Effects of Feeding Corn Stover Treated with Different Nitrogen Sources on Palatability and Dry Matter Intake in Sheep

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ABSTRACT

A trial was conducted to measure the dry matter (DM) intake in sheep fed a basal and a basal plus corn (zea mays) stover treated with different nitrogen (N) sources. The diets were 1) basal, 2) basal plus untreated corn stover, 3) basal plus 3% NH_3-treated stover, 4) basal plus 50% poultry litter treated stover, 5) basal plus 5% urea-treated stover, and 6) basal plus 5.8% urea plus 10% cattle waste-treated stover. Thirty-six crossbred sheep were assigned, according to the initial body weight, in six blocks and randomly allotted to the diets. The animals were kept in individual pens with free access to feed and water. Dry matter intake per unit of metabolic weight was higher ($p < 0.01$) in sheep fed the basal diet compared to the other diets. Intake was higher ($p < 0.05$) for sheep fed the NH_3 and the urea-treated corn stover diets compared to the untreated Stover. Intake was higher ($p < 0.10$) for sheep fed 3% NH_3 treated corn stover, than the Urea treated stovers. In conclusion, cattle waste in diet may improve the DM intake of corn stover in sheep.

Key Words: Corn stover, NH_3, urea, dry matter intake, cattle waste

INTRODUCTION

Low quality roughages including straws, stovers, husks and other crop by-products make up a major portion of animal feed in many developing countries. Expensive concentrates and milling by-products are forcing farmers to rely more upon crop by-products as source of energy. Performance of animals fed crop residues is limited by poor intake, low N-content, and lower digestibility (Peterson et al., 1981).

Chemical treatment has been used to improve the feeding value of crop residues (Waller, 1976). Among chemicals, NH_3 and urea have received a considerable attention (Dias-Da-Silva and Sundstol, 1986) because these chemicals make the treated materials more palatable by solubilizing the hemicellulose fractions, thus improving the DM digestibility and daily DM intake (Saenger et al., 1982). Therefore, the present study was aimed at determining the palatability of corn stover treated with NH_3, poultry litter, urea and urea plus cattle waste in sheep.

MATERIALS AND METHODS

A palatability trial was conducted to evaluate DM intake of corn stover treated with different sources of N. Corn stover was treated with 1) none, 2) 3% NH_3 from NH_4OH, 3) 50% poultry litter, 4) 5.8% urea, and 5) 5.8% urea plus 10% cattle waste. Procedures for treating stover were as follows.

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Treatment of Corn Stover

Corn Stover was baled after the grain was harvested by a mechanical picker-sheller. The bales were stored in an open shed until the time of ensiling. The bales were either 1) not treated or treated with 2) 3% NH_3 from aqueous NH_4OH, 3) 50% poultry litter, 4) 5.8% urea, and 5) 5.8% urea plus 10% cattle waste. The poultry litter with wood shavings as a base was obtained from the Virginia Polytechnic Institute and State University, Poultry Science Department, USA. Cattle waste collected from the concrete floor after cattle stayed overnight, was added as a source of urease. The stover was chopped to a length of about 5 cm, and was mixed with other ingredients. Each mixture was prepared by adding known amounts of respective components for each treatment. Sufficient amount of water was added into each mixture to raise the moisture level to 50%. For NH_3 treatment, the aqueous NH_4OH was directly sprayed on the stover. Each treatment was mixed for 10 minutes.

Ensiling

After mixing, each mixture was packed in 210 kg metal drums double lined with polyethylene bags of 0.08 mm thickness. Packing was done by trampling to ensure maximum exclusion of air. The polyethylene bags were sealed individually. The drums were stored outside and covered with black polyethylene sheet to avoid exposure to rain or snow. After 60 days, the silos were opened and the silages were used in the palatability trial.

Palatability Trial

Thirty six cross-bred (1/2 Dorset x ¼ Finn x ¼ Rambouillet) wethers were included in the study, blocked by body weight, and treatments were randomly allotted within each block. The diets fed to the wethers were 1) basal, 2) basal plus untreated corn stover, 3) basal plus 3% NH_3-treated stover, 4) basal plus 50% poultry litter treated stover, 5) basal plus 5.8% urea-treated stover, and 6) basal plus 5.8% urea plus 10% cattle waste-treated stover. The basal diet was composed of 50% orchardgrass (Dactylis glomerata) hay, 34% ground corn, 10% soybean meal (SBM) and 6% sugarcane (Saccharum officinarum L.) molasses. At the time of each feeding, the basal diet and silages were mixed in 1:1 ratio on DM basis, and supplemented with 20g dicalcium phosphate and 5g iodized salt.

Initially, the sheep averaged 37 kg in bodyweight. The animals were kept in individual pens 1.2 x 1.2 m, bedded with sawdust in an open shed. Water was provided *ad libitum* and fresh feed was given to animals twice daily at 0700 hour and 1900 hour. The animals were given an adaptatibility period during which feed offered was increased until all animals refused some feed, followed by a 10 day preliminary period and a 7 day measurement period. During the measurement period, refusals were collected once daily, weighed, and dried at 60^0C in a forced draft oven.

The initial and final body weights at the start and the end of the palatability trail were used to determine the metabolic size and calculate DM intake. Samples from individual diets from each animal were taken at each feeding, in double layered polyethylene bags and frozen until further analysis. At the end of the trial, the samples were composited and sub sampled. The DM of feed and refusal samples was determined by drying at 60^oC in a forced draft oven.

Statistical Analysis

Data were tested by analysis of variance using GLM procedures of SAS (1982). The model included the effects of treatment and replicates. Contrast used to test least squares mean were: 1) basal vs. basal plus silage, 2) untreated corn stover silage vs. NH_3, urea and urea plus cattle waste-treated stover silage, 3) NH_3 treated stover vs. urea and urea plus cattle waste-treated stover silage,

4) urea-treated stover silage vs. urea plus cattle waste-treated stover silage, and 5) untreated stover silage vs. poultry litter-treated stover silage.

RESULTS AND DISCUSSION

Daily DM intake was higher ($p < 0.01$) for sheep fed the basal diet, compared to sheep fed corn stover diets, when expressed as g/d or g/unit of metabolic size (Table 1).

Daily DM intake was higher ($p < 0.05$) by 15% in the NH_3, urea and urea plus cattle waste treated corn stover compared to the untreated corn stover. Furthermore, the NH_3-treated stover diet was consumed in larger ($p < 0.10$) amounts than the urea-treated diets. The DM intake (g /d or g/unit metabolic size) tended to be higher in sheep fed urea plus cattle waste-treated diet than those fed urea-treated diet. Adding poultry litter to corn stover tended to increase the DM intake, compared to sheep fed untreated stover.

Harmon et al. (1975) showed that the voluntary dry matter intake was highest for silage containing broiler litter than for control and urea silages. Average daily DM consumption was 848 gm for the control silage and 925gm for urea treated silage, whereas the average DM consumption for the silage containing 50% and 30% broiler litter was 1445gm and 1464gm on DM basis, respectively. In an other investigation, Caswell et al. (1977) reported that dry matter intake was higher for cattle fed processed or ensiled litter than those fed soybean meal supplemented ration.

Peterson et al. (1981) reported an increase in DM intake for lambs fed 2 to 4 % NH_3-treated corn stalks vs. untreated cornstalks (398 and 997 g/d). Higher daily DM intake was also reported for cattle fed NH_3 treated stover (Garret et al., 1979; Saenger et al., 1982) cotton plants (Reddy, 1985) and wheat straw (Jewel and Campling, 1986). However, Brown et al. (1987) did not find any significant differences in DM intake by beef cows fed ammoniated warm season grass hay, compared to untreated hay.

Improvement of DM intake by urea treatment has been reported by Doulberg et al. (1981) for wheat straw in sheep by Dias-Da-Silva and Sundstol (1986) for DM and OM intake of wheat straw in sheep and by Brown et al. (1987) for limpograss in steers. Improvement in palatability of corn silage ensiled with broiler litter has been reported by Harmon et al. (1975) when fed to sheep.

Samuels et al. (1991) reported that dry matter intake was greater ($p < 0.01$) for sheep consuming the 60:40 than for consuming the 40:60 crab waste silage diet and less than for sheep fed the 70:30 than those fed the 51:49 fish waste silage diets.

Table 1 Daily dry matter intake by sheep[ab]

Item	Basal and corn stover-treated silages (1:1) [c]						
	Basal	Un-treated	3% NH_3	50% poultry litter	5.8% urea	5.8% urea plus 10% cattle waste	SEM
Daily DM intake, g/d [def]	1459	936	1232	1002	1028	1106	81.12
DM intake, b.w.$^{0.75}$ [def]	90	60	76	64	66	71	4.93

[a]Dry matter basis, Each value represents the mean of six sheep
[b]Ratio of basal and silages, 1:1, DM basis
[c]Basal vs. basal and corn stover-treated silages differ ($p < 0.01$),
[d] Untreated corn stover silage vs. NH_3,
[e]urea and urea plus cattle waste-treated silages differ ($p <0.05$),
[f]NH_3 treated corn stover vs. urea and urea plus cattle waste-treated stover diets differ ($p < 0.10$)

Similarly, Reid et al. (1992) reported that dry matter intake for cultivars of switch grass and nitrogen level combined increased from 50.5 to 71.40 gram/kg body weight, while intake of NDF was increased from 37.6 to 55.6 gram/kg body weight.

Busboom et al. (2000) showed that overall acceptability was not affected in steers fed barley or corn based diets containing 0%, 10%, and 20% potato by-products treated diets. Moreover, the feedlot diets containing corn or barley with or without potato by-products resulted in palatable beef products.

Obese et al. (2007) reported that lipopolysaccharides (LPS) reduced feed intake for 48 hrs ($p < 0.01$) relative to control but syndyphosphate 33 (SD-33) failed to reverse the reduction in feed intake during the period. The later indicated that SD-33 increases the feed intake in sheep after intravenous injected while LPS induced suppression in feed intake in sheep.

In conclusion, NH_3 treatment to corn stover was more effective in enhancing the dry matter intake in sheep through improved palatability than those fed urea or poultry litter-treated diets. On the other hand, addition of cattle wastes in urea-treated tended to improve the palatability of corn stover over urea treatment alone.

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