

Characterization and Comparative Analysis of Soil Fertility Status of Suwana block of Bhilwara District of Rajasthan

Abstract

The present research was conducted from Suwana block in Bhilwara district of Rajasthan for assess the fertility status of cultivated land soils near and far away from industries area was carried out at the Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj. Department of Soil Science and Agricultural Chemistry formerly called Naini Agricultural Institute, (U.P.). During the year 2023-2024. The soil samples were collected at the single depths of 0-15 cm from 30 different villages of one block of Bhilwara district, a total of 90 samples collected and analysed for their physical and chemical parameter by using Standard Laboratory technique. The result showed that the pH of soil samples was observed from neutral, slightly alkaline to strongly alkaline. The EC became secure variety for cultivated land. Soil organic matter content (%) was found in low to medium range. Available nitrogen was low, phosphorus was low to medium, potassium was medium to high, sulphur was low too high in range in soils of Suwana block. Calcium and magnesium had been enough in variety of studied area.

Keywords: Physical, Parameters, Suwana, Bhilwara

1. Introduction

Soil is the soul of infinity life and is generally refer to the loose material composed of weathered rock and other materials including slightly decompose organic matter. It is a reservoir of nutrients and place a pivotal role in supporting the growth of crops and other vegetation maintaining the earth's environment clean. It additionally acts as a supply and sinks for atmospheric gases (Ratan et al., 2011). Soil provides habitant to millions, fodder and fuel for meeting the basic needs of human and animal, with the growth in human and animal population, demand for more food production is on the increase. However, the capacity of soil to produce is limited and limits to production are set by Intrinsic characteristics, Agro-ecological setting, use and management. This demands systematic appraisal of soil resources with respect to their extent, distribution, characteristics, behaviours and use potential' which is very important for developing an effective land use system. For augmenting agricultural manufacturing on sustainable basis (FAO, 1993). Soil trying out makes whole nutrient manipulate a possibility; fertilizer experiments are being patterned to decide economically surest costs of vitamins utility excessive yields with low manufacturing expenses according to unit area must in modern farming. Farmers of today are in different mind to the failure is more certain and sooner unless they are obtaining reasonably high yields, improved drainage, many improved cultural practices, better varieties, and control of insects and disease have

helped to set the stage for high yields (Joshi et al., 2013). Soil is formed by the weathering of rocks, and it can take up to 100 years to develop one cm of soil. Soil is differentiated into horizons of mineral and organic constituents of variable depth, which differ from the parent material in morphology, physical properties, chemical properties, composition, and biological characteristics. The study of soil's formation, classification, survey, and geological distribution is known as pedology, while the study of soil in relation to higher plants is known as edaphology.

2. Materials and Methods

The studied area selected from Bhilwara district in Suwana block shown in figure 1. It's situated between latitude of 25°26'21.25"N and a longitude of 74°35'3.86"E or 25.439235 and 74.584406 respectively. The studied area comes under Sub Agro ecological Sub Region (ICAR) Northern Plain (And Central Highlands) Including Aravalli's, Hot Semi-Arid Eco-Region Agro-Climatic Zone (Planning Commission) Central Plateau and Hills Region (VIII) Agro Climatic Zone (NARP) Sub Humid Southern Plain Zone (RJ-06) Bhilwara district has a dry climate due to low rainfall and arid region zone of Rajasthan.

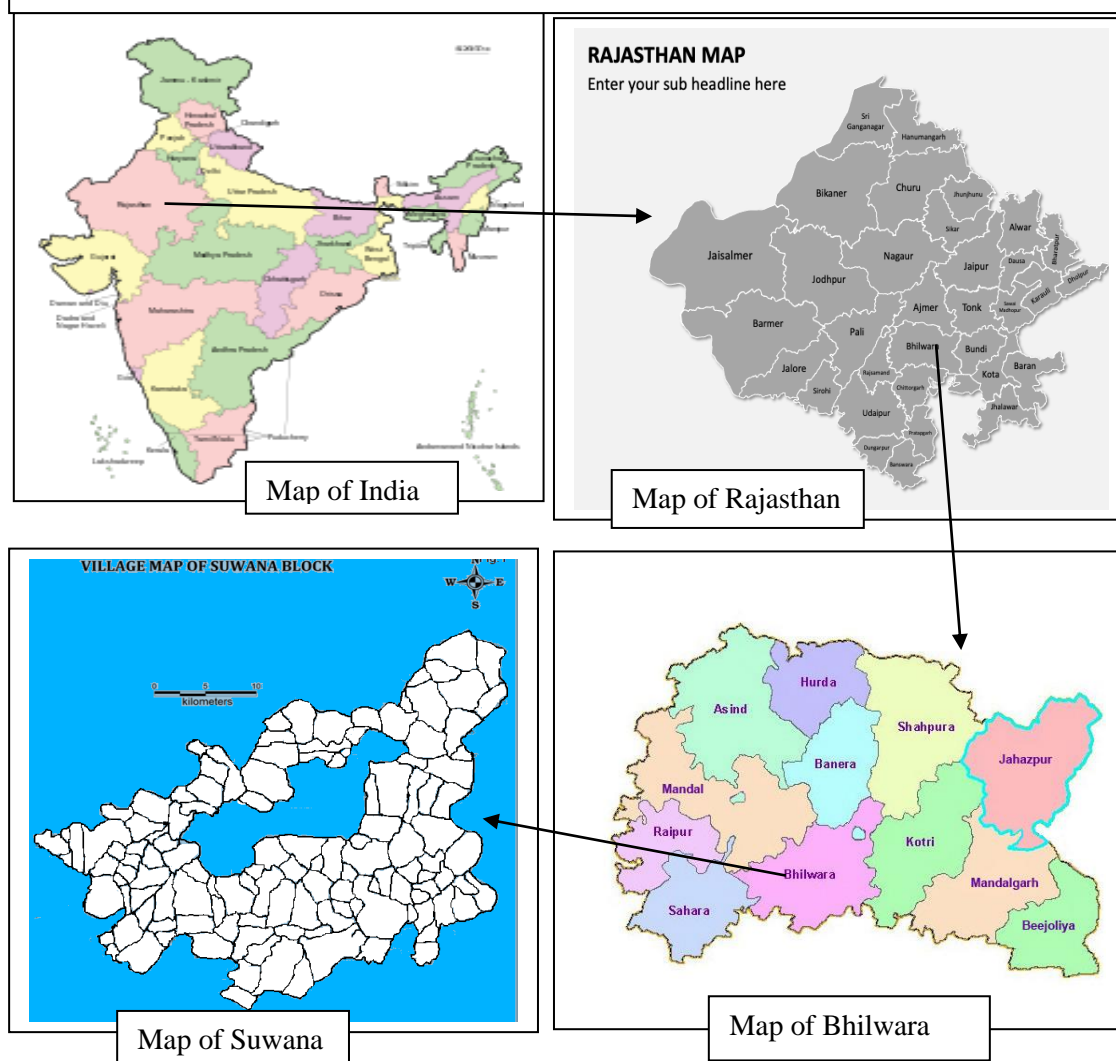
Table 1 Characterisation of soil test value for different nutrients

Nutrients	Rating of soil test value		
	Low	Medium	High
OC (%)	<0.5	0.5-0.75	>0.75
Available N (kg ha-1)	<280	280-560	>560
Available P (kg ha-1)	<10	10-25	>25
Available K (kg ha-1)	<110	110-280	>280
Available S (kg ha-1)	<10	10-20	>20
	Deficient		Sufficient
Calcium (Cmol(P+) kg-1)	<1.5		>1.5
Magnesium (Cmol(P+) kg-1)	< 1		> 1

Its humid climate having mean annual temperature of more than 22 degree Celsius and average rainfall is 650 mm. Soil samples of the cultivated land from different villages of Suwana block were taken randomly to a depth of 0-15 cm with the help of khurpi. The soil samples were mixed thoroughly and about 500 gram of composite soil samples were taken for analysis.

The processed soil samples were analysed for different nutrients using specific standard procedures for primary and macro nutrients. Soil pH was determined by pH meter, EC by conductivity meter and bulk density, particle density, porosity by pycnometer, water holding capacity was measured by measuring cylinder.

The organic matter content was determined by Walkey and Black (1934) method, available nitrogen was estimated by alkaline KMnO4 method, available phosphorus was extracted by 0.5 M NaHCO3 solution pH 8.5. Available potassium was determined by neutral normal ammonium acetate method, with the help of flame photometer. Sulphur was estimation calcium chloride method. Exchangeable calcium and magnesium were analysed by complexometric titration.

Fig. 1 Location of Suwana block in Bhilwara district of Rajasthan

3. Result and Discussion

3.1 Soil Physical Properties

The Status of physical properties is shown in table 2. Out of the total soil samples, pH in categories as 5 (5.55 %) soil samples were neutral (6.5-7.5), 67 (87.77 %) soil samples were slightly alkaline (6.5 to 8.5) and 10 (5.84 %) soil samples were strongly alkaline (7.6 to 9.2) in reaction. The EC was varied from 0.28 to 3.1 dSm⁻¹ with an average value of 0.72 dSm⁻¹. Out of 90 soil samples to 38 (31.11 %) soil samples lie in safe range, 55 samples (66.66 %) are normal range and 2 sample (2.22 %) is unsafe range so studies present in soil electrical conductivity no harm in germination of seed, as maximum number of samples. The bulk density and particle density ranges from 1.13-1.49 and 2.12-2.76 Mgm⁻³ respectively with a mean of 1.33 and 2.53 Mgm⁻³. Water holding capacity of soil ranges from 31.34 to 47.24 %, with a mean of 37.68 %. Porosity of soil ranges from 37.25 to 53.7%, with a mean of 46.57%. The data on per cent organic carbon content were ranges from 0.15 to 0.69 with a mean value of 0.38. Out of 90 soil samples to 69 samples (76.66 %) were found low, 21 samples (23.33%) were found medium in organic carbon. Thus, majority of the soil samples of Suwana block are low and few samples were medium in organic carbon per cent due to the arid area is responsible low organic matter and some areas were medium in OC percent due to use of every year FYM and crop residues. The similar results were also reported by Aggarwal and Kumar (1994), Prakash (2001),

Meena *et al.*, (2006) and Yadav and Meena (2009) and Dinesh Khadka *et al.*, (2016) in Agriculture Research Station, Belachapi, Dhanusha, Nepal.

3.2 Status of primary nutrients in soil

The status of N, P and K has been shown in table .2. Available N content of these soils was ranged from 110.52 to 312.89 kg ha⁻¹ with a mean value of 199.81 kg ha⁻¹. Out of 90 soil samples, 85 samples (94.44 %) soil samples were found low, and 5 (4.67%) samples were found in medium range. Climate has a major impact on availability of nitrogen, maximum soil samples were found in low category, it may be due to denitrification dry climate and use of low amount of bio fertilizers, green manures and use of synthetic fertilizers. The available phosphorus content in these soils was varied from 8.5 to 32.50 Kg ha⁻¹ with a mean value of 14.21 Kg ha⁻¹. Total soil samples collected to 28 (31.11%) soil samples were found low, 60 (66.66%) soil samples were found medium and 2 (2.22%) soil samples were high in Phosphorus content. These results are strongly supported by the findings of Kumar and Seth (1983) who reported that the soil was medium in available phosphorus. Such findings were also reported by Singh and Sharma (1984), Akbari *et al.*, (1993), Kamariya (1995), Ghosh & Hasan (1976).

The potassium content in these soils was ranged from 204.32 to 283.69 kg ha⁻¹ with an average value of 283.13 kg ha⁻¹ K. All of 49 samples (54.44 %) soil samples were medium in Potassium content and 41 samples (45.55 %) were in high categories, may be due to presence of potash bearing minerals (muscovite, biotite and feldspar).

As per criterion laid down by Muhr *et al.*, (1965), maximum soils samples 72.72% were found under high category (above 280 kg K₂O ha⁻¹) of available potassium. Hence, it is found that all soils of the study area were high in available potassium. Such result was also reported by Prakash (2001) and Meena *et al.*, (2006).

3.3 Status of secondary nutrients in soil

The status of S, Ca and Mg is shown in table 4 The data on status of available S exchangeable Ca²⁺ and Mg²⁺ of soils of Suwana block of Bhilwara district were presented in. The available sulphur content in soils of Suwana block was ranged from 4.61 – 19.95 kg ha⁻¹ with an average value of 12.54 kg ha⁻¹. Out of total 90 soil samples, 18 samples (20.00 %) were found low, 72 (80.00 %) soil samples were found medium content in Suwana block. Also, the coarse-textured sandy soils mostly have low total S-content as compared to fine textured soils (Kanwar, 1976). The similar results were found by Jat and Yadav (2006) in soils of Entisols of Jaipur District, Rajasthan and Singh and Singh (2007) in soils of mid-Western Uttar Pradesh.

The data revealed that the exchangeable Ca²⁺ content of these soils ranges from 2.24 to 18.50 Cmol (P⁺) kg⁻¹ with an average value of 7.59 Cmol (P⁺) kg⁻¹. Out of 90 soil samples, all 90 samples (100.00 %) soil samples were found sufficient in available calcium. It may be due to use of calcium rich fertilizer or due to use of lime on the soil of studied area. The similar trend was also recorded by Nayak *et al.*, (2006) in swell and shrink soils of Vertisol order in Vidarbha region and Tripathi and Sawarkar (2007) in soils Vertisol pedon of Kymore plateau in Jabalpur District.

The exchangeable Mg²⁺ content in soils of Suwana block were varied from 0.31 to 7.11 Cmol (P⁺) Kg⁻¹ with a mean value of 2.55 Cmol (P⁺) kg⁻¹. Out of 90 soil samples, all 90 samples (100.00%) soil samples were found sufficient in available magnesium. The similar

results were observed by Prasad *et al.*, (2006) in swell-shrink orange cropped soils of Nagpur District and Nayak *et al.*, (2006) in swell and shrink soils.

Table 2. Variations in physicochemical parameters

Soil Characteristics	Range	Mean	S.D.	C.V. (%)
pH (Soil: water,1:2.5)	7.2-8.6	8.20	0.40	3.86
EC (dSm ⁻¹)	0.25-2.2	0.78	0.30	42.20
B.D. (Mg m ⁻¹)	1.13-1.49	1.34	0.08	5.68
P.D (Mg m ⁻¹)	2.12-2.77	2.54	0.16	6.52
W.H.C. (%)	23.23-54.68	37.68	6.43	7.89
Porosity (%)	37.25-52.7	47.12	3.15	6.46
OC%	0.15-0.69	0.39	0.14	36.64

Table 3. Variations in availability of NPK fertilizers

Soil Characteristics	Range	Mean	S.D.	C.V. (%)
Available N (kg ha ⁻¹)	110.52-312.89	199.81	57.75	28.90
Available P (kg ha ⁻¹)	8.5-32.50	14.22	3.87	27.25
Available K (kg ha ⁻¹)	204.32-383.69	283.13	45.78	16.17

Table 4. Variations in availability of S, Ca, M

Soil Characteristics	Range	Mean	S.D.	C.V. (%)
Available S (kg ha ⁻¹)	3.71-19.95	12.54	3.29	26.20
Available Ca (Cmol (P+) (kg-1)	2.24-18.50	12.54	3.53	46.47
Available M (Cmol (P+) (kg-1)	0.31-7.11	0.46	3.53	51.06

table 5 : Comparison between cultivation soils near cloth industry area, steel plant, bricks industry, sewage water irrigation and area away from industry

S.No.	Parameter	Area near industries (cultivation area)				Area far away from industries (cultivation area)
		Steel Plant	Cloth industry	Sewage water irrigation	Brick industry	
1	pH	7.81	7.63	7.65	8.25	8.19
2	EC (dSm ⁻¹)	0.62	1.17	1.07	0.64	0.65
3	BD (Mg m ⁻³)	1.42	1.31	1.32	1.35	1.33
4	PD (Mg m ⁻³)	2.63	2.37	2.42	2.56	2.55
5	WHC (%)	38.16	32.01	42.59	38.7	40.95
6	OC (%)	0.43	0.39	0.61	0.36	0.35
7	N (Kg ha ⁻¹)	192.33	192.33	240.42	165.09	200.63
8	P (Kg ha ⁻¹)	12.12	13.84	14.81	12.99	14.49
9	K (Kg ha ⁻¹)	237.63	271.93	306.31	282.29	285.06
10	S (Kg ha ⁻¹)	14.30	13.83	11.46	13.54	12.14
11	Ca (Cmol(p+)Kg ⁻¹)	5.14	6.19	13.09	9.37	7.59
12	Mg (Cmol(p+)Kg ⁻¹)	2.90	2.29	3.24	2.44	2.49

Conclusion

It can be concluded that, the soil from Suwana block of Bhilwara district is categorized under neutral to alkaline and slightly saline in reaction, soluble salt content falls under safe range does not affect germination of crops. %OC is low to medium range in the soils of studied area.

The soils under study areas are low in N, P and S is medium while K was found in the soil from medium to high. Calcium and Magnesium also observed sufficient in soils of Suwana block. All areas show similar values of B.D., P.D., except WHC which is high in sewage water irrigated area as compared to areas away from industries.

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