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EVALUATION OF SWEETPOTATO RESPONSE TO LIMESTONE, NITROGEN, AND POTASH

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INTRODUCTION

Soil acidity is a crop production problem that can be overcome by addition of limestone to raise soil pH. Under low nitrogen requirement cropping practices such as row crop vegetable production, limestone application is not an annual input. As a result, soil acidity is often forgotten following limestone treatment until low pH problems cause a yield reduction. The sweetpotato favors an acid soil for disease free production and is known to tolerate acidity ranging from pH 6.8 to 5.0 (Lorenz and Maynard, 1980). However, some fields leased by producers are testing below pH 5.0. The grower's decision to lime or not lime leased ground for a one-year crop is a difficult one when the land owner will not share the cost. Consequently, a two adjacent site rotational study to evaluate the response of sweetpotato to limestone was established. This study would help differentiate sweetpotato yield loss in low pH soils. Nitrogen and potassium were included as variables in this study.

MATERIALS AND METHODS

A one-acre site consisting of pH 5.25 Bowie fine sandy loam was treated with 188 lb elemental sulfur per acre foot of soil in winter of 1989 to lower the pH to 4.5. A second application of this same sulfur rate was made in April, 1989. Two identical experimental sites were established end-to-end to allow for rotation of the sweetpotato crop with forage sorghum and winter wheat. Each major site was divided into sixty-four 13.3 x 20 ft plots. Ends of each plot were separated by a 3-foot alley. Four replications of five rates of limestone were applied to each major site in mid-spring. Limestone with an effective calcium carbonate efficiency rating of 62% was applied at rates ranging from 0 to 4000 lb/acre and roto-till incorporated to a 6-inch depth. Treatments were arranged according to a central composite rotatable design from Cochran and Cox, 1957. The soil test for phosphorus indicated an adequate amount of P was available for crop production, so additional fertilizer phosphorus was not applied. Nitrogen rates ranging from 0 to 120 lb/acre and potash (K_2O) rates ranging from 0 to 200 lb/acre were broadcast onto individual plots prior to bedding. 'Jewel' variety sweetpotato slips with the original roots removed were re-rooted and transplanted into the bedded rows in the north site in 1989. 'Tifleaf' pearl millet was seeded into the second set of treatments on the south site. Sweetpotatoes were transplanted into bedded rows treated with nitrogen and potash rates banded 2 inches to the side of each row in the south site in 1990 following the millet crop. In 1991, sweetpotatoes will be transplanted into the original rotation site following crops of winter wheat and sorghum sudan.

RESULTS

In 1989, all grades of sweetpotatoes showed nonsignificant yield responses to limestone, nitrogen, and potash. Average yields were 222 lb jumbo, 17,105 lb No. 1's, 4,452 lb canners, and 250 lb culls with a total of 21,779 lb marketable/acre.

The 1990 sweetpotato yield response to limestone rates is shown in Table 1. Grades No. 1, canner, and cull sweetpotatoes showed a positive, quadratic response to increasing limestone treatment. The limestone rate which produced optimum yields of these grades was one ton per acre. Soil pH at this limestone rate was 5.78. This was an increase in pH of 1.0 above the zero lime treatment where the pH was 4.78. A pH of 4.78 is not uncommon on neglected east Texas soils that are farmed only occasionally as for sweetpotatoes. Yield of the jumbo grade of sweetpotato was not significantly increased by limestone rate, whereas the total marketable yield of sweetpotatoes was linearly increased due to increasing limestone rate. Sweetpotato yield was not affected by any rate of nitrogen or potassium in 1989 or 1990.

DISCUSSION

These data, although still preliminary, indicate that sweetpotato growers would profit from application of one ton of a good quality limestone to a soil when the pH is below 5.0, even on leased land. The cost of that ton of limestone applied would be less than $30 per acre. If the soil pH is below 5.3, possibly 1/2 ton of limestone per acre would be beneficial.

LITERATURE CITED

1. Cochran, W. G., and G. M. Cox. 1957. Some methods for the study of response surfaces. Experimental Designs. John Wiley and Sons, Inc.
2. Lorenz, O. A. and D. N. Maynard. 1980. Knott's handbook for vegetable growers. 2nd Ed. Wiley-Interscience, John Wiley & Sons, New York.

Table 1. Sweetpotato response to limestone.

Limestone rate (L)	Soil pH	Grade				
		One[1]	Canner[2]	Jumbo	Cull[3]	Marketable[4]
lb/ac		lb/acre				
0	4.78	2558	132	NS	751	2128
1000	5.36	3659	189	NS	1374	4279
2000	5.78	4228	214	NS	1531	6431
3000	6.05	4265	205	NS	1221	8583
4000	6.15	3771	164	NS	443	10734
Mean	5.45	3930	191	2287	1535	6408

[1]Yield of No. 1's = 3.551 + 0.001897(L) - 0.000000369(L^2) $R^2 = 0.25$
[2]Yield of Canners = 0.1831 + 0.000103(L) - 0.000000024(L^2) $R^2 = 0.20$
[3]Yield of Culls = 1.0433 + 0.001189(L) - 0.000000324(L^2) $R^2 = 0.25$
[4]Marketable Yield = 2.9538 + 0.002987(L) $R^2 = 0.39$