RAPID CHEMICAL TESTS OF SOILS

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Terms such as the pH of soil to express its acidity as well as pounds of available phosphorus per acre as an expression of the status of this constituent are no longer reserved for use exclusively by chemists or technically trained agriculturists. Today magazines, newspapers, fertilizer dealers and others use these terms freely and often advise farmers, gardeners or lawn keepers to have their soils tested to see what they need. The extensive present-day use of rapid chemical tests of soils has promoted an insistent demand for knowledge concerning the reliance that may properly be placed upon results by such methods. A widely expressed opinion is that such tests are easy to make but difficult to interpret. The greatly accelerated interest in quick tests which has been particularly evident during the last decade would seem to be due more to an intense desire to obtain helpful information from such tests than from the development of any highly satisfactory procedure applicable to the growing of different kinds of plants on different soils. Great advances in chemistry along many lines have no doubt led to the general idea that chemistry can surely go a long way toward giving information indicating the state of fertility of a soil as well as its fertilizer needs. As a result, first one test and then another has been proposed, so that today a large number of soil-testing procedures are found to give much more reliable results locally than do the original methods. No standard procedure is recogized although some of them are widely used in different localities. Some tests call for an expression of the results as pounds per acre of an available constituent while others group the re-

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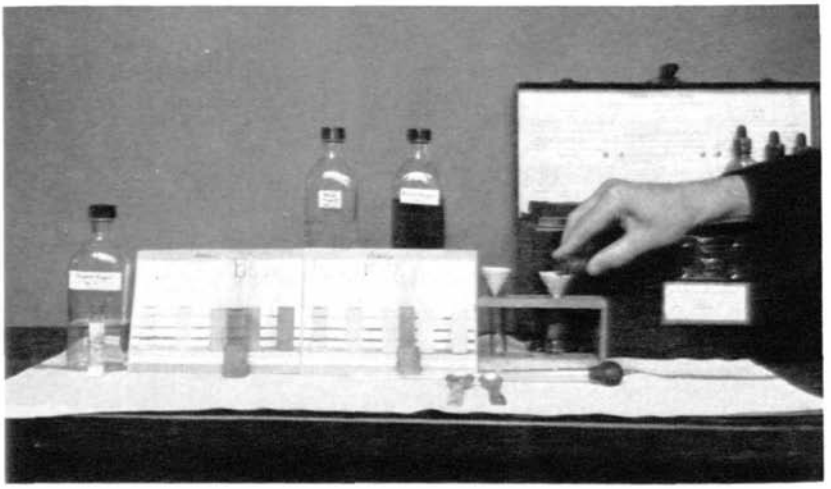
sults into three or more classes, such as high, medium, and low.

Information from soil tests is frequently furnished the layman showing that his soil contains a certain number of pounds per acre of available phosphorus, potassium, or other constituents and that it needs a certain number of tons of lime per acre to neutralize an acid condition. It must be admitted that



One of the soil-testing outfits used for phosphorus and potash. On the right is shown a step in the preparation and filtration of the test solution. At the left is shown color comparison against a standard color chart for phosphate. In the center is shown a turbidity test for potash, in which the intensity of the black lines visible through the turbid solution is compared on a standard chart.

the quantities involved in such reports do not always mean the same thing in terms of treatment needed for maximum response in the growth of grass or other crops.

The results by different methods may vary several fold in pounds per acre of available constituents shown. Results by some particular method may be much more helpful than those

by another method, but even here comparable values are often more helpful than are specific expressions of pounds per acre of a certain constituent taken alone. If the user of the tests has knowledge of the results accomplished in former years by particular treatments, such history aids greatly the interpretation of chemical results.

Soil Acidity Tests

The helpfulness of almost all of the soil acidity and lime requirement tests in the hands of an agriculturist is so marked and so well recognized that little argument need be advanced in their behalf. By far the greater number of soil tests made by most of the state experiment stations and local governmental agencies involve tests for the need of lime applications to soils. The methods used are usually not very precise but are adequate to meet practical needs. The proximity of a limestone supply to the place of use of the product of course greatly influences the cost of the material. As a result the full amount of lime shown by a chemical test as desirable is frequently reduced somewhat for economic reasons. Practical local experiments, guided by the results of tests made on part of the field or turf area in question, are particularly valuable.

Phosphorus and Potassium

Tests for available phosphorus and potassium in soils are widely used but their interpretations are much more difficult than are those for acidity and lime requirement. Local experience must play a very important part in translating pounds per acre of available phosphorus, for instance, into the grade and quantity of fertilizer best suited for use. Some agriculturists

find certain of the tests highly helpful while others feel that such tests are not worth the time and effort involved in their making. Both extremes of opinion are probably at times justified. Oral opinions from various persons dealing with soil tests in state soil testing laboratories and other similar institutions indicate that they make use of chemistry in various ways. It is frequently said that chemical results contribute perhaps 10 percent of the information upon which advisory judgment is based. Others find them of even greater value than this while still others find them less useful. Very frequently chemical tests are particularly useful in cases where soils have been over-fertilized or, where from various causes, the relationships of quantities of constituents is unusual. In this way the 10 percent estimate just referred to may be of considerable importance.

It is interesting to note in current technical literature something of the character of data from which agriculturists are called upon to interpret prospective crop yields in relation to pounds per acre of available phosphorus or potassium shown by different methods in specific series of soil plots. Such experiments involve a wide variety of cultivated crops but data for soils under continuous grass cover are scarce. For example, a report from New Jersey concerning soils of plots on Sassafras loam usually showed an increase in crop yield when both phosphorus and potassium were added. However, the phosphorus values determined by different methods varied in certain cases several fold while differences shown by five potash methods were less marked. An unfertilized, but limed, plot showed not more than 3 pounds of available phosphorus per acre by any method but it grew a fairly good crop of wheat.

In South Carolina the Truog-Myer method for available phosphorus was found to be definitely correlated with avail-

ability of this constituent to plants. A case is presented, however, which would be particularly perplexing without local information regarding the response of different soil types to plant growth and fertilization. An Orangeburg fine sandy loam soil showing about 40 pounds of available phosphorus and 10 pounds of available potassium per acre grew nearly three times as much seed cotton in the 1937 season as did a Cecil sandy loam soil in the same locality which showed 70 pounds of phosphorus and 80 pounds of potassium. In another set of results a Carrington loam soil from Iowa produced good farm crops year after year without mineral fertilization while the tests for phosphorus and potassium showed low availability of both constituents. Furthermore, additions of fertilizers containing these elements gave little or no crop response. These examples illustrate some of the problems encountered in the interpretation of chemical tests in different parts of the country.

Summarizing, it would seem that while soil tests have a definite place in the United States, their limitations are becoming fairly well recognized. Definite values for pounds per acre of available phosphorus and potassium should not be regarded as having the same significance in different soils but comparative values in a locality under comparable conditions may be of considerable value in aiding judgment as to what fertilizer treatment should be given. Emphasis is being more and more placed on the idea that soil testing is a local problem and that particular values for available constituents do not have the same significance with different soils. There is still no short cut which adequately supersedes field tests, but the soil tests can be a distinct aid in the choosing of experimental treatments to be applied to a portion of a field, lawn or golf course. Such a field experiment does not require technical skill and it ordinarily

involves no losses. Successful results observable throughout a season bring conviction to every observer and after a few years it may be possible to tell better what statements such as 5, 25

Chemical laboratory showing some of the quick-testing outfits used for evaluating the available nitrogen, phosphorus, potassium, and other elements contributing to crop productiveness. Laboratory results aid experienced agronomists in determining soil fertility and specific deficiencies and in recommending suitable fertilizer materials or other soil-improving processes.

or 100 pounds of available phosphorus or potassium per acre mean when related to the growth of grass under the local conditions.