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Forage Legume Variety Trials on High pH Soils

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Summary

A variety trial was conducted on an alkaline soil (pH 8.1) to identify the most productive species and cultivars. Rose, berseem, crimson, red, and Koala subterranean clovers and vetch performed well. Total yield of circle valley and serena medics were not as high but they had the best early production of over a ton of dry matter per acre by January 6. A medic and a late growing red clover mixture might be the best forage legume pasture from the standpoint of a long growing season and even forage distribution. Arrowleaf and white clover did poorly. Estimated N_2-fixed per acre ranged from 159 for OVB1 berseem clover down to 71 for Karridale subterranean clover.

KEYWORDS: Alkaline soils/rose clover/berseem clover/vetch/subterranean clover/medics/crimson clover/red clover.

Introduction

A major forage research endeavor in Texas has been to identify adapted legume germplasm for the contrasting climate and soil type combinations of the state. Increased interest by producers and past efforts by research and extension personnel has increased the state forage legume acreage 39 percent from 1980 to 1985 (Evers and Dorsett 1986). Isolated areas of East Texas and most of Central and West Texas have alkaline soils. Greenhouse studies have indicated that some of the most popular clovers such as

arrowleaf and white do poorly on the higher pH soils (Evers 1985). A variety test including a wide range of forage legume species, were evaluated for yield and N_2-fixation on an alkaline soil.

Materials and Methods

The test site was on a Bleiblerville clay near Brenham, Texas with an A_1 horizon to 33 inches and A_2 horizon from 33 to 63 inches. Soil analysis reported a pH of 8.1 and nitrogen, phosphorus, and potassium levels of 4, 1, and 424 ppm, respectively. Eighty pounds of phosphorus per acre were applied at planting on October 10. Seeding rates for the respective species were: white 4 lbs/A, arrowleaf 8 lbs/A, berseem, rose and red 12 lbs/A, subterranean, crimson, and medics 14 lbs/A, ryegrass 25 lbs/A, and vetch 42 lbs/A. Plots consisted of six rows, 17-ft long and 8 inches apart. Experimental design was a randomized complete block with four replications. Fifteen feet of the four middle rows were harvested with a flail mower at a 1.5-inch cutting height for yield. A subsample was taken at random from each harvested plot for dry matter determination and nitrogen analysis. Nitrogen fixation was estimated by the difference in nitrogen content of the legume and ryegrass forage.

Results and Discussion

Medic varieties were superior to all other species for early forage production (Table 1). Berseem, crimson, red, and two subterranean clovers produced some early forage production. Vetch and the early maturing rose clover cultivars had the best late winter production, and red clover the least. Spring production ranged from over 5,000 lbs DM/A for the late maturing rose clover selections to 0 for the early maturing medics. Only red clover was harvested on June 18, the last harvest date.

Of the species harvested, arrowleaf was the least adapted to the alkaline soil. Arrowleaf became chloric during cold, wet weather and grew poorly in late fall and winter. Berseem had the best combination of yield and forage distribution. Breeder and commercial seed of Bigbee were planted because earlier observations indicated that plants from commercial seed were less cold hardy. Before the first harvest, plants from the commercial seed were more upright than the plants from breeder seed which resulted in a slightly higher yield. Plots from the breeder seed were higher yielding at the second and third harvest. Temperatures were mild during the winter and prevented a good test for coldhardiness. Crimson clover

TABLE 1. DRY MATTER PRODUCTION OF FORAGE LEGUMES ON AN ALKALINE SOIL (pH 8.1)

Legume	Jan. 6	March 2	April 23	June 18	Total
	Pounds of Dry Matter/Acre				
Arrowleaf					
Yuchi	0	1,217	2,614	0	3,831
Berseem					
OVB1	285	2,574	3,866	0	6,725
Bigbee (breeder)	575	2,158	3,596	0	6,329
Bigbee (commercial)	708	1,934	3,037	0	5,678
Crimson					
Dixie	648	2,447	2,921	0	6,016
Medics					
Circle Valley	2,246	1,831	0	0	4,077
Serena	2,329	1,279	0	0	3,607
Red					
Kenland	247	613	2,096	2,701	5,658
Rose					
Hykon	0	2,773	1,983	0	4,756
Kondinin	0	3,077	1,829	0	4,906
RD-3	0	1,859	5,836	0	7,695
RM-16	0	1,725	5,821	0	7,546
RD-17	0	1,891	5,694	0	7,585
RH-18	0	1,425	5,316	0	6,966
RF-20	0	2,104	5,342	0	7,446
Subterranean					
Koala	774	2,186	2,797	0	5,757
Clare	460	2,161	1,894	0	4,515
Karridale	0	1,967	1,754	0	3,721
Mt. Barker	0	1,604	2,843	0	4,447
Vetch					
Hairy	0	2,838	2,516	0	5,354
LSD.05	192	574	512	138	712

performed very well with yields similar to berseem clover.

The medic cultivars were obtained from Australia where they are used on high pH soils. Their forage production and distribution was unique compared to the other species. They had excellent fall and winter production but matured too early for any spring production. In contrast red clover had very low early production but good late production because it is a short-lived perennial. Red clover yields were hurt by the poor moisture conditions in late spring. Early maturing medics and late growing red clover may be an excellent mixture for these soils.

The five selections of rose clover were the highest yielding entries in the test. Yields were 50 percent greater than the early maturing commercial cultivars of Hykon and Kondinin. Rose clovers lacked early production and tend to have a flush of growth before flowering. Hykon and Kondinin were in the bud stage at the March 2 harvest and the selections were in full bloom at the April 23 harvest.

Clare and Koala subterranean clover were selected for adaptability to alkaline soils. They had earlier and more upright growth than Mt. Barker and Karridale. Koala is a new release to replace Clare. Karridale is a new cultivar to replace Mt. Barker but was more sensitive to the high soil pH than Mt. Barker. Vetch was well adapted but lacked both early and late production.

White clover stands were very poor. The seedlings were pale green and stunted. Green color of the plants improved in the spring and there was some growth. However, the plots were never harvested. The white clover survived the summer and produced excellent growth the following fall. It appears there was poor or no nodulation the first fall because the introduced rhizobia did not survive or because of competition from native rhizobia. By the second fall an effective strain, introduced or native, had nodulated the white clover. Nitrogen yield is directly related to dry matter production (Table 2). Estimated N_2-fixation ranged from 70 to 159 lbs N/A.

Arrowleaf, white, and Karridale subterranean clovers were the only entries which performed poorly on the alkaline soil site. Differences in forage yields and N_2-fixation of the other entries were primarily a function of maturity.

TABLE 2. PROTEIN PRODUCTION AND ESTIMATED N_2-FIXATION OF FORAGE LEGUMES ON AN ALKALINE SOIL (pH 8.1)

Legume	Protein					Estimated[1] N_2-fixed
	Jan. 6	March 2	April 23	June 18	Total	
	Pounds/Acre					
Arrowleaf						
Yuchi	0	239	400	0	639	70
Berseem						
OVB1	72	530	595	0	1,197	159
Bigbee (breeder)	145	466	572	0	1,183	156
Bigbee (commercial)	179	364	437	0	980	124
Crimson						
Dixie	167	499	386	0	1,052	135
Medics						
Circle Valley	539	430	0	0	969	122
Serena	564	315	0	0	879	108
Red						
Kenland	59	127	365	335	886	109
Rose						
Hykon	0	502	238	0	740	85
Kondinin	0	529	223	0	752	87
RD-3	0	389	683	0	1,072	139
RM-16	0	361	611	0	972	123
RD-17	0	382	655	0	1,037	133
RH-18	0	304	606	0	910	113
RF-20	0	423	641	0	1,064	137
Subterranean						
Koala	197	446	431	0	1,074	139
Clare	116	467	311	0	894	110
Karridale	0	368	282	0	650	71
Mt. Barker	0	354	469	0	823	99
Vetch						
Hairy	0	675	486	0	1,161	153
Gulf ryegrass	10	51	145	0	206	—

[1]Legume protein − grass protein ÷ 6.25 = lb N_2fixed.

Literature Cited

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