Early winter grazing of crops intended for grain

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Take home messages

- **an early sown cereal crop provides a green paddock of feed when regenerating or sown legume pastures are establishing, and avoids the cost and labour of handfeeding**
- **in low to medium rainfall areas, barley and oat crops best tolerate grazing. They have better forage value and their ability to recover lessens production penalties. Grazed wheat varieties are likely to suffer grain yield and quality penalties. Dual purpose winter varieties are generally not suitable.**
- **in low rainfall areas, it is best to graze well before stem elongation for better crop recovery**

Background

An early rainfall event, coupled with good soil moisture levels, presents an opportunity to sow a cereal crop, have it established quickly and cover the ground. Within 6-8 weeks, cereal crops can provide nutritious feed to livestock at a time of the year when stubbles are depleted and regenerating legume pastures are slow-growing.

The ability of the crop to recover dry matter and grain yield after grazing is dependent on variety, the stage of growth of the crop when grazed, soil moisture levels and subsequent growing season rainfall. In higher rainfall areas, dual purpose winter wheats can be grazed between GS13 and GS30 with little risk to grain production. However, winter wheats are generally not suitable for low rainfall areas because the growing season is too short and springs are variable. Early, to mid-maturing spring cereals are much better adapted to low rainfall areas. Rules-of-thumb developed in higher rainfall areas for avoiding or reducing crop grain yield and quality penalties associated with grazing need to be reviewed for low rainfall varieties.

Aim

To evaluate the suitability of different wheat and barley varieties for both grazing and grain production, when sown early in the cropping program in low rainfall western Victoria.

To evaluate how the stage at which the crop is grazed affects its recovery.

This is the third season of trialling grazing spring cereals intended for grain recovery. Previous variety evaluation has occurred at Woomelang (*BCG 2009 Research Results*, pp 46-51) and Culgoa (*BCG 2010 Research Results*, pp 168-173).

Method

Location:	Corack
Replicates:	4
Sowing date:	29 April 2011
Seeding density:	150 plants/m^2

Crop variety (maturity):	wheat:	Axe (early), Scout (mid-late)
	barley:	Hindmarsh (very early), Commander (mid-late), Buloke (early-mid), Urambie (late) , Oxford (mid-late)
	oats: Matika (early)	
Fertiliser:	Granulock®(11:22:0:4, 4%Zn) @ 50 kg/ha	
	Urea topdressed @ 90 kg/ha (17 June) and @ 60 kg/ha (15 July)	
Seeding equipment:	knife point, press wheels (30 cm row spacing)	

A replicated plot trial evaluating wheat, barley and oat varieties with different maturities and grazing times was established in barley stubble at Corack in the southern Mallee.

Grazing occurred at growth stage GS14 (4- leaf) on all varieties for varietal evaluation, and at GS30 (stem elongation) for two wheat and barley varieties: an early maturing and a mid-late maturing type, to evaluate time of grazing on crop recovery and production. Plots were mown to simulate grazing on 11 July (grazed at GS14) and 1 August (grazed at GS30). Mowing instead of using animals enabled randomising of grazing treatments.

Dry matter (DM) production was measured at GS14 or GS30 on respective grazing treatments just prior to 'grazing'. Tissue samples were also taken at GS14 and GS30 and bulked for each crop type for feed testing; nutritional value between varieties has not varied greatly in previous years.

Using DM and feed tests, dry sheep equivalent (DSE) grazing days were calculated using:

DSE grazing days = DM (kg/ha) – 30 (kg/ha; physically unavailable DM) x feedtest metabolisable energy (ME) / 8 MJ, which assumes that each DSE requires 8 MJ/day.

Crops were left to recover and were grown through to harvest. Dry matter was measured at maturity (barley on 10 November, wheat on 2 December) to measure recovery and standing crop value.

Grain yield was measured using a small plot harvester (barley and oats on 15 November, wheat on 2 December), and grain quality analysed. Grain yields were adjusted to 11.5% moisture for barley and oats and 12% for wheat.

Gross margins were calculated for every plot of each treatment; grazing gross margin was added to crop gross margin for grazed treatments.

Crop gross margins were calculated using:

Crop gross margin ($/ha) = crop income - variable costs (input + operational costs).

Grazing gross margins were calculated using DSE grazing days (accounting for DM production and nutritional value), and 2012 RSSA Farm Gross Margin Guide for self-replacing merino flock gross margin of $40/DSE/year (Bruce Hancock, Rural Solutions SA):

Grazing gross margin ($/ha) = DSE grazing days x 40/365

Results

There was plentiful subsoil moisture after 186mm in January and 79mm in February. Following sowing, 18mm rainfall fell on 20 May, but further significant rainfall did not fall until 6-11 August. This Decile 2 period resulted in patchy crop emergence, which was more advanced where stubble lay. Timely rains between early August and early October recovered grain yields.

Tissue tests indicated that all crops had adequate nutrition to meet the minimum requirements of lactating ewes and lambs (Table 1).

Table 1. Nutritional value of grazed crops at GS14 and GS30, Corack 2011

Crop	Crude protein (% of DM)		Neutral detergent fibre (% of DM)		Metabolisable energy (MJ kg/DM)		Digestibility (% of DM)		Magnesium (mg/kg of DM)
	GS14	GS30	GS14	GS30	GS14	GS30	GS14	GS30	GS14
Wheat	28.3	25.4	44.6	48.1	12.4	11.6	81.5	76.9	1300
Barley	32.5	29.8	35.6	38.6	13.8	13.5	89.7	87.9	1400
Oats	32.1		31.5		14.3		92.4		1300
Min. req. for lactating ewes and lambs	*> 16 %*		*> 30 %*		*> 11 MJ kg/DM*		*> 75 %*		*1200 mg/kg DM*

At GS14, plot unevenness resulted in plant growth stage varying up to GS22 in the header row where there was more moisture. As a result, high CVs occurred for dry matter. This lessened by GS30 and crops levelled out as they progressed through the season. Feed value (DSE grazing days) at GS14 was greatest for Commander, Buloke and Oxford barley (Table 2). Commander also had the highest feed value at GS30 (Table 2).

In 2009, Hindmarsh performed well at Woomelang, but as in 2010 at Culgoa, Hindmarsh was of poorer feed production value. Urambie, a dual purpose, feed quality barley with winter habit was included after success during drought conditions at Temora, NSW (pers. comms., J. Hunt, CSIRO Canberra), but it too performed very poorly.

Table 2. Dry matter production (kg/ha) of and grazing value of crops grazed at GS14 and GS30, Corack 2011*

Crop	Variety	GS14 DM (kg/ha)	GS14 DSE grazing days	GS13 Grazing gross margin ($/ha)	GS30 DM (kg/ha)	GS30 DSE grazing days	GS30 Grazing gross margin ($/ha)
Wheat	Axe	164[bc]	208	23	393[b]	526	62
	Scout	134[cd]	161	18	325[b]	428	50
Barley	Hindmarsh	109[de]	136	15	373[b]	579	65
	Commander	207[a]	305	34	489[a]	775	87
	Buloke	203[a]	298	33	-	-	
	Urambie	85[e]	95	10	-	-	
	Oxford	194[ab]	283	31	-	-	
Oats	Matika	135[cd]	188	21	-	-	
	Sig. diff.	**P<0.001**			**P<0.005**		
	LSD (P=<0.05)	**35.9**			**75.1**		
	CV%	**20.8**			**16.6**		

* *(Results that are not statistically significant from one another are followed by the same letter.)*

Maturity dry matter production, grain yield, quality and gross income of crops are presented in Tables 3, 4 and 5.

For wheat, dry matter at maturity was reduced in grazing treatments (Table 3). Grain yield in turn was also reduced, significantly more the later it was grazed, regardless of crop maturity type. Although, on average, protein was 10.5% or above for Axe, it varied between plots with some low readings for grazed plots, which led to downgrading to AGP1. Screenings increased for grazed Scout but not enough to affect quality. Test weights were adequate and did not vary between grazing treatments.

Late (GS30) grazing caused lower grain yields, higher screenings (although still below 5%) and lower gross margins compared with ungrazed plots, despite the value of grazing to the livestock enterprise. Grazing at GS14 also caused reductions but to a lesser extent.

Table 3. Dry matter at maturity, grain yield, quality and gross margin of wheat grazed at GS14, GS30 and ungrazed, Corack 2011

Variety	Quality Maturity	Grazing treatment	Maturity DM (t/ha)	Grain Yield (t/ha)	Protein (%)	Screenings (%)	Total gross margin* ($/ha)
Axe	APW Early	GS14	4.62[b]	2.51[c]	10.5	3.47[abc]	142
		GS30	4.11[b]	2.07[d]	10.6	3.25[bc]	117
		Ungrazed	6.42[a]	2.72[bc]	10.6	2.81[c]	172
Scout	ASW Mid-late	GS14	4.69b	2.82[b]	9.7	4.63[a]	153
		GS30	3.91[b]	2.16[d]	10.0	4.46[ab]	95
		Ungrazed	6.71[a]	3.10[a]	9.8	2.88[c]	174
		Sig. diff.	**P<0.001**	**P<0.001**	**NS**	**P=0.03**	**NS**
		LSD (P=<0.05)	**0.93**	**0.26**		**1.3**	
		CV%	**12.9**	**14.7**	**5.5**	**24**	**34.6**
		LSD (P=<0.05) Variety	**NS**	**0.14**	**0.4**	**0.75**	**NS**
		LSD (P=<0.05) Grazing	**0.69**	**0.17**	**NS**	**0.92**	**49**
		****LSD (P=<0.05) Variety *Grazing**	**NS**	**NS**	**NS**	**NS**	**NS**

**Total gross margin includes crop gross margin, plus grazing gross margin for grazed treatments.*

***Interaction (variety x grazing) analysis: LSD (variety x grazing) can be used to compare table values. LSD Variety and LSD Grazing can be used to compare averages for each variety or grazing treatment respectively.*

For barley, grazing reduced dry matter production at maturity for Hindmarsh, Commander and Buloke, but not for longer season varieties Urambie and Oxford (Table 4). Grain production, however, was not affected by grazing at GS14, but was reduced by grazing at GS30.

Grain quality was good: retention was above 91% for all varieties (CV 0.4). All varieties had test weights adequate for their receival grade (to achieve malt or feed 1). Protein and screening differences occurred between varieties but not grazing treatments.

In contrast to wheat, barley gross margins were not affected by grazing; the grazing value to the livestock enterprise made up for any crop income losses caused.

Table 4. Dry matter at maturity, grain yield, quality and gross margin of barley grazed at GS14, GS30 and ungrazed, Corack 2011

Variety	Quality Maturity	Grazing treatment	Maturity DM (t/ha)	Grain Yield (t/ha)	Protein (%)	Screenings (%)	Total gross margin* ($/ha)
Hindmarsh	Malt Very early	GS14	6.29[de]	3.18[ef]	11.0[a]	1.2[d]	276[b]
		GS30	5.37[e]	2.86[fg]	10.8[ab]	1.5[cd]	273[b]
		Ungrazed	7.74[bc]	3.30[e]	10.2[bc]	1.3[d]	278[b]
Commander	Malt Mid-late	GS14	7.59[bc]	4.01[abc]	9.0[e]	2.0[bc]	421[a]
		GS30	6.29[de]	3.72[cd]	8.7[ef]	2.0[bc]	422[a]
		Ungrazed	9.15[a]	4.13[ab]	9.3[de]	1.5[cd]	414[a]
Buloke	Malt Early-mid	GS14	6.46[cde]	3.57[de]	9.8[cd]	1.4[cd]	390[a]
		Ungrazed	8.38[ab]	3.74[bcd]	10.6[ab]	1.4[cd]	386[a]
Urambie	Feed Late	GS14	5.39[e]	2.77[g]	10.4[abc]	2.5[ab]	192[c]
		Ungrazed	6.55[cde]	2.88[fg]	10.7[ab]	2.9[a]	184[c]
Oxford	Feed Mid-late	GS14	7.18[bcd]	3.91[abcd]	8.1[f]	1.3[d]	388[a]
		Ungrazed	8.41[ab]	4.30[a]	8.8[ef]	1.3[d]	417[a]
		Sig. diff.	**P<0.001**	**P<0.001**	**P<0.001**	**P<0.001**	**P<0.001**
		LSD (P=<0.05)	**1.28**	**0.41**	**0.8**	**0.7**	**68**
		CV%	**12.6**	**8.9**	**5.6**	**12.5**	**13.9**
		LSD (P=<0.05) Variety	**0.59**	**0.26**	**0.3**	**0.5**	**NS**
		LSD (P=<0.05) Grazing	**0.73**	**NS**	**NS**	**NS**	**NS**
		****LSD (P=<0.05) Variety *Grazing**	**NS**	**NS**	**NS**	**NS**	**NS**

**Total gross margin includes crop gross margin, plus grazing gross margin for grazed treatments.*

***Interaction (variety x grazing) analysis: analysis on Hindmarsh and Commander treatments only. LSD (variety x grazing) can be used to compare table values. LSD Variety and LSD Grazing can be used to compare averages for each treatment.*

For Mitika oats, grazing early had no affect on grain production or quality (Table 5). Test weight was adequate and not affected by grazing (CV% 2.1).

The grazed Mitika crop sustained its gross margin compared with the ungrazed crop.

Table 5. Grain yield, quality and gross margin of oats grazed at GS14 or ungrazed, Corack 2011

Variety	Maturity	Stage of growth grazed	Grain Yield (t/ha)	Protein (%)	Screenings (%)	Total gross margin* ($/ha)
Mitika	Early	GS14	3.44	10.8	5.3	325
		Ungrazed	3.32	11.5	4.2	286
		Sig. diff.	**ns**	**ns**	**ns**	**ns**
		CV%	**3.1**	**5.5**	**15**	**6.8**

**Total gross margin includes crop gross margin, plus grazing gross margin for grazed treatments.*

Interpretation

All crops and varieties proved to be nutritious feed sources for lactating ewes and lambs. Barley provided the most forage, with Commander a standout variety in 2011.

Dry matter production at maturity, which becomes available for forage use as stubbles or even a standing crop, was reduced by grazing the growing crop. However, final dry matter production for grazed crops was generally 4.0-4.5t/ha for wheat (compared with 6.7t/ha ungrazed Scout) and 5.4-7.6t/ha for barley (compared with > 9t/ha ungrazed Commander). These crops provide substantial forage banks for use during times of particular need such as lambing once stubbles are consumed. Lodging in barley would need to be considered to avoid wastage. Oats would not be suitable for this purpose, due to grain shedding. Alternatively, grazed crops could be cut for hay in spring; those varieties with more DM at maturity would be likely to have the greatest hay yield at cutting time.

Growth stage at grazing was more important than maturity characteristics on final grain yield. Crops grazed at GS14 incurred little yield penalty, whereas crops grazed at GS30 had reduced yields compared with ungrazed crops.

The grain quality of wheat was affected by grazing, reducing grazed crop gross margins due to reduction of receival category. Grain quality for barley and oats, however, was not affected by grazing. Gross margins were maintained in barley and oat grazed crops, with the value of grazing counteracting any grain income losses due to grain penalties.

Commercial practice: what this means for the farmer

- consider growing a barley or oat crop for stockfeed. An early (April, first week May) established crop can provide a nutritious feed source for stock when regenerating or sown legume pastures are still establishing, and avoids the cost and labour of handfeeding
- in low rainfall areas, early (April) sowing is critical; grain recovery after grazing is more likely to be successful in years with stored subsoil moisture and good spring conditions
- in low rainfall areas, it is best to graze well before stem elongation for better crop recovery. Barley and oat grain crops will tolerate grazing the best, having better forage value and ability to recover and lessen grain production penalties. Grazed grain wheat varieties are likely to suffer grain yield and quality penalties
- dual purpose winter cereal varieties are generally not adapted to low rainfall areas
- the alternative to risking production and grain quality of a crop is to sow an area of crop specifically for forage use: this may be either with a traditional grain cereal, or with a variety bred specifically for forage production. Refer to following article 'Choice of forage crops for winter feed' published in this publication on page 187-192 .

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