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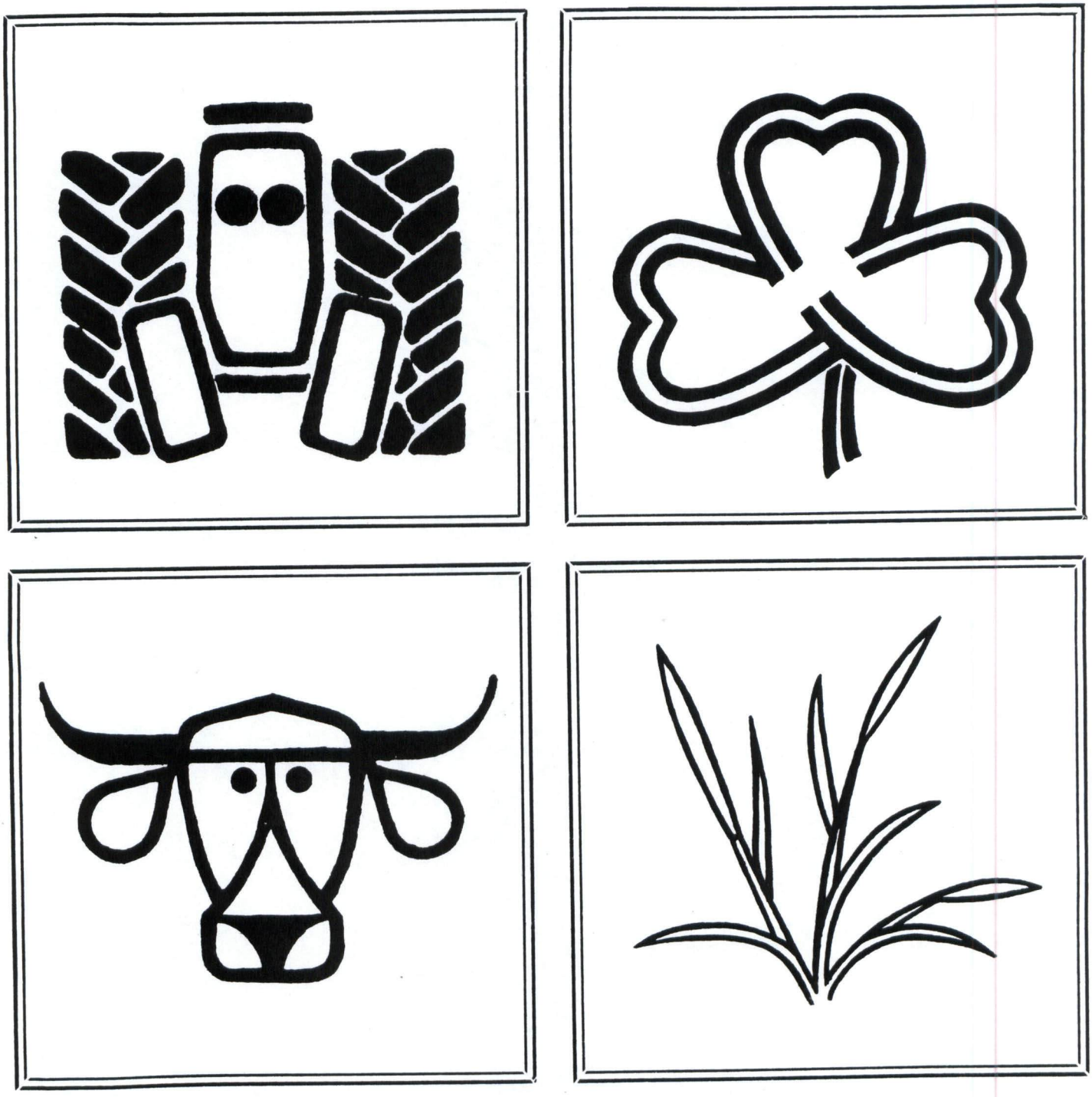

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The Production of Perennial Warm-Season Grass -- Cool Season Legume Mixtures

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SUMMARY

Arrowleaf clover, subterranean clover, and alfalfa were overseeded separately on existing stands of Coastal bermudagrass and Kleingrass 75. Nitrogen and phosphorus were applied in various amounts and at various times. Legume stands and production were better on Coastal than on Kleingrass. The highest spring production occurred with arrowleaf clover on Coastal. Early summer production was lowest with arrowleaf and subterranean clover on coastal. There was no growth after early June because of extreme drought stress so the after effects of legumes on permanent grasses could not be evaluated. Spring (April) application of nitrogen had minimal effect where legume growth was present. Coastal yields in June were increased about 1,500 pounds per acre with 60 pounds of N in April with sub clover and alfalfa. Fall planting of arrowleaf and alfalfa increased production over volunteer stands even though arrowleaf produced seed on the same site the preceeding spring and some alfalfa plants lived through the preceeding summer. Volunteer stands of subterranean clover produced as much as volunteer stands plus fall planting.

INTRODUCTION

The overseeding of temperate legumes on perennial warm-season grasses is an increasingly common practice in the higher rainfall areas of Texas and the Southeastern United States. In areas with lower rainfall the legumes may be less productive and the practice may negatively influence summer production of the perennial grass. Moisture deficits may occur in either fall or spring in the Rio Grande Plains and usually occur in the summer. Rainfall at the Beeville Research Station averages 32 inches annually with peaks in May and September. Rainfall in 1982 totaled only 22 inches with essentially no rain in January, March, June, July, and August. While winter annual forages would almost always produce some winter and early spring forage, the level and reliability of production needs to be determined as well as the effect of these crops on production of the summer grass when they are overseeded on a perennial grass.

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KEY WORDS: Sod overseeding/arrowleaf clover/alfalfa/subterranean clover/Coastal bermudagrass/Kleingrass/stand regeneration/yield/fertilizer response.

MATERIALS AND METHODS

Yuchi arrowleaf clover, Mt. Barker subterranean clover, and Moapa alfalfa were overseeded in 2 acre blocks each on Coastal bermudagrass and Kleingrass in the fall of 1979. Spring growth was minimal in 1980 because of late emergence and dry conditions. The areas were reseeded in October 1980. Each legume was seeded at 15 pounds per acre. Legume growth was excellent in 1980-81 and the areas were grazed in April and May. In the fall of 1981 a plot study was initiated involving amounts and times of application of nitrogen and phosphorus on each legume-grass combination. Also, three fertilizer treatments were set up on the warm-season grasses without legume to evaluate the effect of the legume on early forage production and on summer production of the permanent grass. The treatments were as follows:

Treatment No.	Fertilizer (N-P-K)	Time of application
1	0-60-0	Fall
2	0-120-0	1/2 Fall / 1/2 Spring
3	60-0-0	Spring
4	60-60-0	N Spring, P Fall
5	120-0-0	1/2 Spring / 1/2 Summer
6	120-60-0	N 1/2 Spring / 1/2 Summer, P Fall
7	60-0-0	Spring - No legume
8	60-60-0	Spring - No legume
9	120-60-0	N 1/2 Spring / 1/2 Summer, P Spring No legume

The fertilizers were broadcast on the surface on October 21-22, April 7-9, and June 24-25, respectively for the fall, spring, and summer applications as indicated above.

The experiment also included volunteer stands from natural reseeding versus drill seeding and plots with no legumes (legumes removed with 2.4-D treatment).

The experimental field design was a modified split plot with 4 replications. Subplots were 10x15 feet. Main plots were natural reseeding versus natural reseeding plus drill seeding at 15 pounds of seed per acre. The natural reseeding main plot included 3 subplots in which legume plants were removed by 2, 4-D on April 13-14. The treatments were superimposed on each legume-summer grass combination.

Forage harvests were made on April 2 and June 14. Rainfall after the second harvest was so limited that no regrowth of Coastal and Kleingrass occurred until very late in the growing season. Rainfall record for the 1981-82 growing seasons is shown in Table 1.

Table 1. Rainfall at Beeville during 1981-82 growing season for legumes overseeded on warm-season grasses.

Month	Inches	Month	Inches
October	7.45	April	1.23
November	1.68	May	5.30
December	1.48	June	0
January	.17	July	.31
February	3.62	August	1.59
March	.38	September	.41

RESULTS

Yield data for the fertilizer and no legume treatments are given in Table 2. Arrowleaf clover yields on Coastal bermudagrass on April 2 averaged 1.7 tons per acre. Considering the lack of rain in both January and March these yields are quite good. Production of 1 ton by March 1 is above average. Arrowleaf clover early production (1.7 tons) was much better than that of either sub clover (0.54 tons) or alfalfa (0.59 tons). Other studies have shown that both early and total growth of subterranean clover equals or exceeds arrowleaf clover if plants are removed at the ground level. These plots were harvested with a sickle mower and a much higher percentage of sub clover was below the cutting height than was the case for arrowleaf clover.

Arrowleaf performed much better on Coastal than on Kleingrass. Because of the bunch growth of Kleingrass, stands of overseeded legumes are more difficult to establish and are less uniform than on Coastal or a sod-type growth. Also, Kleingrass continues active growth later in the fall and initiates growth earlier in the spring than Coastal. Thus Kleingrass is more competitive than Coastal during the fall establishment stage as well as the peak spring growth period for the clover.

The plans called for removing the volunteer or surviving legumes from grass plots alone, but this was not accomplished until after the April 2 harvests. Thus, the first cutting yields include legumes in all plots. The second cutting yields show no distinct pattern relative to the presence or absence of a legume. Based on average yields of Kleingrass mixtures at the second cutting, it seems likely that arrowleaf clover and alfalfa were more competitive than subterranean clover resulting in less production when those legumes were present.

The mean effect of legumes on total production is summarized in Table 3 for plots receiving equivalent fertilizer treatments. It should be kept in mind that the values for the no legume plots actually included legumes at the April 2 harvest date. In the absence of a legume, early production should be less than when a cool-season legume is present. On the other hand, summer production of the permanent grass could be reduced by the overseeded legume if moisture is limited following the legume. In 1982 moisture was so limited in June, July, and August (Table 1) that there was no growth of the summer grass whether or not a legume had been present.

Spring (April 7-8) applied nitrogen increased overall forage production slightly (Table 3). The only increases of any magnitude occurred with Coastal bermudagrass where either sub clover or alfalfa were involved, the increase amounting to 1,500 to 1,600 pounds of forage from 60 pounds of nitrogen. Fall applied phosphorus did not increase production (Table 3).

The effect of fall planting where legumes had been present the preceeding spring is shown in Table 4. Fall seeding increased production of arrowleaf clover and alfalfa but not subterranean clover. The largest increases were with alfalfa on Kleingrass followed by arrowleaf clover on Kleingrass. Subterranean clover produced as much from volunteer stands as where additional seed were planted. This is not surprising since subterranean clover produces a seed crop even in the presence of grazing.

Legumes stands were poorer on Kleingrass than on Coastal in 1980-81. Further alfalfa does not produce volunteer stands. While alfalfa is a perennial, some stand loss occurred from grazing and from summer stress. Thus, fall seeding on the existing stand improved production.

Table 2. Forage yield of legume overseeding and fertilizer treatments on warm-season grasses at Beeville, 1982.

Fertilizer treatment and time of application	tons of dry forage per acre					
	Coastal			Klein		
	Apr 2	Jun 14	Total	Apr 2	Jun 14	Total
			Arrowleaf clover			
1. 0-60-0 Fall	1.51	1.30	2.81	.33	1.50	1.83
2. 0-120-0 Fall/Spring	1.76	1.12	2.88	.31	1.18	1.49
3. 60-0-0 Spring	1.55	1.12	2.67	.43	1.49	1.92
4. 60-60-0 N Spring, P Fall	1.82	1.14	2.96	.40	.99	1.39
5. 120-0-0 Fall/Spring	1.68	.92	2.60	.46	1.41	1.87
6. 120-60-0 N Fall/Spring, P Fall	1.72	.50	2.20	.38	1.28	1.66
7. 60-0-0 Spring, No legume	1.72	.79	2.51	.36	1.09	1.45
8. 60-60-0 N Spring, P Fall, No legume	1.47	.77	2.24	.40	1.45	1.85
9. 120-60-0 N Spring/Fall, P Spring, No legume	2.10	1.00	3.10	.51	1.48	1.99
	1.70	.96	2.66	.40	1.32	1.72
			Subterranean clover			
1. 0-60-0 Fall	.52	.33	.85	.52	1.43	1.95
2. 0-120-0 Fall/Spring	.43	.34	.77	.43	1.71	2.14
3. 60-0-0 Spring	.49	.82	1.31	.48	1.65	2.13
4. 60-60-0 N Spring, P Fall	.56	1.00	1.56	.56	1.62	2.18
5. 120-0-0 Fall/Spring	.57	1.17	1.74	.57	1.84	2.41
6. 120-60-0 N Fall/Spring, P Fall	.53	1.16	1.69	.53	1.74	2.27
7. 60-0-0 Spring, No legume	.67	.75	1.42	.67	1.83	2.50
8. 60-60-0 N Spring, P Fall, No legume	.48	.82	1.30	.48	2.00	2.48
9. 120-60-0 N Spring/Fall, P Spring, No legume	.63	.98	1.61	.63	1.60	2.23
	.54	.82	1.36	.54	1.71	2.25
			Alfalfa			
1. 0-60-0 Fall	.73	.98	1.71	.36	1.61	1.97
2. 0-120-0 Fall/Spring	.38	1.13	1.41	.52	1.52	2.04
3. 60-0-0 Spring	.59	1.40	1.99	.45	1.52	1.97
4. 60-60-0 N Spring, P Fall	.69	1.82	2.51	.38	1.36	1.74
5. 120-0-0 Fall/Spring	.46	1.79	2.25	.40	1.73	2.13
6. 120-60-0 N Fall/Spring, P Fall	.81	1.83	2.64	.43	1.69	2.12
7. 60-0-0 Spring, No legume	.46	1.55	2.01	.44	1.06	1.54
8. 60-60-0 N Spring, P Fall, No legume	.29	1.80	2.09	.46	.79	1.25
9. 120-60-0 N Spring/Fall, P Spring, No legume	.89	1.99	2.88	.33	1.09	1.42
	.59	1.59	2.18	.42	1.37	1.79

Table 3. Average effects of fertilizer treatments and legume overseeding on yield of forage at Beeville.

Treatment	Treatment No.	Perennial grass: Coastal Arrow leaf	Coastal Sub	Coastal Alfalfa	Coastal Avg	Klein Arrow leaf	Klein Sub	Klein Alfalfa	Klein Avg	Treat. Avg
		tons of dry forage per acre								
0 N	(1,2)	2.85	.81	1.56	1.74	1.66	2.05	2.01	1.91	1.82
60 N	(3,4,5,6)	2.61	1.58	2.35	2.18	1.71	2.25	1.99	1.98	2.08
0 P	(3,5)	2.64	1.53	2.12	2.10	1.90	2.27	2.05	2.07	2.08
60 P	(4,6)	2.58	1.63	2.58	2.26	1.53	2.22	1.93	1.89	2.08
legume	(3,4,6)	2.61	1.52	2.38	2.17	1.66	2.19	1.94	1.93	2.05
No legume	(7,8,9)	2.62	1.44	2.33	2.13	1.76	2.40	1.40	1.85	1.99

Table 4. Annual planting plus natural reseeding versus natural reseeding of legumes on warm-season grasses at Beeville.

Grass	Legume: Arrowleaf clover Reseed	Arrowleaf clover Volunteer	Subterranean clover Reseed	Subterranean clover Volunteer	Alfalfa Reseed	Alfalfa Volunteer
	tons of dry forage per acre					
Coastal	2.94	2.62	1.13	1.43	2.19	1.99
Kleingrass	1.95	1.42	2.07	2.29	2.30	1.69