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Response of Bigbee Berseem Clover to Fertilizer on Alkaline Soil

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Summary

There are no published data on fertilizer requirements of forage legumes on alkaline soils in southeast Texas. Various combinations of phosphorus and potassium plus additional treatments of nitrogen, sulfur, boron, and a micronutrient mix were applied to Bigbee berseem clover. Only 250 lbs/A of clover or less was produced on plots receiving no phosphorus fertilizer. At least 80 lbs of phosphorus per acre was needed for good clover production. Increasing potassium fertilizer level generally decreased yields. This was probably due to the very high level which naturally occurs in these soils.

Introduction

Past fertilizer studies on clover in southeast Texas have been conducted on acid soils (Cheaney, Weihing, and Ford 1956; Riewe and Smith 1955). Although most of the soils in this area are acid, there are 1.5 million acres of calcareous clayey soils that are alkaline (pH>7.0). Information on fertilizer requirements of forage legumes on these soils is lacking. A study evaluating various levels of phosphorus and potassium and the influence of other nutrients at a set phosphorus and potassium rate were carried out on an alkaline soil in Washington County.

KEYWORDS: Southeast Texas/bigbee berseem clover/alkaline soils/fertilize requirements.

Materials and Methods

The test site was on a Bleiblerville clay with an A_1 horizon to 33 inches and A_2 horizon from 33 to 63 inches. Soil analysis reported a pH of 7.8 and nitrogen, phosphorus, and potassium levels of 4, 11, and 416 ppm, respectively. Bigbee berseem clover was seeded into a sparce native grass sod at 12 lbs of seed/A. All combinations of 0, 40, 80, and 120 lbs of phosphorus and 0, 40, and 80 lbs of potassium per acre were applied on the soil surface at planting. Additional treatments at 80 lbs of phosphorus and 40 lbs of potassium were nitrogen, sulfur, boron, and a micronutrient mix. Only one harvest was taken on March 23 because of a dry spring and thin stand.

Results and Discussion

The most dramatic response was to phosphorus even though the soil analysis reported a moderate level (11 ppm) present. Without phosphorus there was essentially no clover growth (Table 1). Applying 40 lbs of phosphorus resulted in a 400 percent increase in clover production. Increasing phosphorus from 40 to 80 lbs improved yields another 50 percent. The 120-lb rate caused a small yield increase but is probably uneconomical.

Soil analysis indicated a very high level of potassium in the soil. Adding additional potassium actually decreased clover yields. These high potassium levels could be interfering with other nutrient uptake. If the soil has a very high potassium level, it is important not to apply a fertilizer grade with additional potassium in it.

Of the other treatments only the 60-lb nitrogen treatment produced a significant yield increase over the 0-80-40 standard (Table 2). Clover response to nitrogen indicates that nodulation and N_2-fixed is not as good as it should be. The thin clover stand may also be a factor.

There were no trends in nitrogen, phosphorus, or potassium content when only potassium fertilizer was applied (Table 3). The percentage of all three elements increased when 40 lbs of phosphorus was applied. Nitrogen content increased with the application of 40 lbs of potassium if phosphorus was also applied. Phosphorus percentage increased slightly as phosphorus fertilizer rate increased. It also increased when potassium rate went from 0 to 40 lbs if at least 80 lbs of phosphorus was applied.

TABLE 1. RESPONSE OF BIGBEE BERSEEM CLOVER TO PHOSPHORUS AND POTASSIUM ON AN ALKALINE SOIL (pH 7.8)

Potassium (lb K_2O/A)	Phosphorus (lb P_2O_5/A)				
	0	40	80	120	Avg.
	Pounds of Dry Matter/Acre				
0	129g*	970e	1,481bc	1,848a	1,107
40	246g	831ef	1,088de	1,361bcd	882
80	148g	598f	1,083de	1,125de	739
Avg.	174	800	1,217	1,445	

*Yields followed by the same letter are not significantly different at the .05 level Duncan's Multiple Range Test.

TABLE 2. RESPONSE OF BIGBEE BERSEEM CLOVER TO OTHER NUTRIENTS AT 80 AND 40 LBS/A OF PHOSPHORUS AND POTASSIUM, RESPECTIVELY, ON AN ALKALINE SOIL (pH 7.8)

Treatment	Yield
	Pounds of Dry Matter/Acre
60-80-40	1,511
0-80-40 + micronutrients	1,337
0-80-40 + 53 sulfur	1,165
0-80-40 + 2 boron	1,158
31-80-40	1,155
0-80-40	1,088
LSD.05	343

TABLE 3. THE EFFECT OF PHOSPHORUS AND POTASSIUM FERTILIZER ON THE NITROGEN, PHOSPHORUS, AND POTASSIUM CONTENT OF BIGBEE BERSEEM CLOVER ON AN ALKALINE SOIL

Treatment	N	P	K
	----------	Percent	----------
0-0-0	3.19g*	.330cd	2.11d
0-0-40	3.29fg	.325d	2.29cd
0-0-80	2.95h	.330cd	2.23cd
0-40-0	3.43def	.368a-d	2.67ab
0-40-40	3.57a-e	.368a-d	2.52bc
0-40-80	3.50b-e	.368a-d	2.51bc
0-80-0	3.53b-e	.345b-d	2.78ab
0-80-40	3.69ab	.375ab	2.67ab
0-80-80	3.64abc	.383ab	2.82a
0-120-0	3.44c-f	.373a-c	2.86a
0-120-40	3.68ab	.395a	2.91a
0-120-80	3.76a	.390a	2.86a

*Values within a column followed by the same letter are not significantly different at the .05 level Duncan's Multiple Range Test.

Potassium content did not increase with potassium fertilizer rate but did increase as the phosphorus rate increased. This agrees with the soil analysis that the potassium level in the soil was sufficient and that phosphorus was the most limiting element.

Literature Cited

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