Grazing dual-purpose wheats during winter can have indirect effects on pasture production and profitability

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Introduction

The deferment of grazing (resting a pasture from grazing) has long been recognised as a key grazing management tool, with the potential to alter pasture composition and increase pasture productivity (Brand and Goetz 1986). Often, however, the short-term cost to livestock production during the period of deferment can outweigh the benefits later in the growing season. The response of pasture production and composition to grazing deferment is often dependent on the seasonal conditions during which the grazing trial is taking place, with marginal effects likely when rainfall is low (e.g. Garden *et al.* 2000). It can also be difficult to generalise the effects of the timing and length of deferment from grazing trials that run over a relatively short period (<5 years), as they are sampling only a limited number of the potential seasonal conditions.

Recently, the use of dual-purpose cereals as a winter forage has been shown to produce high livestock weight gains (Dove *et al.* 2007). While animals graze the winter wheat crops in other paddocks, grazing pressure on the main pasture area is reduced; grazing of dual-purpose crops should therefore provide the benefits of deferred grazing as well as a short-term boost to animal production. We have therefore analysed the question: to what extent does removing animals onto dual-purpose cereals affect subsequent pasture masses on the rest of a farm, and hence its profitability?

Simulation modelling provides the opportunity to examine the potential benefits of deferred grazing over a long time frame, incorporating climate data from a broad range of years. Another advantage of a modelling approach is the ability to easily compare how deferred grazing may influence pasture productivity and composition in different grazing systems (i.e. different flock or pasture types).

Here we apply the computer based decision support tool, GrassGro, to examine how the timing of cereal grazing influences pasture productivity and gross margins for two enterprise types at Inverleigh (VIC): a self replacing Merino flock and a cross-bred ewe flock. GrassGro models the whole grazing system (soil – pasture – animal), and allows a broad range of management options to be compared quickly and easily for a grazing enterprise (Moore *et al.* 1997).

Method

GrassGro simulations were run using weather data (1960 to 2007, SILO Data Drill) for Inverleigh (VIC 38^{o}09’S 144^{o}03’E). Mean annual precipitation over this period was 545 mm and the soil represented in the simulations was a black cracking clay (light clay overlying medium clay). The pasture simulated was a mixture of perennial ryegrass (*Lolium perenne*), annual grass (non-specific), and subterranean clover (*Trifolium subterraneum*).

Two grazing enterprises were simulated: self-replacing Merinos and cross-bred ewes. For the self-replacing Merino flock, lambing date was 11th August, surplus lambs were sold on 20th December, stocking rate was 12 ewes/ha with hoggets retained, and ewes were supplemented with whole wheat to maintain condition if the thinnest ewes in an age class fell below score 2. For the cross-bred ewe flock, 1st cross ewes were mated to Dorset rams with lambing on 1st August, all lambs were sold (when they reached 45 kg or by 15th March), replacement ewes (18 months) were purchased and CFA ewes sold at 7 years, stocking rate was 9 ewes/ha, and ewes were supplemented with wheat to maintain condition if the thinnest ewes in an age class fell below score 2.5.

Continuous grazing of the pasture was compared with 6 deferment periods, each of two weeks' duration (i.e. a short, intense period of grazing the cereal crop): 15-31 May, 1-14 June, 15-30 June, 1-14 July, 15-31 July, and 1-14 August. In order to mimic grazing a winter wheat crop during deferment, all livestock (ewes and any lambs) were removed from the paddock to a feedlot over the deferral period and fed a very high quality supplement *ad-lib* that had a dry matter content of 20%, dry matter digestibility of 85% (13.1 MJ ME/kg DM) and crude protein content of 24%. To investigate whether the initial amount of pasture influenced the effects of deferment, 2 levels of soil fertility were compared for each enterprise by setting the soil fertility scalar to 0.80 and 0.95 (where 0.5 = very low and 1.0 = very high) with the same stocking rate.

This system was used to test the effect of removing all livestock from the pasture at various times and to calculate the combined benefits of both a high quality diet during grazing of the dual-purpose wheat crop and of additional pasture at lambing. The effects on ewe and lamb production were carried over between seasons and were evaluated using gross margin analysis of the whole enterprise.

Our analysis assumes that animals and plants are free of pests and diseases, that removal of livestock from pastures onto a cereal crop during the pasture deferment period occurs at no cost, and that ample crop is available every year for grazing. Our results are indicative and specific for the weather, soil and enterprise simulated at this site.

Results and Discussion

Self-replacing Merino flock

For the self-replacing Merino flock, deferring grazing for 2 weeks increased median pasture availability on the 1st August by 14-37%, depending on the timing of deferment (Table 1). Median values (the value expected in at least half the years) were used for pasture availability rather than averages, due to the skewed distribution of pasture supply between years. Deferment for 2 weeks in late July resulted in the accumulation of more pasture than earlier deferment (late May) (Fig. 1). The average gross margins of the self replacing Merino flock increased by

6-10% when grazing was deferred for 2 weeks (Table 1). Higher gross margins under deferred grazing were due to two main factors: (1) increased animal production when given 2 weeks consuming a high-quality simulated winter wheat crop, and (2) additional pasture growth being available for consumption after the period of cereal grazing.

Table 1. The response to a 2-week period of deferment for a self replacing Merino ewe flock at Inverleigh, for a pasture with moderate soil fertility and stocking rate of 12 ewes/ha.

Grazing system	**Median green herbage available on 1 Aug** *(kg DM/ha)*	**Additional pasture available on 1 Aug** (relative to continuous grazing) *%*	**Average gross margin** (1961-2006) *$/ha*	**Change in gross margin** (relative to continuous grazing) *%*
Continuous grazing	920	0	562	0
Deferment 15-31 May	1050	14	612	9
Deferment 1-14 Jun	1060	15	598	6
Deferment 15-30 Jun	1140	23	602	7
Deferment 1-14 Jul	1185	28	605	8
Deferment 15-31 Jul	1265	37	621	10
Deferment 1-14 Aug	1025	11	612	9

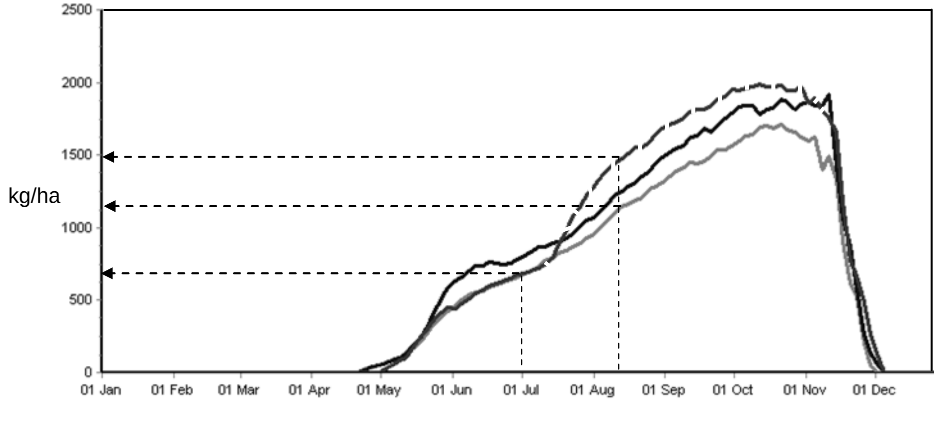

Figure 1. The median amount of available green pasture (kg/ha) for continuous grazing (grey line) and deferment for 2 weeks over 15-31 May (black line) and 15-31 July (dashed line) at Inverleigh (1961-2007) for the self-replacing Merino flock on moderately-fertile soil. Pasture availability under continuous grazing was approximately 600 kg/ha on 1 July and about 1100 kg /ha at lambing (11 August), which increased to about 1500 kg /ha if grazing was deferred during late July.

When deferred grazing was examined on a soil with high fertility, 40-50% more herbage was accumulated by 1 August than for the soil with moderate fertility. However, deferring grazing of the high fertility pasture for 2 weeks increased median pasture availability on the 1st August by only 12-28%, compared to the 14-37% increase for the moderately fertilised pasture. In addition, the absolute amount of pasture accumulated by 1st August due to deferment in late May was similar on both moderate and high fertility soils (about 500kg DM/ha). This result means that deferment was relatively more effective for moderately than for highly-fertilized pasture at the same stocking rate.

Cross-bred ewe flock

When examining the effects of deferred grazing for the cross-bred ewe flock, some key differences emerged in comparison to the self-replacing Merino flock. These differences were largely associated with the lower stocking rate for the cross-bred ewe flock (9 ewes/ha compared to 12 ewes/ha for the Merino flock) which reduced the pasture utilisation rate on the moderately fertile soil to 64% (compared to 74% for the Merino flock).

Table 2. The response to a 2-week period of deferment for a cross-bred ewe flock at Inverleigh, for a pasture with moderate soil fertility and stocking rate of 9 ewes/ha.

Grazing system	**Median green herbage available on 1 Aug**	**Additional pasture available on 1 Aug** (relative to continuous grazing)	**Average gross margin** (1961-2006)	**Change in gross margin** (relative to continuous grazing)
	(kg DM/ha)	*%*	*$/ha*	*%*
Continuous grazing	1780	0	429	0
Deferment 15-31 May	1840	3	444	3
Deferment 1-14 Jun	1820	2	440	3
Deferment 15-30 Jun	1865	4	441	3
Deferment 1-14 Jul	1855	4	453	6
Deferment 15-31 Jul	1900	7	478	11
Deferment 1-14 Aug	1795	1	454	6

For the cross-bred ewe flock, deferring the grazing of the pasture for 2 weeks increased median pasture availability on 1 August by 3-7%, depending on the timing of deferment (Table 2). The cross-bred flock’s pattern of pasture consumption and lower overall pasture utilization rate resulted in higher initial pasture availabilities which were not greatly increased during a 2-week deferment. There were no consistent differences in herbage accumulation between May and July deferment periods. Cereal grazing increased average gross margins of the cross-bred flock by 3-11% (Table 2). Pasture availability was not as limiting for the cross-bred flock as it was for the Merino self-replacing flock and savings in supplementary feed costs were minimal.

When deferred grazing was examined on a soil with high fertility, very similar production values were obtained relative to those on the moderately fertile soil. Increasing the stocking rate of the cross-bred flock to 11 ewes/ha increased the pasture utilization rate to 74%, which was similar to the self-replacing Merino flock. At the higher stocking rate, the relative increase in the amount of pasture accumulated on 1 August from deferment in late July (11%) was also similar to the Merino flock, while the relative increase in gross margin (14%) was greater than the Merino flock.

Conclusion

Our analyses with GrassGro show that for both the self-replacing Merino flock and the cross-bred ewe flock, the timing of the 2 week cereal grazing period was critical in influencing pasture production and gross margins. For the enterprises we examined, deferring grazing at the end of July generated the greatest increases in pasture production and gross margins.

Our analyses also indicated that deferring grazing was relatively more effective at increasing pasture availability on the moderately fertile soil compared to the highly fertile soil. This result is most likely due to the greater effect that grazing has in limiting pasture growth on a less fertile soil, given a constant stocking rate.

The comparison we present between the Merino and the cross-bred ewe flock indicates that responses to grazing deferment can be quite sensitive to the individual conditions of a grazing enterprise. In this case, the cross-bred ewe enterprise did not benefit from grazing deferral as much as the Merino flock did. This result is most likely due to differences in stocking rates between these enterprises, with greater benefits from grazing deferral achieved where the stocking rate is higher. We conclude that grazing dual-purpose cereals is likely to have indirect as well as direct benefits, though increasing pasture availability on the rest of the property, but only if overall pasture utilization is high.

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