Blast Furnace Slags as Agricultural Liming Materials*

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RECENT experiments with several sources of liming materials on light textured soils of the Coastal Plain resulted in outstanding yields from use of blast furnace slag as compared with other sources of lime (11). Earlier investigations have shown that the use of common sources of lime in excessive amounts induced boron deficiency and decreased yields of some crops. It was observed that over-liming injury did not occur on these sandy soils when blast furnace slag was added in amounts equivalent in neutralizing value to that of other sources causing injury (10). It appeared that blast furnace slag supplied boron required for increased growth.

Several workers (1, 2, 3, 4, 5, 6, 7, 9, 15, and 17) have reported favorable results from use of calcium silicate and blast furnace slag in comparison with other liming materials.

The specific objectives were to determine by greenhouse, field, and laboratory investigations, with particular emphasis on field results, the comparative values of (a) representative blast furnace slags* and agricultural limestone in Alabama, (b) different rates of application of blast furnace slag, and (c) different finenesses of blast furnace slags.

Experimental

Field experiments were conducted on Norfolk loamy sand near Auburn, Ala.; on Lloyd sandy clay loam at the Piedmont Substation, Camp Hill, Ala.; and on Hartsells very fine sandy loam near Boaz, Ala. (The experiment was set up as a randomized block design and replicated three times.) The plots were one one-hundredth of an acre in size. Companion tests were conducted in the greenhouse at Auburn. Two cropping systems—alfalfa grown continuously and a crimson clover-corn succession—were used in these tests.

In the fall of 1946, one-half of the liming material was applied and turned under. Two weeks later, the other half of the liming material and the fertilizer were applied and disked in. Alfalfa and the crimson clover were seeded.

The original fertilizer treatment for alfalfa was 80 pounds of 0-14-10 per acre. A minor element mixture, consisting of 10 pounds of manganese sulfate, 5 pounds of borax, and 5 pounds of zinc sulfate, and an additional 20 pounds of borax were added at seeding and 10 pounds was added after the first cutting each year. The experiment was set up as a randomized block design and replicated three times. Hay was removed from the plots. Hay yields were taken as oven-dry weights and adding 15% for moisture to the above yield. The yield was calculated as bushels of shelled corn per acre.

Before liming, soil samples were taken in the spring of 1947, and in the fall of 1949. The individual samples were determined, and means of the triplicates are reported. The remaining samples from the triplicate treatments were used for chemical analysis. Cation exchange capacity, calcium, and exchangeable magnesium were determined by methods of Pech et al. (19). Water-soluble phosphorus was determined by the method of Nafel (11), and decreased.

Results and Discussion

In the alfalfa tests (Table 1), 2 tons of blast furnace slag added produced yields as large as the same amount of limestone with borax except on the Hartsells soil for the second year of the test. Limestone was superior for alfalfa production on the latter soil for these years. Cropping sequences (Table 2) revealed that there were greater amounts of exchangeable calcium on plots treated with limestone than on plots treated with the same amount of blast furnace slag. This probably accounts for the increased yield on Hartsells soils from the use of limestone.

<table>
<thead>
<tr>
<th>Liming treatment Source*</th>
<th>Minor elements added†</th>
<th>Hartsells very fine sandy loam</th>
<th>Lloyd sandy clay loam</th>
<th>Norfolk loamy sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limestone</td>
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<tr>
<td>Blast furnace slag</td>
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<tr>
<td>Limestone + Blast furnace slag</td>
<td>0</td>
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</tbody>
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*All blast furnace slags used in these tests were air-cooled slag.