

Study of Physico- Chemical Parameters of Irrigation Water of Sikar District with its Impact on Quality of Soil

Narendra Singh¹ and N. P. Lamba²

Department of Chemistry Laboratory
Amity University Rajasthan, Jaipur (Raj) INDIA
Corresponding author Email:- Budania1947@gmail.com

(Received on: May 3, 2022)

ABSTRACT

In this study we are using various parameters like pH, EC, T.D.S,Alk, T.H, Ca-H, Mg-H, Fluoride, Nitrate, Sulfate, Sodium, Potassium, Calcium. And we have used various methods consisting of Sodium absorption ration (SAR), and founded that some of the parameters are founded more than the desirable limit.

Key words: Groundwater pollution; agricultural activity; irrigation water quality; impact on Soils; Sikar District area;

INTRODUCTION

Soil fertility is associated with the chemical fertility of soil that is determined by nutrients and pollutants; the view ignores the physical aspects of fertility that are embodied in the soil structure whose importance have been recognized in various published reviews.¹ Irrigated agriculture almost in takes 60 – 80 percent of the total water usages and it nearly contributes in 38 of the percent of global food production.²It have played a superior role in creating employment opportunities in the rural areas and provides food for cheap prices for all those low-income families along with middle-class ones in the urban area.³

In the present study, Sikar District, Tehsils Lachhmangarh and Fatehpur Sekhawati was selected. From 10 irrigation water and 10 Soil samples were collected from the following areas Sikar District, Tehsil's water sample was collected from different locations/ Lachhmangarh and Fatehpur Sekhawati tehsils. The Sikar District is situated in the north-eastern part of Rajasthan and lies between 27⁰38' and 28⁰31' North Latitudes and 75⁰02' and 76⁰06' East Longitudes. It is located at a distance of 230 kms from national capital of India, There are 9 Tehsils in the Sikar district and all the Tehsils have their unique geological, historical and cultural features. Lachhmangarh and Fatehpur(shekhawati) Tehsil are plain land having great agricultural and irrigation dependence on ground water. Fatehpur Tehsil is totally desert with saline ground water and no irrigation. Also, Tehsils depending soils on

ground water but the ground water potentials in these Tehsils is very low. The Sikar District is a maze of all the above and have broad spectrum of irrigation water and soil quality problems. The area is meager in rail-falls and has many water quality problems. If the irrigation water and soils of this area is characterized and problems identified remedial measures may be exercised for safeguard of life.⁴

Various people are interested in agriculture and they use this tube well and bore well water in irrigating fields.⁵The plants and vegetables growing here shows early maturity, but have many disorders like harmfuls, chlorosis, stunting growth and leaf die back etc. Which might be due the use of this tube well and Deep Tube well water. There is a strong probability of aggregation of essential metals in plants/crops, a large amount of population is reliant on their for their comestible purposes, so it will be affect on human population and make them diseased with all this scene, the modern study is purposed.⁶

2. EXPERIMENTAL

Irrigation water and soil samples were collected from Sikar District areas consisting of Lachhmangarh and Fatehpur(shekhawati).

We took 20 samples, 10 of soil and 10 of water respectively. After collecting samples, they were brought to laboratory and following Physico-chemical and Soil samples test shall be conducted.

pH by pH meter method, EC by conductometry method, TDS formula $Ec \times 640 =$ TDS (in ppm), total hardness, total alkalinity, chloride by titrimetric method sulphate by turbidimetry method, Nitrate by spectrophotometrically method, fluoride by Ion selective method. We also used method that is used to determine the physicochemical parameters. Sodium absorption ratio(SAR).

3. RESULTS AND DISCUSSION

The results obtained are presented in Tables 1-4. We used various methods such as pH, Electric Conductivity, T.D.S, ALK, Total hardness, Calcium, Magnesium, Potassium, Sodium, Chloride, SO_4^{2-} , NO_3^- , F^- , Na^+ , K^+ and SAR, for determining the physical chemical parameters of the samples collected in both Lachhmangarh and Fatehpur(shekhawati) tehsils.

Table-1 physical chemical parameter in irrigation water samples of Lachhmangarh tehsil (ppm)

Sr No.	SAMPLE NO.	PH	EC	TDS	ALK	TH	SO_4^{2-}	CL^-	NO_3^-	F^-
1	S ₁	8.2	2160	1050	410	340	96	360	16	2.1
2	S ₂	7.9	2110	1410	520	360	89	365	12	1.9
3	S ₃	8.7	2300	1360	390	405	76	290	11	3.1
4	S ₄	8.6	2100	1505	410	610	76	310	9	2.3
5	S ₅	8.5	2020	1430	380	600	83	405	14	3.0

Table-2 physical chemical parameters in irrigation water samples of Fatehpur tehsil (ppm)

Sr No.	SAMPLE NO.	PH	EC	TDS	ALK	TH	SO ₄ ²⁻	CL ⁻	NO ₃ ⁻	F ⁻
1	S ₁	8.7	2800	2110	740	810	170	1310	39	3.7
2	S ₂	8.5	2450	1790	725	740	145	1290	33	4.8
3	S ₃	8.6	2910	2260	810	790	149	1370	26	4.1
4	S ₄	9.4	3100	2190	840	810	177	1460	38	3.3
5	S ₅	9.3	2930	2320	790	780	165	1445	24	6.1

1. Physicochemical Parameters of Irrigation Groundwater:

The quality of water parameters that describe the quality of water which are given below:

- PH:** According to ISI or WHO, the pH range for irrigation water is 6.5-8.5. We use it to determine the behaviors of water like acidic, basic or neutral. The pH of water and soil cannot directly harm the plant growth. pH generally affects the process of flocculation and the efficiency of coagulation [10]. pH from 7.9 to 9.4 is considered in each area. Sikar district tehsils, Lachhmangarh, Fatehpur, high pH range irrigation water. It is not suitable for plant growth...
- Electrical Conductivity:** The electrical conductivity shows the amount of total minerals in water, is reliant on the temperature of water. Growth in plants gets affected by total electrical conductivity of water.⁷ Good limit of EC is 2100 ppm and in Lachhmangarh and Fatehpur limit for irrigation water is 2020 to 3100 ppm. Lachhmangarh and Fatehpur high electrical conductivity range, irrigation water. It is not suitable in plant growth, in each area...
- Total Dissolved Solids:** It indicates the basic nature of water. It contains the amount of cations (+ve charges ions) along with anions (negatively charged ions). It changes the color and properties of irrigation water.⁸ According to WHO and Indian Standards, TDS value should be around 2000 ppm for irrigation water. Investigation area limit of irrigation water range for 1050 to 2320 ppm. It is normal in Lachhmangarh but high in Fatehpur max at 2320 ppm, but it does not suit plant growth.
- Total Hardness:** The present calcium and magnesium ion concentration in water, and is expressed as the concentration of calcium and magnesium carbonate water hardness does not directly impact plants.⁹ The permissible limit for irrigation water total hardness is 1300 ppm most in plant growth. TH in Lachhmangarh and Fatehpur is in limit 340 to 810 ppm. Total hardness is very low irrigation water under investigation area.

5. **Alkalinity**:- It means the ability or capacity of water to resist acidification, also known as the buffering capacity of water. Alkalinity is required limit in irrigation water 250 to 600ppm. Alkalinity is required plant growth. In Lachhmangarh and Fatehpur is in limit 380 to 840ppm. Investigation area high concentration of Alkalinity does not suitable irrigation filed for irrigation purpose.
6. **Fluoride**: Fluoride is an essential nutrient for plants. The excess of fluoride concentration in drinking water, which can cause fluorosis which affects the teeth and bones.¹⁰ Fluoride required limit for irrigation water is 1.5ppm. Investigation area Lachhmangarh and Fatehpur is in limit for 1.9 to 6.1ppm. All the irrigation water samples, Lachhmangarh and Fatehpur tehsils have toxic range of fluoride.
7. **Nitrate**: If we consume too much of nitrate than it can affect the blood carries oxygen and can cause methemoglobinemia. According W.H.O nitrate permissible limit for irrigation water is 45ppm.¹² Investigation area it is low range, 9.0 to 39.0ppm and because of it the plants become yellowed. With stunted growth and produces smaller fruits and flowers.
8. **Sulfate**: the prescribed limit by BIS is 400ppm (12 Meq/l) in irrigation water and we found that both in Lachhmangarh and Fatehpur it is lower than the normal limit (Table-1&2). The effect of its on plants is characterized by similarly chlorosis in plant and stunted growth.
9. **Chloride**: According to ISI required limit for irrigation water is 600ppm. In the present study area Lachhmangarh and Fatehpur limit 290 to 1460 for irrigation water. Lachhmangarh it is normal but in Fatehpur it is high max at 1460ppm. It is found that chloride ion affects for plants growth in irrigation water. Through osmotic arrangement such as turgor pressure, leaf water probable and osmotic probable's.

2. Physicochemical Parameters of Irrigation Soil:

Investigating of irrigation soil parameters, characterize the quality of soil, which are given below:

Table-3 physical chemical parameters of soil samples in lachhmangarh tehsil (Meq/L)

Sr No.	SAMPLE NO.	pH	E.C	T.D.S	Na ⁺	SAR	K ⁺	Ca ²⁺	Mg ²⁺	SO ₄ ²⁻
1	S ₁	7.7	2.10	680	9.20	6.0	21.10	2.46	1.25	7.30
2	S ₂	7.3	1.90	670	12.20	9.0	25.0	2.51	1.30	9.40
3	S ₃	6.9	2.11	710	8.90	8.0	19.0	2.43	1.40	10.00
4	S ₄	6.7	2.35	700	13.00	8.0	22.10	3.62	1.20	13.20
5	S ₅	7.5	2.47	800	12.10	17.0	26.20	2.49	1.70	10.50

Table-4 physical chemical parameters in soil samples of fatehpur tehsil (Meq/L)

Sr No.	SAMPLE NO.	pH	E.C	T.D.S	Na ⁺	SAR	K ⁺	Ca ²⁺	Mg ²⁺	SO ₄ ²⁻
1	S ₁	8.1	2.25	710	23.22	19.10	27.12	9.0	2.00	6.50
2	S ₂	7.6	2.26	715	26.10	21.62	31.10	11.0	1.00	6.90
3	S ₃	7.9	2.30	730	26.15	18.53	29.10	9.10	2.10	5.80
4	S ₄	8.4	2.22	740	24.90	22.14	27.60	10.5	2.00	11.00
5	S ₅	8.2	2.10	680	25.60	19.22	27.40	9.5	2.50	10.36

- 1. PH of Soil:** The soil PH is an important factor for plant growth nutrition's. pH is that the concentration of atomic number one (H⁺) ions and (OH⁻) ions within the irrigation soil. The pH of soil cannot directly damage the plant growth.¹³ pH typically affects the method of natural action and therefore the potency of natural process. pH is traditional in each area. The PH tolerance limit for soil is 6.00 to 8.00 in most favourable condition of plant growth.

In Sikar District, Lachhmangarh, Fatehpur tehsil agricultural soil, study area, have pH range from 6.7 to 8.4. It is not suitable range for plant growth.

- 2. Electrical Conductivity:** The international organization indicates the amount of total solids in water and depends on the temperature of water. Growth of plants gets full of total electrical physical phenomenon of soil. EC is suitable range for irrigation soil from 1.13 to 1.25 m mhos/cm. Soil of agricultural area has EC range from 1.90 to 2.47 m mhos/cm. This is not suitable for plants growth. In Sikar District, Lachhmangarh, fatehpur tehsil agricultural soil, study area which is not suitable for plants growth irrigation fields.
- 3. Total Dissolved Solids:** Total dissolved solids amendment in colour and quality of irrigation water soil, per United Nations agency and Indian Standards TDS price ought to be around 500ppm for beverage. In Soil samples T.D.S. value range from 670 to 800 ppm. In Sikar District, Lachhmangarh, Fatehpur tehsil agricultural soils, high range of TDS. study area which is not suitable for plants growth irrigation fields.
- 4. Sodium:** The results of atomic number 11 in plants are kind of like those of exposure to drought. Buildup of atomic number 11 in plants will cause scrawny growth and inactive cell development.¹⁴ The specified concentration of Sodium is 30Meq/l. In Sikar District, Lachhmangarh, Fatehpur tehsil agricultural soil, study area has Sodium range from 8.90 to 26.15Meq/l. It is suitable range for plant growth.

- 5. SAR (Sodium Absorption Ratio):-** Per BIS, safest limit of SAR has been recognized as ten however it's relaxable upto 30Meq/l.
Its low in Lachhmangarh however high in Fatehpur grievous bodily harm at thirty-one 6.0 to 22.14 Meq/l. it'll causes adverse effects on physical properties of soil because of lack of electrolyte concentration. This is suitable range for plant growth.
- 6. Potassium:** For the optimum growth plant, requires 2.81 to 5.12 meq/l. Investigation area of Lachhmangarh, Fatehpur tehsil agricultural soil region from 19.0-31.10Meq/l. high Potassium range Lachhmangarh, Fatehpur tehsils, it is not suitable plants growth. Potassium is a mobile element which is transformation to the younger, plant tissues if a shortage occurs. Potassium provides much of the osmotic "Pull" that draws water into plant root. The foremost common symptom is iron deficiency anaemia on the sides of leaves. This happens 1st in older leaves.
- 7. Calcium:** The calcium tolerance limits for optimal growth for plant in 5 to 10Meq/l. Role of calcium in manufacturing plant tissues and permits it to grow higher. calcium is liable for holding along the cell walls of a plants.
Concentration of Calcium in lachhmangarh, Fatehpur tehsils soil samples for 2.43 to 11.00Meq/l it's normal for plant growth. Thus symptoms seems in the younger leaves tips. The growing tips of roots and leaves sling brown colour and die. deficiency isn't typically determined in plants as a result of secondary effects of high acidity ensuing from soil metal deficiency typically limit growth, precluding expressions of metal deficiency symptoms.

Magnesium: The tolerance limit of atomic number 12 is a pair of 2.5 to 12.0 Meq/l. and in each the areas it's low 1.20 to 2.50 Meq/l and therefore the deficiency symptom of interveinal iron deficiency anaemia 1st seems in older leaves. Leaf tissue between the roots is also chromatic, bronze, or reddish, whereas the leaf veins stay inexperienced. Corn leaves seem yellow striped with inexperienced veins, whereas crops like soybeans, tomatoes, potatoes, and cabbage show orange-yellow color with inexperienced veins.¹⁵
- 8. Sulfate:** The prescribed limit by BIS is 400ppm in irrigation water. The result of its on plants is characterized by uniformly iron deficiency anemia plant and scrawny growth.¹⁶ Younger leaves ar iron deficiency anemia with equally, gently coloured veins. Rate is simple-minded and full growth is stoppage. Plant stems are arthritic, thin, and woody. In each the region consisting of Lachhmangarh, Fatehpur it's varied from 2.50-13.20 Meq/l. Lachhmangarh, Fatehpur, low values in irrigation water and soils investigation area. Sulfate deficiency The effect of its on plants is characterized by similarly chlorosis plant and diarises plant growth.

CONCLUSION

The current study that we are studying is focused on the Physico-Chemical parameters of irrigation in Sikar district, Lacchmangarh and Fatehpurtehsils, with its impact on quality of soil and for this purpose we took samples of irrigation groundwater and irrigation soil and by the help of various parameters as like pH, EC, T.D.S, ALK, T.H, Calcium, Magnesium, Chloride, SO_4^{2-} , NO_3^- , F^- , Na^+ , K^+ and SAR we founded that in the irrigation groundwater samples as like pH, EC, ALK, F^- in Lacchmangarh, Fatehpur high range. T.D.S, Chloride is normal in Lacchmangarh but high in Fatehpur and some parameters such as Nitrate and Sulphate are lower limit.

Now in the irrigation soil samples some parameters as like pH, EC, TDS and Potassium is higher range, but some parameters as like Sodium and SAR, is in normal limit. Calcium, Magnesium and Sulphate are lower in Lacchmangarh and Fatehpurtehsils, Sikar District. All parameters irrigation water and soil, higher range in Lacchmangarh and Fatehpurtehsils, Sikar District. It is not suitable irrigation field in future.

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