

decreased throughout the remainder of the trial. An explanation for the marked difference in daily gains of steers in the two pastures during the August 15 to September 18 grazing interval is not apparent. Total gain per acre during the 136-day trial was 393 lb.

Literature Cited

Horn, G.W. and W.E. McMurphy. 1979. Animal Science Research Report. MP-104, p. 104.

Feeding Value of Ammoniated Wheat Straw for Yearling Steers

C.L. Streeter, G.W. Horn
and D.G. Batchelder

Story in Brief

Yearling steers were fed either untreated wheat straw with a crude protein content of 3.0 percent or wheat straw which had been ammoniated during baling with a 6.0 percent crude protein content. The straw was fed in large round bales *ad lib* with 4.0 lb/day of dry matter per head from a ground shelled corn based supplement. Urea was added to the untreated straw supplement so as to provide as much nitrogen as was added to the ammoniated straw.

The daily dry matter intake of the ammoniated straw (7.2 lb/hd) was greater ($P < .10$) than that of the untreated straw (6.3 lb/hd). The average daily gain of steers consuming ammoniated straw (1.00 lb) and untreated straw (1.02 lb) was similar ($P > .10$). The lack of animal response was attributed to a relatively small increase in straw consumption and/or digestibility. The latter was attributed to incomplete ammoniation resulting from large ammonia losses during application.

Introduction

Approximately 1 ton of wheat straw is available as a potential feedstuff for each acre of wheat that yields 25 bushels of grain. The digestibility and crude protein content of wheat straw are low. Chemical treatment of straw with alkaline sodium hydroxide has generally increased digestibility, voluntary intake and animal performance. Ammoniation of wheat straw (Sundstol *et al.*, 1978): 1) costs less than treating with sodium hydroxide, 2) increases the crude protein content of the straw as well as increases digestibility and 3) is not a source of chemical pollution.

In previous experiments conducted in our laboratory, chopped wheat straw was sprayed with ammonium hydroxide at a level of 3.3 percent of the dry matter (Solaiman *et al.*, 1979). Reaction of the ammonia with the straw appeared to be complete in about

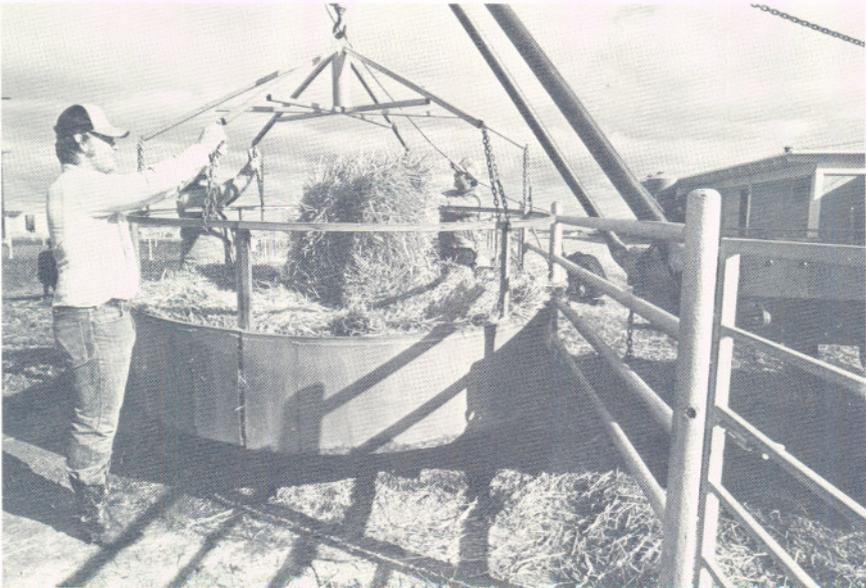
10 days. Adding water with the ammonia increased the crude protein content and *in vitro* dry matter digestibility up to 18 percent water, with minimal increases thereafter.

In the present study, large round bales of ammoniated and untreated straw were fed to steers in drylot to measure *ad lib* consumption of straw and animal performance.

Experimental Procedure

On October 24, 1979, 48 yearling steers weighing 518 lb were shrunk overnight and randomly allocated to six pens with eight head per pen. Ammoniated wheat straw was fed for 77 days in two pens, and untreated wheat straw was fed in four pens. The treated straw was ammoniated during baling with an anhydrous ammonia attachment on a large round baler as described by Horn *et al.*, (1979). The untreated and ammoniated straw contained 3 and 6 percent crude protein, respectively. Approximately 6 percent water was added with the ammonia to decrease ammonia loss during application and storage. The bales were fed in the feeders modified with an enclosed bottom to reduce straw loss and facilitate weighing. Initially the feeders had only four upright supports; however, 18 diagonal slats were added to each feeder on December 10, 1979, to reduce waste.

The bales and orts (refused straw) were weighed each week using a winch truck, gin poles and load cell attached to an electronic readout (see photograph). The dry matter and crude protein contents of the bales were determined weekly so as to compute the consumption of each. The dry matter content of the orts and straw waste was also determined weekly following daily removal of waste straw from the pens.



Apparatus used to weigh feeder and orts.

The cattle were fed 4.0 lb DM per head daily of one of the supplements shown in Table 1. The supplements were fed twice daily. Supplement formulation was such that the total rations were isonitrogenous. The elevated nitrogen content of the ammoniated straw was compensated for by adding an equal amount of nitrogen as urea to the untreated straw supplement.

Results and Discussion

Steers consuming ammoniated straw and untreated straw both gained approximately 1.0 lb per day (Table 2). The steers ate 14 percent more ammoniated straw DM than untreated straw DM (Table 2).

The slightly greater intake of ammoniated straw was apparently of an insufficient magnitude to affect gain. Most reports of ammoniation have shown an increase in dry matter consumption of from 10 to 60 percent (Saxena *et al.*, 1971; Hasimoglu *et al.*, 1969 and Klopfenstein *et al.*, 1979). The large bulk density of intact straw in the present study may have precluded a larger stimulation in intake via a reduced rate of passage. Pelleting the straw during ammoniation could reduce the bulk density of the straw and increase voluntary consumption and performance as suggested by Toddov (1975). DM wastage for the control straw was 0.8 lb/day and 1.36 lb/day for that which was ammoniated (Table 2). Pelleting could have prevented much of the straw wastage. However, the increased performance and decreased wastage would have to be weighed against the cost of pelleting.

Previous studies (Horn *et al.*, 1979) showed that ammonia application during baling also was not as effective in increasing *in vitro* dry matter digestibility (+27 percent) as others (Sundstol *et al.*, 1978) have shown when ammonia was applied in the stack (+60 percent). Ammonia loss during application was large (73 percent), and methods of decreasing this loss are being investigated.

Table 1. Composition of supplements fed to steers receiving ammoniated and untreated straw.

Ingredient	Composition (% DM basis)	
	Ammoniated straw	Untreated straw
Ground shelled corn	89.0	84.9
Soybean meal	6.5	8.5
Dicalcium phosphate	1.4	1.4
Limestone	1.6	1.6
Trace mineralized salt	1.5	1.5
Urea, 46% N	—	2.1
	100.0	100.0

Table 2. Performance and dry matter (DM) intake of steers fed ammoniated and untreated wheat straw.

Measurement	Ammoniated straw	Untreated straw
Number of steers	16	32
Days on feed	77	77
Straw DM intake, lb/day	7.2*	6.3*
Supplement DM intake, lb/day	4.0	4.0
Total DM intake, lb/day	11.2	10.3
Straw waste, lb DM/head/day	1.4	0.8
Initial weight, lb	521	516
Final weight, lb	598	595
Average daily gain, lb	1.00**	1.03**

*P<.10

**P>.10

Literature Cited

- Hasimoglu, S., T.J. Klopfenstein and T.H. Doane. 1969. J. Anim. Sci. 29:160 (abstr.).
- Horn, G.W., C.L. Streeter, D.G. Batchelder and G.L. McLaughlin. 1979. Range cow research center proceedings. Animal Science Dept., Oklahoma State University.
- Klopfenstein, T.J., L.L. Berger and J.A. Paterson. 1979. Fed. Proc. 38:1939.
- Saxena, S.K., D.E. Otterby, J.D. Donker and A.L. Good. 1971. J. Anim. Sci. 33:485.
- Solaiman, S.G., G.W. Horn and F.N. Owens. 1979. J. Anim. Sci. 49:802.
- Sundstol, F., E. Coxworth and D.N. Mowat. 1978. World Anim. Rev. 26:13.
- Toddrov, N.A. 1975. J. Anim. Sci. 29:792.