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The effects of winter grazing rotation speed on the performance of beef finishing systems

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ABSTRACT

A beef farm systems experiment was conducted for 2 years in which winter grazing management of either a fast rotation (FR) of 45 days, or a slow rotation (SR) of 120 days was applied to eight small farms containing either rising-1yr, or rising-2yr Angus steers (15/farm). All farms were managed in a fast rotation (<35 days) during spring and summer. Average farm pasture covers at the end of winter were 563 (±80) and 347 (±53) kg DM/ha higher on the SR farms than the FR farms for the first and second years respectively. The FR steers at the end of winter were on average 26 (±4.0) and 22 (±4.2) kg heavier than the SR steers in the first and second years respectively. By late summer, the FR steers were 15 (±5.3) kg heavier and 2 (±5.6) kg lighter than the SR steers. There were no significant management interactions with age class. Live weight compensation of the SR steers was rapid during the first 6 weeks of spring. The results of this experiment show that winter grazing rotation length had little effect on the final live weight achieved by summer. However, between-year differences showed that systems compensation during spring is dependent on pasture supply, pasture quality and stocking rate. With the ability of a whole-farm system to show compensation, a slow winter rotation is a low risk option if climatic uncertainty is an issue.

Keywords: grazing rotation; pasture cover; cattle live weight; compensatory growth; farm systems.

INTRODUCTION

Within most New Zealand beef finishing systems, winter pasture supply constrains annual stocking rate and farm productivity. In designing winter management systems, beef farmers have to balance stocking rate and cattle growth rate to achieve the most efficient and profitable use of this valuable winter pasture supply.

Once stock policy and stocking rate are established, the ability to control pasture allocation during winter is by alteration of grazing rotation length. The use of a fast rotation or set stocking during winter will generally ensure cattle growth rates are maximised during early winter. However, during late winter, pasture covers may fall too low to sustain both desired cattle and pasture growth rates. The use of a slow grazing rotation during winter will compromise cattle growth rates, but will assist in maintaining farm pasture cover through into late winter-early spring (Sheath *et al*., 1987).

The phenomenon of compensatory growth within beef cattle has been well debated and documented within the agricultural industry (Nicol and Kitessa, 1995; Hogg, 1991). However, most of the research that underpins the understanding of compensatory gain has looked at the animal in isolation from the effects of pasture flow in subsequent seasons. Understanding the interactions between pasture and animal on a whole-farm system basis is important to get a true picture of the implications of differing management systems on target live weights and product quality. The concept that a whole-farm system may display compensation, over and above the normal compensatory growth of the animal, has been little explored.

The experiment reported in this paper was designed to test the farm systems response to two different winter rotation speeds interacting with two different age classes of beef cattle. The effects of these treatments on pasture treading damage and meat quality have previously been reported in Sheath and Boom (1997) and Boom and Sheath (1997) respectively. This paper reports the treatment effects on pasture supply and cattle live weight gains.

MATERIALS AND METHODS

Experimental Design

A farm system experiment was conducted for 2 years at Whatawhata Research Centre with a 2 x 2 factorial design with two replicates giving a total of eight self-contained farms. Treatments were either rising 1-year (R1) vs. rising 2-year (R2) Angus steers which were managed during winter in either a fast (FR) or slow (SR) grazing rotation. The winter grazing treatments were applied from early May through to mid August. The winter grazing rotation length was approximately 45 days for the FR treatment and 120 days for the SR treatment. During spring (mid August onwards) both treatments were run in a fast rotation of approximately 28 days. Pasture grazing levels for the 2 monitored farms are outlined in Table 1.

Land and animals

R1 and R2 farms consisted of 7.2 ha and 11.9 ha each respectively. Each farm contained approximately 40% easy and 60% steep hill land and had a minimum of 15 paddocks. Farmlets were stocked with 15 Angus steers and either 30 or 50 Romney ewes for the R1 and R2 farms respectively. The differing land areas and ewe numbers between the R1 and R2 farms ensured a common winter feed demand/ha and a sheep:cattle ratio of 30:70. This resulted in a nominal stocking rate of 12.8 SU/ha on all farms. To ensure differences did not confound the management x age class interaction, all three generations of Angus steers were sourced from the same beef breeding herd.

At the beginning of each experimental year (April), steers and ewes were randomised onto the farms. Within each farm, steers and ewes were allocated to separate blocks of land from early May through to late November, and then integrated from December to April. This lead to a winter stocking rate on the cattle blocks of 3 and 1.8 steers/ha for the R1 and R2 farms respectively. In order to reflect the

TABLE 1: Average pre and post-graze pasture mass (kg DM/ha) and pasture allowance (kg DM/100 kg LW) for the steers on the rising-1 year fast rotation (R1 FR) and rising-2 year slow rotation (R2 SR) treatments.

Treatment	Pre-graze	Winter Year 1 Post-graze	Allowance	Pre-graze	Spring Year 1 Post-graze	Allowance
R1 FR	2144	1328	7.6	2140	1539	8.3
R2 SR	2700	939	2.6	2772	1830	9.0
		Winter Year 2			Spring Year 2	
R1 FR	1802	1219	9.8	1773	1099	7.5
R2 SR	2131	890	3.6	2311	1385	8.4

seasonal demand of the ewes relative to the cattle, the ewes were allocated 30% of the land area during winter. This was increased to 40% at lambing (1 September) and in the second year of the experiment increased again to 50% in early October. Throughout the experiment, ewes were under common management on all farms so that treatment effects were reflected in the cattle pasture supply and growth rates only. No supplements were fed during the experiment.

Data collection

Steers were weighed 4-weekly after moving into a new pasture break 24 hours earlier in order to ensure a constant level of gut fill. All pasture mass estimates were made by a calibrated visual estimation technique (Haydock and Shaw, 1975). To provide an indication of grazing level pre and post-graze pasture mass was estimated for all steer grazings within the R1 FR and R2 SR treatments of the first replicate. Total farm pasture cover was assessed 3-monthly.

Analysis of variance was used to compare treatment differences (SAS, 1985).

RESULTS AND DISCUSSION

Winter treatment responses

The differing rotation lengths resulted in the FR treatments receiving a pasture allowance during winter nearly three times that of the SR treatments (Table 1). Steer growth rates during winter, which averaged 0.30 and 0.09 kg LWG/head/day for the FR and SR treatments respectively, were very similar between the two experimental years (Table 2). Averaging both years, the R1 FR treatment steers were 18 kg heavier (P<0.001) than the R1 SR steers at the end of winter. The R2 FR steers were more responsive to the winter feeding level, averaging 30 kg heavier (P<0.001) than the R2 SR steers. The live weight differences between FR and SR treatments at the end of winter were surprisingly small given the difference in pasture allowance. Subsequent experiments by the authors (unpublished) have found the winter growth rates of this same line of Angus steers to be approximately half those of Friesian bulls under the same feeding conditions.

At the end of winter, the average farm pasture cover on the cattle blocks of the SR farms was 563 and 347 kg DM/ha higher (P<0.001, both years) than the FR farms in the first and second years respectively (Table 3). This accumulation of pasture on the SR farms was in response to the feed rationing effect of the slow rotation treatment. However, the pasture required for the extra LWG on the FR treatments would account for only 190 kg DM/ha of this pasture cover difference. This would suggest higher pasture growth or less pasture wastage occurred on the SR treatments. Other research would suggest both of these could be involved. Coutinho *et al*. (1998) showed pasture growth increased in response to higher pasture covers during winter, while Sheath and Boom (1997) showed that a slow grazing rotation would result in less pasture mass trodden into the soil on a total farm system basis.

Spring compensation responses

During the spring periods, the SR treatments were given unrestricted access to the saved pasture through a fast rotation. Figures 1 and 2 illustrate the effect of the fast and slow winter rotation on the pasture available for the steers over the spring months. The SR treatments ended winter

TABLE 2: Average steer live weights (kg) for rising-1 year (R1) and rising-2 year (R2) steers under either fast (FR) or slow (SR) winter grazing rotation treatments.

Year 1 Treatment	5 May	29 Jun	18 Aug	14 Sep	12 Oct	10 Nov	14 Dec	25 Mar
R1 FR	190	206	214	229	261	288	314	335
R1 SR	186	191	195	227	246	275	304	324
R2 FR	374	393	406	421	444	486	502	524
R2 SR	370	367	374	417	435	475	483	507
SED	3.7	3.6	4.0	4.3	4.7	4.8	5.0	5.3
Year 2 Treatment	**27 Apr**	**21 Jun**	**16 Aug**	**13 Sep**	**11 Oct**	**8 Nov**	**6 Dec**	**28 Feb**
R1 FR	187	191	221	250	274	299	333	354
R1 SR	188	187	204	236	266	299	327	359
R2 FR	336	343	374	403	440	477	500	519
R2 SR	336	335	346	387	429	459	491	517
SED	4.1	3.9	4.2	4.8	5.2	5.2	5.5	5.6

with a significant advantage in average pasture mass, and had >30% of their paddocks with a pasture mass exceeding 2000 kg DM/ha to begin the spring rotation. It should be noted that although pasture allowances during spring were similar between the treatments, the pre and post-grazing levels were higher in the SR treatments (Table 1).

In the first year, the SR steers had fully compensated after 4 weeks of spring grazing (Table 2). However, as spring progressed the difference between the treatments widened again, whereby the FR treatments were eventually 11 and 17 kg heavier ($P<0.05$) for the R1 and R2 steers respectively. In the second year, compensation within the SR treatments was not so rapid, but was complete after 5 months. In their review paper on compensatory growth in cattle, Nicol and Kitessa (1995) reported that recovery of live weight resulting from restricted feeding only averaged 37%. The higher recovery levels in this experiment, especially in the second year, must be attributed, in part, to the added advantage of higher pasture levels on the SR farms at the start of the recovery period. This reflects the full systems response.

FIGURE 1: Pattern of pasture mass (average of each paddock, kg DM/ha) within FR farms on 24 August.

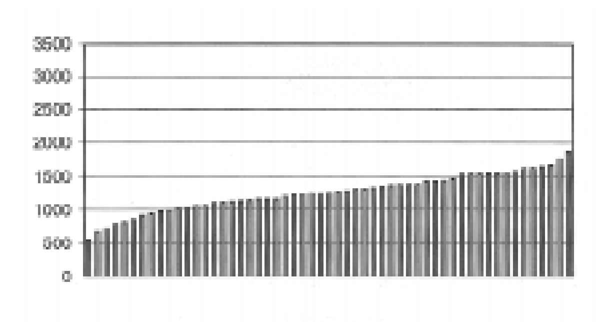
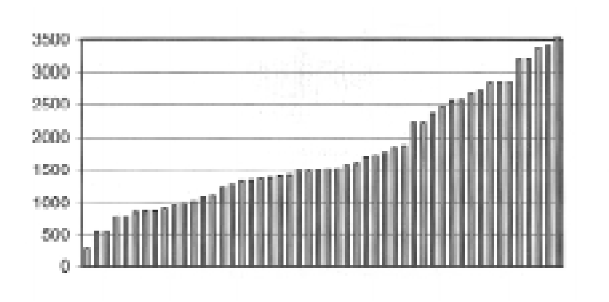


FIGURE 2: Pattern of pasture mass (average of each paddock, kg DM/ha) within SR farms on 24 August.



By mid-November the SR treatments still retained 410 and 323 kg DM/ha higher (Year 1 $P<0.05$, Year 2 $P<0.001$) pasture cover levels on the cattle blocks for the first and second years respectively. This advantage disappeared by late summer in both years.

Pasture supply and quality interactions

The between-year differences in the compensation of steers during spring can be explained by differences in pasture mass. Table 3 shows the average farm pasture cover in November was almost 700 kg DM/ha higher in the first year than the second. The favourable pasture growing conditions that occurred during spring of the first year resulted in the loss of pasture control on the SR farms. The resultant lower pasture quality in these SR farms was a disadvantage to steer live weight gain during late spring/summer. During the second year, lower pasture masses and associated better pasture quality provided the SR steers the opportunity to fully compensate.

These between-year differences demonstrate the significant negative interaction that can occur between pasture quantity and quality. As experienced in the first year, there is little point in accumulating pasture quantity to the extent that quality is jeopardised. Similar results were reported for sheep systems by Smeaton & Rattray (1984). Targeting a pasture cover at the end of winter of 1800 kg DM/ha is often recommended to beef finishers. However, this experiment shows the importance of considering subsequent pasture growth and demand balances when setting such targets. It also highlights the need to be flexible in the allocation of pasture and land to different stock classes or pasture conservation (silage) during the October-November period.

TABLE 3: Average pasture cover (kg DM/ha) on cattle blocks for rising-1 year (R1) and rising-2 year (R2) steers under either fast (FR) or slow (SR) winter grazing rotation treatments.

		Year 1		
Treatment	14 May	24 Aug	16 Nov	23 Mar
R1 FR	2455	1276	2883	1927
R1 SR	2300	1758	3278	1956
R2 FR	2382	1217	3001	2224
R2 SR	2154	1861	3435	2444
SED	93	46	118	88
		Year 2		
Treatment	5 May	24 Aug	22 Nov	22 Feb
R1 FR	1674	1225	2095	1463
R1 SR	1620	1710	2609	1604
R2 FR	1892	1361	2511	1859
R2 SR	1791	1570	2643	1869
SED	46	25	20	93

Age effects

Differences in live weight that were generated by the winter rotation treatments were smaller for the R1 steers (Table 2). Consequently, this age class had a lower level of live weight compensation to achieve. During spring, the extent of the relative compensation within each age class was similar. Therefore, there was no rotation length x age class interaction recorded in this experiment. Other work on compensatory growth would support this result in that only with very young animals (i.e.; less than 16 weeks) does age have an effect on the ability to compensate for previously restricted feeding regimes (Hogg, 1991). The implication of these results rests in the opportunity to differentially feed different age classes according to target growth paths without incurring any negative interactions within the system.

Fast or slow?

The restriction of cattle growth rates over winter through the use of a slow rotation has been advocated as a tool to fully express the growth potential of both pastures and cattle in early spring (Sheath *et al*., 1987). The significance of this period is well illustrated in this experiment by comparing the winter and spring growth rates of FR cattle.

Spring live weight gains far exceeded those of the winter, yet pre and post-grazing herbage masses were similar for the 2 periods (Table 1).

The decision of rotation speed during winter will depend on the balance of pasture supply and demand, and the element of risk that is acceptable with regard to maintaining late winter-early spring pasture covers. The use of a slow rotation during winter reduces this risk. The extent of the restriction will be counterbalanced by the need to maintain positive growth to achieve targeted market times and weights. From the results of this experiment it would seem that the choice of winter rotation speed and differential management of age classes lies in the management of risk and achieving market targets, rather than the effect on total system production.

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