SOIL TESTING

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There are a number of things you can do for a better and quicker soil test. To make your soil test more accurate, make a special effort to do a good job of sampling your soil. To speed the return of your soil test results, proper preparation of the sample to be tested is important. This may mean revising your present system or it may not. The following report should help you decide this.

Soil testing is one of the older services offered to the farmer by state experiment stations. Not until the last few years, however, has it been generally recognized that greenhouse operators need a different type of soil test which is in line with the high fertility levels which are normally maintained in greenhouse soils. To date, not many states are equipped to do a good, rapid job of testing greenhouse soils. Of the ones which are, there are almost as many methods as there are soil testing laboratories. If you have sent soil samples to more than one laboratory testing greenhouse soils, you may well have gotten different numerical results for the same soil. Every good method is based upon research data and satisfactory experience with that test in the past in the area where it is used. A difference in soil test reading is simply a matter of scale and different laboratories will eventually arrive at the same fertilizer recommendations, even though the numerical values may differ. Even then, a soil test is, at best, an approximation involving considerable error. Some of the ways in which you can help to reduce this error are included in good sampling technique.

SAMPLING TECHNIQUE

Sampling error is the greatest block to accurate soil testing. In almost every case, sampling error is considerably greater than the error involved in the soil test itself. As a result, the accuracy and value of the soil test are largely in the hands of the person who takes the sample. The three main sources of error in sampling soils are discussed below. With care they can be minimized.

(1) Depth of sampling: The nutrient level of a greenhouse soil can vary considerably with depth. For instance, immediately after addition of fertilizer, the top inch would be expected to be much richer in nutrients than soil at deeper levels, since the fertilizer would not have had time to wash very far into the soil. On the other hand, when the soil is somewhat depleted of fertilizer, the top inch would be expected to be the most depleted area, due to more complete washing of fertilizer from this layer. This error can be eliminated by using a soil sampling tube which takes a core equally representative of all depths. A trowel can be used, in which case much more care must be used to sample equally from all depths. In some cases, it may be of value to remove the top half or quarter inch prior to sampling, especially if salts tend to accumulate on the surface, as in the constant water level method of watering.

(2) Evenness of surface: If the surface of the soil is not level, water will tend to collect in the low areas and leach the fertilizer more heavily in those areas. Care should be taken to keep the surface as level as possible and to sample equally from high and low areas.

(3) Section of bench: It is common for a soil to vary in nutrient level at different locations along the bench, due to uneven application of fertilizer, uneven watering, uneven soil preparation or composition, uneven plant growth due to non-soil factors, or any of a number of other reasons. This is where most of the sampling error occurs. Variation across the bench can be taken into account by sampling at different distances between the edge and center of the bench. Variation along the length of the bench can best be counteracted by including soil from a number of different locations along the bench in the sample. The following data will illustrate the type of variation which can be expected and will indicate the value of good soil sampling.

July 11, 1956, ten-foot sections of four benches were selected and from each section ten cores were taken, one per linear foot. All cores were taken halfway between the edge and center of the bench. The results of soil tests made at the Floriculture Soil Testing Laboratory on the first bench sampled are shown in the following table:

Core Number	NO_3	P	K	pH	Soluble Salts
1	4	10	10	7.0	86
2	4	8	8	6.9	84
3	3	6	tr	7.1	55
4	5	10	tr	7.0	86
5	5	8	tr	6.8	93
6	4	6	tr	6.9	82
7	3	4	tr	7.1	64
8	3	4	tr	7.0	53
9	2	6	tr	6.8	70
10	2	6	tr	6.9	45

It is evident from these results that had one core been taken from any of these locations, it would have represented the whole area almost as well as the ten cores did. This is because the whole area was badly in need of a fertilizer application. When fertilizer levels are higher, in the low part of the favorable range, however, variation becomes more important, as is shown in the test results of the second bench below, which contained chrysanthemums.

Core Number	NO_3	P	K	pH	Soluble Salts
1	3	6	tr	6.8	86
2	4	3	tr	7.0	74
3	16	4	5	6.8	104
4	41	4	5	6.8	129
5	48	6	8	6.6	110
6	55	8	8	6.4	151
7	50	7	5	6.6	129
8	29	6	5	6.6	117
9	21	6	5	6.8	92
10	29	6	5	6.6	125

Even more extreme variation is demonstrated in the test results of a third bench in which roses were growing well.

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Core Number	NO_3	P	K	pH	Soluble Salts
1	6	6	10	5.7	32
2	71	10	38	5.3	107
3	65	10	40	5.1	117
4	22	5	20	5.2	59
5	2	6	10	6.6	23
6	16	6	15	6.2	32
7	11	6	12	6.2	27
8	28	10	18	6.2	59
9	80	10	25	5.2	107
10	51	8	15	5.2	74

It can be seen from these results that careful and thorough sampling can greatly affect the accuracy of the soil tests. Suppose, for instance, that three cores were taken in this last bench, and suppose that they were numbers 1, 4, and 7. The average of these would be as follows:

Core Number	NO_3	P	K	pH	Soluble Salts
1, 4, 7	13	6	14	5.7	39

If on the other hand, cores 2, 5, and 8 were averaged, the results would be:

Core Number	NO_3	P	K	pH	Soluble Salts
2, 5, 8	34	9	22	6.0	63

If one location alone was sampled, the results could be as far apart as those of cores number 2 and 5. It is apparent that a single recommendation as to the number of samples to take cannot be made which will fit all situations. The best rule to follow is this: Try to know as much about the history of the soil in a given bench as possible, so as to know where to expect unusually large variation. Then sample accordingly. The number of cores which go into a sample should be more than enough to fill a sample box. When the cores to go into one sample have been collected, place them all in a pile and mix very thoroughly. Then take enough from the pile to fill the sample box well. If you know that half a bench has had different treatment from the other half, it would probably pay to sample each half separately and make two benches of it for testing purposes, at least until the two halves once more become similar. When very long benches are involved, this procedure may prove economical even when no unusually large variation is expected.

PREPARATION OF THE SAMPLE

When a sample of soil to be tested is sent to the Floriculture Soil Testing Laboratory at Cornell, it is possible, by following a few rules in preparing the sample, to speed the return of the results by a day or two. A certain amount of preparatory work on a sample is necessary before that sample can be tested. When a sample arrives with the bulk of this preparation already done, it can be tested before unprepared samples which have been received a day or two earlier.

Some of the things which can be done to prepare a sample for analysis are listed below:

(1) Screening. Each sample received must be pushed through a 2 mm. screen before it can be tested. Common fly screening is adequate for this purpose. In this way, stones and large pebbles which would cause an error in the test are eliminated. The entire sample must be screened, even though only a part of it is used for testing.

(2) Drying. Each sample must be dried to air-dryness before it can be tested. This may be done simply by spreading the sample out on paper in the sun and allow it to dry out. In dark weather or for quicker drying at any time, samples may be placed in an oven at low heat (below 100°F).

(3) Wrapping. The sample boxes furnished by the laboratory are waterproof. If a sample is sent in wet, it does not need to be wrapped in any other material. Too much wrapping of a wet sample often results in mildewing.

(4) Information cards. For most efficient operation, the information cards should arrive at the laboratory at the same time as the sample. One simple way to insure this is to wrap all the samples in one package to be sent fourth class mail. The completely filled out cards can then be enclosed in an envelope, stamped for first class and attached to the package going fourth class. Failure to send the information card greatly lessens the value of the soil test.

(5) Size of sample. So that there will be adequate material for the complete series of soil tests, the sample boxes should be well filled. Too small a sample may result in delay or incomplete testing.

(6) Information sheet. The laboratory sends out a sheet on soil sampling and packing. Be sure you have one of these on hand. Information sheets, as well as boxes, can be obtained from:

Soils Laboratory
Department of Floriculture
Plant Science Building
Cornell University
Ithaca, New York

INTERPRETATION OF RESULTS

As part of your soil testing service, recommendations are made from the interpretation of the tests based on the numerical values of the test and the information card. Since these tests do not measure insoluble fertilizers, it is important that the person making the recommendations should know whether the fertilizer which has been applied is soluble or not. When such fertilizers as urea, urea formaldehydes, and some of the older organic fertilizers are used, the nutrients measured are those which are in immediately available form for plants. The reserve nutrients, though present, are not measured by standard soil tests. This should be kept in mind as a distinct disadvantage of these types of fertilizers.

RESULTS

Recommendations are more or less standard for convenience in application of fertilizers. They are made in an attempt to keep nutrient levels within a favorable range rather than at a single point, as plants grow well over a fairly wide range. Closer control would be impractical, if not impossible.

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