Original Research Article

Assessment of irrigation ground water quality different blocks in Jaipur district of rajasthan, india

ABSTRACT

An survey experiment conducted for irrigation water quality status checking of three different blocks (Chomu, Sanganer, Shahpura)of jaipur district of rajasthanand each block three villages were selected during the year 2021-22. Total nine irrigation water samples were collected from nine farmers tubewell in water bottles and analysed. Different results were reported. E.C., pH,Ca^{2+}, Mg^{2+}, Na^{+}, CO_3^{2-},HCO_3^{-}, Cl^{-}, $SO_{4,}$ RSC, SAR ranges of irrigation ground water were reported 0.76-2.81 dS/m.,7.3-9.0, 1.3-4.0 me/L, 5.5-26.0 me/L, 1.0-2.0 me/L, 1.7-4.0 me/L, 1.5-3.5 me/L, 3.4-18.7 me/L, 1.0-3.8 me/L, 7.46-26.0. The study indicated that a majority of the collected samples surpressedthe established thresholds for critical levels of irrigation water quality. Sutaible crops required to grow at study area.

Keywords: Ground water, samples collection sites, Analysis methods, RSC, SAR, etc.

INTRODUCTION

The importance of groundwater for the existence of human society cannot be overemphasized and without it, we cannot imagine our life.Earths ¾ part covered by water but we are unable to use this water. Groundwater is the major source of drinking water and irrigation. Around 95 % of human population in both rural and urban areas of India is mainly depending on groundwater for drinking purpose (Dahiphale*et al.*, 2014). Besides, it is an important source of water for the agricultural and the industrial sector (Johnny and Sashikumar, 2014).

In many parts of arid and semi-arid regions, groundwaterwhichisoftenofpoorqualityisusedasmajorsourceofirrigation.Thecontinuous use of such water for irrigation creates salinity or sodicity insoil.Thesoil degradationduetosalinity andsodicity problemshadaffected significant areas of fertiletracts particularly inarid and semi-aridregionsofcountryandcausedsignificantlosstocropproductivity.These salt-contaminated soils are found in most states across the country. The problem is aggravated in areas where saline/calcareous groundwater is used as the main source of irrigation due to lack of good quality water. Salt-affected soils cover an area of nearly 13.8 million hectares in the country (Yadav, 2007) and 1.24 million hectares in Rajasthan and occur to a greater or lesser extent in virtually all districts of the state (Sharma *et al.*, 2004).

Thegroundwaterofnorth-westernRajasthanistypicalwaterwith problem of high salinity flanked with high chloride and sulphates.SuchwateriscontinuouslyinuseforThe groundwater in northwestern Rajasthan is a typical water with the problem of high salinity flanked by high chloride and sulphate levels. This water is constantly used for agriculture depending on the level of hazardous constituents. In addition, several farmers have abandoned their underground irrigation source due to soil degradation, resulting in drastic crop yield losses. Although the irrigation water in these areas is of poor quality, it is inevitable because there is no alternative source of irrigation in these areas.The salinity of groundwater ranged from 2.1 to 9.1 dSm^{-1} in the wells of Rajasthan (Agrawal *et al.*, 2002).

The unscientific and indiscriminate use of saline water for irrigation leads to accumulation of soluble salts in the root zone and adversely affects the physical and chemical properties of irrigated soils, which in turn reduces crop productivity due to reduced water availability (Chauhan *et al.*, 1988).

Plant growth is either impaired or prevented altogether by the excessive increase in soil salinity resulting from irrigation with saline water. In addition to osmotic stress, plant productivity is affected by specific ionic toxicities, inadequate nutrient availability, and cationic imbalances in plants. These soils, underlain by poor quality groundwater in arid and semiarid regions, have low organic matter content and are therefore not very fertile (Bajwa*et al.*, 1998). Therefore, prudent management of irrigation water in these soils is as important as their reclamation.

MATERIALS AND METHODS

Present study area

Jaipur, located in the state of Rajasthan, serves as both the capital and the largest city of the state. Geographically, Jaipur district is positioned at a latitude of 26.9124° N and a longitude of 75.7873° E. The district covers a total geographical area of 11,06,148 hectares or 11,061.48 square kilometers. Within the city, the gross cropped area spans across 8,48,313 hectares, out of which the net sown area occupies 6,63,167 hectares. Among the net sown area, only 3,02,428 hectares are designated as Net Irrigated area. In other words, this means that out of the total cropped area, a portion of land is cultivated for agricultural purposes, with a smaller portion being irrigated for enhanced productivity. Jaipur district is situated in agro-climatic zone 3-A, specifically the semi-arid eastern plain zone. The district experiences a mild winter and hot summer climate. The average maximum temperature in the area reaches 40.6 degrees Celsius, while the average minimum temperature is 6.2 degrees Celsius. Temperature fluctuations can be significant, with highs of up to 47 degrees Celsius in May and June and lows of around 1.0 degree Celsius in January. The district receives an annual rainfall of approximately 650 millimeters, resulting in a relatively humid climate. The monsoon season occurs from June to September, during which heavy rains and thunderstorms are common. Throughout the year, temperatures tend to remain on the higher side in Jaipur district (District Fact Book., 2019).

Ground water Samples collection sites

According to table-1, Total nine tubewell from water samples were gathered form nine villages, specifically for irrigation purposes, considering the past five years of usage. To ensure the samples were representative, the pump was kept operational before each collection.

The collected samples were then carefully stored in bottles that had been thoroughly cleaned, rinsed, and appropriatelylabeled. Prior to sealing the bottles, a small amount of toluene was added to monitor potential microbial growth.

Methods used for analysis of water samples

According table-2, and serial 1 to 9, these methods were used to check theirrigationwater quality collected from Farmer's Tubewell.

RESULTS AND DISCUSSION

In table-3 and fig-1, The Minimum E.C. of irrigation water was found 0.76 dS/m in villageMorija(V_2)and maximum 2.81 dS/m invillageShivpuri (V_7).pH were reported minimum 7.3 in villageShrikishanpura (V_5) and maximum pH 9.0 was recorded invillageMorija (V_2). Highest Ca^{2+} and Mg^{2+}4.0 me/Lwas drivedin villageShivpuri (V_7)lowest was 1.3 me/L in villageNindola (V_3).The maximum available Na^+ was found 26.0 me/L at in village Shrikishanpura(V_5)and minimum available $Na^+$was found 5.5me/L in village Goner(V_4). The maximum available CO_3^{2-} was found 2.0 me/L at in village Shivpuri(V_7)and minimum available CO_3^{2-} was found 1.0 me/L in village Goner(V_4). The maximum available HCO_3^- was found 4.0 me/L at in village Shivpuri(V_7)and minimum available HCO_3^- was found 1.7 me/L in villageMorija(V_2). The maximum available Cl^- was found 3.5 me/L at in villageShrikishanpura (V_5)and minimum available HCO_3^- was found 1.7 me/L in villageMorija(V_2). The maximum available $SO_4$was found 18.7 me/L at in villageShrikishanpura (V_5)and minimum available HCO_3^- was found 3.4 me/L in villageMorija(V_2). The maximum available RSCwas found 3.8 me/L at in village Shrikishanpura(V_5)and minimum available RSC was found 1.0 me/L in villageGoner (V_4). The maximum available SARwas found 26.00meq/L at in village Shrikishanpura(V_5)and minimum available SARwas found 5.0 meq/L in villageMorija(V_2).Similar results were also reported by Gurjer*et al.* (2015), Bhangee*et al.* (2016) and Yadav and Singh (2018) in their studies at different locations.

CONCLUSION

In survey area,Theamount of major anions and cations have very high in irrigation groundwater. The studied groundwater for irrigation purposes has high alkalinity. The groundwater quality of the 3 blocks of Jaipur district is not suitable for irrigation. Long term use of groundwater may increase the problems of salinity and alkalinity in the soils. Therefore, there is an urgent need to improve irrigation practices and develop resistant crop varieties that can grow without sacrificing yield.

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Table-1: water samples collection sites

S.No.	Blocks	Village	Latitude(^{0}N)	Longitude(^{0}E)

1.	Chomu(B_1)	KeshavNagar (V_1)	26.9039^0	75.7844^0
		Morija(V_2)	27.2068^0	75.7582^0
		Nindola(V_3)	27.3185^0	75.7081^0
2.	Sanganer(B_2)	Goner(V_4)	26.8865^0	75.8341^0
		Shrikishanpura(V_5)	26.7998^0	75.8582^0
		Durgapura(V_6)	26.8518^0	75.7862^0
3.	Shahpura(B_3)	Shivpuri (V_7)	26.9426^0	75.7526^0
		Manoharpur(V_8)	26.2994^0	75.9571^0
		Nwalpura(V_9)	26.8103^0	75.8365^0

Blocks	**Villages**	**EC (dS/m)**	**pH**	**Ca^{2+} Mg^{2+} (me/L)**	**Na^+(me/L)**	**CO_3^{2-} (me/L)**	**HCO_3^- (me/L)**	**Cl^- (me/L)**	**SO_4(me/L)**	**RSC (me/L)**	**SAR**
B_1	V_1	1.30	8.4	1.6	11.4	2.0	2.5	3.0	5.50	2.90	12.80
	V_2	0.76	9.0	1.4	6.2	1.1	1.7	1.5	3.40	1.30	7.46
	V_3	1.28	8.	1.3	11.5	1.5	3.5	3.5	4.30	3.70	14.

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B_2	V_4	0.80	8.9	2.5	5.5	1.0	2.5	1.5	3.50	1.00	5.00
	V_5	2.80	7.3	2.0	26.0	2.0	3.8	3.5	18.7	3.80	26.00
	V_6	1.85	8.0	2.0	16.5	1.5	2.0	2.5	12.5	1.50	16.50
B_3	V_7	2.81	7.5	4.0	24.0	2.0	4.0	3.5	18.5	2.00	17.02
	V_8	1.85	8.0	2.9	15.6	1.7	2.5	2.0	12.3	1.30	13.00
	V_9	1.35	8.4	2.4	11.1	1.8	2.0	2.9	6.80	2.50	10.18

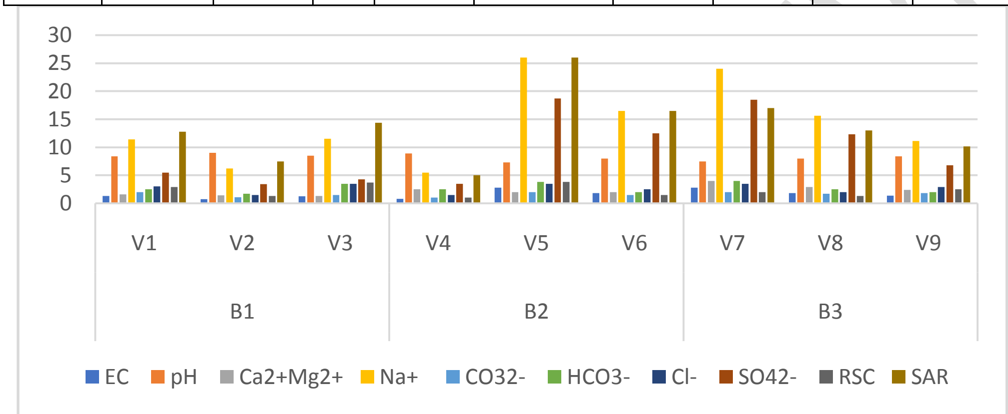

Fig-1. Status of Irrigation Ground Water Quality

Table No.- 2. Different results are shown in study areas.

Table-3: Methods to be Used for Checking of irrigation ground water Quality

S. No.	Experiment	Method	Reference
1.	EC	WiththehelpofECmeteraspermethod(4b)USDAHandbookNo.60	Richards (1954)
2.	Ph	pHmeter	Richards (1954)
3.	Ca^{2+}+ Mg^{2+}	With standard EDTA solution as permethod No. 7 USDA, Hand book No.60	Richards (1954)
4.	Na^{+}	Withthehelpofflamephotometeras permethod(10a)USDA,HandbookNo. 60.	Richards (1954)
5.	CO_3^{2-} &HCO_3^{-}	WithstandardH_2SO_4aspermethod12, USDA,HandbookNo.60.	Richards (1954)
6.	Cl^{-}	Withstandard$AgNO_3$aspermethodNo.13,USDAHandBookNo.60	Richards (1954)
7.	SAR	$SAR = Na^{+} / [(Ca^{2+} + Mg^{2+})/2]^{0.5}$ Wheresolublecationsareinme/L	Richards (1954)
8.	RSC	$(CO_3^{2-} + HCO_3^{-}) – (Ca^{2+} + Mg^{2+})$ Where CO_3^{2-}, HCO_3^{-}, Ca^{2+} and Mg^{2+} are in me/ L	Richards (1954)
9.	EC	WiththehelpofECmeteraspermethod(4b)USDAHandbookNo.60	Richards (1954)