

# Physicochemical Analysis of Soil of Nainwa Tehsil, of District Bundi and their Statistical Interpretation

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**Abstract:** Agriculture plays a vital role in the Indian economy. Over 70 per cent of the rural households depend on agriculture. Both humans and animals depend on agriculture for food. Food not only provides us energy but also essential nutrients. So, it's important that the food we consume should have all nutrients in it. Now the quality of food grown depends on the quality of various factors which govern the growth of crops. Soil is a critical part of successful agriculture and is the original source of the nutrients. The soil is made up of air, water, decayed plant residue, organic matter, and minerals, such as sand, silt, and clay. Increasing soil organic matter typically improves soil health, as this organic matter affects several critical soil functions. Healthy soils are also porous, which allows air and water to move freely through them. This balance ensures a suitable habitat for soil organisms that support growing plants. This study was set-up to determine the key factors affecting soil quality of Nainwa Tehsil of Bundi District. The soil samples were collected and analyzed for specific 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:** Agriculture, food, Soil, soil health, nutrients, minerals, soil factors, Nainwa, Bundi

## 1. Introduction

Nainwan is a tehsil of district Bundi) and a municipality in the Hadoti region of Rajasthan state in northwest India. Nainwan is located at 25.77°N 75.85°E.<sup>[1]</sup> It has an average elevation of 291 metres (954 feet).The town is situated at a distance of 95 km from Kota, 165 km from Jaipur, and 65 km from Bundi. There is no rail network in the town. The nearest railway station is in Indergarh, at a distance of 25 km from Nainwa. As of 2011 census,<sup>[2]</sup> the Nainwa Municipality has population of 19,485 of which 10,098 are males while 9,387 are females. Tourism attractions in the area include the Talwas Lake, Paibalapura Dam and Ranthambore National Park. The main source of water in Nainwa is the Paibalapura dam.

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. The soils of the district are clay to clay loam in texture. Among fruits, guava, lemon, papaya are the major fruit trees which

are widely grown in entire district. 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 Nainwa tehsil, soil samples were collected from eight locations named village Dei, Dodi, Khajuri, Jetpur, Modasa, Nainwa, Peepliya and Sisola. In the present work, samples collected from Nainwa 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 analyzed at Ummedganj Research Centre of Kota district which comes under Kota Agriculture University.

## 3. Experimental Data of Nainwa Tehsil, Bundi

Property / Samples	BN1	BN 2	BN 3	BN 4	BN 5	BN 6	BN7	BN8
<b>Physical Properties</b>								
OC (%)	0.64	0.71	0.81	0.49	0.78	0.53	0.85	0.87
pH	7.90	7.25	8.19	7.02	8.24	8.92	8.45	7.80
temp (°C)	35	36	37	39	40	40	44	32
EC (dS/m)	0.50	0.65	0.55	0.40	0.70	0.80	0.70	0.63
<b>Micronutrients</b>								
Cu (ppm)	66.00	82.10	78.35	74.10	78.95	86.55	76.75	80.37
Fe (ppm)	39.50	54.10	48.19	52.14	47.12	42.95	52.10	45.55
Zn (ppm)	0.72	0.50	0.70	0.68	0.59	0.85	0.85	0.60
Mn (ppm)	17.75	15.91	15.77	16.10	16.83	14.80	17.27	15.30
<b>Macronutrients</b>								
N (%)	0.70	0.80	0.65	0.90	0.58	0.69	0.60	0.88
P (Kg/ha)	32.70	45.90	45.15	37.25	49.50	39.20	35.00	55.11
K (Kg/ha)	200.31	285.25	250.90	238.22	265.35	215.22	237.53	261.00

\*BN – Bundi Nainwa

#### 4. Statistical Interpretation of Data of Nainwa Tehsil, Bundi

##### 1) MEAN ( $\bar{X}$ )

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

Where,

$f_i$  = frequency of regarding class

$x_i$  = intermediate of class

$f_i x_i$  = multiplication of frequency and class intermediate

$\Sigma$  = 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 (%)	0.71	0.85
pH	7.97	8.00
Electrical Conductivity (dS/m)	0.61625	0.70
Copper (ppm)	77.89	75.00
Iron (ppm)	47.70625	45.00
Zinc (ppm)	0.68625	0.85
Manganese (ppm)	16.21625	15.50
Nitrogen (%)	0.725	0.65
Phosphorous (Kg/ha)	42.47625	35.00
Potassium (Kg/ha)	244.2225	238.00

#### 5. Result and Discussions

- Organic Carbon:** - Soil fertility is basically dependent on organic carbon present in it. It releases nutrients for plant growth, promotes the structure, biological and physical health of soil, and is a buffer against harmful substances<sup>3, 4</sup>. In Nainwa Tehsil the percentage of OC varies from 0.49-0.87.
- pH:** - Soil's Cation and anion exchange capacities, decide its ability to hold and supply nutrients is related to it, and the number of parking spaces for nutrients on soil particles. Cation and anion exchange capacities are influenced by soil pH<sup>5</sup>. The soil samples collected from Nainwa Tehsil has pH ranging from 7.02- 8.92.
- 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<sup>6</sup>. The soil samples collected from Ninwa Tehsil has EC ranging from 0.40-0.80.
- Copper:** - Copper participates in various physiological processes and is an important chemical compound for several metalloproteins<sup>7</sup>. 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<sup>8</sup>. In Nainwa tehsil the range of copper is 66.00 to 86.55 ppm.

- 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<sup>9</sup>. In Nainwa tehsil the range of Iron is 39.50 to 54.10 ppm.
- 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<sup>10</sup>. The soil samples collected from Nainwa Tehsil has Zinc amounts ranging from 0.50-0.85 ppm.
- Manganese:** - Manganese is an essential element for plants, intervening in several metabolic processes, mainly in photosynthesis and as an enzyme antioxidant-cofactor<sup>11</sup>. 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 Nainwa tehsil the range of Manganese is 14.80 to 17.75 ppm.
- 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<sup>12</sup>. The soil samples collected from Nainwa Tehsil has Nitrogen percentage varies ranging from 0.58 to 0.90.
- 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 Nainwa Tehsil has Phosphorous amounts ranging from 32.70 to 55.11 Kg/ha.
- 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<sup>13</sup>. The soil samples collected from Nainwa Tehsil has Potassium amounts ranging from 200.31 to 285.25 Kg/ha.

#### 6. Conclusion

As per the results obtained it can be concluded that all data are in optimum range and soil of Nainwa 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 Manganese 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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