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Influence of Ralgro Implant and Nitrogen Fertilizer Rate on Animal Performance from Rye-Ryegrass Pastures

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Summary

Spring-born, ½ Senepol x ¼ Brahman x ¼ Hereford, steers and heifers were weaned in October and grazed on nitrogen fertilizer x Ralgro implant treatments using rye-ryegrass pastures. Nitrogen was applied at the rates of either 60, 120, or 230 lb/A. The use of Ralgro implant resulted in additional average daily gains (ADG) of .2 lb ($P<.16$). Steers had higher ADG than heifers. The ADG of calves grazing at the high (H) rate of nitrogen was higher than calves on the low (L), and medium (M) rates of nitrogen. Stocking rates ranged from 1.75 for calves on L to 2.55 head/A for calves on H pastures. Gain per acre from H was approximately twice that from L pastures (900 lb versus 450 lb). Steers stocked at 2.5 head/A and ADG of >2.5 lb gained approximately 1,000 lb/A on H pastures.

Introduction

Management of cool-season annual pastures predominately includes levels of fertilization and stocking rates. Other factors to consider include planting date, seeding rate, and various animal health practices including the use of growth implants. The objective of this trial was to determine the effect of Ralgro implant and rate of nitrogen fertilizer on gain per animal and gain per acre of steers and heifers grazing rye-ryegrass pastures.

Procedure

Spring-born, ½ Senepol x ¼ Brahman x ¼ Hereford, steers (n = 30) and heifers (n = 30) were weaned in October and stratified into each of six groups based on age, weight, and body condition. Each of the six groups of steers and heifers, respectively, were randomly allocated to one of the following Ralgro implant x nitrogen (N) fertilizer treatments: (1) Non-Implanted + Low N Rate; (2) Implanted + Low N rate; (3) Non-Implanted + Medium N; (4) Implanted + Medium N; (5) Non-Implanted + High N; and (6) Implanted + High N. Each treatment was replicated twice using five calves of similar sex per replication; thus, a total of 12 pastures were used in this study. Calves initiated grazing on November 17, 1984 and were weighed at approximately 28-day intervals until May 29, 1985 (183 days). Those calves in the Implant group were implanted initially on November 27, 1984 and re-implanted on February 27, 1985. All calves were wormed with Panacur on November 27, 1984 and again on February 27, 1985.

All steers used in this trial had been previously implanted with Ralgro at 150 to 180 days prior to initiation of the trial. None of the heifers had been implanted until the trial was initiated. The five 'Tester' calves which were assigned to each group remained on the pastures during the entire test period. 'Regulator' animals were used as a

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means of maintaining forage availability across all pastures, and were added in periods of abundant growth and removed in periods of depressed growth (Put-and-Take technique). Tester animals were used to calculate individual performance (average daily gain [ADG]); whereas, both Testers and Regulators were used to calculate animal grazing days and stocking rates. The ADG and stocking rates were then used to calculate animal gain per acre.

'Elbon' rye at 100 lb/A and 'Marshall' ryegrass at 25 lb/A were direct drilled (sod-seeded) into well-established bermudagrass pastures on October 10, 1984. The three N rates were (1) 60 (L), (2) 120 (M), and (3) 230 (H) lb/A. All pastures were fertilized with 300 lb/A of 0-20-20 and 180 lb/A of 33.5-0-0 on November 8, 1984 to provide a base rate of 60-60-60 lb/A of N-P_2O_5-K_2O. This constituted the total seasonal fertilizer for the L rate. The M pastures received an additional 60 lb N/A as ammonium nitrate on February 20, 1985. The H pastures received ammonium nitrate at the rate of 50 lb N/A on December 13, 1984, 60 lb N/A on February 20, 1985, and 60 lb N/A on April 1, 1985 (Table 1). No additional P or K was applied after the initial 0-60-60 rate. Pasture size ranged from 3 to 5 acres each. Each of the 12 pastures had two protected areas (5-foot diameter wire cage) from which each of two, one square foot areas were hand-clipped to ground level at approximately 28-day intervals (four caged samples per pasture). Four, one square foot areas were hand-clipped to ground level outside the cages at randomly selected sites on the same date as the caged samples. The outside cage samples represented forage available for consumption. The samples taken from within the cages allowed for estimates of both forage dry matter production and forage disappearance. Forage quality assessment (protein and in vitro dry matter digestibility) were taken at approximately 2-week intervals by hand-plucking plant parts which visually approximated the diet being selected by grazing animals in each pasture.

Because of climatic conditions and drastically reduced forage growth rates, all calves were removed from the test pastures on January 14, 1985, placed on a similar pasture and offered 4.5 lb/hd/day of whole shelled corn plus hay *ad libitum* to maintain body condition and weight. The M and H pastures had sufficient forage available to resume full time grazing on February 27; whereas, the L pastures did not have adequate forage until March 11 (Table 2). In addition, the L pastures were vacated again from April 16 to May 2 due to lack of adequate available forage.

Results and Discussion

Table 2 shows the average daily gain (ADG) of each pasture by periods. The Test period ADG shows the actual weight gained during the residence time on the specific test pastures; whereas, the Total period ADG shows the weight gain made throughout the 183-day period and includes that weight gained while receiving corn and hay supplements. Thus, insofar as pasture (fertilizer) performance is concerned, the Test period should be considered. Any forage that grew in response to fertilizer was harvested by the stocker steers and heifers. And, if there was not sufficient forage to support full-time, continuous grazing, cattle were vacated from the test pastures. On the other hand, since all cattle were in a common, single herd during the supplemental period, the Total period gains may be used as an implant comparison. With reference to the Total period, Ralgro implanted calves had consistent gain advantages of 0.20 lb/hd/day irrespective of pasture level. On the L pastures, heifers appeared to have benefited most from implantation; whereas, on the H pastures, steers were responsible for most of the weight-gain advantage.

TABLE 1. FERTILIZER APPLICATION DATES AND RATES DURING THE TREATMENT PERIOD

Date	Rate (lb/A) N-P_2O_5-K_2O	Treatments Receiving Fertilizer
11-8-84	0-60-60	
	60-0-0	Low, Med, High
12-13-84	50-0-0	High
2-20-85	60-0-0	Med, High
4-1-85	60-0-0	High

Gain per animal, stocking rate, and gain per acre are summarized for each treatment in Table 3. Although the initial weight of the heifers was approximately 315 lb and that of steers was 365 lb, a stocking rate of one animal was set equal to 500 lb since this was the approximate average weight of all calves during the trial (on weight + off weight ÷ 2). Any weight may be used as an animal-equivalent, but the weight should be the same across all treatments for comparison purposes. Stocking rates were from about 1.7 to 2.5 animal-equivalents/A across treatments. The relatively low stocking rate for steers on M pastures was a reflection of either lack of forage production from those specific pastures which may have been due to winter damage or a delay in management decision to add Regulators at the appropriate time. Thus, the relatively low stocking rate on the M pastures for steers was also responsible for the lower than expected gain/A. Of particular interest was the magnitude of gain/animal and gain/A at the H nitrogen rate. In addition to producing more forage/A as expressed by stocking rate, the N treatments also dramatically affected specie composition of the pastures. On the L pastures, Elbon rye began to boot and eventually set seed in late March. Because of the obvious N deficiency of the L pastures, ryegrass was restricted in its regrowth potential which caused it to seed in late April-early May. Thus, bermudagrass became the dominant forage available for intake during the last 30 days of the trial on the L pastures. Had these treatments been conducted on a prepared seedbed rather than a bermudagrass sod, grazing on the L pastures would have terminated in late April. Thus, the practice of sodseeding becomes a primary consideration in the biological-economic management of winter pastures in the southeastern United States. On the H pastures, however, N delayed maturity of the rye and kept it in a vegetative state for an additional 30 to 45 days. In addition, the extra N allowed ryegrass to remain in a vigorous, vegetative state until late May-early June. The M Pastures were intermediate to L and H with regard to forage maturity.

Table 4 shows animal performance summaries by various treatment combinations. For the Total period (183 days), implant calves gained about 0.2 lb/hd/day more

TABLE 2. AVERAGE DAILY GAIN OF STEERS AND HEIFERS BY TREATMENT

Treatment			Initial	Weigh Periods for L Pastures							Test	Total
Fert.	Imp.	Sex	Weight (lb)	11-27 to 1-3	1-3 to 1-14	1-14 to 3-11*	3-11 to 3-27	3-27 to 4-16	4-16 to 5-2**	5-2 to 5-29	Period (lb)	Period 11-27 to 5-29 (lb)
			Pounds									
Low	O	H	320	0.63	0.27	0.57*	1.83	1.46	1.20**	1.85	1.21	1.01
Low	O	S	360	0.86	1.04	0.16*	3.09	1.41	0.76**	2.96	1.80	1.21
	REP AVG		340	.75	.66	.37	2.46	1.44	.98	2.41	1.51	1.11
Low	I	H	322	0.44	0.48	1.10*	2.34	1.50	1.31**	2.80	1.48	1.35
Low	I	S	364	0.89	0.62	0.58*	3.19	1.77	0.60**	2.33	1.70	1.26
	REP AVG		343	.67	.55	.84	2.77	1.64	.96	2.57	1.59	1.31
				Weigh Periods for M and H Pastures								
				11-27 to 1-3	1-3 to 1-14	1-14 to 2-27*	2-27 to 3-27	3-19 to 4-8**	3-27 to 5-2	5-2 to 5-29		
			Pounds									
Med	O	H	305	1.00	0.93	0.05*	2.62		1.75	1.90	1.68	1.29
Med	O	S	362	0.42	0.44	0.22*	2.83		2.33	2.65	1.84	1.45
	REP AVG		334	.71	.69	.14	2.73		2.04	2.28	1.76	1.37
Med	I	H	314	0.78	0.36	0.72*	2.27[1]	2.49**	2.18[2]	2.02	1.55	1.46
Med	I	S	365	0.05	0.69	1.19*	2.79		2.88	2.25	1.82	1.67
	REP AVG		340	.42	.53	.96	2.53		2.53	2.14	1.69	1.57
High	O	H	304	1.19	0.65	0.73*	2.21		2.09	2.16	1.77	1.52
High	O	S	360	1.90	1.78	0.81*	2.61		2.48	3.32	2.46	2.07
	REP AVG		332	1.55	1.22	.77	2.41		2.29	2.74	2.12	1.80
High	I	H	311	1.29	1.65	1.01*	2.60		1.62	2.24	1.85	1.64
High	I	S	368	2.43	2.56	1.08*	3.32		2.88	2.93	2.83	2.42
	REP AVG		340	1.86	2.11	1.05	2.96		2.25	2.59	2.34	2.03

*Denotes off test pastures; calves placed in a common herd and fed 4.5#/hd/day corn + *ad libitum* hay.

**Denotes off test pastures; calves received pasture similar to test pastures without supplementation.

[1]Grazing period 2-27 to 3-19.

[2]Grazing period 4-8 to 5-2.

TABLE 3. GAIN PER ANIMAL AND PER ACRE FROM VARIOUS TREATMENTS

Treatment			No. Days		Gain/Animal		Stocking Rate[1]		Gain/Acre[2]	
Fert.	Imp.	Sex	Test Period	Total Period	Test Period	Total Period	Test Period	Total Period	Test Period	Total Period
					Pounds				Pounds	
Low	O	H	111	183	134	185	1.80	1.88	271	373
Low	O	S	111	183	200	221	1.72	1.83	363	405
	REP AVG		111	183	167	203	1.76	1.86	317	389
Low	I	H	111	183	164	247	1.57	1.74	290	456
Low	I	S	111	183	189	231	1.91	1.95	386	470
	REP AVG		111	183	177	239	1.74	1.85	338	463
Med	O	H	139	183	234	236	2.02	2.02	492	496
Med	O	S	139	183	256	266	1.29	1.46	350	370
	REP AVG		139	183	245	251	1.65	1.74	421	433
Med	I	H	119	183	185	267	1.94	1.96	394	558
Med	I	S	139	183	255	305	1.50	1.62	421	525
	REP AVG		129	183	220	286	1.72	1.79	408	542
High	O	H	139	183	246	278	2.61	2.46	673	737
High	O	S	139	183	342	378	2.57	2.43	908	980
	REP AVG		139	183	294	328	2.59	2.45	791	859
High	I	H	139	183	257	301	2.53	2.40	662	750
High	I	S	139	183	394	442	2.49	2.37	987	1,083
	REP AVG		139	183	326	372	2.51	2.39	825	917

[1]Stocking rate was based on a 500 lb equivalent.

[2]Gain/Animal × Stocking Rate = Gain/Acre.

than non-implant calves (P<.16); steers gained about 0.3 lb/hd/day more than heifers; and there was about 0.6 lb/hd/day difference between calves grazing L versus H fertilized pastures.

The quantity of forage available for consumption on each pasture by periods is presented in Table 5. One of the primary considerations in this trial was to maintain forage availability at similar levels across all treatment pastures. Had we chosen to maintain a constant stocking rate, the trial would have been biased from the standpoint of gain/A with the wide variation in quantity of N fertilizer used. Table 5 shows some of the variation that existed among and between treatments, but on the average, these pastures were quite uniform with respect to forage availability.

Grazing pressures were more appropriately depicted in Table 6 in which available forage was expressed as pounds of forage dry matter per 100 lb animal body weight. The larger the number in the table, the more forage was available for consumption per unit body weight. It is clear from this table that the M pastures were not appropriately stocked during a brief period in March to April. Failure to add an adequate number of Regulators during this time accounted for the low stocking rates shown.

TABLE 4. ANIMAL PERFORMANCE SUMMARIES BY TREATMENT COMBINATION

Item	ADG		Gain/Animal		Stocking Rate		Gain/Acre	
	Test	Total	Test	Total	Test	Total	Test	Total
	Pounds		Pounds		Au/A		Pounds	
All non-Implant	1.79 NS[1]	1.43 NS	235 NS	261 NS	2.00 NS	2.02 NS	510 NS	560 NS
All Implant	1.87 NS	1.62 NS	241 NS	299 NS	1.99 NS	2.01 NS	524 NS	641 NS
All Low N	1.55 a	1.21 a	172 a	221 a	1.75 a	1.86 a	328 a	426 a
All Med N	1.72 a	1.47 a	233 a	269 a	1.69 a	1.77 a	415 a	488 a
All High N	2.23 b	1.91 b	310 b	350 b	2.55 b	2.42 b	808 b	888 b
All Heifers	1.59 a	1.38 a	203 a	252 a	2.08 NS	2.08 NS	464 NS	562 NS
All Steers	2.08 b	1.68 b	273 b	307 b	1.91 NS	1.94 NS	569 NS	639 NS
Low N+O Imp	1.51	1.11	167	203	1.76	1.86	317	389
Low N+Imp	1.59	1.31	177	239	1.74	1.85	338	463
Med N+O Imp	1.76	1.37	245	251	1.65	1.74	421	433
Med N+Imp	1.69	1.57	220	286	1.72	1.79	408	542
High N+O Imp	2.12	1.80	294	328	2.59	2.45	791	859
High N+Imp	2.34	2.03	326	372	2.51	2.39	825	917

[1]Means within a specified grouping, followed by the same letter are not significantly different at the 0.05 level by the LSD method.

TABLE 5. FORAGE AVAILABLE ON EACH TREATMENT PASTURE

Treatment			Harvest Date							
Fert.	Imp.	Sex	12-3-84	1-3-85	1-29-85	2-25-85	3-25-85	4-25-85	5-23-85	6-10-85
			Pounds DM/A							
Low	O	H	1,626	1,140	1,443	1,136	2,244	1,920	966	1,299
Low	O	S	1,085	1,198	1,037	704	1,868	1,752	1,315	1,275
	REP AVG		1,356	1,169	1,240	920	2,056	1,836	1,141	1,287
Low	I	H	1,243	923	848	635	1,701	1,790	909	1,492
Low	I	S	1,367	1,419	1,574	809	2,255	1,898	1,829	1,499
	REP AVG		1,305	1,171	1,211	722	1,978	1,844	1,369	1,496
Med	O	H	1,806	1,169	1,103	912	2,446	1,971	1,268	1,337
Med	O	S	1,668	811	627	845	2,130	2,150	1,846	1,722
	REP AVG		1,737	990	865	879	2,288	2,061	1,557	1,530
Med	I	H	1,199	935	1,179	661	1,484	2,712	1,414	1,029
Med	I	S	1,599	925	605	711	2,701	2,258	1,757	1,957
	REP AVG		1,399	930	892	686	2,093	2,485	1,586	1,493
High	O	H	1,551	1,057	1,347	721	3,017	2,378	2,323	1,215
High	O	S	1,578	756	1,288	823	2,733	1,891	1,849	1,244
	REP AVG		1,565	907	1,318	772	2,875	2,135	2,086	1,230
High	I	H	1,285	1,087	1,515	1,318	2,816	2,383	2,945	1,513
High	I	S	1,311	1,106	1,446	532	2,480	1,843	1,699	1,389
	REP AVG		1,298	1,097	1,481	925	2,648	2,113	2,322	1,451

TABLE 6. FORAGE AVAILABLE PER UNIT ANIMAL WEIGHT

Treatment			Harvest Date							
Fert.	Imp.	Sex	12-3-84	1-3-85	1-29-85	2-25-85	3-25-85	4-25-85	5-23-85	6-10-85
			Pounds DM/100 Pounds BW[1]							
Low	O	H	263	178	226	146	211	159	79	100
Low	O	S	150	159	136	84	210	191	126	114
	REP AVG		207	169	181	115	211	175	103	107
Low	I	H	198	144	131	80	204	208	91	139
Low	I	S	194	193	212	95	187	152	150	116
	REP AVG		196	169	172	88	196	180	121	128
Med	O	H	268	164	152	124	209	153	89	89
Med	O	S	282	236	182	237	376	298	198	174
	REP AVG		275	200	167	181	293	226	144	132
Med	I	H	175	131	164	84	160	241	100	69
Med	I	S	266	278	180	133	429	271	148	159
	REP AVG		221	205	172	109	295	256	124	114
High	O	H	170	99	124	112	212	154	112	55
High	O	S	160	65	108	102	187	120	113	71
	REP AVG		165	82	116	107	200	137	113	63
High	I	H	141	103	140	194	203	168	145	70
High	I	S	146	88	111	60	162	110	132	103
	REP AVG		144	100	130	127	183	139	139	87

[1]Pounds DM/100 lb BW = Pounds dry matter/100 lb body weight.

Forage utilization of winter pastures is most important from the standpoint of biological efficiency by utilizing all forage produced and from the standpoint of economic efficiency by increasing gain per acre. Data from this 1-year trial clearly show the influence of rate of N on both quantity and quality of the pastures and the effect of both fertilizer, implant, and sex of calf on animal gains. Economic comparisons of these fertility-implant treatments are presented in a companion paper.