High Residue Diets For Lactating Beef Cows: A LISA PROJECT

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North Dakota farmers annually produce an estimated 14 million tons of crop residue in the form of wheat, barley and oats straw and corn stover. An estimated 10 percent or less is harvested or utilized by ruminant animals for bedding or feed. This biomass resource has many potential uses.

Considerable recent attention has been given to animal feed, specifically ruminants (Han, 1978). Straws and stovers contain large amounts of cellulose that can be utilized by ruminants for energy. Compared to common grass, legume hay and grains, crop residues (straw and stover) are (1) lower in digestibility, (2) lower in protein, (3) less palatable, and (4) more bulky. However, when chemically treated or properly supplemented, crop residues can make an attractice and inexpensive addition to ruminant diets, especially diets near a maintenance level (Acock et al., 1979; Anderson, 1978; Males, 1987). The critical factor is keeping harvesting, handling, storage and feeding costs low enough to be competitive with other feed sources (Ward, 1978).

In the days of the threshing machine, the straw pile was part of the winter feed supply and cows were essentially self fed. Since then, most research has concentrated on using crop residues for wintering cows (Acock et al., 1979; Males, 1987). Very little work has been done using crop residues in diets for lactating cows. Smith et al. (1976) fed stalklage (ensiled corn stover) with limited supplements to lactating cows with marginal success. In North Dakota trials, small grain straw was offered as a dry matter filler to average milking cows fed corn silage and protein supplements (Anderson, 1983), and lactating cows fed limited alfalfa/brome hay consumed small grain straw to appetite (Anderson, 1988).

Recent interest in broadening the economic base for crop farmers and enhancing the sustainability of the total farm suggests adding ruminants to the farming system. With abundant crop residues and by-products and little or no available grazing, drylot beef cow/calf production may be a potential market for farm grown forages and residues. In addition to crop residues, grain farmers produce substantial amounts of screenings and occasionally some sprouted grain and forage from hail damaged crops, all of which have feed value for ruminant animals.

The Agriculture Productivity Act was passed by Congress in 1985. This act encourages research and education programs in alternative farming systems. It is referred to as low input sustainable agriculture (LISA). Low-input technologies offer opportunities to reduce farmers' dependence on certain kinds of purchased inputs and optimize the use of current resources. The purpose of this project was to increase the value of currently available crop residues through a cattle operation.

The objectives of this study are to (1) determine the production potential and unique management needs of lactating beef cows fed large amounts of crop residue and by-products and (2) evaluate economic worth of marketing available crop products and unused labor through ruminant livestock. This is a preliminary report so no statistical analysis has been completed.

EXPERIMENTAL PROCEDURE

Spring calving Hereford and Hereford cross cows (n = 44) were randomly allotted to one of four rations at the conclusion of calving in late April 1988. Two diets were high hay (1 and 2) while two used low levels of hay (Table 1). One lot of each hay level was supplemented with corn grain and the other with wheat screenings. Corn stover was fed *ad. lib.* from 28 April - 13 July. Wheat straw was fed *ad. lib.* from July 13 to September 14. Corn stover and straw were fed in large round bales in ring or oblong metal feeders. Feeders were refilled at visual appraisal of 80 to 90 percent consumption of edible contents. Stover and straw values given in Table 1 represent total feed offered. Estimates of wasted feed from nosing out, refusal of coarse material, spoiling and other causes range from 15 to 30 percent. Wheat screenings and corn grain were fed from April 29 until the end of breeding season. The screenings were approximately 95 percent foxtail seed (pigeongrass) ground fine to prevent germination and to enhance digestion. Corn grain was dry rolled. Protein content of alfalfa/brome hay was 15.6 percent, wheat screenings 14.2, corn grain 7.8 percent, corn stover 6.1 percent, and wheat straw 4.5 percent on a dry matter basis.

Table 1. High residue lactating beef cow rations.

	Treatment			
Feeds	**1**	**2**	**3**	**4**
Breeding Season Diets				
Alfalfa (lbs.)	13.6	13.6	9.1	9.1
Corn (lbs.)	—	4	—	8
Screenings (lbs.)	5	—	10	—
Corn Stover (lbs.)	16.3	16.3	26.1	25.5
Post Breeding Season Diets				
Alfalfa (lbs.)	15.9	15.9	11.3	11.3
Straw (lbs.)	17.7	17.6	20.9	18.7

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Calves were offered creep grain and hay by treatment group inside adjacent barns. Creep fed grain consisted of approximately two-thirds rolled grain sorghum and one-third rolled corn grain. Calves in each treatment were fed approximately equal amounts based on the group consuming the least grain. Creep hay, an alfalfa/grass mix, was offered *ad. lib.* in long form.

Cow weights were taken at the start of the trial, at the end of breeding season and at weaning on September 14. Condition scores were taken at the start of the trial and at the end of breeding season. Pairs were maintained in paved lots to allow for complete manure collection. Calves had access to separate creep feed bunks housed in adjacent barns.

RESULTS

Cow and calf performance was generally satisfactory in the first year of this experiment. Cows seemed to acclimate to the high residue diets after several days of expecting to get fed more of the higher quality feedstuffs. More corn stover was used than expected. Cows seemed to be very aggressive in sorting through and selecting edible portions. Calves were frequently observed consuming husks and leaves.

Average overall calf gains for each group were 2.22, 2.19, 2.40 and 2.20 pounds per day for the four treatments, respectively, during the 139-day trial (Table 2). Calf gains were similar to gains of calves from the same cows in previous years.

Table 2. Calf performance from cows on high residue diets.

	Treatment			
	1	2	3	4
Number Weaned	11	11	11	11
Start Wt. (lbs.)	136	134	141	131
Mid Wt. (lbs.)	304	297	320	298
ADG (Start-Mid, lbs.)	2.22	2.14	2.36	2.20
End Wt.	444	439	475	455
ADG (Overall, lbs.)	2.22	2.19	2.40	2.33

Cows maintained their condition very well, even gaining weight and increasing in condition score from April 28 to the end of the breeding season on July 13 (Table 3). Rebreeding was also within the acceptable range for treatments 1, 2 and 3. Three cows in treatment 4 were open after the 45-day breeding season.

Creep feed consumption for the calves was 4.20, 3.97, 4.30 and 4.27 pounds per day, respectively, for the four treatments (Table 4). Creep feed consumption was generally similar to what calves of the breed groups consumed in previous years.

Feed costs are highly dependent on how feedstuffs are priced. The two treatments fed screenings during the breeding season had lower feed costs for that period (Table 5). After breeding season, the two groups on lower hay levels were less expensive. The combination of low hay and high screenings levels with the given feed prices produced the lowest feed cost. This same group (Treatment 3) tended to have higher gains and heavier weaning weights.

Table 3. Cow performance on high residue diets.

	Treatment			
	1	2	3	4
Number Pairs	11	11	11	11
Start Wt. (lbs.)	1196	1174	1212	1204
Mid Wt. (lbs.)	1185	1197	1253	1211
End Wt. (lbs.)	1176	1167	1196	1182
Start Condition Score*	5.27	5.36	5.36	5.27
End Condition Score*	5.27	5.45	5.73	5.64

* Condition score is a visual evaluation of fatness with 1 = emaciated, 9 = very obese.

Table 4. Daily calf creep feed consumption.

	Treatment			
Feed	1	2	3	4
⅔ Gr. Sorghum, ⅓ Corn (lbs.), Dry rolled	2.99	2.86	3.01	2.98
Alfalfa Hay, square baled (lbs.)	1.21	1.21	1.29	1.29
Total feed intake per day	4.20	3.97	4.30	4.27

Table 5. Feed costs for cows and calves on high residue diets.

	Treatment			
	1	2	3	4
COW FEED COST				
Breeding Season ($/day)	.70	.85	.65	.96
Post Breed Season ($/day)	.80	.80	.63	.62
TOTAL Cow Feed Cost (139 days)	103.22	115.00	89.09	112.02
CALF FEED COST	24.87	23.44	25.37	25.19
TOTAL FEED COST	128.09	138.44	114.46	137.21
FEED COST PER DAY	.922	.996	.823	.987

Based on: Alfalfa Hay @ $75/ton; Grain @ $2.50/bu.; Straw/Stover @ $20/ton; Screenings @ $10/ton

Manure accumulation for the summer was 1.69, 1.75, and 2.1 tons of dry matter per cow. The manure was composted and spread on fields in the spring.

DISCUSSION

High residue diets for drylot feeding of average milking beef cows appears to be possible from preliminary results of this trial. Screenings and limited legume supplementation with free choice corn stover or small grain straw appear to support adequate cow condition, and calf growth. Several more variables need to be evaluated to make a practical system acceptible to farmers. These variables include methods of reducing labor, early weaning, chemical treatment of residues, creep feeding systems and alternative legumes.

Whole farm economic analysis should be done to include added income to the cropping system from marketing residues and screenings and reduced cash cost for fertilizer through manure application. The study described in this

paper is ongoing and a thorough economic analysis will be conducted after two years of data. The companion cropping system study is used as a model for crop products generated. As estimate of the livestock carrying capacity of a crops-only farm can then be made with animals maintained in confinement during the growing season.

This project is partially funded by Federal grant money under Low Input Sustainable Agriculture (LISA) Project No. LI-88-1.

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