urambie with late May planting. The other eight barley varieties performed similarly with late May sowing.

Figure 4: Grain yield (t/ha) response of barley varieties to sowing time at Dandaragan in 2015. Varieties arranged in order of maturity.



Grain quality - wheat

Limited grain quality analysis of wheat samples from Dandaragan has indicated that the mid-April planting had issues with staining of the grain. At Dandaragan, Cutlass, Mace, Magenta, Yitpi and Zen had stained grain above the maximum limit of 25 but below 75 which would result in a downgrade to UH or GP depending on protein levels.

Small grain screenings were an issue in 2015 across WA. Data so far indicates a typical response of increased screenings with delayed sowing for wheat at this site.

Mid-April sowings can also expose grain to conditions which may result in lower falling numbers. Unfortunately the data was not available at the time of publication.

Grain quality - barley

Only grain quality data for the two May planting dates is presented due to possible purity issues with the barley samples from the mid-April planting affecting the reliability of the results.

Grain of all barley varieties with a malt classification (Bass, Baudin, Flinders, Granger, La Trobe and Scope CL) or under consideration for a malt classification (Compass and Maltstar) were received as either Malt 1 or Malt 2, except Maltstar with late May sowing (due

to high screenings). Bass and Granger were the only two varieties that were acceptable as Malt 1 at both sowing dates. Varietal downgrading from Malt 1 to Malt 2 with early May planting was due to low protein in Compass and high screenings in Scope CL. Downgrading with late May planting was due to high screenings in Baudin, La Trobe and Scope CL.

Table 1. Receival grain quality of barley varieties with each time of sowing. Mid-April planting data has been excluded due to possible purity issues with samples.

Time of sowing Variety	TOS1 16-Apr	TOS2 7-May	TOS3 21-May
Bass	-	Malt 1	Malt 1
Baudin	-	Malt 1	Malt 2
Compass[1]	-	Malt 2	Malt 1
Flinders	-	Malt 1	Malt 2
Granger	-	Malt 1	Malt 1
La Trobe	-	Malt 1	Malt 2
Lockyer[2]	-	Feed	Feed
Maltstar[3]	-	Malt 1	Feed
Oxford[2]	-	Feed	Feed
Rosalind[2]*	-	Feed	Feed
Scope CL	-	Malt 2	Malt 2
Urambie[2]	-	Feed	Feed

[1]Compass will enter Stage 1 of malt accreditation in 2016.
[2]Feed-only varieties.
[3]Maltstar is likely to enter Stage 1 of malt accreditation in 2017.

Hectolitre weight averaged across varieties decreased as seeding was delayed (73.8 vs 72.4 kg/hL respectively for the 'malt' varieties at each TOS). Varietal differences were observed. Of the 'malt' varieties, Bass, Flinders and La Trobe had a slightly higher hectolitre weight (74.2 kg/hl averaged across early May and late May) whilst Baudin and Maltstar were slightly lower (71.9 kg/hl) than the other 'malt' varieties.

Screenings doubled with delays in seeding from early May to late May (11 vs 26 % respectively for the 'malt' varieties at each TOS, respectively). Varietal differences were observed. Of the 'malt' varieties, Bass, Compass, Flinders and Granger (12% screenings averaged over early and late May) had lower screenings than Baudin, La Trobe, Maltstar and Scope CL (25%).

Average grain protein concentration was similar across times of sowing. Varietal differences were observed. Of the 'malt' varieties, Bass and Scope CL (11.3% averaged across TOS2 and TOS3) had the highest grain protein and Compass (9.8% averaged across TOS2 and TOS3) the lowest.

Grain brightness increased as seeding was delayed (58 vs 60 'L*' respectively for the 'malt' varieties at each TOS, respectively). Varietal differences were observed. Of the 'malt' varieties, Baudin and Compass had the brightest grain and Granger the darkest grain, although varietal rankings did change slightly with time of sowing.

DISCUSSION

Traditionally sowing wheat in Western Australia was not recommended until after Anzac Day. A date based on the yield performance and maturities of commercially available wheat varieties in the 1990s. Since then growers have seen the release of Mace, a high yielding and very adaptable variety which at 67% dominates the area sown to wheat in WA in 2015 (Data courtesy of CBH group). Growers are now set up and keen to take advantage of any summer rainfall, but there is limited information on which wheat varieties to grow with a very early sowing opportunity.

Research carried out by James Hunt *et al*. (2014) suggested that the faster maturing winter wheat Whistler appeared well adapted to WA. When sown in mid-April Whistler was able to yield equivalent or better than Mace planted in late May (Crop Updates 2015). Results from Dandaragan and Katanning trials do support this suggestion but this research also suggests there are commercial varieties currently available in WA which can yield similar or higher and have a superior grain quality classification compared to Whistler. However these varieties can still be at the risk of frost and grain quality problems associated with very early sowings.

At all three sites in this trial series, barley out yielded wheat with both the mid-April and the early May planting (note we have included the predicted yield for barley with mid-April planting at Dandaragan of 7t/ha in this assessment). Barley was over 1.5t/ha better than wheat with both mid-April and early May planting. Whilst this research continues to highlight the need for a wheat variety which is more suitable for early sowing opportunities in Western Australia, growers looking for a cereal to sow in April could consider barley as being their new wheat variety until such wheats are released. Whilst this is only one year of observations there are many reasons to consider barley particularly with mid-April planting ahead of planting a wheat variety, including reduced (but still possible) frost risk.

The feed barley varieties Lockyer, Oxford, Rosalind and Urambie did not provide any yield advantage over those with a ‘malt’ classification at Dandaragan in 2015. The ‘malt’ varieties would therefore have been more profitable than the feed varieties as they were received with a premium over the feed barley varieties (either Malt 1 or Malt 2) at a similar grain yield.

With any early planting opportunity growers need to factor in increased fungicide costs. At Dandaragan powdery mildew and barley leaf rust in the barley plots and yellow spot in the wheat plots had to be controlled, particularly in the mid-April planting.

ACKNOWLEDGEMENTS

This research is supported by the Department of Agriculture and Food Western Australia with co-funding from the Grains Research and Development Corporation (wheat – DAW00249 and barley - DAW00224). Sincere thanks to West Midlands Group and Andrew and Charles Roberts for the provision of land, to the Geraldton RSU for the management of trials and for the technical support of Melanie Kupsch, Bruce Haig and Sue Cartledge.