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Popular Kheti
Volume -6, Issue-4 (October-December), 2018
Available online at www.popularkheti.com

eISSN: 2321-0001

Soil Testing: Feed the Soil by Knowing its Existing Nutrient Status

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Soil testing is an important diagnostic tool for determining the nutrient needs of plants and for environmental assessments. Some soils are inherently deficient in plant nutrients where as other soils had sufficient levels of nutrients in the past, but removal with crop harvest has depleted the reserves. Thus, soil testing is widely accepted and used in most advanced crop- production areas of the world to determine fertilization needs for crops. Soil testing can also be used to identify application rates of waste materials containing nutrients or other elements that could harm the environment.

Introduction

The farmers find it extremely difficult to know the proper type of fertilizer, which would match their soils. In using a fertilizer one must take into account the requirement of his crops and the characteristics of the soil. Soil testing is required prior to the crop planting to calculate the fertiliser rate for primary and secondary nutrients. The basic objective of the soil-testing programme is to give farmers a service leading to better and more economic use of fertilizers and better soil management practices for increasing agricultural production. High crop yields cannot be obtained without applying sufficient fertilizers to overcome existing deficiencies. Efficient use of fertilizers is a major factor in any programme designed to bring about an economic increase in agricultural production. The farmers involved in such a programme will have to use increasing quantities of fertilizers to achieve the desired yield levels. However the amounts and kinds of fertilizers required for the same crop vary from soil to soil, even field to field on the same soil. The use of fertilizers without first testing the soil is like *taking medicine without first consulting a physician to find out what is needed*. It is observed that the fertilizers increase yields and the farmers are aware of this. But are they applying right quantities of the right kind of fertilizers at the right time at the right place to ensure maximum profit? Without a fertilizer recommendation based upon a soil test, a farmer may be applying too much of a little needed plant food element and too little of another element which is actually the principal factor limiting plant growth. This may not only be uneconomical use of fertilizers, but also in some cases crop yields actually may be reduced because of use of the wrong kinds or amounts, or improper use of fertilizers. A fertilizers recommendation from a soil testing laboratory is based on carefully conducted soil analyses and up-to-date agronomic research on the crop, and therefore it is most important to have scientific information available on fertilization of particular crop in that field. Each recommendation based on a soil test takes into account the values obtained by analysis, the research work so far conducted on the crop in the particular soil areas and the management practices of the concerned farmer.

The soil test with the resulting fertilizer recommendation is the actual connecting link between agronomic research and its practical application to the farmers' fields. However, soil testing is not the end in itself. It is one of all the means to the end leading to significant production. Mere following the soil test recommendations alone does not assure a good crop. Good crop yields are the result of the application of other good management practices, such as proper tillage, efficient water management, good seed, and adequate plant protection measures, etc. Soil testing is essential and is the first step in obtaining high yields and maximum returns from the cost incurred in fertilizers.

Objectives of Soil Testing

- To evaluate the fertility status of a soil for providing an index of nutrient availability or supply in a given soil.
- To predict the probability of obtaining a profitable response to lime and fertilizers.
- To provide a basis for recommendations on the amount of lime and fertilizer.
- To evaluate the fertility status of a soil on area basis by the use of soil test summaries. Such summaries are helpful in developing both farm level and nutrient management programmes.

The soil testing is comprised of four consecutive steps (i) Collect a representative soil sample from the field (ii) Determine the quantity of plant available nutrient in soil sample with the help of soil test (iii) Interpret the soil test results (iv) Estimate the quantity of nutrient required by the crop.

Soil Sampling

The most critical aspect of soil testing is obtaining a soil sample that should be representative of the whole field. A useful soil testing service starts with the collection of representative soil samples. Soil sample must be taken at the right time and in the right way. The tools used, the area sampled, the depth and the correct mix of the sample, the information provided, and packaging all influence quality of the soil test data.

Sampling Time

Soil samples must be taken before sowing of the crop or establishing a new orchard. For agricultural crops, the best time of sampling is when the field is free of crops. For horticultural crops, the best time to collect a soil sample is during autumn. As a general rule, it is best to go for soil sampling a couple of weeks prior to the start of any seedbed preparation. In case of perennial crops like forage and fruit trees, soil sampling should be done prior to the beginning of a new flush of growth.

Tools Required

Uniformity of samples is necessary for representative or composite field samples. The tools required are:

- A soil auger or probe or a shovel or spade
- A clean pail for mixing
- Sample bags and information sheets

Fig. 1

Sampling Units

Divide the area into sampling units based on visual observations on crop growth, appearance of the soil, soil colour, field slope, previous crop history, past crop management practices like manuring, fertilization techniques and cropping techniques etc. Collect one composite sample from each block or unit.

Sampling for Agricultural Crops

Step 1: First remove the litter from the surface by scraping it away at each spot selected for soil sampling.

Step 2: If probe auger/specially designed soil sampling tubes are available, then take about 15-20 surface soil samples (0-15 cm) from each block (sampling unit) of about ½ acre area in a random zig-zag manner as shown in figure 2. Avoid sampling near houses, roads, bunds, channels, marshy spots, trees, recently fertilized area, compost pits, any other abnormal spots and other non-representative locations. Collect these in a clean dry container or cloth sheet.

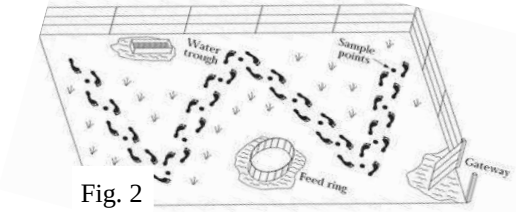


Fig. 2

Step 3: If a *khurpi* or a spade is used, first dig a 'V' shaped hole (15-20 cm) and take out the soil-slice (like bread-slice) of ½ inch thickness from one of the exposed surface (Figure 3).

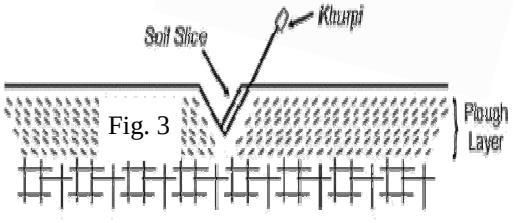


Fig. 3

Step 4. Mix the collected soil samples thoroughly on a clean piece of cloth or polythene sheet. Level it and divide into four quarters with the help of finger or wooden stick (Figure 4). Discard the soil in the opposite quarters (Figure 5).

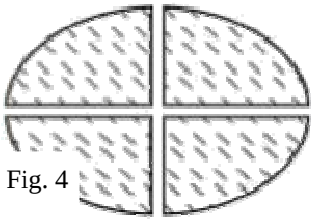


Fig. 4

Step 5. Mix rest of the soil and continue quartering till about ½ kg of representative soil is obtained. Dry the sample in shade and fill in the cloth or polythene bag with adding the label. The soil sample is now ready for submitting/sending to the soil testing laboratory for its analysis.

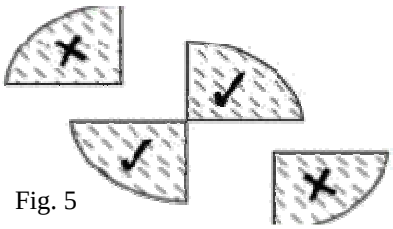


Fig. 5

Step 6. If the sample is to be analyzed for micronutrient(s), a stainless steel probe auger must be used. In case, stainless steel probe auger is not available, then stainless steel *khurpi* could be used for drawing the soil sample.

Sampling for Horticultural Crops

Roots of horticultural crops penetrate deep into the soil profile and the success of plantations depends upon the fertility status of sub-soil layers. So, the method of collecting samples for horticultural crops is different from agricultural crops.

Step 1. Dig a pit to a maximum of 150 cm depth or till one gets hard pan/bed rock or water table. Make one side of this pit vertical for soil sampling.

Step 2. Mark the vertical side of the pit at 15, 30, 60, 90, 120 and 150 cm depth from the surface.

Step 3. Hold a bucket or container at 150 cm mark and collect about half kg of soil-slice of ½ inch thickness from 120-150 cm depth and transfer the sample to a storage bag.

Step 4. In the same way collect the samples from preceding upper layers i.e. 90–120, 60–90, 30–60, 15–30 and 0–15 cm depths. Mark sample number with corresponding depth on each sample. For example sample collected from 90–120 cm depth would be sample no. 5 and the one from 60–90 cm depth sample no. 4.

Step 5. Put one information label inside each bag and tie one to the sampling bag.

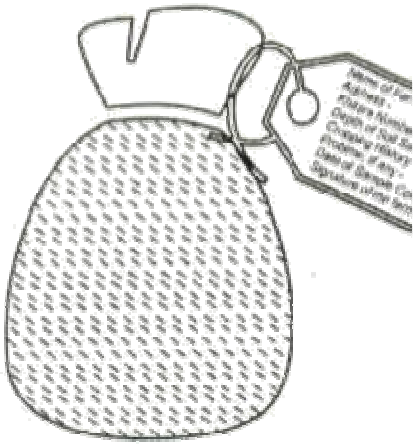
Step 6. Send the soil sample to the nearest soil testing laboratory.

Precautions during sampling for horticultural crops

- While sampling soil at different depths in a soil profile or sampling pit, care must be taken to start sampling from the last layer so as to avoid mixing of soil from the upper layers with the soil of lower layers.
- In case there is hard pan within 150 cm depth from the soil surface, its depth and thickness must be recorded, because the recommendations for orchard establishment would depend upon effective soil depth and its nutritional status.
- Similarly, if water table is shallow, its depth must also be recorded.

Sample Submission

After completion of soil sampling some basic information have to be provided along with the soil sample which includes (a) Name and address of the farmer (b) Khasra number or any other identity that identifies the field i.e. Latitude & Longitude (c) Availability of irrigation facilities (d) Land type: Upland/Medium land/Lowland (e) Information of the previous crops before soil sample collection (f) Name and variety of the crops that would be grown during the next seasons (g) Dose of fertilizers, if applied. (h) Problem(s), if any in the sampling area (like water logging problem, low yields, low response to added inputs, stunted growth of plantation crops etc.) (i) Date of soil sample collection etc. Send soil samples to your nearest soil testing laboratories as early as possible.



Role of the Extension Service in Soil Testing

The actual analysis of the sample and the making out of fertilizer recommendation is only part of the soil testing service. To a large measure, the efficiency of this service depends upon the care and effort put forth by extension workers and farmers in the collection and dispatch of samples to the laboratory. Its effectiveness also depends upon the proper follow the fertilizer recommendations on farmer's field. In this work, extension service play the most important role, since they are the people directly in contact with the farmers or this reason, the soil chemist in charge of the laboratory must give periodic and through training to the extension staff on these subjects.

Conclusion

Applying right quantities of the right kind of fertilizers at the right time at the right place to ensure maximum profit is possible after soil testing. Therefore soil testing is essentially and equally important as other aspects of crop management.