RAPID TESTING OF SOILS FOR PLANT FOOD DEFICIENCIES UNDER SOUTHERN CONDITIONS

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Introduction

Quick tests for soil deficiencies as used today are of rather recent development. This does not mean, however, that previous to that time nothing was done to estimate these deficiencies. On the contrary, many schemes have been proposed and used. A brief review of these is given to lay the foundation for the present work.

The technique and reagents used in determining the individual ions have changed considerably during the last few years. Since, however, the whole effort is to determine the presence and abundance of the recognized essential ions, the extracting solution would appear to be the basic factor. Approaching the problem from this angle the previous work can be roughly divided into three periods, namely:

1. Early development to 1900—Various weak mineral acids were used.
2. From 1900 to 1920—Water was used.
3. From 1920 to date—The trend has been back to weak acids and to biological tests.

During the early development practically all of the work was done in Europe. Dilute solutions of HCl, HNO₃, ammonium citrate, ammonium oxalate, citric acid, acetic acid, CO₂ saturated H₂O, and some stronger solutions such as aqua regia were used as extracting solutions by such men as Liebig (10), Deherain (2), Vogel (16), Dugast (3), Le-Chartier (9), and Dyer (4). Dyer's work perhaps exerted the greatest influence upon quick testing of all other work done during this period. Based upon the acidity of the feeding roots of many different kinds of plants, he concluded that 1% citric acid would extract the ions which would be available to plants.

From 1900 to 1920 most of the work was done in the United States. King (8) initiated the effort, using H₂O as an extractant. About the same time Whitney and Cameron (17), and a little later Schreiner and Failyer (12) did considerable work in quick testing, all using water as an extractant.

Since 1920 there has been a definite trend back toward weak acids. According to a survey made by Thomas (13) most of the quick testing for available plant food nutrients is done in a few central, eastern, and southeastern states, with the exception of tests for individual ions. The extracting solutions most extensively used were Morgan's, Spurway's, Bray's, and Truog's (13), or a modification of one of these.

Very little rapid testing has been done in the extreme south. No doubt one reason for this is that none of the above-mentioned solutions have given satisfactory results. Because of this fact, the present work was undertaken.

Experimental

An attempt is made to find an extracting solution that will extract plant foods that are available to plants under southern conditions. Since several of the mentioned solutions have served a good purpose in other parts of the country, it seems best to study them under local conditions and to find any possible lead. These solutions were, therefore, compared on a soil of known fertilizer treatment and yield history. Bray's newly proposed acid sodium perchlorate solution was included in the comparison.

The perchloric acid solution promised of being the best possibility of the group. The soil extract was much clearer and considerably more phosphorus was extracted. All other extractants were discarded, and a more detailed study was made of this solution. In this preliminary work, however, serious handicaps were encountered in connection with this method, namely:

1. If the solution were made from the salt, it could not be used in testing for SO₄ and NO₃ because of their presence in the salt as impurities.