

# USING BARLEY CULTIVARS FOR NON-HERBICIDE CONTROL OF GRASS WEEDS

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## TAKE HOME MESSAGES

- 'Compass type' varieties with good early vigour, combined with a prostrate growth habit are the best competitors (Compass, Fathom, Scope CL, RGT Planet).
  - 'Hindmarsh type' and 'Urambie type' varieties with very slow early vigour are poor competitors (Hindmarsh, Spartacus CL, Urambie).
  - In the presence of grass weeds there was an average of 0.9t/ha yield loss across all barley varieties.
  - Three years of data has reinforced that certain varieties can be used as a non-herbicide option for grass weed control.
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## BACKGROUND

The increasing resistance issues throughout Australia deem it very important to look for alternative weed control methods, as part of an integrated weed management approach. Non-herbicide methods such as sowing competitive barley cultivars is an option that growers need to be considering when planning their paddock rotations.

As part of the GRDC-funded 'Barley agronomy for the southern region' project, BCG has been investigating the competitive nature of barley, when sown into high weed burdens, over a three-year period. This in turn helps to form management packages around new varieties to aid in variety selection.

## AIM

To compare the competitive ability of new and existing barley varieties in the presence and absence of weeds.

## PADDOCK DETAILS

Location:	Curyo
Annual rainfall:	297mm
GSR (Apr-Oct):	215mm
Soil type:	Sandy clay loam
Paddock history:	Lentil

## TRIAL DETAILS

Crop type:	Barley: Fathom, RGT Planet, Spartacus CL, Westminster, Urambie and La Trobe
Treatments:	Plus and minus weeds (Durack oat used to simulate grass weeds)
Target plant density:	Barley: 130 plants/m <sup>2</sup> , oat/weeds: 75 plants/m <sup>2</sup>
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Sowing date:	5 May 2017
Replicates:	Four
Harvest date:	13 November 2017
Trial average yield:	4.9t/ha

## TRIAL INPUTS

Fertiliser:	Granulock Supreme Z + Impact @ 60kg/ha at sowing, 90kg/ha of urea applied at early tillering and 60kg/ha urea applied at late tillering.	
Herbicide:	May 5	Dual Gold® @ 500mL/ha + Diuron @ 500mL/ha + glyphosate 2000mL/ha
	13 June	Lontrel Advanced® @ 75mL/ha + Liase® 2%
Insecticide:	25 August	Lorsban® @ 600mL/ha
Fungicide:	22 June	Propiconazole @ 300mL/ha
	21 July	Amistar Xtra® @ 400mL/ha
	25 August	Amistar Xtra @ 400mL/ha
Seed treatment:	Systiva® @ 150mL/100kg seed + Gaucho® @ 240mL/100kg seed	

## METHOD

A replicated field trial was sown at Curyo using a split plot trial design, including six barley varieties (main plot) with plus and minus weed plots (sub plot). Durack oat was used to simulate brome grass and was chosen for its vigorous early growth and early maturity. The oat were broadcast prior to sowing and then incorporated into the soil with the seeder at sowing.

The barley varieties chosen aimed to represent different plant architectures and growth habits that may influence competition (Table 1). This may then be used to categorise other similar varieties into these groups.

**Table 1. Visual assessments of plant structure and characteristics that can influence competition.**

Category/type	Height	Canopy structure	Early vigour	Representative varieties in trial
1. Hindmarsh type plant	Short	Erect	Slow	Spartacus CL, La Trobe
2. Compass type plant	Moderate – tall	Prostrate	Fast	Fathom, RGT Planet
3. Westminster type plant	Short – moderately tall	Prostrate	Moderately slow	Westminster
4. Urambie type plant	Short	Very prostrate	Very slow	Urambie

Assessments throughout the season included establishment counts on the barley and oat, NDVI, barley and oat biomass cuts at GS30 (beginning of stem elongation) to measure early vigour and competition, and maturity biomass cuts on barley and oat at GS99. Grain yield and quality parameters were measured using a CropScan grain analyser.

To determine the weed yield and obtain a 'true' barley yield in the 'weed' plots, the maturity biomass cuts of the weeds (oat) were threshed out and grain weight was deducted from the overall plot yield.

## RESULTS AND INTERPRETATION

The site received good follow up rains post sowing, ensuring good establishment of the weeds (oat) and barley. The oat germinated at a plant density of 67 plants/m<sup>2</sup> (target was 75plants/m<sup>2</sup> (Table 2)).

### How did 'weeds' affect overall barley yield?

When weeds were present in the barley (average of all varieties), there was a 0.9t/ha yield loss due to weed competition (Table 2). As found in previous years, the trial again highlights the importance of keeping the crop as free of grass weeds as possible.

Barley biomass taken at first node formation (GS30) indicated that weeds had no earlier effect on the barley biomass (1.3t/ha for both treatments). However, biomass taken at GS99 resulted in a 1.8t/ha reduction in biomass due to weed competition.

As expected, grain quality was also affected in the presence of weeds, with screenings increasing, and test weight and retention decreasing, when weeds were present in the sample.

**Table 2. The 2017 average of all barley varieties in the presence and absence of weeds, including barley plants/m<sup>2</sup>, weeds/m<sup>2</sup>, barley and weed biomass at GS30 and GS99 and barley grain yield t/ha.**

Treatment	Barley plants/m <sup>2</sup>	Weeds/m <sup>2</sup>	GS30 Barley biomass (t/ha)	GS30 Weed biomass (t/ha)	GS99 barley biomass (t/ha)	GS99 weed biomass (t/ha)	Barley grain yield (t/ha)
Minus weeds	129	0	1.3	0	11.6	0	5.3
Plus weeds	130	67	1.3	0.2	9.8	1.9	4.4
<b>Sig. diff.</b>	NS (P=0.65)	NS (P=0.538)	NS (P=0.339)	P<0.001	P<0.001	P<0.001	P<0.001
<b>LSD (P=0.05)</b>	5.26	7.70	0.06	0.03	0.47	0.21	0.13
<b>CV%</b>	6.7	7.7	7.3	16.0	7.3	37.5	4.4

## How did different varieties compete in the presence of weeds?

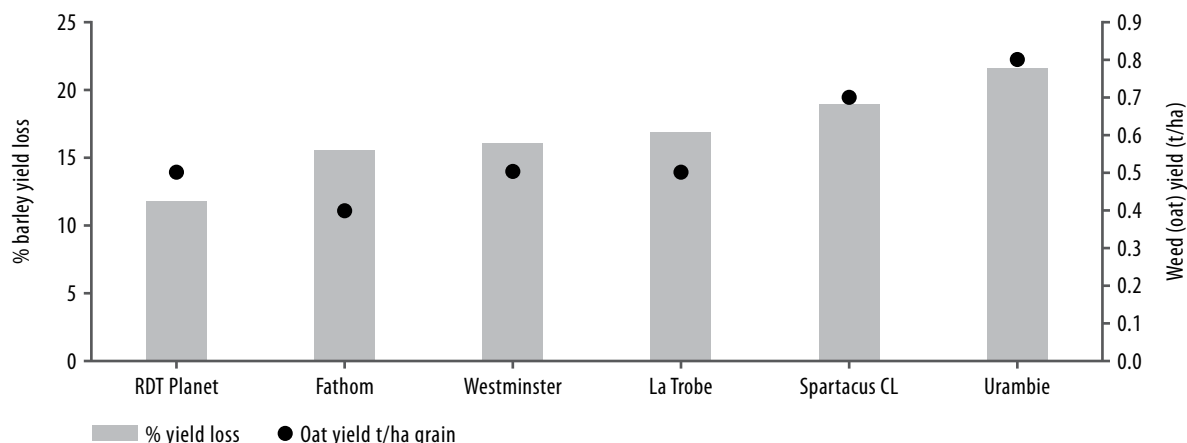
Biomass cuts were taken at GS30 (first node formation) to determine if there was a difference between variety competition early on. There were no varietal differences in barley or weed biomass, even though it might have been expected that weed biomass would be higher in varieties that exhibited poorer early vigour or an open canopy. The oat plants (used to simulate weeds) were slightly behind the growth stage of the barley, likely due to poor seed soil contact (due to sowing method), so there may not have been enough early competition from the oat to influence early barley biomass.

Biomass at maturity concluded that in the presence of weeds, Urambie and Westminster lost a significant amount of biomass (3.1t/ha and 2.1t/ha), whilst Fathom had the least reduction (0.6t/ha), indicating a high tolerance to weed pressure, as biomass wasn't greatly affected.

Taller varieties generally compete better, however RGT Planet is shorter in height (similar to Hindmarsh types). It is a mid-maturing variety that has a prostrate canopy structure and good early vigour. It offered good competition against grass weeds, incurring the least yield loss (Figure 1). Fathom (Compass type) also performed well, incurring a lower yield loss and a good ability to suppress weed seed set (0.4t/ha, the lowest among the six varieties). Good early vigour is very influential in increasing the competitiveness of a variety, in combination with a prostrate growth habit and generally a taller plant height.

Urambie (type 4) was the poorest competitor, followed by Spartacus CL (Hindmarsh type), both incurring the highest yield losses (22 per cent and 19 per cent respectively) and had the poorest ability to suppress weed seed set (0.7-0.8 kg/ha respectively). These varieties, whilst having different canopy structures, exhibit very poor early vigour.

It appears varieties that fall into type 1 (Hindmarsh type) don't all behave the same. These varieties have poor early vigour and an erect open canopy. Whilst previous research has shown that Hindmarsh and Spartacus CL are poor competitors as would be expected with this plant growth habit, La Trobe still appears to be a slightly better competitor than its phenotypically similar counterparts (slightly lower yield loss and weed seed set over the three years tested).

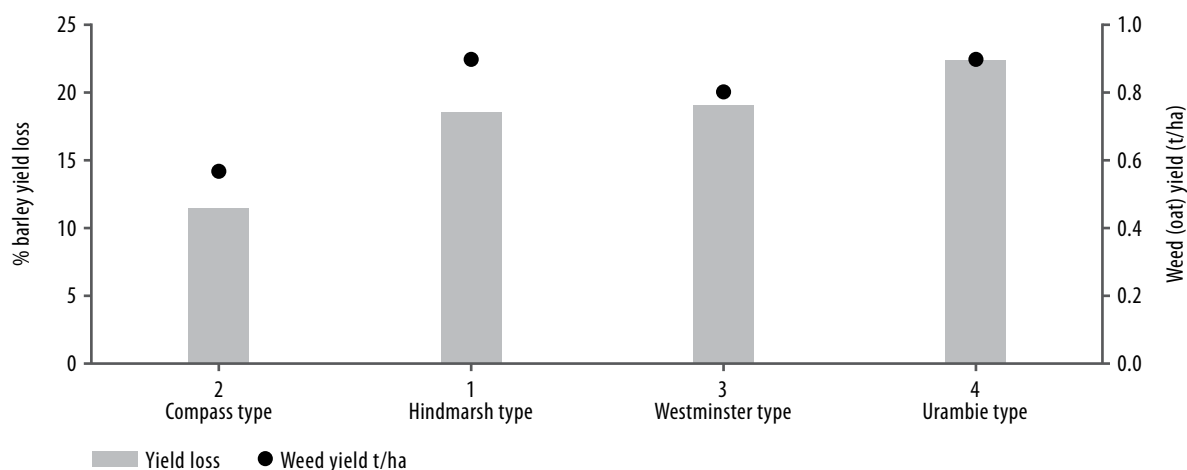


**Figure 1: 2017 barley yield loss (%) between varieties and the amount of weed yield (t/ha).**

There were no differences in protein, screenings, retention and test weight between varieties in the presence and absence of weeds.

### How have varieties performed over three years of trials?

Figure 2 represents varieties that fit into different plant types (refer Table 1), based on their growth habits. Results are consistent over the three years showing ‘Compass type’ varieties (plant type 2) that exhibit good early vigour and a prostrate canopy structure have a greater ability to compete (lowest yield loss) and reduce weed seed set. Hindmarsh type varieties (plant type 1) with a slow early vigour and erect growth habit have the poorest ability to reduce weed seed set. Urambie type varieties are the worst competitors, with the highest yield losses over the three years of data (and high weed seed set).



**Figure 2: Three-year average of barley grain yield loss (%) of different plant types (based on their phenology) from 2013, 2016 and 2017 data.**

## COMMERCIAL PRACTICE

Varieties can be grouped into different plant growth types to a certain degree, which gives a good indication of where they sit in terms of their competitive ability (Table 3). Varieties that fit into category 2 (Compass type) are the most suitable to use as a weed competitor, if rotation options are limited and you are sowing into a weedy paddock situation. Westminster and Urambie type varieties are poor competitors and Hindmarsh type varieties allow the greatest amount of weed seed to set.

**Table 3: Different plant types, their competitive ability and similar varieties that fit into those categories.**

Category/type	Level of competition	Varieties	Example of best rotation
1. Hindmarsh type	Poor	Hindmarsh, Spartacus CL, La Trobe*	Sow into weed-free paddock *La Trobe offers slightly better competition than other Hindmarsh type varieties.
2. Compass type	Good	Fathom, Scope CL, Compass, RGT Planet, Commander	Best option if sowing into high weed burdens
3. Westminster type	Poor to moderate	Westminster, Oxford, GrangeR	Preferable to sow into weed-free paddock
4. Urambie type	Very poor	Urambie	Sow into weed-free paddock

Selecting a barley variety is a decision that should be viewed as part of a long-term strategy, with an overarching aim to reduce seed bank levels and to maintain or improve the productivity of the paddock. Choosing a competitive variety and managing it to be competitive, will help to reduce weed burdens and potentially reduce the amount of yield loss, when used as part of an integrated approach to weed control.

## ON-FARM PROFITABILITY

The lower the competitiveness of a variety, the greater the economic loss when weeds are present in the paddock and are unable to be controlled. This year, barley grain prices are higher (in comparison to 2016), so the impact is much greater, further emphasising the need to put the right variety in the right paddock.

**Table 4: Associated income loss (\$/ha) in 2017 from yield loss in the presence of weeds using current malt and feed prices from Birchip AWB.**

Variety	Yield loss (t/ha) when weeds present	Price achieved based on grade (\$)	Income loss (\$/ha)
Fathom	0.8	202	165
La Trobe	0.9	235	213
RGT Planet	0.7	202	143
Spartacus CL	1.0	202	203
Urambie	1.1	202	224
Westminster	0.8	202	159

## REFERENCES

Walters L., 2016, *2016 BCG Season Research Results*, 'Increasing weed competition with barley' pp 164-171.

Craig S., Walters L., Jones B, 2013, *2013 BCG Season Research Results*, 'Is Hindmarsh really a poor weed competitor?' pp 76-80.

## ACKNOWLEDGEMENTS

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