

Yield response of wheat varieties to sowing time in NSW

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Primary Industries variety evaluation program and National Variety Trials (NVT) program from 1998 to 2007.

Trials were grown across 4 NSW wheat regions: NE, NW, SE and SW. There were 160, 216, 212 and 174 trials respectively sown in the 4 wheat regions.

There were 678 dryland and 84 irrigated trials grown across 106 locations included in the analysis.

The autumn break in NSW can occur between March and June. The wide range of maturity available in wheat varieties in NSW allows growers to choose a variety which best suits the timing of the autumn break and their farming system.

Varieties suited for sowing in NSW range in maturity from winter to early spring types. This presents the opportunity to plant wheat crops from late March until the end of June and still have the crop flowering when risk of frost and heat stress are acceptable. Varieties differ in their ability to achieve high yield from different sowing times.

Variety trials in NSW are divided into very early sown, early sown and main season sown sets. Varieties are allocated to groups based on their relative maturity. Those with late winter or winter habit are included in the very early sown set. Those with winter or facultative spring habit are included in the early sown set and those with spring habit in the main season sown set.

Over a period of years the sets of variety trials are sown across a range of sowing dates. Consequently it is possible to estimate yield response of a variety to changes in sowing date. This Primefact reports variety yield response to sowing date estimates.

Trials and years

Data included in the analysis includes data from trials conducted in NSW by the Enterprise Grains Australia breeding program, NSW Department of

Sowing times

Sowing dates, or times of sowing (TOS), are expressed as year day, which is the number of days after 1st January. Sowing dates across all years ranged from 13th of April (year day 103) to the 14th of August (year day 225). The bulk of trials were sown between the middle of May (year day 135) and the middle of June (year day 165).

Genotypes

In order to reduce the computation involved, only those genotypes which were grown in at least 5 trials have been included in the analysis. 1168 genotypes were included in the analysis. Results are reported for only those genotypes which have been released as varieties.

Trial results

There was a differential genotype response to time of sowing (shown by the difference in slopes of individual genotype response Figures 2–8) which accounted for a reasonably large percentage (10%) of the total genetic variation. There was a large main effect of genotypes (10%). Terms such as genotype by irrigated and genotype by year interactions contributed reasonable effects of 5% and 11% respectively. If we could report individual genotype regression lines as a whole this would represent a total of 21% of the genetic variation in the data (see Table 1).



Table 1. Contributions to variance (actual and as percent of total genetic variance) for the time of sowing analysis.

Source	Variance	%Total
Genotype	0.01558	10%
Genotype.TOS	0.01567	10%
Genotype.spline (TOS)	0.00155	1%
Genotype.Irrigated	0.00845	5%
Genotype.Year	0.01662	11%
Genotype.Region	0.00194	1%
Genotype.Year.Region	0.00000	0%
Genotype.Year.Irrigated	0.01209	8%
Genotype.Region.Irrigated	0.00394	3%
Genotype.Year.Region.Irrigated	0.01250	8%
Genotype.Trial	0.06589	43%
Total Genetic	0.15422	100%

Genotype responses

There were differences in variety response to sowing time. There seem to be 3 basic types of genotype response: genotypes which yield better when sown early (negative slope), those that yield better when sown late (positive slope) and those which perform similarly (flat slope) over all sowing times (see Figure 1). The estimated yield responses of individual varieties are presented in Figures 2–8.

Varieties graphed are divided into 3 groups, those suited to main season sowing, those suited to early sowing and the remainder. The remainder are prime soft quality and durum varieties.

The different response curves indicate that there is the potential to use response to sowing date as an aid in identifying the best variety for a particular sowing date. Examples of the three response types are shown in Figure 1. Whistler is a winter variety with a response curve with negative slope and Waagan a high yielding spring variety with a response curve with negative slope. Ellison is an intermediate maturing variety with a response curve with positive slope. Janz is a mid season maturity variety with a flat response curve.

Janz, Ellison and Whistler achieve roughly the same yield at around year day 140 (20 May) (Figure 1). Whistler is likely to be higher yielding than Ellison if sown before year day 140 and lower yielding if sown after year day 140.

The data shown in Figures 2–8 should be used as an aid in choosing the highest yielding variety for individual sowing dates. It should be used in conjunction with the across sites analysis from the NVT trials. Data from the across sites analysis is available from the NVT web site (www.nvtonline.com.au). A subset is reproduced in the *Winter crop variety sowing guide* for the current year (McRae et al. 2008).

Whilst this analysis is the best available estimate of the relative response of varieties to sowing time there are still some unexplained issues with the responses. It is a widely held view that yield

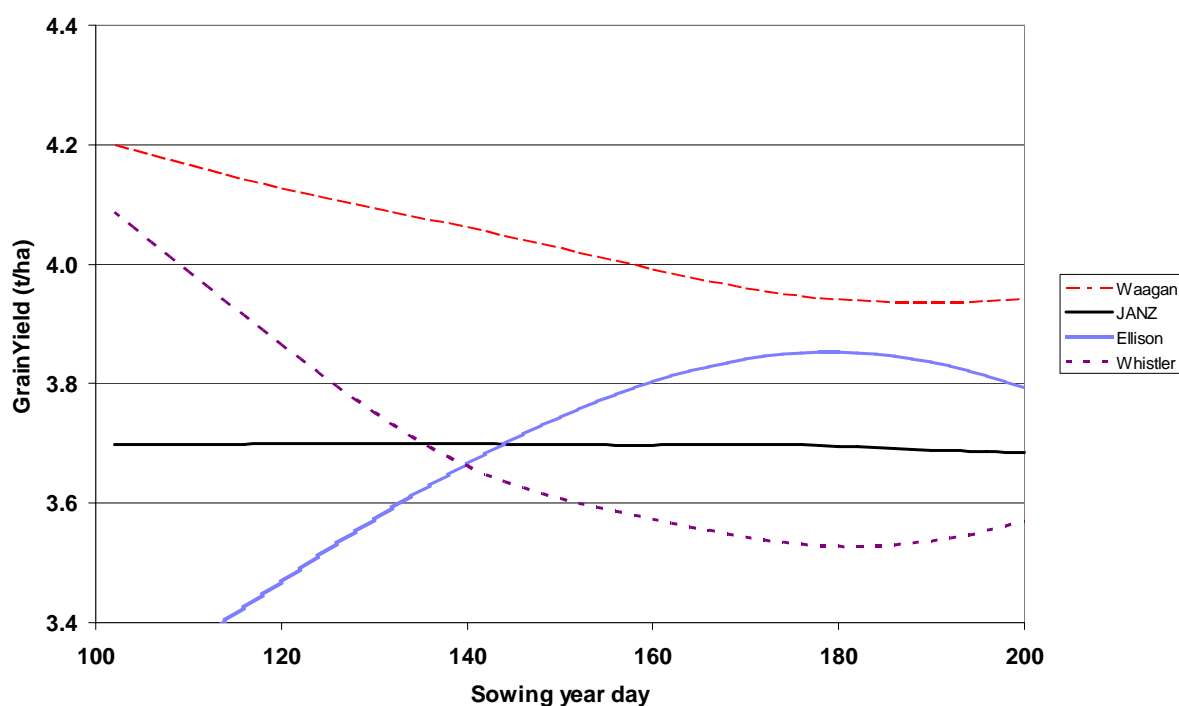


Figure 1. Examples of variety response to sowing date response curves, with negative slope Waggan and Whistler), positive slope (Ellison) and flat slope (JANZ).

declines by 4–7% for each week sowing is delayed after the optimum sowing time. The response curves with positive slope and flat slope do not reflect this response to later sowing. The variety response curves with negative slope also seem to level off as sowing date is delayed past about year day 170 (19 June). This may be a reflection of the reduced number of trials in that part of the response curve.

The response curves of very early flowering genotypes, such as Waagan, Ventura and H46, did not decline with early sowing. A possible reason for this is that variety trials which have been badly frosted are usually excluded from analysis or not harvested.

Acknowledgements

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References

McRae FJ, McCaffery DW, Matthews PW (2008) *Winter crop variety sowing guide*. (New South Wales Department of Primary Industries).

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Yield response curves for common varieties

Yield response (t/ha) of a range of wheat varieties to sowing time (year day of sowing). Solid line is the estimated grain yield; the dashed lines are upper and lower 95% confidence limits.

Figure 2. Main season varieties

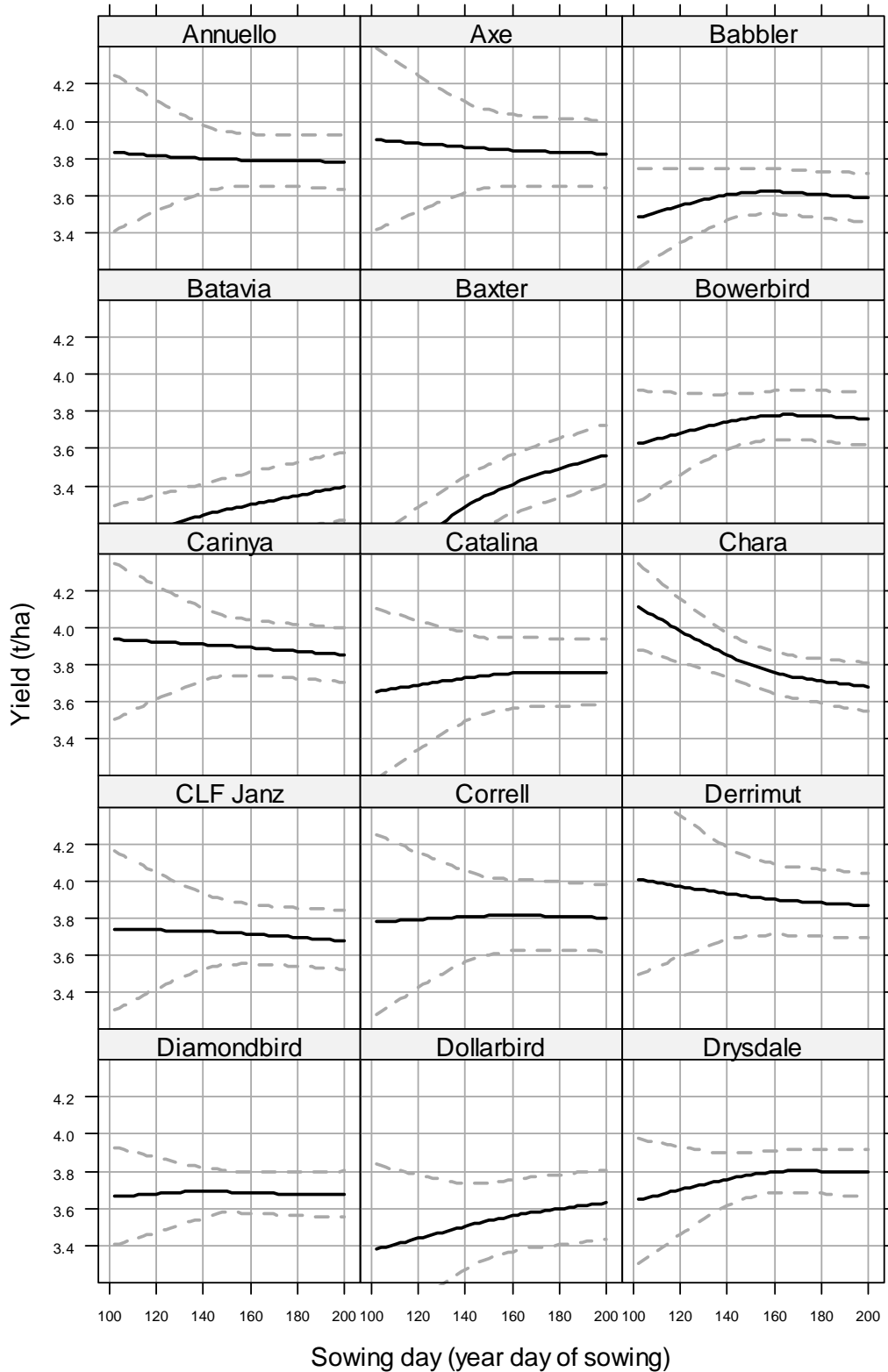


Figure 3. Main season varieties (continued)

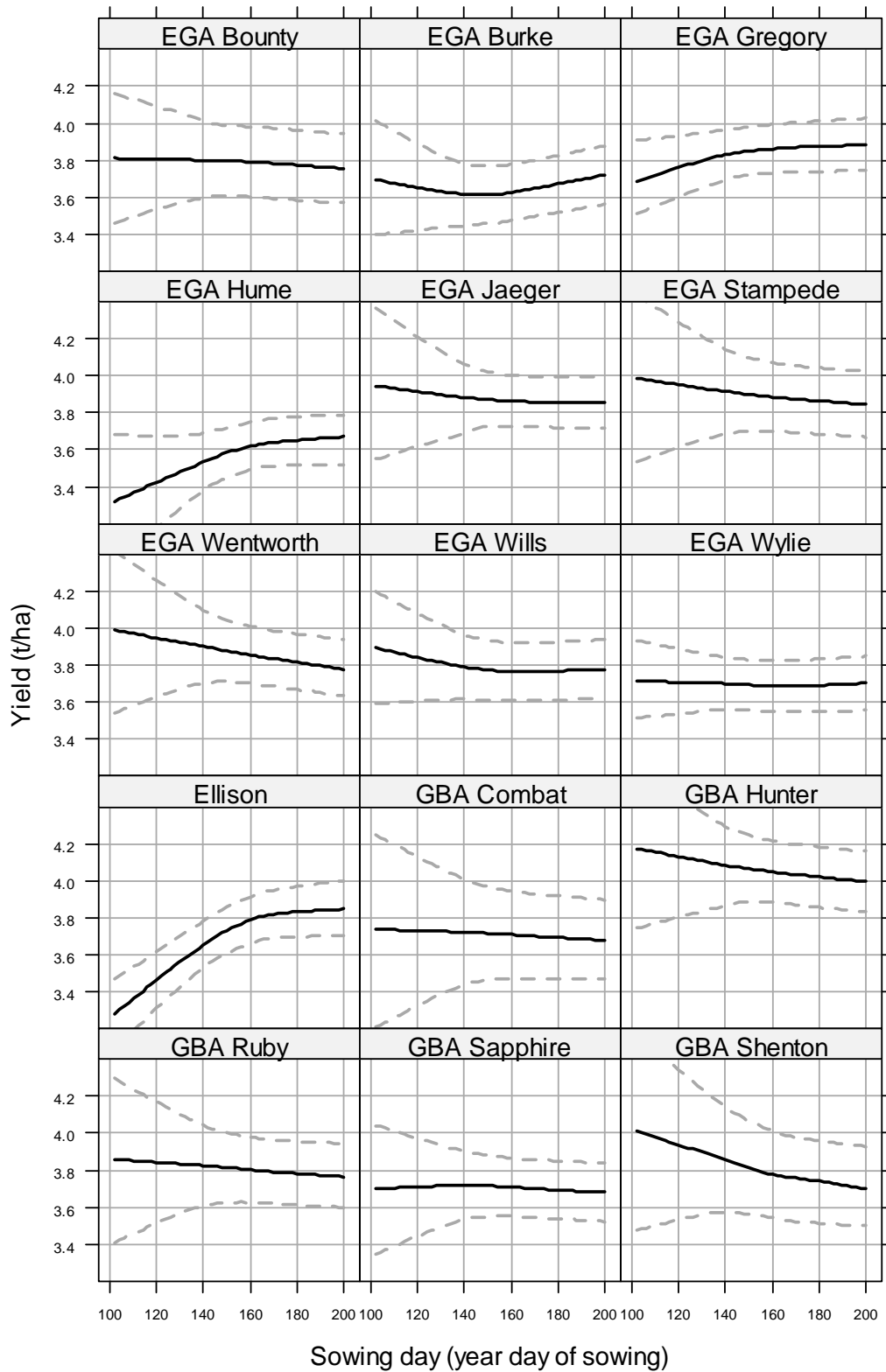


Figure 4. Main season varieties (continued)

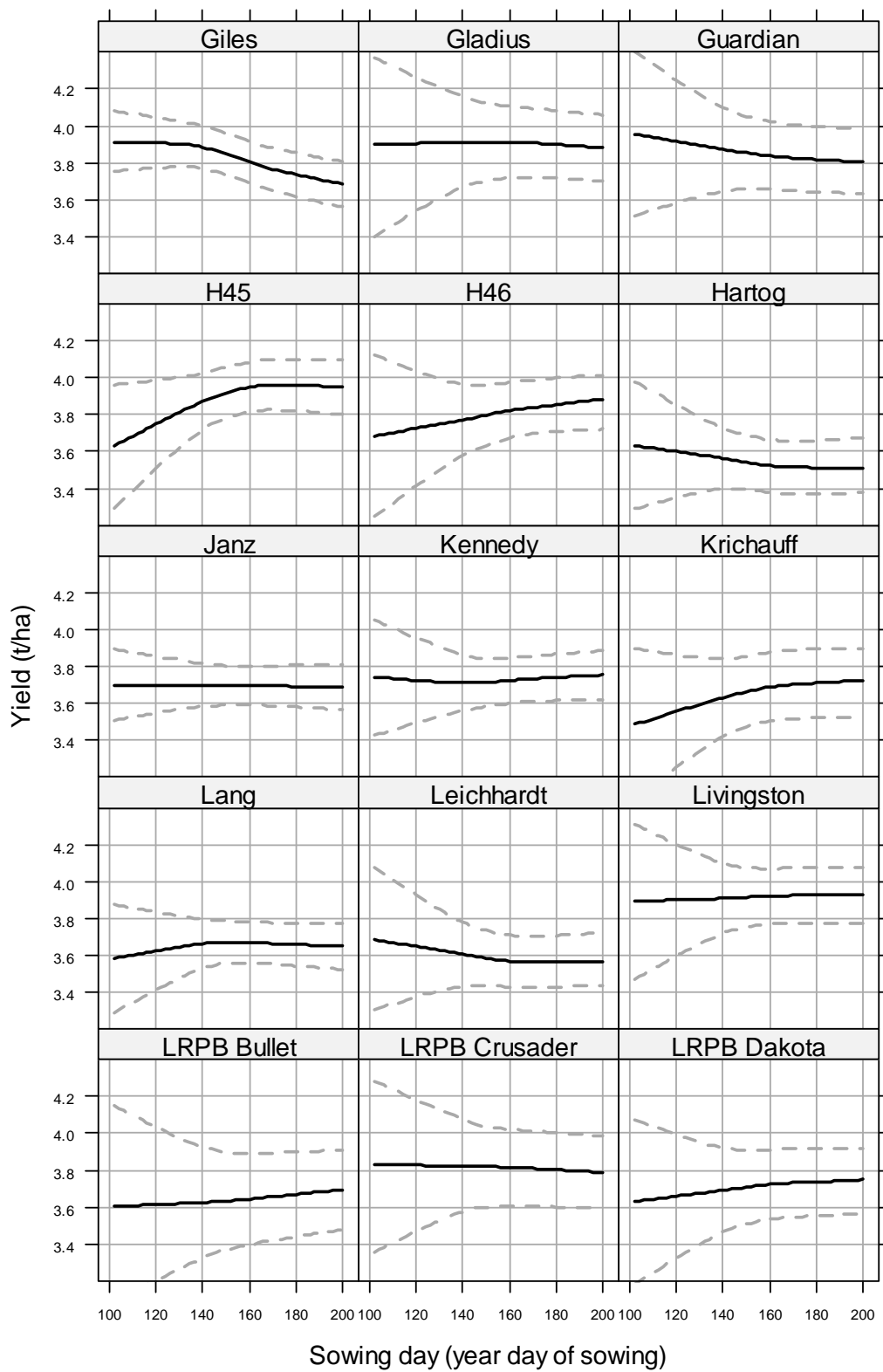


Figure 5. Main season varieties (continued)

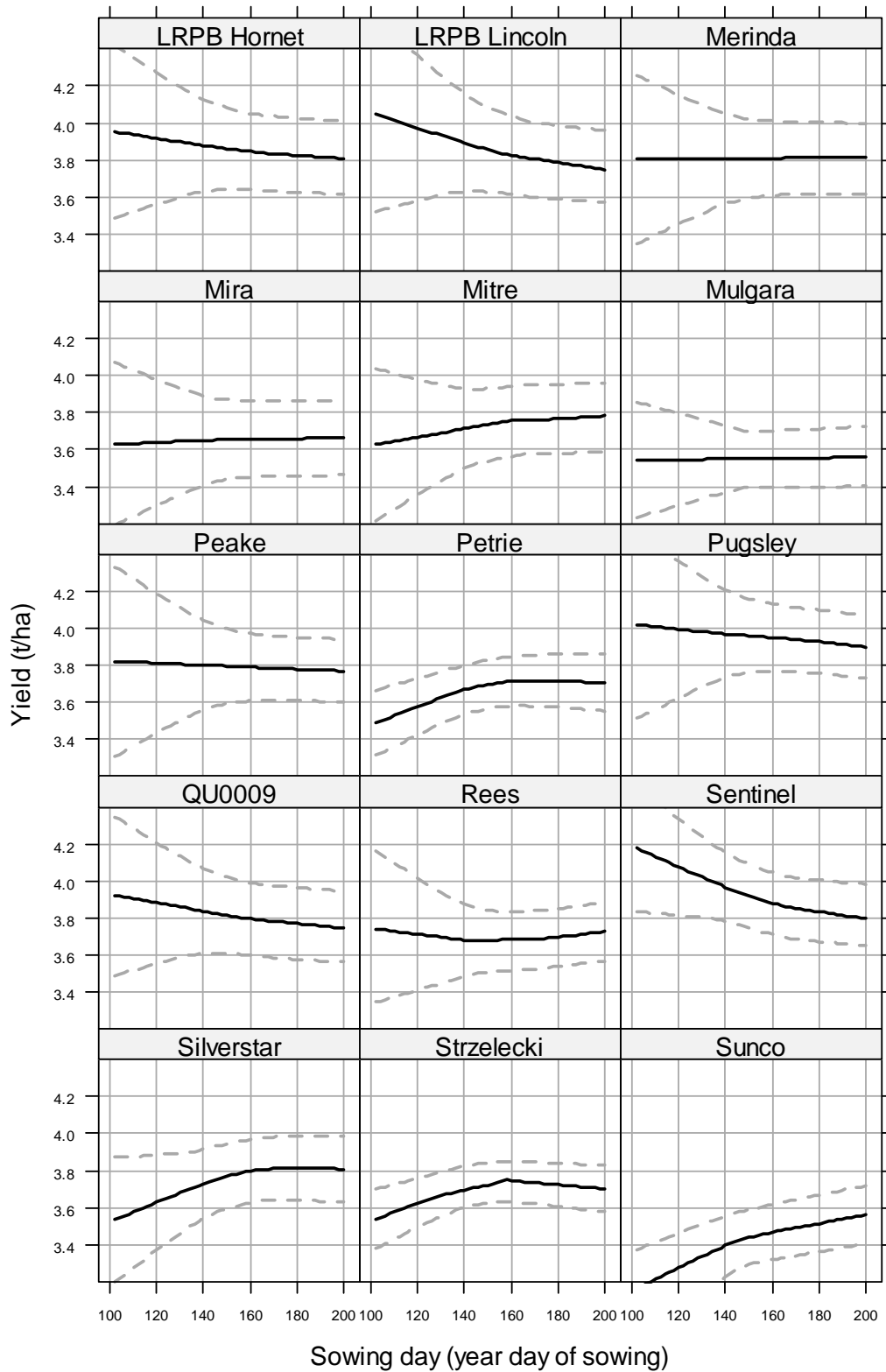


Figure 6. Main season varieties (continued)

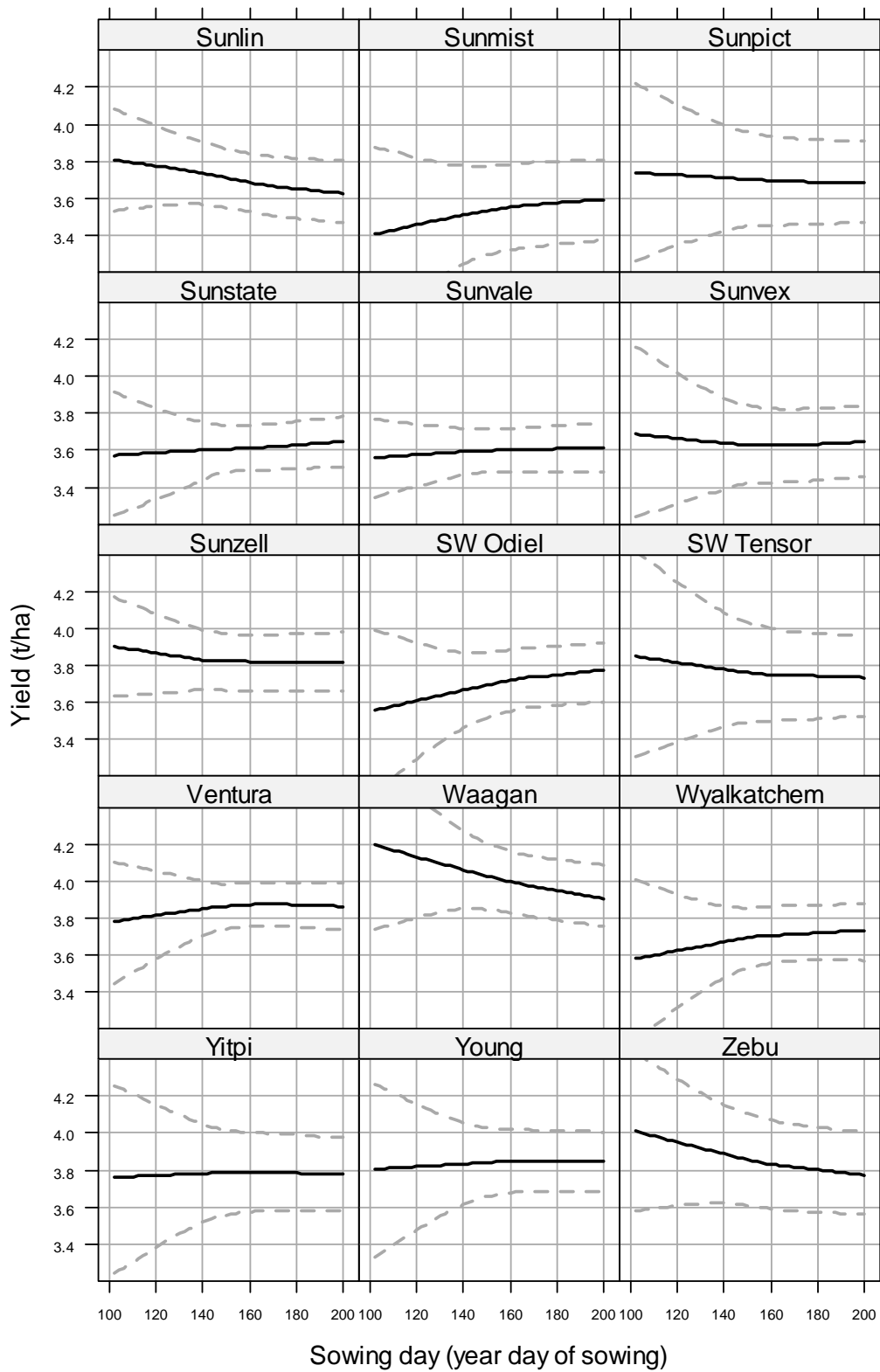


Figure 7. Early sown varieties

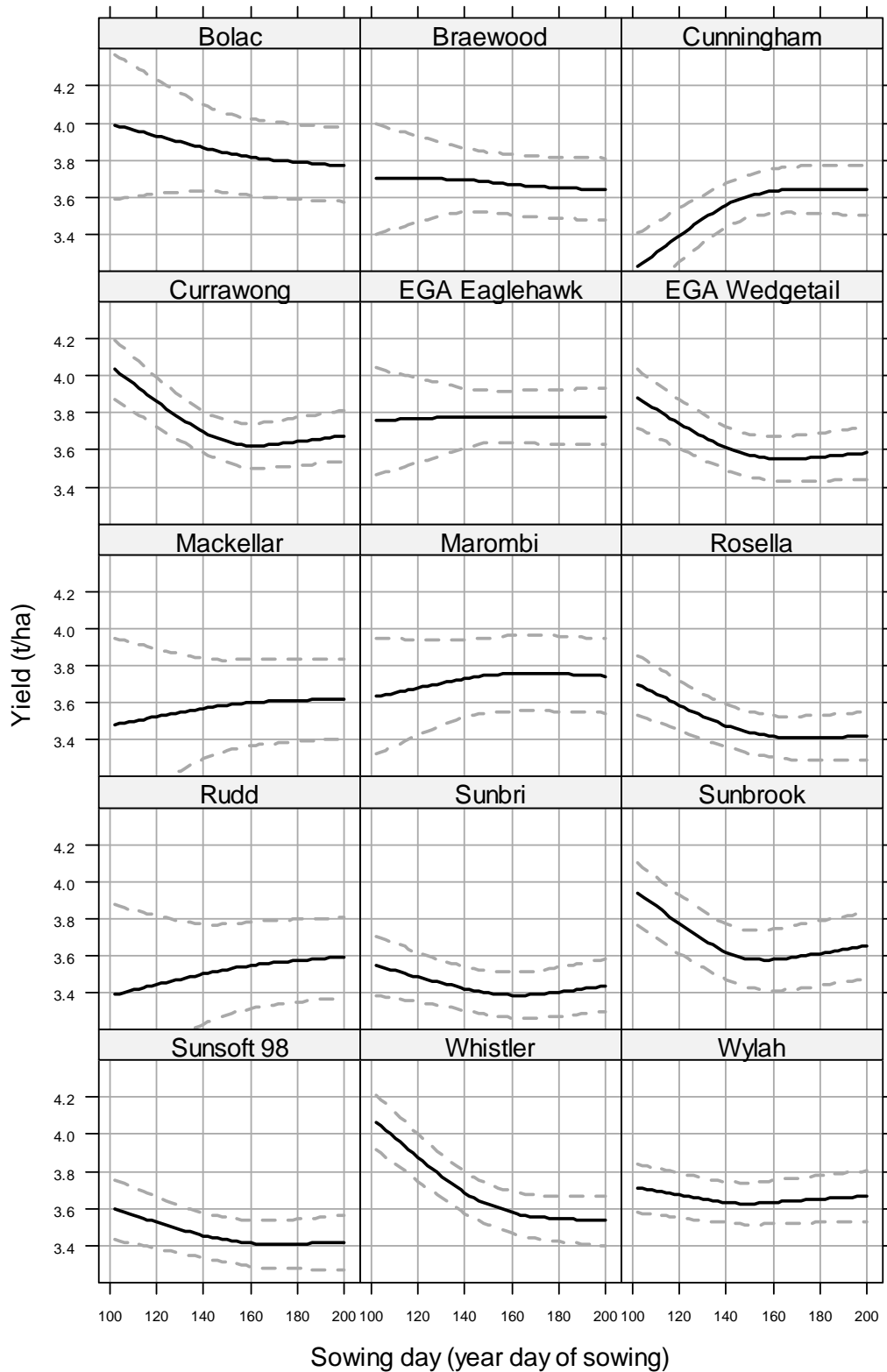


Figure 8. Soft and durum varieties

