Pakistan Journal of Applied Sciences 3 (3): 173-177, 2003
ISSN 1607-8926

Fertility Status of the Soils Around Tandojam, District Hyderabad, Sindh, Pakistan

[1]F.C. Oad, [1]U.K. Gaimnani and [2]H.A. Samo
[1]Sindh Agricultural University Tandojam, Pakistan
[2]Arid Zone Research Institute (PARC), Umerkot, Pakistan

ABSTRACT

In order to determine the macro nutrients content (N.P.K) and some physico-chemical properties of the soils of different soil series around Tandojam, the soils samples were collected from six different soil series i.e Lalian, Miani, Pacca, Rustam, Shahdara and Sultanpur. The soils were generally heavy in texture, non-saline and low in organic matter. All the soil series were slightly to moderately alkaline in reaction (pH >7.0) and moderately calcarious in nature. The nitrogen contents ranged from 0.004-0.064%. The Available phosphorus contents ranged from 0.75-7.5 mg kg^{-1}, whereas, exchangeable potassium varied from 100-440 mg kg^{-1}. The N, P, K and Organic matter content were higher in the upper soil profile and decreased as the soil profile depths increased linearly.

Key words: Tandojam, fertility status, soil

INTRODUCTION

Soils of widely different modes and sources of origin are not grouped together even though they may bear a close superficial resemblance to one another. Each of the great soil group is divided into series. All the members of any series have, in addition to a common mode and source of origin, similarity in topography, drainage, depth, color, structure and reaction of their A and B horizons. The series name is usually that of the locality in which the soil was first recognized and mapped as a separate entity. Soil is an important source of agriculture production and varies from place to place depending upon the effect of different soil forming factors that is, climate, (temperature and precipitation) living organisms, nature of parent materials (texture and structure, chemical and mineral composition), topography of area and time. The soil can only be called fertile, if it supplies all the essential nutrients to the plants in reasonable amounts and on soluble balance. The fertility of soil can be managed with the application of fertilizers but farmer must aware of the nature and severity of the nutrient problems in his field in order to arrive at decision regarding the kind and dose of fertilizer to be applied (Rashid *et al.*, 1988).

Different researchers analyzed fertility status in different areas. Among them, Kashmiri (2001) analyzed soil samples from Taluka Tando Allahyar, Hyderabad, Pakistan and reported that the lowest and highest ranges for nitrogen content were 0.07 to 0.12% at the depth of 0-40 cm. Malik (2001) analyzed soil samples from Taluka Pano Akil, Sindh, Pakistan, the lowest and highest range for N content was 0.015 to 0.034%, available phosphorus and potassium were 1.25 to 7 mg kg^{-1} and 89.7 to 456.3 mg kg^{-1} respectively at the depth of 0-40 cm. Both researchers were in the view that nitrogen and phosphorus content in soil decreased successively with the increase in soil depth. Mian and Ali (1980) reported that sandy soils, however, are usually deficient in K, in this regard the extent of the sandy soils in Pakistan is nearly 6% (1.6 million acres) of the total cultivated area in canal commended areas. In view of continues increasing in population, it is important to enhance crop productivity by adopting modern techniques as suited to different soils of the area. A protocol assessment of soil fertility status is thus essential to identify nutrient deficiencies and other soil related problems in advance. It is therefore very important to classify the soil according to their fertility status as they tend to vary from place to place not only in nutrient capacity, but also in other physico-chemical properties due to various soil forming processes.

MATERIALS AND METHODS

Soil samples at various depths (0-20, 20-40, 40-60, 60-80 and 80-100 cm) of Lalian, Miani, Pacca, Rustam, Shahadra and Sultanpur soil series around Tandojam, District Hyderabad, Sindh, Pakistan were collected, air dried, ground to pass through 2 mm sieve and analysed for NPK and some physico-chemical properties studies. The analytical procedures used for different parameters under study are described below.

S. No.	Determinations	Methods followed
1.	Texture	By Bouyoucos Hydrometer Method, Practical Agriculture Chemistry by Kanwar and Chopra (1959) P:48.
2.	Electrical conductivity (dS m^{-1})	By digital EC meter model AGB-5001, Phillips, using 1:5 soil-water suspension.
3.	Soil Reaction (pH)	By using digital pH meter AGB-4001, Phillips, by using 1:5 soil-water suspension.
4.	Lime content (%)	By acid neutralization method ($CaCO_3$ %) as described in practical Agri-Chem. (Kanwar and Chopra, 1959).
5.	Organic matter (%)	By Walkley-Black method as described in soil chemical analysis by Jackson, 1958. P: 213-214.
6.	Total N (%)	Kjeldahl's method, practical Agri. Chem.By Kanwar and Chopra (1959). P: 52.
7.	Available P	By AB-DTPA method Soltanpour and (mg kg^{-1}) Schwab (1977), by spectrophotometer.
8.	Exchangeable K	By AB-DTPA method Soltanpour (mg kg^{-1}) and Schwab (1977), by flame photometer.

RESULTS AND DISCUSSION

Soil Texture

Texture has an important bearing on physico-chemical behaviour of the soil and it has significant role in the productivity of the soil. It affects the nutrient holding capacity, nutrient availability, internal drainage, tillage, water and wind erosion, infiltration rate, root penetration and many other properties of the soil. The clay has high cation exchange capacity and better potential to supply nutrients to growing plants.

Textural categories of all soil series showed that, mostly soil samples were heavy to medium in texture. The assessment of findings showed that soil samples were dominant in silty clay, silty clay loam and varied from clay loam to sandy loam. Memon (1985) also reported textural data for samples collected from major soil series of district Hyderabad. He reported that majority of the samples were medium (silt loam, loam etc) to heavy (clay, silty clay) in texture.

Electrical Conductivity

Jackson (1958) classified the saline soils into various categories as: 0-2 non-saline, 2-4 slightly saline, 4-8 medium saline and 8-16 dS m^{-1} strongly saline. According to the Jackson classification, the results are given in Table 1, depicted that, Sultanpur soil series had highest 0.43 dS m^{-1} in EC value, where as, Rustam and Shahdra soil series had lowest 0.14 dS m^{-1} in EC value than other. The assessment of findings shows that all soil series were non-saline.

Soil Reaction (pH)

Mean pH values were found highest i.e 7.5 in Lalian, Miani and Rustam, soil series, while Shahdara, Pacca and Sultanpur soil series had mean pH values i.e 7.4. It was further noted that highest (8.0) pH values was found at the depth 0-20 cm of Lalian soil series. Where as, Rustam and Shahdara soil series had lowest (7.1) pH value at the depths of 60-80 and 80-100 cm respectively (Table 2). It was observed from the results that the soil samples were slightly alkaline to medium alkaline in nature.

Organic Matter

The analytical results for organic matter showed the mean values were highest in Sultanpur soil series i.e 0.67%, while Shahdara soil series had lowest mean value i.e 0.32% than other soil series, which were intermediate in organic matter content. Profile organic matter was maximum (1.28%) in Sultanpur at 0-20 cm depth and minimum (0.07) was noted in Pacca soil series at 80-100 cm depth. The assessment of findings indicated that all the soil samples were low in organic matter except one sample of Sultanpur soil series which had medium (1.28%). Organic matter was more at upper surface layers as compared to lower

Table 1: Electrical conductivity

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahdara	Sultanpur
0-20	0.23	0.18	0.34	0.12	0.14	0.36
20-40	0.19	0.21	0.20	0.14	0.11	0.44
40-60	0.13	0.17	0.17	0.15	0.12	0.44
60-80	0.11	0.18	0.15	0.17	0.17	0.47
80-100	0.10	0.17	0.13	0.15	0.16	0.46
Average	0.15	0.18	0.19	0.14	0.14	0.43

Category:
Non-saline = < 0-2 dS m^{-1} Slightly saline = 2-4 dS m^{-1} Moderately saline = 4-8 dS m^{-1}
Strongly saline = 8-16 dS m^{-1} V.Strongly saline = > 16 dS m^{-1} Source: Jackson (1958)

Table 2: Soil reaction (pH)

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahdara	Sultanpur
0-20	8.0	7.8	7.6	7.9	7.4	7.8
20-40	7.8	7.6	7.4	7.6	7.5	7.6
40-60	7.5	7.5	7.5	7.3	7.3	7.5
60-80	7.5	7.6	7.5	7.6	7.1	7.4
80-100	7.4	7.5	7.3	7.1	7.1	7.2
Average	7.5	7.5	7.4	7.5	7.4	7.4

Category:
Neutral = 7.0 Slightly alkaline= 7.1-7.5 Moderately alkaline= 7.6-8.0
Strongly alkaline=8.1-9.0 V.Strongly alkaline= > 9.1 Source: Cheema *et al.* (1991)

Table 3: Organic matter (%)

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahdara	Sultanpur
0-20	0.79	0.80	0.74	0.78	0.70	1.28
20-40	0.41	0.60	0.57	0.60	0.32	0.71
40-60	0.17	0.47	0.43	0.53	0.24	0.60
60-80	0.17	0.39	0.31	0.37	0.20	0.45
80-100	0.12	0.14	0.07	0.23	0.16	0.35
Average	0.35	0.35	0.42	0.52	0.32	0.67

Category:
Low= < 0.86% Medium = 0.86-1.29%
High= > 1.29% Source: Rashid *et al.* (1988)

Table 4: Nitrogen (%)

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahdara	Sultanpur
0-20	0.039	0.040	0.037	0.039	0.035	0.064
20-40	0.021	0.030	0.029	0.030	0.016	0.036
40-60	0.009	0.024	0.021	0.027	0.012	0.030
60-80	0.009	0.020	0.016	0.019	0.010	0.023
80-100	0.006	0.007	0.004	0.012	0.008	0.018
Average	0.017	0.025	0.021	0.025	0.016	0.034

Category:
Poor = < 0.05 Medium = 0.05-0.1
Fairly fertile = 0.1-0.2 Fertile = > 0.2 Source: Melherb (1963)

Table 5: Phosphorus (mg kg^{-1})

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahdara	Sultanpur
0-20	3.50	4.50	3.50	4.00	4.70	7.50
20-40	1.50	2.20	2.50	3.50	3.50	3.50
40-60	1.70	2.00	1.50	2.00	1.70	2.50
60-80	1.20	1.70	1.00	1.00	1.50	1.50
80-100	1.50	1.50	1.00	0.75	1.20	1.00
Average	1.88	2.38	1.98	2.25	2.52	3.20

Category:
Low = < 3 Medium = 4-7
High = 8-11 Very high = > 11 Source: Soltanpour and Schwab (1977)

Table 6: Potassium (mg kg^{-1})

	Soil series					
Soil depths (cm)	Lilian	Miani	Pacca	Rustam	Shahadra	Sultanpur
0-20	140	180	440	220	140	240
20-40	110	160	270	200	140	180
40-60	100	130	200	200	100	160
60-80	100	140	210	120	100	180
80-100	150	160	270	220	140	220
Average	120	154	278	210	124	196

Category:
Low = < 60 Medium = 60-120
High = > 120 Source: Soltanpour and Schwab (1977)

soil surface layers (Table 3). The Similar results have also been reported by Aslam (1970) who reported that with increase in the soil depths the percent organic matter also decreased.

Nitrogen

The nitrogen content in Sultanpur soil series was maximum (0.034%) and minimum in Shahdara soil series (0.016%). However, remaining soil series under observation were intermediate in N content. It was further noted that the highest N concentration was found at the upper soil i.e 0-20 cm depth in Sultanpur soil series whereas, Shahdara soil series recorded the minimum amount at 80-100 cm depth (Table 4). The assessment of the findings depicted that all soil samples were poor in total N. The results are similar to those reported by Leghari (1997) that N percentage was poor in various soil series around Tandojam, District Hyderabad, Sindh, Pakistan.

Phosphorus

It is evident from data (Table 5) that mean value of available P in Sultanpur soil series was highest (3.2 mg kg^{-1}) and in Lalian soil series it was the lowest (1.88 mg kg^{-1}) than other soil series. Remaining soil series under observation were intermediate in available P content.

The results showed that the upper surface layer of all soils series were medium to low in P content, but most of soil samples at the lower surface of soil series were low in available P. The results are similar to those reported by Junejo (2001) that available P was medium at upper surface and deficient in lower layer of Latif Farm, Tandojam.

Potassium

The result for K content shows that the mean value of exchangeable K was maximum (278 mg kg^{-1}) in Pacca soil series and minimum (120 mg kg^{-1}) in Lalian. Remaining soil series under observation were intermediate in exchangeable K content. It was further noted that the highest exchangeable K concentration

was found at the upper soil surface (0-20 cm depth) in Pacca soil series where as Lalian and Shahdara soil series showed the lowest at the depth of 60-80 cm (Table 6). The assessment of the findings depicted that the majority of the soil series samples were adequate in exchangeable K, but some samples were medium in exchangeable K. The result are similar to those reported by Madhu Bala (1995) that exchangeable potassium were adequate in soils of District Hyderabad.

It is concluded that soils around Tandojam were mostly heavy in texture, non-saline, slightly to moderately alkaline in reaction and moderately calcareous in nature. Organic matter, total N and available P were low in all soil series, while exchangeable K was quite adequate.

Therefore application of farm yard manure organic matter, N and P fertilizers are suggested to maintain soil fertility as well as to get maximum yield production.

REFERENCES

Aslam, M., 1970. Some physico-chemical properties of the soils of Jacobabad taluka. M.Sc. Thesis, Sindh University Jamshoro, Sindh, Pakistan.

Cheema, S.S., B.K. Dhaliwal and T.S. Sahota, 1991. Theory and digest of agronomy. 1st ed. Kalyani publishers, Daryaganj, New delhi, India.

Jackson, M.L., 1958. Soil Chemical Analysis. Prentice Hall Englewood Cliffs, New jersey.

Junejo, N., 2001. Macronutrient status of soils of Latif farm Block B and C. M.Sc. Thesis, Sindh Agriculture University Tandojam, Pakistan.

Kashmiri, N.A., 2001. Status of NPK in soil of taluka Tandoallahyar. M.Sc. Thesis, Sindh Agriculture University Tandojam, Pakistan.

Kanwar, J.S. and S.L. Chopra, 1959. Practical Agri. Chem. S. Chand and Co. Delhi, pp: 33-34.

Leghari, N.M., 1997. Some physico-chemical properties of various soil series around Tandojam. M.Sc. Thesis Sindh Agriculture University Tandojam, Pakistan.

Madhu Bala, 1995. Status of available P, K and S in soils of district Hyderabad, Sindh. M.Sc. Thesis Sindh Agriculture University Tandojam, Pakistan.

Malik, H.A., 2001. Status of N, P and K in soils of Dharejo farm in taluka Pano Akil. M.Sc. Thesis, Sindh Agriculture University Tandojam, Pakistan.

Melherb, I.D.V., 1953. Soil fertility University press, London, Oxford.

Memon, K.S., 1985. Cooperative research Programme on Micro-nutrientStatus of Pakistan Soils. First annual report, Dept. Soil Sci., Sindh Agric. Univ. Tandojam, Pakistan.

Mian, M.A. and M.A. Ali, 1980. Haincl the sources in the irrigated plains of Pakistan Pak. Soil Bull, 13.

Rashid, A., N. Bughio and M. Saleem, 1988. Calibration of Three Tests for Determining Phosphorus Fertility of Soils to Support Cereals, Legumes and Oilseed, pp: 86-93. In: P.N. Soltanpour (Ed.) Proc., Second Regional Workshop on Soil Test Calibration in West Asia and North Africa, Ankarah, Turkey, pp: 1-6.

Soltanpour, P.N. and A.P. Schwab, 1977. Use of ammonium bi-carbonate-DTPA soil test to evaluate element availability and toxicity. Comm. Soil. Sci. Plant Anal., 16: 323-338.