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RESPONSE OF SUBTERRANEAN AND ROSE CLOVERS TO FERTILIZER NUTRIENTS

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SUMMARY

'Kondinin' rose and 'Mt. Barker' subterranean were utilized to evaluate clover response to three rates each of nine plant nutrients in an acid Lilbert loamy fine sand in a glasshouse experiment. Nutrients tested were phosphorus, potassium, calcium, magnesium, sulfur, zinc, manganese, boron, and molybdenum. Treatments consisted of a check, all nutrients at the 1x rate, and all nutrients at the 2x rate. In addition, the zero and the 2x rates of each individual nutrient were tested at the 1x rate of the eight other nutrients. Summation of the total yields from four harvests of each clover variety indicated a 134% response to phosphorus, a 46% response to boron, and a 23% response to potassium. Calcium, magnesium, sulfur, and molybdenum increased yields up to 10%. Manganese and zinc failed to increase yields.

INTRODUCTION

Clovers are normally interseeded into a Coastal bermudagrass sod for a winter forage in East Texas. Establishment success has been variable, and has usually been attributed to low rainfall and dry soil conditions. The poor nutrient supplying power of these soils may also contribute to poor clover establishment. The main objective of this study was to determine which plant nutrients, when added to the soil, would produce the greatest yield increases in sub and rose clovers.

PROCEDURE

Two subterranean clover varieties were seeded into potted surface soil from a Lilbert loamy fine sand (loamy, siliceous, thermic, Arenic Plinthic Paleudult) in a glasshouse. The soil had been dried and homogenized prior to treatment. Treatments consisted of nine nutrients selected as possibly deficient or toxic in acid soils. Nutrients studied included boron (B), calcium (Ca), potassium (K), magnesium (Mg), manganese (Mn), molybdenum (Mo), phosphorus (P), sulfur (S), and zinc (Zn). Rates and materials applied are indicated in Table 1. Chloride and sodium salts were used where necessary to avoid nutrient contamination.

The Lilbert soil was obtained from a mature pine forest. Initial analysis for selected nutrients follows: P - 3.2, K - 20.8, Ca - 251, Mg - 13.4, Mn - 16.8, Zn - 1.34, and S - 3.39. All values are parts per million. Initial soil pH was 5.6. Soil testing procedures were those routinely used by the Texas Agricultural Extension Service Soil Testing Laboratory.

The treatment plan consisted of a check in which no nutrients were applied, all nutrients applied at the 1x rate, and all nutrients applied at the 2x rate. Additional treatments consisted of selectively varying individual nutrients applied at the zero and 2x rates while maintaining all other nutrients at the 1x rate of application. The all nutrient 1x rate thus became a common medium rate for each nutrient. Appropriate nutrient concentrations were mixed into the soil. Inoculated seeds of each clover variety were planted into appropriate pots of soil.

TABLE 1. PLANT NUTRIENTS, RATES, AND FERTILIZER MATERIALS

Plant Nutrient	Rates			Fertilizer Material
	0	1x	2x	
	-------------lb/ac-----------			
B	0	1.0	2.0	Boric Acid
Ca	0	690	1380	Hydrated Lime
K	0	80	160	Potassium Chloride
Mg	0	30	60	Magnesium Chloride
Mn	0	3.0	6.0	Manganese Chloride
Mo	0	.19	.38	Sodium Molybdate
P	0	50	100	Phosphoric Acid
S	0	30	60	Sodium Sulfate
Zn	0	3.0	6.0	Zinc Chelate

Two harvests were made the spring following initial seeding. The soil was allowed to dry during the summer, then was rehydrated and reseeded to the same clover varieties. Two additional clover harvests were made that fall. Plants from each harvest were dried, ground, and chemically analyzed. Soils were sampled after each two clover harvests, dried, screened to <20-mesh and chemically analyzed. Preliminary statistical analyses for significant effects of individual nutrients were done by MSUSTAT. Detailed regression analyses for response surfaces can be determined by the procedure for the general linear model in SAS.

RESULTS

The most deficient nutrients for clover production in this Lilbert soil are indicated in Table 2. These three nutrients were tested by withholding each but adding the 1x rate of the other eight. With no nutrients at all added to the soil, yields for both clovers were lowest. Addition of the other eight nutrients without P slightly increased yields of both clovers over the four harvests. Phosphorus was the most limiting nutrient for clover production in this soil. Clover yields were increased 134% by fertilization of the soil with P (data not shown). Subterranean clover plant response to P was quadratic and had peaked at 50 lb P/ac, whereas, plant uptake of P was linear to 0.36% at the 100 lb/ac rate. This suggests that soil test calibrations should not be based on nutrient uptake data. Soil test P increase was approximately linear, increasing from about 2 ppm at zero P to 13 ppm at the 100 lb/ac application rate.

TABLE 2. CLOVER RESPONSE IN UNTREATED SOIL AND IN SOIL TREATED WITH EIGHT NUTRIENTS MINUS PHOSPHORUS, BORON, OR POTASSIUM

	Clover Yield		
Nutrient	Subterranean	Rose	Total
	grams/pot		
Control	3.90	3.13	7.03
- P	5.77	3.77	9.54
- B	9.44	8.71	18.15
- K	11.68	8.11	19.79

Boron was the second most deficient nutrient in this Lilbert soil. Subterranean clover response to B was nearly linear to the 2 lb B/ac rate. Plant B content increased as the rate of B was increased. Clover yield was increased 46% by fertilization of this soil with B (data not shown).

Potassium was the third most limiting nutrient in this test. Fertilization with K increased clover yields 23% (data not shown). Subterranean clover response to applied K and plant uptake were nearly linear as the rate was increased to 160 lb/ac.

Clover yield increases to other nutrients were Mg and Mo - 10%, Ca - 9%, S - 6%, and Zn and Mn had no effect on yields at the rates applied to this soil.