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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.*, 1987). According to Myskow *et al.* (1994) the results of the investigations obtained in a long term field experiment at Boborowko gave a basis for formulation of the Biological Index of soil fertility (F) 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, grow 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.*, 1993). 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 (Hargitai, 1993). Gupta *et al.* (1992) reported that the availability of N, P, K and organic carbon content of soil at 0 to 15, 16 to 30 and 31 to 45 cm depths 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 mearly 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 122-550 mg K kg^{-1} in 6-12 inch depth (Bhatti, 1978).

According to Guillaume *et al.* (1999) the typical features of soil organic matter dynamics and soil texture were studied to discuss 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 the toxic ions besides maintaining assured supply of K^+. Similarly K^+ concentration had a pivitol 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. Arshad and Akram (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, 1988). 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.*, 1987) and green manuring (Akram *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). Bhariaguvanshi (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 fertlity. 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 (Hargitai, 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,

Lithology	Density	pH of Lithology	% of Organic Carbon in Rock	% of Oxygen Matter in Rock	% of Oxygen in Organic Matter	% of Sulphur in Organic Matter	% of Nitrogen in Organic Matter	% of Hydrogen in Organic Matter
Clay Sand	2.45	7.2	0.48	0.92	9.6	1.30	0.16	8.00
Clay Stone	2.43	6.9	0.43	0.82	7.00	3.20	0.27	5.66
Lime Stone	2.69	7.8	0.47	0.87	6.30	1.02	0.60	8.80
Sand	2.54	6.9	0.46	0.90	8.20	0.20	0.48	8.40
Shale	2.80	7.4	0.57	1.10	13.20	1.10	0.38	7.60
Shale Sand	2.50	7.4	0.55	1.03	8.9	1.16	1.68	7.00

nutrients in several ways by increasing the rate of recycling.

Qureshi *et al*. (2000) reported the organic matter status of Gujar Khan Tehsil that 100% soil samples were deficient in organic matter because of intensive cultivations 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 Gujar Khan tehsil.

Soils testing program is essential to formulate site-specific fertilizer recommendations, as proposed by Welch and Wiere (1977). Out of 29595 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 (1978) reported that soil of Pakistan are generally considered well supplied with potassium except for some soil in districts of Mianwali, Faisalabad, Rawalpindi, Attock, Jehlum, Sialkot, 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 physico chemical characteristics in G & R Laboratory OGTI, I-9 Islamabad. Soil samples were analyzed for organic matter (Cottenie *et al.*,1979). Soil pH was recorded (Schofield and Taylor, 1955). According to the methods of Richard (1954) the elements like Hydrogen, Oxygen, Sulphur & Nitrogen from the organic matter were determined.

Rock eval 2 plus (Crumieri & 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 Kjeldahal method (Heese, 1971) and sulphur is determined by Bardsley and Lancastes 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 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 %).

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According to Arshad & Akram (1999), it is well to remember that plant growth is dependent upon a favourable combination of manufactures: light, mechanical support, air, water & nutrients. If any one of them is out of balance with others, it can reduce or even entirely prevent the growth of plants. Furthermore the factor, which is least optimum, will determine the level of crop production. Soil fertility status varies with nature of crop pattern & management practices. Therefore, assay of fertility is essential for judicious fertilization and assurance of better return from food and fibre.

Keeping in view situation, the silty shale soil is strongly recommended to be suitable for plants growth because the organic matter and other essential elements are available in adequate and satisfactory level. So the farmers should grow wheat (*Triticum aestivum* Linn.) and rapes and mustard (*Brassica sp.*) with chick pea (*Cicer arietinum*) alternatively in winter (Rabi) while groundnut (*Arachis hypogaea*) and pulses with maize (*Zea mays*) and Sorghum (*Sorghum vulgare*) in summer (Kharif) season in the same field to restore the soil fertility.

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