AN EPD FOR STAYABILITY OF BEEF COWS

W. M. Snelling, B. L. Golden and R. M. Bourdon
Colorado State University Department of Animal Sciences, Fort Collins, CO 80523

INTRODUCTION

Expected progeny differences, or EPD, have become widely accepted by beef cattle producers. Commonly available EPD include birth weight, weaning weight, yearling weight, milk and total maternal. Using these EPD, producers may tailor their breeding herds to levels of these traits appropriate to their environment and management. One complaint about the traditional EPD, however, is they do not address reproductive performance. The stayability EPD predict the probability that females will remain in production until a specific age, and may provide genetic evaluations for reproductive performance in beef cows.

MATERIALS AND METHODS

Stayability defined. Stayability has been defined as the probability of surviving to a specific age, given the opportunity to reach that age (Hudson and Van Vleck, 1981). The meaning of stayability traits can change, depending on the age considered and which animals are considered to have the opportunity to reach that age. For beef cows, a useful stayability trait is the probability that a cow in production will remain in production to raise enough calves to pay for her development and maintainence costs. Since reproductive failure is the most common reason for cows to leave a herd, EPD for this stayability trait provide genetic indications of reproductive ability.

The age a cow must reach to break even depends on the value of replacement females, annual profit per cow and salvage value of cull cows (Dalsted and Guiterrez, 1989). For the ranges of values presented in table 1, a cow must remain in the herd for one to fourteen years. While favorable economic conditions may allow a cow to pay for herself with three or fewer calves, more typical situations demand that a cow produce at least five calves. For a herd to be profitable, some cows must remain in production past the breakeven number of calves to compensate for those cows culled before their breakeven age.

For national cattle evaluation (NCE) of stayability, historical pedigree and other information on file with beef breed registries is useful to assign stayability observations. Which females entered production may be determined by which females became dams. The age a cow left production may be determined from her age when she had her last recorded calf. Necessary data exist so stayability EPD can be computed now. Developing EPD for other measures of reproduction may require several years of collecting additional data before sufficient information is available to produce meaningful EPD.

Measurement. Data for an initial NCE of stayability were obtained from the Red Angus Association of America (RAAA). These data represented 422,386 animals reported to the RAAA through November, 1993. The analyses provided prototype stayability EPD, estimated genetic and environmental stayability trends, and examined the relationship between stayability and other EPD. The stayability trait considered was the probability of a cow having a calf at or after the age of six, given she had a calf at age five or earlier. The age of six was used since it is close to the breakeven age for many economic conditions, and was greater than the mean age at last calving of RAAA dams. Cows were considered to have entered production if they had a calf at age five or earlier. Those cows that calved when they were six years old or older received a favorable observation, those whose last calf was earlier than age six received an unfavorable observation. Cows that entered production less than five years ago did not recieve an observation. This definition of stayability was used to account for cows with calves that were not reported to the breed association. In this way, cows that calved every year, even though some calves were not reported, could be more fairly evaluated.

Analysis. Since observations were binary, stayability EPD were obtained from a single trait threshold model (Gianola and Foulley, 1983; Harville and Mee, 1984). The analysis fit animal as a random effect with an inverse numerator relationship matrix that accounted for all known relationships among RAAA animals (Golden et al., 1991). Contemporary group was fit as a fixed effect, with contemporary groups defined by birth year of cow, breeder of cow and breeder of her calves through five years of age. If a cow's calf was not reported at a given age, the breeder her most previous calf was assigned as the breeder of her calf at that age.

A heritability estimate of .10, obtained from within herd analyses of stayability (Snelling, 1994) was used in this analysis. Animal and contemporary group solutions on the underlying scale of the threshold model were translated to a percent probability scale, and expressed as deviations from a 50% probability. Mean EPD and contemporary group solutions by birth year were calculated to estimate genetic and environmental trends. Means and ranges of traditional birth weight (BW), direct weaning weight (WW_d), maternal weaning weight (WW_m) and yearling weight (YW) EPD were determined for sires and bull calves with high and low stayability EPD. The traditional EPD were obtained from analyses incorporating genetic groups based on EPD from NCE of another breed (Golden et al., 1994).

RESULTS AND DISCUSSION

A clear separation of genetic and environmental trends for stayability is shown by figure 1. Mean contemporary group effects by birth year indicates a general decline in environmental effects on stayability, with large year to year fluctuations. Mean EPD by birth year indicates genetic trend for stayability is less subject to annual fluctuation. A gradual increase started 1970. This may be a result of practices such as culling open cows and fertility testing bulls, which became common in the United States in the 1970's. Some practices apparently resulted in increased use of sires and dams with superior genetics for stayability and fertility.

Stayability EPD ranged from -11.8% to 14.2% (table 2). The animals with the lowest and highest stayability EPD are both sires, with a difference of 28.4% between EPD of these sires. EPD of bull calves represent the predicted genetic merit of RAAA bull calves born in 1993. Due to the increasing genetic trend, the mean stayability EPD of these calves is somewhat higher than the mean EPD of the entire population.

Table 3 indicates the range of BW, WW_d, WW_m and YW EPD available in sires with high stayability EPD is similar to the range of these EPD when stayability is not considered. The 20% of sires with the highest stayability EPD included sires with the highest and lowest BW EPD. These sires also included those with the highest WW_d, WW_m and YW EPD. Sires with low WW_d, WW_m and YW EPD were among the high stayability EPD sires, but not those sires with the lowest EPD for these traits.

Stayability EPD may be considered without severely limiting selection using traditional EPD. Selection criteria used to with traditional EPD may still be applied. Of the potential parents meeting traditional criteria, those with low stayability EPD, whose daughters are least likely to remain in production may be eliminated from consideration. Genetic improvement of stayability may allow beef producers to increase reproductive performance in their herds, or maintain a constant level of reproducitve performance with a less favorable environment.

SUMMARY

The new stayability EPD are predictions of genetic merit for the probability of cows staying in production to the age of six and beyond. This is near the age required for cows to break even, so the EPD may be considered predictions for the probability that cows be profitable. Since reproductive failure is the primary cause of cows leaving production, the stayability EPD are also EPD for reproductive performance. Some genetic progress for stayability has been made over the last twenty years, and this progress may be accelerated by use of the stayability EPD. Genetic improvement of stayability may increase reproductive performance, or allow a desired level of reproductive performance to be maintained

at a lower cost. The stayability EPD may be incorporated into selection criteria using traditional EPD without restricting the range of traditional EPD that may be considered. Selection primarily on stayability EPD is not suggested until these EPD have been achieved general acceptance and are well understood.

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Table 1. Breakeven ownership period of a cow (years).[a]

Replacement Heifer Value[c]	Salvage Value[c]	Net Return/Cow[bc] $50	$100	$150
$500	$400	4	2	1
	450	2	1	1
	500	1	1	1
$600	$400	8	3	2
	450	6	2	2
	500	5	2	1
$700	$400	14	5	3
	450	12	4	3
	500	10	3	2

[a]Dalsted and Gutierrez, 1989.
[b]90% weaning rate and 5% discount rate.
[c]U.S. dollars

Table 2. Mean and range of Red Angus stayability EPD.

Animals	Mean	Minimum	Maximum
All	2.2	-11.8	14.2
Sires	2.0	-11.8	14.2
Bull Calves	3.7	-2.1	9.5

Table 3. Range of traditional EPD among all sires and among sires with the highest 20% of stayability EPD.

Trait	Sires	Traditional EPD Minimum	Traditional EPD Maximum
Birth weight	All	-10.0	13.7
	Top 20% Stayability	-10.0	13.7
Direct weaning weight	All	-40.1	70.4
	Top 20% Stayability	-24.6	70.4
Maternal weaning weight	All	-34.0	31.1
	Top 20% Stayability	-27.7	31.1
Yearling weight	All	-63.6	109.0
	Top 20% Stayability	-38.1	109.0

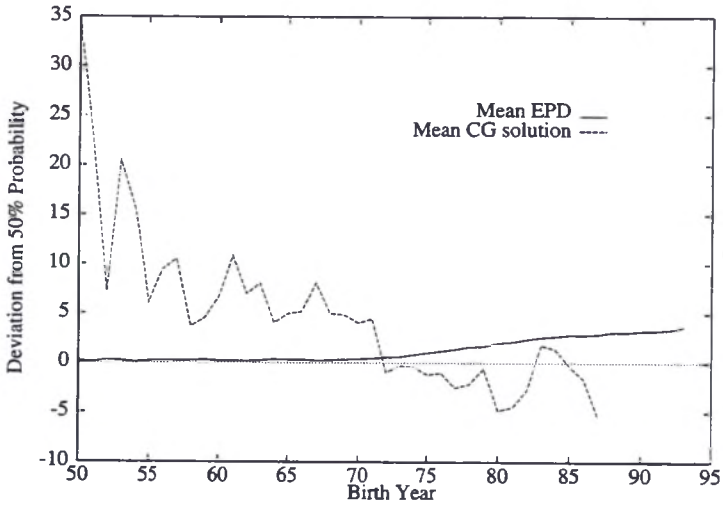

Figure 1. Mean stayability EPD and contemporary group (CG) solutions by birth year.