Grazing systems for winter cereals

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Abstract

To make an economic assessment of the role of grazing cereals in farming systems, it is necessary to estimate the impact of grazing on the yield of the crop and determine any benefits to livestock production. It is the second of these components that is the subject of this paper. Two grazing systems, each replicated three times, were compared in terms of pasture availability and the liveweight gain of 30 kg Merino x Dorper lambs. Lambs grazed either lucerne pasture (composed of lucerne ~ 50% with barley grass, annual ryegrass and capeweed) for 18 weeks from 13 June to 15 October 2007 (treatment - L) or lucerne pasture for 6 weeks followed by wheat (cv. EGA Wedgetail) for 6 weeks and then returned to the lucerne for a further 6 weeks (treatment - LW). Lucerne plots were divided into three sub plots, which allowed the establishment of a 2 week on – 4 week off rotational grazing system, and were grazed at a stocking rate of 12.5 lambs/ha. Average liveweight gain for the LW treatment (20.1 kg/head) was significantly greater than the L treatment (16.1 kg/head). This difference in liveweight was only apparent at the end of the period of grazing the wheat crop. For the period after the LW lambs were returned to lucerne pasture there was no significant difference in the rate of liveweight gain between the two treatments. These results are discussed with respect to the future of systems level research in grain and graze enterprises.

Key Words

Grazing wheat, winter wheat, lucerne, grazing systems

Introduction

The opportunity to incorporate winter wheat cultivars into the cropping program of mixed farming systems has provided farmers with scope to increase the availability of winter feed on a whole-farm basis. The recent increase in interest in this option could be due to a number of factors, such as the availability of winter cultivars with better grain quality characteristics and considerable research and development support through the Grain and Graze program (e.g. Virgona et al. 2006a). Recent results obtained in southern NSW on the management of winter wheat showed that, even after heavy grazing, grain yield may only be slightly decreased (Virgona et al. 2006b). The impact on yield will depend considerably on prevailing weather conditions, particularly rainfall. In addition, management could play an important role but there is little data available to describe the impact of grazing on grain yield and its components.

To assess the worth of a dual-purpose grain crop in economic terms, it is important to quantify both the impact of grazing on grain yield and the effects on livestock production. In the simplest sense, this analysis can be done by measuring the change in liveweight of stock while grazing the crop, assessing the impact of grazing on grain yield and assigning a dollar value to these components. However, the flaw in such analyses is that they may be based on results from treatments imposed in experiments rather than the full set of options available to farmers. For instance, in the mixed-farming system of southern Australia, farmers can sow either winter wheat (presumably for grazing and grain recovery) or spring wheat (grain only). In experiments, the loss/gain in grain yield from grazing is usually compared to an ungrazed control. Instead, the yield of a well-managed spring wheat crop should be used as a comparison instead of the yield of an ungrazed winter wheat.

With respect to livestock production, a broader appreciation of the role of dual-purpose wheat will be gained from an analysis of the whole production system (including livestock and pasture) and not just livestock performance over the period of time that the wheat is being grazed. On most farms in the region, sheep will be moved from a pasture onto grazing wheat for a period of time in mid winter. Generally, depending on the season, stock could spend 2-8 weeks grazing wheat. This means that there could be some pastures on-farm that have not been grazed for a lengthy period over the winter months or, at least, have been grazed at lower stocking rates. While there are many indirect benefits of this rest (e.g. farmers able to spray pasture for weed control), the impact on subsequent livestock production (after being removed from the crop) needs to be taken into account as pastures rested over the wheat grazing period will enter the late-winter spring period with relatively high levels of feed available. For lucerne pastures, grazed on a rotational basis (e.g. Southwood and Robards 1971), it is possible that some paddocks may not be grazed for up to 10-12 weeks (depending on length of the grazing rotation) by the time sheep are returned to lucerne after grazing wheat. The experiment reported here assessed the effect on lamb liveweight of grazing lucerne-based pasture alone compared to a system in which grazing wheat was made available for a set period after which sheep were returned to the lucerne. In addition, measurements of pasture productivity are also reported.

Methods

The experiment was located on the Wagga Wagga Agricultural Institute (35º 5' S, 148º 6' E., elevation 219 m, average annual rainfall 572 mm). Part of an existing paddock originally sown to lucerne (cv. Aurora) on a red kandosol soil in 2004 was subdivided into 6 plots (each 0.4 ha in size). Two treatments, grazing lucerne only (L) and grazing lucerne interrupted by a period grazing winter wheat (LW), were allocated to the plots consistent with a randomised complete block design of two treatments and three replicates. Merino x Dorper lambs (approximately 30 kg at commencement of the experiment) either grazed lucerne pasture for 18 weeks from 13 June to 15 October 2007 (L) or grazed lucerne pasture for the first 6 weeks from 13 June followed by a period grazing wheat for 6 weeks and then returned to the lucerne for a further 6 weeks (LW). Each of the three replicate flocks grazed the wheat paddock in common. Each lucerne plot was divided into three equal-sized sub plots which allowed the implementation of a 2 weeks on – 4 weeks off rotational grazing system. Each plot was grazed with 5 lambs at a stocking rate of 12.5 lambs/ha. The wheat crop that was grazed for the LW treatment was sown to the cultivar EGA Wedgetail on 8 May 2007 on the same soil type in a nearby paddock. The LW lambs grazed this area at the same stocking rate (12.5 head/ha) as the lucerne pasture.

Dry matter estimates were made on subplots that had either ceased to be grazed or were about to be grazed every two weeks. For the first four measurements these were done using the comparative yield method of Haydock and Shaw (1975). A shortage of experienced operators resulted in a change by making direct cuts on ten 0.25 m^2 randomly placed quadrats per plot at each subsequent sampling time. Similarly, dry matter cuts were taken every two weeks while sheep grazed the winter wheat. The lucerne pasture of the LW treatment was not measured whilst the lambs were grazing wheat. Statistical analysis was confined to a simple analysis of variance of lamb growth rates.

Results

In 2007 little rain fell over the crucial May-October period (153 mm compared to median of 295 mm). As a result, pasture growth was generally poor. In addition, as there was lower than average rainfall in preceding years, the annual component of the pasture was less than would normally be expected. Hence, the pastures were dominated by lucerne (48%) with barley grass (19%), capeweed (15%) and annual ryegrass (10%) present. Unusually, there were only trace amounts of annual legumes in the pasture – presumably the result of the run of poor seasons.

Liveweight gains for three grazing periods are reported in Table 1. The first and third periods are the times that lambs in both treatments were grazing lucerne only. There was no treatment effect on the rate of liveweight gain for either period. However, in the second period when L sheep grazed lucerne pasture and LW sheep grazed winter wheat, there was a significant difference in rate of liveweight gain. Over the whole grazing period this meant that the LW lambs grew at a significantly faster rate ($P < 0.05$) than the L lambs. By the conclusion of the experiment, the liveweight gain of LW lambs was 20.1 kg/head compared with 16.1 kg/head for the L lambs

In Figure 1, feed availability is presented as the average of the amount available when grazing commenced and the amount left when grazing ceased in each sub plot. Over the first six weeks there were no differences between the treatments (Figure 1). The increase in feed available when the LW lambs were moved to grazing wheat is obvious but no valid statistical comparison can be made. Note also that there was a greater availability of feed to the LW lambs when they were returned to lucerne pasture (after 11 September) which had not been grazed for 10 weeks.

Table 1. Growth rate (g/day) of lambs grazing lucerne only (L) and lucerne with a period on grazing wheat (LW). Lambs in L treatment grazed Lucerne throughout whereas lamb in the LW treatment grazed wheat in the second period and Lucerne in periods one and three. Statistically significant (P<0.05) differences within a time period are denoted by *.

	First period 13 June – 23 July	Second period 23 July – 3 Sept.	Third period 3 Sept. – 15 Oct	Whole period 13 June – 15 Oct.
Lucerne	77	135	244	129
Lucerne/Wheat	113	209*	235	162*

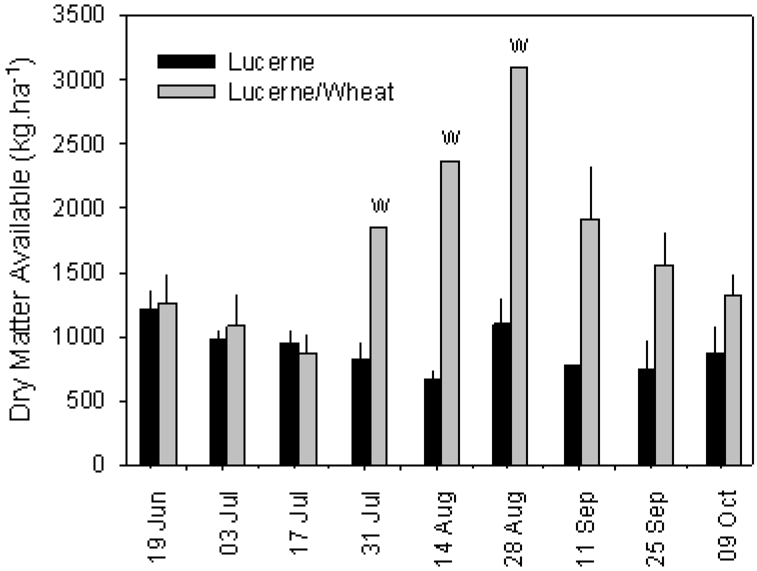

Figure 1. Average and standard error (bar) of feed availability (kg/ha) for each grazing period for lucerne and lucerne/wheat treatments. Each of the three replicate flocks grazed the wheat (marked by a w on the graph) in common so estimates of replicate error cannot be made.

Discussion

The results clearly show the advantage of having winter wheat available in mid winter for grazing in terms of liveweight gain. However, the extra pasture available that accumulated while lambs were grazing wheat did not increase subsequent growth rate when the lambs were returned to lucerne pasture. Presumably, there was enough pasture available in the Lucerne only treatment to maximize liveweight gain. This result, although based on only one year of data, tends to support the notion that performance of livestock while grazing wheat alone will be enough to determine the returns from the livestock enterprise.

There is a further need to investigate how other aspects of livestock management (stocking rate, timing of lambing etc.) could be altered to make more efficient use of the wheat feed base. It is very likely that systems level experimentation (of which this is a very limited example) will need to take place in order to assess the practicality and economics of such options. Nonetheless, given the array of management options available, it is unlikely that experimentation alone will be able to test all of these. Hence, system-level experimentation will need to proceed in partnership with systems-level modeling in order to fully explore the role of grazing wheat in mixed farming systems. The experimentation is required for both extension and validation of model outcomes while the modeling is required to extrapolate beyond the limited management options that can be tested using experimentation.

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