COMPARATIVE EFFECTS OF PLOWING AND OTHER METHODS OF SEEDBED PREPARATION ON NUTRIENT ELEMENT DEFICIENCIES IN CORN

C. A. BOWER, G. M. BROWNING, AND R. A. NORTON

FIELD EXPERIMENTS designed to compare plowing with other methods of seedbed preparation for corn production have been in progress in Iowa since 1939. The results of various experiments which include comparisons of plowing with listing, diskng, and subsurface tillage have been summarized by Norton, et al. (5) and by Browning, et al. (1, 2). Although the use of such tillage methods as listing, diskng, and subsurface tillage has resulted in lower seedbed preparation costs and in smaller soil and water losses on sloping land when compared with plowing, corn yields on plots where the soil was prepared by these methods has been in many cases markedly lower than on plots where the soil was plowed. Observations on the appearance of plants in the variously tilled plots during the growing season have indicated that the lower yields obtained where the soil was not plowed were due largely to nutrient element deficiencies.

The purpose of this investigation was to study the effects of various methods of seedbed preparation on N and K deficiency in corn. This was accomplished by means of chemical analyses made on plant and soil samples taken during the growing season from variously tilled plots.

EXPERIMENTAL DESCRIPTION OF SOILS

Brief descriptions of the soils used in this study are given in Table 1.

FIELD EXPERIMENTS

The results obtained in this study are from two types of field experiments. One type, hereafter called "tillage experiment", consists of four seedbed preparation treatments, viz., plowing, hard-ground listing, diskng, and subsurface tillage, with and without fertilizer. Twenty-inch sweeps operating at a depth of 4 to 5 inches were used in preparing a seedbed by subsurface tillage, whereas seedbed preparation by diskng was accomplished by going over the soil several times thoroughly with a weighted disk harrow. The fertilizer used was 5-10-5 applied in the hill at the rate of 200 pounds per acre at planting time. The other type of experiment, hereafter called "mulch culture experiment", involves two seedbed preparation methods, plowing and subsurface tillage, and various methods of handling crop residues. The treatments in this experiment have been described in detail by Norton, et al. (5). For the purpose of this study, however, comparisons were made only between plowed and subsurface tillage plots where they occurred adjacent to each other and where the method of handling crop residues was the same in most cases.

METHODS

In obtaining plant samples for chemical analysis 10 plants were taken at random from the plot. After drying the plants at a temperature of 70° to 75° C, they were weighed and then ground. Soil samples were taken from the center of the corn rows where absorption of nutrient elements by the roots had taken place to a minimum extent. The soil samples, which were the composite of 10 auger borings, were air-dried at once and then ground.

For P and K analysis, samples of the plant material were wet-ashed with nitric and perchloric acids. Phosphorus was determined by the method of Truog and Meyer (7) and K by the method of William's (8). Total N was determined by the Kjeldahl method and NO₃ N by the method of Harper (3). Exchangeable K was extracted from soil with neutral NH₄Cl solution, whereas water-soluble K was extracted by leaching 100 grams of soil with 500 ml of distilled water. A glass electrode was used in making pH determinations.

RESULTS ON TAMA SILT LOAM

The tillage experiment selected to study the effect of various methods of seedbed preparation on N deficiency was located on Tama silt loam soil which had been used for red clover hay production the previous year.

The results obtained in this study are given in Table 2. As shown by the data on weight of 10 plants sampled on July 13, there was a marked difference in the early growth of the corn on the variously tilled plots. Where fertilizer was applied as well as where not applied, the early growth of corn on plowed soil was significantly greater than that on soil tilled by any of the other three methods. There was a response in early growth to fertilizer in the case of all tillage

2. Research Assistant Professor of Soils and Soil Conservationists, respectively.
3. Figures in parenthesis refer to "Literature Cited", p. 146.