# A STUDY OF PHYSICO - CHEMICAL PROPERTIES OF SOIL OF VEGETABLE FARMS NEAR NAYAWAS AND MANDRELLA BY–PASS AT JHUNJHUNU CITY (RAJ.)

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## ABSTRACT

Sewage water is used for irrigation in vegetable farms near Nayawas and Mandrella by–pass. This water affects the physico-chemical properties of soil and deteriorate the soil fertility. Therefore, 13 soil samples were collected from the vegetable farms. The various physico-chemical parameters such as EC, TDS, SAR, alkalinity, sodium and potassium were determined. The results show that these parameters are beyond the limits of Indian standards. Therefore, the study of parameters are important for the utilization and proper management of soils in agronomy.

**Key words**: Physico-chemical, Soil

## INTRODUCTION

Soil is a vital component, medium of unconsolidated materials and nutrients, forms the life layer of plants. It is the basic life support component of biosphere. Study of physico-chemical parameters are very much relevant to agricultural chemists for plant growth and soil management[1-3].

In Jhunjhunu city, sewage water is used for irrigation in vegetable farms near Nayawas and Mandrella by–pass. This sewage water gets contaminated by waste emanating out of industries, domestics and agricultural fields. This contamination degrade land quality and deteriorate soil productivity[4].

Therefore, it is necessary to examine physico-chemical parameters of soil. This study reveals the interaction of parameters, influencing the land quality and productivity of the ecosystems[5]. These parameters significantly not only affects the total content but also the chemical composition and more specifically the function and reactivity of native organic matter of soil[6,7].

In the present investigation, an attempt has been made to ascertain whether this sewage water is suitable for irrigation of soil or not ? and what are its adverse effects on parameters of soil?

## EXPERIMENTAL

13 different soil samples were collected from vegetable farms near Nayawas and Mandrella by-pass and one from Rani Sati area. They were named as S, N-1 to N -6 and M-1 to M-6. The samples were collected in a clean plastic bags. After processing, there samples were analysed. Standard procedure were employed for physical and chemical analysis[8,9].

## RESULTS AND DISCUSSION

The results obtained during the course of investigation are presented in Tables 1, 2 and 3. Physico-chemical parameters include colour, odour, EC, pH, TDS, OC, SAR, PAR, anions (carbonates, bicarbonates. chloride, sulphate) and cations ($Ca^{2+}$, $Mg^{2+}$, $Na^+$, $K^+$).

All the samples are brown in colour and have foul and unpleasant smell.

**pH:** pH is one the most important physico-chemical parameter. It affects mineral nutrient soil quality and many micro-organism activities[10].

The pH range of 6.5 to 8.00 has been recommended optimum for plant's growth[1]. As per Table-1, pH value of soil ranges from 6.99 to 8.00. The alkaline nature is due to basic components used in industries. These pH values are in permissible restriction.

**EC:** EC of soil samples under investigation, collected from Rani Sati area, Nayawas and Mandrella by–pass ranges from 2.69, 0.57 to 2.31 and 0.44 to 1.80 mS, respectively.

| SAR | EC | Soil type |
|-----|-----|-----------|
| < 15 | < 4 | Non–saline, Non–alkaline |
| < 15 | > 4 | Saline |
| > 15 | < 4 | Alkaline |
| > 15 | > 4 | Saline – alkaline |

It appears that all the soil samples have SAR less than 15 and EC less than 4. So, all the samples stand in non-alkaline or non–saline category.

**Table 1. Physicochemical characteristics of soil samples**

| S. No. | pH | EC (ms) | TDS (ppm) | Organic carbon (%) | Na⁺ (meq/L) | SO₄²⁻ (meq/L) | SAR (meq/L) | PAR (meq/L) | HCO₃⁻ (meq/L) | K⁺ (ppm) | Ca⁺² (ppm) | Cl⁻ (ppm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | 8.0 | 2.69 | 1721.6 | 1.20 | 24.25 | 12.05 | 10.34 | 1.62 | 8.0 | 148.2 | 220 | 639.00 |
| N–1 | 6.9 | 2.31 | 1978.4 | 1.12 | 18.50 | 6.80 | 8.19 | 0.70 | 7.5 | 62.4 | 204 | 568.00 |
| N–2 | 7.0 | 1.40 | 896.4 | 1.32 | 17.25 | 6.45 | 7.79 | 0.63 | 6.5 | 54.6 | 196 | 514.75 |
| N–3 | 7.0 | 1.16 | 742.4 | 1.32 | 15.75 | 6.65 | 7.60 | 0.62 | 6.0 | 50.7 | 172 | 461.50 |
| N–4 | 7.2 | 0.94 | 601.6 | 1.28 | 13.00 | 5.80 | 6.42 | 0.54 | 4.5 | 42.9 | 164 | 390.50 |
| N–5 | 7.0 | 0.84 | 537.6 | 1.32 | 12.25 | 7.35 | 6.12 | 0.55 | 3.5 | 42.9 | 160 | 372.75 |
| N–6 | 7.2 | 0.57 | 364.8 | 1.28 | 11.00 | 7.30 | 5.57 | 0.50 | 3.0 | 39.0 | 156 | 337.25 |
| M–1 | 7.1 | 1.80 | 1152.0 | 1.36 | 16.00 | 4.80 | 7.23 | 0.68 | 7.5 | 58.5 | 196 | 497.00 |
| M–2 | 7.0 | 1.50 | 960.0 | 1.39 | 15.25 | 6.55 | 7.03 | 0.65 | 6.0 | 54.6 | 188 | 479.25 |
| M–3 | 7.1 | 0.94 | 601.6 | 1.28 | 13.50 | 6.40 | 6.36 | 0.66 | 4.5 | 54.6 | 180 | 426.00 |
| M–4 | 7.3 | 0.49 | 313.6 | 1.12 | 12.50 | 6.70 | 6.25 | 0.60 | 3.5 | 46.8 | 160 | 908.25 |
| M–5 | 7.2 | 0.45 | 288.0 | 0.88 | 10.75 | 6.55 | 5.44 | 0.50 | 3.0 | 39.0 | 156 | 355.00 |
| M–6 | 7.0 | 0.44 | 256.0 | 0.80 | 9.80 | 6.80 | 5.17 | 0.42 | 2.5 | 31.2 | 144 | 301.75 |

**Table 2. Variation of soil parameters with distance in Nayawas and Mandrella by–pass**

| S. No. | Name of Parameters | Concentration with distance from | |
|---|---|---|---|
| | | Nayawas | Mandrella by – pass |
| 1 | pH | Variable (6.86 to 7.20) | Variable (7.00 to 7.30) |
| 2 | EC | Decreasing (2.31 to 0.57) | Decreasing (1.80 to 0.44) |
| 3 | TDS | Decreasing (1478.4 to 364.8) | Decreasing (1152.0 to 256.0) |
| 4 | OC | Variable & medium OC (1.32 to 1.12) | Variable & medium OC (1.36 to 1.84) |
| 5 | SAR | Decreasing (8.19 to 5.57) | Decreasing (7.23 to 5.17) |
| 6 | Sodium (meq/L) | Decreasing (18.50 to 11.00) | Decreasing (16.00 to 9.80) |
| 7 | Potassium (meq/L) | Decreasing (1.60 to 1.10) | Decreasing (1.50 to 0.80) |
| 8 | PAR | Decreasing (0.70 to 0.50) | Decreasing (0.68 to 0.92) |
| 9 | $CO_3^{2-}$ | Constant | Constant |
| 10 | $HCO_3^-$ | Decreasing ( 7.5 to 3.0) | Decreasing ( 7.5 to 2.5) |
| 11 | $SO_4^{2-}$ (meq/L) | Alternately up and down | Alternately up and down |
| 12 | $Ca^{2+} + Mg^{2+}$ (meq/L) | Decreasing (10.2 to 7.8) | Decreasing (9.8 to 7.2) |
| 13 | Chloride (meq/L) | Decreasing (16.0 to 9.5) | Decreasing (14.0 to 8.5) |

**TDS**

It's values varies from 364.8 to 1478.4 ppm and from 256.0 to 1152.0 ppm near Nayawas and Mandrella by-pass, respectively. Rani Sati areas show the high TDS value i.e. 1721.6 ppm. Samples N–1 and M–1 has also high TDS value. Higher is the TDS value, then less water is available to plants.

**Organic matter in soil**

It is the chief source of mineral's return to soil. The accumulation of organic matter in soil is strongly influenced by temperature and availability of oxygen[12]. Certain metals

such as Zn, Cu, Fe were investigated, which affect soil organic matter. On examination of soil samples, concentration of organic carbon ranges from 0.84 to 1.36 (Table 1).

## Sodium

Sodium concentration in soil samples is found to be very high i.e. 24.25 meq/L near Rani Sati area, 18.50 meq/L near, Nayawas and 16.00 meq/L near Mandrella by–pass. Excess of Na causes alkaline nature, which hinders plant growth. Sodium in irrigation water gradually gets accumulated in surface soils and cause sodicity and renders soils unproductive and creates waste lands[13].

## Sulphate

Sulphate ions are generally present as immobilised insoluble minerals or as soluble salts in soils. Sulphate concentration ranges from 4.80 to 12.05 meq/L (Table 1). Sulphate concentration is higher (i.e. 12.05 meq/L) near Rani Sati area. It is alternately goes up and down in both Nayawas and Mandrella by–pass samples. It's high concentration causes harmful effects in plants.

## SAR

SAR values of soil samples ranges from 5.17 to 10.34 meq/L. The values of SAR at Nayawas and Mandrella by–pass decreases when we moves on from Rani Sati area. In Nayawas, it's value decreases from 8.19 to 5.57 meq/L, where as at Mandrella by–pass, it decreases from 7.23 to 5.17 meq/L. High SAR values results in deflocculation of soil particles.

## PAR

Potassium plays an important role in anion neutralisation, membrane transport and enzyme activation. It's deficiency causes chlorosis and stunted growth in plants. It's values is found to be variable from 0.42 to 1.62 meq/L.

## Carbonate–Bicarbonate

On analysis of soil samples, concentration of carbonate ion was observed 1.00 meq/L only for S, N–2, N–4, M–1 and M–3. Bicarbonate ion's concentration ranges from 2.5 to 8.0 meq/L. It's concentration at Nayawas was higher as compared to Mandrella by–pass.

## Potassium

Potassium is required for building of protein, photosynthesis, fruit quality and reduction of diseases. Potassium concentration ranges from 31.2 ppm to 148.2 ppm. It's value was high at Rani Sati area is 148.2 ppm. Potassium excess may lead to iron chlorides and magnesium deficiency.

## Calcium

Calcium is an essential part of plant cell wall structure, which provides normal transport and retention of other elements. It's deficiency causes reduced growth and necrosis. In soil samples, concentration of calcium varies from 7.2 to 11.0 meq/L (144 ppm to 220 ppm).

## Chloride

Chloride aids to plant metabolism. The concentration $Cl^-$ varies from 8.5 meq/L to 18.0 meq/L (301.75 ppm to 639.0 ppm) in soil samples. It's deficiency causes chlorosis and wilting of plants.

## Variation in values of parameters with distances

To illustrate alternation in the values, soil samples were carefully collected at 15-15 meters distance. From the value of soil parameters, we can conclude that there is variation of soil parameters as we move on from Rani Sati area to Nayawas and Mandrella by-pass (Table 1). The concentration values decreases from Nayawas to Mandrella by–pass (Table 2). About 15 meters away from Rani Sati area, there is a steep decrease in the value of soil parameters.

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