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COLLECTING AND TESTING SOIL SAMPLES

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A sample of soil should be collected to represent a soil type rather than to represent any particular field, for a field may include two or more different kinds of soil. One should study the field or farm sufficiently to be able to know the prevailing type or types of soil concerning which he desires to secure information based upon chemical analysis.

After one has become familiar with the type to be studied, the sample is collected by taking borings from twenty or more different places, a few rods apart, in each of which the soil should appear to be truly representative of the type. These borings thoroly mixed should make a trustworthy composite sample for analysis. An auger about 1¼ inches in diameter is the most satisfactory implement to use. If a considerable number of samples are to be taken, and particularly if samples of the subsoil are also to be secured, it is well to have the stem of the auger cut in two and a steel rod of good quality welded in to make the auger about 40 inches long. A wooden handle may be used or the stem end of the auger may be enlarged and threaded and a handle made by using two 6-inch pieces of ½-inch galvanized iron gas-pipe and a ½-inch "T." If the auger is to be used especially for examining and sampling soils, it is well to file off the screw point and the vertical lips.

Ordinarily, samples may well be taken in sets of three: the surface, or average plowed soil (0 to 6⅔ inches); the subsurface, or that which can possibly be moved with a subsoil plow (6⅔ to 20 inches); and the subsoil (20 to 40 inches); corresponding to about 2 million, 4 million, and 6 million pounds, respectively, of ordinary soil. The surface boring is made and the hole enlarged about ½ inch in diameter, the soil all being saved. The subsurface boring is then taken and the hole again enlarged, but the extra soil

is not saved. Finally the subsoil boring is taken and the soil saved from only one half (one groove) of the auger. This provides about equal quantities of soil from each stratum.

For the regular chemical analysis the sample of plowed soil representing the surface stratum (0 to 6⅔ inches) is by far the most important, and frequently this is the only sample that is analyzed. Perhaps the greatest importance which attaches to the subsurface and subsoil samples relates to the amount of limestone present or required. Very commonly the surface soil is practically neutral in reaction; whereas, the subsoil may be strongly acid in one class of soil types or it may contain an abundance of limestone in other soil types. If the subsoil is strongly acid, then it is very important that liberal applications of limestone should be made; otherwise the capillary waters rising from the subsoil in times of partial drouth will carry additional acidity into the surface soil, and if the surface soil contains no limestone, injurious results are almost certain to follow, especially with such sensitive crops as clover and alfalfa. But if the subsurface and subsoil contain limestone in solution, then as the water evaporates from the surface and the moisture in the subsurface and subsoil rises, the limestone will tend to correct any acidity existing in the surface stratum and thus prove beneficial to crops that are sensitive to acid conditions.

In so far as the subsurface and the subsoil are concerned, it is usually sufficient to make thoro tests for acidity and for alkalinity. The latter condition is represented chiefly by the carbonates of calcium and magnesium.

Following are directions for making these tests:

Soil Acidity.—To test for soil acidity make a ball of fresh, moist soil, break it in two, insert a piece of blue litmus paper, and press the soil firmly together again. After a few minutes examine the paper. If it has turned pink or red, soil acidity is indicated. The intensity of color and the rapidity with which it develops indicates to some extent the amount of acidity. (Blue litmus paper can be obtained from most drug stores, and five cents' worth is sufficient to make fifteen or twenty tests. To keep the unused paper fresh it should be preserved in a stoppered bottle in a dark place.)

It is especially important to test the subsoil for acidity, as already explained; but to make a thoro examination, samples should be tested both from the surface and from the subsoil at several different places in the field. The tests should be made by the landowner in the field rather than by the chemist in the laboratory.

The litmus paper test for soil acidity is long-established, trustworthy, and very useful. It can also be used for determining acidity in other materials, as in acid phosphate or in mixed fertilizers that contain acid phosphate. Put two or three spoonfuls of the fertilizer in a glass, add half a glass of water, stir well, let settle,

and then insert a strip of blue litmus paper; the paper will be quickly reddened by the acid solution.

Carbonates.—A positive test for carbonates in the soil precludes the presence of soil acidity, for carbonates, such as calcium and magnesium carbonate, are easily decomposed by acids, and serve as mild alkalis in the presence of which soil acidity cannot exist.

To test for carbonates, make a shallow cup of a ball of soil and pour into it a few drops of concentrated hydrochloric acid. If carbonates are present, they are decomposed with the liberation of carbon dioxid, which appears as gas bubbles, producing foaming, or effervescence. With much carbonate present the action is rapid and abundant, but with mere traces of it, only a few bubbles appear.

The same test may be applied to limestone, marl, etc., to ascertain whether carbonates are contained in the material. Most limestones and marls show some effervescence when brought into contact with cold concentrated acid, but some nearly pure dolomitic limestones require the application of heat to properly develop the reaction.

Five cents' worth of concentrated hydrochloric acid in a small glass-stoppered bottle is sufficient for many tests for carbonates. Of course, care must be taken not to get the acid on the clothing or skin. In case it gets on the fingers it should be washed off, or rubbed off with soil, as soon as possible. It is not especially dangerous to handle, but will soon "eat" or "burn" thru the skin if not removed or neutralized, which is easily done by rubbing with soil containing carbonates.

In the case of carbonates as in the case of acidity, it is especially important that the subsoil be tested, for an abundance of carbonates only 1 to 3 feet beneath the surface serves as a store and protection especially in critical periods in the growth of such plants as clover and alfalfa. These plants may die during a few weeks of summer drouth if the rising capillary moisture carries acidity, while if it brings traces of calcium bicarbonate, they will be kept alive.

Systematic Soil Investigations

Attention is called to the fact that a full report of the general soil survey of Illinois is given in Bulletin 123 of this station, "The Fertility in Illinois Soils." The bulletin includes a colored map showing all the great soil areas of the state, hundreds of soil analyses representing twenty-five of the most important and extensive soil types in Illinois, and typical illustrations of results obtained from different kinds of soil treatment and soil improvement on experiment fields in all sections of the state. Besides this the bulletin contains some definite information relating to the plant-food requirements of different crops, and the sources, the approximate cost, and the methods of using different plant-food materials.

Attention is also called to the fact that the detail soil survey of Illinois already covers forty-six counties. In this detail survey the extent, location, and boundary lines of every type of soil covering an area of ten acres are determined and mapped. Soil samples are collected from every type, and these are being analyzed and pot-culture and field experiments are being conducted so far as possible, so that when the maps are published the reports may also include definite information relating to the stock of plant food in every type of soil on every farm in the state, together with tried methods for maintaining or improving its productive power. (Soil Reports Nos. 1, 2, 3, 4, and 5, for Clay, Moultrie, Hardin, Sangamon, and LaSalle counties, have been published, and No. 6, for Knox county, is now in press.)

If the landowner has no other source of information concerning the composition of his soil, it is altogether advisable that he collect a composite sample of the surface stratum (made by mixing together borings taken from about twenty different places where the soil appears to be uniform and truly representative of the type) and employ a skilled commercial chemist to determine the total phosphorus and the total nitrogen content. In case of naturally poor or abnormal soils it is well also to have determined the total potassium, total magnesium, and total calcium.

The chief value of a chemical analysis is that it serves as an absolute foundation upon which methods of soil treatment can be safely based for the adoption of systems of permanent soil enrichment, not for one crop or one year only, but for progressive improvement.

No Chemical Analyses For Private Parties.

The Agricultural Experiment Station does not undertake to analyze samples of fertilizers, soils, or other materials for private parties: First, because the total annual appropriation for the investigation of all the soil problems of the state is less than 30 cents for each quarter-section of Illinois land, while to analyze a soil or fertilizer would cost many times that amount, thus rendering it impossible to make such analyses for all; and second, because the Experiment Station is established for the investigation of problems of public interest, and not for the inspection or control of private investments or enterprises.

That farmers generally understand and appreciate the fact that the State Experiment Station cannot and ought not to make such analyses is evidenced by the fact that, with a few exceptions, there has been no demand by Illinois citizens for such private work at public expense. That it would be impossible to do such work for all Illinois citizens is also evidenced by the fact that we have received as many as eleven samples of soil from one man with the request that they should all be analyzed. To attempt to do such work would only delay the progress of the systematic detail soil survey which, as already explained, is being made to cover every type of soil on every farm in the state.

It will never be possible for the Experiment Station to analyze the soil from every field of every Illinois farm, but it is possible and practicable to map the soils of the state in detail, and then to analyze representative samples of every type, so that ultimately every farmer can know what type or types of soil cover his farm, what the average composition of each type is, what crops are best adapted to the different soils, and what kinds of soil treatment or management are required to maintain or to increase the crop yields. All samples taken for analysis by the Station are collected by Experiment Station men connected with the systematic investigation of the soils of the state.