IS HINDMARSH REALLY A POOR WEED COMPETITOR?

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TAKE HOME MESSAGES

- Wimmera had the greatest yield loss in the presence of weeds and produced the highest weed yield. Hindmarsh also produced the same weed yield. Both of these varieties should not be sown into weedy paddocks unless there is a good management strategy.
- Scope CL, Buloke and Compass were identified as very competitive varieties, with the least amount of yield loss and weed seed production.
- Generally, the presence of weeds reduced barley yields by 1.4t/ha on a 5.4t/ha crop (mean of all varieties).

KEY WORDS

Barley, barley agronomy, crop canopy, management, varieties, weed competition.

BACKGROUND

Weed competition can be affected by crop species, crop variety, weed species, crop and weed density and time of emergence of the crop relative to the weed.

After being widely adopted over the past five years, Hindmarsh has been criticised for its lack of competitiveness, particularly in the presence of ryegrass and brome grass. Hindmarsh's open canopy does lend itself to be mistaken for favouring the growth of weeds, when in fact there are other factors that are contributing to the weed problem. These include the adoption of wider row spacings which have reduced Hindmarsh's ability to compete given its canopy structure. Due to its ability to yield on challenging soil types and also when sown late, Hindmarsh paddocks usually rank lower on the priority list for sowing and pre-emergent herbicide mixes. Late sowing in particular will reduce the competitiveness of any crop as the soil is colder and growth is slow. Reducing pre-emergent herbicides is going to place greater pressure on the barley. For grasses such as ryegrass, getting a good knockdown prior to sowing will ease some of the weed pressure.

With very few in-crop herbicides that can effectively control problematic grasses, greater weight will be placed on growing varieties that will compete strongly against weeds or possess tolerance to chemicals such as Scope CL (the imi-tolerant Buloke derivative).

AIM

To determine the weed competitiveness of current and new barley varieties so management packages can be developed for growers to use.

METHOD

Location:	Nhill	
Replicates:	Three	
Sowing date:	23 April	
Target density:	Barley - 130 plants/m^2	Oat (weed) - 75 plants/m^2
Varieties:	Fathom, Westminster, Gairdner, Sloop SA, Commander, Maritime, Bass, La Trobe, Compass, Hindmarsh, Grange, Flinders, Navigator, Yarra, Wimmera, Skipper, Scope CL, Buloke	
Fertilisers:	23 April	Granulock Supreme Z (55kg/ha)
	11 July	Urea (90kg/ha)
	17 July	Urea (90kg/ha)
	20 August	Urea (90kg/ha)
Herbicides:	23 April	No pre-emergent herbicides used
	28 June	Velocity (670ml/ha) + Lontrel (100ml/ha) + Hasten (1% v/v)
Fungicides:	23 April	Intake Hi Load Gold (200ml/ha) (on fertiliser)
	11 September	Prosaro (150ml/ha) + BS1000 (0.25% v/v) - Scald
	25 September	Prosaro (150ml/ha) + BS1000 (0.25% v/v) - Scald
Insecticides:	30 September	Alpha Duo (200ml/ha) - Cereal Aphids
Seeding equipment:	Knife point, press wheels on 30cm spacings	

Table 1. Description of the treatments that each variety was subjected to.

Treatment	Description
No weeds	plots were kept weed free during the season
Weeds	Winteroo oats were broadcast at 42kg/ha (75 plants/m^2) prior to sowing and incorporated by sowing

Table 2. List of the varieties used in this trial and their specific characteristics.

Variety	Height	Growth habit	Maturity	Height to head	Known competitiveness ability
Bass	M	prostrate	ML	4	unknown
Buloke	MT	semi-erect	ME	7	moderate
Commander	MT	semi-erect	ME	6	competitive mid-season
Compass	MT	erect	M	6	unknown
Fathom	MT	erect	VE	6	unknown
Flinders	MS	prostrate	ML		unknown
Gairdner	M	prostrate	ML	5	moderately good
GrangeR	M	Prostrate	ML	6	moderately good
Hindmarsh	S-MS	very erect	VE	5	poor competitor
La Trobe	S-MS	very erect	E	5	poor competitor
Maritime	MT	semi-erect	ME		most competitive
Navigator	S-MS	semi-erect	ML	4	unknown
Scope CL	MT	semi-erect	ME	7	moderate
Skipper	M	semi-erect	ME	6	unknown
Sloop SA	MT	semi-erect	M	7	competitive mid-season
Westminster	MT	prostrate	ML		unknown
Wimmera	S-MS	semi-prostrate	ML		unknown
Yarra	S-MS	prostrate	ML		poor competitor – late maturing

Height: T = tall, MT = moderately tall, M = medium, MS = moderately short, S = short

Maturity: VE = very early, E = early, ME = moderately early, M = mid, L = late

Height to head: Scale based on 0-9, with the higher the number indicating the greater the distance the head is from the ground.

Assessments included; establishment counts (barley and oats), crop biomass (barley), stem counts (barley and oats – October), NDVI (GS31 and GS80), seed production (oats), 1000 grain weight (barley and oats), grain yield and quality parameters. The amount of oats in the 'weed' treatments meant grain quality analysis could not be done on these treatments. The sub-samples (40g) were taken from the original plot sub-samples. The yield of the oats and barley in treatments was subsequently determined by physically separating, counting and weighing the grains.

RESULTS AND INTERPRETATION

The trial established well and the method of incorporating the oats into the 'plus' weeds treatments were successful with a good strike of oats establishing in the inter-rows of the intended plots. This later proved useful for determining the yield of the oats ('weeds') compared to the barley yield.

It is important to note that the site did receive above average rainfall throughout the year with the only dry month being April-May. This, as well as the site having a low N status, meant that higher rates of urea were applied; subsequently the oats would have been better fertilised than in a normal season. The benefit of this is that the competitiveness of the varieties determined from this trial would be expected to be better in drier seasons when moisture is limited.

Effect of 'weeds' on the crop growth and yield

As expected, all barley varieties were affected in the presence of weeds (Table 3). While there was no reduction in the plant establishment, later in the season it was evident the weeds reduced stems and the biomass of the barley. This was also shown by the difference in NDVI at GS77-80 (milky-soft dough). It would have been expected that given the NDVI cannot differentiate between oats and barley, that the values would be higher where oats were present, when in actual fact it was the opposite. The biomass taken at flowering may only tell part of the story as it was only measured for the barley, not the oats. Whether the oats and the barley competed strongly against each other and then as a result began to senesce more quickly is one plausible reason why this difference occurred in the NDVI.

The total (oat + barley) yields of the plots showed only a small reduction with weeds. The barley yields (determined from sub-sampling the original plot sub-samples) were found to be closer to 3.8t/ha and the oat (weed) yields about 1.4t/ha. So not only did the weeds reduce the yields of the barley but also resulted in the quality of the sample being contaminated, reducing it to feed.

Table 3. Production data for the mean of varieties with and without oats.

Treatment	Plants (/m^2)	Biomass GS65 (t/ha)	Barley stems (m^2)	NDVI (GS80)	Grain yield (t/ha)
Weed-free	120	6.02	196	0.44	5.41
Weeds	118	3.96	137	0.40	3.99
Sig. diff.	NS	P<0.001	P<0.001	P<0.001	P<0.001
LSD (P=0.05)		0.27	10	0.012	0.12

Was there a difference between varieties?

Wimmera stood out from the rest of the varieties as being a very poor competitor against weeds, incurring substantial yield loss and the greatest weed yield (Table 4 and Figure 1). Skipper, Navigator, Flinders and Westminster behaved very similarly and indicated moderate to poor competitiveness. As expected, Hindmarsh was also found to be a poorer competitor, with higher yield loss and oat yield. La Trobe, although it has very similar characteristics to Hindmarsh, had similar reduction in yield but significantly lower weed yield than Hindmarsh.

Table 4. Grain yields (barley and oat) for each variety.

Variety	Barley grain yield (t/ha)			Yield loss (%)	Oat yield (t/ha)
	No weeds	weeds	Difference		
Bass	5.35	4.16	1.19	22	1.41
Buloke	5.57	4.73	0.84	15	1.08
Commander	6.08	4.76	1.32	22	1.35
Compass	5.87	5.00	0.87	15	0.99
Fathom	5.27	4.19	1.09	21	1.39
Flinders	5.08	3.37	1.71	34	2.08
Gairdner	5.11	3.59	1.52	30	1.68
GrangeR	5.29	3.84	1.45	27	1.68
Hindmarsh	5.44	3.72	1.64	30	2.09
La Trobe	6.03	4.44	1.54	26	1.53
Maritime	5.77	4.41	1.36	24	1.16
Navigator	5.70	4.03	1.68	29	1.67
Scope CL	5.03	4.42	0.59	12	1.10
Skipper	5.12	3.35	1.78	35	1.83
Sloop SA	4.70	3.81	0.90	19	1.47
Westminster	5.14	3.50	1.64	32	1.71
Wimmera	5.74	3.20	2.54	44	2.38
Yarra	5.12	3.48	1.63	32	2.06
Sig. diff.					
Variety	P<0.001		P=0.007		P<0.001
'Weeds'	P<0.001		NS		NS
Variety x 'weeds'	P=0.003		NS		NS
LSD (P=0.05)					
Variety	0.50t/ha		0.78t/ha		0.53t/ha
'Weeds'	0.12t/ha		–		–
Variety x 'weeds'	0.61t/ha		–		–
CV%			33.1		19.9

There was a strong correlation between the height of the variety and its subsequent yield loss; the shorter the variety, the greater the yield loss. Wimmera (S-MS), Flinders (MS), Navigator (S-MS), Hindmarsh (S-MS) and Yarra (S-MS) all lost significant yield when weeds were present. Scope CL, Buloke, Compass, Sloop SA, Fathom are all moderately tall varieties and had the least amount of yield loss when weeds were present. It was not consistent for each variety with Skipper (M) and Westminster (MT) incurring similar yield losses to the shorter varieties. So, not all varieties can be grouped into 'competitiveness' without some form of evaluation however, height can still provide a useful early indication. Other characteristics with height maybe identified with further analysis that may explain why Skipper and Westminster lost greater yield than other taller varieties.

When grain protein and yields increased within individual plots (suggesting greater initial soil N), the greater the yield loss and growth of the weeds. This could mean two things; competitiveness of barley may decrease when more N is available and increase competitiveness when N is less available (can be dependent on weed species present). Given water was not limiting in the trial, you would also expect the competition of barley would have been greater if water was limiting.

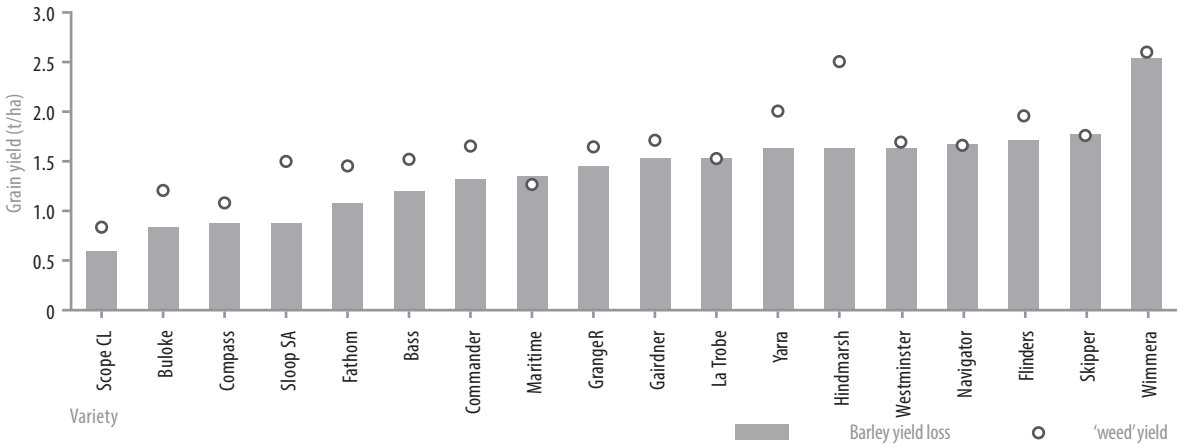

Figure 1. The grain yield loss and the weed yield for each of the barley varieties.

Figure 1 above shows the yield loss of the varieties with the yield of the 'weeds'. It illustrates that Wimmera and Hindmarsh are the least competitive (for reducing weed yields) while Scope CL, Buloke and Compass are very competitive.

COMMERCIAL PRACTICE

This trial confirms what growers have known about some varieties, such as Hindmarsh; it has a poor ability to compete against weeds (in this case the oats). Oats competitiveness is similar to that of ryegrass and wild oats. Brome grass would behave differently as it has a cold requirement. These results have provided a greater understanding of where other varieties perform in relation to Hindmarsh. La Trobe, should be considered to have a similar yield loss penalty as Hindmarsh, but potentially a better ability to prevent as much weed seed set as Hindmarsh would. Scope CL and Buloke, though not the highest yielding varieties, offered greater weed competition. Scope CL, with its tolerance to Clearfield herbicide, has an added advantage in its ability to keep the crop weed-free. Recent named variety Compass (bred as WI4593) has shown excellent competitiveness with the least amount of yield loss and has performed very well in terms of yield in other NVT and BCG trials.

Wimmera, Skipper, Navigator, Flinders, Westminster and Hindmarsh should not be sown in paddocks with a known weed problem. Dry sowing weedy paddocks should not be considered without a good pre-emergent and in-crop spray strategy.

While this trial has shown varieties will differ in their ability to compete, it still reinforces the need to keep crops weed free to maximise yields. This trial is being replicated in South Australia and NSW, the results will be compiled and specific characteristics will be identified, such as plant height, which was identified in this trial. This will allow for early prediction of what a variety's competitive ability will be prior to it being commercially grown.

ACKNOWLEDGMENTS

This trial was funded by GRDC through the 'Barley agronomy in the southern Australia' project, code: DAN00173.