Sources of Nonprotein-Nitrogen as a Substitute for Protein in Ruminant Rations[1] (Project 5-804

D. Richardson, E. F. Smith, H. B. Perry, L. L. Dunn and L. H. Harbers

Americans consume large quantities of meat. An increasing population will demand more production to maintain present consumption rates. Protein is an essential nutrient for all animals. The simple-stomached animals (pigs, chickens, dogs, human beings, etc.) can utilize only natural protein, whereas ruminant animals can use nonprotein-nitrogen as a source of ammonia to produce microbial protein in the rumen. This project was to evaluate various ammoniated phosphates in ruminant rations.

Experimental Procedure

Steers and sheep were used in preliminary feeding tests to determine safety and acceptability of mono and diammonium phosphate, a blend of mono and diammonium phosphate, a blend of monoammonium phosphate and urea and urea-dicalcium phosphate. Levels up to 0.45 pound per head daily were fed to steers with no symptoms of harmful effects observed. Lambs consumed .075 pound per day with no observed harmful effects.

Fistulated steers were used to determine rate and amount of ammonia release and amounts of crude and true protein in rumen contents. Ammonia production was greater with all nonprotein-nitrogen sources than with natural protein; however, there were no significant differences between the nonprotein-nitroben sources, nor in true protein of rumen contents.

The feedlot experiment with steers receiving a finishing ration was designed to compare results with the supplemental protein (1) all natural protein (2) part natural protein and part nonprotein-nitrogen and (3) nonprotein-nitrogen supplement without soybean oil meal. The supplements are shown in table 19 and the chemical analyses in table 20. Fifty Hereford steers (purchased from Warners Ranch in Rice county) were divided into five lots of 10 each. They had been used in a wintering test using a ration of sorghum silage, soybean oil meal and limited grain. They were started on a ration of 10 pounds prairie hay, 4 pounds sorghum grain and 2 pounds of their respective supplements. Grain was increased to a full feed and hay reduced to 3 pounds per head daily. Hay was reduced to 2 pounds daily the last 37 days of the test.

---

1. This project was partially supported by U. S. Phosphoric Products Division of Tennessee Corporation, Tampa, Florida.

Results and Observations

Results are shown in table 21.

There were no significant differences in rate of gain, feed efficiency, carcass grades or carcass characteristics measured. The steers in lot 6, which did not receive soybean oil meal in the supplement, were very reluctant to eat their supplement at first and to a lesser degree throughout the test. All sources of nonprotein-nitrogen tested were found to be of equal value in this experiment. No symptoms of harmful effect were observed.

Table 19
Percentage of Indicated Ingredients in Supplements[1]

Ingredient	Soybean oil meal	Molasses	Dehy. Alfalfa	DiCal. phosphate	Calcium Carbonate	DiAmmon.[2] phosphate	DAP-[3] Urea	Urea[4]	Sorghum grain
Supplement No.									
79	64	3	20	10	3	---	---	---	---
80	30	5	25	---	10	12	---	---	18
81	30	5	25	5	7	---	7.6	---	20.4
82	30	5	25	12	2	---	---	5.2	20.8
83	---	5	25	---	11	11	---	4.5	43.5

1. Each pound of supplement supplied 10000 I.U. vitamin A, 35 mg. Aureomycin and 5 mg. diethylstilbestrol.
2. Diammonium phosphate = 18% nitrogen (112.5% protein equivalent) and 21% phosphorus.
3. Diammonium phosphate - urea blend = 26% nitrogen (162.5% protein equivalent and 13% phosphorus).
4. Urea = 42% nitrogen (262% protein equivalent).

Table 20
Chemical Analyses of Feedstuffs (%)

	Dry matter	Crude protein	Ether extract	Crude fiber	Nitrogen free extract	Ash	Calcium	Phos-phorus
Prairie hay	92.5	3.9	2.1	29.6	49.1	7.8	---	---
Sorghum grain	87.2	11.3	1.9	1.7	71.2	1.2	---	---
Supplement								
79	89.8	33.7	1.2	7.8	34.4	12.8	4.2	2.2
80	89.9	35.8	1.5	7.9	29.5	15.3	4.2	2.8
81	90.4	35.1	1.5	7.7	33.5	12.7	4.4	2.2
82	89.8	33.5	1.5	7.4	33.6	13.8	4.3	2.5
83	90.0	33.2	1.9	6.9	34.1	14.0	4.5	2.5

Table 21

Results of Finishing Steers with Different Protein Supplements
June 15 - December 9, 1965, 177 days.

Lot no.	2	3	4	5	6
Added protein source, Supplement:	79	80	81	82	83
No. steers per lot	10	10	10	10	10
Av. initial wt., lb.	666	667.5	668	666.5	666
Av. final wt., lb.	1117.5	1140	1136	1139	1115
Av. daily gain, lb.	2.55	2.67	2.64	2.67	2.54
Av. daily ration, lb:					
Sorghum grain	16.7	18.2	17.4	17.2	16.5
Prairie hay	3.7	3.7	3.7	3.7	3.7
Supplement	2.00	2.00	2.00	2.00	2.00
Feed per cwt. gain, lb:					
Sorghum grain	655	683	658	646	650
Prairie hay	143	137	138	137	144
Supplement	77	74	75	74	78
Feed cost per cwt. gain[1]	$18.56	$18.13	$18.28	$17.75	$17.80
Shrink to market, %	1.97	2.68	2.33	2.28	3.32
Av. hot carcass wt., lb.	677.4	681.0	690.6	684.5	661.6
Av. dressing % feedlot wt.	60.6	59.7	60.8	60.1	59.3
Av. fat thickness 12th rib, in.	.86	.89	.81	.72	.76
Av. size rib eye, sq. in.	11.45	11.64	11.60	12.13	11.68
Av. degree marbling[2]	5.0	5.4	5.0	5.0	5.2
Estimated kidney knob %[3]	2.55	2.75	2.55	2.50	2.35
Carcass grades					
Top choice					1
Medium choice	1	4	2	2	3
Low choice	8	6	6	6	4
Top good	1		2	2	2
Av. carcass grade[4]	19	19.4	19	19	19.3

1. Prairie hay, $20 per ton; Sorghum grain $2 per cwt; Lot 2 supplement $104/ton; Lot 3 supplement $84/ton; Lot 4 supplement $100.26/ton; Lot 5 $93.80/ton; Lot 6 supplement $86.15/ton.

2. 4=slight, 5=small, 6=modest.

3. Less kidney fat is desirable.

4. 21=high choice, 20=medium choice, 19=low choice, 18=high good, 17=medium good, 16=low good