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Animal Performance from Winter Pastures Using Fertilizer or Cowpeas and Clover for the Nitrogen Source

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Summary

Winter pastures were fertilized with either a complete or no-nitrogen fertilizer during a 5-year period to determine the influence of nitrogen source on performance of animals and pasture. Cowpeas grown during the summer and disked under during early fall, plus crimson clover grown in association with the winter annual grasses, provided a source of nitrogen for the no-nitrogen fertilizer treatment. The 5-year average fertilizer rates used were 292-52-64 versus 4-82-82 lbs/A of N-P_2O_5-K_2O, respectively, for nitrogen versus no-nitrogen. Both systems were grazed to equivalent grazing pressures (lbs forage/unit body weight). The nitrogen fertilized pasture produced the most forage, and therefore, had the highest stocking rate at 3.41 calves/A and gain per acre at 897 lbs/A. The no-nitrogen fertilized pasture was stocked at an average of 2.16 calves/A and produced 689 lbs/A gain annually during the 5-year period. The no-nitrogen fertilized, legume-grass pasture produced the slightly higher daily gains compared to the complete fertilized treatment. Cost per pound of gain favored the nitrogen fertilized pastures ($0.133 versus $0.164) primarily because of cowpea seed costs and total gain per acre.

Introduction

Much of the pasture lands in the humid southeastern U.S. are acidic and low in fertility. However, with the addition of lime and fertilizer, especially nitrogen, these pastures can become very productive during most months. The intensive management of these cool-season and warm-season forages often causes concern for economic risk and potential contamination of water supplies. This study was initiated to compare conventional rates of fertilizer used under high input systems with alternative sources of nitrogen for winter pasture production. The objective of this study was to evaluate the use of cowpeas as a green manure crop and clover as a companion crop as an alternative source of nitrogen for small grain-ryegrass pastures.

KEYWORDS: Nitrogen/cowpeas/clover/winter pasture.

Procedures

Upland, well-drained sandy sites, which had received identical fertilizer and management during previous years, were selected for the study area. The two treatments compared were: (1) winter pasture of 'Elbon' rye and 'Marshall' ryegrass planted on a well-prepared seedbed in September-October and fertilized with N-P_2O_5-K_2O; and (2) winter pasture of 'Elbon' rye, 'Marshall' ryegrass and 'Dixie' crimson clover planted on a well-prepared seedbed at the same time (September-October) as Treatment 1 and fertilized with P_2O_5 and K_2O. During the summer months, prior to the winter pasture planting, the area assigned to Treatment 1 (nitrogen) was disked two to three times to maintain a fallow situation. For Treatment 2 (no-nitrogen), the area was disked in early summer and planted to 'Iron and Clay' cowpeas. The cowpeas were allowed to reach a height of approximately 2 feet before cattle were allowed to graze. Grazing was conducted at a light grazing pressure during 3 of the 5 years. The duration of the grazing period was approximately 30 days. During the remaining 2 years, grazing was not allowed due to unfavorable climatic conditions for cowpea regrowth. In late August to early September of each year, the cowpeas were disked into the soil.

The entire amount of fertilizer used in the no-nitrogen treatment was applied at planting as 0-20-20 during years 1 through 4 and as 6-24-24 during year 5. Thus, this area was fertilized only one time during each 12-month period. The area that was assigned to the complete fertilizer treatment (nitrogen) received all of the P_2O_5 and K_2O at planting and received four split nitrogen applications. Total nitrogen fertilizer applied to Treatment 1 ranged from 240 to 350 lbs/A during the 5-year period (Table 1). The average fertilizer ratio for the nitrogen treatment was 292-52-64 lbs/A of N-P_2O_5-K_2O. With the exception of year 5 when 300 lbs/A of 6-24-24 was applied, the no-nitrogen pasture received only P_2O_5 and

TABLE 3. PERFORMANCE PER ANIMAL AND PER ACRE FROM WINTER PASTURE FERTILIZED WITH NITROGEN *VS* NO NITROGEN

Fertilizer Treatment	Avg. Wt. on Test	Avg. Age on Test	No. Days on Test	Sex of Testers	Avg. Daily Gain	Stk. Rate*	Gain/ Acre
	lbs	mo.			lbs/day	an/A	lbs/A
Nitrogen							
YR 1	662	14	174	Steers	2.01	3.05	1064
YR 2	593	8	196	Steers	1.63	3.23	1034
YR 3	462	8	143	Steers + Heifers	1.42	3.78	769
YR 4	476	8	131	Heifers	2.09	3.29	900
YR 5	396	7	174	Heifers	1.12	3.68	719
5-YR AVG.	518	9	164		1.65	3.41	897
No Nitrogen							
YR 1	665	14	174	Steers	2.30	2.01	806
YR 2	587	8	196	Steers	1.90	1.93	719
YR 3	459	8	154	Steers + Heifers	1.66	2.45	628
YR 4	478	8	137	Heifers	2.70	2.32	858
YR 5	404	7	174	Heifers	1.19	2.10	436
5-YR AVG.	519	9	167		1.95	2.16	689

*Stocking Rate based on 500 lbs = 1 animal.

intake as compared to the no-nitrogen forage. With the exception of year 5 when the ADG were a disappointing 1.12 and 1.19 lbs/day, respectively, the individual animal performance was approximately 1.75 to 2.0 lbs/day as anticipated. The unusually low ADG of year 5 may have been primarily due to the quality and gain potential of the Tester animals used.

Stocking rates were calculated on a monthly basis and a total, yearly trial stocking rate was calculated from these values. Stocking rates based on 500 lb animals ranged from 3.78 during year 3 to 3.05 for year 1 on the nitrogen fertilized treatment. The no-nitrogen pasture supported stocking rates of 2.45 to 1.93 animals/A. The 5-year average stocking rate was 3.41 for the nitrogen fertilized pasture and 2.16 calves/A for the no-nitrogen pasture. Using these stocking rates and ADG figures, the trial gain per acre was computed and ranged from 1,064 to 719 lbs/A and averaged 897 lbs/A on the nitrogen fertilized pasture for the 5-year duration. On the no-nitrogen fertilized pasture, gain per acre ranged from 858 to 436 lbs/A and averaged 689 lbs/A for the 5-year period.

Gain per animal and gain per acre are excellent indicators of forage quality, forage production, and grazing management. However, an economic assessment may be necessary to further differentiate between management alternatives and/or pasture-animal systems. A preliminary economic assessment of two methods of producing winter pasture is presented in Table 4. The estimated fertilizer costs for the 5-year average rate was $88.30 for the nitrogen fertilized pasture and $33.70 for the no-nitrogen pastures. Seed costs for the no-nitrogen treatment, however, were nearly triple that for the nitrogen fertilized pasture at $59.63 and $21.00/A, respectively. Thus, the monetary savings from the fertilizer applications were nearly eliminated in seed costs with the overall costs totaling $113.33 for no-nitrogen and $119.30/A for the nitrogen fertilized pasture. And, with the 200-pound gain/A advantage of the nitrogen fertilized pasture, the estimated cost per pound of gain was $0.133 versus $0.164 for nitrogen versus no-nitrogen pasture systems.

The overall implications of using cowpeas and clovers for nitrogen fixation rather than nitrogen fertilizer may be important to management decisions in the following manners: (1) acceptable gains per animal and per acre are possible from winter pastures without the use of nitrogen fertilizer; (2) using rates of nitrogen up to nearly 300 lbs/A during the 8-month growing period is economically feasible as long as efficient forage utilization practices are followed; (3) the relative cost per pound of gain for calves grazing either system is likely to be less than 20 to 25 cents with optimum forage utilization; (4) with a more efficient approach to the timeliness of planting cowpeas, extra animal gains will potentially offset a portion of the cowpea seed costs; (5) unpublished data from

TABLE 4. ESTIMATED COSTS PER POUND OF GAIN FROM WINTER PASTURES RECEIVING NITROGEN *VS* NO-NITROGEN FERTILIZER

Item	Winter Pastures	
	Nitrogen	No Nitrogen
	per acre	
Avg. Fertilizer Rate	292-52-64	4-82-82
1. N @ 22.5 cents/lb	$ 65.70	$ 0.90
2. P_2O_5 @ 25 cents/lb	13.00	20.50
3. K_2O @ 15 cents/lb	9.60	12.30
Total Fertilizer Cost	$ 88.30	$ 33.70
Avg. Seeding Rate		
1. 85 lb/A Cowpeas @	0	$ 27.63
$32.50/cwt	$ 7.50	7.50
2. 30 lb/A Ryegrass @	13.50	13.50
$25.00/cwt	0	11.00
3. 90 lb/A Rye @ $15.00/cwt		
4. 20 lb/A Clover @ $55.00/cwt		
Total Seed Cost	$ 21.00	$ 59.63
Planting		
1. Winter Pasture	$ 10.00	$ 10.00
2. Cowpeas	0	10.00
Total Planting Costs	$10.00	$ 20.00
Total Costs*	$119.30	$113.33
Total Gain (lbs)	897	689
Cost/lb Gain	$0.133	$0.164

*Costs are not inclusive since interest, land, etc. are not included.

plot trials have shown that 'Iron and Clay'cowpeas may produce as much as 1 ton/A dry matter by mid-summer and as much as 6 tons/A dry matter by late September; (6) cowpeas are susceptible to invasion by weeds such as pigweed (*Amaranthus* sp); therefore, a pre-emergence herbicide is recommended; (7) visual observations have documented a moderate to heavy use by deer during the summer months; and (8) cowpeas tended to reduce erosion during the summer months.