

Identifying Forage Legumes Adapted to High pH Soils

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Summary

Reported data are the second year's results of a study to identify forage legumes adapted to high pH soils. Entries included rose, subterranean, berseem, crimson, and red clovers, and annual medics. The most productive entries were Bigbee berseem (4,742 lbs/A), RD-17 rose (4,261 lbs/A), and red clover-medic mixture (4,206 lbs/A). Annual medics had the best early forage production. Paraggio, Jemalong, Circle Valley, Sephi, and Serena produced a ton of dry matter by the first harvest on March 14. Koala was the highest yielding subterranean variety with 3,425 lbs/A. Dixie crimson (3,767 lbs/A) did well but the Kenland red clover yield (3,336 lbs/A) was low because of the poor moisture conditions in April, May, and June.

Introduction

Most of the soils in Southeast Texas are neutral to acid. However, there is a strip of black clay soil stretching from Dewitt County northeast to Grimes and Montgomery Counties which is alkaline with a soil pH of 7.5 to over 8.0. Past cropping history was primarily cotton with some corn and grain sorghum. Due to the uneconomical small farm size and rolling terrain of the area, most of the land has been converted to pasture.

Incorporating forage legumes into these pastures is critical to improve animal performance and reduce production costs (Evers 1984). Previous efforts to determine the best adapted and productive forage legumes for the eastern third of Texas have been carried out on neutral or acid soils (Smith et al. 1988, Shipe and Evers 1981). Variety testing was begun in fall 1986 on an alkaline soil site in Washington County to identify the best forage legumes for this blackland area (Evers 1988). This report discusses the second year (1987-88) results.

Procedure

The test site was on a Bleiberville clay near Brenham, Texas with an A₁ horizon to 33 inches and A₂ horizon from 33 to 63 inches. Soil analysis reported a pH of 8.1. Eighty pounds of phosphorus per acre were applied before planting. Seeding rates for the respective species were: berseem, rose and red, 12 lbs/A; subterranean, crimson, and medics, 14 lbs/A; and ryegrass, 25 lbs/A. The test site was planted October 7, 1987. Plots consisted of six 8-inch rows, 17 ft long. Experimental design was a Complete Randomized Block with four replications. Fifteen feet of the four middle rows were harvested with a flail mower at a 1.5-inch cutting height

on March 14, April 20, and May 26, 1988. A subsample was taken at random from each harvested plot for dry matter determination and nitrogen analysis. Micro Kjeldahl procedure was used to determine nitrogen content. Nitrogen fixation was estimated by the difference in nitrogen content of the legume and ryegrass forage.

Results and Discussion

Rainfall was lacking in October and early November and in the spring. Yields were below those observed in 1986-87, because of the poor spring moisture conditions. Rose clover yields ranged from about 2,000 to 4,000 lbs/A (Table 1). Hykon and Kondinin are two commercial varieties which are available but are early maturing and, therefore, lower yielding. The other five rose clover entries are later maturing than Hykon and Kondinin and higher yielding as indicated by the April 20 harvest. Koala and Clare are two subterranean varieties which are adapted to alkaline or high pH soils. Koala has been higher yielding than Clare and is believed to have more cold tolerance than Clare. Entry SR is from an Australian seed company which was being evaluated for alkaline soils.

There were nine varieties of annual medics similar to common burclover which is found throughout the area. The annual medics are early maturing and have the ability to produce a lot of early forage. Five of the entries produced a ton of forage by the first harvest which was more than other forage legume entries. Research on the annual medics was initiated recently in Texas so little information on managing medics in the state is available at this time. Cold tolerance of the annual medics has not been determined at this time.

Bigbee berseem was the highest yielding forage legume at 4,742 lbs/A. It is a late maturing species which will grow into June if moisture is available. A limitation to the current variety of berseem is its poor ability to reseed each fall. Red clover will persist for 2 years in the north-central region of the United States. In southeast Texas, summer survival is inconsistent because of the hot, dry conditions. The Kenland variety of red clover was put in the study to demonstrate that red clover is adapted to these clay alkaline soils but has poor early growth and will not have any summer production if moisture is limiting.

The medic-red clover mixture was an attempt to combine the early forage production of the medics with the late production of red clover. Early production was similar to the pure stand of medics but the late production was about half the pure stand of red clover. The early growing medic dominated the mixture and reduced the red clover stand. If such a mixture were grazed, with early and frequent defoliation, the red clover stand would be better. Dixie crimson clover was also well adapted with production similar to the most productive

KEYWORDS: Clovers/alkaline soils/pasture.

TABLE 1. FORAGE PRODUCTION, PROTEIN PRODUCTION, AND ESTIMATED N₂-FIXATION OF ANNUAL FORAGE LEGUMES ON AN ALKALINE (HIGH PH) SOIL IN WASHINGTON COUNTY 1987-88

	Yield					Estimated
	14 Mar.	20 Apr.	26 May	Total	Protein	N ₂ -fixed
	pounds per acre					
Rose						
RD-17	1,560	2,701	0	4,261	854	47
RM-16	1,301	2,625	0	3,927	789	36
RF-20	1,187	2,679	0	3,867	779	35
RD-3	902	2,816	0	3,718	716	25
RH-18	1,060	2,574	0	3,634	725	26
Hykon	1,578	690	0	2,268	498	-10
Kondinin	1,233	840	0	2,073	443	-19
Subterranean						
Koala	1,533	1,892	0	3,425	829	43
Clare	1,622	1,468	0	3,091	711	24
SR (SEEDCO)	1,133	1,719	0	2,851	613	8
Medics						
Paraggio	2,092	1,301	0	3,393	838	44
Jemalong	1,987	1,238	0	3,224	766	32
Circle Valley	2,260	905	0	3,165	760	32
Sephi	2,054	642	0	2,695	657	15
Serena	2,427	0	0	2,427	589	4
Sapo	1,133	830	0	1,963	450	-18
Paragosa	1,195	748	0	1,942	447	-19
Sava snail ¹	1,718	0	0	1,718	403	-26
Paraponto	1,521	0	0	1,521	368	-31
Miscellaneous						
Bigbee berseem	1,187	1,644	1,912	4,742	996	69
Kenland red	563	1,017	1,756	3,336	732	27
medic-red mixture	2,117	1,122	967	4,206	921	57
Dixie crimson	1,612	2,155	0	3,767	707	23
Gulf ryegrass	3,609	669	727	5,004	564	0
LSD.05	262	262	100	327	95	15
C.V.	13	15	32	8	11	11

¹ Sava snail medic was killed in March when 1 lb/A of Basagran was applied for broadleaf weed control.

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rose, subterranean, and medic varieties. However, like berseem, it has not been a dependable reseed. Protein yields were directly related to forage production.

The high yields of Gulf ryegrass without nitrogen fertilizer were unexpected. The test site was kept fallow the previous summer but had volunteer sweetclover and burclover growing on the site the previous winter. Both these factors could cause a build up of soil nitrogen which is necessary for the high yield of ryegrass at the first harvest. Very low yields at the second and third harvests indicate most of the available soil nitrogen had been used up by this time.

The estimate of N₂-fixation (the amount of nitrogen the legume removed from the air) is based on the different nitrogen content of a grass receiving no nitrogen fertilizer and

the legume. The nitrogen content of the grass is an indication of how much soil nitrogen is available for plants since this is the grass plant's only source of nitrogen. The legume plant can remove nitrogen from the soil and from the air if properly nodulated with an effective strain of rhizobia. The difference in nitrogen content of the grass, which gets its nitrogen from the soil and the legume, which can get its nitrogen from the soil and air, provides an estimate of the nitrogen in the legume from the air. This method underestimates N₂-fixation because the grass plant will extract more nitrogen from the soil than the legume plant. The grass plant is more efficient at extracting nutrients from the soil because it has a fibrous root system and the soil is its only nitrogen source. The fallacy of the method is demonstrated by the negative values for N₂-fixation by the lower yielding cultivars of rose clover and

medics. Even though the absolute values are too low, the method does provide a ranking of legume varieties for N-fixation.

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Acknowledgements

The author wishes to thank Bill Thane of Washington County for providing land and assistance in land preparation.