Sensitivity of Barley Varieties to Crop Management

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KEY MESSAGES

- Varieties differ in their response to management inputs, especially for the important grain receival traits hectolitre weight, screenings and grain brightness.
- Varieties do not appear to differ greatly in their grain yield response to N fertiliser or seeding rate, but do differ in their grain yield sensitivity to date of seeding.
- Screenings of plump grained varieties is generally less sensitive to delays in seeding date or increases in applied N than the screenings of narrow grain varieties.
- To improve the chances of 'new' malting barley varieties being received into malt segregations, variety specific management guidelines are being developed for release within 12 months of their first commercial segregation in Western Australia.
- Management guidelines are currently being developed for Bass and Commander barley.

VARIETY INTERACTIONS WITH MANAGEMENT

Do barley varieties differ in their response to management inputs such as date of seeding, nitrogen fertiliser and planting density? YES (Table 1, Figures 1 to 3).

Small plot research trials were sown in range of locations around Western Australia in the period between 2005 and 2011. Barley varieties were assessed for their reaction to one or more of the following management factors: date of seeding, N fertiliser application (as urea) and seeding rate. Planting dates in the time of sowing trials usually differed by 3 weeks, with 2 or 3 dates of seeding per trial. N fertiliser rates, targeting 3 – 4 rates topdressed 3 – 6 weeks after seeding, ranged from 0 kg N/ha to 100 kg N/ha. Seeding rate targets were 75, 150 and 300 plants/m^2.

Table 1. Likelihood[1] of barley varieties differing in their reaction to a delay in the seeding date or an increase in the rate of N applied or an increase in the seeding rate.

Variety interaction with	Time of sowing	N applied	Seeding rate
Plant trait			
Plant height (cm)	50% chance	Occasionally	Rarely
Grain yield (kg/ha)	50% chance	Occasionally	Rarely
Average grain weight (mg, db)	Often	Occasionally	50% chance
Hectolitre weight (kg/hl)	Often	50% chance	Occasionally
Screenings (% < 2.5 mm)	Often	50% chance	50% chance
Grain protein (%, db)	50% chance	Occasionally	Occasionally
Grain brightness ('L*')	Often	Occasionally	50% chance
Grain hardness (SKCS)	50% chance	50% chance	Occasionally
Background			
Years in which trials conducted	2005–2011	2008–2011	2005–2011
Number of trials	56 trials	20 trials	26 trials
Number of management factors	2 – 3 seeding dates	3 – 4 N rates	3 seeding rates
Number of varieties sown	7 – 24 varieties	6 – 8 varieties	3 – 8 varieties

[1]Rarely (interaction observed in fewer than 20% of trials), Occasionally (20 – 40% trials), 50% chance (40 – 60% trials), Often (60 – 80% trials) and Consistently (interaction observed in more than 80% of trials).

Table 1 summarises the occurrence of significant interactions ($p<0.05$) between varieties and time of sowing, varieties and N fertiliser and varieties and seeding rate for range of plant traits. What Table 1 tells us is that the grain quality of barley varieties is generally more sensitive to management inputs than either their plant height or their grain yield. Hence the need for variety specific management packages for malting barley varieties. It

also tells us that varieties will differ more often in their yield and grain quality to delays in seeding than to increasing N application or increasing seeding rate.

Figures 1 to 3 compares the response of four varieties differing in their grain shape, but with a similar duration to awn emergence (when sown in late May), to delayed seeding, increasing N application and increasing plant density. Bass and Vlamingh are classed as plump grained varieties, whilst Baudin and Buloke are classed as narrow grained varieties.

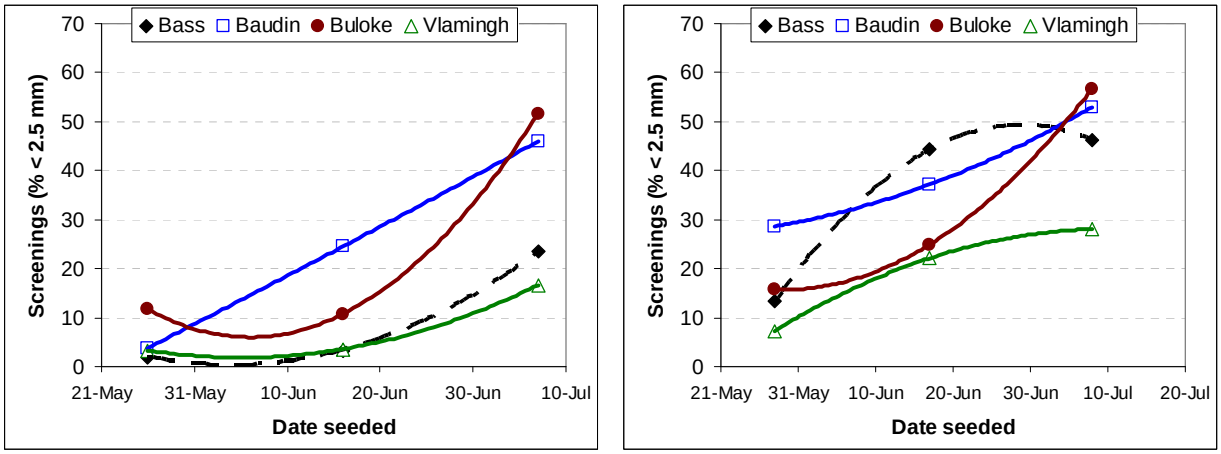

Figure 1. Example of differences in the screenings (% < 2.5 mm) response of 4 varieties (Bass, Baudin, Buloke and Vlamingh) to delayed seeding for two locations where the V x TOS interaction was significant: (L) Gibson, 2009 and (R) Yerecoin, 2010.

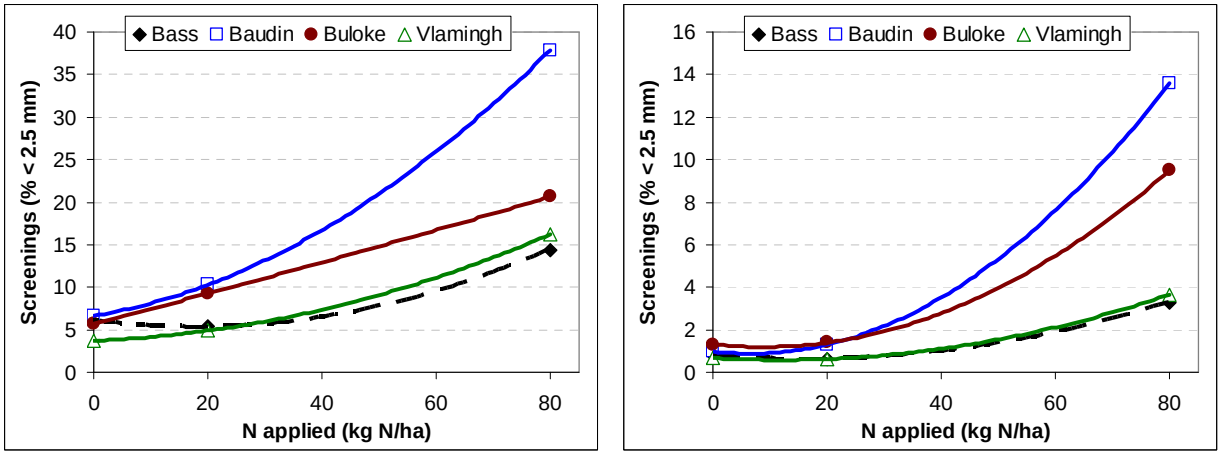

Figure 2. Example of differences in the screenings (% < 2.5 mm) response of 4 varieties (Bass, Baudin, Buloke and Vlamingh) to increasing N fertiliser application for two locations where the V x N interaction was significant: (L) Wittenoom Hills, 2010 and (R) Yerecoin, 2011.

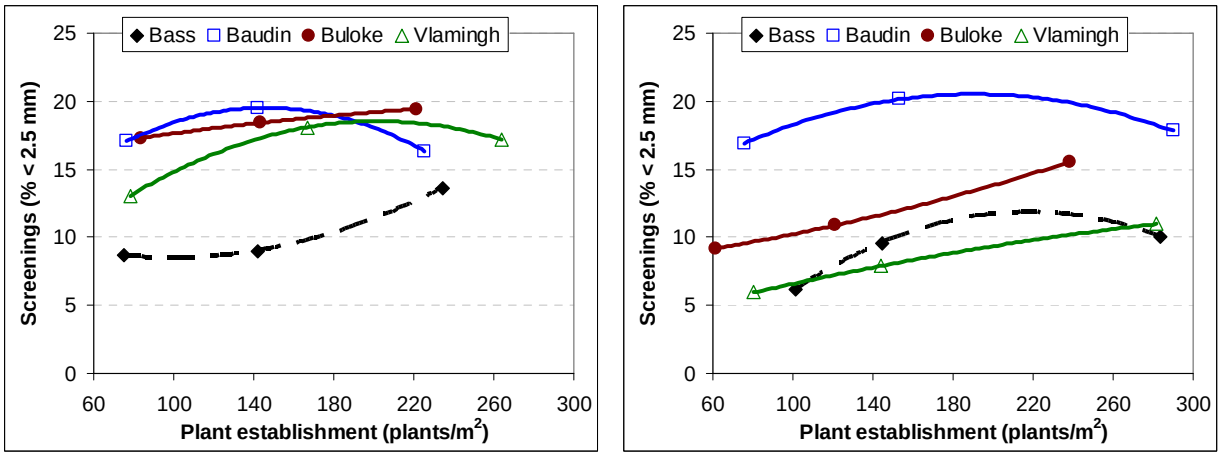

Figure 3. Example of differences in the screenings (% < 2.5 mm) response of 4 varieties (Bass, Baudin, Buloke and Vlamingh) to increasing plant density for two locations where the V x SR interaction was significant: (L) Muresk, 2009 and (R) Wittenoom Hills, 2010.

Whilst varieties can differ in their grain yield response to delayed seeding, their grain quality is more sensitive. Variety interactions occurred for hectolitre weight and grain brightness in two thirds of trials and for screenings in just under four fifths of trials. Grain shape, for example, is a large determinant of the responsiveness of varieties to delayed seeding, with narrow grained varieties being generally, but not always, more sensitive to delayed seeding than plump grained varieties (Figure 1).

The grain yield of varieties generally responded similarly to increasing N fertiliser and increasing seeding rate, suggesting that all varieties require the same inputs. Varieties however differed in their grain quality sensitivity to increasing N fertiliser and increasing seeding rate. This is illustrated in Figures 2 and 3 using screenings as an example. Differences in the sensitivity of varieties differing in their grain shape to applied N is clearly observed in Figure 2. Whilst all four varieties had similar screenings at nil N input, the rate of increase in screenings with increasing N was higher in the narrow grained varieties than in the plump grained varieties. Such a relationship was not as evident, however, in response to increasing seeding rate (Figure 3), but varieties did differ in their response.

AGRONOMIC RESEARCH WITH BARLEY VARIETIES

Data generated from Genotype (G) x Environment (E) x Management (M) trials has several outputs:

- comparing the performance of 'new' barley varieties (ie. barley variety sowing guide),
- development of variety specific management guidelines,
- development of decision support tools (ie. seeding rate calculator), and
- discussions with the barley supply chain in Western Australia (and nationally) on the likely suitability of varieties under consideration for release as malting.

Clearly barley varieties differ in their sensitivity to management inputs and for those with a malting classification this in turn influences the probability of their receival as malt barley. Subject to pricing, this sensitivity then affects their likely adoption. Variety specific management packages aim to provide growers with the first steps to growing a new malting barley variety. Variety specific management guidelines are an output of our new 5-year barley agronomy project "The management of barley and barley cultivars in Western Australia (DAW00224)" co-sponsored by DAFWA and the GRDC. Bass and Commander were commercially received for the first time at 2012/13 harvest and we are currently reviewing our data to produce the first steps or guiding management principles for those two varieties.

The expected outcome of our new project is growers having access to improved barley varieties, management information, market information and industry decisions to align crop production with market requirements will be more profitable.

Our success will be measured at project end by the number of growers using project outputs (target – 1,500 barley growers (>100 ha) in Western Australia) and by providing industry with examples of the practice change that has occurred (target – 100 examples of practice change recorded). Additionally we would like to see at least 20% of growers and next users surveyed utilising our technical information and/or decision support tools to assist them select barley varieties and management practices suited to their business structure, their business location and to meet market requirements. Our expected impact is 5 – 15% of barley growers using information generated by our project will achieve a 5 – 15% increase in profitability through greater barley production and/or an increase in per cent receival as malting.

Whilst agronomic performance is important, market pull drives the successful commercialisation of a variety. Agronomic performance and market pull together (with pricing) drive adoption and production and if both are good, this will ultimately ensure our customers get access to reliable supplies year in – year out from key varieties. Varieties with poor agronomic performance will only remain viable whilst the premium to deliver them outweighs the cost of growing them.

KEY WORDS

barley, variety specific management, grain yield, grain quality

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