Measurement of Soil Organic Matter in Different Lithology of Karachi

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Abstract: Different soil types of the area were collected, analyzed and classified for organic matter, pH, and density, hydrogen, oxygen, sulphur & nitrogen contents. Organic matter is maximum in shale (1.10%), which falls in the poor category, having pH weak alkaline (7.4). Nitrogen is higher in shale sand (1.68%), which is alkaline (7.4) is considered as best for normal plant growth. Sulphur contents are higher in clay stone (3.20%). Fertilizer recommendations were advised the farmers according to soil conditions.

Key words: Organic matter, soil types, fertility status, nitrogen, hydrogen, lithology of Karachi.

Introduction
Soils of the Punjab alluvial plains are generally low in nitrogen and phosphorus due to long mining of these elements by crops. Accordingly the behaviour of applied major nutrients like N, P and K reflects different response trends on different crops under varied fertility level of soils (Khan et al., 1997). According to Myszkow et al. (1994) the results of the investigations obtained in a long term field experiment at Boboroukovo gave a basis for formulation of the Biological Index of soil fertility (B) for sandy soils, amended by fertilizing with manure and enriched with lime and clay. This Index is the function of three variables: 1. The rate of multiplication, of the microflora groups or the enzyme activity in the soil (M). 2. The content of organic matter in the soil (H) and 3. The total absorption capacity of the soil (T).

The annual crop legumes, grown in rotation with cereal crops, can contribute to the total pool of N in the soil and improve yields of the cereals (Herridge et al., 1983). According to Tissen et al. (1994) reported that many tropical soils are poor in inorganic nutrients and rely on the recycling of the nutrients from soil organic matter to maintain fertility. The role of organic matter in soil fertility has been well known for hundreds of years, but the role of humus quality and its environmental functions has been discovered only during the last 30 years (Hargitsi, 1993). Gupta et al. (1992) reported that the availability of N, P, K and organic carbon content of soil at 0 to 15, 15 to 30 and 30 to 45 cm depth were estimated in a long term field experiment testing farm yard manure (FYM) and fertilizer N doses in a pearl millet - wheat cropping sequence. Application of farm yard manure increased available P, K and organic carbon content of soil at all depths and doses of fertilizer recommendations (Chaudhary, 1980). K is absorbed by plants in large quantities than any other element except nitrogen and is essential in complicated processes of plant metabolism and exert favorable effect on plant growth yield and crop quality (Saleem and Bertilsson et al., 1978).

The amount of potassium in soil may influence the need for potash fertilizer. It is of general view that most of cultivated soil in Pakistan has sufficient supply of available potassium for optimum plant growth (Bhatti, 1978). Sandy soil, however, are usually deficient in potash. In this regard, the extent of sandy soils in Pakistan is nearly 6% (1.6 ha) of total cultivated area in the canal commanded area (Mian and Ashraf, 1980). Analysis of thousand of soil sample in Punjab during 1973-78 show K value (ammonium acetate extractable) ranged from 142-360 mg K kg⁻¹, available potassium in surface 0.6 inch depth and 122-656 mg K kg⁻¹ in 6-12 inch depth (Bhatti, 1978). According to Guillaum et al. (1999) the typical features of soil organic matter dynamics and soil texture were used to study the particular spatial pattern of tiger bush in Niger and its variability in the vegetation as well as in the bare area. These variations are linked to water / wind erosion and termite activity. According to Aslam et al. (1994) there are numerous biochemical reasons as to why tolerant rice’s maintained better K⁺ and K⁺ Na in their tissues relatively free from toxic ions besides maintaining assured supply of K⁺. Similarly K⁺ concentration had a pivotal role in the induction of salt tolerance in rice Aslam et al. (1993 b). They further argued that Na⁺ and particularly Cl⁻ exclusion besides maintenance of high K⁺ concentrations and especially the K⁺ Na ratio was the major physiological traits of salinity tolerance in rice. Ashraf and Akrum (1999) reported that in Central Rechna Doab that the use of potassium should be popularized.

The soils of Pakistan are characteristically low in organic matter < 1% (Azam, 1986). Studies on different crops had shown large increase in yields in soils deficient in organic matter under increasing level of N and P (Khan et al., 1997) and greening manuring (Akrum et al., 1982). Farm yard manure (FYM) is specially beneficial as it improved the physical condition of soils and offset nutritional problems of the plants (Ghafoor et al., 1990) and its continuous use resulted in lowering of soil pH increase in organic matter, cation exchange capacity (CEC) and exchangeable cations (Lohia et al., 1980). Bhairaguvanchi (1988) observed that long term application of FYM and fertilizers did not effect soil pH, however water holding capacity (WHC) was improved by 25% in sandy loam and 35% in clay loam soils while use of fertilizers alone increased salt content (Conductivity) of soils. Many tropical soils are poor in inorganic nutrients and rely on the recycling of the nutrients from soil organic matter to maintain fertility. In undisturbed rainforests such nutrients are recycled via the litter (Tissen et al., 1994). The role of organic matter in soil fertility has been well known for hundreds of years, but the role of humus quality and its environmental functions has been discovered only during the last 30 years (Hargitsi, 1993). Scholes (1990) observed that in dry savannas, soil fertility has a controlling influence on the slope of the relation between annual rainfall and annual above ground herbaceous production. It also influences many other aspects of their structure and function; such as species composition, morphology, forage chemistry and degree and type of herbivore. Syers and Springett, (1984) reported that earthworm redistribute organic materials within the soil, increase the soil penetrability and, under certain conditions, influence ion transport in soils. They influence the supply of
Table 1: Number of lithology analyzed for density, pH, hydrogen, oxygen, sulphur & nitrogen in soil organic matter.

<table>
<thead>
<tr>
<th>Lithology</th>
<th>Density</th>
<th>pH of Lithology</th>
<th>% of Organic Carbon in Rock</th>
<th>% of Oxygen Matter in Rock</th>
<th>% of Oxygen in Organic Matter</th>
<th>% of Sulphur in Organic Matter</th>
<th>% of Nitrogen in Organic Matter</th>
<th>% of Hydrogen in Organic Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Sand</td>
<td>2.45</td>
<td>7.2</td>
<td>0.48</td>
<td>0.92</td>
<td>9.6</td>
<td>1.30</td>
<td>0.18</td>
<td>0.87</td>
</tr>
<tr>
<td>Clay Stone</td>
<td>2.43</td>
<td>7.8</td>
<td>0.47</td>
<td>0.87</td>
<td>2.00</td>
<td>4.20</td>
<td>0.48</td>
<td>4.80</td>
</tr>
<tr>
<td>Lime Stone</td>
<td>2.69</td>
<td>6.8</td>
<td>0.45</td>
<td>0.96</td>
<td>2.00</td>
<td>4.20</td>
<td>0.48</td>
<td>4.80</td>
</tr>
<tr>
<td>Sand</td>
<td>2.54</td>
<td>6.9</td>
<td>0.57</td>
<td>1.00</td>
<td>2.00</td>
<td>4.20</td>
<td>0.48</td>
<td>4.80</td>
</tr>
<tr>
<td>Shale</td>
<td>2.80</td>
<td>7.4</td>
<td>0.55</td>
<td>1.00</td>
<td>2.00</td>
<td>4.20</td>
<td>0.48</td>
<td>4.80</td>
</tr>
<tr>
<td>Shale Sand</td>
<td>2.50</td>
<td>7.4</td>
<td>0.50</td>
<td>1.00</td>
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<td>4.80</td>
</tr>
</tbody>
</table>

nutrients in several ways by increasing the rate of recycling. Qureshi et al. (2000) reported the organic matter status of Gujrat Khan Tehsil that 100% soil samples were deficient in organic matter because of intensive cultivation of crops and arid climate had further aggravated the situation. As regards the texture 25% samples were sandy loam, 60% loam and 15% were clay loam in all the sites of Gujrat Khan tehsil. Soils testing program is essential to formulate site-specific fertilizer recommendations, as proposed by Welch and Vliere (1977). Out of 269 soil samples analyzed from Rawalpindi district during 1990-1995, 84% soil samples were adequate and 16% were satisfactory in potassium (Mehmood et al. (1998)). Saleem and Bertilsson (1970) reported that soil of Pakistan are generally considered well supplied with potassium except for some soil in districts of Mianwali, Faisalabad, Rawalpindi, Attock, Jehovah, Slalkot, Gujranwala and Rahim Yar Khan. Objective of this study was to evaluate soil fertility status on the basis of soil samples of Karachi.

Materials and Methods
Composite soil samples from Fatehjang of District Attock were collected from 0-15 and 15-30 cm depths to assess organic matter status. Previous crop history was recorded for formulating the recommendations. Samples were air dried, ground and passed through 2mm sieve and analyzed for physicochemical characteristics in G & R Laboratory GTLI, I-9 Islamabad. Soil samples were analyzed for organic matter (Cottenie et al., 1979). Soil pH was recorded (Schofield and Taylor, 1965). According to the methods of Richard (1954) the elements like Hydrogen, Oxygen, Sulphur & Nitrogen from the organic matter were determined.

Rock eval 2 plus (Crommene & Espitalie, 1989) with acquisition workstation has been deployed for the determination of organic matter hydrogen and oxygen in the soil. Total organic nitrogen is determined by semi micro Kjeldahl method (Heese, 1971) and sulphur is determined by Bardsley and Lancastres methods.

Results and Discussion
The data concerning soil organic matter, conductivity, pH, hydrogen, oxygen, sulphur & nitrogen is given in Table 1. Organic matter is essentially required for plant growth but its contents varies in different soil types. Organic matter is maximum in shales (1.10%), which falls in the poor category, having pH weak alkaline (7.4). Nitrogen is higher in shale sand (1.68%), which is alkaline (7.4) is considered as best for normal plant growth. Sulphur contents are higher in clay stone (3.20%).

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References
Abbas et al.: The measurement of soil organic matter in different lithology of Karachi


