Stayability of beef-cross-dairy breeding cows to six years of age

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Abstract

The use of dairy-beef crosses is widespread throughout the New Zealand beef industry. Cattle originating from dairy herds make up 50 – 55% of New Zealand beef exports by weight (Morris & Kenyon 2014). However, there is little information available regarding the use of beef-cross-dairy cows as breeding cows in terms of reproductive success and stayability in the herd. A study was conducted to investigate the pattern of cow culling and stayability from eight months of age until marking of the fifth calf of straight-bred Angus and Angus-cross-Friesian, Angus-cross-Jersey and Angus-cross-Kiwicross cows. The results showed that the stayability of these breeding cows was low, however, there were no differences in the stayability of straight-bred Angus or beef-cross-dairy cows.

Introduction

The use of beef-cross-dairy cows as breeding cows is facilitated in New Zealand by the ready source of replacements from the dairy industry (Hickson et al. 2012). There is, however, little information available on the reproductive success of modern beef-cross-dairy cows. Benefits of crossbreeding are achieved through increased fertility and growth rate of calves (Morris et al. 1993a, Morris et al. 1993b). This has been demonstrated by Morris et al. (1986) whereby the pregnancy rate of straightbred Angus cows was lower than that of Friesian-cross-Angus cows although Jersey-cross-Angus cows were intermediate.

The focus of cow selection in the beef industry is weaning many calves, weaning heavy calves and maintaining low cow death rate in the herd (Morris 2013). Thus, cow culling decisions are made based on factors such as failure to conceive or maintain a pregnancy, failure to wean a calf, and physical or health considerations (Anon. 2008). Although it is recognised that beef cows have relatively low weaning rates (Morris et al. 1987, Morris et al. 1993b) there are few reports that describe cow stayability (the likelihood of a cow remaining in the herd). The present experiment was designed to monitor straight-bred Angus and Angus-cross-Friesian, Angus-cross-Jersey and Angus-cross-Kiwicross cows to determine the pattern of cow culling and stayability from eight months of age until marking of their fifth calf.

Materials and methods

This study was conducted at Massey University's Tuapaka farm 15 km east of Palmerston North, New Zealand (latitude 40°20'S, longitude 175°43'E) with approval from the Massey University Animal Ethics Committee.

Study design

Straightbred Angus and Angus-cross-dairy cows were generated through contract inseminations of Angus, Holstein Friesian, Jersey and Kiwicross cows (Hickson et al. 2012). All cows were sired by one of four Angus bulls: bull A (n=48), bull B (n=65), bull C (n=41) and bull D (n=41). These resulted in: straightbred Angus (AA; n=68), Angus-cross-Friesian (AF; n=43), Angus-cross-Jersey (AJ; n=53) and Angus-cross-Kiwicross (AK; n=31) cows. The cows were recorded from eight months of age until the marking of calving of their fifth calf at six years of age.

Cows were first bred as 16-month-old heifers for seven weeks beginning on the 8th December in 2009 (Hickson et al. 2012). Cows were bred to 15-month-old Hereford bulls at a ratio of 3:60. In each of the subsequent five breeding periods (until six years of age) cows were joined beginning on the 8th December for nine weeks (except for 50 late calving cows in 2010 which were joined for 10 weeks). In the second breeding period cows were joined with Angus (n=4) and Simmental bulls (n=4) at a ratio of between 2:39 and 2:54. In the third breeding period cows were joined with Charolais bulls (n=6) at a ratio of between 2:34 and 2:49. In the fourth and fifth breeding periods cows were joined with Charolais bulls (n=4) at a ratio of between 2:43 and 2:53. Pregnancy diagnosis was conducted approximately six weeks after the completion of each joining. During the calving period cows were observed and the date of parturition was recorded. Calves were identified to their dam within 24 hours of birth. During each reproductive period, records were maintained of pregnancy status, calving date, whether a calf was weaned, if a cow was culled, and if the cow was alive or dead. Cows were culled if they failed to be diagnosed as pregnant, failed to calve or the calf died prior to weaning. Throughout the lactation period cow and calf deaths and the cause of cow death was recorded.

Statistical analyses

Data were analysed using the Statistical Analysis System (SAS version 9.4, SAS Institute Inc., Cary, NC, USA, 2001). The effects of breed-cross and sire of the cow on the percentage of cows that were removed from the herd throughout the study were determined using a generalised model with a binomial distribution and logit

transformation. The model included the fixed effects of cow breed-cross, sire and their two-way interaction. If the two-way interaction was not significant (P>0.05), the interaction was removed and the model re-run.

The effect of cow breed-cross and sire on the stayability of cows from eight months of age until the marking of their fifth calf was conducted using a survival analysis. Cows remaining in the herd at the marking of their fifth calf were considered censored at this time point. The product-limit method using the LIFETEST model was used to test the significance of breed-cross and sire against stayability trends. The Log-rank test was used to evaluate differences in population means.

Results

Effect of cow breed-cross

The pregnancy rate of each breed-cross was generally more than 80% except for AK cows in the fifth reproductive period (at five years of age; Table 1). Across the five reproductive periods the mean percentage of cows that were diagnosed pregnant did not differ among breed-crosses (91.5, 94.7, 91.1 and 89.6% for AA, AF, AJ and AK cows respectively; P>0.05). Neither did the percentage of cows that successfully weaned a calf, of those diagnosed pregnant (or reared a calf to marking at approximately three months after the start of the calving period in the fifth reproductive period), differ among breed-crosses AA, AF, AJ and AK (92.3, 88.9, 87.4 and 85.8%, respectively P>0.05). When weaning rate was expressed as the percentage of cows joined, the rates for each breed-cross did not differ (84.6, 84.0, 79.7 and 77.4% for AA, AF, AJ and AK cows, respectively; P>0.05).

Cow losses did not differ among cow breed-crosses (P>0.05). At the marking of the fifth calf 42.6%, 41.9%, 32.1% and 25.6% of cows were still present in the herd for the AA, AF, AJ and AK breeds, respectively (Fig.1).

Effect of sire

The pregnancy rate of cows from each sire was generally greater than 80%, except for cows sired by bull A on both the fourth and fifth reproductive periods (Table 1). On average across the five reproductive periods, fewer cows sired by bull A (84.8%) were diagnosed as pregnant compared to cows sired by bull B, C and D (93.1, 96.7 and 93.2%, respectively, P<0.05). Of the cows that were diagnosed as pregnant, the percentage that successfully weaned a calf was less for cows sired by bull D (79.9%) than cows sired by bulls A, B and C (93.9, 89.8 and 91.4%, respectively; P<0.05). When the number of calves weaned was expressed as the percentage of cows joined cows sired by bull D (74.9%) differed only from cows sired by bull C (88.3%). The weaning rates of cows sired by bulls A and B were intermediate and did not differ from any other sire (79.4 and 83.5%, respectively P>0.05).

Sire had an effect on cow stayability at marking of their fifth calf at six years of age (Figure 2) such that a greater percentage of cows sired by bull C (53.7%) remained in the herd compared with cows sired by bulls D and A (22.0 and 31.3%, respectively; P<0.05). The percentage of cows sired by bull B that remained in the herd (40.0%) was intermediate and did not differ from cows sired by bulls A, C or D (P>0.05).

Table 1 The effect of cow breed-cross (straightbred Angus, AA; Angus-cross-Friesian, AF; Angus-cross-Jersey, AJ; Angus-cross-Kiwicross, AK) and sire (bull A, B, C or D) on the number (or percentage of cows that were diagnosed pregnant or reared a calf to weaning or marking).

		1st reproductive period		2nd reproductive period		3rd reproductive period		4th reproductive period		5th reproductive period	
	n	Pregnant	Weaned calf	Pregnant	Weaned calf	Pregnant	Weaned calf	Pregnant	Weaned calf	Pregnant	Marked calf
Cow breed-cross											
AA	68	59[1] (86)[2]	48[3] (81)[4]	43 (90)	38 (88)	38 (100)	36 (95)	32 (89)	31 (97)	29 (94)	29 (100)
AF	43	41 (95)	35 (85)	32 (91)	29 (91)	29 (100)	24 (83)	22 (92)	21 (96)	20 (95)	18 (90)
AJ	53	49 (91)	42 (86)	41 (98)	36 (88)	35 (97)	30 (86)	24 (80)	20 (83)	18 (90)	17 (94)
AK	31	28 (90)	23 (82)	21 (91)	17 (81)	16 (94)	16 (100)	15 (94)	14 (93)	11 (79)	8 (73)
Sire											
A	48	42 (88)	35 (83)	31 (89)	29 (94)	27 (93)	25 (93)	19 (76)	19 (100)	15 (79)	15 (31)
B	65	60 (92)	50 (83)	46 (92)	38 (83)	38 (100)	33 (87)	29 (88)	29 (100)	27 (93)	26 (40)
C	41	41 (100)	38 (93)	36 (95)	32 (89)	32 (100)	28 (88)	26 (93)	25 (96)	24 (96)	22 (54)
D	41	34 (83)	25 (74)	24 (96)	21 (88)	21 (100)	20 (95)	19 (95)	13 (68)	12 (92)	9 (22)
Overall	197	177 (90)	148 (84)	137 (93)	120 (88)	118 (98)	106 (90)	93 (88)	86 (93)	78 (91)	72 (92)

[1] Number of cows diagnosed pregnant of cows joined in the reproductive period. [2] Percentage of cows diagnosed pregnant of cows joined in the reproductive period. [3] Number of cows that weaned a calf of cows diagnosed pregnant in the reproductive period. [4] Percentage of cows that weaned a calf of cows diagnosed pregnant in the reproductive period.

Figure 1 The survival from eight months of age until the weaning of their fifth calf at six years of age of straight-bred Angus (AA), Angus-cross-Friesian (AF), Angus-cross-Jersey (AJ), and Angus-cross-Kiwicross (AK) cows.

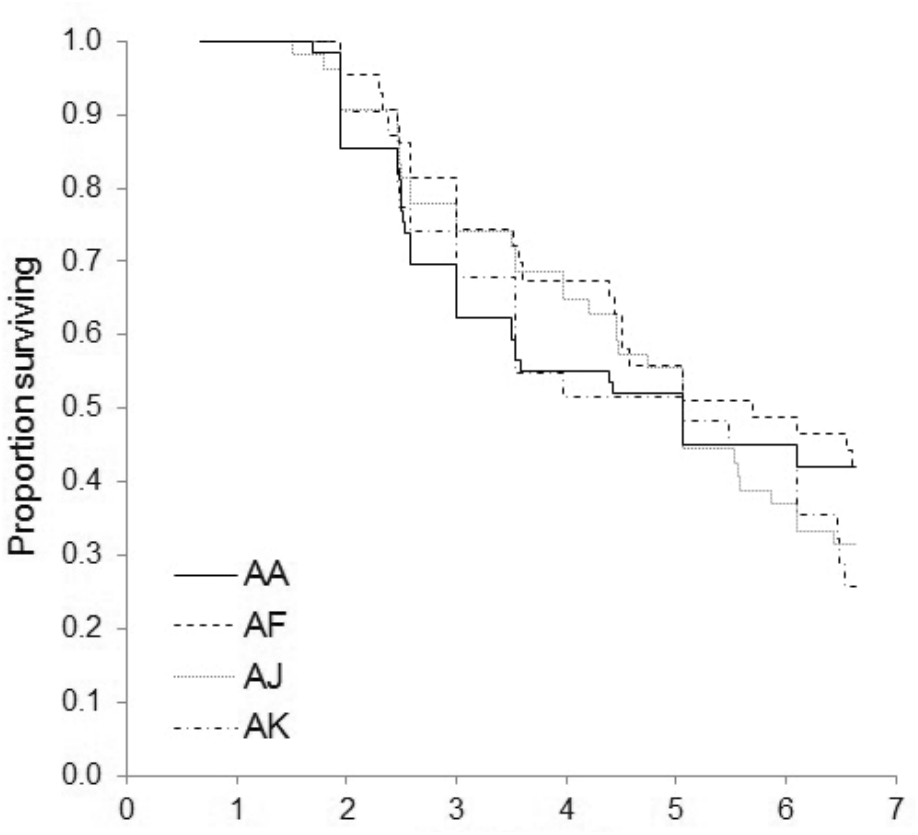
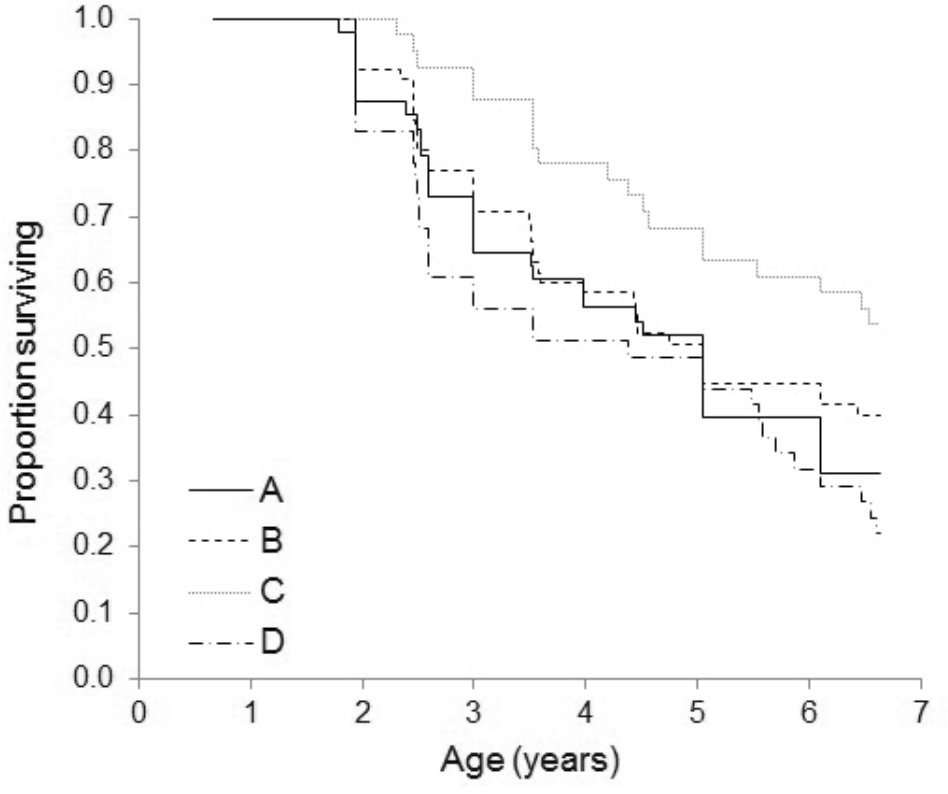


Figure 2 The survival of cows from eight months of age until the weaning of their fifth calf at six years of age for each sire A, sire B, sire C and sire D.



Cause of cow removal from herd

Overall, 37% of cows remained in the herd at the marking of their fifth calf. The primary cause of cow removal from the herd was culling due to abortion of the fetus or death of the calf (n=58; Table 2). This was followed closely by being diagnosed as not pregnant (n=51). Ill-health was the cause of 16 cows being removed from the herd (AA=3, AF n=3, AJ n=6 and AK n=4). Of the cows removed for ill-health there were culled and the remainder died (n=13). Mastitis was the primary single cause of cow deaths at 50% (n=7; AA=0, AF n=2, AJ n=3 and AK n=2).

There was no effect of cow breed-cross on the reasons cows were removed from the herd. Sire, however, affected the number of cows removed from the herd due to being non-pregnant, their calf died and ill-health. More cows sired by bull A ($P<0.05$) were removed from the herd due to being diagnosed as non-pregnant (43.8% of cows that began the study) than bull B (23.1%) and bull C (12.2%) and tended to differ ($P=0.06$) from bull D (24.4%). Fewer cows sired by bull A ($P<0.05$) were removed from the herd due to calf death (12.5% of cows that began the study) than bull B (29.2%), but did not differ ($P>0.05$) from bulls C and D which were intermediate (14.6 and 22.0%, respectively). The number of cows removed from the herd due to ill health was greater ($P<0.05$) for cows sired by bull D (21.9% of cows that began the study) than bulls A, B or C (4.2, 0 and 7.3%, respectively).

Table 2 The total number and the number of cows in each reproductive period (1st, 2nd, 3rd, 4th, 5th) that were removed from the herd as a result of being not pregnant, aborted fetus, calf death, cow death or culled due to ill health.

Cause of cow	Reproductive period					
Removal from herd	1st	2nd	3rd	4th	5th	Total
Not pregnant	17	11	2	13	8	51
Aborted fetus	9	7	2	0	0	18
Calf death	17	8	9	3	3	40
Cow death	5	1	1	3	3	13
Cull (ill health)	1	1	0	1	0	3
Overall	49	28	14	20	14	125

Discussion

The overall stayability of beef-cross-dairy breeding cows in the current study was low with 37% of cows remaining in the herd at the marking of their fifth calf. The stayability rates were lower than previously reported (Morris et al. 1987, Rohrer et al. 1988). This is likely to be a result of the strict culling regime employed whereby cows were culled if they failed to be diagnosed as pregnant or failed to wean a calf. Both Morris et al. (1987) and Rohrer et al. (1988) culled cows only after there were two consecutive reproductive periods where a cow had reproductive failure or failed to wean a calf.

Cow stayability in the current study was not influenced by the cow breed-cross. Although this finding is in agreement with Morris et al. (1987), a number of other studies have reported that crossbred cows on pasture had greater longevity when compared to straightbred cows (Spelbring et al. 1977, Nunez-Dominguez et al. 1991, Arthur et al. 1992). A similar finding was also reported of cattle in a feedlot environment (Rohrer et al. 1988). Stayability in the current study was only observed until marking of the fifth calf at 6 years of age so it is possible that the breeds may diverge as the cows grow older. In addition, the binary nature of the data collected and the relatively small number of cows enrolled in the study may limit the ability of the statistical analyses to detect differences in the longevity of each of the cross-breeds.

Sire of the cow had a significant effect on pregnancy and weaning rates and, as a result, on cow stayability. In terms of pregnancy rate, sire A had poorer performance than the three other sires whereas sire D had lower weaning rates (per cow identified pregnant) than the three other sires. The stayability of cows sired by bull C was greater than for cows sired by bull D. A sire effect on cow stayability was unsurprising given that the heritability of cow stayability to consecutive calvings was moderate at 0.15 to 0.35 for second to fifth calvings (Jamrozik et al. 2013).

In the present study, 91.8% of all joinings resulted in pregnancy and 82.0% of cows joined successfully weaned a calf. Therefore, in the present study, the differences in stayability appear to be due equally to a failure to conceive and failure to wean a calf. The pregnancy and weaning rates achieved in this study were both greater than those reported by Morris et al. (1987, 1993b) which were between 75.5 and 85.9% for pregnancy rates and between 66.2 and 77.5% for weaning rates (as a percentage of cows joined). In the present study there was no effect of cow breed-cross on pregnancy and weaning rates. Morris et al. (1987) reported that crossbred cows had 10.2% better pregnancy rates and 15.1% better weaning rates than straightbred cows. Although, it is acknowledged that the cows included in the present study were produced in a dairy herd whereas Morris et al. (1987) had crossbred cows that were produced in a beef herd. The pregnancy rates achieved in the present study would rank the herd in the 50th percentile of beef cow herds in New Zealand for a nine week joining period (McFadden et al. 2005). Therefore, the performance of the herd can be used as an indicator of the performance of an average beef cow herd.

The greatest loss of cows in this study occurred during the first reproductive period (from the first joining until weaning of the first calf) where almost 40% of all cows left the herd. This finding is in agreement with Arthur et al. (1992) and Tanida et al. (1988). The pregnancy rates in both the first and second reproductive periods were similar, however, in the first calving period a greater proportion of calves died as a result of mis-mothering and exposure as a result of very wet conditions. This is in contrast to Arthur et al. (1992) who reported that almost 70% of cows that left the herd at one year of age did so due to reproductive failure and at two years of age approximately 20% had lost a calf.

The primary causes of cow loss were failure to conceive (40%) and calf death (32%). However, if fetal abortion is grouped with calf death, then this becomes the primary cause of cow loss. In terms of economic impact of cow loss, failure to conceive is less "expensive" because the cow is removed from the herd earlier than if there are fetal abortions or calf deaths thereby eliminating the need to carrying cows through winter only to cull them in the spring.

Conclusion

The results of this study showed that when employing a strict culling policy, and removing cows after failing to become pregnant or wean a calf, the stayability of cows was low. There were, however, no differences in the stayability of straight-bred Angus or beef-cross-dairy cows. Increases in pregnancy rate and calf survival offer the potential to greatly increase stayability of cows in the herd. Selection of appropriate sires also contributes to cow stayability, and therefore, selection of bulls could be used to improve cow retention within the herd.

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