Effects of Bedding Material on Performance and Carcass Traits of Steers Fed During the Winter in North Dakota

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Introduction

Feeding cattle in North Dakota poses some environmental challenges with wind and cold. Wind fence and shelterbelt protection have been proven to be effective in enhancing performance of feedlot cattle in North Dakota (Anderson and Bird, 1993). Bedding has also been proven to be a profitable management tool for cattle feeders during winter months. Many North Dakota farmer-feeders use straw for their livestock and spread the manure back on cropland as part of their fertility program. Straw (wheat, barley, or oats) is one of a few residues available in volume that may be a useful bedding source. This project was conducted to evaluate different bedding materials for feeding cattle during the winter.

Bedding studies evaluated scraped pens, compared to straw corn stove or soybean residue.

Procedures

Calves born and raised at the Carrington Research Extension Center and purchased calves that closely matched the age and weight were allotted to four bedding treatments in late fall of 2004 (n=113). The bedding treatments were no bedding (pens were scraped approximately two times per month), and bedding with wheat straw, corn stover, or soybean residue. All bedding materials were harvested with a large round baler. Steers were assigned to one of eight pens with 14-15 head per pen, and two replicates per treatment. All steers were weighed every 28 days to compare performance during segments of the winter and spring.

A common corn-based diet formulated to contain 13.1% CP and 60 MCal NEg/cwt (Table 1) was fed to all cattle in this study. Feed was delivered as a totally-mixed ration once daily to appetite. Steers were fed in open drylot pens equipped with automatic waterers and fenceline bunks, which allowed for two feet of bunk space per head. A windbreak shelterbelt was located approximately 100 feet to the north of the pens. All pens were identical in size, orientation (south sloping), and water source with approximately 300 square feet per head.

Table 1. Finishing diet for bedding study steers.

Ingredient	Percent (DM Basis)
High moisture corn, (72% DM) rolled	47.10
Field peas, rolled	11.87
Flax screenings, ground	6.33
Corn silage	5.94
Triticale hay, chopped	5.94
Rumensin supplement	1.19

Diet Specifications	
Dry matter, %	79.10
NEg Mcal/lb.	60.00
Crude protein, %	13.10

Steers were bedded approximately weekly or as required considering weather challenges. Bedding was accomplished with a Haybuster Straw Cannon®, a modified bale processor with a blower and "spout," that is capable of blowing bedding into a pen from the feed alley. The spout is mounted to distribute straw into the pen behind the bunkline and was directionally controllable with hydraulics from the tractor cab. In some cases, bales were placed in the pen with a payloader and spread with the bucket and grapple fork. The same number of bales was used in each pen.

Haybuster straw cannon bedding pens from feed alley.

Cattle were vaccinated for protection against IBR, BVD, BRSV, PI3 (Bovishield-4; Pfizer, Exton, PA), and clostridia (7-way + somnus; Pfizer, Exton, PA) prior to the start of the study. Health status of the cattle was monitored daily and rectal temperatures were measured in animals that were visibly anorexic or had severe nasal mucous drainage and rapid or labored breathing. Sick animals were treated with one of two antibiotics according to label instructions (Micotil, Elanco, Indianapolis, IN; A180, Pfizer, Exton, PA). Micotil was used on first and second pulls, followed by A180, if cattle were unresponsive. Antibiotic treatment continued until animals appeared healthy. Research protocols regarding animal care followed guidelines recommended in the Guide for the Care and Use of Agricultural Animals in Agricultural Research and Teaching (FASS, 1998).

Steers were marketed to Tyson Foods (Dakota City, NE) on May 17, 2005. Hot carcass weight, fat thickness, percentage kidney, pelvic and heart fat, ribeye muscle area, and USDA quality and yield grades were determined by qualified personnel 48 hours after slaughter.
Data were subjected to a one-way analysis of variance as a completely randomized design using the GLM procedures of SAS (Version 8.0; SAS Inst. Inc., Cary, NC). Pen was the experimental unit.

Results and Discussion

Feedlot Performance

Calves in this study generally performed very well during the winter with some positive effects due to bedding observed. Month of the year associated with spring thaw and breakup had some negative effects on intake and gain across all treatments, however.

Dry matter intake (Table 2) tended to be lower ($P<.12$) overall for the calves bedded with corn stover vs. all other treatments. The palatability of stover is well known and calves tend to eat the leaves and husks, if available. A modest dilution in the energy density may have contributed to the lower ($P<.01$) gains for the stover-bedded calves. Dry matter intake was equal for all other treatments over the length of the study. Calves bedded with wheat straw gained the fastest ($P<.01$) followed by soybean residue, stover, and the calves in the scraped control pen (Table 2). Differences in weight gain over several months led to significantly heavier ($P<.05$) calves in the wheat straw treatment during the last two months of the study, followed by soybean residue, corn stover, and no bedding. Feed efficiency was greatest for the bedded calves ($P=.03$ to $.11$) during the first three months on feed, the coldest part of the winter. No differences were observed for the last two months of feed.

Table 2. Performance of steers bedded with different materials during the winter.

Item	Treatment: No Bedding	Wheat Straw	Corn Stover	Soybean Residue	St Error	P Value
Weight, lbs.						
December 12, 2004	652.9	651.9	652.9	652.0	7.96	0.98
January 11, 2005	742.7	755.9	751.9	759.4	8.64	0.58
February 10, 2005	855.7	875.9	860.8	880.6	9.75	0.25
March 11, 2005	973.4	1022.6	991.0	1015.4	11.57	0.19
April 7, 2005	1065.0	1122.2	1065.8	1101.5	12.20	0.01
May 17, 2005	1211.7	1253.8	1225.6	1243.3	14.10	0.05
Dry Matter Intake, lbs.						
Period 1	19.32[a]	18.47[b]	18.41[b]	18.56[b]	0.17	0.06
Period 2	24.13[a]	21.44[b]	21.40[b]	23.22[ab]	0.51	0.05
Period 3	21.53[a]	23.35[b]	21.39[a]	22.86[ab]	0.51	0.13
Period 4	20.29[a]	21.81[b]	20.46[ab]	21.80[b]	0.40	0.10
Period 5	16.11	16.59	16.19	16.69	0.46	0.77
Overall	20.24[ab]	20.30[ab]	19.62[a]	20.59[b]	0.21	0.12
Avg. Daily Gain, lbs.						
Period 1	3.22	3.71	3.52	3.84	0.12	0.01
Period 2	3.77	4.00	3.65	4.04	0.11	0.04
Period 3	4.06	5.06	4.48	4.65	0.13	0.01
Period 4	3.38	3.69	2.78	3.19	0.12	0.01
Period 5	3.66	3.30	3.99	3.55	0.13	0.01
Overall	3.63	3.91	3.72	3.84	0.07	0.01
Feed Efficiency (Gain/Feed)						
Period 1	0.165	0.201	0.191	0.207	0.009	0.11
Period 2	0.157	0.187	0.171	0.174	0.004	0.05
Period 3	0.189	0.217	0.200	0.204	0.004	0.03
Period 4	0.167	0.169	0.136	0.146	0.016	0.49
Period 5	0.227	0.196	0.247	0.213	0.013	0.18
Overall	0.179	0.193	0.189	0.187	0.003	0.12

[ab] means on the same line with different superscripts differ, P<.05.

Some differences were observed by month due to bedding treatment. Dry matter intake was reduced (P<.06) compared to control pens in most bedding treatments during the first two months on feed. This suggests calves without bedding had greater appetites and higher maintenance requirements, as gains in the control pens were lower for the first three months on feed. During periods 3 and 4, the inverse tended to occur, (P<.13) with bedded calves consuming more feed and exhibiting similar or greater gains. Intake during periods 4 and 5 decreased with spring thaw, mud, and challenging temperatures, however, gains seemed to be stable from previous months.

With no difference in feed efficiency observed in this study, the primary advantage of bedding calves is to market cattle at a heavier weight or with fewer days on feed.

Carcass Quality

Hot carcass weights reflect the difference in live weight due to treatment as no differences (P>.17) in dressing percent and marbling score were observed (Table 3). However, yield grade and fat thickness appear to be affected by treatment (P<.02) and patterned after live weight with increased fat deposition

in straw-bedded calves followed by soybean residue, control, and corn stover. Ribeye area and kidney-pelvic-heart fat were not affected by treatment.

Table 3. Carcass traits for steers bedded with different materials.

	Treatment					
Item	No Bedding	Wheat Straw	Corn Stover	Soybean Residue	St Error	P Value
Hot carcass Weight., lbs.	724.3	754.4	73.4	743.1	9.1	0.17
Dressing percent	62.23	62.69	62.29	62.26	0.002	0.51
Marbling score*	464	448	430	484	17.2	0.17
Yield grade	3.37^{ab}	3.53^{a}	3.22^{b}	3.42^{ab}	0.067	0.02
Fat thickness, in.	0.55^{ab}	0.61^{a}	0.49^{b}	0.57^{ab}	0.02	0.02
Ribeye area, sq. in.	12.32	12.59	12.43	12.59	0.16	0.60
Kidney, pelvic, heart fat, %	2.33	2.44	2.36	2.38	0.04	0.31

*** 300 = Select, 400 = Low Choice, 500 = Avg. Choice**

^{ab} means on the same line with different superscripts differ, P<.05.

Discussion

There appear to be some real differences in bedding materials for steers. The commonly held idea that wheat straw is the best bedding material is supported in this study. Corn stover and soybean residue may be more useful in situations where gain is not critical (growing heifers, beef cows near calving) and these residues are available on a cost-competitive basis. The results are not as dramatic in favor of bedding as reported previously by Anderson et al. (2005). Part of the reason may be the cattle in this study were not marketed at the end of the stressful winter period, but fed during spring thaw and muddy conditions in relatively stable pens. Deeper mud in the previous study would cause reduced animal performance.

In a South Dakota study, Birkelo and Lounsbery (1992) also observed a positive effect on gain, feed efficiency, and return when using 266 pounds of bedding per head in open lots. A Colorado study (Stanton and Schutz, 1996) also concluded that bedding improves gain and dressing percent in finishing steers but had no impact on feed intake and returned an extra $8.00 per head above costs.

While bedding is important for the comfort of the animals and to increase profits, it may be more important in reducing ammonia volatilization from animal manure. Previous research at the Carrington Center suggests that adding carbon to the manure as bedding is effective in limiting ammonia release from manure. Work continues in this area.

Literature Cited

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