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Comparison of Arrowleaf Clover and Potassium Versus Ryegrass and Nitrogen on Common Bermudagrass Pastures Stocked at Three Levels

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Summary

Common 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 of N-P_2O_5-K_2O were divided into two paddocks each. One paddock was overseeded with 'Yuchi' arrowleaf clover and received a total seasonal rate of 0-0-100 lb/A of K_2O; whereas, the other paddock was overseeded with 'Marshall' ryegrass and received only nitrogen (N) fertilizer at the rate of 390 lb N/A for the season. Cows and calves were used to evaluate pasture productivity. Stocking rates were approximately 1.75, 1.45, and 0.85 animal units (Au)/A for high (H), medium (M), and low (L), respectively. In terms of liveweight calf gain per acre, the ryegrass-N paddocks showed a total season advantage of 202, 113, and 77 lb/A at the H, M, and L stocking rates, respectively. The primary gain advantage, however, occurred during the spring period with considerably less difference between paddocks during the summer period. A simple economic assessment of fertilizer cost per pound of gain showed that clover plus K_2O was \$.018 to \$.034 per pound versus that for ryegrass plus N which was \$.11 to \$.24/lb.

KEYWORDS: Arrowleaf clover and potassium/ryegrass and nitrogen/common bermudagrass/fertility level.

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 common bermudagrass pastures receiving either clover and potassium or ryegrass and nitrogen.

Procedure

Common 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 were subdivided into two equal-sized paddocks. One paddock was overseeded with 'Yuchi' arrowleaf clover at 10 lb/A 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 added for the duration of the spring-summer grazing period. The other paddock was overseeded with 'Marshall' ryegrass at 40 lb/A on October 18, 1984 and fertilized with 33.5-0-0 at the rate of 50 to 60 lb N/A each of seven times beginning February 20, 1985. The total rate of N used during the spring-summer period was 390 lb/A. These fertility-winter annual forage treatments were applied to each of three pastures which had been stocked at different rates (high, medium, and low) during the 15-year period. Spring grazing was initiated when adequate forage was available to maintain planned stocking rates (March 6 for ryegrass-N paddocks and March 18 for clover-K_2O paddocks).

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 June 13. From June 14 to October 2, cows and their spring calves of similar breeding to the fall cattle were used as test animals. Regulator animals were used to maintain forage availabilities within and between pastures (put-and-take technique). Because of drought conditions and slow regrowth of common bermudagrass, grazing was terminated on all pastures from July 9 to July 31 (22 days). Cattle were placed back on all pastures on July 31 and remained until October 2. Stocking rates were calculated based on total body weight per acre with one animal-unit being equivalent to 1,500 lb.

Results and Discussion

Table 1 shows the forage available to ground level in each of the paddocks. The drought condition was evident by the July 3 harvest date. Table 2 shows a more detailed comparison of grazing pressures by expressing forage availability as pounds of dry matter (DM)/100 lb body weight (BW). Thus, as the number of ratio increases, the lighter is the stocking rate. Generally, *ad libitum* intake is achieved as this ratio approaches 100. Comparisons were made between common bermudagrass pastures overseeded with either arrowleaf clover-K_2O or ryegrass-N at each of three stocking rates (Tables 3 to 5). Ryegrass-N paddocks had adequate forage for continuous grazing on March 6; whereas, the clover-K_2O paddocks were not ready for grazing until March 18. Clover stands were less than anticipated and averaged approximately 50 percent.

TABLE 1. FORAGE AVAILABLE AT THREE STOCKING RATES

	Stocking Rates					
	High		Medium		Low	
Date	CL[1]	RG[2]	CL	RG	CL	RG
	Pounds DM/A					
3-13-85	972	2186	1498	1778	1994	1618
4-9-85	1704	1920	2443	2112	3787	2849
5-8-85	1541	2340	2486	2129	3586	2712
6-5-85	1450	1814	2578	2031	4001	3806
7-3-85	468	607	713	576	1721	1536
7-31-85	1277	1795	1740	1721	1855	1951
8-27-85	1190	1565	1498	1882	2371	3497
9-23-85	130	197	1229	1087	1954	2213

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

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	37	92	79	91	180	158
4-9-85	62	74	118	99	317	245
5-8-85	59	87	111	94	268	210
6-5-85	55	66	110	83	278	273
7-3-85	17	22	37	30	139	123
7-31-85	48	68	89	88	148	160
8-27-85	28	35	70	88	175	257
9-23-85	5	4	58	51	142	113

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

TABLE 3. COMMON BERMUDAGRASS PASTURES OVRSEEDED WITH EITHER ARROWLEAF 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 Common	3-18 to 6-13	87	1.35	1.77	208	
Ryegrass Common	3-6 to 6-13	99	2.07	1.75	360	+152
Clover Common	6-14 to 10-2	88	1.44	1.99	267	
Ryegrass Common	6-14 to 10-2	88	1.80	2.44	317	+ 50
		- TOTALS -				
Clover Common	3-18 to 10-2	175	1.40	1.88	475	
Ryegrass Common	3-6 to 10-2	187	1.94	2.07	677	+202

TABLE 4. COMMON BERMUDAGRASS PASTURES OVERSEEDED WITH EITHER ARROWLEAF 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 Common	3-18 to 6-13	87	2.57	1.45	319	
Ryegrass Common	3-6 to 6-13	99	2.83	1.48	415	+ 96
Clover Common	6-14 to 10-2	88	2.03	1.36	242	
Ryegrass Common	6-14 to 10-2	88	2.19	1.35	259	+ 17
		- TOTALS -				
Clover Coastal	3-18 to 10-2	175	2.30	1.40	561	
Ryegrass Common	3-6 to 10-2	187	2.53	1.42	674	+113

TABLE 5. COMMON BERMUDAGRASS PASTURES OVERSEEDED WITH EITHER ARROWLEAF 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 Common	3-18 to 6-13	87	3.00	0.87	223	
Ryegrass Common	3-6 to 6-13	99	3.12	0.82	251	+28
Clover Common	6-14 to 10-2	88	2.46	0.86	188	
Ryegrass Common	6-14 to 10-2	88	2.80	0.98	237	+49
		- TOTALS -				
Clover Common	3-18 to 10-2	175	2.73	0.86	411	
Ryegrass Common	3-6 to 10-2	187	2.97	0.90	488	+77

Stocking rates were similar on clover-K_2O and ryegrass-N paddocks from March to mid-June and ranged from about 1.75, 1.45, and 0.85 Au/A for high (H), medium (M), and low (L), respectively. There was, however, a difference in calf average daily gain (ADG) between the clover-K_2O versus ryegrass-N at each of the three stocking rates (1.35 versus 2.07 lb on H; 2.57 versus 2.83 lb on M; and 3.00 versus 3.12 lb on L pastures). The difference in ADG plus the extra 12 days of grazing at initiation of the trial resulted in liveweight gain advantages for ryegrass-N paddocks of 152, 96, and 28 lb/A, respectively at H, M, and L stocking rates.

During the grazing period which included only common bermudagrass (June 14 to October 2), calf ADG remained higher on the N-fertilized paddocks as compared to the K-fertilized paddocks (1.44 versus 1.80 lb on H; 2.03 versus 2.19 lb on M; and 2.46 versus 2.80 lb on L pastures). The N-fertilized paddocks had a maximum of only a 50 lb gain/A advantage (H and L pastures) during the bermudagrass phase. Thus, for common bermudagrass, there was apparently adequate plant nutrient reserves remaining in the pastures to provide acceptable forage production-animal performance without additional N fertilizer. At least during the first year of zero N-fertilizer application following an extended period of N-P_2O_5-K_2O fertilization, the recycling of plant food nutrients was sufficient to nearly maintain performance levels. An examination of the total season performance indicated an approximate doubling of the gain/acre advantage of ryegrass-N paddocks over the clover-K_2O paddocks. The gain per acre advantage of ryegrass-N was 77, 113, and 202 lb/A for L, M, and H pastures, respectively.

Table 6 shows a simple comparison of fertilizer costs to total liveweight gain per acre. A more detailed economic evaluation would be necessary to determine profit-loss situations for these pasture systems; however, this does illustrate the differences in fertilizer costs per pound of gain between clover plus K_2O versus ryegrass plus N. Fertilizer costs per pound of calf gain ranged from nearly \$.018 to \$.034 for clover plus K_2O and from \$.11 to \$.24 for ryegrass plus N. As stocking rate was decreased, fertilizer costs per pound of gain increased nearly twofold on each paddock. Previous research has shown common bermu-

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

			Fertilizer Cost/lb Gain					
			K_2O[1]			N[2]		
Stocking Rate	Winter Pasture	Calf Gain lb/A	\$ .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	475	.0211	.0253	.0295	—	—	—
High	Ryegrass	677	—	—	—	.115	.144	.173
Medium	Clover	561	.0178	.0214	.0250	—	—	—
Medium	Ryegrass	674	—	—	—	.116	.145	.174
Low	Clover	411	.0243	.0292	.0341	—	—	—
Low	Ryegrass	488	—	—	—	.160	.200	.240

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

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

dagrass to produce about 50 to 60 percent as much forage as Coastal bermudagrass. Thus, when these costs are compared to those of the companion paper, the 390 lb/A N on common bermudagrass, and especially during a dry year, can prove to be very costly. The extent of nutrient recycling is shown in the clover plus K_2O only paddocks.

The most important point revealed by these data is the extent of recycled plant nutrients which were used to nearly maintain pasture production levels in the no-N paddocks. A sound economic management decision may include the omission of N fertilizer for one year following an extended period of fertility × grazing management. The length of time this type of management practice may be used is uncertain at this time, but is certainly controlled by several soil, plant, climate, and economic factors. Certainly, the net profit made from any grazing operation may be calculated only after all costs are tabulated. The fertilizer costs represent only one portion of these total expenses.