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Effects of Production System on Cow and Calf Performance

Shelby E. Gardine

University of Nebraska-Lincoln, sgardine2@unl.edu

Jason M. Warner

University of Nebraska-Lincoln

Robert G. Bondurant Bondurant

University of Nebraska-Lincoln, robby.bondurant@unl.edu

F. Henry Hilscher


University of Nebraska-Lincoln, henry.hilscher@unl.edu

Karla H. Jenkins

University of Nebraska - Lincoln, kjenkins2@unl.edu

See next page for additional authors

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Authors

Shelby E. Gardine, Jason M. Warner, Robert G. Bondurant Bondurant, F. Henry Hilscher, Karla H. Jenkins, Galen E. Erickson, and Terry J. Klopfenstein

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Summary with Implications

Limited traditional forage resources have prompted interest for alternative cow-calf production systems. This study evaluated the effects of two winter cow-calf production systems (cornstalk grazing and dry-lot feeding) on cow-calf performance in a summer-calving, intensively managed cowherd at two locations. Grazing cow-calf pairs on cornstalks resulted in similar or lower ending BW of cows and lower ADG of calves when compared to cow-calf pairs wintered in the dry-lot. A partial budget of incorporating winter cornstalk grazing into an intensive production system suggests that cows wintered on cornstalks may be \$137 more profitable compared to cows wintered in the dry-lot.

Introduction

Diminishing traditional forage resources have stimulated cow-calf producers to seek alternative production systems. Research has shown that intensive management of cows can be utilized as an alternative system to traditional pasture beef production (2015 *Nebraska Beef Cattle Report*, pp. 16–18). Areas that are challenged by limited traditional forage resources will commonly have greater grain crop production, resulting in greater availability of corn residue for fall/winter grazing with by-product supplementation. An economic analysis of an alternative production system suggests that integrating corn residue grazing in a semi-confined cow-calf production

Table 1. Diets fed to cow-calf pairs from November to April by location and year^{1,2}

Ingredient, %	Year 1	Year 2		Year 3	
	ENREC ³	ENREC ³	PREC ⁴	ENREC ³	PREC ⁴
Modified wet distillers grains plus solubles	55	55	—	55	—
Wet distillers grains plus solubles	—	—	58	—	58
Cornstalks	—	40	—	—	—
Wheat straw	40	—	40	40	40
Supplement ⁵	5	5	2	5	2

¹All values presented on a DM basis

²Dry matter offered (range of 24.5 lb. to 29.5 lb.) increased monthly throughout the study

³ENREC = Eastern Nebraska Research and Extension Center

⁴PREC = Panhandle Research and Extension Center

⁵Supplements included limestone, trace minerals, vitamin A,D,E premix

system may reduce production costs (2015 *Nebraska Beef Cattle Report* pp. 19–21). However, minimal research is available on the performance of a cow-calf pair grazing corn residue. Therefore, the objective of the current study was to evaluate the effects of winter corn residue grazing in a semi-confined cow-calf production system on cow and calf performance.

Procedure

This study was conducted over three years at the Eastern Nebraska Research and Extension Center (ENREC) and two years at the Panhandle Research and Extension Center (PREC). Lactating, composite (Red Angus x Red Poll X Tarentaise x South Devon x Devon) beef cows (n=127 at ENREC; n=56 at PREC) with summer-born calves were utilized in the study. In year one, cow-calf pairs within location were blocked by cow BW (4 blocks at ENREC; 2 blocks at PREC), stratified by calf age, and assigned randomly within strata to one of two winter cow-calf production treatments with four (ENREC) or two (PREC) replications (pens or paddocks) per treatment. Treatments were 1) dry-lot feeding (DL) or 2) cornstalk grazing (CS). In the subsequent years, cows within location were assigned to the same treatment as assigned in year one.

Prior to trial initiation, cows were con-

fined in a common pen within location during the summer calving season (mean calving date: ENREC=July 14; PREC=July 15). A distillers and crop residue based diet was limit-fed to cow-calf pairs during this time.

The trial was initiated at the beginning of cornstalk grazing within each location (Nov 11 at ENREC and Nov 22 at PREC). Cow-calf pairs in the CS treatment were hauled to irrigated cornstalk fields, while cow-calf pairs assigned to DL treatment remained in dry-lot pens.

Dry-lot pairs within location were limit-fed a diet (Table 1) formulated to maintain a lactating cow in early gestation. Dry matter offered (range of 24.5 lb. to 29.5 lb.) per day increased monthly throughout the study to account for the increasing intake of the growing calves.

Stocking rate for cow-calf pairs grazing corn residue was calculated using estimated residue intakes of the cow and calf (2009 *Nebraska Beef Cattle Report*, pp. 13–14) and assuming 8 lb of husk and leaf residue (DM) were consumed per bushel of corn yield. A dried distillers grain based pellet (Table 2) was supplemented in bunks to pairs wintered on cornstalks at a rate of 5.3 lb. (range of 3.7 lb. to 7.1 lb.) DM/pair daily. Estimated DM intake of the cow and calf (2009 *Nebraska Beef Cattle Report*, pp. 13–14) and estimated digestibility values

Table 2. Supplement fed to cow-calf pairs grazing cornstalks^{1,2}

Ingredient, %	
Dried distillers grains plus solubles	93.28
Limestone	6.23
Pelleting binder (urea formaldehyde polymer and calcium sulfate)	0.21
Vitamin A,D,E	0.11
Trace mineral ³	0.17

¹All values presented on a DM basis

²Supplemented on average at a rate of 5.3 lb. (range of 3.7 lb. to 7.1 lb.) DM/pair daily

³Trace mineral: 0.4389% Cu, 3.1818% Mn, 2.1511% Zn, 0.0067% Co, 0.0152% I, 94.2064% Limestone carrier

of the cornstalk residue throughout the grazing period (2004 *Nebraska Beef Cattle Report*, pp. 13–15) were used to calculate supplementation rate to meet cow-calf requirements. Additional supplemental feed was only fed to grazing pairs if snow cover prevented grazing. In year 2, approximately 170 lb. (DM) of ammoniated cornstalks was fed per cow-calf pair at ENREC.

The trial was completed when winter cornstalk grazing ended on April 10 (ENREC) or April 6 (PREC), which coincided with weaning time. Cow BW and calf BW were recorded over two consecutive days at trial initiation and completion to determine changes in BW. Body condition score (BCS) of cows was also evaluated at trial initiation and completion to calculate differences in condition score. Prior to being weighed at trial initiation, all pairs were limit-fed for a minimum of 5 consecutive days to reduce weight variation due to gastrointestinal tract fill. At trial completion, cow and calves were separated and limit-fed a minimum of 5 days before being weighed. Cows were exposed to bulls (approximately 1 bull: 10 cows) beginning Sept 25 and September 26 with a 73 and 74 day breeding season at ENREC and PREC, respectively.

Data from ENREC and PREC were analyzed separately. Data were analyzed as a randomized block design using the mixed procedure of SAS. The model included pen or paddock as the experimental unit, cow-calf production system as the fixed effect, and block and year as random effects. Because the proportion of steer and heifer calves varied within pens, proportion of steers was included in the model as a covariate for all calf performance variables. Significance was declared at $P \leq 0.05$.

Table 3. Performance of cows by cow-calf production system¹

Item	ENREC		SEM	P-value	PREC		SEM	P-value
	CS ²	DL ³			CS ²	DL ³		
Cow BW, lb								
Initial ⁴	1219	1225	60	0.86	1332	1300	133	0.59
Ending ⁵	1147	1313	48	<0.01	1351	1360	96	0.86
Cow BW Change, lb	-72	88	20	<0.01	19	60	37	0.42
Cow BCS ⁶								
Initial ⁴	5.49	5.58	0.31	0.62	6.09	5.92	0.71	0.50
Ending ⁵	5.03	5.82	0.18	<0.01	5.83	5.95	0.70	0.41
Cow BCS change ⁴	-0.46	0.24	0.20	<0.01	-0.26	0.03	0.08	0.04
Pregnancy ⁷ , %	97.5	83.1	8.1	0.24	87.5	89.0	13.2	0.94

¹Three years of data from ENREC and two years of data from PREC

²CS= pairs wintered on cornstalks

³DL= pairs wintered in dry-lot

⁴Initial date= November 11 at ENREC and November 22 at PREC

⁵Ending date= April 10 at ENREC and April 6 at PREC

⁶BCS on a 1 (emaciated) to 9 (obese) scale

⁷Reproduction data from years 2 and 3 (ENREC) or year 2 (PREC) due to breeding season beginning prior to trial initiation within yr

Results

Cow-calf pairs at ENREC grazed from Nov 11 to April 10 (152 d). At PREC, the grazing period was 137 days (Nov 22 to April 6). Dry-lot cow-calf pairs were limit-fed 27.2 lb DM (ENREC) or 26.14 lb DM (PREC) on average throughout the trial.

Cow performance is presented in Table 3. Cows that were managed in the dry-lot at ENREC had greater ending BW and BCS compared to cows grazing cornstalks ($P < 0.01$). Cows wintered on cornstalks at ENREC lost BW and had a 0.5 unit decrease in BCS, while cows in the dry-lot gained BW and had a 0.2 unit increase in BCS. At PREC, BCS increased for cows wintered in the dry-lot and decreased for cows wintered on cornstalks ($P = 0.04$). No significant differences ($P \geq 0.41$) were observed between treatments for any other cow performance variables at PREC. The increase in BW and BCS observed in cows managed in the dry-lot over the winter indicates that DL cows were over-fed and not at maintenance.

Reproduction data required that cows had a treatment applied prior to the breeding season; therefore, treatment effect on pregnancy rate was measured for years 2 and 3 at ENREC and year 2 at PREC. There were 61 cows (CS= 33; DL= 28) and 19 (CS=10; DL= 9) cows total from ENREC and PREC, respectively, that met these criteria. Although cow numbers within treatments are minimal, current data sug-

gest that there is not a treatment difference for pregnancy rates.

Calf performance is presented in Table 4. Similar production effects were observed at both locations. Calves wintered in the dry-lot had greater BW change compared to calves grazing cornstalks ($P \leq 0.04$). Likewise, calves wintered in the dry-lot had greater ADG and BW per d of age compared to CS calves ($P \leq 0.03$). Weaning weights and ADG for June calves grazed on cornstalks and weaned in April (2010 *Nebraska Beef Report*, pp. 5–7) were similar to the performance of calves wintered on cornstalks in the current study. Post-weaning performance of the DL and CS calves was evaluated in a subsequent study (2018 *Nebraska Beef Report-Gardine*; Post-weaning management).

Numerically, the cows grazing cornstalks at PREC gained 19 lb. while the cows at ENREC lost 72 lb. Calves at PREC gained 1.54 lb/d while those at ENREC gained 1.32 lb/d. In vitro analysis of the corn residue at each location was conducted to determine if residue quality was related to the apparent differences in performance of the pairs grazing cornstalks. Digestible organic matter of corn residue was 45.9 % and 56.8 % at ENREC (223 bushels/acre) and PREC (230 bushels/acre), respectively. Research (1991 *Nebraska Beef Cattle Report*, pp. 19–22) demonstrated that calves gained

Table 4. Performance of calves by cow-calf production system¹

Item	ENREC		SEM	P-value	PREC		SEM	P-value
	CS ²	DL ³			CS ²	DL ³		
Initial age, d ⁴	121	118	4	0.43	131	129	17	0.62
Calf BW, lb								
Initial ⁵	331	312	8	0.08	318	317	29	0.97
Ending ⁶	529	637	12	<0.01	513	595	33	<0.01
Calf BW change	198	326	9	<0.01	211	279	25	0.04
Calf ADG, lb	1.32	2.15	0.06	<0.01	1.54	2.06	0.13	0.03
BW•d ⁻¹ age ⁻¹ , lb ⁷	1.93	2.38	0.06	<0.01	1.97	2.28	0.14	0.02

¹Three years of data from ENREC and 2 years of data from PREC
²CS= pairs wintered on cornstalks
³DL= pairs wintered in dry-lot
⁴Initial age= age at initiation of cornstalk grazing period
⁵Initial date= November 11 at ENREC and November 22 at PREC
⁶Ending date= April 10 at ENREC and April 6 at PREC
⁷Weight per d of age at collecting weights following weaning

0.3 lb./day more grazing dryland compared to irrigated cornstalks, suggesting that the quality of dryland cornstalks was greater than irrigated cornstalks. More recent data (2011 *Nebraska Beef Cattle Report*, pp. 22–23) show 8.8% greater digestibility of leaves and husks from corn residue at Scottsbluff (148 bushels/acre corn) compared to residue from 10 corn plant hybrids grown near Paxton (245 bushels/acre corn). It was hypothesized that lower yields due to environmental conditions increases the quality

of corn residue. However, the current study would disagree with this hypothesis as yields were equivalent between locations. A partial budget (2017 Nebraska Beef Report, pp. 19–21) was utilized to economically compare reduced performance, as well as decreased winter production cost of the CS wintering system. In that study, incorporating winter cornstalk grazing into an intensive production system resulted in a cost savings of \$137 per pair. The decrease in production cost more

than offset reduced performance of calves wintered on cornstalks.

Conclusion

Cow-calf pairs grazing corn residue in the winter may have similar or reduced performance compared to pairs fed a complete diet throughout the winter in the dry-lot. Reduced BW and BCS of cows wintered on cornstalks does not appear to impede pregnancy rates if cows are in adequate body condition score (≥5) prior to the breeding season. Calf ADG may be less than calves wintered in the dry-lot. However, lower winter production inputs may be significant enough to compensate for reduced performance of calves when cow-calf pairs are wintered on cornstalks.

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Shelby E. Gardine, graduate student
Jason M. Warner, graduate student
Robert G. Bondurant and F. Henry Hilscher, research technicians, Department of Animal Science, Lincoln
Karla H. Jenkins, associate professor, Panhandle Research and Extension Center, Scottsbluff
Galen E. Erickson and Terry J. Klopfenstein, professors, Department of Animal Science, Lincoln