Evaluation of Crimson Clover and Potassium Versus Ryegrass and Nitrogen on Coastal Bermudagrass Pastures Stocked at Three Levels

F. M. ROUQUETTE, JR., M. J. FLORENCE, V. A. HABY, AND G. R. SMITH

Summary

Coastal bermudagrass pastures which had been previously stocked at either a high, medium, or low rate and fertilized with annual rates of 200-100-100 lb/A N-P_2O_5-K_2O were subdivided into two equal-sized paddocks. One paddock was overseeded with crimson clover and fertilized with 0-0-100 lb/A N-P_2O_5-K_2O; whereas, the other paddock was overseeded with ryegrass and fertilized with nitrogen (N) at the rate of 390 lb/A for the season. The N fertilized paddocks produced about 135 lb more liveweight gain/A than K_2O fertilized pastures at the low stocking rate 1.22 and 1.06 animal units (Au)/A, respectively. This gain per acre advantage was doubled (223 lb) as pastures were stocked at the medium level and doubled again (546 lb) as pastures were stocked at the high level. The extent of recycled nutrients was apparently great enough to encourage the no-nitrogen approach for at least one year following an extended period of fertilizing and grazing management. A simple economic assessment showed the fertilizer cost per pound of calf gain at $.016 to $.029 for K_2O fertilized paddocks and $.07 to $.19 for N fertilizer paddocks.

Introduction

Fertilizer applied to pastures is either used by the plant, lost from the soil via leaching, volatilization, etc., or bound to certain soil fractions so as to be slowly or non-available to the plant. Those nutrients which are taken up by the plant also have various routes of deposition. Under a pasture situation, plants which are consumed by the grazing animal are partially degraded by microbial action in the rumen and the undigested fractions pass via dung or urine. This excreta then becomes a recycled source of nutrients from which the plant may make additional growth. Numerous factors affect the rate and extent of nutrient recycling, but among the most notable factors is the stocking density of any particular pasture. The objective of this trial was to determine the influence of previous stocking rate and fertility level on Coastal bermudagrass pastures receiving either clover and potassium or ryegrass and nitrogen.

Procedure

Coastal bermudagrass pastures which had received yearly fertilizer rates of 200-100-100 lb/A N-P_2O_5-K_2O for a 15-year period, and had high residual phosphorus levels, were subdivided into two equal-sized paddocks. One paddock was overseeded with 20 lb/A 'Tibbee' crimson clover on October 18, 1984 and fertilized with 0-0-100 lb/A N-P_2O_5-K_2O in a single application on November 29, 1984. This was the only fertilizer used on the Coastal-crimson pasture during the spring-summer grazing period (March-October). The other paddock was overseeded with 40 lb/A 'Marshall' ryegrass on October 18, 1984 and fertilized with 33.5-0-0 at the rate of 50-60 lb N/A each of seven times. The total rate of N used during the trial was 390 lb/A. The pasture division x fertilizer was applied to each of three pastures which had been stocked at different rates (high, medium, and low) during the previous 15-year period. Spring grazing was initiated when adequate forage was available to maintain planned stocking rates (March 6 for ryegrass and March 28 for crimson clover). Crimson clover germination was excellent because of excessive precipitation (15-18") during the previous fall. However, fall seedling survival was reduced due to vigorous growth of Coastal bermudagrass. Thus, there was less than a 50 percent stand of clover available during the following spring.

Forage availability in clover and ryegrass paddocks was maintained as similar as possible within any stocking rate. Brahman x Hereford F-1 cows and their Simmental-sired fall calves were grazed from initiation in March until time of weaning on June 13. From June 14 to October 2, cows and their spring calves of similar breed as the fall cattle were used as test animals. Regulator animals were used to maintain forage availability within and between pastures via put-and-take technique. Stocking rates were calculated based on total body weight per acre with one cow-calf unit being equivalent to 1,500 lb.

Results and Discussions

Table 1 shows the amount of forage available to cattle grazing either clover-potassium or ryegrass-nitrogen treated Coastal bermudagrass. The similarities between the two paddocks within any stocking rate are more clearly shown in Table 2. The lighter stocking rate has the most forage dry matter (DM) available/100 lb of animal body weight (BW). The larger the tabular value, the more forage was available to the animals. Coastal bermudagrass overseeded with ryegrass and fertilized with N produced 323 lb/A more calf gain than clover-K_2O pastures when stocked at a high rate during the March-June period (Table 3). Although stocking rates were similar at 2.0

TABLE 1. FORAGE AVAILABILITIES (DM) AT THREE LEVELS OF STOCKING

	Stocking Rates					
	High		Medium		Low	
Date	CL[1]	RG[2]	CL	RG	CL	RG
	Pounds DM/A					
3-13-85	1382	2501	1733	2294	2035	2042
4-9-85	2390	2136	2820	2822	3379	3653
5-8-85	2539	2218	2640	2597	3029	3514
6-5-85	1884	2210	2534	3768	4519	5626
7-3-85	1068	1195	1716	2782	4577	4368
7-31-85	1865	1954	2310	2513	6043	6111
8-27-85	1243	1478	2251	3521	7666	7574
9-23-85	538	396	2503	1862	5419	6221

[1]CL = crimson clover + potassium only.

[2]RG = ryegrass + nitrogen only.

KEYWORDS: Fertilization/nutrient recycling/stocking density/crimson clover and potassium/ryegrass and nitrogen.

TABLE 2. FORAGE AVAILABLE (DM) PER UNIT BODY WEIGHT (BW) OF GRAZING ANIMALS AT THREE STOCKING RATES

	Stocking Rates					
	High		Medium		Low	
Date	CL[1]	RG[2]	CL	RG	CL	RG
	Pounds DM/100 lb BW					
3-13-85	not grazed	95	not grazed	125	not grazed	205
4-9-85	84	72	140	138	289	327
5-8-85	83	72	118	118	233	280
6-5-85	61	68	107	158	321	400
7-3-85	27	23	82	93	380	188
7-31-85	35	30	110	63	329	262
8-27-85	22	21	98	82	385	299
9-23-85	8	6	75	44	213	241

[1]CL + crimson clover + potassium only. [2]RG = ryegrass + nitrogen only.

TABLE 3. COASTAL BERMUDAGRASS PASTURES OVERSEEDED WITH EITHER CRIMSON CLOVER OR RYEGRASS AND STOCKED AT A HIGH RATE

Pasture	Grazing Period	Grazing Days	Calf ADG lb	Stk Rate Au/A	Gain lb/A	Gain Advantage lb/A
Clover Coastal	3-28 to 6-13	77	1.79	2.01	180	
Ryegrass Coastal	3-6 to 6-13	99	2.55	2.00	503	+323
Clover Coastal	6-14 to 10-2	110	1.25	3.31	430	
Ryegrass Coastal	6-14 to 10-2	110	1.49	4.12	635	+223
		- TOTALS -				
Clover Coastal	3-28 to 10-2	187	1.47	2.77	610	
Ryegrass Coastal	3-6 to 10-2	209	1.99	3.12	1156	+546

TABLE 4. COASTAL BERMUDAGRASS PASTURES OVERSEEDED WITH EITHER CRIMSON CLOVER OR RYEGRASS AND STOCKED AT A MEDIUM RATE

Pasture	Grazing Period	Grazing Days	Calf ADG lb	Stk Rate Au/A	Gain lb/A	Gain Advantage lb/A
Clover Coastal	3-28 to 6-13	77	2.40	1.47	291	
Ryegrass Coastal	3-6 to 6-13	99	2.46	1.42	347	+ 56
Clover Coastal	6-14 to 10-2	110	2.09	1.53	336	
Ryegrass Coastal	6-14 to 10-2	110	1.88	2.47	503	+167
		- TOTALS -				
Clover Coastal	3-28 to 10-2	187	2.22	1.51	627	
Ryegrass Coastal	3-6 to 10-2	209	2.15	1.97	850	+223

TABLE 5. COASTAL BERMUDAGRASS PASTURES OVERSEEDED WITH EITHER CRIMSON CLOVER OR RYEGRASS AND STOCKED AT A LOW RATE

Pasture	Grazing Period	Grazing Days	Calf ADG lb	Stk Rate Au/A	Gain lb/A	Gain Advantage lb/A
Clover Coastal	3-28 to 6-13	77	2.72	0.86	179	
Ryegrass Coastal	3-6 to 6-13	99	3.06	0.80	245	+ 66
Clover Coastal	6-14 to 10-2	110	2.38	1.20	309	
Ryegrass Coastal	6-14 to 10-2	110	2.19	1.59	380	+ 71
		- TOTALS -				
Clover Coastal	3-28 to 10-2	187	2.52	1.06	488	
Ryegrass Coastal	3-6 to 10-2	209	2.60	1.22	625	+137

Au/A, the average daily gain (ADG) of those calves on ryegrass pastures exceeded those calves on clover pastures by about .75 lb/day. This can be explained in part due to the relatively poor stand of clover as compared to that of ryegrass. During the exclusive bermudagrass phase (June 14 to October 2) the N fertilized pastures produced 223 lb gain/A more than the K_2O-fertilized pastures. The season total calf gain/A on the high stocked pastures was 1,156 lb for ryegrass-N and 610 lb for clover-K_2O pastures, or a difference of 546 lb/A. Even though the overall stocking rate was 3.12 Au/A for the N fertilized pastures, the K_2O-only paddock accommodated a stocking rate of 2.77 Au/A. This would emphasize the significance of the nutrient recycling processes which have occurred on these pastures during the previous 15-year period.

Tables 4 and 5 show the levels of animal performance at the medium and low stocking rates. At both of these stocking rates it was apparent that the difference between clover-K_2O versus ryegrass-N treated pastures was less than at the high rate of stocking. Acceptable calf ADG of 2.2 lb on the medium-stocked and 2.5 lb on the low-stocked pastures was evident regardless of winter pasture selection or fertilizer used. The nitrogen-fertilized pastures had slightly higher stocking rates which accounted for the gain/A advantage. The results of this first year nutrient recycling study would indicate that acceptable animal performance may be obtained by omitting nitrogen fertilizer for at least one year from Coastal bermudagrass pastures which had received annual applications of 200 lb N/A for an extended period.

Table 6 shows a simple comparison of fertilizer costs to total live weight gain per acre. The fertilizer costs per pound of calf gain were calculated using a range in fertilizer prices. For example, 0-0-60 which costs \$130/ton applied has a K_2O nutrient cost of \$.108/lb; and 33.5-0-0 which costs \$160.00/ton applied has a N nutrient cost of \$.24/lb. The sod-seeded crimson clover plus 100 lb/A K_2O resulted in the lowest fertilizer costs per pound

TABLE 6. COMPARISON OF FERTILIZER COSTS PER POUND OF GAIN FOR COASTAL BERMUDAGRASS FERTILIZED WITH POTASSIUM (K_2O) OR NITROGEN (N) AND GRAZED AT THREE STOCKING RATES

Stocking Rate	Winter Pasture	Calf Gain lb/A	Fertilizer Cost/lb Gain					
			K_2O[1]			N[2]		
			$ .10	.12	.14 —cost/lb—	$ .20	.25	.30
			$10.00	12.00	14.00 —cost/A—	$78.00	97.50	117.00
			$/lb					
High	Clover	610	.0164	.0197	.0230	—	—	—
High	Ryegrass	1156	—	—	—	.0675	.0843	.101
Medium	Clover	627	.0159	.0191	.0223	—	—	—
Medium	Ryegrass	850	—	—	—	.0918	.115	.138
Low	Clover	488	.0205	.0246	.0287	—	—	—
Low	Ryegrass	625	—	—	—	.125	.156	.187

[1] K_2O applied at rate of 100 lb/A (0-0-100).

[2] N applied at rate of 390 lb/A (390-0-0).

of gain at approximately $.016 to $.029/lb of calf gain. The ryegrass plus nitrogen treatment resulted in fertilizer costs per pound of gain which ranged from approximately $.07 to $.19. Within either of the two treatments, fertilizer costs per pound of gain increased rapidly at the low stocking rate. Forage that is fertilized to make growth, must be utilized to achieve economic efficiency. Other management factors such as gain per animal, risks, etc., must be considered before a stocking rate × forage utilization factor is set. A complete economic analysis which includes all expenses and income is necessary, however, before a treatment is selected on the basis of net profit.

The most noteworthy conclusion, however, is concerned with the extent of nutrient recycling which has occurred during the past several grazing seasons. The impact of these recycled nutrients on pasture production is evident in the potassium fertilized only paddocks which were nearly as productive as the 390 lb/A N fertilized paddocks. Thus, for one year following an extended grazing period, the most economically advantageous management practice would include the omission of N fertilizer. The duration or length of this type practice, however, is dependent upon several factors and should be reconsidered prior to each grazing season.