7.4 Effect of grazing at different growth stages on the grain yield, quality and stubble mass of Yerong barley – Ceres

Location:
Ceres

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

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Rainfall (mm)
Rainfall from sowing to the completion of grazing (May 26 to September 19) was only 122.5 mm (table 1).

Table 1: Growing season rainfall during the grazing period at Ceres

May	Jun	Jul	Aug	Sept
4.0	13.0	37.5	32.5	39.0

Summary of findings:
Very dry conditions during the growing season and the inherent variability with the trial site requires the results to be viewed with caution. However these results show grazing *Yerong* barley during the vegetative stage of growth will have no impact on grain yield and is likely to be beneficial. The grazing benefits to the whole farm system are considerable and the small reduction in stubble mass, although not huge is a positive outcome.

Grazing at or after the commencement of stem elongation will provide greater drymatter for livestock and dramatically decrease stubble loads, but it comes at significant loss of grain yield.

These conclusions are consistent with cereal grazing trials in South west Victoria (for a summary of the conclusion from a range of cereal grazing trails conducted by Grain and Graze and SFS, visit the SFS website).

Background:
Winter cereals offer a potential feed for grazing in winter. However there have been mixed reports on the impact grazing can have on grain yield and stubble mass post harvest (refer to SFS results book, 2005, pp 92, SFS results book 2004, pp 148). Analysis of these results would suggest the growth stage of the crop at the *completion* of grazing has a major influence on final grain yield. A trial was established to examine the impact grazing at different stages of growth would have on dry matter, grain yield and stubble yield post harvest.

Trial input & design:
A 10.4 ha paddock was sown on 26th May at 100 kg/ha to *Yerong* barley. 100 kg/ha of DAP was used at sowing. The paddock was sprayed on July with Dicamba (280 ml/ha) and MCPA (1.2 l/ha) for thistles, capeweed and wild raddish.

After sowing the paddock was divided into six areas of decreasing size. This was designed to provide a relatively constant period of grazing in each plot of between seven and 10 days. In the early grazed plots sheep were offered a larger area (as less feed per hectare was on offer). The grazing area decreased in size as more feed per hectare became available (table 2). Five areas were excluded from the last grazed area to provide a no grazing benchmark.

Table 2: Approximate area for grazing

Grazing sequence	Area (ha)
First	5.0
Second	1.8
Third	1.0
Fourth	1.4
Fifth	0.6
Sixth	0.6
Not grazed	5 x 6m^2 plots

Given the size of the trial site, three soil tests were taken in areas that may have influence the results. The key soil indicators of these three areas are presented (table 3).

Table 3: Key soil indicators over the trial site (0 – 10 cm, taken May 26 2006)

	Potential 'high' yield area	Potential 'medium' yield area	Potential 'low' yield area
Corresponds to grazing at	GS 25	GS22, GS24, GS32, No grazing	GS 22, GS 30
Soil texture	Clay loam	Clay loam	Clay loam
Phosphorus (Olsen)	18.7	17.0	20.0
Potassium (Colwell)	203	203	255
Sulphur (KCl 40)	15.8	13.2	13.7
pH ($CaCl_2$)	4.8	4.7	4.5
Nitrate	65	51	70
Aluminium (% of cations)	0.6	1.2	1.5

56 first cross ewes with lambs at foot (114% lambing) began grazing on July 17. Once the area was grazed down, (less that 350 kg/ha DM), the ewes were moved to the next area. Due to the extremely dry conditions stock were relocated onto pasture for six days in mid August and four days in early September (table 4).

Table 4: Grazing dates and duration of grazing

Grazing sequence	Area (ha)	Grazing dates	Period of grazing
First	5.0	26 Jul – 7 Aug	12
Second	1.8	7 Aug – 15 Aug	9
Third	1.0	21 Aug – 24 Aug	4
Fourth	1.4	24 Aug – 30 Aug	6
Fifth	0.6	30 Aug – 7 Sep	7
Sixth	0.6	11 Sep – 19 Sep	9
Not grazed	5 x 6m^2 plots	None	0

Five 10 m^2 plots were harvested out of each treatment, except for the no grazed area which was five 4 m^2 areas. All plots were cut to ground level, with the grain threshed and remaining straw and trash collected and weighed. The no graze and early grazed plots were harvested on December 12 and the later grazed plots on December 19.

Trial results:
The trial results are presented in terms of feed on offer and impact on grain yield and quality and stubble mass.

Feed on offer:
The six grazing times represented different growth stages of the crop. The quantity of available feed at each growth stage is presented (table 5).

Table 5: Crop growth stage corresponding to time of grazing and feed on offer

Grazing sequence	Growth stage	Grazing dates	Feed on offer (kg/ha)
First	GS 22	26 Jul – 7 Aug	309
Second	GS 24	7 Aug – 15 Aug	639
Third	GS 25 (early)	21 Aug – 24 Aug	700
Fourth	GS 25 (late)	24 Aug – 30 Aug	866
Fifth	GS 30	30 Aug – 7 Sep	1774
Sixth	GS 32	11 Sep – 19 Sep	3175
Not grazed	5 x 6m^2 plots	None	0

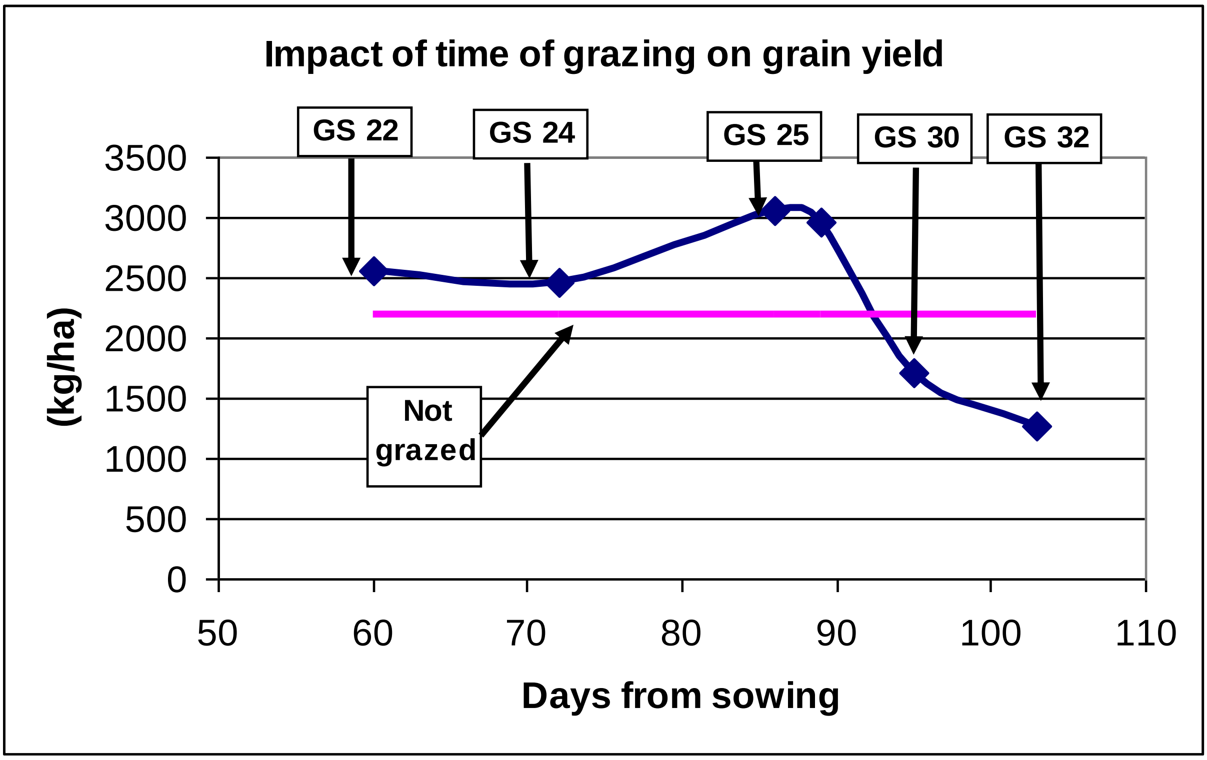
The quality of the feed on offer changed dramatically during the grazing period. The energy rose from 12.5 MJ ME/kg at GS 22 to 13.5 MJ ME/kg at GS 30, before declining. The opposite occurred with the protein in the crop. Protein was highest at GS 22 (36.7%) but declined rapidly over the grazing period to 19.6% at GS 32.

A total of 47 days grazing was achieved on the 10.4 ha, an equivalent of 19.4 DSE/ha[1] over the grazing period.

Impact of grain yield and quality:
The impact of grazing pre GS 30 had a positive impact on grain yield compared to the ungrazed area. Grazing at the later vegetative growth stages (GS 25) achieved the greatest yield benefit. Grazing at GS 30 or later had a negative impact on grain yield (figure 1).

[1] Ewes with lamb at foot rated at 3.6 DSE

Figure 1: Impact of grazing on grain yield



Impact on stubble yield:
Grazing reduced the amount of stubble remaining after harvest, irrespective of the time of grazing. The greatest reductions occurred when grazed at GS 30 or later, however there was still a reduction in stubble yield with the earlier grazing at the vegetative stage (figure 2).

Figure 2: Impact of grazing on stubble yield

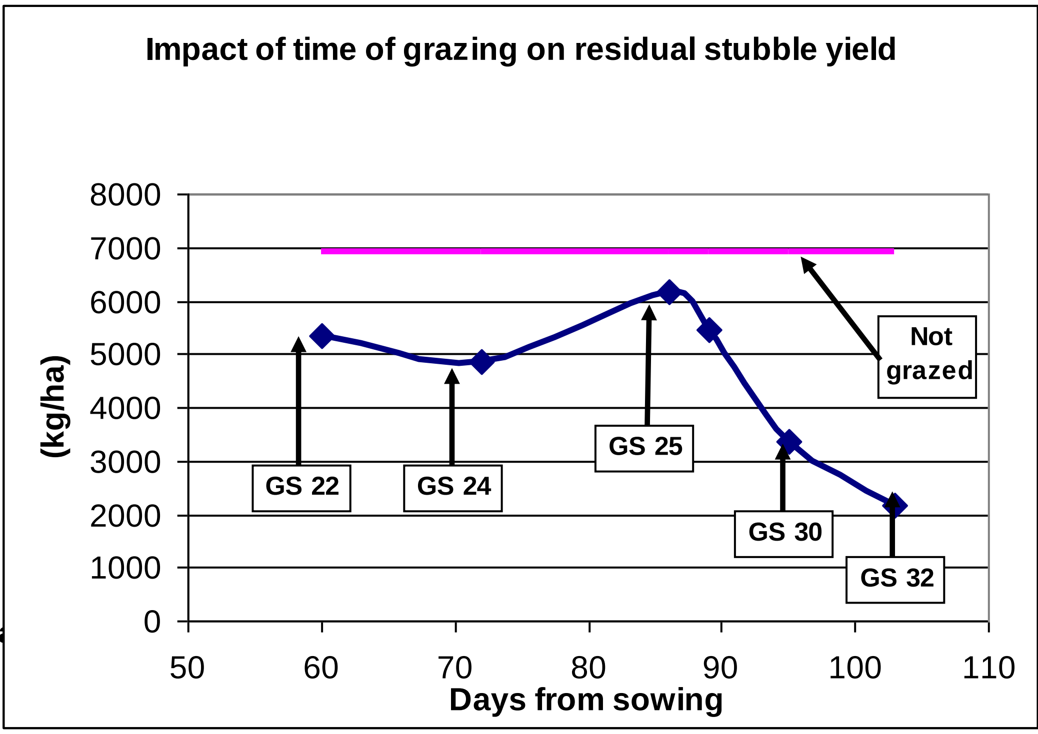


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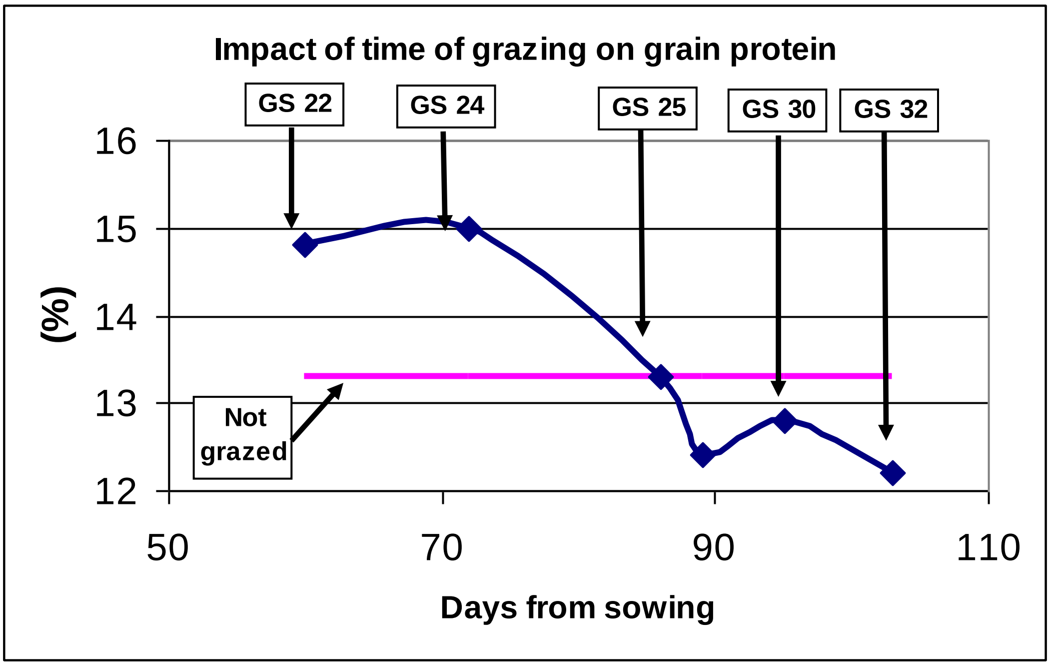
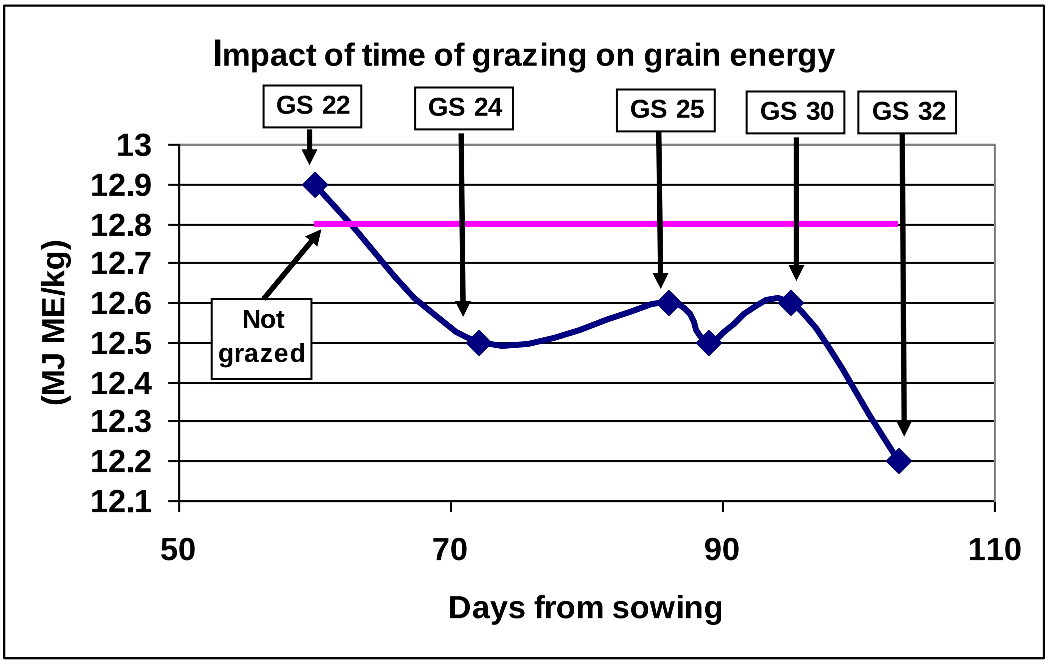
Figure 3: Impact of grazing on grain protein



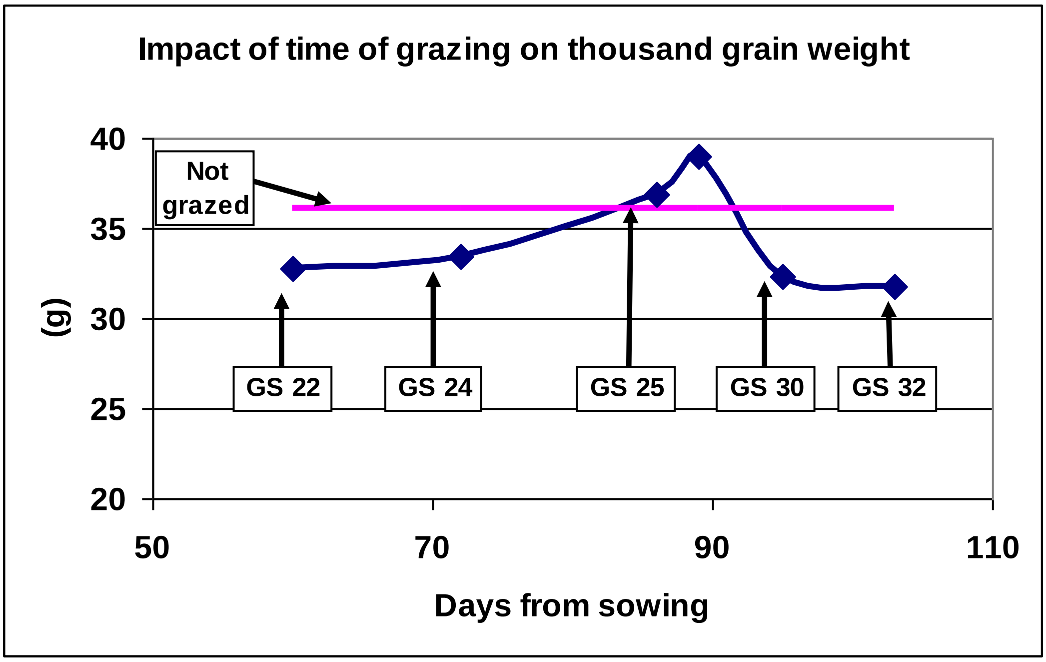
The energy appears to decline due to grazing however the size of the decline is less than 0.5 MJ ME/kg (figure 4).

Figure 4: Impact of grazing on grain energy



Thousand grain weight was less than the no grazed treatment when grazing occurred early or late in the season (figure 5).

Figure 5: Impact of grazing on thousand grain weight



Trial observations:
The extremely dry conditions decreased the amount of drymatter grown in the early vegetative stage. Between the start of grazing (July 26) to the end of the fourth grazing (August 30) only 32.5 mm of rain fell, with the majority of this falling on August 24 and 25 and would explain the lack of growth up to the fourth grazing period. Rain in late August greatly increased crop growth, which averaged 165 kg/ha/day.

The grazing value from the crop was significant given the dry year. The crop was grazed for 47 days at an average stocking rate of 19.4 DSE/ha over the grazing period or 2.5 DSE/ha over the entire year. For a typical farm in the South West Victoria that has an average stocking rate of 15.8 DSE/ha/yr[2], this grazing represents 16% of the total feed requirement for the year and is provided at a time of year when feed is in short supply.

No livestock performance was measured on this trial but previous research would indicate a high degree of variability in the performance of stock grazing cereals (Hugh Dove, CSIRO, pers comm). The reason for this variability is still being researched, with magnesium deficiencies suggested as one possible reason for less that anticipated growth rates. However the dramatic difference in the amount of protein and energy in the feed on offer at the start and end of grazing period may also be an explanation. At the start of grazing the ratio of protein (%) to metabolisable energy (MJ ME/kg) was 2.9:1 and this declined to 1.6:1 at GS 32. This effect is proposed as the reason for less than optimum growth of lambs grazing lush lucerne when the protein to energy ration exceed about 2.2.

Grazing in the vegetative stage of crop growth seems to have a beneficial impact on grain yield compared to no grazing. The reason for this gain is likely to be a combination of moisture, frost and time of harvest. The removal of leaf during a dry winter was likely to have conserved soil moisture which was utilised by the crop later in the season. This response is greatest when the crop was grazed at the late vegetative stage, where a gain of 0.86 t/ha or 39% was achieved over the no grazing areas. The thousand grain weight peaked at GS 25 and is probably a reflection of moisture availability. Removal of the canopy

[2] Farm Monitor Project, 2004/2005 (DPI, 2005)

at this stage is likely to have reduced evapotranspiration leaving slightly more moisture for grain fill. However the difference to other grazing times is not large.

The removal of the crop canopy is thought to reduce the incidence of rust. However in this year very little rust was observed in the no grazed plots and none in the late grazed areas.

Grazing also delayed ear emergence by between seven and 10 days, which may have avoided periods of frost.   This delay also made harvesting difficult, with the no grazed plots ready for harvest 20 days before the late grazed (GS 32) areas. Visual observations would suggest some grain may have been lost (seed shaken from the heads), although it is highly unlikely to explain the total yield difference between the grazed and ungrazed plots.

The effect of grazing on grain quality was inconclusive. Protein levels were higher than the control in the early grazed plots and decline to less than the no grazed plots when grazed later. The change in grain protein was more than 2%, which may be important especially for barley. The apparent fall in energy due to later grazing was only in the order of 0.5 MJ ME/kg. While the decline in both could be attributed to the loss of leaf area due to grazing, further work is required to determine if this decline is repeatable and if so the magnitude of this change.

Grazing at or after the commencement of stem elongation reduced grain yield compared to the control. This is expected as heavy grazing will remove the embryo ear as it begins to move up the stem of the tiller. Grazing at GS 32 reduce yield by 0.93t/ha or 43 % compared to no grazing.

The removal of dry matter had an impact on final stubble mass after harvest. Grazing after the commencement of stem elongation reduced stubble mass by more than 50% or 4 t/ha. Grazing before stem elongation reduced stubble mass but to a lesser extent (average reduction of 21%).