7.2 Effect of grazing on the grain yield and quality of seven cereals

Location:
Inverleigh (SFS site)

Funding:
Grain and Graze, National Landcare Program (NLP)

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Rainfall (mm)
235 mm

Summary of findings:
Intensive grazing at GS 30 – GS 31 (start of stem elongation) reduced grain yield compared to no grazing by an average of 37%. The greatest yield loss of 57% occurred with *Monstress* triticale and the lowest yield loss occurred with *Amarok* wheat (18%). Up to 2.1 t/ha of drymatter was available for grazing before stem elongation was reached. *Yerong* barley yielded the greatest drymatter pre grazing, with *Brennan* wheat the lowest drymatter yielding at 1.5 t/ha.

Background:
Grazing cereal offers a benefit to the farm system if it can be achieved with minimal or no impact to the grain yield of the crop. Previous trialling would indicate grain yield is reduced if grazing occurs around or after GS 31. Yet grazing the crop later increases the amount of drymatter on offer. The ability to identify the ideal growth stage to graze is complicated because of the different times varieties reach the commencement of stem elongation.

To achieve the maximum benefit for both the grazing and cropping enterprises, there is a need to maximise drymatter production available for grazing but also refine the point where grazing must cease otherwise grain yield will be reduced.

This trial is designed to quantify the drymatter potential of seven long season cereal crops before stem elongation is reached and to determine the impact on grain yield if heavy grazing occurs at GS 31.

Trial input & design:
Seven long season cereal varieties (4 x wheat, 2 x barley & 1 x triticale) were sown in three replicates on 11th May 2006. One wheat variety with a shorter growing season was chosen as a marker to provide forewarning of the onset of GS 31. The varieties were:

- Wheat – *Mackellar, Amarok, Marombi, Brennan*
- Barley – *Yerong, Gairdner* (used as a marker)
- Triticale – *Monstress*

Pre and post sowing treatments were:

Pre-emergent: Sprayseed @ 2.0 l/ha, Triflur @ 1.2 l/ha
Post-emergent: Dual Gold @ 250 ml/ha, Diuron @ 500 ml/ha
Tigrex – 1.0 l/ha on July 14th
Urea @ 50kg/ha on September 24th
Tilt Xtra @ 250ml/ha on ungrazed plots on September 25th
Tilt Xtra @ 250ml/ha on grazed plots on October 13th

Each plot was 16m x 2m, with 8 m buffer strips. Each variety was monitored for growth stage and grazing commenced when GS 30 was reached. Six cuts of 0.1 m^2 were taken from each variety immediately before grazing to determine drymatter on offer.

Exclusion areas were erected to prevent grazing on half of each of the plots. Plots were grazed with 10 month old merino wethers for between one and four days (until all drymatter was removed).

Plots were harvested on 13th December.

Trial results:
Grazing of the *Gairdner* barley commenced on August 7, 81 days after sowing. The last grazing of *Amarok* wheat occurred 14 days later on August 21. The amount of drymatter present and the growth stage at grazing is presented (table 1).

Table 1: Days from sowing to grazing, growth stage at grazing and available drymatter

Variety	Date grazing commenced	Growth stage	Days grazed	Days from sowing to grazing	Feed on offer (kg/ha)
Yerong barley	11/8	GS 30 - GS 31	3	88	2190
Monstress triticale	11/8	GS 30 - GS 31	3	95	2120
Amarok wheat	21/08	GS 30	1	85	2020
Gairdner barley	7/8	GS 31 - GS 32	2	88	1920
Mackellar wheat	14/8	GS30 - GS31	4	81	1730
Marombi wheat	14/8	GS 30	4	85	1490
Brennan wheat	14/8	GS 30	4	88	1480
				LSD $_{(0.05)}$	**700**

Grazing resulted in a significant reduction in grain yield, from an average 4.1 t/ha to 2.6 t/ha. However the yield reduction varied between varieties, with *Yerong* barley and *Brennan* wheat showing no statistical significance in yield loss despite declines of 1.5 t/ha and 1.3 t/ha respectively (table 2).

Table 2: Impact of grazing on grain yield

Variety	Growth stage	Yield (ungrazed) (t/ha)	Yield (grazed) (t/ha)	Difference in yield due to grazing (t/ha)	Statistical significance (p=0.05)
Gairdner barley	GS 31 - GS 32	4.9	3.2	- 1.7	Sig (1.6)
Yerong Barley	GS 30 - GS 31	4.4	2.9	-1.5	NS (1.5)
Monstress triticale	GS 30 - GS 31	4.1	1.8	-2.3	Sig (1.6)

Marombi wheat	GS 30	4.1	2.5	-1.6	Sig (1.3)
Mackellar wheat	GS30 - GS31	4.0	2.7	-1.3	Sig (0.2)
Amarok wheat	GS 30	3.8	3.1	-0.7	Sig (0.1)
Brennan wheat	GS30	3.1	1.9	- 1.2	NS (1.4)

Grain quality was also affected by grazing (table 3, 4).

Table 3: Impact of grazing on grain protein

Variety	Growth stage	Protein (ungrazed) (%)	Protein (grazed) (%)	Difference in protein due to grazing	Statistical significance (p=0.05)
Gairdner barley	GS 31 - GS 32	11.9	11.3	- 0.6	NS (2.6)
Yerong Barley	GS 30 - GS 31	12.0	11.4	- 0.6	NS (1.3)
Monstress triticale	GS 30 - GS 31	11.0	10.8	- 0.2	NS (2.2)
Marombi wheat	GS 30	11.2	10.6	- 0.6	NS (2.3)
Mackellar wheat	GS30 - GS31	11.2	9.6	- 1.6	Sig (0.9)
Amarok wheat	GS 30	11.4	9.8	- 1.6	Sig (0.1)
Brennan wheat	GS30	12.3	11.8	- 0.5	NS (1.3)

Table 4: Impact of grazing on thousand grain weight

Variety	Growth stage	TGW (ungrazed)	TGW (grazed)	Difference in TGW due to grazing	Statistical significance (p=0.05)
Gairdner barley	GS 31 - GS 32	32.2	34.3	+ 2.1	NS (6.4)
Yerong Barley	GS 30 - GS 31	33.8	36.8	+ 3.0	NS (6.5)
Monstress triticale	GS 30 - GS 31	37.8	28.2	- 9.6	Sig (8.3)
Marombi wheat	GS 30	33.5	27.6	- 5.9	Sig (2.4)
Mackellar wheat	GS30 - GS31	27.5	25.1	- 2.4	Sig (1.6)
Amarok wheat	GS 30	35.4	30.3	- 5.1	Sig (3.0)
Brennan wheat	GS30	34.8	29.6	- 5.2	Sig (4.6)

Trial observations:
The amount of drymatter on offer varied between varieties. The two barley varieties, *Yerong* and *Gairdner, Monstress* triticale and *Amarok* wheat produced around 2 tonnes of drymatter by GS 30 – GS 31. However the time from sowing to reach GS 31 varied, with *Gairdner* barley reaching stem elongation 14 bays before *Amarok* wheat. The other wheat varieties tested produced closer to 1.5 t/ha before reaching GS 31.

Although there is a difference between the total amount of drymatter produced, even the lower drymatter yielding wheat varieties (*Brennan, Mackellar, Marombi*) still produced a valuable quantity of high quality feed at a time of year when pasture is often in short supply.

The time to reach GS 31 varied by up to two weeks, even though all varieties except for *Gairdner* are considered dual purpose cereals. This is useful information when determining the time of grazing.

Grazing at GS 30 – GS 31 reduced grain yield compared to no grazing by an average of 37%. The greatest yield loss of 57% occurred with *Monstress* triticale and the lowest yield loss occurred with *Amarok* wheat (18%).

Despite the yield loss, the ability for the cereals to recover given the timing and intensity of grazing was surprising. Physical examination of the plants showed a difference in growth stage between tillers on any individual plant. An average was taken to determine the growth stage for this experiment, however some tillers had already commenced stem elongation. Given the intensity the plots were grazed (see photos) it is highly likely some embryonic ears were removed, reducing yield. This is especially so for triticale where a minimum grazing height of 5 to 7 cm is suggested. Lighter grazing that left some drymatter behind may have lessened the grain yield loss.

No measurements were taken to determine if the yield loss was due to a loss of ears per plant or loss of grains per ear. The size of the grains per ear measured as thousand grain weight (TGW) was significantly lower in all the wheat varieties tested and the triticale. The average reduction in TGW was 16% due to grazing, which accounts for approximately 40% of the average grain loss in the wheat and triticale.

Surprisingly the TGW of the two barley varieties increased by 8% despite the barley yields being reduced by 35% due to grazing. This difference in response from the wheat and barley is difficult to explain, as the removal of leaf area at stem elongation would have been expected to conserve soil moisture, thus allowing increased grain size.

The impact of grazing would suggest a reduction in grain protein over the no grazed cereal. All varieties exhibited a decline in grain protein, however the reduction was only statistically significant with two varieties (*Mackellar* and *Amarok* wheat). The decline in grain protein due to grazing is consistent with observations from other trials and is thought to be a consequence of reducing the nitrogen available for grain fill when the leaves are eaten.