

Evaluation of Some Physico-Chemical Parameters of Soil of Amanishah-Nala and Its Surrounding Areas of Jaipur City, Rajasthan (India) with Reference to Agricultural and Irrigational Purposes

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Abstract

The aim of this study was to evaluate the levels of some physical and chemical parameters of soil of Amanisha-nala of Jaipur City during post monsoon session (October 2009—January 2010) and to access the quality of soil for determining its suitability for agricultural and irrigation purposes. Physico-chemical parameters of soil such as pH, EC, available organic-carbon, phosphate, potash and micronutrients such as Zn, Fe, Cu and Mn were analyzed. Soil samples from ten sites of Amanisha-nala were taken during post monsoon session. The analysis of soil samples shows that there was problem of alkalinity in soil nature regarding pH which was somewhat not permissible for irrigation and agricultural purposes. Further there were six soil samples out of ten having close proximity of alkalinity problem. However all the values of EC came in permissible range. The percentage analysis of organic carbon showed low level in the entire soil samples whereas eight samples belonged to medium level of phosphate. Potash showed medium nutrient level. The mean concentration of micronutrients was in order of Fe > Mn > Cu > Zn (in ppm).

Key words : Soil Pollution, Amanisha-nala, Physical-chemical parameters, Alkalinity, Micro-nutrients.

Soil is a living tissue with complex biological reactions going on continuously. It is one of the most important and essential commodity in biosphere, which is responsible for the existence and development of life on the earth. Garbage or wastes are produced by every home make up the municipal garbage, may be biodegradable or non-biodegradable in nature, today which is a growing environmental problem (1). Limited land and environmental resources, continuous degradation of environment (2). The seriousness of the situation can be realized by the soil pollution, through the indiscriminate use of pesticides and sewage waste as reported by Almeida (3) Who estimated 375,000 cases of human poisoning by pesticides in developing countries every year with some 10,000 deaths. Similarly Gupta (4) reported that about 10,000 people die every year and another 400,000 suffers from various effects of pesticides poisoning in the developing countries. Jeyapriya and Saseetharan (5) reported that dumping of solid wastes has altered the color and texture of the receiving soil with increase in physico-chemical and chemical con-

stituents. It was also found increase in organic matter content and interactions of the metals with the organic-content (adsorption and complex formation) are the reasons for high value of the tested constituents in soil after the refuse is dumped in soil. Jeevan Rao and Shantaram (6) studied the various characteristics of soil profiles under the urban solid waste dumps in a land fill site at Hyderabad. The extend of heavy metal pollution caused in agricultural land due to the application of MSW in Calcutta was studied by Olaniya et al. (7). Bhoyar et al. (8) also studied the fate

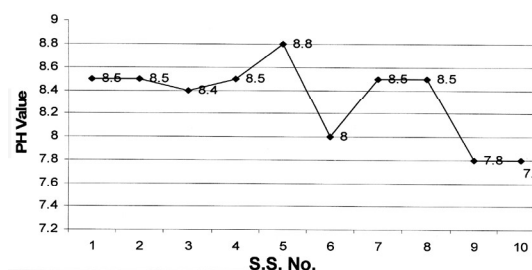


Figure 1. Variation of pH value.

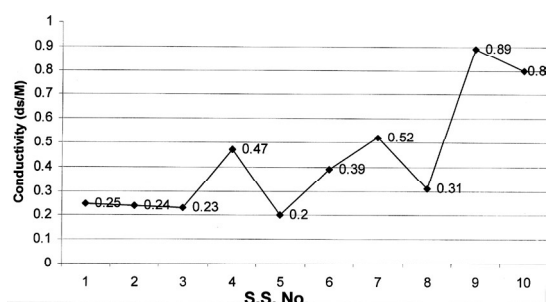


Figure 2. Variation of conductivity.

of heavy metals in black cotton soil amended with sewage sludge and refuse compost. In the present communication the studied areas have been well documented during the post monsoon session (October 2009 - January 2010) and systematic study was made to predict the suitability of soil for irrigation purposes.

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Methods

During last two decades the indiscriminate disposal of Industrial waste on mother earth slowly makes soil susceptible to pollution. Amanishah-nala is located on 26°55' north latitude and 75°49' east longitude in Jaipur city Rajasthan (India) is becoming fragile and has been concern due to increasing industrialization, urbanization and due to all of this, the soil pollution is increasing day by day in amanishah-nala and its surrounding areas. All the waste from domestic, municipal and industries are discharge in

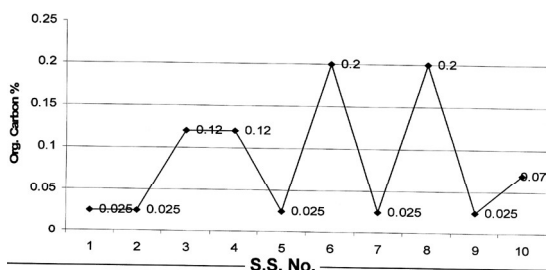


Figure 3. Variation of organic carbon (%).

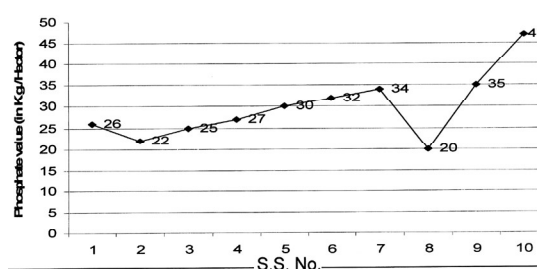


Figure 4. Variation phosphate.

Amanishah-nala which is the largest element of drainage system of this city and covers the whole city.

Now a day the various sites of this Amanishah-nala are used as agriculture land, which is not permissible, because various harmful, hazardous pollutants could be present inside the soil and which may cause serious harmful effects on human health and becomes an upcoming serious threat for the health of people of this city. Therefore it is essential to assess the quality of soil for its safer use. Therefore the present study of the physico-chemical characteristics of soil of amanishah-nala and its surrounding are has been taken up.

Soil samples from 10 different sampling stations were analyzed during post monsoon session (October 2009 - January 2010). Samples were prepared by collecting soil up to a depth of 22.8 cm. Quartering technique was used to prepare sample of the required mass and collected in clean good quality polyethylene bags.

Physical parameters like pH and EC of the soil samples were estimated in soil, by water suspension (in 1 : 2) with the help of a pH-meter and Electrical conductivity meter by using digital portable soil-water analyzer kit.

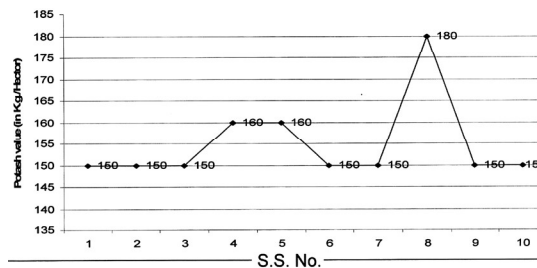


Figure 5. Variation of potash.

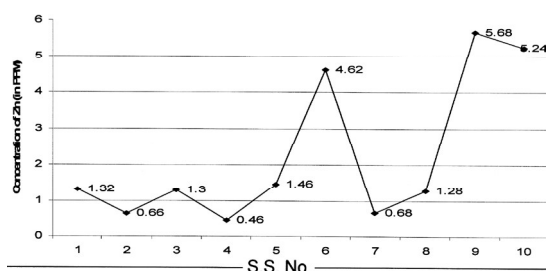


Figure 6. Variation of zinc.

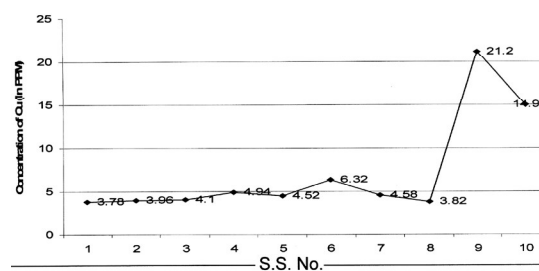


Figure 8. Variation of iron.

Available organic - carbon was determined by the wet digestion titration method of Walkley and Black. Phosphate determined by Olsen's method for alkaline and acidic soil, whereas potash was determined by Flame photometer (in kg/ha).

Available micronutrients such as Zn, Fe, Cu and Mn were determined by atomic adsorption spectroscopy (AAS).

Results and Discussion

The pH

The pH values of soil varied from 7.8 to 8.8 within average value of 8.33. Tables 1 and 2 and Figure 1 show that in one soil sample (SS 5) there is a problem of alkalinity and total six soil samples (SS1, SS2, SS3, SS4, SS7 and SS8) out of ten soil samples, having close proximity of alkalinity problem. The remaining three soil samples (SS6, SS9 and SS10) become fragile of alkalinity problem in near future. The average value of pH 8.33 indicates that soil is somewhat alkaline in nature, which is not permissible for irrigation of agricultural practices.

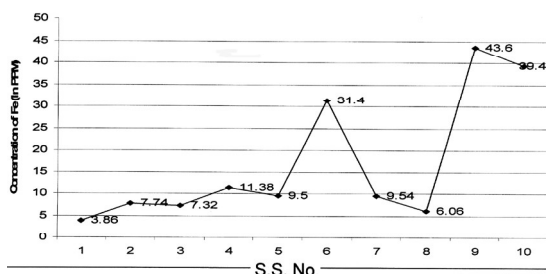


Figure 7. Variation of copper.

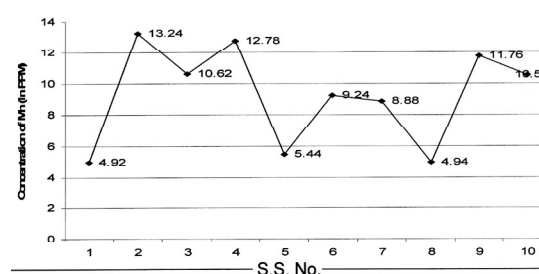


Figure 9. Variation of manganese.

EC

The EC values range from 0.20 to 0.89 (ds/m). Out of 10 samples of soil the maximum value of EC was observed 0.89 (ds/m) and the minimum value was 0.20 (ds/m) and the average of EC is 0.43 ds/m. All the values come in normal range. However, two soil samples (SS9 and SS10) may have alkalinity problem in future (Tables 1 and 2 and Fig. 2).

Percentage of Organic Carbon

The entire soil samples contain low level of organic carbon (Tables 1 and 2, Fig. 3). The minimum organic carbon percentage was found to be 0.025 in five soil samples (SS1, SS2, SS5, SS7 and SS9) and the maximum percentage of organic carbon was 0.20 in two soil samples (SS6 and SS8). The average value of organic carbon was found to be 0.083 (%).

Phosphate

Phosphate (available phosphorus) values ranged from 20 to 47 (kg/ha), with an average value of 29.80. The prescribed value of it according to ISI is

Table 1. Physico-chemical parameters of soil of Amanishah-nala and its surrounding areas of Jaipur city.

Soil sample no. (SS)	pH	EC (ds/m)	Organic carbon (%)	Phosphate value (kg/ha)	Potash value (kg/ha)	Zn (ppm)	Fe (ppm)	Cu (ppm)	Mn (ppm)
1	8.5	0.25	0.025	26	150	1.32	3.86	3.78	4.92
2	8.5	0.24	0.025	22	150	0.66	7.74	3.96	13.24
3	8.4	0.23	0.12	25	150	1.30	7.32	4.10	10.62
4	8.5	0.47	0.12	27	160	0.46	11.38	4.94	12.78
5	8.8	0.20	0.025	30	160	1.46	9.50	4.52	5.44
6	8.0	0.39	0.20	32	150	4.62	31.4	6.32	9.24
7	8.5	0.52	0.025	34	150	0.68	9.54	4.58	8.88
8	8.5	0.31	0.20	20	180	1.28	6.06	3.82	4.94
9	7.8	0.89	0.025	35	150	5.68	43.6	21.2	11.76
10	7.8	0.80	0.07	47	150	5.24	39.4	14.98	10.54

56 (kg/ha). In two soil samples (SS 2 and SS 8) it was low remaining eight soil samples belonged to medium category level for phosphate (Tables 1 and 2, Fig. 4).

Potash

Potash values ranged from 150 to 180 kg/ha showing medium potash levels. However, seven soil samples (SS1, 2, 3, 6, 7, 9 and 10) had low nutrient levels. The average value of potash was 155 kg/ha (Fig. 5).

Variations of Micronutrients

The mean concentration of micronutrients such as Zn, Fe, Cu and Mn was in order Fe > Mn > Cu > Zn.

Zn-Ion Concentration (ppm). The Zn ion concentration varied from 0.46 (SS 4) to 5.68 ppm (SS 9) with an average value of 2.27. The desirable value of zinc ion is 0.6 ppm or more (Fig. 6).

Fe-Ion Concentration (ppm). The Fe ion concentration varied from 3.86 (SS 1) to 43.6 ppm (SS 9) with an average value of 16.98. The desirable value of ferrous ion is 4.5 ppm or more. Thus Fe-ion concentration was much above the normal desirable value, which is not good for vegetation (Fig. 7).

Cu-Ion Concentration (ppm). The Cu-ion concentration varied from 3.78 (SS 1) to 21.2 ppm (SS 9) with an average value of 7.22. The prescribed value of copper ion in soil is 0.2 ppm or more (Fig. 8).

Mn-Ion Concentration (ppm). The Mn-ion concentration ranges from 4.92 (SS 1) to 13.24 ppm (SS 2) with an average value of 9.23. The desirable value of

Table 2. Characteristics of soil on the basis of various parameters (except micronutrients)

Parameters	Values	Conclusion	Representing samples (SS)
pH	7—8.5	Normal	
		Close proximity of alkalinity	1, 2, 3, 4, 7, 8
		Fragile of alkalinity	6, 9, 10
EC (ds/m)	> 8.5	Problem of alkalinity	5
	0—1	Normal	All ten soil samples
	>1	Problem of alkalinity	Nil
Org carbon (%)	0—0.50	Low nutrient level	All ten soil samples
	0.5—0.75	Medium nutrient level	Nil
	>0.75	High nutrient level	Nil
Phosphate (kg/ha)	0—23	Low nutrient level	2, 8
	23—56	Medium nutrient level	1, 3, 4, 5, 6, 7, 9, 10
	>56	High nutrient level	Nil
		Low nutrient level	Nil
Potash (kg/ha)	0—142	Low nutrient level	Nil
	142—337	Medium nutrient level	All ten soil samples
	>337	High nutrient level	Nil

Mn-ion in soil is 2 ppm or more and thus the Mn-ion concentration was much above the desirable value (Fig9).

Conclusion

Soil pH is the main important factor controlling the solubility and availability of trace metals in soil. The sorption of trace metals becomes good in soil having low pH value and it could be reduced as the soil pH increasing. In this study, there is a problem of alkalinity which goes up to 8.8. So regarding to pH value soil of Amanishah-nala does not hold good for solubility and availability of trace metals. Percentage of organic carbon in soil of Amanishah-nala is also found to be low in all ten soil samples ; it is not a good sign for agricultural practice because low organic carbon reduces the availability of micronutrients. Most of the soil samples belong to medium category of phosphate level, similarly most of the soil samples belong to low potash level. Regarding micronutrients Zn and Cu-ion concentrations show normal permissible range but Fe and Mn-ions show high concentrations.

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