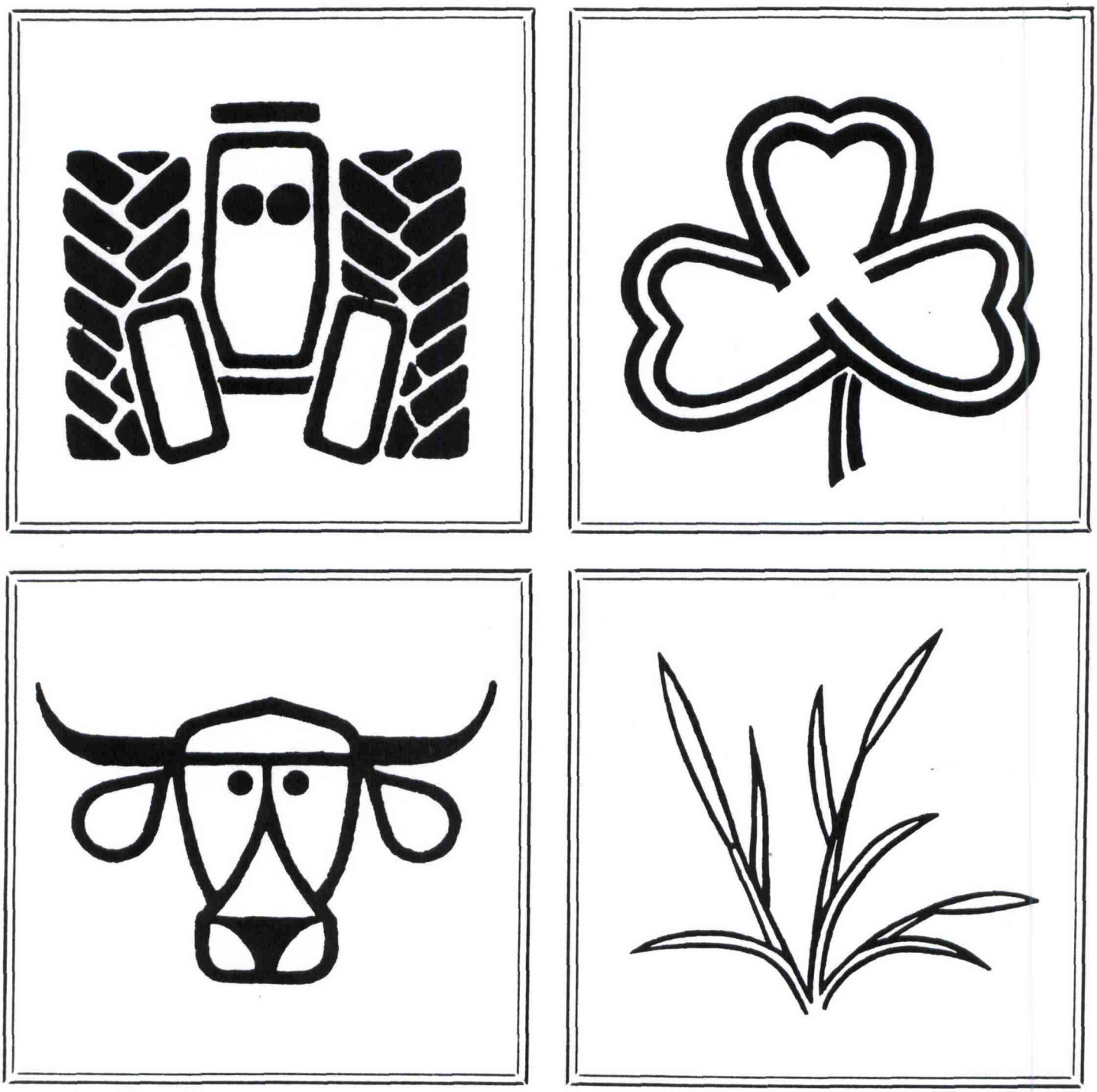
PUBLICATIONS

1984

CPR—4253
October 1984



Forage Research in Texas

1984

The Texas Agricultural Experiment Station, Neville P. Clarke, Director, The Texas A&M University System, College Station, Texas

CLOVER-GRASS MIXTURES AND NITROGEN RELATIONS

G. R. Smith, F. M. Rouquette, Jr., and R. W. Weaver[1]

SUMMARY

Sod-seeded arrowleaf clover, ryegrass and arrowleaf-ryegrass mixtures were compared under varying N fertility treatments. Sod-seeded subterranean (sub) clover and sub clover-ryegrass mixtures were compared to ryegrass with different N fertility treatments. Nitrogen fertilizer increased grass yields but had little effect on clover yields in pure stands. In mixtures of arrowleaf and ryegrass, nitrogen fertilizer depressed clover production, increased grass production and, at 100 lbs N/acre, increased total production only slightly. Ryegrass yield in clover-ryegrass mixtures was decreased compared to ryegrass receiving no nitrogen.

INTRODUCTION

Annual clovers are often planted in mixtures with ryegrass or other annual grasses. Recommendations for nitrogen fertilization of these clover-grass mixtures are varied. Relatively little is known concerning the effects of biological nitrogen fixation, in the clover-*Rhizobium* symbiosis, on nitrogen nutrition of associated grasses. The data reported here is the initial result of nitrogen cycling research with annual clovers and companion grasses. The objectives of this research were: 1) to determine the effects of fertilizer nitrogen on seasonal production of arrowleaf clover, ryegrass and arrowleaf-ryegrass mixtures; 2) to measure the effect of fertilizer nitrogen on botanical composition of arrowleaf-ryegrass mixtures; 3) to compare ryegrass yield at varying levels of N fertility to sub clover-ryegrass mixtures.

PROCEDURE

Arrowleaf clover, ryegrass and a mixture of arrowleaf and ryegrass were drilled into a Coastal bermudagrass sod in 5x15 foot plots November 2, 1981. Ryegrass was seeded at 25 lbs/acre and arrowleaf, inoculated with Nitragin type O peat inoculant, at 14 lbs/acre. Three hundred pounds per acre of 0-25-25 were applied prior to planting. One and one-half tons of lime were applied in late July. Three nitrogen (as ammonia nitrate) treatments were imposed on plots containing arrowleaf alone, ryegrass alone and a mixture of arrowleaf and ryegrass. Treatments included no nitrogen, 50 lbs N/acre applied Feb. 12, 50 lbs N/acre applied April 8 and 50 lbs N/acre applied both Feb. 12 and April 8 (100 lbs total). Plots were harvested four times

---

[1]Respectively, assistant professor and professor, Texas Agricultural Experiment Station, Overton; professor, Texas A&M University, Soil & Crop Sciences, College Station.

KEYWORDS: Annual clover/clover-grass mixtures/nitrogen/sward composition/plant competition

beginning in mid-March. Botanical separations were made, each component was dried at 70°C for 48 hours and lbs DM/acre calculated.

Subterranean (sub) clover, ryegrass and sub clover-ryegrass mixtures were drilled into a native sod (common bermudagrass and Paspalum setaceum) in 5x7 foot plots October 13, 1982. Planting rates for the sub clover and ryegrass were 20 and 25 lbs/acre, respectively. The sub clover was inoculated with Nitragin type WR peat inoculant. Soil test ratings of phosphorus and potassium were low and medium, respectively. Soil pH of the Bowie fine sandy loam was 7.1. Four hundred and fifty pounds per acre of 0-20-20 fertilizer were applied prior to planting. The sod was mowed to two inches prior to planting. Ryegrass with five different nitrogen treatments was compared to sub clover alone and ryegrass-sub clover mixtures. The nitrogen treatments included 220 lbs N/acre applied in three split applications, 100 lbs N/acre applied in two split applications, 50 lbs N/acre applied Feb. 14, 50 lbs N/acre applied March 18 and zero nitrogen. The plots were harvested four times beginning in December.

RESULTS AND DISCUSSION

In the arrowleaf-ryegrass experiment, nitrogen application on ryegrass (RG) alone increased yields from 1282 to 3374 lbs DM/acre for 0 and 100 total lbs N/acre, respectively (Table 1). Nitrogen fertilizer on arrowleaf (AL) depressed clover yields but increased bermudagrass yields with the result that total forage yield from AL + 0 lbs N/acre was not different from AL + 100 lbs N/acre. Both early and late spring applications of 50 lbs N/acre depressed AL production and total plot yields were lower than on AL + 0 lbs N/acre (Table 1).

Arrowleaf clover production in AL + RG + 0 lbs N/acre was depressed due to competition from the grasses. As N levels were increased in the mixed plots, the clover component decreased. The late application of N on the mixture allowed more clover production than the early or the early and the late N treatments (Table 1).

Seasonal distribution of forage production from RG was affected by N fertilizer levels and time of application. Fifty lbs N/acre applied to pure ryegrass in early spring resulted in production more evenly distributed over the season than 50 lbs N/acre applied late (Table 2).

Total dry matter yield (including both clover and Coastal bermudagrass) from AL plots was not affected by N applications. Slight depression of yield at the April and May harvests was noted on AL plots receiving N fertilizer. Forage yield was increased at the last harvest of AL + 100 lbs N/acre primarily due to response of Coastal bermudagrass to the available N (Table 2). Total forage yield from AL + RG + 100 lbs N/acre was higher than AL + RG + 0 lbs N/acre or AL + RG + 50 lbs N/acre (Feb.). No significant differences were noted between AL + RG + 100 lbs N/acre and AL + RG + 50 lbs N/acre (April) or AL alone with no nitrogen. Nitrogen applied early (Feb.) to the mixture resulted in yield depression at the May harvest (Table 2). Arrowleaf + ryegrass with 0 lbs N/acre produced slightly less total forage than AL + 0 lbs N/acre.

Sod-seeded mixtures of Mt. Barker sub clover and ryegrass with no N produced total forage yields equal to ryegrass + 220 lb N/acre (Table 3). These ryegrass yields were lower than normal considering the quantity of N applied. Late planting and competition from the sod may account for these differences. Mt. Barker sub with 0 lbs N/acre produced more clover than the Mt. Barker-ryegrass mixture, but total forage yields were not significantly different. Ryegrass-Nungarin sub clover (an early variety of sub) produced less forage than Mt. Barker sub or Mt. Barker-ryegrass mixture. Nungarin sub clover matures and dies too early to take advantage of our growing season.

The data examined in these two experiments indicated that ryegrass grown in combination with arrowleaf or sub clover did not benefit from the association. The ryegrass yield component in clover-ryegrass mixtures was depressed compared to ryegrass alone + 0 lbs N/acre. This was a plant competition effect. Nitrogen applied to AL + RG mixtures depressed clover production, increased grass production and at high N rates, increased total production. However, N fertilized AL + RG mixtures were not significantly higher in total season dry matter yield compared to AL + 0 lbs N/acre.

TABLE 1. THE EFFECT OF NITROGEN APPLICATIONS ON COMPONENT FORAGE PRODUCTION OF ARROWLEAF CLOVER, RYEGRASS, AND ARROWLEAF RYEGRASS MIXTURES OVERSEEDED ON COASTAL BERMUDAGRASS SOD

Treatment[1]	Clover	Grass		Total
		Ryegrass	Coastal	
	lb DM/acre			
AL + RG 50-50	724	1422	1540	3686 a[2]
RG 50-50	-	2171	1203	3374 ab
AL 50-50	1590	-	1712	3302 ab
AL + RG 0-50	1323	833	1017	3173 abc
AL 0-0	2172	-	954	3126 abc
AL 50-0	1780	-	1205	2987 bc
AL + RG 0-0	1694	378	816	2888 bc
AL + RG 50-0	996	1003	810	2809 bc
RG 0-50	-	1390	1311	2701 bc
AL 0-50	1626	-	1009	2635 bc
RG 50-0	-	1512	1014	2526 c
RG 0-0	-	581	701	1282 d

C.V. = 8.9%

TABLE 2. THE EFFECT OF NITROGEN APPLICATIONS ON SEASONAL FORAGE PRODUCTION OF ARROWLEAF CLOVER, RYEGRASS AND ARROWLEAF-RYEGRASS MIXTURES OVERSEEDED ON COASTAL BERMUDAGRASS SOD

Treatment[1]	Harvest Date				Total
	3-16-82	4-6-82	5-11-82	6-15-82	
	lb DM/acre				
AL 0-0	232 a[2]	466 ab	1759 ab	667 bc	3126 abc
AL 0-50	202 abc	390 b	1336 cd	707 bc	2635 bc
AL 50-0	246 a	358 b	1522 abc	859 b	2987 bc
AL 50-50	235 a	398 b	1490 abcd	1179 a	3302 ab
RG 0-0	55 bc	128 c	548 e	551 c	1282 d
RG 0-50	53 c	116 c	1770 abc	762 bc	2701 bc
RG 50-0	219 ab	515 ab	1124 d	668 bc	2526 c
RG 50-50	290 a	504 ab	1852 a	728 bc	3374 ab
AL + RG 0-0	232 a	433 ab	1662 a	561 c	2888 bc
AL + RG 0-50	207 abc	429 ab	1848 a	689 bc	3173 ab
AL + RG 50-0	337 a	540 ab	1386 bcd	546 c	2809 bc
AL + RG 50-50	295 a	608 a	1869 a	911 b	3686 a

[1]50 lbs N/acre was applied 2-12-82 (50-0), 4-8-82 (0-50), both 2-12-82 and 4-8-82 (50-50) or no nitrogen was applied (0-0).

[2]Yields followed by the same letters are not significantly different at the 0.01 level using the Student Newman-Keuls Multiple range test.

TABLE 3. COMPARISON OF COMPONENT FORAGE PRODUCTION OF N-FERTILIZED RYEGRASS TO RYEGRASS-SUB CLOVER MIXTURES

Treatment	Clover	Ryegrass	Total
	----------lb DM/acre----------		
RG + 220 N[1]	-	4410	4410 a[5]
RG + Mt. Barker Sub	3337	985	4322 a
Mt. Barker Sub	4058	-	4058 ab
RG + 100 N[2]	-	3421	3421 b
RG + 50 N[3]	-	2689	2689 c
RG + 50 N[4]	-	2495	2495 c
RG + Nungarin Sub	629	1612	2241 c
RG + 0 N	-	1920	1920 c
Nungarin Sub	993	-	993 d
C.V. = 12.9%			

[1]Applied in three splits (100-60-60) on 10-22-82, 2-14-83 and 3-18-83

[2]Applied in two splits (50-50) on 2-14-83 and 3-18-83

[3]Applied 2-14-83

[4]Applied 3-18-83

[5]Yields followed by the same letters are not significantly different at the 0.01 level using the Student Newman-Keuls Multiple range test.