

Capturing early sowing opportunities for wheat in WA

Brenda Shackley, Christine Zaicou-Kunesch, Jeremy Curry and Dion Nicol, DAFWA (Katanning, Geraldton, Esperance and Merredin)

Key messages

- Highest grain yields are not always achieved at the earliest sowing opportunity.
- Mace is not suitable for April sowing times but other current mid to long maturing varieties have good adaption for yield in WA.
- Frost events were severe and repeated at Katanning and even longer season spring and winter wheats were severely damaged.

Aims

To determine grain yield and quality responses of long season wheat varieties sown mid-April compared to the more conventional sowing times.

Method

A series of time-of-sowing trials were located at Mullewa, Merredin (Merredin Dryland Institute), Katanning (Great Southern Agriculture Research Institute) and Gibson (Esperance Downs Research Station, EDRS) in 2016. These trials examined 12 wheat varieties sown at three sowing dates. The varieties included in all trials were Mace^a, Magenta^a, Trojan^a, Yitpi^a, Cutlass^a, Zen^a, DS Pascal^a, Forrest^a, Wylah^a, the newly released LRPB Arrow^a and two potential mid to long season varieties (advanced breeding lines). At EDRS Bremer^a was sown in place of Zen^a. Wylah^a is an APW winter wheat, Forrest^a is a longer maturing daylength responsive variety (default classification of ASW), and DS Pascal^a is a feed wheat in WA (default in WA, APW in SA) that exhibits the leading germination index (i.e. inherent resistance to sprouting) of current commercial varieties. The sowing dates were similar at all four sites (Table 1). These dates will be collectively referred to as mid-April, early May and late May.

All trials were sown into canola stubble (except Merredin, which followed fallow) with Uniform® treated fertiliser banded below the seed. Plots were seeded to target an establishment of 150 plants/m². Further nitrogen was applied at 4-5 weeks after sowing as Flexi-N®, and Prosaro® was applied as required to control powdery mildew and yellow spot/septoria compendium.

Plant establishment counts were conducted at 2-3 weeks after sowing. Heading and flowering dates were recorded at each location by routinely recording the Zadok score either two or three times a week.

Results

Summer rainfall levels were high across much of the wheatbelt of WA in 2016, although Mullewa received significantly less than the other trial sites (Table 1). With the high rainfall continuing into April, the first sowing time (mid-April) was sown into good levels of moisture at Merredin, Katanning and EDRS, and drying topsoils at Mullewa. Excellent plant establishment was achieved at EDRS and Katanning (Table 1). Although moisture was not an issue for seeding at Merredin, establishment was reduced.

Table 1: Summary of trial details for the sites at Mullewa, Merredin, Katanning and EDRS in 2016.

	Sowing dates	Establishment (Plants/m ²)	Rainfall (mm)			No. of frost events	
			Pre (Jan-Mar)	Grain Fill (Sep-Oct)	GSR (Apr-Oct)	Min 0-2°C	Min <0°C
Mullewa	April 14. May 5 & 26	118, 120 & 162	37	12	358	12	2
Merredin	April 15. May 10 & 27	96, 102 & 104	183	30	255	14	13
Katanning	April 14. May 5 & 26	146, 148 & 132	105	54	303	14	3
EDRS	April 14. May 9 & 26	155, 165 & 171	135	98	480	0	0

Minimum temperatures were well below average across WA in 2016. Table 1 shows the large number of events where minimum temperature where either between 0°C and 2°C or below 0°C. No minimum temperatures below 2°C were recorded at EDRS, however waterlogging was present throughout much of the season.

Weather stations are only an indication of the temperatures experienced by the crop canopy. Comparison between minimum temperatures recorded at the DAFWA weather station at Katanning, which is located higher in the landscape, compared to the average minimum temperature recorded from 10 Tinytag temperature loggers located at the trial site at canopy height were on average 2.6°C lower than the weather station over the flowering period of the trial (August, September and October), with the difference being greater with the lower temperatures.

Although low temperatures were recorded at Mullewa and Merredin, negligible frost damage was observed at the trial sites. This will be confirmed when the yield component data is available. At the Katanning site, major frost damage was observed and this was reflected in the grain yields recorded. Position in landscape and soil type played a large role in the extent of frost damage in the trials.

Flowering observations

Actual flowering dates vary with sowing date, location, season and variety. Figure 1 shows the flowering dates of six varieties sown at Mullewa, Merredin, Katanning and EDRS and how they relate to the “estimated flowering window” for each location. The terminology “estimated” and not “optimum” is used as these “windows” have not been updated since the early 1990’s, however they are still a useful guide.

Mace^a sown in mid-April in 2016 reached flowering 40 days before the flowering window at Mullewa, 18 days for Merredin, 21 days for Katanning and 16 days for EDRS. In contrast, the winter wheat Wylah^a sown mid-April reached flowering 4 days outside flowering window at Mullewa, Merredin, Katanning and only 1 day at EDRS in 2016. Actual flowering dates do change from year to year with 2016 generally considered to have flowering dates later than 2015.

Figure 1 shows the spread of flowering dates representing a range of development times of current varieties that are available to assist with earlier sowings. However, a clear gap is evident between the long maturing Wylah^a and Forrest^a and the mid to long maturing variety which is represented by Cutlass^a.

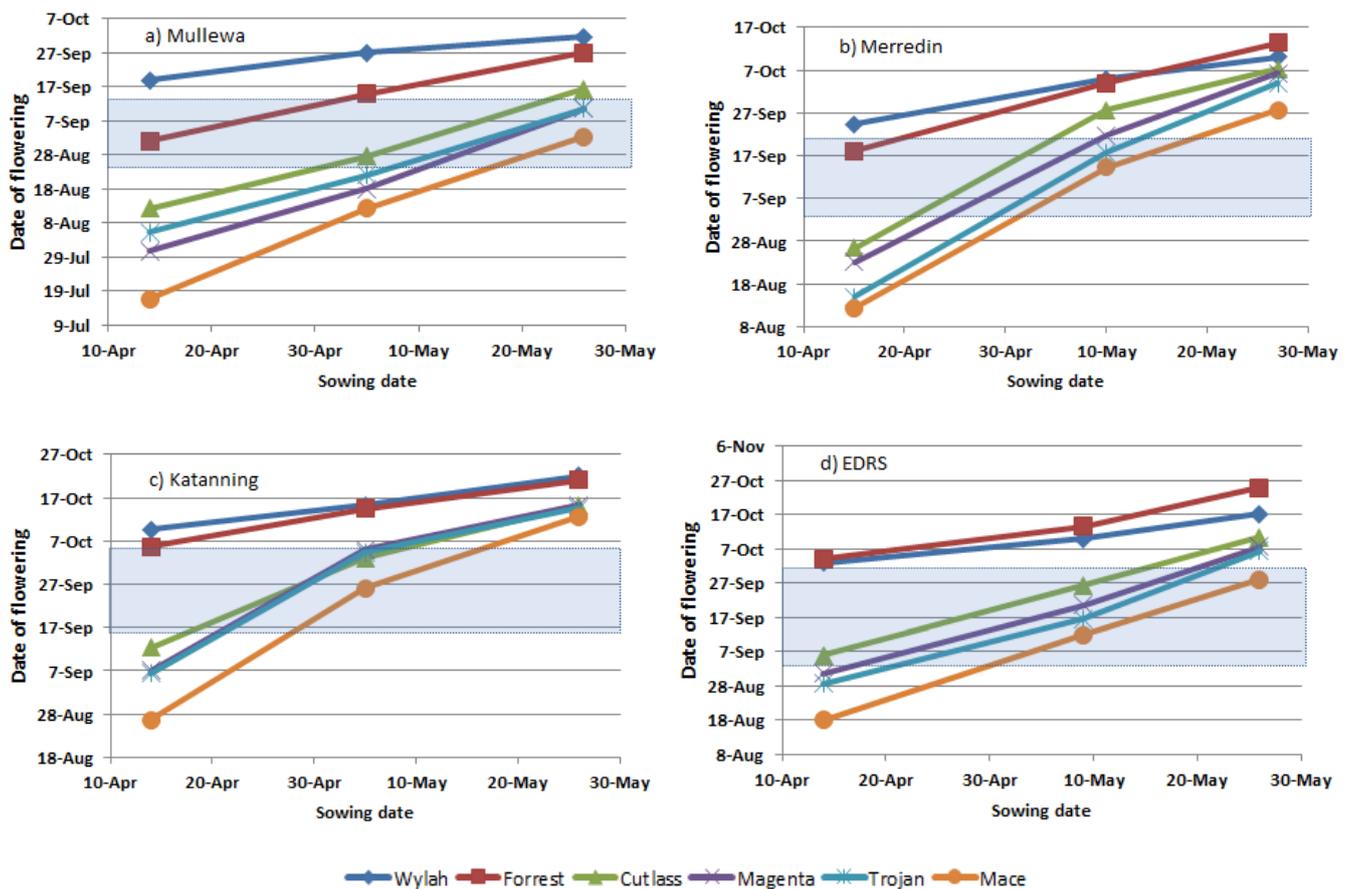


Figure 1: Date of flowering (Z65) for six wheat varieties at a) Mullewa, b) Merredin, c) Katanning and d) EDRS in 2016 as seeding is delayed from mid-April. Highlighted area corresponds to the “estimated flowering window” for each location.

Grain yield

The average grain yield ranged from 4.5t/ha for the mid-April and early May sowings at EDRS, to a near total yield wipe-out due to frost at Katanning sown mid-April (Figure 2). Most varieties produced their highest yields at the early May sowing time or the yields were not significantly different between mid-April and early May sowings. The exception was Forrest^a at Merredin which obtained the highest yield when sown mid-April.

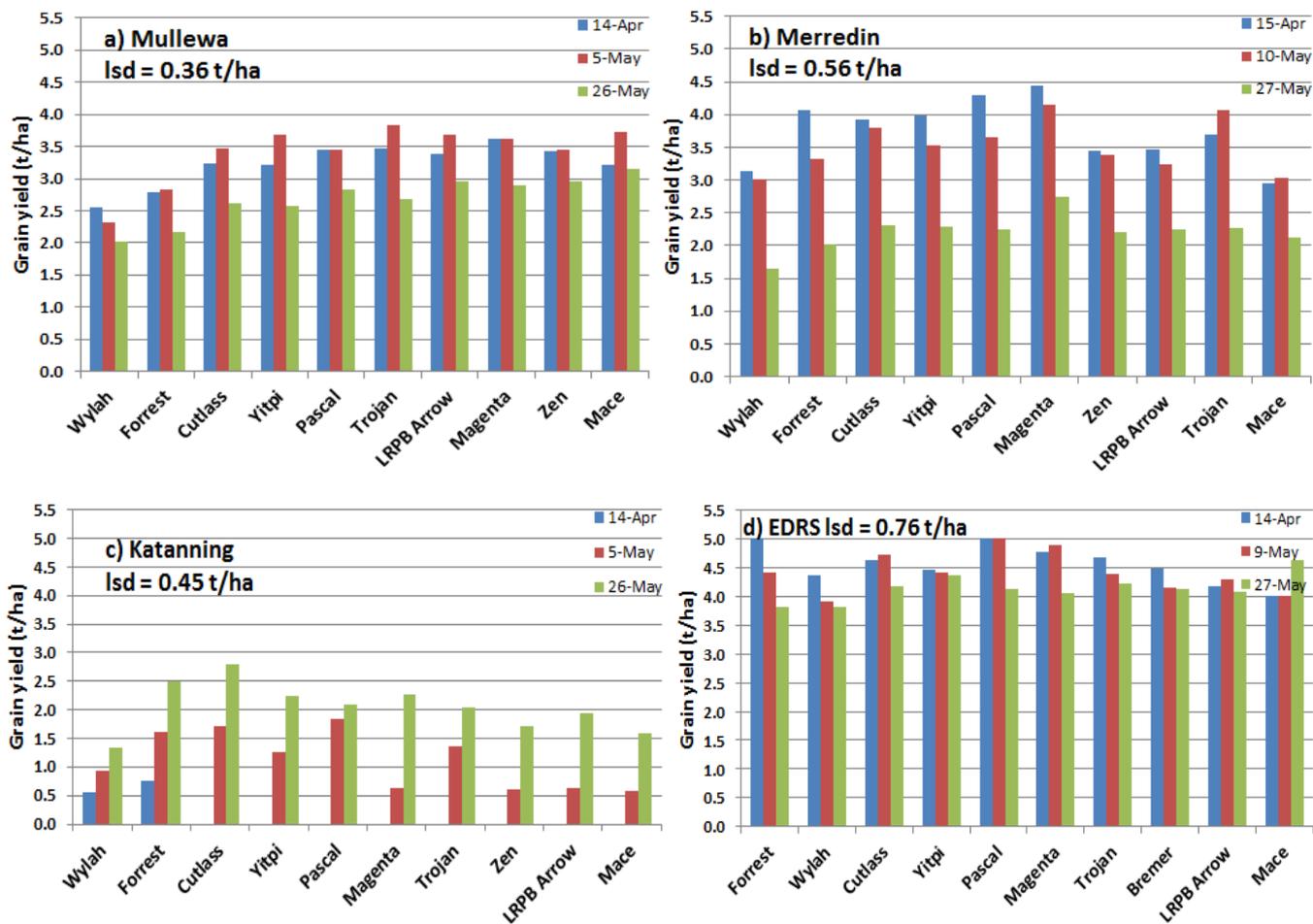


Figure 2: Grain yield (t/ha) response of wheat varieties to sowing time at a) Mullewa, b) Merredin, c) Katanning and d) EDRS in 2016. Varieties arranged from left to right in order of average maturity at that site. Severe frost damage occurred at Katanning.

At Mullewa, there was a trend for the mid to long maturing varieties to yield higher at the early May sowing time than the target early sowing time of mid-April. This result was consistent with findings at Dandaragan, the most northern site of the 2015 trial series (Shackley et al, GRDC Research Update Perth 2016). Despite Forrest^a being the highest yielding variety when sown early April at a GRDC Regional Cropping Solution Network trial at Yuna in 2015, both Forrest^a and the winter wheat Wylah^a (of a similar flowering time) were not yield competitive at any sowing time in 2016. Mace^a, the fastest maturing variety in the trial, was one of the highest yielding varieties at Mullewa sown early May in 2016. Although there are some obvious differences (e.g. soil type) between the Mullewa site in 2016 and other northern sites for which results have been compared (Dandaragan and Yuna in 2015), the drier finish to the season at Mullewa in 2016 would also be an important factor (Table 1).

At Merredin, despite the winter wheat Wylah^a being one of the lowest yielding varieties, Forrest^a was competitive with the mid to long maturing varieties Cutlass^a, Yitpi^a, DS Pascal^a and Magenta^a, particularly at the mid-April sowing time. Magenta^a was the highest yielding variety at all sowing times while Mace^a was the lowest. Overall, mid-April sowing gave the highest average yield, with almost all varieties performing best at this sowing time.

Frost events were so extreme and frequent at Katanning in 2016 that even the longest maturing varieties Wylah^a and Forrest^a could not avoid frost damage, with frost induced sterility scores of 90% and 73% respectively for the early May sowing (preliminary results). Analysis and conclusions drawn from the yield and quality results from Katanning need to be treated with extreme caution due to the severe frost damage, which also highlighted that under extreme conditions all of the current commercial varieties examined are at a risk with early sowing.

At EDRS in 2016, Forrest^a and DS Pascal^a were the highest yielding varieties sown mid-April, although only significantly higher yielding than Mace^a and LRPB Arrow^a. DS Pascal^a was again the highest yielding variety sown early May, but only significantly higher yielding than Wylah^a, Bremer^a and Mace^a. Mace^a was the highest yielding variety sown late May, significantly higher yielding than only Wylah^a and Forrest^a. There was very little yield decline with delayed sowing at this site with averages of 4.5t/ha sown mid-April and early May and 4.2t/ha sown late May. Waterlogging was evident at this site, a year with decile 10 rainfall. In contrast, 2015 had a rating of decile 5 and Mace^a was consistently one of the highest yielding varieties at all three sowing times, while the longer maturing varieties were consistently lower yielding even at the earlier sowing dates.

Yield component analysis is still to be completed for all the four sites in 2016.

Grain quality

Limited grain quality analysis completed to date from the Mullewa and EDRS sites has indicated that mid-April sowings can have issues with stained grain (Blackpoint). At Mullewa, Yitpi[®] was the only variety with stained grain above the maximum limit (of 25 stained grains per 1 Black Plastic Measuring cup - BPM) for milling grades. At EDRS, Yitpi[®] had excess stained grain at all sowing times while Cutlass[®] and Magenta[®] had stained grains above the 25 grain limit (although still less than Yitpi[®]) for the mid-April and early May sowing times only. There were no staining issues at Merredin.

Not only did Katanning experience well below expected yields due to frost but the grain was also downgraded due to small grain screenings and frost distorted grains.

Mid-April sowings can also expose grain to conditions which may result in lower falling numbers. However this was not an issue at any of the sites in 2015 or 2016.

Conclusion

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, changing rainfall trends (particularly at the start of the growing season), as well as changes to farming systems, have seen growers show willingness to sow wheat even earlier than Anzac day. This has coincided with the release and dominance of Mace[®], a high yielding and very adaptable short to mid maturing variety. This presents the challenge of knowing 'how early is too early' with the accepted and popular Mace, or whether there are varieties that are better suited to taking these early sowing opportunities. Unfortunately there is limited information on which wheat varieties to grow with a very early sowing opportunity.

Research carried out by Dr. James Hunt (GRDC Crop Updates Perth 2015) suggested that the faster maturing winter wheat Whistler[®] appears to be well adapted to WA and when sown in mid-April was able to yield as well as, or better than, Mace[®] planted in late May. The results of Whistler in 2015 (Shackley et al, GRDC Research Updates Perth 2016), or the similar maturing Wylah[®] in 2016, do support this suggestion, but this research also suggests there are commercial mid to long maturing varieties currently available in WA which can yield similar or higher than both these winter wheats and Mace[®]. The longer maturing variety Forrest[®] was examined in 2016 and appears to be more adaptable to WA conditions than Wylah[®]. However, all these varieties can still be at the risk of frost and grain quality problems associated with very early sowing and despite replicated trials across WA, no variety has consistently shown the ability to outperform others in any particular set of conditions, be that geographic location or sowing time.

The research continues to highlight the need for a variety which is better suited for early sowing opportunities in WA and that will give an improvement on traditional strategies of sowing an early to mid maturing variety in May. Such a variety would not only need to consistently out-yield other varieties sown at early or conventional sowing times, but would require some level of resistance to common grain quality issues associated with early sowing, such as pre-harvest sprouting, staining and frost.

® Varieties displaying this symbol beside them are protected under the Plant Breeders Rights Act 1994.

® Registered trademark

Key words

Early sowing, flowering date, wheat varieties

Acknowledgments

The research undertaken as part of this project is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support. This research is also co-funded by DAFWA. Sincere thanks Nino Messina for the provision of land at Mullewa, to the Geraldton, Merredin, Katanning and Esperance RSUs for the management of trials and for the technical support of Melanie Kupsch, Bruce Haig, Rod Bowey and Rachel Brunt.

GRDC Project Number: DAW00249 'Tactical wheat agronomy for the west'

Paper reviewed by: Dr Bob French