Physicochemical Analysis of Soil of Bundi Tehsil, of district Bundi and their Statistical Interpretation

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Abstract: We live in a country where agriculture is one of the most important occupation. Farmers grow crops which are the source of food for both humans and animals. We consume food to get energy and nutrition. The quality of food grown depends on the quality of various factors which govern the growth of crops. Soil is one of them. Quality of soil or soil health is the foundation of productive farming practices. Various minerals, including micro and macro nutrients (N, P, K), organic matter, biomass and amount of water governs the health of the soil. This study was set-up to determine the key factors affecting soil quality Bundi Tehsil of Bundi District. The soil samples were analyzed for selected physical and chemical quality indices. Factors affecting soil quality maintenance in the area according to the findings are natural and man-induced, including agricultural practices in general and deforestation, soil degradation and erosion, as well as biodiversity loss in particular.

Keywords: *Soil, soil health, minerals, micronutrients, macronutrients, soil factors, Bundi*

1. Introduction

Bundi is a district of Rajasthan in western India. The town of Bundi is the district headquarters. It has an area of 5,550 km² and a population of 1,110,906 (2011 census). The latitude of Bundi is 25.430513, and the longitude is 75.649902. It is located in India in the Cities place category with the gps coordinates of 25° 25' 49.8468" N and 75° 38' 59.6472" E. It is divided into 5 tehsils which are: Bundi, Hindoli, Nainwa, Keshoraipatan and Indergarh. Bundi in Rajasthan is popular for its exclusive forts and palaces. Located at a distance of 36 kilometers from Kota and 206 kilometer from Jaipur, Bundi has developed as a popular tourist destination in the state. The Bundi economy is primarily supported by agriculture, textile and tourism industry. Agriculture contributes a major portion to the overall economic growth in Bundi. Major agricultural crops include pulses, wheat, gram, barley, cotton, tobacco and oil seeds. Soybean, paddy, maize, sorghum, black gram and green gram are the main Kharif crops whereas wheat, mustard, barley and gram are the major Rabi crops of the district. Among oil seeds, mustard and rape are the mostly produced. Important fruit trees in Bundi include orange, papaya, pomegranate, lemon, guava and mango. The soil and vegetation of the state of Rajasthan varies with its wide-ranging topography of arid plains or parched regions, hilly tracts of the Aravalis, the flood prone plains of Eastern Rajasthan. Soil quality and fertility is largely influenced by controlling factors like climate, soil topography whereas soil erosion is a serious problem for productive agricultural land[1, 2]. The purpose of present study is to create awareness about the soil quality of above said region which might help in maintaining and improving yield and economy.

2. Materials and Methods

For the Physico Chemical analysis of soil of Bundi district, samples were collected from various tehsils.

In the present work, samples collected from Bundi tehsil of Bundi district are discussed. For analysis of physicochemical properties all parameters such as % OC, pH, EC, N, P, K, Zn, Fe, Cu and Mn were analysed at Ummedganj Research Centre of Kota district which comes under Kota Agriculture University.

3. Experimental Data of Bundi Tehsil, Bundi

Property / Samples	BB1	BB2	BB3	BB4	BB5	BB6	BB7	BB8
Physical Properties								
OC (%)	0.59	0.75	0.78	0.49	0.78	0.58	0.89	0.73
pH	8.93	7.94	8.10	7.95	8.24	8.92	8.43	7.55
temp (^{0}C)	34	36	37	39	32	36	34	40
EC (dS/m)	0.49	0.68	0.56	0.52	0.68	0.59	0.77	0.69
Micronutrients								
Cu (ppm)	66.56	84.16	78.35	71.58	68.95	86.55	76.75	82.37
Fe (ppm)	33.54	54.12	48.18	43.14	47.12	42.14	52.12	45.19
Zn (ppm)	0.72	0.54	0.74	0.68	0.58	0.85	0.68	0.67
Mn (ppm)	15.75	15.91	15.77	17.11	15.33	14.52	16.47	15.14
Macronutrients								
N (%)	0.74	0.78	0.65	0.71	0.58	0.65	0.61	0.81
P (Kg/ha)	30.70	42.90	45.76	37.33	42.45	39.54	35.41	45.41
K (Kg/ha)	207.31	241.25	245.98	258.89	238.45	215.14	227.53	251.72

*BB – Bundi Tehsil

4. Statistical Interpretation of Data of Bundi Tehsil, Bundi

1) MEAN ($\overline{X}$)

$$\overline{X} = \frac{\sum f_i x_i}{\sum f_i}$$

Where,
f_i = frequency of regarding class
x_i= intermediate of class
$f_i x_i$ = multiplication of frequency and class intermediate
Σ = symbol of summation

2) MODE

$$Mode = L + \frac{(f_m - f_1) \times h}{(2f_m - f_1 - f_2)}$$

Where,
L = Lower limit of modal class
f_m = Frequency Point of modal class
f_1 = Frequency Point of class preceding the modal class
f_2 = Frequency Point of class succeeding the modal class
h = Size of class interval

PROPERTIES	MEAN VALUES	MODE VALUES
Organic Carbon (%)	0.69875	0.78
pH	8.2575	7.92
Electrical Conductivity (dS/m)	0.6225	0.68
Copper (ppm)	76.90875	76.75
Iron (ppm)	45.69375	45.19
Zinc (ppm)	0.6825	0.68
Manganese (ppm)	15.75	15.77
Nitrogen (%)	0.69125	0.65
Phosphorous (Kg/ha)	39.9375	39.54
Potassium (Kg/ha)	235.78	238.75

5. Result and Discussions

i. **Organic Carbon**: - Soil organic carbon is the basis of soil fertility. It releases nutrients for plant growth, promotes the structure, biological and physical health of soil, and is a buffer against harmful substances[3, 4]. In Bundi Tehsil the percentage of OC varies from 0.49-0.89.

ii. **pH:-** Soil's ability to hold and supply nutrients is related to its cation and anion exchange capacities, the number of parking spaces for nutrients on soil particles. Cation and anion exchange capacities are influenced by soil pH[5].The soil samples collected from Bundi Tehsil has pH ranging from 7.55- 8.93.

iii. **Electrical Conductivity:** - Soil electrical conductivity (EC) is a measurement that correlates with soil properties that affect crop productivity, including soil texture, cation exchange capacity (CEC), drainage conditions, organic matter level, salinity, and subsoil characteristics[6]. The soil samples collected from Bundi Tehsil has EC ranging from 0.49-0.77.

iv. **Copper:** - Copper participates in various physiological processes and is an important chemical compound for several metalloproteins[7]. Copper is an activator of several enzyme systems in plants and functions in electron transport and energy capture by oxidative proteins and enzymes. It may play a role in vitamin A production[8]. In Bundi tehsil the range of copper is 66.56 to 84.16 ppm.

v. **Iron:** - Iron is a very important element on earth and in soil it is mainly present in the form of silicate minerals and iron oxides. It is important in soil for plant growth as it promotes the production of chlorophyll[9]. In Bundi tehsil the range of Iron is 33.54 to 54.12 ppm.

vi. **Zinc:** - Zinc is plant micronutrient which is involved in many physiological functions its inadequate supply will reduce crop yields. Zinc deficiencies can affect plant by stunting its growth, decreasing number of tillers, chlorosis and smaller leaves, increasing crop maturity period, spikelet sterility and inferior quality of harvested products[10]. The soil samples collected from Bundi Tehsil has Zinc amounts ranging from 0.54-0.85 ppm.

vii. **Manganese:** - Manganese is an essential element for plants, intervening in several metabolic processes, mainly in photosynthesis and as an enzyme antioxidant-cofactor[11]. Its deficit is dangerous for chloroplasts because it affects the water-splitting system of photosystem II (PSII), which provides the necessary electrons for photosynthesis. In Bundi tehsil the range of Manganese is 14.52 to 17.11 ppm.

viii. **Nitrogen: -** Nitrogen is found in all soils, and is required by all living creatures. In plants, nitrogen is the nutrient required in the largest amounts. It is a key constituent of critical organic molecules such as amino acids, nucleic acids, and proteins[12]. The soil samples collected from Bundi Tehsil has Nitrogen percentage varies ranging from 0.58 to 0.81.

ix. **Phosphorous:** - Phosphorus is an essential nutrient both as a part of several key plant structure compounds and as a catalysis in the conversion of numerous key biochemical reactions in plants. Phosphorus is noted especially for its role in capturing and converting the sun's energy into useful plant compounds. The soil samples collected from Bundi Tehsil has Phosphorous amounts ranging from 30.70 to 45.76 Kg/ha.

x. **Potassium: -** Among the plant nutrients, potassium (K) is one of the vital elements required for plant growth and physiology. Potassium is not only a constituent of the plant structure but it also has a regulatory function in several biochemical processes related to protein synthesis, carbohydrate metabolism, and enzyme activation. Several physiological processes depend on K, such as stomatal regulation and photosynthesis[13]. The soil samples collected from Bundi Tehsil has Potassium amounts ranging from 207.31 to 258.89 Kg/ha.

6. Conclusion

As per the results obtained it can be concluded that all data are in optimum range and soil of Bundi district is suitable for agricultural purpose. As the pH is above 7 so the soil is alkaline in nature. All micronutrients viz. Copper, Iron, Zinc and Mangenese are present within the optimum range. Similarly, macronutrients like Nitrogen, Phosphorus and Potassium amounts are also in the desired range. Sufficient amount of NPK indicates that use of Urea is not required in the soil. However, for the cultivation of some crops DAP fertilizers may be required.

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