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Breeding System Effects on Production Efficiency Through Weaning-Preliminary Results

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BREEDING SYSTEM EFFECTS ON PRODUCTION EFFICIENCY THROUGH WEANING-PRELIMINARY RESULTS

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Summary

Preliminary results are presented on production efficiency for a comparison of two-breed rotational crossbreeding to the terminal phase of a rotational-terminal combination system with Charolais as the terminal sire breed. The breeding system comparisons were made within each of three types of dam: Simmental x Hereford, Angus x Hereford, and Tarentaise x Hereford. The two breeding systems had similar average values for dam size, condition score, and feed ME through weaning. Results indicate an increase for terminal matings compared to rotational matings in terms of weaning weight and efficiency ratio (calf weaning weight/dam and calf feed ME) within the Angus x Hereford group, while the effect of breeding system was nonsignificant within the other two dam types.

(Key Words: Beef Cattle, Breeding System, Production Efficiency.)

Introduction

Crossbreeding allows the potential for 1) making quick and dramatic genetic change within a herd, 2) utilization of heterosis, and 3) genetic complementarity. Rotational crossbreeding systems take advantage of heterosis and have the desirable feature of producing replacement females within the system. In herds that are large enough to support an additional breeding group, a terminal mating phase can be invoked in addition to the rotation. Such rotational-terminal combination systems are sometimes called rotaterminal systems. Replacement females are retained from the rotational phase but not from the terminal phase of the rotaterminal system. Terminal matings have the most potential for genetic complementarity by allowing the use of specialized breed types. That is, the genetic makeup of dams can include breeds that excel in maternal traits, while the sire excels in growth and carcass traits.

To justify the additional complications required to maintain a rotaterminal breeding system compared to a rotational system, there must be an improvement in performance to weaning or a premium on the price of feeder calves based on expected improved feedlot performance or carcass value. Two-breed rotations have been developed and maintained for a number of years in the SDSU beef breeding research herd. A terminal phase has been added in recent years. An adequate evaluation of breeding systems requires that the cow-calf, postweaning-feedlot, and carcass-packing segments of production are included. The objective of the present paper is to present preliminary information on the comparison of rotational versus terminal matings for cow-calf production in a drylot management system. Postweaning and carcass information will be presented in the future as it becomes available.

Materials and Methods

Three different two-breed rotations--Simmental x Hereford, Angus x Hereford, and Tarentaise x Hereford--have been developed at the Antelope Range Livestock Station in northwestern South Dakota. [Note: Hereford and Polled Hereford are referred to interchangeably. The breed composition of many cows in this herd include both types.] Within a two-breed rotation, cows of low percentage Hereford are mated to Polled Hereford bulls, while cows of high percentage Hereford are mated to the bulls of the other breed used in the

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rotation. In other words, the cow is mated to a bull of the breed other than that of her own sire.

For the present study, a portion of the dams continue to be mated within their respective rotation, while another portion have been mated to Charolais bulls in a terminal cross. The full array of matings are shown in Table 1. The Simmental x Hereford and Angus x Hereford rotations have been in place a number of years, so that there are no longer any first-cross (F1) cows remaining. The Tarentaise x Hereford rotation was established more recently, and includes a number of F1 cows. For purposes of analyses in this paper, the F1 cows have been grouped with the Tarentaise x Hereford cows of low percentage Hereford.

A sample of cows from each mating type were transported to a drylot in Brookings with facilities for feeding cows individually. Cows entered the drylot study one week after weaning in October, 1990, and remained there through weaning in October, 1991. Calves were born primarily in March and April. A total of 64 cow-calf pairs completed the 360-day test.

Initial feed levels offered to cows were based on NRC (1984) guidelines, and so initial differences between cows varied with cow weight. Cow weights and visual condition scores were monitored at 4-week intervals. Feed levels were adjusted at 4-week intervals in an attempt to minimize differences in condition score among cows, with a target score of 5 to 6 on a scale of 1 through 9. The cow precalving diet consisted of chopped hay and pelleted hay, while corn grain was added during lactation. The metabolizable energy (ME) content of each feedstuff was estimated from NRC (1984). Cumulative ME was calculated for nonlactation and lactation, and then calving date was included in the statistical model. Therefore, the values for nonlactating ME and lactating ME are adjusted to the overall average lengths of those respective periods (158 and 202 days for nonlactation and lactation, respectively). Calf weaning weight and efficiency ratio (calf weaning weight/dam and calf feed ME) are also adjusted to the overall average calf weaning age.

Table 1. Sire and dam breeds used in rotational and terminal matings

Dam breed[a]	Sire breed	
	Rotational	Terminal
SHS	Polled Hereford	Charolais
HSH	Simmental	Charolais
AHA	Polled Hereford	Charolais
HAH	Angus	Charolais
THT	Polled Hereford	Charolais
HTH	Tarentaise	Charolais

[a] SHS = Simmental x Hereford dams sired by Simmental, HSH = Simmental x Hereford dams sired by Polled Hereford, AHA = Angus x Hereford dams sired by Angus, HAH = Angus x Hereford dams sired by Polled Hereford, THT = Tarentaise x Hereford dams sired by Tarentaise, and HTH = Tarentaise x Hereford dams sired by Polled Hereford.

Results and Discussion

The objective of the present paper is to compare rotational versus terminal matings for each of the three dam types. Differences between rotational versus terminal matings reflect 1) differences in additive genetic effects of Charolais versus the two breeds in the dam rotation, and 2) additional individual heterosis for terminal matings compared to rotational matings. Also of interest is the extent to which rotational versus terminal comparisons vary across dam types (i.e., dam type x breeding system interaction). Discussion regarding dam type as a main effect, while of interest, will be limited in this paper.

Average levels of performance are presented by dam type and breeding system in Table 2. The breeding system comparison was not significant for any of the measures of dam size, condition score, or feed ME. When averaged across dam types, calf birth weights were 11.3 lb heavier in terminal matings than in rotational matings. The difference was especially large for the Angus x Hereford group (17.4 lb). No significant difference in calving difficulty between breeding systems was observed among these cows which ranged from five to ten years of age.

The dam type x breeding system interaction was significant only for calf weaning weight and the efficiency ratio. The Angus x Hereford group seemed to benefit most from the terminal breeding phase. Average weaning weight and efficiency ratio were significantly higher for terminal matings than for rotational matings within the Angus x Hereford group, while the breeding system comparison was nonsignificant for the other two dam types.

These results should be regarded as preliminary in two respects. First, a second set of animals (1992 calf crop) are currently under evaluation to provide additional observations for the data set. Secondly, calf postweaning feedlot performance and carcass traits will be evaluated on both calf crops. This additional information should provide a more comprehensive evaluation of breeding system effects on total system efficiency. It should also be noted that reproductive performance was not evaluated for this paper.

It should be noted that only mature cows were evaluated in this study. The large effect of terminal matings on birth weight within the Angus x Hereford group, and to a lessor extent within Tarentaise x Hereford, illustrates the need for caution regarding bull type when consideration is given to dam age. The impact of larger calf birth weights on calving difficulty is likely to be much greater in first-calf heifers in particular. In this particular herd, presently heifers are bred to Angus or Red Angus bulls with low predicted genetic values for birth weight. Females are not exposed to terminal-sire matings until their second breeding year or later.

Table 2. Average performance in drylot by dam type and breeding system

Dam type	Simmental x Hereford			Angus x Hereford			Tarentaise x Hereford			Avg SE	Avg difference Ter-Rot
Breeding system[a]	Rot	Ter	Diff.	Rot	Ter	Diff.	Rot	Ter	Diff.		
Number dam-calf pairs	7	13		9	13		14	8			
Dam traits											
Avg precalving wt, lb	1264	1290	ns	1265	1242	ns	1165	1178	ns	30.9	5.8
Avg lactating wt, lb	1203	1224	ns	1226	1173	ns	1129	1131	ns	30.6	-10.1
Overall avg wt, lb	1226	1249	ns	1241	1198	ns	1143	1148	ns	30.5	-5.2
Avg precalving condition score[b]	4.8	5.0	ns	5.4	5.6	ns	4.9	4.9	ns	.165	.11
Avg lactating condition score[b]	4.5	4.7	ns	5.6	5.5	ns	4.8	4.8	ns	.162	.03
Overall avg condition score[b]	4.6	4.8	ns	5.5	5.5	ns	4.9	4.8	ns	.158	.07
Precalving ME, Mcal	2879	2902	ns	2810	2774	ns	2699	2747	ns	49.5	12.0
Lactating ME, Mcal	5912	5885	ns	5468	5444	ns	5626	5672	ns	79.4	-1.6
Total cow ME, Mcal	8791	8787	ns	8278	8219	ns	8325	8419	ns	118.8	10.2
Calf traits											
Birth wt, lb	104.8	111.7	ns	93.5	110.9	**	100.5	110.0	+	3.82	11.3**
Creep ME, Mcal	335.1	339.9	ns	358.0	365.9	ns	351.5	342.0	ns	25.0	1.1
Weaning wt, lb	556.6	558.7	ns	472.5	531.2	**	542.8	541.4	ns	14.7	19.7
Dam-calf traits											
Total ME, Mcal	9125	9127	ns	8636	8583	ns	8674	8754	ns	120.2	9.4
Calf weaning wt/total ME, lb/Mcal	.0609	.0612	ns	.0546	.0620	**	.0619	.0625	ns	.00157	.0028*

[a] Rot = two-breed rotation; Ter = rotaterminal system with two-breed rotational cows mated to Charolais bulls.

[b] Based on a scale of 1 (thinnest) through 9 (fattest).

ns Nonsignificant, +P<.10, *P<.05, **P<.01.