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Establishment of Cowpeas in a Bermudagrass Sod

F. M. Rouquette, Jr., G. R. Smith, M. J. Florence, C. L. Gilbert, and R. P. Gillespie

Summary

'Iron and Clay' cowpeas were seeded at four rates into a well-established 'Coastal' bermudagrass sod that had been untreated or treated with Gramoxone. Cowpeas were direct-drilled at seeding rates of 0, 50, 100, or 150 lb/A into both treated and untreated bermudagrass. Bermudagrass dry matter production was suppressed by chemical treatment and by cowpea seeding rate. Cowpea yields were influenced primarily by bermudagrass sod treatment and secondarily by seeding rate. Both sod treatment and seeding rate benefited cowpea forage production. Cowpea leaf contained about 21% protein, whereas cowpea stem contained nearly 9% protein. Protein percentage of cowpea plant parts was not affected by treatments. Protein levels in the bermudagrass, however, increased with increasing seeding rate of cowpeas, which suggests some direct transfer of nitrogen from cowpeas to bermudagrass. Data from this 1-year trial suggest that cowpeas may be successfully grown in a bermudagrass sod if the competitive nature of the grass for moisture and light can be reduced for a brief period.

Introduction

Cowpeas have traditionally been used as both a livestock feed and as a green manure crop in a multiple-cropping system. During the past 30 to 35 years, hybrid bermudagrasses have been established throughout the lower south and southeastern United States. Thus, the use of cowpeas on these permanent pasture areas has been essentially non-existent. The soil and climatic conditions of East Texas are ideal for growth of cowpeas and bermudagrass. Seldom, if ever, are two summer crops grown together. The objectives of this study, therefore, were to ascertain the influence of a chemical desiccant on bermudagrass and the multiple seeding rates of cowpeas on the establishment, dry matter production, and nitrogen content of bermudagrass-cowpea forage.

Keywords: cowpea / bermudagrass / sod-seeded / nitrogen.

Procedure

Iron and Clay cowpeas were direct-drilled into a well-established Coastal bermudagrass sod that had either been sprayed with Gramoxone at 1 qt/A or not been sprayed. The plot design was a split block; the herbicide treatment served as main blocks and the cowpea-seeding rates served as subplots. Cowpeas were sod-seeded at 0, 50, 100, or 150 lb/A into each of four replications, and individual seeding rate plot size was 5 ft x 20 ft. Cowpeas were planted on June 19, 1989, and harvested on August 16, 1989. The bermudagrass sod was shredded to a 2-in. stubble before planting. The plot area was fertilized with 300 lb/A of 6-24-24 nitrogen-phosphorus-potassium (N-P_2O_5-K_2O) at planting.

Forage plots were harvested with a sickle-type hand mower and separated into cowpea and bermudagrass components before weighing. The harvested area was weighed, and a subsample was taken for cowpea leaf:stem separations and subsequent protein analyses of both the bermudagrass and the cowpeas. Data were analyzed with appropriate SAS procedures, and the Student Newman Keuls multiple range test was used to detect differences between treatments.

Results and Discussion

The most difficult period affecting the success rate of growing an annual legume in a bermudagrass sod is during establishment of the annual forage.

We chose a time (June 16) when bermudagrass had potentially high growth rates in which to assess the impact of a chemical desiccant and cowpea-seeding rate on establishment and subsequent dry matter production of cowpeas. Total bermudagrass plus cowpea forage yield during a 58-day, single harvest period was approximately 4,400 lb/A (Table 1) and was not affected ($P > 0.48$) by the chemical desiccant treatment. The bermudagrass-cowpea components, however, were significantly affected by the Gramoxone application. Bermudagrass yields were reduced ($P < 0.01$) from 4,218 to 3,177 lb/A by the chemical desiccant. In sharp contrast, cowpea dry matter production was increased ($P < 0.01$) about 9-fold from 150 to 1,318 lb/A by chemically treating the bermudagrass. At the time of harvest, cowpeas ranged from 2 to 3 ft in height and exhibited the ability to make sufficiently rapid growth to produce a canopy cover above the bermudagrass. The unsprayed bermudagrass obviously competed for soil moisture and space (light) that severely restricted successful establishment and growth of the cowpeas.

Cowpea seeding rate and the interaction of seeding rate and bermudagrass sod treatment had significant ($P < 0.01$) impact on both grass and cowpea production (Table 2). Bermudagrass yields

Table 1. Bermudagrass, cowpea, and total forage yield as influenced by a chemical desiccant treatment to the sod.

Forage yield	Untreated	Chemical desiccant
	lb/A	
Bermudagrass	4218 a*	3177 b
Cowpea	150 a	1318 b
Total	4368 a	4495 a

*Means in the same row followed by a different letter are statistically different ($P < 0.01$).

Table 2. Forage production as influenced by seeding rate.

	Cowpea seeding rate			
Forage yield	0	50	100	150
	lb/A			
Bermudagrass	4396 a*	3997 a	3384 b	3012 b
Untreated	4654	4282	4232	3702
Treated	4137	3712	2536	2322
Cowpea	0 c	539 b	1037 ab	1361 a
Untreated	0	46	112	442
Treated	0	1032	1962	2280
Total	4396 a	4536 a	4421 a	4373 a

*Means in the same row followed by a different letter are statistically different ($P < 0.01$).

in the non-treated area ranged from 4,654 lb/A on the non-seeded plots to 3,702 lb/A on the plots seeded at 150 lb/A cowpeas. Thus, an approximate 25% reduction in bermudagrass yield was evident at the 150-lb seeding rate of cowpeas. Bermudagrass yield in the chemically treated areas was reduced by nearly 50% by the 100- and 150-lb seeding rate of cowpeas. Yield of cowpeas was influenced by seeding rate in both treated and untreated bermudagrass sod. In the untreated sod, cowpea production increased nearly 10-fold from 46 lb/A in the 50-lb/A seeding rate plots to 442 lb/A in the 150-lb/A seeding rate plots. In the chemically desiccated sod, there was a doubling of cowpea yield by seeding either 100 or 150 lb/A compared with the 50-lb/A rate. Cowpea yields from the 50-lb/A seeding rate were improved more than 20-fold from 46 lb/A to 1,032 lb/A by chemically desiccating the bermudagrass sod. Although the magnitude of yield improvement was only 5-fold in the 150-lb/A seeding rate plots, the total production of cowpea forage increased from 442 to 2,280 lb/A because of the chemical treatment.

Cowpeas were separated into leaf and stem-petiole components to assess leaf:stem ratios and protein percentage of each plant part. In general, cowpeas were 60% leaf and 40% stem. This ratio (54:46) deviated slightly in the 100-lb/A seeding rate plots, but this change was not thought to be of biological significance. Protein content of cowpea leaf was 21% (Table 3) and was not influenced by either seeding rate or bermudagrass treatment. Cowpea stems contained only 8.9% protein and were likewise unaffected by any of the treatments. Both visual observations and protein content of bermudagrass plots suggest some direct transfer of nitrogen from the cowpeas to the grass sod. Protein content of bermudagrass grown alone was 5.1%, whereas bermudagrass grown in association with either 100- or 150-lb/A seeding rate of cowpeas was 6.5 and 6.7 ($P < 0.02$), respectively.

Calculations were made to quantify the production of protein (lb/A) by combining dry matter

Table 3. Protein percentage of bermudagrass and cowpea forage.

	Cowpea seeding rate (lb/A)			
Protein	0	50	100	150
	%			
Bermudagrass	5.1 b*	5.6 ab	6.5 a	6.7 a
Cowpea leaf	0 b	21.2 a	21.0 a	21.6 a
Cowpea stem	0 b	8.9 a	8.9 a	8.8 a

*Means in the same row followed by a different letter are statistically different ($P < 0.01$).

Table 4. Total protein production from bermudagrass and cowpea forage.

	Cowpea seeding rate			
Total protein	0	50	100	150
	lb/A			
Bermudagrass	228* a	227 a	217 a	197 a
Cowpea	0 c	97 b	176 ab	226 a
Pea leaf	0 c	82 b	141 ab	182 a
Pea stem	0 b	15 b	35 a	44 a
Grass + pea	228 c	324 b	393 ab	422 a

*Means in the same row followed by a different letter are statistically different ($P < 0.01$).

yields and protein percentage (Table 4). Total protein of bermudagrass was unaffected by seeding rate ($P > 0.65$) and was approximately 220 lb/A. However, the chemically desiccated bermudagrass produced less ($P < 0.01$) total forage protein than that of the non-treated bermudagrass (181 vs. 253 lb/A). Total forage protein from cowpea leaf, stem, and leaf + stem exhibited similar trends in that forage from the 150-lb/A seeding rates had more total protein than forage from the 50- and 0-lb/A seeding rates. By combining grass and cowpeas into a total protein production value, the plots seeded to 150 lb/A cowpeas yielded nearly twice ($P < 0.01$) as much total protein as did the non-seeded plots (422 vs. 228 lb/A).

Results of this single-year trial indicate that cowpeas may be successfully grown in an actively growing bermudagrass sod during the summer months. However, total cowpea production was influenced primarily by sod treatment and seeding rate. In addition, there appears to be an active transfer of nitrogen from the cowpeas to the companion bermudagrass. The objectives of this study were met with a single harvest date. Certainly, additional defoliation schedules would impact both total and multiple harvest yields. Late summer regrowth of cowpeas in this study was impaired by severe drought conditions and the defoliation of plots by whitetailed deer. Because cowpeas are palatable to deer, this crop may be considered as a wildlife feed source. Some potential management practices to ensure success with this cropping system may include (1) early planting of cowpeas (May to early June); (2) mechanical disturbance or chemical desiccation of bermudagrass sod; (3) application of non-nitrogen fertilizer; (4) single harvest of forage if for hay or silage; (5) attention to stubble height and rainfall patterns if for multiple harvests.