

# Three Levels of Nitrogen for Bermudagrass Grazed by Cows and Calves

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## Story in Brief

Three levels of nitrogen fertilization (65, 165 and 290 lb. per acre) were applied to Midland bermudagrass for three years. Increasing stocking rates were used with increasing levels of nitrogen. Calf daily gains (1.70, 1.73, 1.76 lb./day) and adjusted 240-day weaning weights (501, 492, 487 lb.) averaged over the three years indicated no significant difference in forage quality at different levels of nitrogen fertilization. The general trend observed in increasing pounds of beef per acre (233, 333, 390 lb./acre) with increasing nitrogen fertilization rates in all three years is attributed to the higher stocking rates with the higher levels of nitrogen.

Although the highest level of fertilization produced the greatest net return per acre in the first two years, the lowest level of nitrogen returned the greatest profit the third year due to changing economic conditions. Each producer should examine the current economic situation before deciding what level of nitrogen fertilization to use.

## Introduction

In recent years bermudagrass has become popular as a high yielding forage for grazing cattle. It is best suited to cow-calf programs because bermudagrass is of sufficiently high quality to promote high rates of gain with stockers for only 60-90 days per year.

Nitrogen fertilization has been shown to increase forage yield significantly, but forage quality slightly in terms of crude protein content. Since forage quantity and quality are prime considerations in maximizing cattle production per unit area, the main purpose of this study was to determine the effects of three levels of nitrogen fertilization upon forage quality and quantity and their relationship to the performance of cows and calves grazing Midland bermudagrass. The effects of level of nitrogen fertilization were presented in Animal Sciences and Industry Report MP-92, 1974. This paper presents the effects of different levels of fertilization on animal performance.

## Materials and Methods

This study was conducted at the Fort Reno Livestock Research Station near El Reno, Oklahoma: Midland bermudagrass (*Cynodon dactylon*) was planted in each of 12 pastures. Each pasture was fertilized with one of three levels of nitrogen (65, 165, and 300 lb. N/acre) in split applications (May, July, and September);  $P_2O_5$  and  $K_2O$  were applied according to soil analysis. All pastures were fertilized with liquid nitrogen in May of 1974 to enable the inclusion of 2,4-D. Urea (45 percent N) was used as the source of N for the second and third application in 1974. Ammonium nitrate was used the first two years. Pastures were graduated in size so that carrying capacity was similar for all three nitrogen levels.

Sixty Angus x Hereford cows were mated to Angus bulls for each of three years (1972, 1973, and 1974) and randomly assigned to the twelve pastures on the basis of calving date in 1972. Calf birth weights were taken within 24 hours after birth. Calves were weaned in November. Cow and calf weights were taken near the first of each month after a six hour period without feed or water.

Similar amounts of forage among pastures were maintained by varying grazing pressure with the use of "put-and-take" animals. Pastures were dragged as often as deemed necessary to prevent excessive manure buildup. Hay was cut and baled approximately every two months to control maturity. A mineral supplement composed of two parts trace mineralized salt and one part dicalcium phosphate was fed free-choice to all treatment groups.

## Results and Discussion

### Cow Average Daily Gain

Due to slight variation in the length of the grazing period in different years, cow daily gains rather than total weight gains were evaluated. In the first year of this study daily gains among treatments were similar because available forage was effectively equalized among treatments by the use of "put-and-take" animals. However, in the second and third years, cows on the medium level of nitrogen made the lowest gains. Therefore, the daily gains averaged over the three years showed the lowest cow gains on the medium level of nitrogen. The fact that cow gains were similar on the low and high levels of nitrogen fertilization indicates that the lower gains observed on the medium level were due to pasture differences resulting in differences in available forage, rather than level of nitrogen.

### Calf Performance

Calf daily gains and weaning weights differed only slightly between levels of fertilization or years. These results indicate that increasing nitro-

**Table 1. Effects of Level of Nitrogen Fertilization of Midland Bermudagrass on Cow Average Daily Gain, Calf Average Daily Gain, Adjusted Weaning Weight, and Beef Production per acre.**

Year	Level of Nitrogen lb. N/acre		
	65	165	290
1972			
Cow daily gain, <sup>1</sup> lb.	0.97 <sup>1</sup>	0.88 <sup>1</sup>	0.92 <sup>1</sup>
Calf daily gain, lb.	1.67	1.75	1.68
Adjusted weaning weight, <sup>2</sup> lb.	477.	492.	482.
Pounds beef produced/acre, lb.	221.	332.	386.
Pounds beef produced/acre, % increase over lowest N level		50.	75.
1973			
Cow daily gain, <sup>1</sup> lb.	1.02 <sup>2</sup>	0.58 <sup>1</sup>	1.08 <sup>2</sup>
Calf daily gain, lb.	1.74	1.73	1.72
Adjusted weaning weight, <sup>2</sup> lb.	501.	495.	490.
Pounds beef produced/acre, lb.	233	337	392.
Pounds beef produced/acre, % Increase over lowest N level		45.	68.
1974			
Cow daily gain, <sup>1</sup> lb.	0.91 <sup>1</sup>	0.57 <sup>2</sup>	0.68 <sup>2</sup>
Calf daily gain, lb.	1.87	1.71	1.71
Adjusted weaning weight, <sup>2</sup> lb.	526.	489.	488.
Pounds beef produced/acre, lb.	244.	331.	392.
Pounds beef produced/acre, % increase over lowest N level		36.	61.
3-Year Average			
Cow daily gain <sup>1</sup> , lb.	0.97 <sup>2</sup>	0.68 <sup>1</sup>	0.89 <sup>2</sup>
Calf daily gain, lb.	1.70	1.73	1.76
Adjusted weaning weight, <sup>2</sup> lb.	501	492	487
Pounds beef produced/acre, lb.	233	333	390
Pounds beef produced/acre, % increase over lowest N level		43.	67.

<sup>1</sup> Cow average daily gain for period May to November.

<sup>2</sup> 240-day weight based on daily gain from birth to weaning, average of steers and heifers.

<sup>1-2</sup> Means having different superscripts in the same row are significantly different ( $P \leq .05$ ).

gen fertilization did not improve forage quality but effectually increased forage quantity and carrying capacity. The fact that weaning weights were not markedly decreased at the higher levels of nitrogen indicates that the greater concentration of cattle at the higher levels of fertilization did not greatly affect calf performance.

Each year there was a linear increase in the pounds of beef produced per acre as nitrogen level increased. The three year average indicates that the medium and high levels of fertilization produced 43 and 67 percent more beef/acre than the low level. The increased beef production per acre was due to the higher carrying capacities at the higher levels of nitrogen fertilization, since daily gain of calves was not increased.

## Economic Analysis

Changing economic conditions demand the revaluation of each producer's program each year. In the first year of this study, the advantage in net return per acre for the high level of nitrogen over the low level was approximately \$41.00 (Table 2). Although nitrogen prices increased in 1973, higher priced calves produced a \$47.00 advantage for the high level (Table 3). However, the economic situation changed dramatically in the third year (1974). With increasing nitrogen costs and declining calf prices the low level of nitrogen returned \$16.00 more per acre than the medium level, while the high level resulted in a loss (Table 4). With present (1975) calf and nitrogen prices applied to a three year average of calf performance it is obvious that the higher levels of nitrogen would be unprofitable (Table 5).

Although in other locations with different soil types results may vary slightly, the general conclusions would probably be similar. Increasing levels of nitrogen result in increased carrying capacity and thus more beef produced per acre. However, nitrogen and calf prices may limit the feasibility of high levels of nitrogen. This study emphasized the need for each producer to reevaluate his program each year.

**Table 2. Effects of Level of Nitrogen Fertilization of Midland Bermudagrass on Net Return/Acre, Summer 1972.**

	Level of Nitrogen lb. N/acre		
	65	165	290
Acres/cow-calf pair <sup>1</sup>	2.51	1.91	1.33
Cow-calf pairs/acre	0.40	0.52	0.75
Cow weight gain <sup>2</sup> , lb.	194	176	184
Calf daily gain <sup>3</sup> , lb.	1.67	1.75	1.68
Weaning weight <sup>4</sup> , lb.	476	492	482
Calf/acre, lb.	190	258	362
Value of calf/acre <sup>5</sup> , \$	89.30	121.26	170.14
Fertilizer cost/acre <sup>6</sup> , \$	4.55	11.55	20.30
Return/acre above fertilizer cost, \$	84.75	109.71	149.84
Net return above cow and fertilizer cost/acre, \$	56.75	73.31	97.34

<sup>1</sup> Beginning 4-21-72.

<sup>2</sup> From 4-21-72 to 11-8-72.

<sup>3</sup> From birth to 11-8-72.

<sup>4</sup> 240 day weight based on daily gain from birth to 11-8-72, average of steers and heifers.

<sup>5</sup> Based on \$47.00/cwt. for calves, average for steers and heifers.

<sup>6</sup> Based on \$0.07/lb. of nitrogen.

<sup>7</sup> Based on an annual non-land fixed cow cost of \$70.00/cow.

**Table 3. Effects of Level of Nitrogen Fertilization of Midland Bermudagrass on Net Return/Acre, Summer 1973.**

	Level of Nitrogen lb. N/acre		
	65	165	290
Acres/cow-calf pair	2.28	1.74	1.21
Cow-calf pairs/acre	0.44	0.57	0.83
Cow weight gain <sup>1</sup> , lb.	187	107	197
Calf daily gain <sup>2</sup> , lb.	1.75	1.73	1.72
Weaning weight <sup>3</sup> , lb.	501	495	490
Calf/acre, lb.	220	284	405
Value of calf/acre <sup>4</sup> , \$	121.00	156.00	222.75
Fertilizer cost/acre <sup>5</sup> , \$	7.80	19.80	34.80
Return/acre above fertilizer cost, \$	113.20	136.40	187.95
Net return above cow and fertilizer cost/acre <sup>7</sup> , \$	82.40	96.50	129.85

<sup>1</sup> Beginning 5-2-73.

<sup>2</sup> From 5-2-73 to 11-1-73.

<sup>3</sup> From 5-2-73 to 11-1-73.

<sup>4</sup> 240 day weight based on daily gain from birth to 11-1-73, average of steers and heifers.

<sup>5</sup> Based on \$55.00/cwt. for calves, average for steers and heifers.

<sup>6</sup> Based on \$0.12/lb. of nitrogen.

<sup>7</sup> Based on an annual non-land fixed cow cost of \$70.00/cow.

**Table 4. Effects of Level of Nitrogen Fertilization of Midland Bermudagrass on Net Return/Acre, Summer 1974.**

	Level of Nitrogen lb. N/acre		
	65	165	290
Acres/cow-calf pair <sup>1</sup>	2.17	1.52	1.38
Cow-calf pairs/acre	0.46	0.66	0.72
Cow weight gain <sup>2</sup> , lb.	172	107	130
Calf daily gain <sup>3</sup> , lb.	1.87	1.71	1.71
Weaning weight <sup>4</sup> , lb.	526	489	488
Calf/acre, lb.	245	331	392
Value of calf/acre <sup>5</sup> , \$	73.50	99.30	117.60
Fertilizer cost/acre <sup>6</sup> , \$	16.25	41.25	72.50
Return/acre above fertilizer cost, \$	57.25	58.05	45.10
Net return above cow and fertilizer cost/acre <sup>7</sup> , \$	18.15	1.95	-16.10

<sup>1</sup> Beginning 4-30-74.

<sup>2</sup> From 4-30-74 to 11-5-74.

<sup>3</sup> From 4-30-74 to 11-5-74.

<sup>4</sup> 240 day weight based on daily gain from birth to 11-5-74, average of steers and heifers.

<sup>5</sup> Based on \$30.00/cwt. for calves, average for steers and heifers.

<sup>6</sup> Based on \$0.25/lb. of nitrogen.

<sup>7</sup> Based on an annual non-land fixed cow cost of \$85.00/cow.

Table 5. Effects of Level of Nitrogen Fertilization of Midland Bermudagrass on Net Return/Acre, 3-year-Average (January, 1975 Prices Used for Economic Analysis)

	Level of Nitrogen lb. N/acre		
	65	165	290
Acres/cow-calf pair <sup>1</sup>	2.32	1.72	1.31
Cow-calf pairs/acre	0.43	0.54	0.76
Cow weight gain <sup>2</sup> , lb.	184	130	170
Calf daily gain <sup>3</sup> , lb.	1.76	1.73	1.70
Weaning weight <sup>4</sup> , lb.	501	492	487
Calf/acre, lb.	216	286	372
Value of calf/acre <sup>5</sup> , \$	54.00	71.50	93.00
Fertilizer cost/acre <sup>6</sup> , \$	16.90	42.90	75.40
Return/acre above fertilizer cost, \$	37.10	28.60	17.60
Net return above cow and fertilizer cost/acre <sup>7</sup> , \$	0.55	-20.70	-47.00

<sup>1</sup> Beginning 5-1.

<sup>2</sup> Adjusted for period 5-1 to 11-1.

<sup>3</sup> From birth to 11-1.

<sup>4</sup> 240 day weight based on daily gain from birth to 11-1, average of steers and heifers.

<sup>5</sup> Based on \$25.00/cwt. for calves, average for steers and heifers, Oklahoma City Market prices.

<sup>6</sup> Based on \$0.26/lb. of nitrogen.

<sup>7</sup> Based on an annual non-land fixed cow cost of \$85.00/cow.