Optimising dual-purpose wheat management practices for grazing and grain production in drier environments

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Key points

- During 2018, applying foliar micronutrient to a dual-purpose wheat crop after grazing helped aid crop recovery and maintained grain yield potential.

Background

High-value dual-purpose wheat for grazing and grain production is becoming an increasingly popular option in mixed farming systems. Dual-purpose wheat provides diversity within the system, generating income from both forage and grain in the production system.

Within a mixed farming enterprise, dual-purpose crops can fill an important winter feed gap when pasture growth rates are unable to meet livestock requirements. Mixed farming systems that incorporate dual-purpose wheats are also better placed to generate some income from livestock production (through grazing) if the crop fails due to climatic stresses, such as those experienced in many areas during 2018.

However, the impact on grain yield of grazing a wheat crop, particularly during a drier season, has always been a major concern for growers. In dry seasons, water availability becomes the most limiting factor to obtaining optimum crop yields because moisture stress impedes biomass production. This affects the ability of the crop to support recommended stocking rates without incurring grain yield penalties from grazing.

Plants also require macronutrients and micronutrients for optimal growth and development. Although micronutrients are only required in small amounts, they play an important role in various plant processes and are an important factor in crop growth and grain yield. Changing climatic conditions and limited options for crop rotations have affected soil health, especially beneficial macro and microflora, and the availability of adequate levels of macronutrients and micronutrients. Supporting the grazing and grain yield potential of a dual-purpose wheat crop requires an adequate supply of both micronutrients along with macronutrients.

Objectives

The project objectives were to

a) evaluate the performance of a dual-purpose wheat variety grazed during one of two different windows (the recommended grazing window and a later-than-recommended grazing window)

b) to evaluate the effect of micronutrient foliar application on crop recovery (grain yield) after grazing.

Materials and methods

The Australian Hard quality (South Australia and Victoria) dual-purpose wheat variety LRBP Kittyhawk, was used in this study. The trial site was located at The University of Melbourne, Dookie Campus farm (36.395°S, 145.703°E) in a paddock with a history of wheat and canola crop production. The trial site experiences a temperate climate, receiving an average annual rainfall of 575mm. The soil type is classified as Currawa Loam.

Kittyhawk wheat was sown into moisture at a rate of 85kg/ha on 27 April 2018. The crop was raised according to standard growing practices. The experiment was laid out in randomised complete block design with three replicates. Each replicate had six treatments;

1. Control (no grazing and no micronutrients)
2. Control with micronutrients (no grazing with micronutrients)
3. First grazing window (no micronutrients)
4. Second grazing window (no micronutrients)
5. First grazing window (with micronutrients)
6. Second grazing window (with micronutrients)

In total, there were 18 plots and each plot measured 33.3m × 50m in size.

Grazing windows, stocking rate and sampling data

A stocking rate of 21 sheep per hectare (calculated based on biomass available for grazing) was tested for two grazing windows; a) the recommended grazing window, 95–100 days after sowing at the 3–4 leaf stage and b) a second



grazing window, 110-115 days after sowing at the 5–6 leaf stage. Regular monitoring ensured sheep were removed before the crop was grazed below a certain height and this meant the grazing duration was different for each sowing window.

Due to there being less moisture in the paddock, the crop did not gain the expected biomass for the recommended grazing start time and stock were introduced only when the crop had accumulated enough biomass. Due to the drier start to the season, this was later than planned and also required a reduced stocking rate to ensure there was enough biomass for sheep to graze. These options were tested to see if late grazing (both windows) and a lower stocking rate would minimise grain yield penalties.

The first grazing window treatment saw sheep introduced at the 3–4 leaf stage (GS13–14) for 18 days and removed when the crop reached early tillering (GS23–24). The second sowing window treatment involved introducing sheep at the 5–6 leaf stage (GS 15–GS16) for 16 days, with sheep being removed at late tillering (GS28).

Foliar application of the micronutrients, at the rate of 1.0L/ha for the treated plots, was carried out after the completion of grazing for each of the two grazing windows and before flowering.

The micronutrient formulation used (not specified in this report) has had a proven effect on yield, irrespective of micronutrients available in the soil (paddock soil test results not presented). Sometimes these micronutrients are not available in plant usable form or there may be other interactions occurring in soil, which affect their availability to the plant. Therefore, foliar application of a specific micronutrient formulation can boost crop growth after grazing, particularly when water is a major limitation (because it can indirectly affect micronutrient uptake from soil in the time of need).

Results and discussion

The data were recorded for biomass production and grain yield as higher biomass production is generally linked to higher grain production in cereals when plants are not under stress. There were no significant differences between the two grazing windows in terms of the actual amount of dry matter (DM) removed due to grazing (Table 1).

Within the first grazing window, micronutrient application showed an improved, though non-significant yield increase of 0.066t/ha over the treatment that didn't receive a micronutrient application. For the second grazing window there was a similar, non-significant, trend towards a marginal yield increase with micronutrient application. Across all the treatments, the control (ungrazed) treatment with micronutrient application had the highest yield (0.935t/ha) (Figure 1, Table 2), which was significantly greater than the yield of the grazing window treatments that did not receive micronutrients. However, when yields from the first and second grazing windows were compared, micronutrient application led to a non-significant trend for higher grain yield from the first grazing window compared with the second window. The yield from the first grazing window with the micronutrient treatment was not significantly different from the grain yield of the ungrazed control with micronutrient treatment. The similarity in yield between these treatments suggests micronutrient application provided the crop with a boost which aided crop recovery after grazing and meant that there was no grain yield penalty from grazing in the first window compared to the control treatment.

Conclusion

Grazing duration, plant growth stage and stocking rate are critical factors affecting the success of dual-purpose crops during drier seasons. In a dry year, like 2018, grazing at the 3–4 leaf stage (when there is sufficient biomass), followed by a micronutrient foliar application, may be an option to maximise recovery and yield after grazing.

TABLE 1 Comparison of dry biomass after each grazing window

Treatment	Dry matter before grazing (t/ha)	Dry matter after grazing (t/ha)	Total dry matter removed due to grazing (t/ha)
First grazing window (T1)	0.64	0.70	0.52
Control*	0.60	1.22	
LSD	0.139	0.225	
Second grazing Window (T2)	0.99	1.08	0.54
Control*	1.22	1.62	
LSD	0.137	0.290	

* Respective control plot values of DM for each grazing window

Note: Stock were removed at early tillering (GS 23–24) for the first grazing window and at late-tillering (GS28) for the second grazing window.

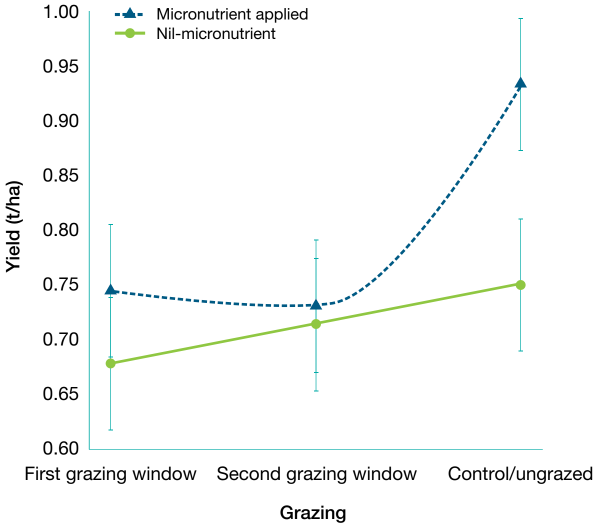

FIGURE 1 Grain yield comparison among various treatments

Wheat grazed after the first node stage (GS31–32) requires close attention to prevent the growing point being removed or damaged by livestock. Removal or damage to the growing point can lead to delayed plant recovery and low biomass production, which can ultimately affect grain yield.

TABLE 2 Comparisons of average grain yield according to treatment

	Without micronutrient	With micronutrient
	Grain yield (t/ha)	Grain yield (t/ha)
Grazing window 1	0.680[a]	0.746[ab]
Grazing window 2	0.716[a]	0.732[ab]
Control	0.752[ab]	0.935[b]
LSD (Interaction)	0.1916	

Note: Means for each grazing treatment with the same letter in common are not significantly different from one another.

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