WHOLE CORN AND COTTONSEED HULL ADDITIONS TO AMMONIATED WHEAT STRAW FOR SHEEP

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Story in Brief

Eleven yearling wethers (70 lb) were used to evaluate (1) the effect of ammoniation of wheat straw as a base diet supplemented with whole corn (WC) and cottonseed hulls (CSH) and (2) the effect of supplementation of an ammoniated wheat straw based diet (A-S) with WC and(or) CSH. Ammoniation of wheat straw increased ($P<.01$) nitrogen (N) intake, apparent digestibility and balance. Supplementation of ammoniated straw with WC increased digestible OM intake and apparent digestibility and N intake and balance. Supplementation with WC had no detrimental effect on intake of A-S or fiber digestion. Cottonseed hulls had no effect on any of the measurements. Supplementation of A-S based diets with WC improved nutrient utilization, especially N. This practice should reduce the amount of supplemental protein needed and result in more economical animal performance.

Introduction

Although supplementation of low quality roughages with processed grain increases total intake of digestible energy, decreased roughage intake and cellulose digestion often occur (Orskov, 1981). Orskov (1981) concluded that grain processing for sheep is undesirable . This effect has also been reported in sheep fed high moisture ammoniated wheat straw supplemented with a ground shelled corn/soybean meal mixture (Streeter et al., 1983). Ammoniation of low quality roughages may correct nitrogen deficiency; however, inadequate energy supplies for maximal bacterial growth and fiber digestion could limit efficiency of utilization. Rapid ruminal exit rate of alkali treated straw may also limit digestion. Hence, potential utilization benefits by energy supplementation or inclusion of dietary ingredients to slow passage rate are possible. The objectives of this experiment were to study the effects of whole corn or cottonseed hull supplementation to ammoniated straw diets for sheep.

Materials and Methods

A class comparison, unbalanced trial was conducted to study effects of feeding ammoniated (A-S) versus untreated wheat straw (U-S) and supplementation of a basal A-S diet with whole corn (WC) and(or) cottonseed hulls (CSH; Table 1). Wheat straw was ammoniated (4 percent ammonia of straw DM) by the stack method. Eleven rumen fistulated yearling lambs (70 lb), maintained in metabolism crates, were used in two 23-day periods. Measurements of rumen fermentation activity, rate of passage of ruminal digesta, apparent digestibility of nutrients and N balance were made during the last 10 days of each period. Levels of WC

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Table 1. Diet composition (g as-fed/head/day).

Ingredient	Treatments A-S WC/CSH (1)	A-S CSH (2)	A-S WC (3)	U-S WC/CSH (4)
Wheat straw:				
Untreated	---	---	---	Ad lib
Ammoniated	Ad lib	Ad lib	Ad lib	---
Whole corn	158	---	152	150
Cottonseed hulls	75	95	---	50
Trace mineralized salt	12	12	12	12
Urea	---	---	---	5

and CSH were fed 10 and 5 g/metabolic body weight for WC and CSH, respectively. Straw was offered ad libitum. Observations per treatment were 6 for A-S and 4 for U-S. All or part of the following analyses were conducted on feed, feed refusals, feces, urine and strained rumen fluid: dry matter, ash, fiber fractions, total N, pH, ammonia N.

Results and Discussion

Crude protein content of straw was increased while hemicellulose content was decreased by ammoniation (Table 2). Ammoniation of wheat straw increased total N intake ($P<.004$), apparent digestibility of N ($P<.02$) and N balance ($P<.0005$). Intake of straw DM was not increased by ammoniation. Supplementation of A-S based diets with WC (treatments 1 vs 2) increased ($P<.05$) total digestible OM intake, apparent OM digestibility and nitrogen intake and balance. Supplementation with WC had no detrimental effect on A-S intake or the apparent digestibility of acid detergent fiber (ADF). Inclusion of CSH had no effect on any variables measured.

The marked improvement in nitrogen balance of lambs fed A-S and supplemented with WC may indicate a ruminal energy deficiency with the basal A-S diet. Supplementation with a source of energy in a suitable

Table 2. Effect of ammoniation on chemical composition (% DM) of wheat straw.

Item	Type of straw: Untreated	Ammoniated
DM	92.5[a]	90.0[a]
Crude protein	4.4[a]	10.9[b]
Neutral detergent fiber	80.9[a]	70.26[b]
Acid detergent fiber	56.7[a]	57.01[a]
Hemicellulose	24.2[a]	13.4[b]

[a,b]Means are different ($P<.01$).

Table 3. Feed intake, utilization of nutrients and ruminal fermentation data.

	Treatments			
	A-S			U-S
Ingredient	WC/CSH 158/75 (1)	CSH 75 (2)	WC 152 (3)	WC/CSH 150/50 (4)
Intake				
Total digestible OM,				
g/day	325*[a]	201[b]	356[a]	252[a]
%/BW	1.01[a]	.66[b]	1.16[a]	.80[a]
Straw DM				
g/day	377[a]	346[a]	455[a]	289[a]
%/BW	1.20[a]	1.13[a]	1.46[a]	.91[a]
Total diet apparent digestibility, %				
Organic matter	59.7[a]	50.9[b]	61.9[a]	56.8[a]
Crude protein	45.2[a]	36.7[a]	47.7[a]	26.2[b]
Acid detergent fiber	40.4[a]	42.2[a]	45.3[a]	37.3[a]
Nitrogen balance, g/day	1.71[a]	-.54[b]	2.06[a]	-2.10[b]
Rumen fermentation				
pH	6.62[a]	6.67[a]	6.58[a]	6.36[a]
Ammonia-N, mg/100 ml	5.81[a]	7.34[a]	8.44[a]	10.31[a]

*Treatment means comparisons: 1 vs 2; 1 vs 3 and 1 vs 4.
[a,b]Means are different (P<.05).

form (WC), probably enhances rumen microbial activity and conversion of ammonia N into microbial protein. Indications are that the rate and extent of release of energy of WC did not upset ruminal fermentation, in terms of ruminal pH, ADF digestion and voluntary intake. Such energy supplementation should reduce the amount of supplemental protein needed and result in more economical animal performance. In case of cattle, a similar response could be expected by offering the whole corn, previously treated with alkalies: sodium or ammonium hydroxide for example. Research on this topic is underway at the present time.

Literature Cited

Orskov, E.R. 1981. In: Recent Developments in Ruminant Nutrition. Eds. W. Haresign and D.J.A. Cole. Butterworths.
Streeter et al. 1983. Anim. Prod. 36:481.