Are yearling heifer mating and more productive beef cow breeds a worthwhile use of winter feed?

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ABSTRACT

The efficiency of winter feed use for weaner calf production was compared in a yearling heifer mating system compared to a 2 year old first mating system in traditional and dairy x beef cows. These computer modelling analyses illustrated, with yearling heifer mating compared to 2 year old first mating, that the total weight of calf weaned per unit of winter feed required is increased by only 2% (Angus dams) and 6% (Hereford x Friesian dams, HxF). With HxF dams compared to Angus dams, the total weight of calf weaned per unit of winter feed required was increased by 8% (2 year old first mating) and 13% (yearling heifer mating).

Yearling heifer mating rather than 2 year old first mating within a traditional beef cow breed is questioned, when compared at the same winter feed requirement. The superiority of dairy x beef breeding cows on the basis of calf production from winter feed is confirmed by this analysis. Furthermore, this superiority is maximum when yearling heifer mating is also adopted.

Keywords Beef cows, yearling heifer mating, weaning weight, calves, cross breeding, herd performance, feed requirements, dairy x beef, efficiency.

INTRODUCTION

Efficient beef breeding cow herds give the maximum weight of calf weaned per unit land required to feed them. A reproductive and a calf growth component contribute to calf weaning weight. Of these two factors, the reproductive component is considered the most important on a per head basis (Carter *et al.*, 1980; Nicol, 1984). It is therefore not surprising that considerable research effort has focused on the reproductive efficiency of breeding cows. In particular, the practice of yearling heifer mating has been well researched and advocated as a means of increasing per head performance (Carter and Cox, 1973; Smeaton and Winn, 1981; Morris, 1982). Dairy x beef breeding cows have also been advocated (Morris, 1982).

Little consideration has previously been given to the additional feed costs associated with these more productive options, although it has been acknowledged that dairy x beef breeding cows are heavier (Baker *et al.*, 1981). Winter feed requirements can limit the number of cows able to be run in a grazing beef cow herd. The development of a model for comparing the winter feed costs and the production benefits of various options (e.g. breed of cow, age at first mating, breed of bull, etc.) would be a useful aid to focus beef breeding cow farmers and research and extension agencies on the relative contributions of these options to efficiency. The purpose of this analysis was to evaluate the per ha efficiency of calf weaning weight produced from yearling heifer mating (i.e. first joining at 1.25 years of age) compared to 2 year old first mating (i.e. first joining at 2.25 years of age), and the use of dairy x beef compared to traditional breeds of breeding cow when calving in the spring. The efficiency index chosen was total kg calf weaning weight per unit of *winter* feed required.

MATERIALS AND METHODS

Herd Structure and Performance

The mean of seven years per head performance data from the Whatawhata Research Centre beef cow herds (McCall *et al.*, 1987) was used to generate an age structure for a traditional beef breed herd (Angus) and

TABLE 1 Performance data for Angus and HxF herds mated to Angus bull (McCall *et al.*, 1987).

Age	Breed	Age at Mating Yearling	2 years	3 years	4+ years
Mating live weight (kg)	Angus	248	327	371	410
	HxF	254	357	398	444
In-calf rate (%)	Angus	71	85	90	92
	HxF	86	87	88	89
Calf birth weight (kg)	Angus	24.7	25.5	28.9	28.9
	HxF	30.0	30.6	34.0	34.0
Calf survival to weaning (%)	Angus	82	91	92	92
	HxF	87	97	96	96
Calf weaning weight (kg)	Angus	122	142	152	152
	HxF	154	168	179	179

a dairy x beef herd (Hereford x Friesian; HxF) (Tables 1 and 2). Mortality rates were assumed to be 1% between the first and second winter; 3% for first calvers and 2% for subsequent calvers. Only pregnant animals and young replacements were wintered. Heifers and cows which calved but failed to wean calves were retained for the following winter provided they were pregnant. Compulsory culling of cows was at 10.5 years of age at weaning time. Heifers first mated at 2 years of age were assumed to have the same reproductive performance as heifers which had previously been mated as yearlings (Morris, 1982) but were lighter until 2 year old joining (Fig. 1 and 2). Angus bulls were used for all mating and weaning was at a mean calf age of 5 months (McCall *et al.*, 1987). First mating was for 6 weeks and subsequent mating for 8 weeks.

Estimated Feed Requirements

The winter feed requirements were chosen to compare strategies since they represent the most difficult period for matching requirements and demands on most properties running beef cows. An arbitrary 120 day winter period was chosen. To simplify the analysis, this 120 day period was assumed to be coincident with the last 120 days of gestation.

Winter feed requirements were calculated from the winter live weight profiles of heifers and cows (Fig. 1 and 2) used in previous studies (McCall *et al.*, 1987). Cows older than 3.5 years were assumed to follow the live weight pattern of cows aged between 3.5 and 4.5 years. Conceptus free cow live weight and live weight change were calculated by removing conceptus weight. Conceptus weights and associated energy requirements were predicted using calf birth weights (Table 1) and published descriptions of conceptus growth (A.R.C., 1980). Cow live weight maintenance requirements and energy requirements for body gain and loss were taken from published New Zealand results (Geenty and Rattray, 1987). In all analyses the Angus herd with first mating at 2 years of age was assigned an efficiency value of 100.

RESULTS

Herd Structure and Performance

Herd size including replacements, adjusted to the same winter feed requirement, and age composition at the start of the winter, are shown in Table 2. The number of animals wintered ranged from 100 to 83 depending on breed of cow and policy on age at first mating. The major source of variation in number wintered was the number of mixed age cows wintered which ranged from 40 to 58.

The higher per head performance of the HxF for calf weights, yearling reproductive performance and cow live weight is highlighted (Table 1).

TABLE 2 Number of cows and replacement heifers wintered with first mating either as yearlings or at 2 years of age in Angus and HxF herds.

Cow age	Angus 2 year old	Angus Yearling	HxF 2 year old	HxF Yearling
Rising 1 year	15	19	14	17
Rising 2 year	15	13	14	14
Rising 3 year	12	11	12	12
Rising 4 to 10 year	58	50	49	40
Total Animals	100	93	89	83

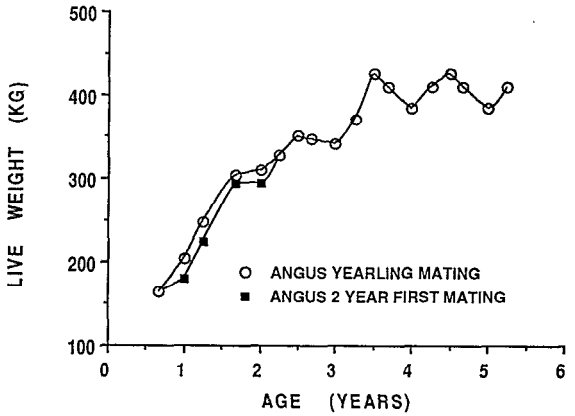

FIG 1 Live weight profiles of Angus herds from 8 months of age until adult with first mating as either yearlings or at 2 years of age.

Age at First Mating

Yearling mating was 2% more efficient in Angus and 6% more efficient in the HxF compared to 2 year old first mating (Table 3). The most efficient herd was the HxF with yearling heifer mating at 115. For both beef cow breeds, 7% fewer cows and replacements could be grazed per unit of winter feed required (i.e. per ha) with a yearling heifer mating policy when Angus bulls were used (Table 3). This reduction in number wintered was a direct reflection of the higher yearling live weight gains and therefore higher feed requirement for the yearling mated animals. For Angus cattle, 5% more calves were weaned per ha. with yearling heifer mating compared to first mating at 2 years of age because more animals wintered were pregnant (80% vs 70%). In HxF cattle, 8% more calves were weaned and 82% of the yearling herd were pregnant compared to 69% in 2 year old herd. Mean calf weaning weight was lower with yearling mating compared to 2 year old first mating policies in both the Angus (146 vs 150 kg) and HxF herds (173 vs 177 kg) because calves from yearling pregnancies were lighter (Table 1).

Breed of Cow

TABLE 3 Effects of age at first mating and cow breed on number of cows and replacements wintered, winter feed requirements and calf production when considered at the *same* level of winter feed requirement.

	Angus 2 year old	Angus Yearling	HxF 2 year old	HxF Yearling
No. wintered	100	93	89	83
Daily kg DM required/hd	4.35	4.65	4.86	5.22
No. calves born	70	75	61	68
No. calves weaned	64	67	59	64
Mean weaning weight calf (kg)	150	146	177	173
Ratio total kg weaning weight calf	100.0	101.7	108.2	114.8

The Angus herd were 92% as efficient as the HxF herd with 2 year old first mating and only 89% as efficient with yearling heifer mating. Within the same mating policy, approximately 12% more Angus cows could be grazed per ha compared to HxF cows (Table 3) because they were lighter (Fig. 1 and 2). Approximately 8% more calves were weaned per ha. from Angus cows compared to HxF cows with 2 year old first mating and 5% more with yearling heifer mating. Calves from Angus cows were about 85% as heavy at weaning as calves from HxF dams within both mating policies.

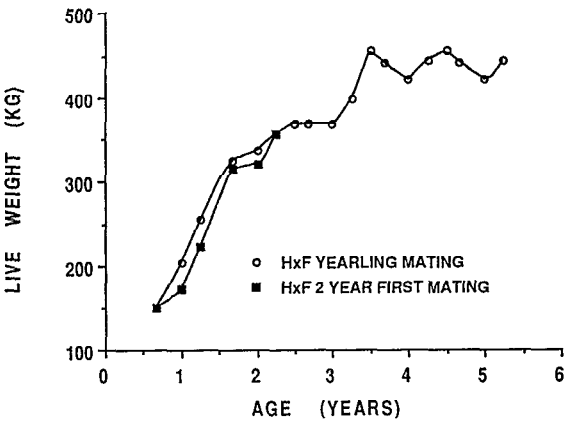

FIG 2 Live weight profiles of HxF herds from 8 months of age until adult with and without yearling heifer mating.

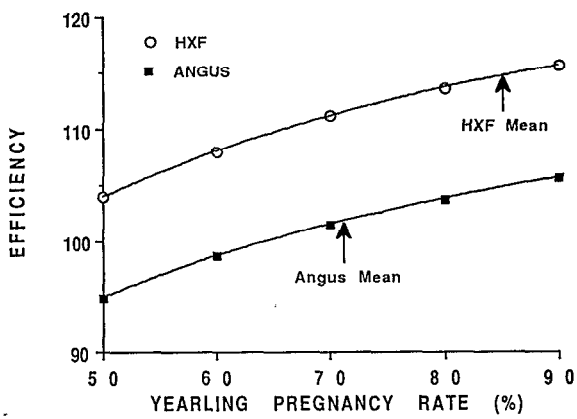

FIG 3 Efficiency of winter feed usage in Angus and HxF yearling heifer mated herds over a range of yearling heifer pregnancy rates.

Sensitivity to Yearling Performance

The apparent interaction of age at first mating with breed of cow can be explained by differences in yearling performance between the two breeds. For yearling heifer mating policies, higher levels of yearling performance were associated with higher levels of efficiency (Figure 3). In the Angus, the break-even yearling pregnancy rate for efficiency to equal 100 (i.e the same as that of 2 year old first mating) is about 68% (Figure 3) but the mean performance of Angus yearlings is very near this at only 71% (Table 1). The net effect of the pregnancy rate increase from 68% to 71% is only a 2% increase in efficiency. Angus yearlings would require a pregnancy rate in excess of 95% to achieve the same 6% efficiency advantage of yearling mating as the HxF. In contrast, the break-even pregnancy rate in the HxF for efficiency to equal 108 (i.e the same as that of 2 year old first mating) was about 42% which is considerably below the HxF mean yearling pregnancy rate of 86% (Table 1). Similarly, mean calf weaning weight would have to increase from 122 kg to 161 kg in Angus yearlings to achieve the same 6% efficiency advantage as the HxF for yearling heifer mating.

DISCUSSION

This analysis challenges the advocacy of yearling heifer mating as a routine option for traditional beef breeds. For dairy x beef cows a policy of yearling mating may be worthwhile. The reasons for this apparent interaction are that the performance in yearlings compared to the rest of the herd for Angus cattle are much lower than for HxF cattle. For example, in Angus cattle the ratio of calves weaned per animal joined with the bull was 58% in yearlings and 83% for the rest of the herd but in the HxF the ratios were 75% and 85% respectively. Hence a greater proportion of non-calf producing Angus yearlings need to be wintered at high feeding levels. If the reproductive rate in Angus yearlings was above 90%, the interaction would dissappear. It would thus appear that the low reproductive performance in Angus yearlings was a significant source of this apparent interaction. It is unlikely that Angus yearlings could consistently achieve more than a 90% pregnancy rate at about 250 kg joining live weight (Smeaton and Winn, 1981). Therefore, the chances of successfully improving the biological efficiency of beef herds by further research into improved conception in yearling heifers of traditional beef breeds is small.

The superiority of dairy x beef breeding herds over traditional beef herds, when compared on the basis of the same winter feed requirements, is confirmed by our analyses. Previous results have highlighted the superiority on a per head basis (Baker *et al.*, 1981). The reduction in animal numbers necessary to feed HxF

herds the same as Angus herds over the winter, and the resultant decrease in calves weaned, is clearly more than compensated for by the heavier mean weight of calf from the dairy x beef herd.

The extension effort to increase industry adoption of dairy x beef breeding cows should continue and yearling heifer mating is probably worthwhile in this genotype. This is particularly pertinent owing to the versatility of dairy x beef cows to cope well under poor and good feed supply conditions when compared to traditional beef breeds (Morris, 1982). This type of cow also provides versatility in that calves of mainly beef type can be produced by using traditional or exotic beef bull breeds or, alternatively, calves of mainly dairy type can be produced if bulls of dairy origin are used. Traditional beef cow breeds do not permit this level of flexibility. Future attempts to increase efficiency, such as two calves per cow, are likely to be more worthwhile in dairy cross beef cows compared to traditional beef breeds because of their higher milk production capacity.

Collectively, these results demonstrate that the combination of HxF cows with a policy of yearling heifer mating is necessary to maximise the amount of calf weaning weight produced from a given requirement for winter feed. The advantage over an Angus system with a 2 year old first mating policy is about 15%.

These analyses have not taken account of the cost and revenue flows associated with the various policies nor the implications for managing pasture at other times of the year. For instance, yearling heifer mating policies are likely to require more bulls. However, since there are fewer animals to winter and transport (only 83% as many in the yearling mated HxF herd as in the 2 year old first calving Angus herd) some savings associated with per head costs (e.g. animal health, bulls, interest) need to be taken into account. Some gross margin analyses that we have undertaken (W.H. McMillan and D.G. McCall, unpublished data), indicate that the biological benefits from these per ha analysis are further increased if a gross margin/ha analysis is conducted. This then provides the economic justification for a dairy x beef breeding herd with yearling heifer mating.

Collectively, the results of this study question the benefit of investing further research and extension effort into increasing yearling heifer reproductive performance and calf weaning weight above the levels previously reported (McCall *et al.*, 1987). The extra returns to producers with respect to producing calf weaning weight from winter feed appears minimal. However, a change from traditional breeds of cow to a dairy x beef breeding cow in conjunction with yearling heifer mating does seem worthwhile. Further options for increasing the efficiency of winter feed use in the beef herd are likely to centre on choice of breed of bull, heifer replacement wintering policies, time of calving, culling of non-pregnant cows following pregnancy diagnosis, and herd age structure (McMillan and McCall, 1991). Twinning in beef herds also warrants investigation.

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