

establishes a commercial laboratory with a conscientious approach must have basically a very broad knowledge of the history of soil testing and the requirements of the crops concerned.

Table I illustrates in what great detail a grower must consider his problems to be a successful producer. These data are from one farm, but the average of these tests is virtually worthless. There is such a great variation in the analyses that each field presents a separate fertilizer and soil amendment problem.

Probably no soil in the world has the ideal concentrations of all the elements essential to the proper growth of plants and animals. The fertilizer industry has striven energetically to supply these essential elements to the grower in the proportions needed. It has recognized the very great differences in the requirements of plants. Two very different crops are blueberries and alfalfa. Blueberries thrive on an extremely acid

soil with high magnesium and potash content and other essential elements. Alfalfa requires a high pH, which controls the availability of molybdenum, essential to nodule formation.

The methods of soil analysis developed by this laboratory are based on extraction of the soil with sodium acetate at pH 5.0. The sodium, a very active element, replaces most of the readily available cations in the soil. The acetate anion has the specific ability to replace available anionic plant nutrients such as phosphates. This salt complex is desirable from the standpoint of analytical procedures, because it does not involve essential plant nutrients.

Commercial laboratories have a unique position, because they are not hampered by limitation of field activities and concentration on any one crop. They correlate data and information accumulated for all crops into a rounded picture of soil conditions and plant nu-

trient requirements. This laboratory has analyzed soil from 24 states and many South and Central American countries. Correlation of the information from all these sections adds to the value of information ascertained from a single analysis of a specific crop.

Progressive plant and animal breeders recognize that there are superior genes, but they have conceded that the essential nutrition of plants and animals helps them to achieve maximum efficiency. This point is illustrated by the fact that this laboratory has been called upon periodically to analyze the soil on which is produced feed for the race horses of a number of the leading breeders and racers.

Literature Cited

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Operation of a Soil-Testing and Recommendation Service in a Plant Food Sales Program

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New laboratory facilities provide farmers in the Corn Belt with a means of getting their soil tested by the newest equipment and the latest analytical procedures.

MANY new, modern soil-testing laboratories employing the very latest methods and procedures have been established in recent years throughout the United States. Farmers are benefiting from this service, through which they have been able to keep their total production costs at a minimum while increasing their yields and profits. The farmer feels that the ideal soil fertility program is the one that makes the most money for him, considering his time and investment. He is, therefore, depending more and more on the interpretation of soil tests to aid him in making profits.

Many farmers do not know the proper procedure for collecting soil samples—how to take them, how many to take, or how to interpret the recommendations of the soil-testing laboratory. However, in most instances, they know they can depend on local agricultural authorities for assistance. They are “getting the message” from all directions: The efficient way to raise any crop is to farm intensively with the heaviest practical fertilizer applications on fewer acres. They are being told again and again that proper fertilizer usage takes a big share of the “gamble” out of farming,

that during periods of drought and in areas of consistently low rainfall crops grown on fertilized acres make more efficient use of rainfall and soil moisture, and that crops grown on properly fertilized land are better able to withstand the effects of diseases, insects, and other natural enemies.

In any fertilizer soil-testing program, the basic and primary requisite is to provide recommendations on properly feeding the soil, so that the soil, in turn, can properly feed the crop being grown. Recommendations should be aimed at building up good soil tilth, providing adequate quantities of plant food, and supplying an abundance of organic matter throughout the surface of the soil where all of the roots—as well as the important soil bacteria—can be nourished to full capacity at all times. Recommendations for supplemental plant food, however, cannot be used as a formula that will give an exact answer in terms of crop yields. A great deal depends on the kind of season experienced, and how efficiently a soil management program is followed. The soil test serves only as a guide to good fertilizer and management practices to produce the desired yield.

A soil testing service must consider five general phases of soil testing:

- Obtaining the sample.
- Analyzing the sample.
- Calibrating.
- Interpreting and recommending.
- Evaluating the soil test.

Consolidated Laboratories, Congerville, Ill., is an example of the workings of a modern soil-testing laboratory. This laboratory was opened September 10, 1958, to serve the needs of farmers in the Corn Belt area. It uses the newest equipment and the very latest analytical procedures. Facilities were installed following a thorough study of laboratory techniques as practiced in several state universities in the Midwest. The laboratory technicians were sent to the various colleges and universities to learn firsthand the latest techniques and procedures of soil testing employed in each state. Their resulting Soil Master Series specializes in the following tests:

Measuring the exchange capacity (the ability of the soil colloids to hold plant food), and determining what needs to be done to utilize the capacity of the colloids.

Measuring status of the organic matter, for management purposes in determining

the soil's tilth, water-holding capacity, support of soil bacteria, and ability to store plant nutrients.

Measuring soil pH, to determine percentage or degree of acidity or alkalinity of the soil.

Determining hydrogen—this being a by-product of plant root activity, it denotes the soil's degree of activity and reserve acidity.

Determining magnesium.

Determining calcium.

Determining nitrogen.

Determining phosphorus.

Determining potassium.

Interpreting results with regard to the soil type tested.

Also made available are the Illinois, Missouri, Iowa, Wisconsin, and Indiana series of soil testing, plus tests for manganese and boron. Equipment in the laboratory includes the Spectronic 20 used for interpretation, a custom-built pH meter, a distillation apparatus for determining available nitrogen, a soil-grinding and screening unit, automatic pipet equipment for metering reagents, a soil dryer, an exhaust system, a glass dryer, special shakers, and an air conditioner for maintaining constant temperatures. Plans are also in the making to add a flame photometer to aid in the speed and accuracy of testing.

The laboratory's facilities are geared to handle 2000 soil samples per day. The final results and the interpretation are mailed back to the fertilizer dealer—or salesman—who is trained to explain the results of the test to the farmer and to assist him in procuring the needed fertilizer materials. A copy of the test results and the laboratory's recommendations is retained by the laboratory and filed alphabetically by area or state. Samples are retained only briefly. When a retest is needed, new samples are collected from the farmer's field.

Consolidated Laboratories was established for a number of reasons—primarily to give faster service and more complete tests than were readily available to farmers in the sales territory service by the laboratory. Simplicity in analyzing the report was a must to enable the farmer to understand the fertilizer requirements of his soil. Another reason was to strengthen fertilizer sales programs, for it has been proved that after a dealer or salesman collects the soil samples and helps the farmer to interpret the results, it is easier to break down sales resistance and to promote his buying the right kinds of fertilizer materials.

One of the biggest problems confronting salesmen and dealers is getting farmers to take accurate samples. The farmers themselves are aware of this failing, and consequently, a high percentage will wait for the dealer or salesman to take the samples for them. In many cases it is even difficult to get the farmer to accompany the dealer or salesman while his fields are being sampled. He is content to allow the dealer or salesman to collect the samples and then wait to review the final report as to what is recommended to bring his farm up to the desired level of fertility.

Value of Soil Testing

For years articles in farm magazines, farm newspapers, and college bulletins and pamphlets have stressed the value of soil testing. Yet, in spite of all this publicity, including specific instructions on obtaining accurate soil samples, many farmers still do not take the time to have their soil tested. Most farmers do not use enough fertilizer. Others may purchase quantities of various costly elements not required by their soil. In some instances they purchase fertilizer materials on the basis of what

their neighbor buys, even though they are not farming exactly as he is, and may not have the same type of soil. With a soil test—and perhaps by spending a few more dollars per acre—profits can be materially increased.

A soil test report is vital to the farmer. He should keep it in a safe place, but available for easy reference. Consolidated Laboratories emphasizes the importance of the soil test by forwarding the laboratory report in an attractive, durable folder, suitable for placing in a file or bookcase. Handled in this manner it has less tendency to become mixed with other papers and misplaced.

In the Midwest, and in the center of the Corn Belt, there is an extremely wide variation in soil types and classifications. Soils range from practically pure sand to highly organic to almost pure clay—with all the various combinations in between. Some soils are highly calcareous, others podzolic, others well drained, still others subject to severe erosion. The midwest area has been farmed a shorter length of time than most other areas in the United States, and only in recent years have recommendations called for fairly high rates of supplemental plant food. Climatic factors generally favor high yields of corn, soybean, and hay crops.

Soil testing has definite value—to the dealer and the customer. However, experience has shown also that the report on the soil test must be expressed in simple terms so the farmer can understand its meaning. By having the report sent to the dealer or salesman, a twofold purpose is accomplished. After discussing the farmer's soil requirements, both know what fertilizer materials are needed to raise the desired bushels per acre. And after following recommendations, the farmer knows the soil-testing program really works.

Looking Ahead in Soil Testing

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It is essential to think ahead and consider what will be important 10 years from now. The prime objective is to bring about the most efficient and profitable use of plant nutrients by the agricultural producer.

WHILE soil testing is only one of many tools to assist the farmer in doing a precision job, it is an important link that demands top-flight programs. Thus we need to think ahead and consider what the agricultural producer

might want in the future—say 10 years hence. We must keep in mind that he will have a high investment business operation and will be interested in maximum profits. He will want to eliminate as many limiting factors as

possible. Through adequate soil testing one controllable factor, plant nutrient supply, will be taken care of. The prime objective is the most efficient and profitable use of lime and fertilizer by agricultural producers.