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Brief Communication: Managing liveweight gain of Holstein-Friesian, Jersey and Holstein-Friesian-Jersey crossbred heifer calves

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Introduction

Large numbers of replacement heifers are not meeting target live weights in New Zealand (McNaughton & Lopdell 2012; Handcock et al. 2016) which has implications for future milk production, fertility and subsequent longevity in the herd (Van Amburgh & Tikofsky 2001; McNaughton & Lopdell 2013). Undergrown heifers can lead to an overall decline in a herd's reproductive performance and milk production (McNaughton & Lopdell 2012). McNaughton and Lopdell (2013) reported that for every 1% increase in the percentage of live weight attained, heifers produced approximately 23 litres of extra milk during their first two lactations. As such, heifer growth, particularly post-weaning growth, has been identified as an area requiring greater attention from farmers to improve cow performance. There are established breed liveweight targets as well as liveweight targets based on an individual animals genetic potential and the growth of individual animals and groups can be monitored using programmes such as Livestock Improvement Corporation's MINDA Weights™ herd-recording software. However, while growth targets are commonly used, in many cases, being 'on-target' is based on a mob average, resulting in a proportion of animals below target live weight.

On Massey University's Dairy 1 farm, heifers born in the 2014-15 dairy season have been monitored from birth till their first calving (2016-17 dairy season) with regular weights recorded. The aim of this experiment is to examine the magnitude of the variation within a mob of animals that is generated by attempting to have all animals 'on-target'.

Materials and methods

This study was approved by the Massey University Ethics Committee and conducted from July 2014 – May 2016. Sixty-one heifer calves were used in this experiment: 14 Holstein-Friesian (F), eight Jersey (J) and 39 FxJ crossbreds (FxJ). All were born at Dairy 1, Massey University, Palmerston North, New Zealand, between July 21st and August 29th 2014. Calf management from birth to weaning has been previously reported by Coleman et al. (2015) and Cardoso et al. (2015). After weaning, calves were grazed on Massey University's Keeble farm. Calves were weighed every two weeks throughout the experiment, until first calving and monitored using MINDA Weights™.

Data handling and statistical methods

Individual target live weights were calculated using the breeding value method detailed by McNaughton and Lopdell (2012). The target live weight (minus birth weight) was regressed on age then added back to birth weight to obtain a predicted target live weight at all age periods. Percentage of target live weight achieved was calculated by dividing actual live weight by predicted target live weight at that age, at all weigh dates. Achievement of target live weight was binomially coded with 1 for achieved and 0 for not achieved. Average daily live weight gain (ADG) was calculated as live weight minus birth weight divided by age in days. This was done for each age period, giving a moving average daily gain over the whole period. Live weight, target live weights, and percentage of target live weight, proportion of heifers at target live weight were analysed using a general linear model in SAS 9.3 (SAS Institute Inc., Cary NZ, North Carolina). The model included the fixed effects of breed, treatment (pre-weaning), age group (clustered by month of age) and the interaction of breed by age group. Minima and maxima were obtained using the means procedure in SAS 9.3 grouped by breed and age group.

Results

Live weight, percentage of target live weight, average daily gain and percentage of heifers on target by age and breed are presented in Table 1. Over the 21 months of the study, heifers grew at an average of 0.65 kg/day. Breed differences were evident as ADG was 0.70, 0.56 and 0.66 kg/day for F, J and FxJ, respectively.

Average daily gains were greater than 0.60 kg/day for the whole period except for the J heifers at 21 months of age. A greater proportion of F heifers were on or above target live weight at 6, 9, 15 and 21 months than either J or FxJ heifers. At 21 months of age only 25% of JE heifers were on target. Growth rates decreased as the heifers aged, regardless of breed. At six months of age F, J and FxJ calves were on average 133, 124 and 134% of target live weight respectively. By 21 months these averages had decreased to 108, 98 and 108% of target live weigh for F, J and FxJ calves respectively.

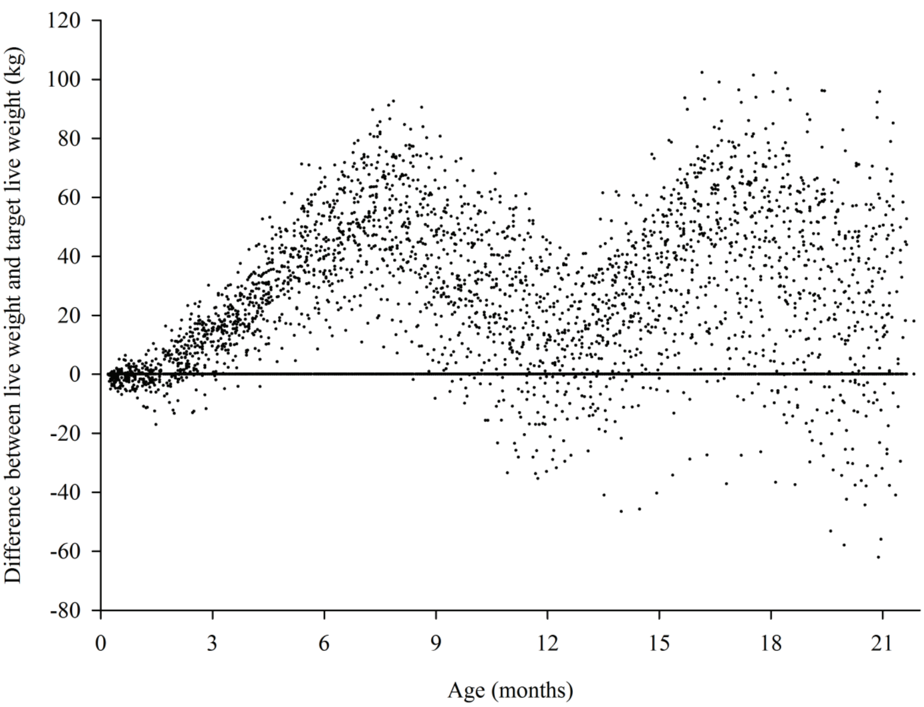
Figure 1 presents the difference between the actual live weight and target live weight for each heifer at each month of age. Aiming to have all animals on target resulted

Table 1 Live weight, percentage of target live weight achieved, average daily gain (ADG) and percentage of heifers on target at 6, 9, 15 and 21 months of age for Holstein-Friesian (F, n=14), Jersey (J, n=8) and FxJ crossbred (n=39) heifers, with minimum and maximum values in parenthesis. Data are least squares means and standard error of the mean.

Age[1]	Breed	Live weight (kg)	% of target achieved	ADG (kg/d)	% heifers on target
6 months	F	$211^{a} \pm 2.5$	$133^{a} \pm 1.70$	$0.89^{a} \pm 0.013$	100
(150 kg)		(176 – 246)	(112 – 140)	(0.77 – 1.02)	
	J	$173^{c} \pm 3.8$	$124^{b} \pm 2.50$	$0.75^{c} \pm 0.019$	99.4
		(145 – 194)	(106 – 140)	(0.67 – 0.81)	
	FxJ	$199^{b} \pm 1.5$	$134^{a} \pm 0.98$	$0.86^{b} \pm 0.008$	100
		(161 – 239)	(106 – 161)	(0.69 – 0.99)	
9 months	F	$259^{a} \pm 3.5$	$122^{a} \pm 1.7$	$0.77^{a} \pm 0.013$	96.9
(200 kg)		(213 – 298)	(102 – 140)	(0.61 – 0.95)	
	J	$209^{c} \pm 5.3$	$112^{b} \pm 2.60$	$0.64^{c} \pm 0.019$	93.1
		(183 – 232)	(100 – 126)	(0.57 – 0.74)	
	FxJ	$242^{b} \pm 2.2$	$122^{a} \pm 1.10$	$0.74^{b} \pm 0.08$	93.0
		(193 – 284)	(95 – 144)	(0.59 – 0.88)	
15 months	F	$381^{a} \pm 3.8$	$119^{a} \pm 1.30$	$0.74^{a} \pm 0.013$	100
(300 kg)		(350 – 449)	(108 – 137)	(0.67 – 0.86)	
	J	$317^{c} \pm 5.5$	$114^{b} \pm 1.90$	$0.61^{c} \pm 0.018$	87.1
		(281 – 347)	(103 – 124)	(0.56 – 0.68)	
	FxJ	$358^{b} \pm 2.3$	$120^{a} \pm 0.70$	$0.70^{b} \pm 0.008$	94.5
		(277 – 409)	(94 – 139)	(0.54 – 0.79)	
21 months	F	$485^{a} \pm 8.1$	$108^{a} \pm 1.80$	$0.70^{a} \pm 0.019$	100
(425 kg)		(465 – 546)	(101 – 118)	(0.66 – 0.79)	
	J	$388^{c} \pm 11.0$	$98^{b} \pm 2.50$	$0.56^{c} \pm 0.025$	25.0
		(353 – 407)	(91 – 104)	(0.52 – 0.59)	
	FxJ	$456^{b} \pm 4.8$	$108^{a} \pm 1.10$	$0.66^{b} \pm 0.012$	84.5
		(373 – 506)	(87 – 122)	(0.54 – 0.74)	

[abc] Values within a column without superscripts in common differ at the P<0.05 level.
[1] Predicted mob average live weight in parenthesis.

Figure 1 Graphical illustration of the variation observed in the difference between live weight and target live weight over time (21 months) for each individual heifer (n=61) grazed in one mob.



in accelerated growth for the first eight months, with all heifers above target. This was followed by slower growth through the first autumn and winter (9-13 months of age) and a proportion of heifers fell behind target. Heifer growth rates increased during their second spring, but the variation within the mob became greater, as not all animals recovered to be on or above target. This was further exacerbated by slowing growth rates over the second autumn and winter (18-21 months of age).

Discussion

The heifers grew well during the first eight months, being grazed on good-quality ryegrass pasture, a forage herb crop and lucerne. Results presented in Table 1 and Figure 1 demonstrate the variation in proportion of target achieved, ranging from 87% of target at the lowest to 140% at the highest. However, if this is compared with information using a 'mob' average as shown by using MINDA weights™, at six months, all heifer calves were above target, which resulted in a mob average growth rate of 0.9 kg/day, and the mob being 38 kg above target. Heavy rain and waterlogged paddocks during winter resulted in the lowest growth rate of 0.3 kg/day with the mob being 'on target' but 30% (18/61 heifers) being below target. During the second spring, compensatory growth occurred, with a mob growth rate of 0.9 kg/day, resulting in the mob being 35 kg above target, with one heifer below target. Figure 1 demonstrates how great the variation within the mob had become by this stage, and that, although some compensatory growth occurred, it was not sufficient to get and keep all heifers back on target, which is in agreement with the results of McNaughton and Lopdell (2012).

The results presented here indicate a role for identifying and preferentially grazing slower-growing animals (which are not necessarily the smallest ones). Future work will examine whether there is an advantage in preferentially grazing small and slower-growing animals, and what happens when they are re-introduced to their mob.

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