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Comparison of grazing management systems for calves and yearling steers

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Abstract

In dairy beef systems, calves and yearlings are managed together at pasture in a leader/follower grazing arrangement. In this study, leader/follower (L), mixed (M) and separate (S) grazing systems were compared. The M calves and yearlings grazed together while the S calves and yearlings had separate paddocks. Yearlings and calves were turned out to pasture on March 19 and May 14, respectively and the treatments ended on September 23. The yearlings were then finished indoors and slaughtered the following spring. The calves were housed for the winter on a moderate plane of nutrition and were subsequently turned out to pasture for a second grazing season. Mean live weight gains of the calves for L, M and S during the grazing treatments were 964, 685 and 573 (s.e. 28.8, P<0.001) g/day, respectively. Corresponding values for the yearlings were 891, 948 and 1075 (s.e. 35.5, P<0.01) g/day. There was no compensatory growth the following winter in either the calves or yearlings. Slaughter weights and carcass weights for the yearlings when finished were 642, 661 and 678 (s.e. 9.4, P<0.05) kg, and 345, 357 and 366 (s.e. 5.6, P< 0.05) kg, for L, M and S respectively. There was some compensatory growth in the second grazing season. It is concluded that L benefited the calves but restricted the yearlings while S had the opposite effect. The challenge is to devise grazing systems to achieve the L calf performance and the S yearling performance.

1. Introduction

In two-year-old dairy beef systems, calves and yearlings are managed together at pasture. There are many systems of management but the standard is a leader/follower rotational grazing arrangement, with the calves as leaders and the yearlings as followers. The animals are moved in rotation through a series of paddocks and the speed of movement within the rotation is determined by the stubble height on the yearling paddock. When this reaches a pre-determined value (ca. 6 cm), the yearlings move to the next paddock which is then vacated by the calves. The calves in turn move forward to a fresh paddock. A major benefit of leader/follower grazing in the past was that it aided the control of gastrointestinal parasites in the calves. With the advent of systemic anthelmintics, management-based control of parasites is now less critical so other grazing arrangements can be considered. In a leader/follower system, calves have first choice of herbage selection so the system would be expected to benefit them to the detriment of the yearlings. With stocking rates now constrained on many beef farms to comply with agri-environmental schemes such as the Rural Environment Protection Scheme (REPS) in Ireland and the Nitrates Directive, it is opportune to consider other grazing managements systems.

The objective of this study was to compare three grazing management systems, namely leader/follower (L), mixed grazing of calves and yearlings (M), and separate grazing of calves and yearlings (S).

2. Materials and Methods

2.1 *Animals and land*

Charolais x Friesian yearling steers (n = 48) and calves (n = 48) were managed on a 16 ha grassland farm unit that provided both grazing and silage for the animals.

The yearlings were blocked on live weight and assigned to the L, M, S treatments at turnout. The calves were assigned at random to the treatments when they were turned out. Silage was harvested from 9.25 ha in late May and from 7.75 ha in late July, leaving 6.75 ha and 8.25 ha available for grazing until mid June and end of July, respectively. The 6.75 ha area grazed until mid June was divided into 27 paddocks of 0.25 for each. From these, 9 paddocks were assigned at random to the L, M and S, grazing managements. The 1.5 ha of first-cut silage area returned to grazing immediately afterwards was divided into 6 paddocks each of 0.25 ha. These were assigned at random to the three grazing managements. The second silage cut area was afterwards divided into 9 paddocks of 0.86 ha each and 3 were assigned to each of the grazing managements. The first cut silage was fed to the yearlings, and the second cut was fed to the calves, during the winter.

2.2. ***Grazing management***

Grazing rotations were about 4 weeks in duration until early August when they were extended by 5 days per rotation to a maximum of 45 days by the end of the grazing season. The 3 groups of yearlings commenced each rotation together but moved independently during the rotation based on the target post grazing sward height of 6 cm. Herbage in excess of that required in any rotation was harvested and conserved as baled silage. Where this occurred in a treatment, the corresponding paddocks for the other two treatments were cut or topped.

The L system was operated conventionally with the calves grazing the paddocks immediately ahead of the yearlings. When the yearlings had grazed to the target stubble height they moved to the next paddock and the calves did likewise. In the M system, the calves and yearlings grazed together throughout the season.

In the S system, paddocks were assigned to the calves and yearlings in approximate ratios of their mean metabolic body weights at the start of each rotation, subject to a minimum of 3 paddocks for the calves. The animals grazed those paddocks rotationally and the yearlings moved on the basis of 6 cm sward stubble height. It was originally intended that the calves would graze to this sward stubble height also but that proved impractical as sward height became progressively more uneven as the season progressed. Therefore, the calves moved when the tightly grazed areas within the paddock reached a sward stubble height of 6 cm. The paddock was then topped. Because of this, the calves moved more frequently than the yearlings, and this together with their smaller number of paddocks resulted in some or all paddocks being grazed more than once in a rotation.

2.3 ***Management schedule***

The experiment commenced at turnout of the yearlings to pasture on March 19. Initially, they grazed the silage area before moving to the experimental grazing area on April 15. The calves were turned out on May 14 (corresponding yearling weight taken on May 8), so in reality the treatments commenced then. The comparison ended on September 17, and from then until September 23, all the animals (calves and yearlings separately) grazed together to equalise gastrointestinal contents. This is taken as the end date for the treatments and it was also the date of castration of the calves. From September 30 to housing on November 18, the calves were offered 1kg concentrates per head daily at pasture. The yearlings remained at pasture without supplementary concentrates until October 28 when they were housed in a slatted floor shed and offered grass silage *ad libitum* until November 18 when finishing commenced. The finishing diet was

grass silage *ad libitum* plus 5 kg concentrates per head daily. After a finishing period of 147 days they were slaughtered together in a commercial abattoir. Carcass weights, carcass classification and perirenal plus retroperitonal fat weights were recorded.

The calves were also housed in a slatted floor shed in winter and offered grass silage plus 1kg concentrates per head daily over a 126–day period until March 24. They were then turned out to pasture and grazed as a single group in a leader/follower rotational grazing system for 224 days until November 3 when the experiment ended.

2.4 *Statistical analysis*

The data were analysed using the general model least squares procedures of the Statistical Analysis Systems Institute (SAS, 2002-2003). The data for the calves were analysed for treatment effects only whereas in the yearlings data analysis there was also a term for block. Means were separated using the PDIFF statement.

3. Results

3.1 *Feed analysis*

The analysis of the first cut silage was 188 g/kg dry matter (DM), 151 g/kg crude protein (CP), 745 g/kg *in vitro* DM digestibility (DMD) and pH 4.0. The second cut silage had corresponding values of 218, 138, 711 and 3.9. The analysis of the concentrate mix used for all animals was 862 g/kg DM, 139 g/kg CP and 69 g/kg ash. The estimated metabolisabale energy value was 11.2 MJ/kg.

3.2 *Calves*

Live weights of the calves from purchase to housing at the end of their second grazing season are shown in Table 1.

Table 1. Live weights (kg) of calves on leader/follower, mixed and separate grazing treatments.

	L/F	Mixed	Separate	s.e	Sig
Day of calf arrival	March 12	March 16	March 13	2.9	NS
Event (date)					
Arrival	74	75	76	2.6	NS
1st Turnout (May 14)	115	115	115	4.5	NS
Early 1st Summer (June 25)	147	141	132	5.8	NS
Late 1st Summer (August 05)	183[a]	162[b]	153[b]	6.6	**
End treatments (Sept. 23)[1]	242[a]	205[b]	190[c]	7.3	***
1st Housing (Nov. 18)	259[a]	220[b]	208[c]	6.9	***
2nd Turnout (March 24)	332[a]	290[b]	280[b]	8.6	***
Early 2nd Summer (June 02)	405[a]	371[b]	360[b]	8.2	***
Late 2nd Summer (Aug. 05)	470[a]	447[b]	426[c]	8.3	**
2nd Housing (Nov. 03)	515[a]	493[b]	476[c]	8.3	**

[1]End of grazing treatments; L/F = Leader/follower.

There was no difference between the grazing treatments at turnout, but shortly afterwards differences emerged and from late summer until the end of the study the L animals were significantly heavier than both other treatment groups. The M group was generally heavier than S, but the difference was not always statistically significant. By the end of the grazing treatments, L was 37 kg heavier than M, which in turn was 15 kg heavier than S. At housing, the corresponding differences were 39 kg and 12 kg, while at turnout the following spring they were 42 and 10 kg, respectively. During the second grazing season, the differences decreased somewhat. The 52 kg difference between L and S at turnout decreased

to 45 kg, 44 kg and 39 kg by early summer, late summer and housing, respectively suggesting delayed compensatory growth during the second grazing season.

Live weight gains are shown in Table 2. There was no difference between the treatments from arrival to turnout. This indicates that there was no difference between the treatments in the growth potential of the calves. For the various measurement periods and overall, L gained significantly faster than both M and S, and M generally gained significantly faster than S. For the overall period, L gained 279 g/day faster than M, which in turn gained 112 g/day faster than S.

Table 2. Live weight gains (g/d) of calves at pasture on leader/follower, mixed and separate grazing treatments.

	No. days	L/F	Mixed	Separate	s.e.	Sig
Period						
Arrival to turnout	61	642	661	619	44.3	NS
Turnout to early Summer	42	774[a]	612[b]	420[c]	53.2	***
Early to late Summer	41	883[a]	509[b]	492[b]	41.8	***
Late Summer to end[1]	49	1195[a]	1055[b]	771[c]	48.1	***
Turnout to end[1]	132	964[a]	685[b]	573[c]	28.8	***

[1]of grazing treatments on September 23; L/F = Leader/follower.

Live weight gains subsequent to the grazing treatments are shown in Table 3. There was no difference between the groups in the late grazing season or during the first winter. From turnout in the second grazing season to late summer, M gained significantly faster than L. The S group also gained significantly faster than L in early summer. These trends continued in the late grazing season but the differences were not statistically significant. For the second grazing season overall, M and S gained 87 g/day and 55 g/day, respectively more than L, but these differences were not statistically significant.

Table 3. Live weight gains (g/d) of calves following leader/follower, mixed and separate grazing treatments.

	No. days	L/F	Mixed	Separate	s.e.	Sig
Period						
End[1] to 1st housing	56	301	256	316	69.6	NS
1st Housing to second turnout	127	573	554	566	35.0	NS
2nd Turnout to early Summer	70	1046[a]	1160[b]	1141[b]	42.6	*
Early to late Summer	64	1019[a]	1183[b]	1037[a]	46.7	*
Late Summer to 2nd housing	90	504	516	555	36.9	NS
2nd Turnout to 2nd housing	224	821	908	876	29.8	P<0.12

[1]of grazing treatments; L/F = Leader/follower.

3.3 *Yearlings*

Live weights of the yearlings from turnout in spring to slaughter the following spring are shown in Table 4. There was no difference between the treatments (none would be expected) at yearling or calf turnout times. During the grazing season, both M and S were significantly heavier than L, and S was generally heavier than M. By the end of the grazing treatments, M was 11 kg heavier than L, and S was 24 kg heavier (P<0.01) than M.

Table 4. Live weights (kg) of yearling steers on leader/follower, mixed and separate grazing treatments.

	L/F	Mixed	Separate	s.e.d	Sig
Event (date)					
Turnout (March 19)	326	326	326	2.2	NS
Calf turnout (May 08)	396	395	406	4.2	NS
Late Summer (Aug. 05)	452[a]	466[b]	482[c]	6.7	**
End treatments (Sept. 23)	494[a]	505[a]	529[b]	7.1	**
Housing (Nov. 18)	523[a]	535[a]	550[b]	7.6	*
Slaughter (Apr. 14)	642[a]	661[b]	678[c]	9.4	*

L/F = Leader/follower.

Live weight gains for the various periods of the experiment are shown in Table 5. There was no significant difference between the treatments before calf turnout (none would be expected as the treatments did not become effective until the calves were turned out). From then to the end of the treatments, M gained significantly faster than L, and S gained significantly faster than M. The same was true from the period from yearling turnout to the end of the treatments where the advantage was 57 g/day for M over L, and 127 g/day for S over M.

Table 5. Live weight gains (g/d) at pasture of yearling steers on leader/follower, mixed and separate grazing treatments.

	No. days	L/F	Mixed	Separate	s.e.d	Sig
Period						
Yearling to calf turnout	50	1393	1368	1593	68.8	NS
Calf turnout to end[1]	138	709[a]	796[b]	888[c]	34.8	**
Yearling turnout to end[1]	188	891[a]	948[b]	1075[c]	35.5	**

[1]of grazing treatments (Sept. 23); L/F = Leader/follower.

Live weight gains for the period following the end of the experimental treatments to slaughter are shown in Table 6. There was no significant difference between the treatment groups at any time indicating that there was no compensatory growth during the finishing period. From yearling turnout to slaughter, mean daily gain was 47 g higher for M than L, and 44 g higher for S than M, giving a difference of 91 g/day between L and S which was significant.

Table 6. Live weight gains (g/d) of yearling steers following leader/follower, mixed and separate grazing treatments.

	No. days	L/F	Mixed	Separate	s.e.d	Sig
Period						
End[1] to housing	56	522	537	384	58.5	NS
Housing to 84 days finishing	84	728	778	808	51.5	NS
84 days finishing to slaughter	63	921	961	952	68.8	NS
Housing to slaughter	147	810	857	870	42.8	NS
Yearling turnout to slaughter	391	808[a]	855[ab]	899[b]	29.9	*

[1]of grazing treatments (Sept 23.); L/F = Leader/follower.

with a difference of 21 kg between L and S. None of the other slaughter traits differed significantly between the treatments.

Table 7. Slaughter traits for steers finished following leader/follower, mixed and separate grazing season treatments.

	L/F	Mixed	Separate	s.e.d	Sig
Carcass weight (kg)	345[a]	357[b]	366[c]	5.6	*
Kill-out (g/kg)	537	540	540	3.7	NS
Carcass conformation[1]	2.63	2.75	2.88	0.125	NS
Carcass fatness[2]	4.24	4.16	4.19	0.093	NS
Perirenal + retroperitoneal fat (kg)	15.9	15.0	16.2	0.86	NS
Perirenal + retroperitoneal fat (g/kg)[3]	46	43	44	2.4	NS

[1]EU Beef Carcass Classification Scheme – scale 1 (poorest) to 5 (best)
[2]EU Beef Carcass Classification Scheme – scale 1 (leanest) to 5 (fattest)
[3] g/kg carcass; LF = Leader/follower.

4. Discussion

There were clear differences between the treatments in live weight gains of both the calves and yearlings. In calves, growth rate was highest on L and lowest on S, whereas the opposite was so for yearlings. The greatest difference was between L and S in both the calves and yearlings. However, in calves, the difference between L and M was greater than between M and S, whereas the opposite was SO for yearlings. For the final 56 days at pasture after the treatments ended, and for the 127-day winter period indoors, there was no evidence of compensatory growth in the calves. However, at pasture the following grazing season some compensation did occur and about 25% of the live weight difference at the end of the first grazing season and first winter was compensated by the end of the second grazing season. It may be that the level of nutrition at the end of the first grazing season and during the first winter was insufficient to allow expression of

compensatory growth. Then when nutritional level increased following turnout to pasture some expression of compensatory growth occured. It would have been of interest to ascertain if compensation continued beyond the end of the second grazing season but it was not possible to examine that. It was surprising that there was any compensation even belatedly. At the time the treatments ended, mean live weights of the calf treatment groups ranged from 190 to 242 kg. Generally there is little compensation for growth differences that occur below about 250 kg live weight in late maturing animals such as used here.

ystem was clearly superior for calves, it was poorest for yearlings, presumably because the calves had already selected the highest quality herbage, and had fouled what remained, possibly reducing intake of the yearlings. This can be overcome, to some extent at least, by grazing the calves half a rotation ahead of the yearlings rather than immediately ahead. That S was superior to M for yearlings demonstrates that there was competition between the two animal categories for the better quality herbage. In the absence of such competition the yearlings benefited but the calves suffered. Because of their low intakes and grazing selectivity the calves could not control herbage supply and thereby maintain quality. In the L and S treatments, the yearlings did this to the benefit of the calves but to the detriment of their own growth rate. This shows that it is necessary to have adult animals in the system to maintain herbage quality for calves, but ideally these should not be animals on which high performance is required. Dry or culled dairy or beef cows would be better suited as followers for calves in leader/follower grazing systems than yearling steers destined for slaughter the following winter.

The absence of compensatory growth during finishing indicates that any live weight gain foregone during the grazing season will not be made up before slaughter except through a higher level of feeding or a longer finishing period. As it is more costly to feed animals in winter than at pasture, it is not economically sensible to accept impaired performance at pasture and then restore it by more expensive feeding in the finishing winter.

The differences in carcass weight were as expected from the differences in slaughter weight, and as there were no other differences in slaughter traits, the economic effects of the treatments on slaughter value can be estimated by simply multiplying the carcass weight differences by the preveiling carcass value per unit weight. When the live weight gains of the calves and yearlings were aggregated there was little difference between the treatments. From turnout to housing, total grazing season live weight gains for calves were 144, 105 and 93 kg for L, M and S, respectively. The corresponding values for yearlings were 197, 209 and 224 kg, giving aggregate values of 311, 314 and 317 kg for L, M and S, respectively. It is concluded that at current commercial stocking rates (as constrained by the Nitrates Directive and participation in agri-environment schemes) it should be possible to devise grazing management systems that simultaneously achieve the L calf performance and the S yearling performance.

References

SAS (Statistical Analysis Systems Institute) 2002-2003. SAS/STAT Users Guide, Release 9.1. SAS Institute, Cary, NC.