



## To survey and analyse the soil samples for physicochemical and biochemical parameters from different villages (Nagaur district) Rajasthan, India

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### Abstract

Rajasthan being geographically the largest state in the country has a varied topography where soils differ in quality depending on the organic matter present in them, their physical structure, local climatic variation, the crop rotation cycle that is followed, availability of moisture etc. The nutrient carrying capacity of soils varies not only within the district but also village to village and even farm to farm. Soils of the state have low microbial activities and poor soil organic carbon due to which more than 75% soils of the state are not in good health. Deficiencies of Nitrogen, Phosphorous, Sulphur, Zinc and Iron are quite common. The physicochemical parameters of soil determine their adaptability to cultivation and the level of biological activity that can be supported by the soil. The present work has been carried out to study some parameters of soil samples collected from different villages of district Nagaur.

**Keywords:** physicochemical parameters; bio chemicals parameters; soil analysis; nitrogen; phosphorus; sulphur; zinc; iron

### Introduction

Nagaur district is in the central part of Rajasthan. It is bounded in the north by Bikaner and Churu districts, in the east by Sikar and Jaipur, south by Pali and Ajmer districts and the western boundary is bounded by Jodhpur district. Agricultural activities may result in a decrease in soil organic carbon (SOC) in cultivated soils in comparison with their non-cultivated counterparts when losses are not sufficiently compensated by inputs. Tillage and the progressive replacement of organic amendments by inorganic fertilizers are among the processes that have contributed to the loss of soil organic matter (SOM) in cropped soils. Given the key role of organic matter in soil functions and agricultural sustainability, the maintenance of appropriate soil organic matter levels is essential to ensure soil quality and sustainability of soil use. Urban wastes and in particular municipal solid waste (MSW) are interesting sources of organic matter for agricultural soils now that urban areas are increasing at expenses of rural areas. Through composting, urban wastes can be transformed in safe soil amendments that have been demonstrated to be of use in low-fertility, degraded or low-quality soils, where nutrient and organic matter inputs are necessary to restore productivity. Notwithstanding, the problem with urban wastes is growing and compost use should be envisaged also for agricultural soils that do not necessarily need an increasing of fertility or organic matter content. In this case, potential negative effects of urban wastes, such as excess nutrient leaching or accumulation of potentially toxic elements, must be taken into account. Soil properties that are sensitive to changes in the management can be used as indicators (Borkar, A.D.2015). When working with degraded systems, where soil fertility must be restored before any other consideration, these potential drawbacks can be

considered a minor concern. In turn, if MSW composts are to be used in fertile soils with soil functions other than plant production in mind, environmental issues gain relevance. In this sense, the general objective of this work was to know what happens in very fertile and organic matter-rich soils: whether, in this case, the potential advantages of composts beyond plant yield have more weight than the associated risks.

### Study Area

Table 1

S. No.	Area	Sample code
1	Inana	(V-1)
2	Khajwana	(V-2)
3	Janana	(V-3)
4	Chhilra	(V-4)
5	Gaju	(V-5)
6	Kuchera	(V-6)
7	Parashara	(V-7)
8	Balaya	(V-8)
9	Dehroli	(V-9)
10	Silariya	(V-10)
11	Rohina	(V-11)
12	Barsuna	(V-12)
13	Dehri	(V-13)

### Research Methodology

#### Soil Sampling and Preparation of Soil Sample

Personal Protective apparatus: Gloves, Long Sleeves, Boots & Mask etc.

**Tools:** These tools were used in soil sampling khurpi, auger, spade, pen- paper, sieve, plastic ag, banner and board etc

### Methodology of Soil Sampling

1. First of all removed the surface litter, grass and debris from the sampling point.
2. After that made a V" shape cut to a depth of 15cm in the sampling spot using by spade and drawled the soil sample.
3. The soil sample was mixed thoroughly and that mixed soil sample divided into four quarters.
4. The soil of the opposite two quarters was removed.
5. Put the remaining soil sample in the plastic bag, properly labeled and submitted it for further analysis.
6. Soil samples were dried in shade place for 6-7 days. After drying the soil samples were analysed.

### Physicochemical and Bio Chemical Parameters

Table 2

Physicochemical Parameters	Biochemical Parameters
pH	Soil Macronutrients (N, P, K and S)
Organic Carbon (OC)	Soil Micronutrients (B, Mn, Cu, Fe and Zn)
Electric Conductivity(EC)	
Alkalinity and Acidity	

### Instruments used for physicochemical analysis of soil samples

Table 3

Parameters	Measuring Instrument
pH	Digital pH meter
Electric Conductivity(EC)	Digital conductivity meter/Smart Soil Pro method
Alkalinity and Acidity	pH meter
Organic Carbon	Smart Soil Pro method

### Methodology of Soil pH

1. pH meter was first calibrated using a known pH solution( buffer). Generally buffer solution of pH 4.0, 7.0 & 9.2 are used.
2. After that 10gm of soil were mixed in 25ml of water.
3. The mixture was mixed well with the glass rod and waited for 30min.
4. After that Readings were taken.

### Methodology of Soil EC

1. Electro conductivity meter was first calibrated using a known solution 0.1M KCl
2. After that 10gm of soil were mixed in with 20ml water.
3. The mixture was mixed well with the glass rod and waited for 30min.
4. After that Readings were taken.

### Instruments used for Biochemical Analysis of Soil Samples

Parameters	Method Used
<b>Soil Macronutrients</b>	
Nitrogen (N)	Smart Soil Pro Method
Phosphorus (P)	
Sulfur (S)	
Potassium (K)	
<b>Soil Micronutrients</b>	
Boron (B)	Smart Soil Pro Method
Manganese (Mn)	
Copper (Cu)	
Iron (Fe)	
Zinc (Zn)	

Fig 1

### Methodology of Smart Soil Pro

1. First we took two plastic tubes, one for soil sample testing and other for blank (without soil).
2. Took 10gm soil with help of weighing balance in a 50ml plastic tube.
3. Took an empty 50ml plastic tube for blank.
4. Added a pinch of chemical powder (Reagent no.6) in both the tubes.
5. The pH of soil were more then six (pH >6) so in it added 20ml of solution from Reagent no.7 in both the tubes with the help of measuring cylinder (25ml). Shaken the content for 30min
6. Filtered both the content (soil sample and blank) in another 50ml plastic tube.
7. Took 5ml of Filtrate solution with the help of a 5 ml syringe in another 50ml plastic tube. Weighed 0.26gm of chemical from Reagent no.10 with the help of weighing balance in a clean and dry beaker of size 100ml
8. Added 50ml of solution from Reagent no.11 with the help of a 50 ml measuring cylinder. Dissolved the contents thoroughly with the help of glass rod (say A)
9. Took 4ml of A with the help of syringe and added in filtrate.
10. Made up volume to 25ml with distilled water. Shaken well and waited for 10min.
11. Selected the soil parameter from main menu of smart soil pro.
12. First took the distilled water in the cuvette and set the knob on zero (left side reading on the screen Now took out the distilled water from the cuvette, put blank sample in it and pressed enter button.
13. Put soil sample in another cuvette. Waited for 5sec. Pressed enter button and took parameters reading.

### Data Analysis

Physicochemical and Bio chemical Parameters of soil samples for different villages in Nagaur Region in Rajasthan.

Table 4

Parameters	Soil Samples of different Villages of Nagaur Region in Rajasthan												
	V-1	V-2	V-3	V-4	V-5	V-6	V-7	V-8	V-9	V-10	V-11	V-12	V-13
pH (7.0-8.5pH)	9.7	9.3	8.5	8.4	8.5	10.0	8.9	8.7	9.0	8.7	9.0	8.9	8.7
EC (<1.5dc/m)	0.32	0.35	0.45	0.31	0.84	0.51	0.43	0.22	0.38	0.89	0.27	0.21	0.75

OC (0.5-0.75%)	0.10	0.08	0.36	0.39	0.28	0.37	0.39	0.36	0.32	0.32	0.20	0.29	0.36
N (180-560kg/ht.)	129.80	181.10	215.10	185.40	189.10	185.40	137.70	180.10	189.20	182.10	161.60	186.30	185.40
P (23-56kg/ht.)	23	28	23	26	38	31	38	44	20	23	33	38	41
K (142-337kg/ht.)	220	237	204	264	237	226	215	210	258	220	296	204	194
S (>10ppm)	50.00	11.38	5.89	12.25	7.03	43.00	29.40	16.01	44.00	42.00	14.00	45.10	47.00
Zn (>0.6ppm)	0.38	0.52	0.34	0.46	0.36	0.52	0.38	0.46	0.24	0.29	0.30	0.64	0.36
B (>0.5ppm)	1.29	0.40	0.50	0.85	0.78	0.96	0.82	1.20	2.73	0.77	0.89	0.83	0.89
Fe (>4.5ppm)	2.24	2.36	2.56	1.86	2.52	2.46	2.78	2.42	2.76	2.76	2.42	2.86	2.11
Cu (>2.0ppm)	0.56	0.50	0.48	0.32	0.46	0.38	0.46	0.30	0.62	0.31	0.54	0.33	0.46
Mn (>0.2ppm)	3.44	2.15	2.18	2.46	2.76	2.58	2.86	2.56	2.30	2.52	2.38	2.54	2.76

**Comparative study of soil parameters for different village of Nagaur district In Rajasthan**

**Table 5**

S No. (Village)	pH (7.0-8.5pH)	EC (<1.5dc/m)	Org. Carbon (0.5-0.75%)	Acidic/Alkaline (<7 />7)
V-1	9.70	0.32	0.10	Alkaline
V-2	9.30	0.35	0.08	Alkaline
V-3	8.50	0.45	0.36	Alkaline
V-4	8.40	0.31	0.39	Alkaline
V-5	8.50	0.84	0.28	Alkaline
V-6	10.0	0.51	0.37	Alkaline
V-7	8.90	0.43	0.39	Alkaline
V-8	8.70	0.22	0.36	Alkaline
V-9	9.00	0.38	0.32	Alkaline
V-10	8.70	0.89	0.32	Alkaline
V-11	9.00	0.27	0.20	Alkaline
V-12	8.90	0.21	0.29	Alkaline
V-13	8.70	0.75	0.36	Alkaline

**Table 6:** Comparative study of pH, EC and OC for V-1 to V-13

S. No. (Village)	Nitrogen (180-560kg/ht.)	Phosphorus (23-56kg/ht.)	Potassium (142-337kg/ht)
V-1	129.80	23	220
V-2	181.10	28	237
V-3	215.10	23	204
V-4	185.40	26	264
V-5	189.10	38	237
V-6	185.40	31	226
V-7	137.70	38	215
V-8	180.10	44	210
V-9	189.20	20	258
V-10	182.10	23	220
V-11	161.60	33	296
V-12	186.30	38	204
V-13	185.40	41	194

**Table 7:** Comparative study of N, P and K for V-1 to V-13

S. No. (Village)	Iron (>4.5ppm)	Copper (>2.0ppm)	Manganes (>0.2ppm)
V-1	2.24	0.56	3.44
V-2	2.36	0.50	2.15
V-3	2.56	0.48	2.18
V-4	1.86	0.32	2.46
V-5	2.52	0.46	2.76
V-6	2.46	0.38	2.58
V-7	2.78	0.46	2.86
V-8	2.42	0.30	2.56
V-9	2.76	0.62	2.30
V-10	2.76	0.31	2.52
V-11	2.42	0.54	2.38
V-12	2.86	0.33	2.54
V-13	2.11	0.46	2.76

## Data interpretation of soil parameters for different village of Nagaur district in Rajasthan

**Table 8:** Comparative study of Fe, Cu and Mn for V-1 to V-13

pH – a) Maxi Value for V-6 village (10pH) b) Near by Stand Value for V-7 and V-12 villages (8.90pH) c) Mini. Value for V-4 village (8.40pH)	Nitrogen – a) Maxi Value for V-3 village (215.10kg/ht) b) Mini. Value for V-1 village (129.80kg/ht)
EC – a) Maxi Value for V-10 village (0.89dc/m) b) Near by Stand. Value for V-10 village (0.89dc/m) c) Mini. Value for V-12 village (0.21dc/m)	Zinc - a) Maxi Value for V-12 village (0.64ppm) b) Mini. Value for V-9 village (0.24ppm)
OC – a) Maxi Value for V-4 and V-7 villages (0.39%) b) Mini. Value for V-2 village (0.08%)	Iron – a) Maxi Value for V-12 village (2.86ppm) b) Mini. Value for V-4 village (1.86ppm)
Phosphorus- a) Maxi Value for V-8 village (44 kg/ht) b) Mini. Value for V-9 village (20 kg/ht)	Copper – a) Maxi Value for V-9 village (0.62ppm) b) Mini Value for V-8 village (0.30ppm)
Potassium – a) Maxi Value for V-11 village (296kg/ht) b) Mini. Value for V-13 village (194kg/ht)	Manganese –a) Maxi Value for V-1 village (3.44ppm) b) Mini. Value for V-2 village (2.15ppm)
Sulphur – a) Maxi Value for V-1 village (50ppm) b) Mini. Value for V-3 village (5.89ppm)	Boron – a) Maxi Value for V-1 village (1.29ppm) b) Mini. Value for V-2 village (0.40ppm)

$$\sigma = \sqrt{\frac{\sum (x - \text{mean})^2}{n}}$$

x is a set of numbers  
mean is the average of the set of numbers  
n is the size of the set  
 $\sigma$  is the standard deviation

**Table 9:** Comparative study of S, Zn and B for V-1 to V-13

Soil Parameters	Soil Samples of different Villages of Nagaur Region in Rajasthan			
	Maximum	Minimum	Mean	SD
pH (7.0-8.5pH)	10.0	8.4	8.94	0.4525
EC (<1.5dc/m)	0.89	0.21	0.45	0.2206
OC (0.5-0.75%)	0.39	0.08	0.29	0.1004
N (180-560kg/ht.)	215.10	129.80	177.56	21.66
P (23-56kg/ht.)	44	20	31.23	7.67
K (142-337kg/ht.)	296	194	229.61	27.56
S (>10ppm)	50	5.89	28.23	16.65
Zn (>0.6ppm)	0.64	0.24	0.40	0.105
B (>0.5ppm)	1.29	0.40	0.99	0.5820
Fe (>4.5ppm)	2.86	1.86	2.47	0.2771
Cu (>2.0ppm)	0.62	0.30	0.44	0.1004
Mn (>0.2ppm)	3.44	2.15	2.57	0.3241

### Conclusion

Study of physicochemical parameters is important to agricultural chemists for plant growth and soil management. It is concluded from the data that the soil of all the villages was alkaline (> pH 8.0). The electro conductivity value of soil from all the villages was found to be normal. The organic carbon was found in very low amounts in the soil of all villages.

Nitrogen, Zinc, Boron and Iron were found in low amounts in the soil of these villages. Phosphorus and Potassium were found in medium amounts in the soil of these villages. Sulphur, Manganese and Copper were found in normal amounts in the soil of these villages.

Sulphur, Boron and Manganese were found in abundance ample amount in the soil of the V-1( Inana) in compare to these 13 villages. For this reason the soil of V-1 will be beneficial for the cultivation of cumin and cotton. The pH value of V-6 (Kuchera) was highest in compare to these 13 villages. Due to this soil of village was very alkaline. N, K, S, B, P, Zn and EC were also found in abundance in the soil of this village. For this reason, this soil is beneficial for the cultivation of cumin and cotton. The OC (Organic Carbon) value of V-4, V-5 and V-7 (Chhilra, Gaju and Parashara) were maximum in compare to these 13 villages. For this reason the soil of these villages will be beneficial for the

cultivation of cumin and cotton. The EC (Electro conductivity) value of V-10 (Silariya) was maximum in compare to these 13 villages. Due to this soil of V-10 was very soluble salt. Nitrogen, Iron and Manganese were also found in abundance in the soil of this village. For this reason, this soil will be beneficial from the point of view of cultivation of cumin and cotton. The Phosphorus value of V-8 (Balaya) was maximum in compare to these 13 villages. Nitrogen, Potassium, Boron and Zinc were also found in abundance in the soil of this village. OC and pH were also high. For this reason, this soil will be also be beneficial from the point of view of cultivation of cumin and cotton.

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