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Assessment of Underground Irrigation Water Quality of Kanpur Dehat District of Uttar Pradesh

RAVINDRA KUMAR, DEVENDRA SINGH AND ARVIND KUMAR

Department of Soil Science and Agricultural Chemistry, C. S. Azad University of Agriculture and Technology, Kanpur (U.P.) 208 002

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India has 42 % share of global water resources and supports about 16.7% of the global population. Agriculture alone accounts for about 85% water use in the country and the remainder 15% is used by the domestic and industrial sector. Water is vital for realizing the full potential of the agriculture sector and country development with the advancement in modern technologies and irrigation system, there is a tremendous pressure on ground water quantity and quality. As a consequence, ground water depth and quality are deteriorating at a alarming rate in many part of state. Good quality water available in desired quantities is of utmost impotence for higher agriculture productivity. Besides continues decrease in the available of fresh water resources, many part in India suffering from water scarcity are also usually undertaking by poor quality groundwater and the maximum area under saline, alkali and brackish groundwater occurs in the arid and semi arid regions Rajasthan, Punjab, Haryana, Delhi and Uttar Pradesh. The main cause of salanigation and sodification is the use of poor quality irrigation water and continuous use of this water, ultimately results in increased cost of production and crop failures (Minhas and Tyagi 1998). Keeping these facts in view, the evaluation appraisal of the underground water of Kanpur dehat district was done for irrigation purpose.

Two hundred thirty four underground irrigation water samples collected from well, tube well and hand pumps of Kanpur dehat district (U.P.) during November and December 2015 along with GPS location and were characterized to assess the quality of water for irrigation. The running open wells, tube wells and hand pumps were selected randomly for collection of water samples. Each selected water resources was run for some time and then the samples were collected in the cleaned plastic bottles. The bottles were well rinsed before sampling and tightly sealed after collection and leveled for chemical analysis. These underground irrigation water samples were analyzed for pH, EC, cations and anions using the methods described by Richards (1954). Sodium adsorption ratio (SAR) and residual sodium carbonate (RSC) were worked out.

Table 1: Range and mean of different water quality parameters of Kanpur dehat district

Parameters	Range	Mean
pH	7.1-8.6	7.83
EC (dSm^{-1})	0.32-4.11	0.95
Anions (me L^{-1})		
CO_3	0.0-1.2	0.21
HCO_3	0.8-20.2	3.56
SO_4	0.2-4.7	1.25
Cl	0.5-32.2	4.68
Cations (me L^{-1})		
Ca	1.6-17.7	3.36
Mg	0.3-12.8	1.55
Na	0.7-25.9	3.85
K	0.1-0.8	0.03
SAR (mmol $l^{-1})^{1/2}$	0.0-10.2	2.92
RSC(me L^{-1})	0.0-7.5	0.32

The electrical conductivity of underground irrigation water ranged from 0.32 to 4.11 dSm^{-1} with a mean value of 0.95 dSm^{-1} (Table1). The lowest EC of 0.32 dSm^{-1} in water samples was observed in Kariapur village of Rasulabad block and highest (4.11 dSm^{-1}) in Karsha village of Sarvankhera block. The range of pH was between 7.1 and 8.6 with the mean value of 7.83.The minimum value of pH was recorded in Bhavanpur village of Jhinjak block and maximum in Rajpur village of Derapur block. The sodium adsorption ratio (SAR) varied from 0.0 to 10.2 (mmol $l^{-1})^{1/2}$ with the mean value of 2.92 (mmol $l^{-1})^{1/2}$. Minimum value of SAR was recorded in Dhakpura village of Maintha block and maximum in Amrahat village of Sandalpur block. The value of residual sodium carbonate (RSC) was

Derapur block and lowest in Dharampur village of Sndalpur block. The maximum value of carbonate was observed in Bijalipurava village of Derapur block and minimum in Nayapurawa of Rashulabad block with a range of 0.0 to 1.2 me L^{-1}. Highest bicarbonate was recorded in Rajpur village of Rajpur block and lowest in Jaitpur of Sandalpur block with a range of 0.8 to 20.2 me L^{-1}. The maximum value of sulphate was recorded from Khurjapur and minimum in Khojaphool village of Rajpur block. The minimum value of chloride was recprded in from Behta of Maitha block and maximum in Rampur village of Rasulabad block. The chloride ranged from 0.5 to 32.2 me L^{-1}. The mean values of carbonate, bicarbonate, sulphate and chloride anions were 0.21, 3.56, 1.25 and 4.68 me L^{-1} respectively. In the water samples bicarbonate dominate followed by chloride anions among other anions. The maximum calcium value observed in Behuna and minimum in Pailawar village of Rajpur block were from1.6 to 17.7 me L^{-1} with the mean value of 3.36 me L^{-1}.

Table 2: Quality of underground irrigation water of Kanpur Dehat district

Category	No. of water samples	Per cent
Good	192	82.05
Marginally Saline	32	13.68
Saline	02	0.85
Highly Saline	03	1.28
Marginally Alkali	02	0.85
Alkali	02	0.85
Highly alkali	01	0.44

The magnesium ranged from 0.3 to 12.8 me L^{-1} with the mean value of 1.55 me L^{-1}. The corresponding range for sodium was from 0.7 to 25.9 me L^{-1}. The potassium in these water samples ranged from 0.1 to 0.8 me L^{-1}. In these water samples, sodium dominates followed by calcium. The results are in close conformity with those of Kumar and Kumar (2014) and Yadav and Sekhon (2016). According to AICRP on Management of Salt Affected Soils and Use of Saline Water in Agriculture classification, it was found that, out of the 234 samples, there was 82.0 % samples belong to good category, 13.7 % samples marginally saline category, 0.8 % samples saline water category, 1.3 % samples highly saline water category, 0.8 % samples marginally alkaline category, 0.8 % samples alkaline category and 0.4 % samples highly alkaline water category in Kanpur dehat district of Uttar Pradesh. Similar results were reported by Sharma (2011) and Kumar and Kumar (2015).

Based on the present study, it can be concluded that about 18 percent waters of the Kanpur dehat district had marginal and poor quality, but this poor quality ground water can be used with special management practices depending upon the soil types, rainfall and crops to be grown. The application gypsum alongwith good amount of FYM in light to medium textured, well drained and permeable soils will enhance the efficacy of this marginal and poor quality ground water and helpful in arresting the decreasing trend in crop production.

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