THE DIAGNOSTIC APPROACH AS APPLIED TO A LONG-TIME FERTILITY EXPERIMENT IN INDIANA

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The plant tissue test technic developed at Purdue University and described by Thornton, Conner, and Fraser (7) makes an excellent tool for studying the nutritional status of crops grown on long-time fertility experiments. As further modified by Scarseth (5, 6), this method has been used with favorable results as a diagnostic aid in evaluating the various soil treatments in current fertilizer experiments in Indiana. The Purdue station at present maintains seven outlying experimental fields (4) which are located on the major soil areas of the state. Most of these fields were laid out between 1916 and 1920, and thus the various empirical fertility treatments have been continued for over 20 years. Marked differences in yields of various plots have been obtained.

When these experiments were set up, the general concept of permanent agriculture stimulated by Hopkins (1) was quite popular. The potassium supply of the soil was considered to be abundant because it was believed that the total potash content of the soil (from 20,000 to 40,000 pounds per acre plow depth) was sufficient for several centuries of cropping. The nitrogen was to be furnished by the legumes in the rotation, so lime and phosphoric acid were the primary factors which were compared. The experiments, by necessity, were exploratory in nature, i.e., they were primarily set up to compare various systems of farming, using empirical rates and kinds of fertilizer materials. Thus, they were not designed to determine the functions of individual elements in the production of maximum yields.

For the purpose of comparing the long-time effects of systems of farming where various empirical soil treatments are used, these experiments have become more valuable with time. For obtaining current information on the needs for nitrogen, phosphorus, and potash which can be used when giving fertilizer recommendations involving rates and balances in quantities between these nutrient elements, however, the experiments are wholly inadequate. This arises from the inability to interpret the yield performance in terms of the individual nutrient elements.

The Purdue plant tissue test technic (7) presented an excellent opportunity to analyze these long-time fertility experiments. During the 1941 and 1942 growing seasons, tissue tests were made on the corn and soybean crops growing on the outlying experimental fields in Indiana. These tests have revealed several cases nutrients which were previously assumed to be adequate have been the limiting factors in the growth of the crops. This information would not have been obtained if a diagnostic point of view had not been used. The tissue tests were a very tant and valuable factor in this diagnostic approach to the problem.

An example of the use of tissue tests in long-time fertility experiments is discussed below, using only data from one of the experimental fields in Indiana. Similar cases can be found in almost all old fertility experimental fields. To know these facts makes the fields more valuable because the limitations will obviate erroneous conclusions.

DIAGNOSIS OF A CASE AT THE HUNTINGTON EXPERIMENT FIELD

In 1919 a general fertility experiment was established on a field of mixed St. Clair and Napp ane silt loams (formerly classified as Miami and Crosby silty clay loams) and Brookston silt loam near Huntington in the northeastern corner of Indiana.

This experiment included a comparison of different kinds of phosphate fertilizers for crop production. Inasmuch as these phosphate plots were established at a time when it was believed that the soil supply adequate quantities of potassium for normal plant growth, potash was not included in the treatments.

WHAT DO YIELD DATA SHOW?

The average yields of some of these plots in the 4-year rotation of corn, oats, wheat, and clover for the period 1919-40 are presented in Table 1. The data indicate that the yields of both the limed and the unlimed phosphate plots leveled off at about 37 or 38 bushels of corn and about 3,400 pounds of hay per acre. Both of these crops are known to require large amounts of potash whereas wheat and oats are more vigorous for potash and have lower requirements.

On plots 20 and 21, however, where crop residues were returned, the corn yields of 45 bushels per acre and the clover hay yields of 3,800 pounds per acre show a definite response from the potash which was applied.