

Original Research Article

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## Assessment of Groundwater Quality of Borewells Water Used for the Cultivation of Pomegranate Crop in Hosadurga Taluk of Central Dryzone of Karnataka, India

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### ABSTRACT

An investigation was carried out to study the quality of irrigation water in pomegranate growing areas of Hosadurga taluk in central dry zone of Karnataka. Water samples were collected from the bore wells of different age groups (< 2 years and > 2 years) of pomegranate gardens and were analyzed for various parameters. The analysis of the samples revealed that the pH of irrigation water was Alkaline in nature with mean of 8.65. Electrical conductivity was (mean) of 0.67 dS m<sup>-1</sup>. Calcium and Magnesium concentrations were mean values of 4.7 and 2.1 meq l<sup>-1</sup> respectively. The mean Na and K concentration in irrigation water were 0.57 and 0.12 meq l<sup>-1</sup> respectively. The mean carbonate and bicarbonate content in irrigation water was 1.42 and 4.35 meq l<sup>-1</sup>. The residual sodium carbonate content (RSC) ranged from -0.2 to -3.1 meq l<sup>-1</sup> with mean of -1.03. The sodium adsorption ratio (SAR) ranged from 0.08 to 0.96 meq l<sup>-1</sup> with a mean value of 0.30 meq l<sup>-1</sup>. Nitrate and sulphate concentration in irrigation water ranged from 0.08 to 1.15 and 1.3 to 4.2 with mean values of 0.66 and 0.22 ppm respectively. The irrigation water was slightly alkaline in nature and all other quality parameters are placed within the safer zone.

#### Keywords

Water quality, Pomegranate garden, SAR, ESP, RSC

#### Article Info

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### Introduction

Ground water is about 20% of the world resource of fresh water and widely used by industry, irrigation and domestic purposes. Only about 1% of all of fresh water available from rivers, ponds and lakes, out of 0.03% water require for survival and growth of many forms of animal and plant life on the earth surface. In town and villages people completely depend on ground water for domestic as well as for agriculture purpose,

hence quality of ground water is very important. Ground water is also polluted by acid rain, fertilizers, industrial waste, garbage and domestic waste. Groundwater is a highly useful and often abundant resource, however over use or overdraft can cause major problems to human beings and to the environment (Chhaya *et al.*, 2009). Groundwater is used for domestic supply and agriculture in most parts of Chitradurga district in Karnataka, Water is a replenishable resource and has inherent advantages over

surface water. There has been a tremendous increase in the demand for fresh water due to growth in population. Among the various sources of water, groundwater is said to be the safest water for domestic and agricultural purposes. Nevertheless, several factors, like discharge of agricultural, domestic and industrial wastes, land use practices, geological formation, rainfall patterns and infiltration rate are reported to affect the quality of ground water in an area. As groundwater moves along flow lines from recharge to discharge areas, its chemistry is altered by the effect of a variety of geochemical processes (Government of India Ministry of Water Resources Central Ground Water Board).

Chitradurga district covers a geographical area of 8388 sq.kms and comprises six taluks. It receives low to moderate rainfall and is one of the drought prone districts in the state. Normal annual rainfall varies between 668mm in Holalkere in western part to 457mm in Chellakere, in the northeastern part. Hence it is clear that water quality assessment studies in Karnataka especially in Chitradurga district are inadequate. Dry land horticulture is picking up fast in this area, Hosadurga taluk have emerged as the leading pomegranate growing area in Karnataka state. In Hosadurga taluk, where the study was conducted, pomegranate is being grown on commercial scale. The area under pomegranate in the district is 1297 ha (10.79 % of total area under pomegranate in the state). Therefore, the present study has been undertaken to assess the irrigation water quality of pomegranate growing areas of Hosadurga taluk in Central dry zone of Karnataka.

### **Material and Methods**

Ground water samples were collected from fifty different locations (Villages) of Hosadurga taluk of chitradurga district.

Samples were collected in sterilized screw-capped polyethylene bottles of one liter capacity, labeled properly and analyzed in laboratory. Samples were used for determination of pH by Potentiometry, Electrical conductivity by conductometric method, sodium and potassium by Flame photometry, nitrate and Boron by using continuous flow analyser, calcium and magnesium by using Versenate titration method, sulphate by Turbidometry, Chlorine by Winkler's method using potassium chromate as indicator, carbonates by Titration method using phenolphthalein indicator and bicarbonates by Titration method using methyl orange indicator respectively. Using above irrigation water quality parameters Residual sodium carbonate (RSC) and Sodium adsorption ratio (SAR) were calculated. In order to analyse the above irrigation water quality parameters standard method has followed (Manivasakam, 1987).

### **Results and Discussion**

The data pertaining to characterization of irrigation water for various parameters were presented in Table 1. The analysis of the samples revealed that the pH value of irrigation water ranged from 7.92 to 9.02 with mean of 8.65. Electrical conductivity was in the range of 0.24 to 1.48 with mean of 0.67 dS m<sup>-1</sup>. Ca and Mg concentrations ranged from 2.5 to 5.9 and 1.1 to 3.5 with mean values of 4.7 and 2.1 meq L<sup>-1</sup>, respectively. The Na and K concentration in irrigation water ranged from 0.31 to 0.97 and 0.03 to 0.31 with mean values of 0.57 and 0.12 meq L<sup>-1</sup>. The carbonate and bicarbonate content in irrigation water ranged from 0.2 to 2.4 and 2.2 to 6.4 with mean values of 1.42 and 4.35 meq L<sup>-1</sup>. The residual sodium carbonate content ranged from -0.2 to -3.1 meq L<sup>-1</sup> with mean of -1.03. The sodium adsorption ratio ranged from 0.08 to 0.96 meq L<sup>-1</sup> with the mean value of 0.30 meq L<sup>-1</sup>.

**Table.1** Irrigation water quality parameters of bore well water used for cultivation of pomegranate in Hosadurga taluk in central dry zone of Karnataka

Sl. No	pH	EC (dS m <sup>-1</sup> )	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Ca	Mg	RSC	Na	K	Cl	SAR	NO <sub>3</sub> <sup>-</sup>	SO <sub>4</sub> <sup>2-</sup>	B
			meq L <sup>-1</sup>									Ppm		
1	9.01	0.85	1.1	5.6	5.4	2.1	-0.80	0.56	0.12	0.4	0.44	0.28	1.5	0.21
2	8.82	0.76	0.7	2.6	2.5	1.3	-0.50	0.32	0.12	0.3	0.96	0.39	2.2	0.25
3	8.85	0.78	2.1	2.4	3.4	1.8	-0.66	0.43	0.1	0.3	0.27	0.53	1.8	0.26
4	8.96	0.88	1.6	2.7	3.0	2.0	-0.66	0.64	0.29	0.3	0.41	0.34	1.4	0.18
5	8.95	1.12	0.8	5.2	5.2	3.5	-2.70	0.39	0.12	0.9	0.08	0.44	1.8	0.08
6	9.02	1.02	1.2	4.7	5.3	1.6	-1.06	0.44	0.09	0.4	0.24	0.37	1.6	0.15
7	9.01	0.68	1.6	4.8	5.7	1.3	-0.64	0.33	0.13	1.5	0.15	0.33	1.4	0.14
8	8.8	1.05	0.6	3.1	4.8	1.5	-2.60	0.83	0.16	0.3	0.30	1.15	2.2	0.08
9	8.64	1.08	0.7	6.2	5.1	2.2	-0.40	0.46	0.1	0.6	0.12	0.85	2.1	0.05
10	8.9	1.13	1.2	6.4	5.2	3.1	-0.70	0.47	0.14	0.3	0.20	0.67	1.3	0.22
11	8.71	0.66	1.6	5.2	4.8	2.8	-0.80	0.54	0.06	0.3	0.30	0.64	2.1	0.21
12	8.93	1.42	1.2	2.6	3.1	1.5	-0.78	0.6	0.18	1.1	0.45	0.53	1.8	0.26
13	8.98	1.48	1.4	6.3	5.9	2.4	-0.56	0.47	0.17	1.1	0.24	0.49	2.4	0.18
14	8.58	1.11	0.5	6.1	4.8	3.3	-1.50	0.43	0.11	0.3	0.30	0.44	1.8	0.26
15	8.62	0.45	0.2	5.1	4.8	1.4	-0.90	0.37	0.23	0.3	0.23	1.32	1.8	0.24
16	8.69	0.6	0.4	4.3	4.5	1.8	-1.60	0.69	0.1	0.3	0.39	0.03	2	0.21
17	8.63	0.38	0.2	4.1	4.1	2.1	-1.90	0.31	0.19	0.3	0.08	2.11	1.8	0.05
18	8.95	1.45	1.2	3.6	3.8	1.2	-0.20	0.4	0.05	1.1	0.17	0.47	1.7	0.22
19	8.9	1.18	2.3	3.9	4.2	2.4	-0.40	0.54	0.11	0.4	0.14	0.27	2.3	0.14
20	8.8	0.65	2	4.5	5.1	2.3	-0.90	0.67	0.1	0.3	0.29	0.22	2.4	0.19
21	8.59	0.45	1.5	5.6	5.5	2.4	-0.80	0.45	0.31	0.4	0.17	0.28	3.2	0.25
22	8.69	0.59	1.4	5.5	5.2	2.4	-0.70	0.65	0.2	0.4	0.16	0.41	2.4	0.12
23	8.78	0.57	1.1	4.2	4.4	1.3	-0.40	0.57	0.04	0.6	0.30	0.35	3.2	0.18
24	8.68	0.61	2.4	3.8	4.1	2.9	-0.82	0.48	0.15	0.4	0.24	0.23	2.4	0.11
25	8.77	0.53	2	4.6	5.3	2.7	-1.38	0.57	0.18	0.4	0.26	0.36	3.2	0.09

**Table.1** Cont....

Sl. No	pH	EC (dSm <sup>-1</sup> )	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Ca	Mg	RSC	Na	K	Cl	SAR	Ppm		
												NO <sub>3</sub>	SO <sub>4</sub> <sup>2-</sup>	B
			meqL <sup>-1</sup>											
26	8.7	0.57	2.0	4.4	4.8	2.4	-0.80	0.69	0.13	0.4	0.27	0.08	3.4	0.16
27	8.82	0.52	1.8	3.5	4.5	1.2	-0.42	0.71	0.03	0.3	0.42	0.31	3.1	0.15
28	8.78	0.56	1.6	4.8	5.1	2.1	-0.80	0.61	0.2	0.3	0.26	1.11	4.1	0.13
29	8.67	0.38	2.0	5.6	5.4	3.2	-1.00	0.53	0.18	0.4	0.21	0.69	4.2	0.26
30	8.6	0.58	2.2	5.7	5.8	3.1	-0.96	0.34	0.12	0.3	0.16	0.69	3.2	0.24
31	8.78	0.39	2.4	5.2	5.5	2.5	-0.40	0.45	0.04	0.4	0.26	0.57	2.4	0.29
32	8.64	0.58	1.8	3.6	4.5	1.8	-0.90	0.75	0.11	0.5	0.42	0.08	2.1	0.22
33	8.62	0.39	2.1	2.8	5.2	1.5	-1.80	0.41	0.1	0.2	0.21	0.31	1.5	0.21
34	8.32	0.76	1.2	4.2	5.4	3.1	-3.10	0.4	0.07	0.5	0.16	0.32	1.6	0.25
35	8.12	0.60	2.3	2.7	4.6	1.6	-1.20	0.55	0.04	0.4	0.32	0.62	2.4	0.31
36	8.34	0.54	2.3	2.4	4.1	1.5	-0.90	0.62	0.05	0.3	0.34	0.41	1.5	0.24
37	8.63	0.42	0.9	4.3	4.2	1.8	-0.80	0.67	0.06	0.3	0.30	0.61	1.8	0.28
38	8.56	0.42	0.6	2.8	3.9	1.7	-2.20	0.68	0.05	0.4	0.35	0.72	1.4	0.24
39	7.92	0.34	0.4	4.7	4.2	1.9	-1.00	0.51	0.04	0.4	0.28	0.61	1.7	0.3
40	8.14	0.31	0.7	4.5	4.8	1.1	-0.70	0.61	0.04	0.3	0.35	0.52	2.3	0.26
41	8.36	0.24	1.3	4.2	4.2	2.1	-0.80	0.73	0.18	0.4	0.45	0.66	1.6	0.14
42	8.42	0.38	2.0	4.1	4.6	2.1	-0.60	0.65	0.13	0.5	0.45	0.58	1.5	0.06
43	8.72	0.62	1.8	2.2	3.5	2.2	-1.70	0.54	0.19	0.4	0.32	0.62	1.8	0.08
44	8.42	0.42	0.9	4.3	4.2	2.6	-1.60	0.5	0.13	0.3	0.27	0.58	2.6	0.1
45	8.31	0.32	1.6	4.8	4.6	2.5	-0.70	0.68	0.12	0.4	0.39	0.63	3.5	0.08
46	8.64	0.64	2.1	4.2	5.1	1.5	-0.30	0.78	0.09	0.3	0.43	0.52	3.4	0.12
47	8.8	1.04	1.0	3.6	4.2	3.1	-2.68	0.71	0.21	0.3	0.37	0.55	2.7	0.26
48	8.24	0.36	1.6	4.5	5.1	1.6	-0.60	0.47	0.12	0.5	0.26	0.63	1.9	0.14
49	8.32	0.28	1.6	5.1	4.8	2.5	-0.60	0.59	0.25	0.4	0.34	0.63	1.6	0.12
50	8.62	0.66	2.2	6.2	5.7	3.2	-0.48	0.97	0.16	0.3	0.46	0.62	2.1	0.14
Mean	8.65	0.67	1.42	4.35	4.7	2.1	-1.03	0.57	0.12	0.44	0.30	0.66	2.22	0.18
Range	7.92-9.02	0.24-1.48	0.2-2.4	2.2-6.4	2.5-5.9	1.1-3.5	-0.2-3.1	0.31-0.97	0.03-0.31	0.2-0.5	0.08-0.46	0.08-1.15	1.3-4.2	0.05-0.31

**Table.2** Correlation coefficient (r) between irrigation water quality and yield of pomegranate fruits

Water Quality parameters	pH	EC (dS m <sup>-1</sup> )	CO <sub>3</sub> <sup>2-</sup>	HCO <sub>3</sub> <sup>-</sup>	Ca	Mg	RSC	Na	K	Cl	SAR	ppm		
												NO <sub>3</sub>	SO <sub>4</sub> <sup>2-</sup>	B
Yield	-0.135	0.176	-0.323*	-0.231*	-0.160	-0.253*	-0.248*	0.147	-0.005	0.163	-0.254*	-0.439*	-0.239*	-0.301*

\*= 5%; \*\*= 1%

Nitrate and sulphate concentration in irrigation water ranged from 0.08 to 1.15 and 1.3 to 4.2 with mean values of 0.66 and 0.22 ppm respectively. The boron concentration ranged from 0.05 to 0.31 with mean values of 0.18 ppm. The mean value of pH was 8.65; irrigation water is slightly alkaline in reaction. Electrical conductivity was 0.67 dS m<sup>-1</sup> indicated that there are no harmful effect of salts in irrigation water and quite suitable for irrigation. Residual sodium carbonate values were -0.2 to -3.1 meq L<sup>-1</sup> and hence more suitable for irrigation. Sodium adsorption ratio ranged from 0.08 to 0.96. If RSC values recorded <10, such water was regarded as low sodium water and suitable for irrigation. Carbonates (1.42 meq L<sup>-1</sup>), bicarbonates (4.35 meq L<sup>-1</sup>), nitrates (0.66 ppm), sulphates (2.22 ppm) and boron (0.18 ppm) content were below the critical limits and hence water is very much suitable for irrigation. Similar kinds of results were also reported by Prakash and Somashekar, (2006), Veeragandham Srinivasa Rao *et al.*, (2012).

### **Correlation between irrigation water quality with yield of pomegranate fruits**

The data on correlation between irrigation water quality with yield of pomegranate fruits was presented in Table 2. Pomegranate fruit yield was highly significantly and negatively correlated with carbonates ( $r = -0.323^*$ ), bicarbonates ( $r = -0.231^*$ ), magnesium ( $r = -0.253^*$ ), residual sodium carbonate (RSC) ( $r = -0.248^*$ ), sodium adsorption ratio (SAR) ( $r = -0.254^*$ ), nitrates ( $r = -0.439^*$ ), sulphates ( $r = -0.239^*$ ) and boron ( $r = 0.301^*$ ) concentrations of irrigation water. The water

quality parameters indicated that, there is no harmful effect of irrigation water affecting the yield of pomegranate in the study area. Similar types of results were also recorded by Abdul saleem *et al.*, (2012).

### **References**

- Abdul Saleem, Mallikarjun, N. Dandigi and Vijay Kumar, K., 2012, Correlation-regression model for physico-chemical quality of groundwater in the South Indian city of Gulbarga. *Afr. J. Environ. Sci. Tech.*, 6(9): 353-364.
- Chhaya, V. Wagh, Sudarshan, J. Kokate, Haribhau R, Aher and Shashikant, R. Kuchekar., 2009, Physico-chemical analysis of ground water in pravara area, district Ahmednagar, Maharashtra. *Rasayan J.Chem.*, 2(1): 234-242.
- Government of India Ministry of Water Resources Central Ground Water Board., <http://cgwb.gov.in>
- Manivasakam, N., 1987, Physico-chemical examination of water, sewage and industrial effluent. *Pragathi Prakashan*, Merut.
- Prakash, K., L. and Somashekar, R. K., 2006, Groundwater quality - Assessment on Anekal Taluk, Bangalore Urban district, India, *J. Environ. Bio.*, 27(4): 633-637.
- Veeragandham Srinivasa Rao, Prasanthi, S., Jagarlapudi, Shanmukha, V. and Kottapalli Prasad, R. S., 2012, Physicochemical analysis of water samples of Nujendla area in Guntur District, Andhra Pradesh, India. *Int. J. Chem. Tech. Res.*, 4(2): 691-699.

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