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BRIEF COMMUNICATION: Do different grazing strategies affect pre-weaning calf growth rates?

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Introduction

Rearing replacement heifer calves is a labour-intensive and expensive component of dairy systems (Drackley 2008). Large numbers of replacement heifers are not meeting target live weights in New Zealand (McNaughton & Lopdell 2012) which has implications for future milk production, fertility and subsequent longevity in the herd (Van Amburgh & Tikofsky 2001).

This paper reports results from the second year of a long-term experiment being conducted at Massey University that examines the impact of colostrum status and liveweight gain of heifer calves fed different diets on subsequent milk production, fertility and longevity in the herd. Previous work (Cardoso et al. 2015) demonstrated no difference in pre-weaning liveweight gain of calves fed different levels of milk. The calves in that study ate surprisingly little meal. It was surmised that the exposure to frequent shifts onto fresh pasture stimulated intake of pasture, and removed the advantage of feeding calves higher levels of milk and supplementation with meal. Anecdotally, many calves when removed from rearing sheds to pasture are kept on the same paddocks as they are not a high priority for pasture allocation. Therefore, the aim of this experiment was further collection of colostrum and Brix data as described by Coleman et al. (2015), and to compare pre-weaning growth rates of calves that are continually offered fresh pasture to those that are set stocked.

Materials and methods

This study was approved by the Massey University Animal Ethics Committee and conducted from July – December 2015. Cows used in this study were Friesian (n=53), Jersey (n=48) or Friesian-Jersey crossbred (n=99) cows that calved in spring 2015. At their first milking, all cows were milked into individual test buckets, from which a sub-sample was taken for IgG analysis and Brix reading (Coleman et al. 2015). Calves were removed from their dams daily at 0900 h, weighed and placed in the calf-rearing shed. Calves were fed 3 litres of colostrum twice daily at approximately 0800 and 1530 h (Cardoso et al. 2015). Serum samples were collected (n=200, from both heifer replacement calves and bobby calves) via jugular venipuncture the morning after entering the shed (approximately 24-48 h old) for IgG analysis and Brix reading. The 67 heifer calves (17 Friesian (F), 13 Jersey

(J) and 27 Friesian-Jersey crossbred calves (FxJ) selected as replacements (born between July 21st and August 29th 2015)) were then included in the grazing part of this study.

Calves moved from the shed to pasture at 3-4 weeks of age, depending on the capacity of the shed and were allocated to one of two treatment groups: (1) set stocking (SS n=34) and (2) rotational grazing (RG n=33). Treatment groups were balanced for breed and birth weight. The SS calves were managed such that calves were to be moved to new pasture having been in the same break for either 4 weeks or when pasture covers decreased close to 2000 kgDM/ha. This resulted in calves being in each break for 2 weeks, and being moved at covers between 2250 - 2021 kg DM. RG heifers were moved three times a week, with pregrazing mass greater than 2500 kg DM and post-grazing mass greater than 2300 kg DM.

Calves were weighed (non-fasted) every two weeks throughout the experiment, and were moved to a pre-weaning group, or weaned, on the first weighing day that they passed the threshold live weight. For both groups, once calves were within 10 kg of the target weaning live weight, they were fed 3 litres once-daily in a single “pre-weaning” group until weaning. Weaning occurred when calves reached a live weight threshold of 20% of cow mature weight for this herd: 104 kg for F, 100 kg for FxJ or 84 kg for J calves.

The IgG concentration in colostrum and serum was analysed at New Zealand Veterinary Pathology, Palmerston North or by using a refractometer (OPTI digital hand held refractometer, Brix 54, Bellingham & Stanley, Thermo Fisher Scientific) as described by Coleman et al. (2015). IgG concentration in serum was classified as being adequate (>1600 mg/dl) or inadequate (≤1600 mg/dl) (Wittum & Perino 1995). IgG concentration in colostrum samples was classified as adequate (≥3000mg/dl), or inadequate (<3000mg/dl) as per New Zealand values (Holmes et al. 1987).

Data were analysed using SAS (Version 9.3, SAS Institute Inc., Cary, North Carolina, USA). Colostral IgG concentration was analysed using a general linear model that included the fixed effects of breed, cow parity (primiparous and multiparous) and the interaction of breed with parity. Colostral IgG concentration and serum IgG concentration were also analysed using a general linear model that included the fixed effect of the Brix refractometer value.

Average daily gain (ADG) between birth and weaning was analysed using a general linear model procedure with the fixed effects of treatment group (SS or RG) and breed with birth weight fitted as a covariate. Birth weight, weaning weight, end weight and days to weaning were analysed using the general linear model procedure with the fixed effects of breed and treatment. Monthly ADG were analysed using the general linear model procedure with the fixed effects of treatment group (SS or RG) and breed with birth weight fitted as a covariate and the interaction of month with treatment, and the random effect of calf.

Results and discussion

There were no differences among breeds or parity for IgG concentrations (Table 1). Only 56.5% of cows had adequate levels of IgG in their colostrum samples but 83.5% of calves had adequate serum levels of IgG. Whereas 8.5% of calves had inadequate levels of IgG despite their dam having adequate levels of IgG in colostrum. There was no relationship between dam colostrum IgG concentration and calf serum IgG concentration ($r^2=0.41$, $P=0.53$).

Samples of dam colostrum containing adequate concentrations of IgG had a greater ($P<0.001$) mean brix value than samples containing inadequate concentrations ($22.44 \pm 0.33\%$ vs $17.33 \pm 0.37\%$). Samples of calf serum

Table 1 Concentration of IgG in colostrum (mg/dl) from individual cows of different parity and breeds (mean \pm SEM).

	n	IgG concentration (mg/dl)	P value
Parity			
Primiparous	42	3563 \pm 236	0.3884
Multiparous	158	3332 \pm 129	
Breed			
Friesian	53	3571 \pm 222	0.1888
Jersey	48	3144 \pm 227	
Crossbred	99	3628 \pm 178	

Table 2 Birth weight, weaning weight, days to weaning and average daily gain (ADG) of calves either set stocked or rotationally grazed, and by breed (mean \pm SEM).

	Birth weight	Weaning weight	Days to weaning	ADG
Treatment ¹				
SS	31.32 \pm 0.236	102.97 \pm 1.65	91.7 \pm 2.03	0.75 \pm 0.032
RG	31.60 \pm 0.239	101.63 \pm 1.68	91.2 \pm 2.06	0.75 \pm 0.033
Breed ²				
F	36.25 ^a \pm 0.314	110.23 ^a \pm 2.24	89.5 \pm 2.76	0.81 ^a \pm 0.044
J	26.82 ^c \pm 0.347	91.75 ^b \pm 2.46	91.9 \pm 3.04	0.66 ^b \pm 0.047
FxJ	31.33 ^b \pm 0.225	104.92 ^a \pm 1.54	92.8 \pm 1.90	0.78 ^a \pm 0.030

¹SS = set stocking, RG = rotational grazing

²F=Friesian, J=Jersey, FxJ = Friesian-Jersey crossbred

^{abc}rows with different letters denote significant differences ($P<0.05$)

samples containing adequate concentrations of IgG had a greater ($P<0.001$) mean brix value than samples containing inadequate concentrations ($10.32 \pm 0.13\%$ vs $8.30 \pm 0.29\%$).

There was no difference in birth weight, weaning weight, days to weaning and ADG between SS and RG treatments (Table 2). Calves grew slowest during September and fastest during November (0.58 vs 0.87 kg/d, $P = 0.082$). Differences in birth weights, weaning weight and ADG between breeds are shown in Table 2. There was no difference in days to weaning among breeds.

The IgG concentrations from all breeds, primiparous and multiparous cows and proportion of adequate IgG colostrum samples were lower than those reported by Coleman et al. (2015). However, rate of failure of passive transfer appears lower in the current study, as fewer calves had inadequate serum IgG concentrations despite the dam having adequate concentrations of IgG in colostrum compared to Coleman et al. (2015) (8.5% vs 17.5%). The cause for these differences is, however, unknown as both of these studies have occurred on the same farm and included many of the same cows.

Calves in this study grew at similar rates to calves reported by Cardoso et al. (2015) but no difference between RG or SS systems on ADG or days to weaning was seen. Pasture available was never below 2000 kg DM/ha and it appears intakes of the SS calves were not restricted, despite pasture starting to look patchy and contaminated with faeces when calves had been grazing each break for two weeks. Calves are picky eaters and will selectively graze preferred species (Back et al. 2016), or graze less when the pasture is contaminated with faeces (Hutchings et al. 2000). Further work is needed to establish what happens to growth rates when calves are on the same pastures for greater time lengths or graze to lower pasture covers.

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