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IMPORTANCE OF BORON FOR CLOVER GROWTH IN ACID, SANDY SOILS

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Background. In the early 1980's, plant nutrient deficiencies were thought to be preventing optimum growth of clovers in the Alfisol and Ultisol soils (soil orders) on the Coastal Plains of East Texas. Data reported here represent some of the results of research using boron (B) to help improve clover production in these acid, sandy soils.

Research Findings. A preliminary study to determine the plant nutrients most limiting for clover production in the surface 0- to 6-inch depth of a Lilbert loamy fine sand was conducted in the glasshouse. Plant nutrients evaluated for clover production included phosphorus, potassium, magnesium, sulfur, calcium, zinc, manganese, B, and molybdenum. Subterranean clover response to these nutrients at two rates of application are shown in Figure 1. Subclover was most responsive to added phosphorus. Boron increased clover growth up to 65% over the untreated check. The high rate of B equalled to 2 lb/ac. Results from this study showed that this soil was most limiting in phosphorus and B and that these two nutrients had the greatest potential to increase clover growth in field studies. Fertilization of rose clover in field plots on a Darco loamy sand verified the results of the glasshouse nutrient screening study. Boron is a plant micronutrient that becomes less available as the soil pH is increased.

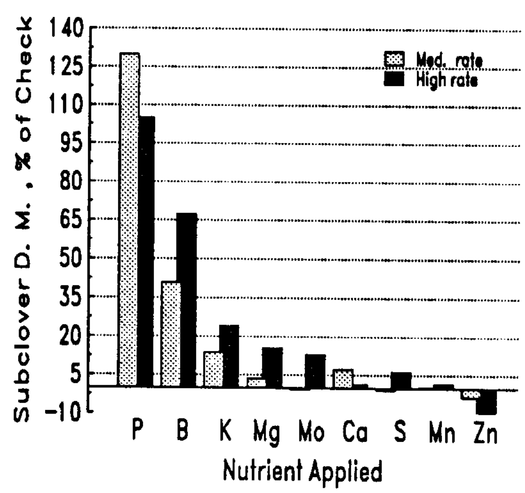

Figure 1. Nutrient effects on subclover.

A field study of the effect of limestone and B treatments for rose clover production was conducted on a Darco loamy sand. The Darco soil is a deep, loamy sand situated on an upland site. The initial pH of the surface 6-inch soil depth was 5.7. Limestones having ECCE percentages of 60 and 100 were applied to the soil surface at rates of 0, 1, and 2 tons/ac. The following autumn, 1 and 2 lb of B/ac were applied to plots and rose clover was seeded. Rose clover dry matter yield was measured to compare the interactive effects of limestone ECCE and B rates on clover dry matter yield.

Response of rose clover to limestone ECCE and B is shown in Figure 2. When no B was applied, rose clover dry matter yield decreased as limestone ECCE was increased from 60% to 100%. In plots treated with ECCE 60 limestone, application of 1 lb B/ac increased yield to 4166 lb D.M./ac. Two lb B/ac with ECCE 60 limestone lowered yield below that of the zero B check. However, when ECCE 100 limestone was applied, yield of rose clover fertilized with 2 lb B/ac was comparable to clover production at the 1 lb/ac rate of B. Increasing limestone fineness evidently decreased the availability of some of the soil B at the 2 lb/ac application rate. These results show there is an interactive effect of limestone and B on clover growth.

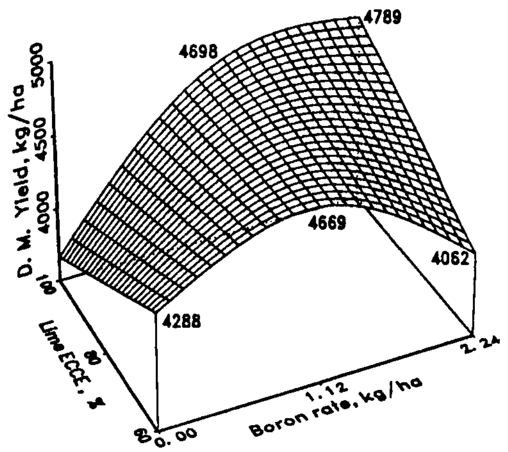

Fig. 2 Rose clover response to lime ECCE and boron

Results of a study of the effect of limestone and B rates on soil B are shown in Figure 3. As the limestone application rate was increased from zero to 1 ton/ac at a constant rate of B, hot water soluble soil B increased. At the 2 ton/ac limestone rate, soil B was appreciably lower. This verified that limestone treatment can decrease B solubility in acid soils. Data in Figure 3 also show the increase in soil B as the rate of B application was increased at a constant lime rate.

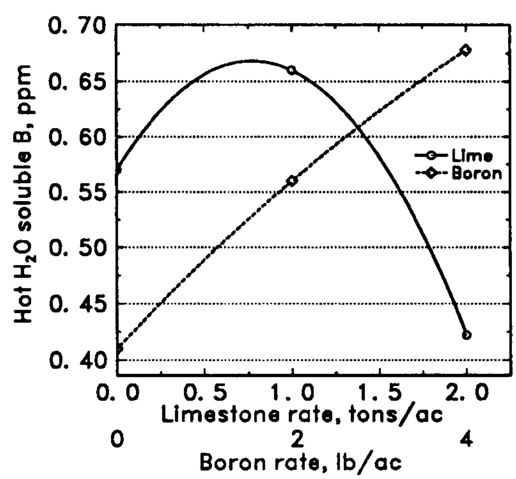

Fig. 3. Effect of limestone and boron rates on hot-water-soluble soil B.

Application. Added B is needed for optimum production of legume crops on lime treated, acid, sandy soils of East Texas. On acid soils, limestone requirement and B tests are recommended when a particular field soil is being considered for production of alfalfa, ryegrass, or clover. The soil pH should be raised at least to 6.0 for clover production. For alfalfa, the soil pH should be 7.0. One to 1-1/2 lbs of B/ac are needed for clover production. Alfalfa has a higher tolerance for B, but 2 lb/ac should be adequate on sandy soils.