GRAZING MANAGEMENT AND NITROGEN FERTILIZER EFFECTS IN GRAZING SYSTEMS FOR BEEF COWS

D. G. Morrison[1], C. C. Willis[1], D. L. Castle[1] and G. J. Cuomo[2]
Louisiana State University Agricultural Center
[1]Rosepine Research Station, P. O. Box 26, Rosepine, LA 70659 USA
[2]Southeast Research Station, P. O. Drawer 567, Franklinton, LA 70438 USA

ABSTRACT
Four 8-ha areas, primarily *Cynodon dactylon* forage, were overseeded in autumn with annual ryegrass (*Lolium multiflorum*) and clover (*Trifolium incarnatum* and *Trifolium repens*). Two areas received no nitrogen (N) fertilizer and two received 168 kg N/ha annually. Within N level (2 x 2 factorial), one area was divided into 4 paddocks (pad) and the other into 16 pad for rotational grazing. Spring-calving beef cows were stocked (2.5/ha) year-round on each area with calves weaned in October. Annual dry matter forage accumulation was greater where N was applied (18.2 vs 14.2 Mg/ha, P=.02) but was unaffected by pad number. Forage availability and annual days of grazing were affected positively both by N and pad number (P<.05). N x pad number interaction affected forage quality (P<.07), cow-calf performance and net returns (P<.01). Generally, responses were similar between 4 and 16 pad at 0 N, but at 168 N, responses were greater for 4 compared with 16 pad. Overall, there was little benefit of increasing pad number from 4 to 16 irrespective of N level, although increased carrying capacity was indicated particularly where N was applied.

KEYWORDS
Beef cattle, grazing systems, nitrogen fertilizer, rotational grazing, cow-calf performance

INTRODUCTION
Beef cattle production in the southeastern USA is based on cow-calf enterprises and efficient year-round grazing systems for this region are needed (Hoveland, 1986). Although interest in rotational-type grazing systems has increased in recent years, most investigations have occurred on native rangeland in the western USA. Results from one locale may not be applicable to other vegetative types and/or climatic conditions (Heitschmidt et al., 1982). Further, results are inconclusive regarding the hypothesis that forage production and quality will vary with livestock density as affected by number of paddocks (Heitschmidt et al., 1987). The objectives of this study were to evaluate forage production and quality and beef cow-calf performance as affected by 4-vs 16-paddock rotational grazing (RG) and nitrogen (N) fertilization in year-round grazing systems.

MATERIALS AND METHODS
This research was conducted in west-central Louisiana (31°N, 93°30W) on typical Coastal Plain (Utisols) soils. Mean annual precipitation was 1453 mm.

Four 8-ha areas with common bermudagrass as the primary base forage specie were used for this 3-year study. Two of the areas received no N and two received 168 kg N/ha annually in three equal applications. Within N level, one area was divided (using single-strand, electrified hi-tensile wire) into four paddocks (pad) of 2 ha each and the other into 16 pad each being 0.5 ha. Thus, treatments (2 x 2 factorial) were: 1) 0 N-4 pad, 2) 0 N-16 pad, 3) 168 N-4 pad and 4) 168 N-16 pad. In each area, 6 ha were overseeded annually in early autumn with annual ryegrass and crimson-white clover mixtures. The remaining 2 ha were overseeded only with white clover and used for winter supplemental hay feeding of the cow herd.

Systems were stocked year-round with 20 crossbred beef cows (2.5/ha). Polled Hereford-sired calves were born in February-March and weaned in mid-October. Cow-calf pairs were rotationally grazed on their assigned area when forage was most actively growing (February through November). Days grazed in each pad usually ranged from 5 to 9 in 4-pad areas and from 2 to 3 in 16-pad areas. Pasture rotations were performed independently for each area based on visual forage supply.

Monthly forage accumulation was estimated by harvesting 0.84 m^2 samples from eight randomly placed exclosures in each area to a 2.5-cm stubble height. Exclosures were moved to new random locations after harvesting. Harvested samples were dried at 60½C for dry matter determination and subsequently analyzed for crude protein, neutral detergent fiber, acid detergent fiber and *in-vitro* true digestibility. Forage availability, measured with a rising-plate meter, and visual botanical composition were estimated before each pad was grazed.

Cow live-weight was recorded each year in January, April, June, August, and October. Calves were weighed monthly from April to October (weaning). A General Linear Models procedure was used to determine the effects of year, N level, grazing management and their interactions on forage and animal data.

RESULTS AND DISCUSSION
Increasing the number of pad from 4 to 16 did not influence dry matter accumulation (Table 1), however, applying N resulted in 27% greater forage accumulation. Applying N increased forage availability 11% while increasing the number of pad increased forage availability 6%. Because there was no interaction of factors, effects were additive with the 168 N-16 pad system averaging 17% greater forage availability than with the 0 N-4 pad system. These results indicate that stocking rates could potentially have been increased where N was applied and pad number was greater.

Although not significant, ryegrass composition increased where N was applied and with increased pad number (Table 1). This increase was apparently at the expense of clover composition which declined as pad number increased from 4 to 16 and was significantly reduced by applied N. The balance of the composition was warm-season perennial forage which, after July, comprised nearly 100% of the pad.

Forage quality was affected by a N x RG interaction (Table 1). Generally, forage quality was similar between the RG treatments at 0 N, but was greater for the 168 N-4 pad system compared with the 168 N-16 pad system. This indicates that greater forage maturity occurred in the 168 N-16 pad system when stocked at 2.5 cow-calf pairs/ha.

The number of days per year that forage supply was sufficient to support grazing without supplemental hay feeding tended to be affected positively by N and 16-pad RG (Table 2). The effect of increasing pad number tended to be greater where no N was applied.

Hay feeding of cows in the 0 N-4 pad system began earlier in autumn than in other systems.

Cow and calf performance and net returns were affected by a N x RG interaction (Table 2). Generally, performance was similar at 0 N regardless of pad number, however, at 168 kg N/ha, performance was greater for 4-pad RG than for 16-pad RG. Corresponding with forage availability data, this indicates that stocking rate was insufficient in this latter system. At 0 N, pad rest periods in the 16-pad system were 27 to 30 days. Whereas, at 168 kg N/ha, rest periods in the 16-pad system were as long as 45 days which resulted in lowered forage quality that negatively affected cow-calf performance and net returns.

In this study, only small increases in forage availability and number of annual grazing days were realized by increasing RG pad number from 4 to 16. N fertilizer interacted with increased pad number to decrease forage quality and cow-calf performance at a similar stocking rate. However, indications were that greater carrying capacity could have been sustained in the 16-pad systems.

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Table 1
Three-year mean annual effects of nitrogen (N) and rotational grazing (RG)[a] on forage production, availability, composition and quality

Forage characteristics	0 N		168 kg/ha N		Probability		
	4 pad	16 pad	4 pad	16 pad	N	RG	N x RG
DMY[b], Mg/ha	14.7	13.8	17.8	18.6	.02	.88	.24
Availability[c]	18.1	19.2	20.1	21.1	.02	.04	.93
Ryegrass[d], %	40.1	51.5	49.9	56.5	.20	.17	.62
Clover[d], %	30.9	27.8	23.2	21.1	.04	.12	.76
CP[e], %	16.1	16.2	17.4	16.2	.16	.22	.16
NDF[e], %	49.3	48.5	48.5	51.6	.36	.37	.07
ADF[e], %	27.7	26.8	26.5	27.5	.57	.87	.02
IVTD[e], %	65.9	66.6	67.9	65.2	.54	.13	.02

[a]RG = 4 paddocks (pad) vs 16 paddocks.
[b]DMY = dry matter yield annually, derived from monthly forage accumulation.
[c]Rising-plate meter readings.
[d]Ryegrass and clover composition averaged from February through July.
[e]CP = crude protein, NDF = neutral detergent fiber, ADF = acid detergent fiber, IVTD = *in vitro* true digestibility.

Table 2
Three-year mean effects of nitrogen (N) fertilizer and rotational-grazing (RG) on cow and calf performance

Item	0 N		168 kg/ha N		Probability		
	4 pad	16 pad	4 pad	16 pad	N	RG	N x RG
No. of cow-calf pairs[a]	60	60	60	60			
Annual grazing days	248	260	261	265	.07	.10	.38
Cow gain[b], kg/d	.14	.16	.16	.08	.69	.64	.01
Calf gain[c], kg/d	.88	.89	.97	.83	.55	.26	.01
Calf weaning wt, kg	260	264	287	256	.77	.57	.01
Net returns/cow, $	42	50	50	6	.60	.61	.01

[a]Twenty cow-calf pairs per 8 ha per year for 3 years.
[b]Live-weight gain from April to October.
[c]Live-weight gain from birth to weaning.