

Effects of Artificial Insemination and Natural Service Breeding Systems on Steer Progeny Backgrounding Performance

P.L. Steichen¹, M.R. Schook¹, C.S. Schauer², B.W. Neville³ and C.R. Dahlen¹

¹Department of Animal Sciences, NDSU, Fargo

²Hettinger Research Extension Center, NDSU, Hettinger

³Central Grasslands Research Extension Center, NDSU, Streeter

The objective of this study was to determine the backgrounding performance of calves born early or late in the calving season and from breeding systems that incorporated artificial insemination or relied solely on natural service. Although distinct performance advantages of AI calves were not observed, calves born early in the calving season had greater feed intake and gain, compared with calves born later in the calving season.

Summary

One hundred eighty-four steers were born from dams exposed to one of two treatments: natural service (NS: cows were only exposed to herd bulls for the duration of the breeding season) and fixed-timed artificial insemination (TAI: cows exposed to estrous synchronization and fixed-time AI followed by natural-service bulls). Within the dam's treatment, steers were divided into two blocks: calves born from day 0 to 26 of the calving season (Early, n = 119) and calves born after day 26 of the calving season (Late, n = 65). They then were placed

in one of 24 pens for a 65-day backgrounding period.

Diets consisted of 61.7 percent ground grass hay, 25.8 percent barley and 12.5 percent liquid supplement, on a dry-matter (DM) basis, and were delivered once daily. At the initiation of the study, early born calves in the TAI treatment (549 pounds) were heavier ($P < 0.05$), compared with early born calves from the NS treatment (514 pounds), which were heavier than late born calves of either treatment (468 and 464 pounds for TAI and NS, respectively; treatment \times block; $P = 0.001$).

Steers in the NS treatment had greater ($P < 0.05$) average daily gain (ADG) than TAI steers, 2.9 and 2.6 pounds/day, respectively. Steers in the TAI treatment had a lower ($P < 0.05$) gain-to-feed ratio (G:F) (0.16 G:F) than NS steers (0.18 G:F). Early born steers had greater ($P < 0.05$) final body weight (BW), dry-matter intake (DMI) and ADG (727 pounds, 16.4 pounds/day and 2.87 pounds/day, respectively), compared with late born steers (648 pounds, 15 pounds/day and 2.62 pounds/day, respectively). In summary, calves in the AI treatment did not outper-



form their NS counterparts and early born steers had greater final BW, DMI and ADG than late born calves.

Introduction

Locally available forage and grain supplies give cattle producers in the upper Great Plains a competitive advantage in placing gain on calves after weaning, compared with regions that require feed to be purchased and hauled long distances. A recent survey revealed that in 2009 to 2011, approximately 42.9 percent of the North Dakota calf crop was retained by its respective owners through a backgrounding phase (Dahlen et al. 2013).

Artificial insemination (AI) can improve the genetic base of a herd rapidly, compared with most natural service sires, by utilizing bulls with superior genetics at costs well below the cost of using a herd bull with equivalent genetic potential. Sires with superior growth and feed efficiency genetics may produce offspring with improved performance in the post-weaning phase (Welch et al. 2012; Johnson and Jones 2008). Selecting for optimal growth traits with high accuracy expected progeny differences (EPDs) may optimize backgrounding performance after weaning. However, only 7.6 percent of all beef operations use AI (NAHMS 2009).

Calf age at weaning also can influence herd performance by shifting the calving or weaning date (Lusby et al. 1981). Our research leading up to the current study has highlighted the fact that incorporating AI into a management scheme can result in older calves and early born calves that are heavier at weaning, compared with a breeding system that relies solely on natural service (Steichen et al. 2012).

However, the post-weaning performance impacts of each respective breeding system are unknown. Therefore, the objective of this study was to evaluate the impact of incorporating AI or natural service breeding systems and the impact of calf age on steer performance during a 65-day backgrounding period.

Materials and Methods

All procedures were approved by the NDSU Institutional Animal Care and Use Committee.

One hundred eighty-four Angus crossbred steer calves were used to evaluate the effects of dam breeding systems on back-



grounding performance. Calves originating from the Central Grasslands Research Extension Center in Streeter, N.D., (n = 159; born in March-April) were shipped (235 miles) and joined steers originating from the Hettinger Research Extension Center (n = 25; born in April) at the Southwest Feeders feedlot in Hettinger, N.D., for a 65-day backgrounding trial. The trial began in early October and ran through mid-December.

Calves originated from dams that were assigned to one of two breeding systems (Steichen et al., 2012): 1) natural service bulls for the duration of the breeding season (NS) or 2) estrous synchronization and artificial insemination followed by exposure to natural service bulls (AI).

Within the dams' treatment, steers were divided into two blocks: 1) calves born from day 0 to 26 of the calving season (Early n = 119) and 2) calves born after day 26 of the calving season (Late, n = 65). In the AI treatment, all calves that were born from AI sires (as opposed to cleanup bulls) were included in the Early block, whereas an equivalent number of natural service calves were included in the Early block for the NS treatment, resulting in the day 26 cutoff. Steers were assigned randomly to one of 24 pens (six to nine head/pen; Early, n = 16; Late, n = 8).

At the initiation and end of the study, all steers received a Ralgro implant (36 milligrams of zeranol; Merck Animal Health, Summit, N.J.). Steer weights were determined on two consecutive days at the beginning and end of the project prior to each morning's ration delivery.

All steers were fed a common total mixed ration once daily at 8 a.m., targeting *ad libitum* intake. The diet consisted of 61.7 percent ground grass hay, 25.8 percent barley and 12.5 percent liquid supplement (Quality Liquid Feeds, Dodgeville, Wis.) on a DM basis. The diet had added water (2 pounds per head/day) to minimize dust from hay. All steers had access to fresh water in their pens. The amount of feed delivered was monitored daily, and feed refusals were collected, weighed and sampled once weekly.

Results and Discussion

The research showed a treatment \times block interaction ($P = 0.001$) for initial BW (Table 1). Early born calves in the TAI treatment were heaviest ($P = 0.05$), followed by early born calves in the NS treatment, followed ($P = 0.05$) by late born calves in the TAI and NS treatments, respectively. Final body weight also was influenced by a treatment \times block interaction ($P = 0.052$). At the end of the study, early born calves from the TAI treatment tended to be heavier ($P = 0.09$) than early born steers in the NS treatment, which were heavier ($P < 0.05$) than late born calves in the TAI or NS treatments. Maintaining a weight advantage through the back-grounding phase may allow early born AI calves to be sold at a greater price per calf, compared with NS calves. However, we did not evaluate sales

price at the end of the back-grounding phase.

Natural service steers had greater ($P < 0.05$) ADG and gain:feed ratios, as well as a lower feed cost of gain, compared with TAI steers. One rationale for the performance difference among treatments would be that the genetic potential of the herd bulls for gain was greater than that of the AI sires. Bulls in both treatments, however, were in the top 25 percent of the Angus breed for weaning weight and yearling weight EPDs.

Most likely, the lower start weight of calves in the NS treatment allowed for compensatory gain of NS during the feeding period (Lofgreen and Kiesling 1985), which manifested itself in the form of greater gain and feed efficiency, compared with AI calves. Slight differences in age among early born calves in the AI and NS treatment also may have contributed to slight performance differences.

Early born steers had greater ($P < 0.05$) final BW, intake and average daily gain than late born steers. Because early born calves were heavier, the pattern of greater intake and gain was expected. Similarly, steers born early gained an additional 0.22 pound/day, compared with later-born calves (Smith et al. 2003) An additional report,



however, showed no difference in gain among calves born during different calving periods (Funston et al. 2012). No differences ($P > 0.10$) in feed efficiency were present among calving groups in the current study. This is in contrast to other reports of cattle during the finishing period (Fike et al. 2010). Perhaps the moderate energy diets in the current

study (as opposed to high-energy diets of previous finishing work) did not allow for differentiation of potential feed efficiency measures among early and late-calving groups.

Implications

The utilization of a breeding system that incorporates fixed-time artificial insemination

yielded an advantage of having greater pre-backgrounding and post-backgrounding body weight. However, calves born in the AI treatment did not have advantages over NS calves in other performance measures (ADG and G:F). Overall, calves born early in the calving season ate more and grew faster, compared with those born later in the calving season.

Table 1. Effects of treatment and calving season on steer backgrounding performance.

Item	Treatment ¹				SE	Trt	P - value		
	TAI		NS				Block	Interaction	
	Early ²	Late ²	Early	Late					
Age, d	180	153	173	153	--	--	--	--	
Initial BW, lb	549.2 ^x	467.7 ^z	514.0 ^y	463.9 ^z	4.54	< 0.001	< 0.001	< 0.001	
Final BW, lb	735.9 ^{xa}	640.3 ^y	721.6 ^{xb}	655.0 ^y	8.13	0.975	< 0.001	0.052	
DMI, lb/hd/d	16.7	14.9	16.7	15.0	0.37	0.541	< 0.001	0.389	
ADG, lb/hd/d	2.71	2.49	2.99	2.76	0.09	0.001	0.007	0.828	
G:F	0.16	0.17	0.19	0.18	0.01	< 0.001	0.655	0.377	
Cost of gain, \$/lb ³	0.73	0.71	0.64	0.64	0.02	< 0.001	0.554	0.330	

¹ Treatments were: dams exposed to fixed-time AI (TAI) and given 7 d CO-Synch + CIDR with cleanup bull or natural service (NS) bulls for the duration of the breeding season.

² Calves were blocked by calving date into early (born in first 26 days) and late (born after day 26) blocks, respectively.

³ Feed cost of gain with hay priced at \$145/ton, barley at \$5.75/bushel and supplement at \$350/ton.

^{x,y,z} Means within row lacking common superscript differ ($P < 0.01$).

^{a,b} Means within row lacking common superscript tend to differ ($P < 0.10$).

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