Proc. Aust. Soc. Anim. Prod. 1994 Vol. 20

INTERRELATIONSHIP AMONG COW SIZE, LIFETIME COW FERTILITY, MILK PRODUCTION AND PRE-WEANING CALF GROWTH IN SUB-TROPICALLY ADAPTED BEEF CATTLE

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SUMMARY

A total of 493 Bonsmara cows were divided according to their average lifetime calving interval into short calving interval (SCI, < 400 days, 296 cows) and long calving interval (LCI, > 400 days, 197 cows) groups. Cows and calves were weighed at weaning (7 months). Hip height of the cows was also measured. Milk production of 10 SC1 and 8 LCI cows were determined over 1 lactational period by the weigh-suckle-weigh method. These cows were chosen randomly. Liveweight, hip height and pre-weaning gain of calves of the SCI cows (482 kg, 129 cm and 0.83 kg/day) were significantly ($P < 0.05$) lower than those of the LCI cows (513 kg, 137 cm and 0.94 kg/day). Calves from SCI cows were born significantly earlier than calves from LCI cows as measured by age at weaning (227 vs 193 days). Cows in the SCI group produced significantly less milk than LCI cows (5.50 vs 8.26 L/day). It is concluded that SCI cows are smaller in size, have reduced milk production with correspondingly significantly lighter calves at weaning. A negative correlation existed between fertility and pre-weaning calf growth.
Keywords: cow size, calving interval, milk production, pre-weaning growth, beef cattle.

INTRODUCTION

Improvement of fertility and growth through selection in beef cattle are becoming increasingly important, since marketable beef is determined by nett reproductive rate, growth to market age of calves and weight of culled cows. It is generally accepted that smaller cows are more fertile under extensive grazing conditions, but that larger cows produce more milk and, therefore, wean heavier calves. However, success of the real practice needs to be demonstrated and the effect of lifetime cow fertility on traits such as mature size, milk production and weaning weight need to be evaluated. Calving interval (CI) was used as a measure of reproductive efficiency in this study, because it was traditionally and still is, the most widely used parameter in South Africa.

The objective of this paper was to study the associations between lifetime cow fertility and cow size, milk production and pre-weaning calf growth in sub-tropically adapted Bonsmara cattle. The Bonsmara is a synthetic cattle breed which was developed in South Africa by the late Prof Jan Bonsma, and is composed of 5/8 Afrikaner *(Bos indicus)* and 3/8 Hereford and Shorthorn *(Bos taurus).*

MATERIALS AND METHODS

A total of 493' calving records from the Bonsmara herd at the University of Fort Hare, South Africa were used in this study. The beef production system was of an extensive nature and animals had to survive on the natural grazing with a summer or winter lick. Breeding seasons were limited to 90 days for the cows and 60 days for the heifers while calves were weaned at approximately 7 months of age. All bulls were fertililty tested before the breeding season commenced and they were put in with the cows at a 3 to 4% ratio. The cows were managed under a stringent culling policy, under which any cow failing to calve each year was disposed of. Cows were divided into 2 groups according to their average lifetime CI: 296 cows with a CI < 400 days (SCI) and 197 cows with a CI > 400 days (LCI). Cows and their calves were weighed at 7 months of age (weaning). Hip height was also recorded as a measure of cow size. Calving date was also recorded.

To investigate the relationships of milk production to CI, cow size and pre-weaning calf growth, 18 Bonsmara cows were randomly selected. The milk production of these 18 cows were determined by the weigh-suckle-weigh method on a weekly basis in the evening and again in the morning after calves were removed from the cows for 12 hours. Additional measurements and treatments were the same as for the first group.

Data were analyzed using the General Linear Models procedure of Statistical Analysis Systems (SAS 1985). Traits were analyzed by least squares means of variance and the model of analysis included effects due to CI (SCI and LCI), age of dam, previous lactation status, sex of calf and a regression effect of day of birth.

RESULTS

The least squares means for weaning weight of calves and cows, as well as hip height of the cows, for the SCI and LCI groups are presented in Table 1.

From these results it is clear that cows with a higher lifetime fertility (SCI) were significantly smaller and lighter, and also weaned significantly lighter calves. These cows dropped 82% of their calves during the first half of the calving season, while only 51% of the LCI cows dropped their calves during the same period, resulting in calves of the SCI group being significantly older (227 days compared to 193 days) at weaning.

Table 1. Least squares means for weights at weaning of calves and cows, as well as hip height of the cows, for short (SCI) and long (LCI) calving interval groups

	SCI	LCI	Test of significance
Number of cows	296	197	*
Cow weight at weaning (kg)	482	513	*
Hip height (cm)	129	137	*
Weaning weight of calves (kg)	207	230	*
Pre-weaning gain (kg/day)	0.83	0.94	*
Age at weaning (days)	227	193	*

*P < 0.05.

Table 2. Least squares means for weights at weaning of calves and cows, hip height and milk production for 18 randomly selected cows from the short (SCI) and long (LCI) calving interval groups

	SCI	LCI	Test of significance
Number of cows	10	8	*
CI (days)	382	490	*
Hip height (cm)	129	137	*
Daily milk production (L)	5.50	8.26	*
Cow weight at weaning (kg)	490	570	*
Pre-weaning gain (kg/day)	0.89	0.99	*
Corrected 205-day weaning weight	220	242	*

*P < 0.05.

The least squares means for the various traits, as well as daily milk production, for the randomly chosen group of 18 cows are presented in Table 2.

The results in Table 2 are consistent with all the findings in Table 1. It is further evidence that smaller cows had a higher lifetime fertility and reduced milk production, with correspondingly significantly lighter calves at weaning.

DISCUSSION

Since the SCI cows were significantly smaller in size than the other group an attempt can be made to state that early and regular reproduction restrict mature size. Under extensive conditions, small size is a desirable adaptive attribute which is generally associated with early and regular reproduction. This may be ascribed to high inherent fertility of the tropically adapted, synthetic Bonsmara, which offers more flexibility under stress conditions to increase productivity, without sacrificing expressed fertility (Swanepoel and Lubout 1992).

Seifert and Rudder (1975) considered that cows with less than average liveweight, tended to have lighter progeny at weaning due to reduced milk production, as substantiated by this study. Therefore

even though the calves of the LCI cows were younger at weaning than the calves of the SCI group, and the weights were corrected for age, they were still heavier as a result of the significantly greater milk production by their dams. A negative correlation between cow fertility and pre-weaning calf growth was apparent. This reduced lactational performance may also be partly responsible for the higher fertility of the smaller cows.

Reduced lactational performance has also been suggested as a contributing factor to improved fertility (Hetzel *et al.* 1989). Other authors (McMorris and Wilton 1986; Swanepoel *et al.* 1992) agree that positive correlations between cow weight and either milk production or calf weaning weight exist. Bourdon and Brinks (1983) and Doren *et al.* (1986) reported a positive influence of weaning weight on cow fertility. Small cow size, reduced milk production and correspondingly lighter weaning weights are actually adaptive characteristics found in tropically and sub-tropically adapted beef cattle (Rege 1993).

CONCLUSIONS

Cows of higher lifetime fertility (shorter CI) are smaller in size, have reduced milk production with correspondingly significantly lighter calves at weaning. Early and regular reproduction restrict mature size. The reduced lactational performance may also partly be contributing to the higher fertility. A negative correlation exists between fertility and pre-weaning calf growth.

ACKNOWLEDGMENTS

The authors would like to thank the staff of Honeydale experimental farm and the Department of Animal and Pasture Science at the University of Fort Hare, for their help in data collection and management of the herd.

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