GRAZED WHEAT CROP RESPONSES

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Take home messages

- In a drier season, early-mid maturing Mace wheat provided better feed and grain value than mid-late maturing Trojan.
- Make variety choice based on the stored soil moisture, the potential time of sowing and the seasonal outlook.
- Variety differences exist between Mace and Trojan and their response to grazing.

Background

Early sown cereal crops have vigorous early growth that can provide valuable feed for sheep in late autumn to early winter. Grain & Graze research has shown that if crops are grazed early (before stem elongation), some residual leaf is left after grazing and there is adequate subsoil moisture or follow up rainfall, then plants have the ability to recover and grain yield penalties are minimised in low to medium rainfall environments.

However, sometimes responses to grazing are unexpected. Grain yield penalties can still occur when best management practice (BMP) is followed, and recovery responses can be variable between varieties of the same genotype. Further investigation is still needed to understand the mechanisms behind crop responses in all environments.

Aim

To determine how post-grazing nitrogen application rates and post flowering rainfall affect the recovery of Mace and Trojan grain wheat crops after grazing.

Trial details

Location:	Berriwillock
Soil type:	Sandy clay, with boron toxicity at 60cm
Annual rainfall 2015:	241mm
GSR 2015 (Apr-Oct):	141mm

Crop types:	Mace and Trojan wheat
Sowing date:	29 April
Seeding equipment:	Knife points, press wheels, 30cm row spacing
Target plant density:	130 plants/m^2
Harvest date:	13 November

Trial inputs

Fertiliser:	Granulock Supreme Z @ 50kg/ha + Impact @ 200mL/ha at sowing
	Post-grazing N rate trial – 0, 10, 25, 50, 75 kg N applied as urea at GS23 (16 July)
	Finishing rainfall trial – 90kg/ha of urea applied at GS25 (27 July)

Weeds, pests and diseases were controlled to best management practice.

Method

Post-grazing N rate trial

A replicated field trial was sown using a split plot design with variety as main plots and variety by nitrogen (N) rate as sub-plots. Grazing was simulated when the crop was at GS23 (16 July) using a line trimmer, cutting the crop to 6cm high. Nitrogen treatments were applied post-grazing. Assessments included crop biomass at grazing time, biomass at anthesis and grain yield and quality parameters.

Finishing rainfall trial

A replicated field trial was sown using a split plot design with variety as main plots and variety by finishing rainfall as sub-plots. Grazing was simulated when the crop was at GS25 (July 27) using a line trimmer, cutting the crop to 6cm high. Finishing rainfall was applied using a dripper line placed in furrows, and watered to deliver 0, 25 or 50mm/ha on 29 September. Assessments included grain yield and quality parameters.

Results and interpretation

The trial was sown following 14.4mm of rainfall on 18 April, then 3.6mm on 25 April. The next significant rain of 13.4mm didn't fall for three weeks, starting on 19 May, hence emergence was staggered and growth stages between plants on 9 July varied from GS13 to GS31.

Post-grazing N rate trial

The amount of biomass available at GS23 for grazing was low due to the drier season, and similar between varieties. Mace had 123kg/ha and Trojan had 128kg/ha (P=NS, CV%=29).

By anthesis, ungrazed Mace had the highest dry matter at 2556kg/ha (Figure 1), but grazed Mace was not able to recover fully and was 326kg/ha lower.

After grazing, Trojan was able to recover biomass by anthesis to equal ungrazed Trojan, and similar to grazed Mace around 2200kg/ha.

This is interesting because it shows there are differences between Mace and Trojan in their ability to recover. It could be reflective of maturity, the short growing season or some other mechanism. Recovery of the plant, and subsequent accumulation of dry matter, after grazing is very important, as there will be more scope for photosynthesis and carbohydrate storage that can be used to fill grain.

Post-grazing nitrogen application had no effect on biomass recovery of either variety after grazing, indicating nitrogen was not limiting in this season.

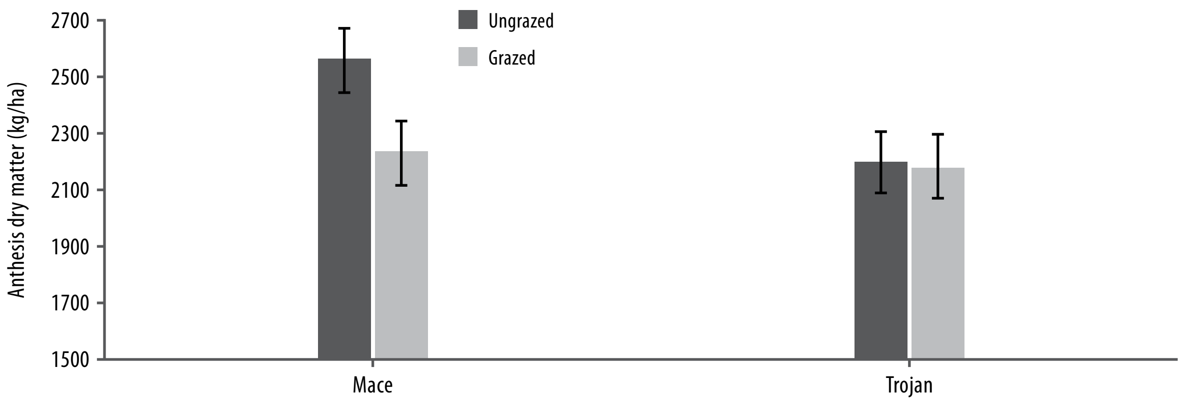

Figure 1. Anthesis dry matter for grazed and ungrazed Mace and Trojan, Berriwillock 2015. Stats: P (variety x grazing) = 0.05, LSD=219.4 kg/ha, CV 13%.

Mace (1.03t/ha) out yielded Trojan (0.82t/ha), a result reflective of the variety maturity, and the season. Grain yield also differed, but only marginally between grazed crops (0.90t/ha) and ungrazed crops (0.95t/ha) (Figure 2).

There was no significant grain yield effect of increasing rates of post-grazing nitrogen, nor were there any interactions between variety, grazing effect and nitrogen response.

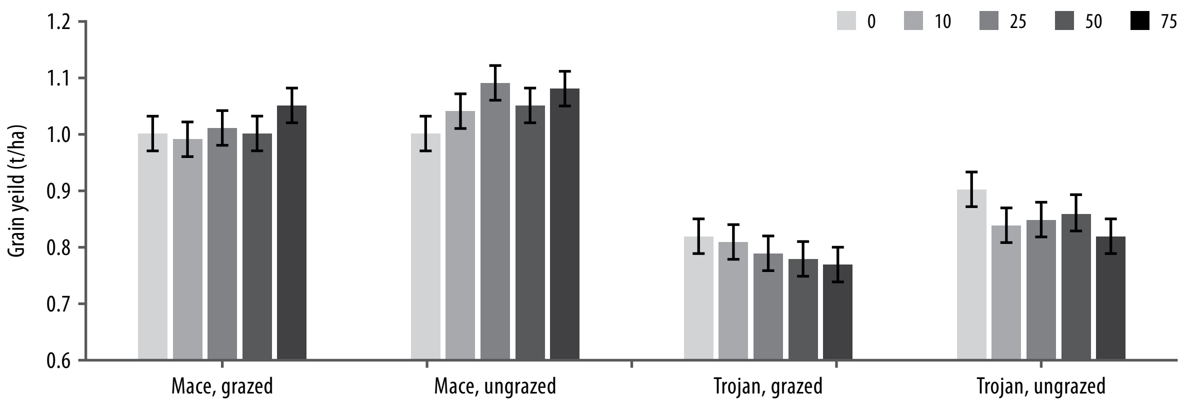

Figure 2. Grain yield of grazed and ungrazed Mace and Trojan, Berriwillock 2015. Note: error bars are for variety x N rate x grazing treatment, P=NS, LSD=0.06, CV%=8.3. Stats: grain yield: P<0.001, LSD=0.04, CV%=8.3, grazing treatment: P=0.017, LSD=0.04, CV%=8.3.

However, while not significant, there was a slight trend for Mace to positively respond to increasing N, while Trojan grain yield declined, particularly for grazed plots. In a similar trial at Navan in South Australia this response was stronger, and merits further investigation.

For grain quality, Mace had 13 per cent protein while Trojan was higher at 13.8 per cent. Grain protein was not affected by grazing, but increased as more post-grazing nitrogen was applied (Table 1). Screenings also increased as post-grazing nitrogen increased.

Table 1. Grain protein response to post-grazing nitrogen application, Berriwillock 2015.

Post-grazing nitrogen rate (kg N/ha)	Protein (%)	Screenings (%)
0	12.2 a	7.4 b
10	12.9 b	8.4 b
25	13.4 c	8.4 b
50	14.1 d	9.7 ab
75	14.5 e	12.5 a
Sig. diff.	P<0.001	P=0.025
LSD (P=0.05)	0.32	3.17
CV%	2.9	41.3

Entering the season in 2015, with a fairly dry profile and limited rainfall for early sowing, as well as a predicted El Nino spring outlook, early-mid maturing Mace became the more suitable variety choice to enable post grazing recovery and to minimise any penalty to grain production. Ensuring that stock are removed well before GS30 is recommended in a dry year, whereas in a more favorable season stock can be left to graze for longer (even past GS30) and plants can recover and maintain yield.

Finishing rainfall trial

Similar to the post-grazing N rate trial, in 2015 Mace (1.30t/ha) out-yielded longer season variety Trojan (1.07t/ha). Grazing (average yield 1.1t/ha) had no significant effect on grain yield compared with ungrazed (1.2 t/ha) (P=0.65).

For crops to recover from grazing and minimise grain yield loss, they need adequate resources – water being of obvious importance. Therefore, the finishing rainfall applied at the end of September (late flowering, early grain fill) had a considerable effect on final grain yields with grazed crops in particular responding to increasing rainfall, and the highest rate of 50mm increasing yield of ungrazed crop (Figure 3).

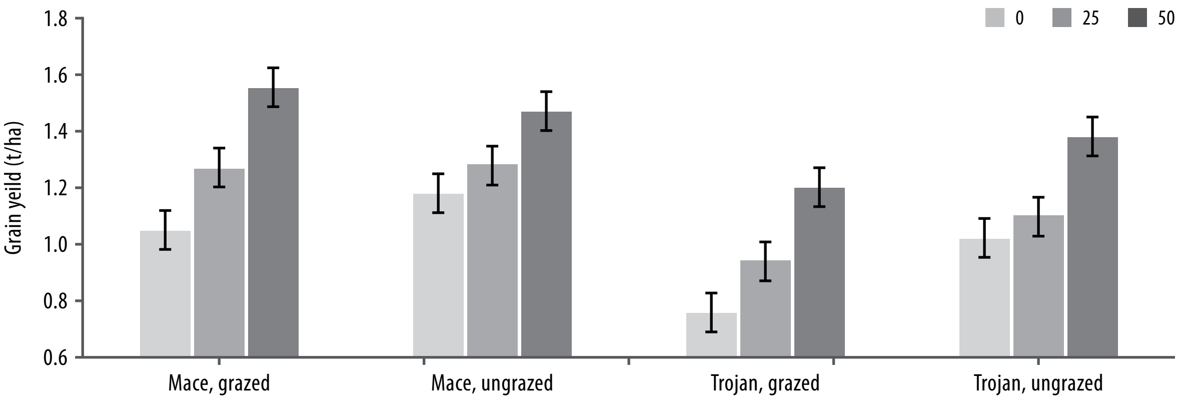

Figure 3. Grain yield of grazed and ungrazed Mace and Trojan, Berriwillock 2015. Note: error bars are for water rate for each variety: P<0.001, LSD=0.142, CV%=14.3.

Trojan again had higher protein (14.6%) compared with Mace (13.3%). Grazed Trojan had higher protein (14.9%) than ungrazed Trojan (14.2%), while grazed Mace had lower protein (12.8%) than ungrazed Mace (13.9%) (P<0.001, LSD=0.552, CV%=4.1).

Zero and 25mm finishing rainfall plots averaged 14.2 per cent protein while the higher finishing rainfall 50mm had lower protein at 13.4 per cent, as you would expect with higher yield.

Screenings were 6.9 per cent for both Mace and Trojan, and were not affected by grazing. Finishing rainfall however reduced screenings. Nil finishing rain (9.1%) and 25mm finishing rain (8.3%) were similar, while 50mm of finishing rain had only 3.2 per cent screenings (P=0.02, LSD=3.16, CV%=54).

The finishing rainfall was generally too late for the plant to respond with better water use efficiency (Table 2), with the exception of ungrazed Trojan which was able to increase its conversion of water into extra grain.

Table 2. Conversion of finishing rain into grain yield, Berriwillock 2015.

		Additional grain produced/finishing rainfall (kg/mm)	
Variety	**Finishing rainfall (mm)**	**25**	**50**
Mace	Grazed	8.8	5.6
	Ungrazed	4.0	3.8
Trojan	Grazed	7.2	5.2
	Ungrazed	3.2	5.6

These trials have highlighted differences between two varieties of similar phenotype (both spring types), Mace and Trojan, in their ability to respond to grazing effects, nitrogen application and late rainfall.

Similar trials have also been conducted by Mick Faulkner (Ag Ex Alliance/AgriLink), Jessica Crettendon (EPARF/SARDI) and Zoe Creelman (SFS) from Mid-North SA, Eyre Peninsula SA and Southern Vic respectively for the Grain & Graze 3 project. Collective results of all trials, which experienced different seasons, will be extended once reports have been completed.

Commercial practice

When choosing a cereal variety to graze in a low-medium rainfall area, consider soil moisture, how early you are able to sow, and whether there is confidence in the season outlook. If it is early, and there is good soil moisture you can choose a longer season variety. If it is approaching May and the soil is dry with an El Nino outlook then a well-adapted short-mid season variety will have good early vigour and reduce the risk of grazing to grain production.

Nitrogen responses are unlikely in lower rainfall seasons, even for grazed crops.

On-farm profitability

Grazing a wheat crop in a dry season will have less grazing value and generally will incur a grain yield penalty. However, the value of looking after lactating ewes and their lamb, or finishing valuable stock on nutritious green feed, on a crop (whether or not it has a compromised outlook) has longer term merit in terms of whole-of-farm resource and risk management.

Acknowledgements

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