Grazing crops to maintain yield

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KEY MESSAGES

- Grazing did not change grain yield in 2015 or 2016. Variety selection was the most important factor for final yield, particularly with the soft finish in 2016.
- Grazing slows crop maturity by one to two weeks, which meant Revenue (long season variety) was still booting during the October heat wave in 2015. In 2016, grazing lengthened the growing season for Bolac (mid-season variety) with a resulting 0.54 t/ha (NS) yield increase.
- To graze without yield loss, it's important to start planning from the beginning of the season, eg. early sowing of long season varieties.

BACKGROUND

Grazing crops has great potential to improve the feed base of mixed farm systems in South Eastern Australia, with livestock gross margins following suit. The draw-back is the additional risk to crop yields, with a survey of growers across South Australia and Victoria pointing to fear of yield loss as being the number one reason for not grazing crops (Creelman et al, 2015).

The aim of the trial was to investigate the drivers for yield loss under grazing with a view to make grazing crops less risky. It was repeated in 2015 and 2016, with sister trials in the Mallee, eastern South Australia and the Eyre Peninsula under the GRDC project Grain and Graze (SFS000028).

METHOD

The trial looked at one environmental based and two management based decisions that are known to influence crop yield:

- Grazing
- Variety (Bolac or Revenue)
- Season rainfall

Figure 1. Rain out shelters erected September 30, 2016 and dismantled October 15, 2016

Plots were grazed with Merino wethers for 2 weeks from July 15. Season rainfall was adapted depending on the year. In 2016, with a season tracking to decile 7, rain-out tents were erected over relevant plots for 11 days at the start of October. The effect being 21 mm rainfall excluded from those plots.

In 2015, relevant plots were irrigated with 50 mm over seven applications between July 27th and October 15th. This coincided with the heat wave in the first week of October experienced across south west Victoria. For more details on the 2015 trial, see the SFS 2015 Results Book (pg. 102).

The trial was sown to wheat (cv. Bolac and Revenue) on the 2nd of May, 2016. In 2015 it was sown on the 1st of May.

Table 1. Inputs throughout the season

	Date	Product
Seed	2/05/2016	86 kg/ha Bolac
		88 kg/ha Revenue
Fertiliser	2/05/2016	100 kg/ha MAP
	4/08/2016	100 kg/ha Urea
	25/08/2016	60 kg/ha Urea
	19/09/2016	500 mL/ha Coptrel
Herbicides	14/06/2016	1 L/ha Precept 150
	14/06/2016	1 L/ha Hasten
Fungicide	22/08/2016	500 mL/ha Opus
	19/09/2016	300 mL/ha Prosaro
	19/10/2016	840 mL/ha Radial

RESULTS AND DISCUSSION

Although the season was very different in 2015 to 2016 (decile 3 in 2015 and decile 8 in 2016), in both years grazing did not significantly alter yields

In 2016, variety had the most significant impact on yield ($p<0.001$), followed by rainfall ($p<0.01$) and then grazing which did not have a significant effect ($p>0.1$). See table 2 for treatment yields.

Table 2. Treatment yields in 2016

Variety	In season treatment	Yield*	
Bolac	Ungrazed, Normal rainfall	6.38	cd
	Ungrazed, Modified rainfall	5.74	d
	Grazed, Normal rainfall	6.92	bc
	Grazed, Modified rainfall	6.23	cd
Revenue	Ungrazed, Normal rainfall	9.62	a
	Ungrazed, Modified rainfall	9.36	a
	Grazed, Normal rainfall	8.96	a
	Grazed, Modified rainfall	7.39	bc

*Statistics in this table are for an one way ANOVA due to insufficient replications in the second and eighth treatments for a three way factorial ANOVA

In 2015, rainfall had a significant impact on yield ($p<0.001$), but variety and grazing did not ($p>0.1$). The lack of difference between varieties in that year was because Revenue flowered during a heat wave, with up to half the florets per head aborting. Bolac was already in grain fill by the time the heat wave arrived with smaller grains causing some yield decline but not as significant as the Revenue.

The focus to this point has been on yield penalties, as is often the case when grazing crops is discussed. However, if 'district practice' is sowing a spring variety and not without grazing, there are opportunities to increase yield and still graze crops. Figure 2 shows how crop yield changed with changed decisions around variety and grazing. Sadly, we cannot choose our rainfall, but the treatments with modified rainfall help show the impact of management decision in different seasons.

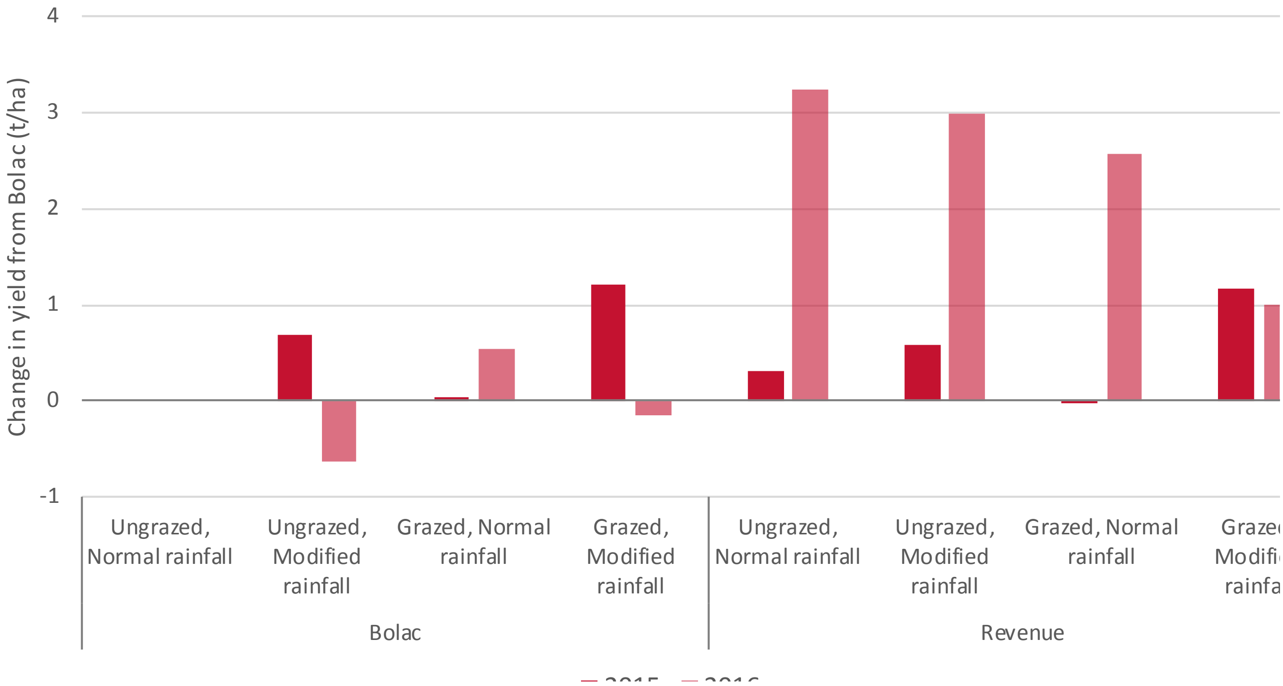

Figure 2. Change in crop yield relative to the control of ungrazed, normal rainfall Bolac in respective years. NB 'Modified rainfall' in 2015 was irrigating, in 2016 it was rain-exclusion, so opposite responses would be expected in the two years.

Variety

Revenue performed significantly better in 2016 than 2015 in the absence of the heat wave. While Bolac in 2016 averaged 6.32 t/ha across the treatments, Revenue averaged 8.83 t/ha. Even considering the price difference between Bolac and Revenue , that yield difference corresponds to an increase of $160/ha net crop income.

Both varieties possibly would have yielded higher with extra nitrogen. Despite receiving a cumulative 104 kg N/ha and having a starting soil N of 135 kg/ha, protein content for Revenue across the trial was 9.09%. The Bolac plots averaged 10.5% protein, just qualifying them for APW1.

Rainfall

Rainfall treatments changed crop yield in both 2015 and 2016 by 0.8 t/ha (significant at $p=0.05$). While rainfall is critical for crop recovery after grazing, in the high rainfall zone we generally receive adequate rainfall to meet crop requirements. Inverleigh soils will reach field capacity 6 out of 10 years under crop (Creelman and Nicholson, 2016). The years the trial ran could not have been more different in how the season turned out, and yet rainfall made a relatively small impact on grain yield. This is especially evident in the bars representing 2016 in figure 2; there was some yield decline from the modified rainfall but variety made a bigger difference overall.

Grazing

The two most important notes about grazing are:

i) Biomass recovery by flowering is critical to yield

ii) Grazing delays crop maturity

A rule of thumb is that 5 t/ha grain requires 9 t DM/ha at flowering, giving a ratio of 0.6 (John Kirkegaard pers comm). In 2015 with the drier season, this ratio was 0.4, with adequate biomass recovery (9.3 t DM/ha) by flowering but the sharp finish penalised yield. Attitudes about grazing crops are shifting from viewing it as an opportunistic 'free feed' to a strategy that needs to be planned for. Sowing longer season varieties earlier allows for earlier establishment, earlier grazing, and earlier stock removal, leaving more time for recovery before flowering. It is also important to manage grazing to optimise crop recovery. Crash grazing to ensure even grazing across the paddock and early removal times are two such techniques. Refer to the Grazing Cropped Land handbook (2016) for more considerations.

Removing crop biomass slows plant development while the crop regenerates, effectively delaying crop maturity for the remainder of the season. Growers in frost prone areas are utilising grazing to delay flowering and reduce the risk of frost damage (Curtin and Whisson, 2012). In south west Victoria, frosts are not as great a concern as they are in other regions, yet delaying maturity with grazing can be a tool to increase the season length of a crop. On September 5, 2016, ungrazed Bolac was at GS51 (early head emergence), while the grazed plots were still at GS37 (flag leaf emergence). With the soft finish, the extended growing season for the grazed Bolac meant that it out yielded the ungrazed Bolac by 0.54 t/ha (NS).

Figure 3. Merino wethers grazed the crop both years

CONCLUSION

The grazing value of crops makes the practice an attractive option, but for it to really be a profitable option either there must be minimal yield loss or the livestock value from grazing crops must be significant enough to outweigh any yield decline. This trial focused on the former, and found that upfront planning to graze crops by planting longer season varieties was key to grazing with minimal impact on yield. Seasonal rainfall was the other key factor which is a risk in any mixed farm system. Both variety and rainfall had greater impact on final yield than grazing did.

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