Improving crop competition in wheat and durum

Kenton Porker and Rob Wheeler, SARDI

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Key findings

- Fathom barley was more competitive than Hindmarsh barley, bread wheat and durum.
- Increasing seeding rate and seed bed utilisation improved crop weed competition (by up to 60%) without a yield penalty or quality downgrading.
- Tjilkuri and Mace sown at 300 seeds/m^2 with a spreader boot achieved similar ARG suppression as Fathom barley sown at 150 seeds/m^2.
- Pre-emergent herbicide application offered the best control of ARG in this trial across all varieties and agronomic management factors.
- Non chemical strategies can significantly enhance crop's competitive ability with weeds and should be integrated with herbicide use.

Why do the trial?

There are few safe and effective grass control herbicide options in durum. Durum has typically been less competitive with annual ryegrass (ARG) than bread wheat and barley. A trial at Hart in 2013, aimed to evaluate the relative competitiveness of durum wheat compared to barley and bread wheat, against annual ryegrass grown under different management practices tailored to influence crop competition. The management factors included variety, seeding rate, increasing seed bed utilisation, row spacing and seed size and vigour.

How was it done?

Plot size: 1.4 m x 10 m

Seeding date: 24th May 2013

Fertiliser: DAP (18:20) + 2% Zn @ 70 kg/ha
50 kg N @ GS31

The trial was a randomised complete block design consisting of 3 replicates, and 21 treatment combinations designed to compete with annual ryegrass (Table 1). The trial was sprayed with a knockdown at sowing and pre-spread with annual ryegrass to establish a consistent level of ryegrass across the site. All 21 treatment combinations were split with half of the plot sprayed with 2.5 L/ha Boxer Gold plus 2 L/ha tri-allate pre-emergent herbicide incorporated by sowing (IBS) and the other half left unsprayed. Mace and Tjilkuri received all additional treatments. Scout, Saintly, Fathom, and Hindmarsh only received standard practice. The standard row spacing was 22.8 cm, and the spreader boot aimed to spread the seed across a 4 cm wide band rather than a single 1 cm wide band (standard).

Table 2. Management treatment combinations of crop type, variety, seeding rate, and additional management used to compete with ryegrass at Hart 2013.

Treatment	Seed rate (seeds/m^2)	Sowing Boot	Management change (relative to standard practice)
1 Standard	200	Standard	Standard (traditional practice)
2	100	Standard	Lower seed rates
3	300	Standard	Higher seed rates
4	100	Spreader boot	Lower seed rates + increased seed bed utilisation
5	200	Spreader boot	Increased seed bed utilisation
6	300	Spreader boot	Higher seed rates + increased seed bed utilisation
7	200	Standard	Narrow Row Spacing (11.5 cm)
8	200	Standard	Increased seed size (large seed size>2.8 mm)
9	200	Standard	Decreased seed size (seed <2.5 mm)

Results and Discussion

Annual rye grass (ARG) establishment

Averaged across all management treatments, there were 63 ARG plants/m^2 when unsprayed and 11 plants/m^2 when sprayed. The management treatments had no significant effect on establishment of ARG.

Crop plant density

Crop plant densities differed between management treatments. Fathom and Hindmarsh barley established similarly and close to their target density of 150 plants/m^2. Plant establishment in the standard treatments of durum and bread wheats (Tjilkuri, Saintly, Scout, and Mace) ranged from 137 – 157 plants/m^2, markedly less than the 200 plants/m^2 target density. All treatments aiming for 100 seeds/m^2 established close to 100 plants/m^2 and the higher density treatments (300 seeds/m^2) all established within the range from 172 – 190 plants/m^2. The effect of herbicide significantly reduced plant establishment by an average of 8% in all treatments.

Crop competition and grain yield - comparison of crop varieties

For all varieties when sprayed with a pre-emergent herbicide (BoxerGold and tri-allate) reduced ARG numbers to the same level, ranging from 5-23 heads/m^2 (Figure 1a). For the unsprayed treatments both Fathom and Hindmarsh barley were the most competitive, reducing ARG numbers to 50 and 79 head/m^2, respectively. Both durum varieties and Scout wheat reduced ARG numbers to 100 heads/m^2. Mace wheat was the least competitive variety in this trial.

Despite large difference in crop competition (Figure 1b) this did not translate to differences in grain yield (Figure 1b) or quality (data not shown).

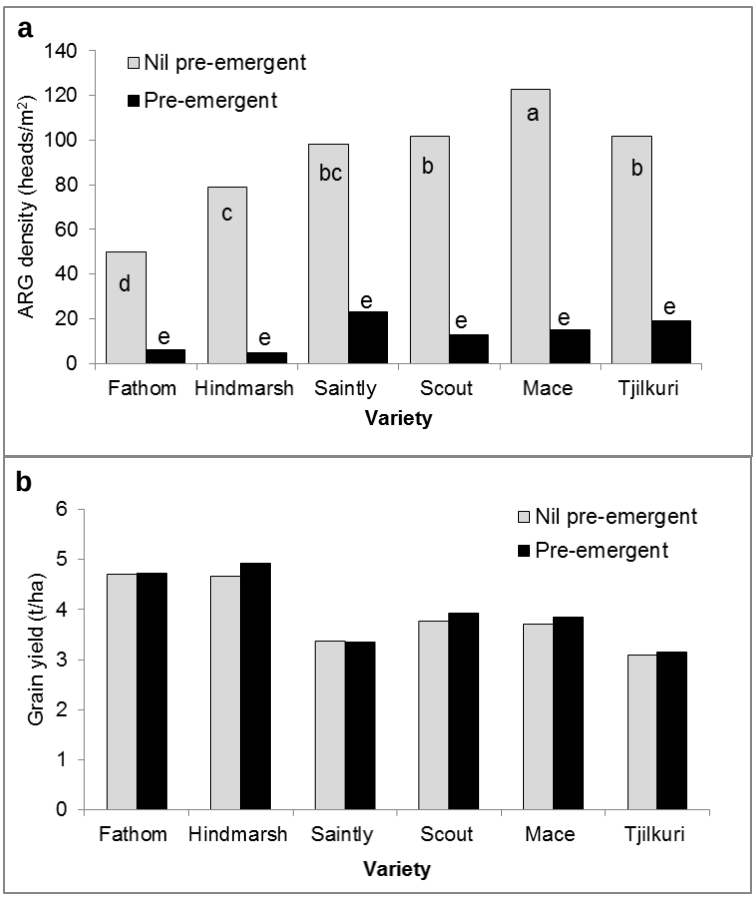

Figure 1. Comparison of varieties sown at standard seeding rates on (a) annual ryegrass plant density (heads/m^2) (treatment x herbicide LSD 21 at P≤0.05) and (b) grain yield (t/ha). Fathom, Hindmarsh, Saintly, Scout, Mace and Tjilkuri @ 150 seeds/m^2.

Crop competition and grain yield - effect of increasing crop density

Both Mace and Tjilkuri were used to look at the effect of increasing seeding rate and seed bed utilisation on the suppression of ARG (Figures 2a and b). For both varieties the combination of a spreader boot and 300 seeds/m^2 without herbicide, gave the best ARG control compared to using a pre-emergent herbicide. Treatments to have the least effect on ARG numbers were the standard and spreader boot at 100 seeds/m^2. Overall, the Tjilkuri durum was poorer at competing with ARG, even with improved control treatments. It should be noted that the actual plant densities were significantly lower than for the 200 and 300 seeds/m^2 targets.

The addition of pre-emergent herbicides gave very good ARG control in this trial and surprisingly the addition of increased crop competition was unable to improve the control further (Figures 2a and b).

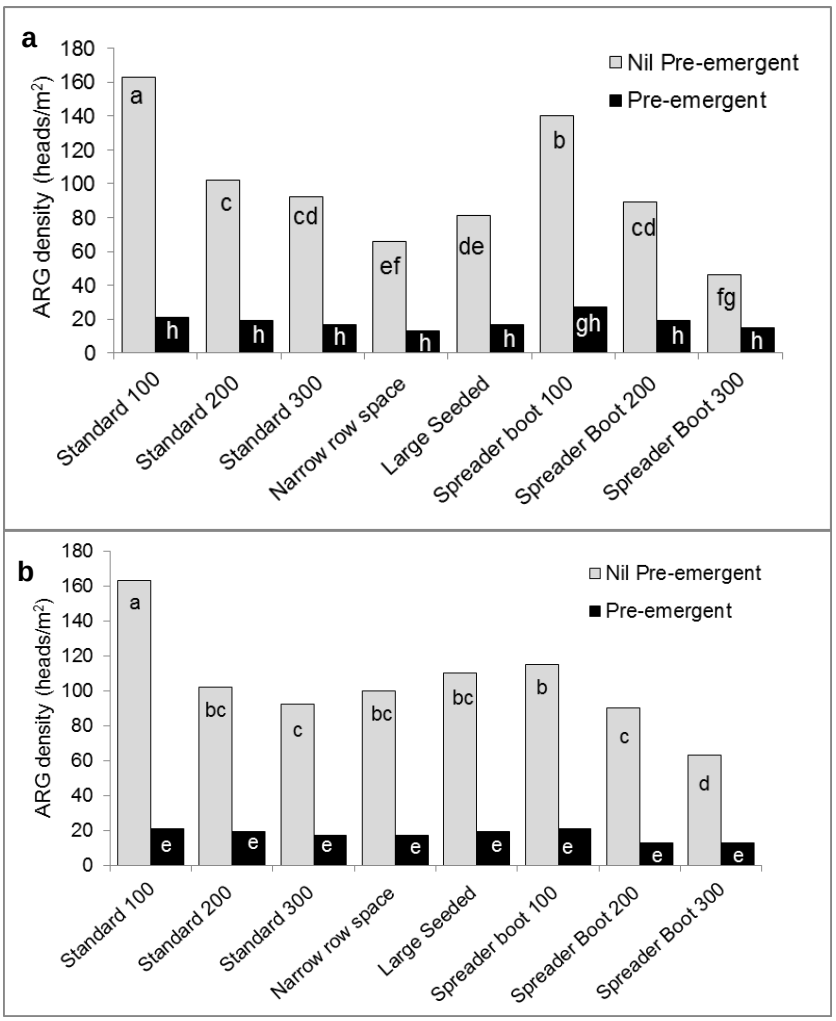

Figure 2. Effects of treatment factors (pre-emergent herbicide, seed size and spread) on annual ryegrass plant density (plants/metre squared) in (a) Mace wheat (b) Tjilkuri durum. (Treatment x herbicide LSD 21 at P≤0.05).

Similar to the comparison of varieties above, large differences in ARG numbers were seen between sprayed and unsprayed treatments. However, this did not have a significant effect on grain yield for Mace or Tjilkuri. The largest yield penalties were seen in Mace using narrow row spacing and the spreader boot at 100 seeds/m^2 which resulted in yield losses of 0.21 and 0.27 t/ha, respectively (Figure 3a).

Mace grain yield was significantly different for seeding rates and seedbed utilisation treatments with large seeded and the seeding rate of 300 seeds/m^2 yielding highest. The lowest yielding treatments were those sown with 100 seeds/m^2. Tjilkuri did not follow this trend and grain yield was similar across all seed rates and seedbed utilisation treatments (Figure 3).

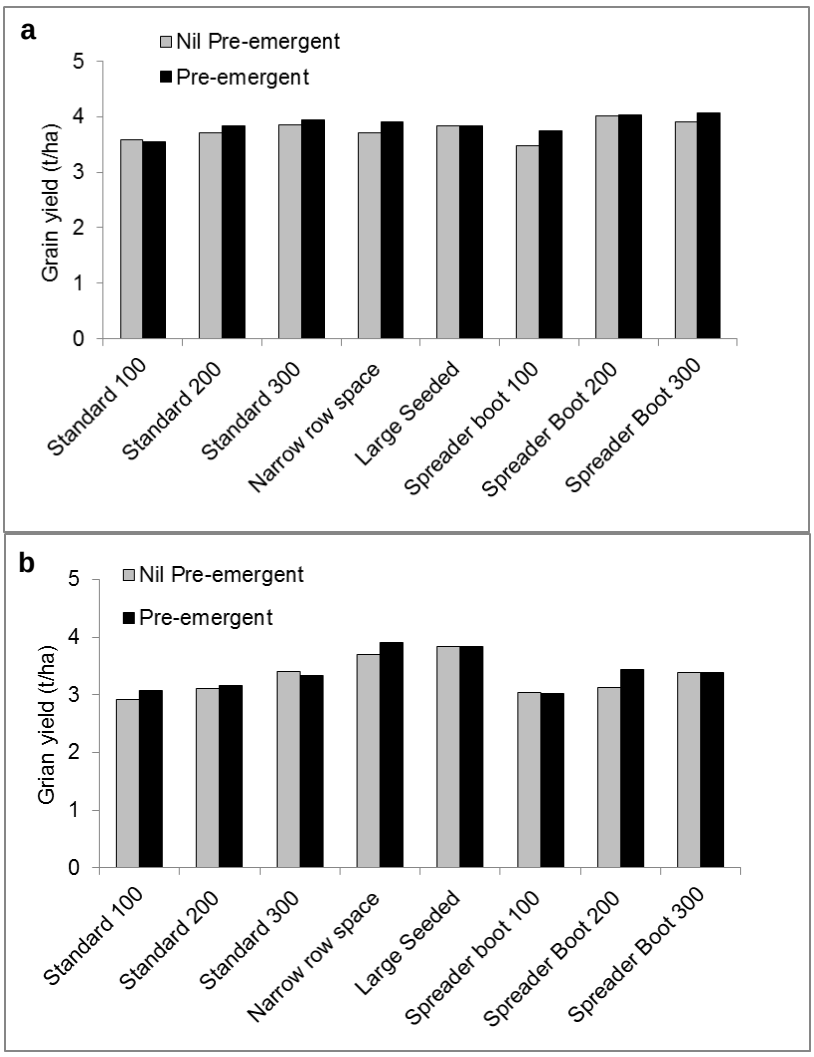

Figure 3. Effects of treatment factors (pre-emergent herbicide, seed size and spread) on grain yield (t/ha) in (a) Mace wheat (b) Tjilkuri durum.

The differences observed in crop competition between unsprayed treatments provide growers with some simple and effective non-chemical strategies to reduced weed pressures. These can then be integrated with herbicide treatments to improve weed control.