Nitrogen, Phosphorus and Potassium

Information on the available nutrient status of soils is used for wide ranging purposes, from advising individual farmers on the fertilizer needs of their fields to the preparation of areawise soil fertility maps and monitoring changes in soil fertility over a period of time.

NPK :

Based on the analysis of several million samples, district-wise soil fertility maps for N, P and K were published in the 1970s (IARI 1980). These provided an overall picture of the available nutrient status of soils.

In spite of their limitations, these have served the purpose of creating an awareness about the extent of nutrient deficiencies in agricultural soils.

Table 1: Generalized available N, P and K status of Indian soils.

Nutrient	Districts Surveyed	Districts having available nutrient status of District Surveyed		
		Low	Medium	High
N	364	228	118	18
P	361	170	184	17
K	361	47	192	122

Source : IARI (1980)

Unfortunately, this exercise of compilation of soil test results has not been continued at the national level with the result that a consolidated, updated picture is not available. Some updating of soil test summaries is carried out by different states and such information is compiled by the FAS's regional offices. In most states, average soil fertility rating is done with district as the unit but in some state (Gujarat, Uttar Pradesh) ratings are available down to the block/taluka level. Actually, it should be rather easy to continuously update soil fertility information since the location

Fertilizer	Nutrient content (%)				
	N	P_2O_5	K_2O	S	Other
Solubor					B19%
Copper Sulphate				13	Cu 24%
Ferrous Sulphate				12	Fe 19%
Cheated Iron as Fe-EDTA					Fe 12%
Manganese Sulphate				15	Mn 30.5%
Zinc Sulphate				11-16	Zn 21%,or33%
Chelated Zinc as Zn-EDTA					Zn 12%

related matters have been spelt out in the Fertilizer Control Order (FCO).

Since common fertilizers also contain a number of micronutrients in variable amounts, this information is provided in Table 7.These micronutrients are not deliberately added but originate from various raw materials and intermediates which are used in fertilizer production. In addition, some pollutant heavy metals such as arsenic, lead and cadmium can also be present in some fertilizers and their contents need to be monitored. Some information on lead, chromium and cadmium content of fertilizers and raw materials is provided in Table 8. In the specification set out in the FCO,the limit of arsenic in ammonium sulphate has been set at maximum of 0.01% As_2O_3 and of lead at.0.003% in zinc sulphate and manganese sulphate. Since the nutrient composition of fertilizers is commonly expressed on fresh weight basis, determination of their moisture content is an integral part of fertilizer analysis.

$$\text{Calculation : } NH_3\text{-N, mg/1} = \frac{(A-B) \times 280}{\text{ml sample}}$$

where A = Volume of H_2SO_4 used for sample,ml
and B = Volume of H_2SO_4 used for blank,ml

Practical suggestions:

- Use NH_3-free distilled water for preparation of boric acid and other reagents.
- Before adding MgO or NaOH, place and connect boric acid containing conical flask to the condenser end point,
- To avoid frothing, add paraffin wax and prevent bumping by adding few glass beads.

Nitrate Nitrogen:

Principle: This method depends upon the reduction of nitrate to ammonia by Devarda's alloy and alkali as under:

$$3NO_3^- + 8A1 + 5\,OH^- + 2\,H_2O \longleftrightarrow 8\,A1O_2^- + 3\,NH_3$$

The nitrite (NO_2^-) if present in the sample are also reduced and determined along with NO_3-N.

Reagents : Same as given for ammonium determination are needed. In addition, Devard's alloy (50 Cu:5 A1:5 Zn) which is finely ground to pass a 0.15 mm sieve is needed.

Procedure : Take either a fresh sample (50 ml) into the distillation flask and add reagents as given under NH_4-N determination along with 0.2 gm of Devarda's alloy or remove the stopper of flask after NH_3 distillation and put 0.2 gm Devarda's alloy if sufficient aliquot (40-50 ml) is left. Rapidly replace the stopper and distill ammonia into fresh boric acid (with mixed indicator) and do the titration as described earlier.

cobalt hydrocarbonate and potassium iodoplationate respectively.

4. A turbidimetric method depending upon a suspension of potassium cobaltinitre can be used where greater accuracy is not required (Olsen 1953). Bennet and Reed (1965) used alkaline tetraphenylboron and measured its turbidity 525 nm after adding solution of EDTA to mask the effect of Ca and Mg.

5. Like sodium, potassium can also be determined with the K selective glass eletrodes in combination with calomel reference electrode by using a potentiometer.

Determination of Trace Elements /Heavy Metals:

Water samples, particularly industrial effluents may contain undesirable amounts of zinc, cadmium, chromium, copper, cobalt, iron, lead, lithium, selenium etc. These can be determined by atomic absorption spectrophotometer by employing the appropriate hollow cathode lamp for the elements of interest. Details of analysis are basically similar to those described for these elements in chapter 10 and chapter 12.

Water Quality Indices and Suitability:

Quality Indices:

After analysis of water samples for different parameters like total salt, (EC), cations and anions, it is imperative to calculate some indices in order to asses water quality and its subsequent effect on soils. Important indices of water quality used are the following:

Sodium Absorption Ratio (SAR) : It is calculated to indicate the sodicity or alkalinity hazard of irrigation water.

$$SAR = \frac{Na}{\left[\frac{Ca + Mg}{2}\right]^{1/2}}$$

where, concentration of cations is in me/1.