SOWING DIRECTION AND ROW SPACING FOR BROME GRASS MANAGEMENT IN THE MALLEE

KEY MESSAGES

- Light interception at midday was significantly higher under east-west sowing compared with north-south.
- It is plausible that sowing direction may influence weed seed set.
- To establish a competitive crop against weeds and maximise yields, growers should aim for the narrowest row spacing to suit their system.

BACKGROUND

The reliance on agrochemicals, particularly herbicides, has increased over time in Wimmera and Mallee farming systems. As a result, the number of weed populations with some level of resistance to herbicides has continued to rise, motivating growers to seek alternatives for weed management.

Previous experiments have shown that crop sowing direction and row spacing have an impact on weed growth and seed production. However, these experiments have only been conducted in environments that differ in many ways to that of the Mallee (Borger 2010; Gardner 2013; Reithmuller 2005). The reported findings suggest narrow rows and sowing in an east-west direction suppresses weeds better. The aim of this experiment was to determine if this was also true in the Mallee, and if there are any benefits from combining the two practices.

In 2015 BCG established a trial at Jil Jil (23km north of Birchip) to investigate how sowing direction and row spacing might influence grass weed populations and growth. The key take-home messages that came from this work included:

- Yields were significantly higher under narrow row spacing, but sowing direction had no influence on yield.
- Weeds had a significant effect on yield, but the scale of yield penalty (t/ha yield loss) did not alter with row spacing or sowing direction in 2015.
- Weeds established faster where row spacing was wider, however by late tillering, all treatments had similar weed numbers and biomass levels.

For further information on the work carried out in 2015 please refer to the 2015 BCG Season Research Results compendium pp. 117-122.

In 2016 a similar trial was established, this time looking at natural grass weed populations comprising primarily of brome grass (Bromus diandrus), but that also containing some barley grass and low levels of ryegrass and wild oats. It was anticipated that by using a real weed population the results could be more relatable to what a grower would encounter and will more accurately indicate whether practice change could benefit their system.

Note: Some of the herbicides used in this trial are not registered for use in certain crops or under certain circumstances, and were used for experimental purposes only. Always read the label and adhere to directions when using herbicides.

AIM

To determine if sowing direction and row spacing can be used to reduce grass weed populations, growth and seed set, and their impact on crop performance in the Mallee.

PADDOCK DETAILS

Location
Jil Jil
Annual rainfall
480.5mm
GSR (Apr-Oct)
373mm
Soil type
Sandy clay loam
Paddock history
2015 grazing with late chemical fallow

TRIAL DETAILS

Crop type
Grenade CL Plus wheat
Treatments
Two sowing directions – east-west and north-south
Three row spacings – 225mm (9 inch), 305mm (12 inch) and 380mm (15 inch)
Plus and minus weeds (obtained by herbicide use)
Target plant density
130 plants/m^2
Seeding equipment
Knife points, press wheels
Sowing date
5 May
Replicates
4
Harvest date
15 December
Trial average yield
3.7t/ha

TRIAL INPUTS

Fertiliser
Granulock Supreme Z @ 70kg/ha at sowing
Urea @ 70kg/ha at GS32
Herbicide
Weed free plots only (IBS)
Sentry™ @ 40g/ha*
Trifluralin @ 1.5L/ha
Avadex® Xtra @ 2L/ha
Weed free plots only (in-crop)
Intervix® 600ml/ha (weed free plots only)
Liase® 2%
Hasten™ 1%
Broadleaf weeds, insect pests and diseases were controlled to best management practice.

Note: Sentry is not registered for pre-emergent use in Clearfield Plus (two gene) cereals and as such is not an endorsed use pattern by BCG, but purely done for trial management purposes. Any use of Sentry contrary to label guidelines are the user's responsibility including residue control, environmental safeguards, and resistance management.

METHOD

A replicated split-plot experiment was established into a paddock with a high background population of brome grass. Sowing direction was the main plot and row spacing by weeds was the sub-plot. The paddock had been a grazed chemical fallow in the previous season, and starting soil nitrogen (N) was 108kg/ha.

Assessments carried out in-crop included: emergence counts of crop and weeds 40 days after sowing; biomass cuts and further weed counts at GS30 (end of tillering) and GS65 (flowering); and crop head and weed panicle numbers at early grain fill.

Plots were harvested and processed for standard yield and grain quality assessments. Light interception was also measured at full flag leaf emergence (GS39) using a ceptometer to determine if the treatments had an impact on the amount of light reaching the weeds lower in the canopy.

RESULTS AND INTERPRETATION

Growing season rainfall in 2016 was exceptional (decile 10) resulting in an average trial yield of 3.7t/ha. Rainfall around sowing time allowed uniform crop establishment with no differences noted between treatments and crop establishment, however weed populations were variable across the site.

Sowing direction and crop growth

As found in 2015 sowing direction had no influence on crop yield or resulting quality.

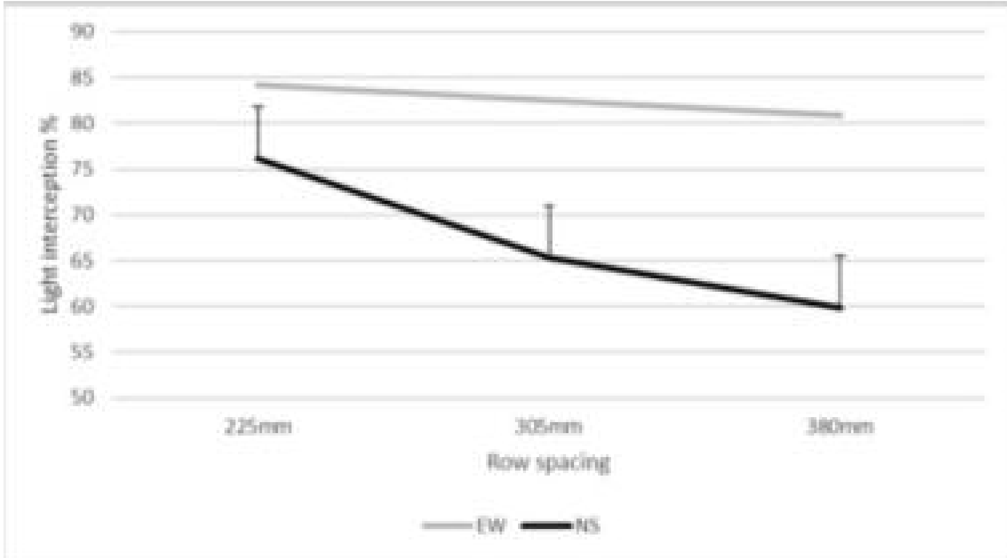

FIGURE 1 Influence of sowing direction and row spacing on light interception at solar noon (midday) expressed as a per cent (%). Error bars on figure indicate significant differences for the interaction (P=0.021, LSD=5.7). Stats for main effects: sowing direction P=0.001, LSD=4; row spacing P=0.001, LSD=4.4, overall CV=6.2%.

An interesting observation was that north-south plots suffered more lodging than the east-west plots following strong winds in spring, but this did not translate into a yield difference.

Row spacing and crop growth

With excellent seed bed moisture, crop establishment was not influenced by row spacing. In previous years, with possibly more marginal seed bed moisture, it has been found that wider rows (with a larger concentration of seed and fertiliser in each row) can create within-row competition, and result in reduced establishment. Crop biomass was also not influenced by row spacing at either the end of tillering (GS30) or at anthesis. By anthesis, the crop had accumulated 6.2t/ha of biomass.

The increased competition between plants in the wider row spacing resulted in lower head density at maturity and, as in 2015, lower yield. The 380mm row spacing yielded 0.26t/ha less than the 225mm spacing (Table 1).

TABLE 1 Mean crop head counts and grain yield as influenced by row spacing.

Row spacing (mm)	Grain yield (t/ha)	Head density (heads/m2)
225	3.8	260.3
305	3.6	248.3
380	3.5	226.3
Sig. diff.	P=0.011	P=0.002
LSD (P<0.05)	0.16	16.23
CV%	5.0	9.0

Grain protein was lower in narrow row spacing compared with wider, however this was due to the dilution effect of higher yields in that treatment. It did not affect the delivered quality of grain with all treatments falling between 9-10 per cent protein and achieving ASW grade.

Influence of sowing direction and row spacing on weeds

Row spacing and sowing direction had no impact on the ability of weeds to germinate and emerge with an average of 38 brome plants/m2.

Similar to last season, the presence of weeds, even at relatively low numbers, reduced yield by 0.25t/ha (P<0.001). Weeds also resulted in lower test weight (due to contaminants in the sample) and lower protein due to weeds utilising nitrogen that would otherwise be available to the crop. However, this did not alter the grade (ASW) due to low protein overall.

A further assessment carried out in 2016 in this trial, not done in earlier years of BCG sowing direction work, was to look at light interception of the crop. This was measured using a ceptometer that can calculate Photosynthetically Active Radiation (PAR), which is the wavelengths of light that are available for plants to use in the photosynthesis process.

PAR measurements were taken twice in the day at midday and late afternoon, and light interception was calculated. There was a significant interaction between row spacing and sowing direction (Figure 1), with light interception greatest in the narrow row spacing and when sown in an east-west direction.

The difference in interception between east-west and north-south becomes greater as row spacing gets wider, with more light hitting the ground under wide rows sown in a north-south direction.

Given the measured differences in light interception, there was a corresponding and plausible near-significant effect of row spacing on weed biomass measured at GS30 and GS65 (Table 2). However, the natural variability in the weed population meant that differences were not detected at the 95 per cent confidence level. There was no significant effect of row spacing on seed set (P=0.925).

Sowing direction had no significant effect on weed biomass production at either GS30 (P=0.458) or GS65 (P=0.407). However, there was a near-significant (P=0.102) effect of sowing direction on seed set with 974 seeds/m² being produced in the east-west treatment compared to 1482 seeds/m² in the north-south treatment.

Once again, the variability of the natural weed population meant that differences could not be detected at the 95 per cent confidence level, but given the measured differences in crop light interception (Figure 1), it is possible this effect could be real, and that sowing direction and its influence on light interception could potentially be used to alter weed seed set, particularly if using wide rows. This result is also corroborated by work that has been carried out in WA looking at ryegrass seed set (Borger 2010; Gardner 2013; Reithmuller 2005).

To confirm the results observed here, it is necessary to test this practice again on a more uniform weed population to see if the effect is repeatable and at a higher level of confidence.

COMMERCIAL PRACTICE

For the second year in a row, a yield penalty for wider row spacing was observed, which has held true in both high (2016) and low (2015) yielding seasons. For this reason, growers should be aiming to operate with the narrowest row spacing possible given stubble handling ability, machinery investment and sowing efficiencies.

There is also some evidence that weeds are able to grow more under wide row spacing, but that sowing in an east-west direction can help reduce seed set by allowing greater light interception, particularly in wide rows.

Another consistent finding was the yield penalty in the presence of even a low density of weeds (38 weeds/m² in 2016). Growers, therefore, should keep weed numbers low through integrated management including both chemical and cultural means.

In summary, both row spacing and sowing direction can assist in integrated weed management by reducing weed growth and seed set, but these are techniques that will always work best when used in conjunction with chemical and harvest weed seed control. The suitability of these practices to an individual enterprise will depend on paddock shape, stubble levels, elevation changes and crop and/or weed species.

ON-FARM PROFITABILITY

The main driver for profitability in this trial was yield, but given low grain prices in 2016 differences of around 0.25t/ha did not equate to big differences in profit.

In 2016, the presence of weeds incurred a cost of around $50/ha because of reduced yield, and sowing on 380mm rather than 225mm row spacing incurred a similar cost. Based on these numbers, the profitability of shifting to narrow row spacing would be marginal given the cost of modifying machinery and likely reduction in travel speeds and hence seeding efficiency. Obviously, the numbers may be more appealing with higher grain prices.

The weed management benefits of row spacing are a little more difficult to quantify in dollar terms. Weed management benefits in one year can have flow on effects in further years, particularly in situations where herbicide resistance is developing.

Sowing direction alone had no direct impact on profitability of the crop in this season, however if there is the potential to reduce grass weed seed set, the financial benefits may be realised in future years with lower seed bank numbers, reduced control costs and yield penalty, and slower development of resistance. The costs of implementing this practice is very low, subject to suitability of individual paddocks for this change.

TABLE 2 Mean weed (brome) biomass (t/ha) as influenced by row spacing.

	Weed biomass (t/ha)	
Row spacing (mm)	4 July (GS30)	21 September (GS65)
225	0.09	1.09
305	0.16	1.40
380	0.11	2.16
Sig. diff.	NS (P=0.135)	N (P=0.120)
LSD (P<0.05)	0.072	1.065
CV%	52.9	61.7

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ACKNOWLEDGEMENTS

This research was funded by the GRDC as part of the Overdependence on Agrochemicals project (CWF00020).

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GRDC project code CWFS00020