Table 2. Lamb Performance.

| Ration | Low Urea | | High Urea | |
|---|---|---|---|---|
| Feeding time | 24 hr. | 1 hr. | 24 hr. | 1 hr. |
| Starting weight, lb. | 86.8 | 95.6 | 92.4 | 94.4 |
| Daily gain, lb. | $0.52^1$ | $0.61^1$ | $0.59^1$ | $0.17^2$ |
| Daily feed, lb. | $3.53^1$ | $3.39^1$ | $4.34^1$ | $2.13^2$ |
| Feed/gain | $6.82^1$ | $5.55^1$ | $7.35^1$ | $12.82^2$ |
| Expected gain, lb. | 0.51 | 0.48 | 0.68 | 0.22 |

$^{1,2}$ Means in a row with different superscripts differ statistically ($P<.05$).

ficiency of net energy use with urea supplementation is apparent.

In summary, higher urea rations fed once daily in a meal inhibited total feed and energy intake. Whether urea based range supplements similarly inhibit intake of dry winter range grass later in the day is uncertain. Increasing the frequency of intake of urea supplements should improve the overall energy balance of animals under feedlot or range conditions.

# Niacin for Growing Sheep and Steers

F. N. Owens, K. L. Mizwicki and B. J. Shockey

## Story in Brief

Niacin was added to high concentrate rations in three feeding studies. First, 63 growing lambs were fed a urea-supplemented 12% protein ration with 0, 250, 500 or 1000 parts per million (ppm) supplemental niacin. Daily gain and feed efficiency were improved slightly by supplementation. In a second trial, 72 steers were fed an 11% protein soybean meal supplemented ration with 0, 250 or 500 ppm supplemental niacin. Average daily gain and feed efficiency for the 117 day trial were 3.89, 5.32; 3.77, 5.32; 3.77, 5.30; and 3.72, 5.47 for the three levels of niacin.

Feed intake was depressed about 4% with added niacin with most marked depression during the first half of the trial. No significant effects on performance, carcass characteristics or rumen fluid composition were evident. In the third trial, 40 steers and heifers were fed a urea-supplemented 11.2% protein ration with 0 or 250 ppm supplemental

niacin. Gains and feed intakes were reduced slightly by niacin and no advantage in feed efficiency was apparent.

## Introduction

Nonruminants require some 20 to 50 ppm niacin in their ration. None is added to ruminant rations since niacin is made by bacteria in the rumen. Yet supplemental niacin could prove beneficial if bacterial growth is hampered such as during adaptation to a new or different ration. Several lamb growth trials have shown that bacterial protein production in the rumen and feed efficiency may be increased by adding niacin. The objective of this experiment was to determine if supplemental niacin would improve performance or carcass chraacteristics of feedlot lambs or steers fed high concentrate rations.

## Materials and Methods

In trial 1, locally purchased lambs of mixed breeding averaging 59 pounds were placed in individual slatted floor pens and fed free choice for 71 days the ration shown in Table 1 with 0, 250, 500 or 1000 ppm added niacin. One thousand ppm equals 0.1% of the ration. Weight gains and feed intakes were obtained at day 35 and at the termination of the study.

Whole blood was obtained at the termination of the trial for measuring niacin level and plasma urea.

For trial 2, seventy-two Angus and Angus-Hereford crossbred steers averaging 744 pounds were assigned to 9 pens of 8 head each and assigned to the three rations (Table 2) which provided 0, 250 or 500 ppm niacin and 11% protein. Steers were weighed initially and at 28 day intervals thereafter. Initial and interval shrunk weights were calculated as 95%

**Table 1. Sheep and Cattle Rations.**

| Ingredient | Sheep ration | Cattle ration |
|---|---|---|
| Corn grain, rolled | 75.00 | 79.12 |
| Cottonseed hulls | 17.85 | 15.00 |
| Molasses, liquid | ---- | 3.00 |
| Molasses, dried | 5.00 | ---- |
| Urea | 0.91 | 1.30 |
| Limestone | 0.80 | 0.80 |
| Dicalcium phosphate | 0.50 | 0.10 |
| Salt, trace mineralized | 0.25 | 0.25 |
| KC1 | ---- | 0.25 |
| Aurofac-50 | 0.025 | 0.025 |
| Vitamin A[1] | 0.020 | 0.020 |

[1] To provide 3000 IU per pound of feed.

of full weight. Feed refusals were weighed back weekly and samples obtained. At day 117, steers were trucked 100 miles and slaughtered. Final animal weight was calculated from hot carcass weight assuming an equal dressing percentage of 62% for all cattle. Incidence of liver abcesses as well as carcass measurements were obtained at slaughter. Rumen fluid samples were obtained on day 84 of the trial via stomach tube for ammonia and acid analysis.

For the third trial, 20 Angus steers and 20 Angus heifers were assigned by weight and sex to pens of 5 head each and fed a ration (Table 1) with 0 or 250 ppm added niacin. On day 28, two more pens of mixed breed steers were placed on each ration and gains and feed intakes measured for another 28 days.

## Results and Discussion

Additional niacin for growing lambs improved feed efficiency ($P<.10$) and tended to increase feed intake and weight gain (Table 3). Blood niacin and urea tended to increase with the higher levels of niacin sup-

**Table 2. Steer Ration Composition.**

| Item | Amount(%)[1] |
|---|---|
| Corn silage | 13.95 |
| High moisture corn grain | 77.05 |
| Soybean meal | 3.56 |
| Corn grain[3] | 3.60 |
| Calcium carbonate | 1.09 |
| Salt | .30 |
| Dehydrated alfalfa meal | .40 |
| Dicalcium phosphate | .05 |
| Vitamin A[2] | + |

[1] Dry matter basis.
[2] 1000 IU per pound of dry matter.
[3] For niacin supplemented rations, niacin was substituted for corn to provide niacin at .025 and .05% of the total ration.

**Table 3. Lamb Feeding Results.**

| | Ration | | | |
|---|---|---|---|---|
| Niacin added, ppm. | 0 | 250 | 500 | 1000 |
| Initial weight, lb. | 58.5 | 54.7 | 58.9 | 64.7 |
| Daily gain, lb. | .39 | .46 | .40 | .46 |
| Daily feed, lb. | 2.42 | 2.54 | 2.48 | 2.65 |
| Feed/gain | 6.39 | 6.27 | 6.11 | 5.81 |
| Blood niacin, ug/ml | 7.78 | 6.65 | 8.75 | 10.17 |
| Plasma urea, mg% | 13.1[1] | 17.0[2] | 14.2[1,2] | 15.7[2] |

[1,2] Means with different superscripts differ significantly.

plementation. This is similar to several reports from Europe concerning benefits of added niacin with urea-supplemented rations.

In the feedlot trial, however, performance and carcass characteristics (Table 4) were not influenced ($P>.05$) by addition of 250 or 500 ppm niacin to the soybean meal supplemented high moisture corn ration, although feed efficiency was lower with 500 than with 250 ppm niacin ($P<.05$). Food intake was depressed by about 4% and performance by 9% for the first 56 days with both levels of added niacin, but intake and performance improved during the last half of the trial. Observed gains were all 30 to 33% above expected gains calculated from net energy intake, indicating that reduced intake, not reduced efficiency of energy use, was responsible for the slightly lower gains with niacin additions.

Rumen fluid composition (Table 5) was not altered by niacin supplementation, and all values were within the expected normal range. Had urea supplementation of lighter cattle been used, a niacin benefit might have been found, but under the imposed conditions, niacin supplementation did not prove beneficial.

In the third trial, performance during the first 28 and 56 days of a feeding period, the adaptation period during which niacin synthesis in the rumen might be reduced, no benefit of supplemental niacin was found (Table 6).

In summation, supplemental niacin may under certain specific conditions improve feed efficiency of ruminants, as with sheep in trial 1. But specific conditions and ideal niacin levels are uncertain at present.

**Table 4. Niacin Steer Feeding Trial Results.**

| | Ration | | |
|---|---|---|---|
| **Niacin added, ppm.** | **0** | **250** | **500** |
| Initial weight, lb. | 751 | 742 | 744 |
| Daily gain, lb. | 3.89 | 3.77 | 3.72 |
| Daily feed, lb. dry matter | 20.7 | 19.9 | 20.3 |
| Feed/gain | 5.32 | 5.30 | 5.47 |
| Dressing percentage[1] | 64.8 | 65.3 | 64.5 |
| Rib eye area, sq. in. | 12.6 | 12.0 | 12.0 |
| Fat thickness, in.[2] | .60 | .62 | .62 |
| Cutability, % | 47.0 | 47.0 | 47.3 |
| Grade[3] | 6.79 | 6.75 | 6.54 |
| Marbling score[4] | 11.7 | 11.8 | 10.6 |
| Kidney, heart, pelvic fat, % | 3.25 | 3.27 | 3.31 |

[1] Calculated on basis of live shrunk weight and hot carcass weight.
[2] Measured from tracing of 12th rib.
[3] High=6, low choice=7.
[4] Small minus=10, small=11, small plus=12.

**Table 5. Steer Ruminal Measurements.**

| | Ration | | |
|---|---|---|---|
| Niacin added, ppm. | 0 | 250 | 500 |
| Ruminal level ammonia, mg N/100 ml | 3.17 | 3.15 | 2.93 |
| Potassium, ppm | 1504 | 1497 | 1392 |
| Acetate, % of total | 46.4 | 48.8 | 46.9 |
| Propionate, % of total | 46.4 | 45.0 | 46.1 |
| Butyrate, % of total | 7.2 | 6.2 | 7.0 |
| Volatile fatty acids, um/ml | 69.8 | 74.2 | 69.7 |

**Table 6. Steer and Heifer Feeding Results.**

| | Ration | |
|---|---|---|
| Niacin added, ppm. | 0 | 250 |
| Initial weight, lb. | 549.5 | 547.0 |
| First 28 days | | |
| Daily gain, lb. | 3.40 | 2.97 |
| Daily feed, lb. | 19.53 | 18.35 |
| Feed/gain | 6.01 | 7.83 |
| First 56 days | | |
| Daily gain, lb. | 3.40 | 3.26 |
| Daily feed, lb. | 20.48 | 20.39 |
| Feed/gain | 6.04 | 6.25 |

# Rumensin, Protein Levels and Urea for Feedlot Cattle[1]

**Jerry Martin[2], F. N. Owens[3] and Donald Gill[3]**

## Story in Brief

One hundred ninety-two yearling steers were fed high moisture corn grain based rations for 117 days at Panhandle State University, Goodwell, Oklahoma. Cattle initially averaging 754 pounds were fed either 11.0% crude protein or 12.4% crude protein diets, with or without 0.50% urea and with or without Rumensin. Protein level did not in-

[1] Experiment conducted at Panhandle State University, Goodwell.
[2] Panhandle State University, Goodwell.
[3] Oklahoma State University, Stillwater.