Soil Analysis

not an answer, merely a tool in the study of soil problems

Warren R. Schoonover and J. C. Martin

Soil analysis almost never furnishes a direct answer to a California soil problem.

It is often useful as a tool for the investigation of soils and of soil and fertilizer interactions, if it supplements field observations made by a trained observer.

It can be used to study fixation of nutrients, the movement of fertilizers in soils, and similar problems.

The principal reason soil analysis is of greater value as an aid in the study of soil problems than as a guide for farm practice is the complexity of soils and of plant life. When these are combined, the result is the very complex problem of soil and plant interrelations.

Salinity and Alkalinity

In California, soil analysis finds its greatest usefulness as an aid in appraisal of salinity and alkalinity problems.

Analyses may indicate the reasons for significant differences in plant growth in various parts of one field.

Repeated analyses from the same location may reveal the progress of reclamation or suggest new reclamation methods.

Because of great variability in salinity or alkalinity conditions, within short distances, no standard sampling method will suffice.

Each field presents a special problem depending upon the kind of soil, topography, drainage conditions, location and nature of the water table, the amount and quality of irrigation water, the crop to be grown, and perhaps to several other factors.

Laboratories

University of California laboratories examine soil samples for alkalinity and salinity to aid staff members in the study of soil problems. Miscellaneous samples are not analyzed as a service to the public because the analysis by itself does not usually yield useful information.

The University, through the Agricultural Extension Service, is expanding its soil salinity and alkalinity studies in the field by establishing several county laboratories. These laboratories will perform those simple tests best adapted to giving county farm advisors a better understanding of local soil problems.

In some instances, the information developed in the local laboratories will be sufficient to serve as the basis of recommendations for reclamation. The more complex problems will be referred to the University laboratories on the several campuses.

Tests for Nutrients

Chemical tests for nutrients are designed to determine the amounts of readily available phosphorus, potassium, or other nutrients in the sample being studied.

Weak acids or other reagents are used for extracting the soil. None of these reagents has an effect on the soil identical with, or even similar to, the effect of living plant roots reacting with the soil particles which they contact, and constantly absorbing nutrients from the soil and soil solution.

Extraction of Nutrients by Plants

Plants differ greatly in their ability to extract nutrients from a soil.

One California soil, which has been studied intensively, will not grow vegetables and field crops without heavy fertilization with phosphate. The same soil yields adequate amounts of phosphate to fruit trees.

Another soil in the same county yields insufficient potash for some trees, but supports annual crops without difficulty.

Soil Series

The situation becomes even more complex in view of the existence in California of about 300 soil series, each containing several textural grades. These soils vary in many particulars, such as parent materials, age, depth, texture, structure, drainage, and acidity or alkalinity.

All of these factors have an influence on the ability of plants to gain a nutrient supply from the soil, but do not influence the reaction of the soils to the ordinary chemical reagents in like manner.

Depth is an example of one simple factor. If the depth of a soil is doubled, and other factors remain the same, its productivity for deep-rooted crops might be doubled, and might remain unchanged for shallow-rooted crops.

Available Nutrients

A number of eastern agricultural colleges analyze soils for so-called available nutrients as a service to farmers who use the analyses as a guide to fertilization of their land.

This service appears to be valuable under certain special conditions, but in many places with less complex problems of soil and plant interrelations than those in California, such systems have failed when tried.

Even more than in the case of alkalinity and salinity, the information developed by analysis must be interpreted in the light of experience developed by observing the effect of fertilizers applied to crops while they are actually growing in the field.

Where such a system of analysis works, conditions are simple and field experience is extensive.

In such places soils are similar in general characteristics. Usually they are shallow, with the principal root system of the crop being grown in the top foot or less. The number of crops for which the system is used is small, usually two or three.

Critical Levels of Nutrients

In all such cases, field trials of various fertilizer treatments have been run on these soils, with these crops, for a series of years. It has been possible to correlate values obtained by certain types of analysis with actual crop yields. It has then been possible to establish critical levels below which it may pay to apply fertilizers.

Attempts to establish critical levels for the major nutrients, for the principal California soils and crops, have been most discouraging. Sometimes very high values indicate that all elements are in adequate supply for all crops. The usual situation is to find the values in a range for which there is, at present, no interpretation.

Analysis as a Guide

Recent coördinated studies—using soil analysis, pot cultures in the greenhouse, and, to some extent, plant tissue analysis—indicate that if simple systems are chosen, analysis may be useful as a guide to fertilizer practice.

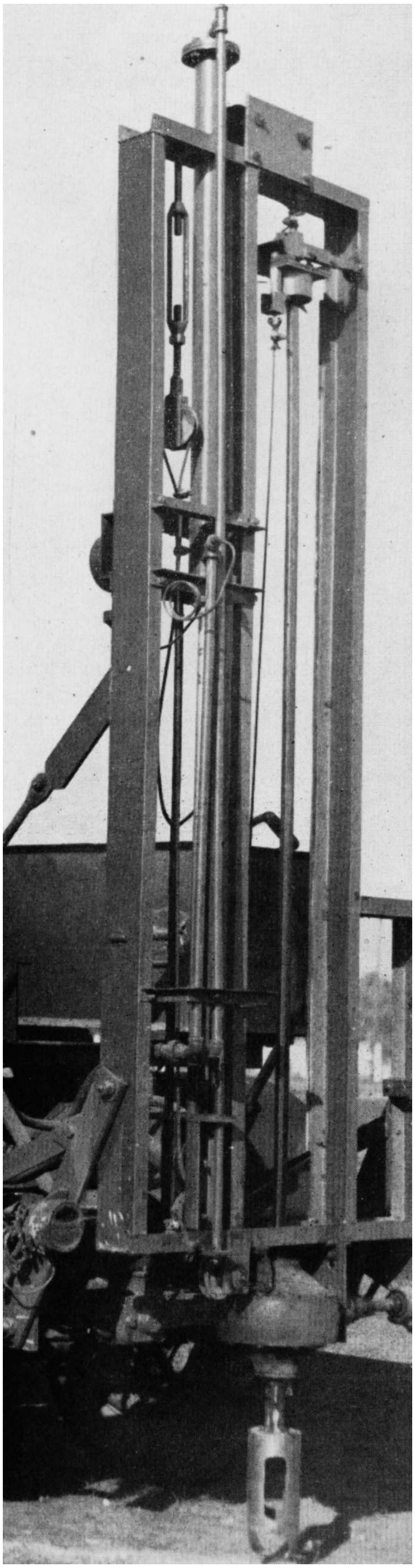
If a given test for phosphorus is applied to the old, alluvial soils of the Central Valley in California, it appears to be well correlated with the yield of lettuce in pots. When other soils or crops are included in the test, the correlation is not good.

Professional advisory services, working with a few crops, have found analysis of soils for nutrients to be of some aid in

Soil Sampler

power-operated and mobile, new device speeds up soil surveying

Rodney J. Arkley



Power-operated Soil Sampler

A POWER-OPERATED soil sampler now does the drudgery in soil surveying—the mechanical job of extracting soil samples which are required by the thousands for an adequate map of a survey area.

The machine is mounted on the rear of a war-surplus weapons carrier, similar to a 1½-ton truck, equipped with four-wheel drive and a power take-off. It consists of three elements.

1. A gear and chain driving mechanism which utilizes power from the truck to rotate a long shaft to which soil sampling bits of various kinds can be attached.
2. An hydraulic mechanism which forces the rotating barrel bit into the soil and removes it when full, operating at pressures up to 2,500 pounds.
3. An hydraulic mechanism which unfolds the device from highway travel position to operating position.

The soil sampler is most advantageous on dry, hard soils.

In comparison of samplings made on the well-known Fresno Alkali hardpan soil it required 6½ minutes of concentrated effort with a pick, shovel, steel bar, and hand auger to obtain a sample 22 inches in depth. Further penetration was effectively stopped by the hardpan.

The power-driven sampler reached the same depth in 1½ minutes; it penetrated the hardpan easily, and a complete soil profile to a depth of five feet was sampled in only four minutes.

Similar results were obtained on the still more dense San Joaquin hardpan soil.

By hand, 11 minutes were required to reach the surface of the hardpan which occurred at 24 inches depth.

The power tool obtained samples to a five-foot depth in only seven minutes.

The mechanical sampler was thus able to furnish important information on the thickness and density of the hardpan which could not have been obtained at all by hand methods.

On dry hard clay soils a five-foot sampling required 20 to 30 minutes of hard hand work, while the power sampler did the job easily in only seven minutes.

No Advantage on Certain Soils

On damp soft soils such as Honcut loam the advantage of the power auger was found to be negligible, as the samples were obtained just as quickly by hand. Moreover the mobility of the machine was considerably restricted by the irrigation ditches and fences which prevail on most soils of this kind.

On Corning gravelly loam, several hours of hand labor were required for obtaining a profile. The power sampler furnished the complete section in 15 to 20 minutes; but where large cobbles were encountered the auger had to yield, often with a broken bit as a result.

The power auger was unable to penetrate the gravelly, concretelike hardpan of the Redding series. Heavier equipment and large heavy worm-type bits are indicated on such extreme soils.

The savings in time and physical energy accomplished with the power auger make it possible for the soil surveyor to devote more attention to studying and recording of the soil characteristics than to digging holes. In addition the areal density of borings is increased many fold.

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The power-operated soil sampler was constructed by C. C. Crothus of Richmond, California, to meet specifications of the Division of Soils.

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formulating soil management procedures for their clients.

Soil analysis finds increasing use each day as a research tool, but the time is far away when it can be used generally as a guide to fertilizer practice.

For the present, there is no substitute for observing plant responses to fertilizers under controlled conditions, such as those found in test plots conducted by the Agricultural Experiment Station or Agricultural Extension Service.

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POULTRY HUSBANDRY

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warm until used, keeping it uncontaminated with fecal material, and using the proper technique in inseminating. During insemination the syringe should be inserted well into the oviduct—not merely into the cloaca—and the pressure on the hen necessary to expose the oviduct should be relaxed before the semen is injected to prevent its being immediately forced out again.