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Dried Poultry Waste as a Protein Supplement for Cows Grazing Winter Forages

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Replacing soybean meal with dried poultry waste and feather meal was effective when supplementing cows grazing either native Sandhills winter range or cornstalks and saved $55/ton in supplement ingredient costs.

Summary

Two trials conducted in 1996-1997 evaluated dried poultry waste relative to soybean meal for cows grazing winter forages. In Trial 1, cows grazing native Sandhills winter range received: 1) no supplement; 2) urea; 3) 22% dried poultry waste+urea; 4) soybean meal; 5) 22% dried poultry waste+soybean meal; or 6) 44% dried poultry waste. Cows receiving supplements gained more weight (P<.001) and maintained greater body condition (P<.001) than unsupplemented cows. Cows receiving urea gained less (P<.10) than cows receiving more natural protein, although body condition remained similar. In Trial 2, cows grazing cornstalks received supplements containing either soybean meal or dried poultry waste; however, gains were not different.

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Introduction

Cornstalks and winter range typically are utilized by cow/calf producers in the Midwest and Central Great Plains as economical alternatives to higher-priced harvested forages. However, grazed winter forages are often deficient in degradable intake protein (DIP) and do not meet the metabolizable protein needs of the gestating cow. Degradable intake protein provides nitrogen to the microbial population and aids in forage digestion. Generally, supplemental protein is fed to meet these needs. As a result, protein supplementation is often the most costly aspect of production and an area which can be improved. One way to lower supplement cost is to find alternative, less-expensive protein sources which adequately meet the cows DIP requirement. Dried poultry waste (DPW) is an acceptable source of DIP for calves on a growing ration; however, DPW has not been evaluated as a source of DIP for cows grazing low-quality forages. Dried poultry waste is approximately 28% protein and 35% ash. Of the 28% protein, 49% is true protein; the remainder is uric acid. In addition, DPW brings minerals such as calcium, phosphorus, copper and zinc to the supplement, further reducing supplement costs.

Two trials were conducted to evaluate dried poultry waste relative to soybean meal (SBM) as a degradable intake protein source for cows on low-quality forages.

Procedure

Trial 1

To evaluate DPW as a DIP source, 60 cows (5 yr, 1,223 lb) grazing native Sandhills winter range were used in a 108-d individual supplementation trial beginning November 19, 1996 and ending March 4, 1997. Cows were assigned randomly to one of six supplemental treatments (10 hd/treatment). Treatments (Table 1) consisted of: 1) No supplementation; 2) Urea; 3) 22% DPW + Urea; 4) SBM; 5) 22% DPW + SBM; and 6) 44% DPW. In addition, feather meal was added in varying amounts to each supplement in order to supply adequate undegradable intake protein (UIP) to the cows and to equalize UIP content. Supplements were formulated to be equal in terms of both DIP and UIP and fed in a cube form (7/8"). Cows were offered 2 lb (as-is) on Monday and Wednesday and 3 lb on Friday. Cows were gathered from a common pasture, sorted in a temporary corral, placed into an individual pen and fed the assigned supplement. Cows were given several minutes to consume their supplement; however, most were finished within 5 minutes. Cows on the control treatment were sorted in the corral and turned back into the pasture. All cows were allowed *ad-libitum* access to salt and limestone.

Forage intake was determined from the fecal output and forage indigestibility of 36 cows (6 cows/treatment) over a five-day collection period (December 16, 1996 through December 20, 1996). Five days prior to the start of collection, cows on the intake portion of the trial were dosed with an intraruminal continuous chromium-releasing bolus to determine fecal output.

Five, 550 lb steers were fitted with fecal collection bags for a total fecal collection and dosed with the same intraruminal continuous chromium-releasing boluses as the cows to determine a correction factor for chromium payout.

Diet samples were collected from six esophageally-fistulated cows (1,250 lb) on one day during the intake period. Although a second diet collection was planned, inclement weather would not permit it. Diet samples were freeze dried, ground and analyzed to determine CP, UIP and digestibility. Forage intake was determined by dividing fecal output by indigestibility of the range diet collected by the esophageally fistulated cows.

Initial and final weights were determined by taking the average of two consecutive day weights at the beginning and end of the trial. A one day midpoint weight also was collected. Body condition scores (1 = thinnest to 9 = fattest) also were determined by palpation of the ribs and thoracic vertebrae at the beginning, middle and end of the trial.

Trial 2

A completely randomized design using 48 cows (6 yr, 1,300 lb) evaluated a supplement containing DPW versus a supplement containing SBM for cows grazing winter corn residue from November 5, 1996 through January 8, 1997. Treatments were: 1) SBM; and 2) 44%

Table 1. Supplement composition for Trials 1 and 2.

	Supplement (% of DM)[a]				
Ingredient	Urea[b]	22% DPW + Urea[b]	SBM[b,c]	22% DPW + SBM[b]	DPW[b,c]
Wheat midds	27.1	18.4	8.26	9.19	8.22
Soybean hulls	27.1	18.4	8.26	9.19	8.22
Feather meal	23.6	24.8	11.5	18.8	26.3
Dried poultry waste	——	22.0	——	22.0	44.0
Urea	3.44	1.7	——	——	——
Soybean meal—47%	——	——	54.5	26.9	——
Molasses	4.0	4.0	4.0	4.0	4.0
Tallow	2.0	2.0	2.0	2.0	2.0
Salt	2.64	2.30	2.88	2.41	1.94
Dicalcium phosphate	2.5	0.42	2.06	0.21	——
Potassium chloride	1.3	0.61	——	——	——
Copper sulfate	0.08	0.056	0.036	0.034	0.033
Limestone	1.0	——	1.16	——	——
Zinc sulfate	——	——	0.044	0.021	——
Vitamin A, D, E	0.25	0.25	0.25	0.25	0.25
Ameribond	5.0	5.0	5.0	5.0	5.0

[a]DPW=dried poultry waste; SBM = soybean meal.
[b]Trial 1 supplements.
[c]Trial 2 supplements.

Table 2. Weight gains of cows grazing native Sandhills winter range (Trial 1).

Item[a]	Treatment[a]						Contrasts[b] (P =)				
	Control	Urea	DPW + Urea	SBM	DPW + SBM	DPW	A	B	C	D	E
IWT, lb	1226	1219	1225	1204	1223	1219	NS	NS	NS	NS	NS
MWT, lb	1179	1195	1197	1181	1187	1192	NS	NS	NS	NS	NS
FWT, lb	1169	1217	1247	1216	1243	1242	0.08	NS	NS	NS	NS
ADG, lb/d											
days 0-53	-0.89	-0.44	-0.53	-0.43	-0.68	-0.51	0.07	NS	NS	NS	NS
days 53-106	-0.19	0.41	0.95	0.65	1.05	0.95	<0.001	0.006	0.09	NS	NS
days 0-106	-0.54	-0.02	0.21	0.11	0.18	0.22	<0.001	0.10	NS	NS	NS

[a]DPW = dried poultry waste; SBM = soybean meal; IWT = initial weight; MWT = mid-point weight; FWT = final weight.
[b]Contrasts were A (control vs. urea, DPW + urea, SBM, DPW + SBM, DPW), B (urea vs. DPW + urea, SBM, DPW + SBM, DPW), C (SBM vs. DPW + Urea, DPW + SBM, DPW), D (DPW vs. DPW + urea, DPW + SBM), E (DPW + urea vs. DPW + SBM); NS = nonsignificant.

DPW. Supplements were the same as treatments 4 (SBM) and 5 (44% DPW) in Trial 1 (Table 1). Cows were assigned randomly to one of six irrigated corn fields (3 cornfields/treatment) at a stocking rate of 0.8 hd/acre. Supplements were fed once daily at 1.25 lb (as-is) in a cube form (7/8").

Animal performance was measured in terms of ADG. Both initial and final weights were the average of two consecutive day weights following three days of limit feeding at 2% of body weight. Cows were removed from fields when, based on visual appraisal, quantity of forage became limiting.

Results

Trial 1

Cows consuming supplement gained more weight (Table 2) and maintained more body condition (*P*<.001) than unsupplemented cows. Each treatment entered the trial with BCS ranging from 5.0-5.2. By the end of the trial, supplemented cow BCS averaged 4.3, while unsupplemented cows had an average BCS of 3.9. Average daily gain and BCS results indicate the control cows were deficient in DIP. Other work supports this conclusion and has shown native Sandhills winter range is deficient in supplying cows with DIP and that cows may respond positively to DIP supplementation (1996 Nebraska Beef Cattle Report, pp. 14-16). However, because supplemented cows did receive energy and added minerals from the supplements, at least some of this response may have been due to energy or any one of the supplemented minerals such as Cu, Zn or P.

Overall, cows consuming natural protein supplements performed better (*P*<.10) than cows fed urea, indicating protein may be required either by the animal or the microbial population (Table 2). Natural protein may be important as a source of amino acids to be utilized by the microbial population. Protein also may have a slower rate of nitrogen release which more closely corresponds to energy release from the slowly digested winter forage. By feeding on alternate days, urea, which is highly soluble in the rumen, would have been immediately available to the microbial population. Due to the slow rate of forage digestion, however, energy would be limiting to microbial protein production, making the microorganisms dependent upon nitrogen recycling by the animal as energy became available. Body condition scores of cows supplemented with urea were similar to those of cows supplemented with natural protein.

Compared to SBM, cows consuming supplements containing DPW had similar weight gains (Table 2) and BCS throughout the trial. No differences were found in ADG (Table 2) or BCS throughout the trial for cows consuming 44% DPW, 22% DPW + urea or 22% DPW + SBM.

Cows consuming either 22% DPW + urea or 22% DPW + SBM had similar ADG (Table 2) and equal BCS. Therefore, if natural protein was required by the microbial population, the DPW and feather meal were supplying adequate amounts.

Esophageally fistulated cows were able to consume diets containing 6.84% CP (DM basis), of which 0.55% was UIP (DM basis). *In vitro* organic matter disappearance (IVOMD) of diets collected by esophageal cows was 48.5% (DM basis), slightly below IVOMD values typically seen (50-52%) on native Sandhills winter range. However, diet collections for this trial were taken one day after four consecutive sub-zero days. Cows may have experienced limited grazing time in the days previous to collections, were hungry, and therefore less selective.

No differences were found in forage organic matter intake (lb; Table 3) or total organic matter intake (lb; Table 3) throughout the trial.

Trial 2

No differences in ADG between DPW and SBM were observed. Performance of cows consuming SBM or DPW were -0.61 and -0.62, respectively. The fact that cows lost weight would indicate the corn residue was of a poorer quality than in previous years.

A major factor determining residue quality is the amount of corn grain remaining in the field after harvest. Initially, corn grain supplies a substantial amount of protein and energy to the cows and accounts for a significant portion of gain. Based on samples collected for other cornstalk grazing trials in 1996-97, little residual corn was available in fields.

Protein studies, especially those using cornstalk grazing, can be confounded by corn intake. The fact that cows are consuming *ad-libitum* quantities of corn residue and the variable

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Table 3. Cow daily forage and total organic matter intake (Trial 1).

	Treatment[a]						Contrasts[b] (P =)				
Item[a]	Control	Urea	DPW + Urea	SBM	DPW + SBM	DPW	A	B	C	D	E
FOMI (lb)	29.9	29.6	27.8	29.2	27.3	28.1	NS	NS	NS	NS	NS
TOMI (lb)	29.9	30.4	28.6	30.0	28.1	28.9	NS	NS	NS	NS	NS

[a]DPW = dried poultry waste; SBM = soybean meal; FOMI = forage organic matter intake; TOMI = total organic matter intake.
[b]Contrasts were A (control vs. urea, DPW + urea, SBM, DPW + SBM, DPW), B (urea vs. DPW + urea, SBM, DPW + SBM, DPW), C (SBM vs. DPW + Urea, DPW + SBM, DPW), D (DPW vs. DPW + urea, DPW + SBM), E (DPW + urea vs. DPW + SBM); NS = nonsignificant.

amount of downed corn often do not allow for the control of corn intake by animals in trials such as these.

Another likely factor for the observed weight loss was inclement weather. When energy requirements become greater than can be met by available forage, animals mobilize body reserves for heat production. Although the weather was favorable during most of the trial, a relatively severe cold period did occur during the last two weeks of the trial. This cold period also corresponded to the time of most limited forage.

Based on visual observations throughout both Trials 1 and 2, DPW is as acceptable to cows as SBM. In both trials, with the exception of a single animal on the DPW treatment in each, the cows readily consumed all supplements. Cows in both Trials 1 and 2 came to the supplements and quickly consumed all cubes from day 1 through the end of the trials.

For cows on winter range or cows consuming corn residues, dried poultry waste and feather meal appear to be viable substitutes compared to more traditional protein supplement ingredients such as soybean meal. Economic analysis of the DPW and SBM supplements used in the present trials indicate the DPW supplement was $57 less/ton, resulting in a savings of $0.04/hd/day and a total savings over 80 days of $3.20/hd.

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