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Evaluation of physic-chemicals property of water available from different sources for irrigation purposes from Berhampur, Murshidabad district, West Bengal

DK Verma, PK Dhara, AK Tailor and Meenakshee Dwivedi

Abstract
Thirty two water samples were collected from Berhampur of difference sources like, Deep tube well, Shallow tube well, Pond and River water in before monsoon (April-May) and after monsoon (September-October) in year 2011. The same practice fallow for the collection of water samples in next year 2012. Surface water source pond then river water were found good quality of water for the irrigation purpose in before monsoon (C1S1-C2S1) and after monsoon (C1S1-C1S1) in 2011 and 2012. Water samples have contain less soluble salt and safe for the irrigation use for any crops. They have no required any management practice before the use. In respect of the ground water like deep tube well and shallow tube well water were found high saline water before monsoon (C2S1-C3S1) in both years. Salinity of water high due to the high temperature, low water table, evaporation of soil moisture and accumulation of salt. Irrigation quality of the water after the monsoon (C2S1) improve due to the rain fall and its result infiltrate water in ground and improve water table and quality also. The trend of the soil quality were found in the respect of EC and SAR and availability of the nutrients is Pond irrigated soil> River irrigated soil> Deep tub well irrigated soil > Shallow tube well irrigated soil. Surface water irrigated soil were found good compare to the ground water. Analysed plant samples of paddy and spinach crop in pond and river water (Surface water) irrigated field in both year 2011and 2012.

Keywords: Irrigation water, Water quality, Groundwater, Surface water

Introduction
The beginning of 21st century is marked by global scarcity of water resources, environmental pollution and increased salinization of soil and water. Increasing human population and reduction in land available for cultivation are two threats for agricultural sustainability (Shahbaz and Ashraf, 2013) [8]. Various environmental stresses viz. high winds, extreme temperatures, soil salinity, drought and flood have affected the production and cultivation of agricultural crops, among these soil salinity is one of the most devastating environmental stresses, which causes major reductions in cultivated land area, crop productivity and quality (Yamaguchi and Blumwald, 2005; Shahbaz and Ashraf, 2013) [11, 8]. A saline soil is generally defined as one in which the electrical conductivity (EC) of the saturation extract (ECe) in the root zone exceeds 4 dSm^{-1} (approximately 40 mMNaCl) at 25 ^0C and has an exchangeable sodium of 15%. The yield of most crop plants is reduced at this ECe, though many crops exhibit yield reduction at lower ECes (Munns, 2005; Jamil *et al*., 2011) [12]. It has been estimated that worldwide 20% of total cultivated and 33% of irrigated agricultural lands are affected by high salinity. Furthermore, the salinized areas are increasing at a rate of 10% annually for various reasons, including low precipitation, high surface evaporation, weathering of native rocks, irrigation with saline water, and poor cultural practices. It has been estimated that more than 50% of the arable land would be salinized by the year 2050 (Mitran, *et al*., 2016) [4].
The water resources management contemplates as necessary the knowledge of the water availability and quality for the different uses to assure the sustainable development of the populations. In India, the supply of fresh water resources is almost constant and even if it is not falling, from which the agriculture sector draws the lion's share (80-90 per cent) (see Kumar *et al*., 2005; Gupta and Deshpande, 2004; Vira *et al*., 2004 and Chopra, 2003). Hence, with the growing demand and rising scarcity for water, in future all the demands for agricultural use cannot be met by fresh water resources alone, but will gradually depend on

marginal quality water or refuse water from domestic and industrial sectors (Bouwer, 2000). However, both domestic sewage and industrial effluents contain various water pollutants, which need to be treated before use for irrigation. Water quality is a key environmental issue facing the agricultural sector today. Meeting the right quantity and desirable quality of water for agriculture is not only essential for food security but also for food safety. Irrigation with untreated or partially treated wastewater and effluents could create environmental and human health hazards. Although water is a renewable natural resource, like other natural resources water can also get depleted and degraded due to unsustainable utilization (Rahman *et al.*, 2000) [5].

The concentration and ratios of accompanying elements can influence the uptake and transport of a particular nutrient and indirectly may affect the uptake and translocation of others. These interactions are complicated further by numerous environmental factors such as aeration, temperature, and stresses both biotic and abiotic. Crops vary not only in the rate at which they absorb an available nutrient element, but also in the manner by which they distribute the element spatially within the plant. Certain ions in the salinizing media such as sodium can have a profound effect on calcium mobility and distribution within certain plant organs. Similar examples can be made for other essential nutrients. The aim of this study to identify the suitable water sources (Surface and ground) for irrigation purposes in Berhampur.

Materials and Method

Description of site

The study area forms a part of lower Ganga in west Bengal. About 300 km stretch of the river under study start from Berhampore, District Mursidabad in the north (88018'9' to 2403'5'E) and extend up to Uluberia, Berhampore is situated about 115 km. away in the south from farakka where the river Ganga gets bifurcated into two parts Viz. the Padama (which enter into Bangladesh) and the Hooghly (which flow through West Bengal).Therefore, our study stretch of the river takes the name Hooghly.

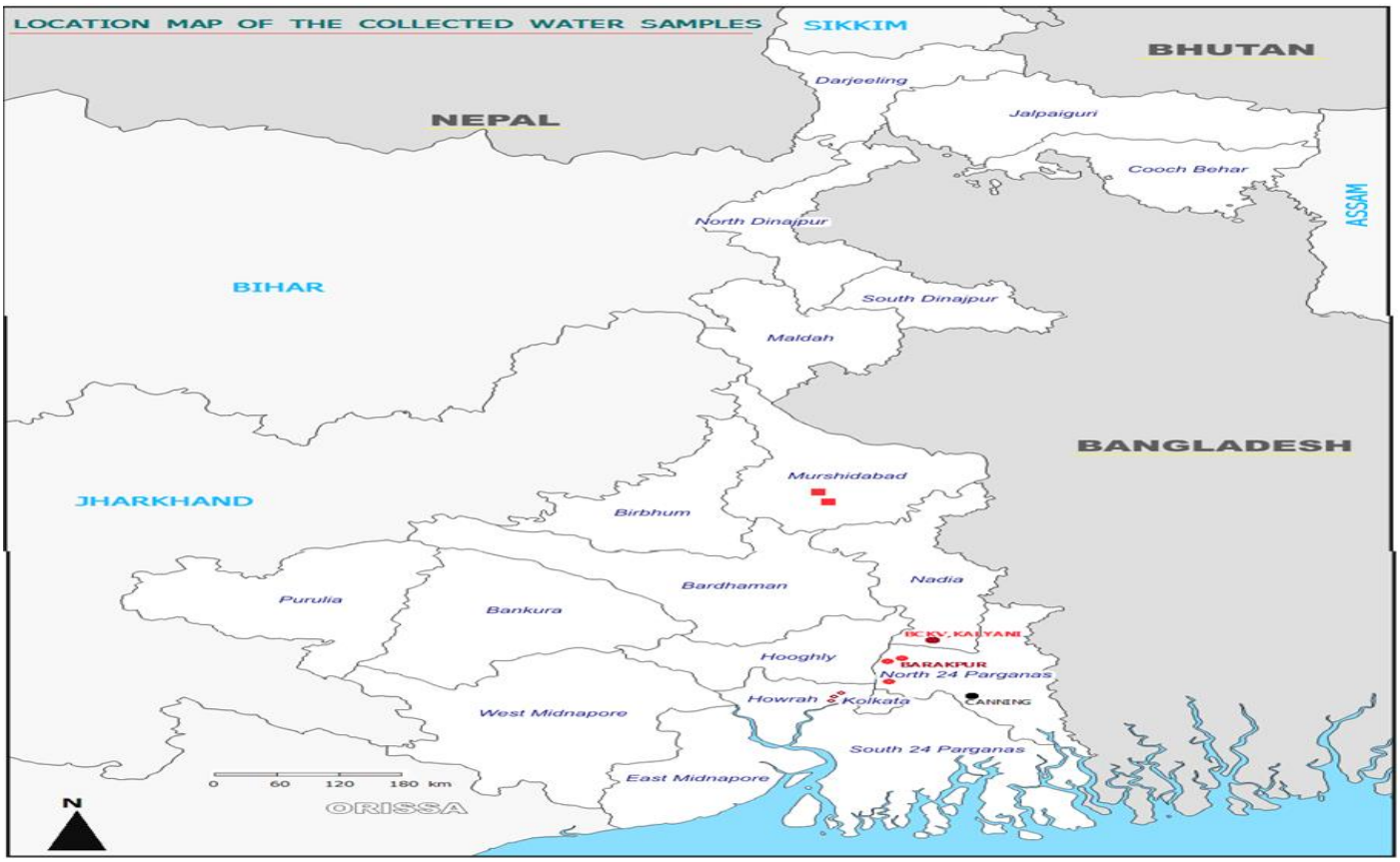

Fig 1: Map of the water samples collection sites

Water sample collection and preservation

Water samples were collected from different sources like River, Pond Submersible pump and deep tube well from Berhampur, of lower gangatic zone, Murshidabad district in West Bengal during pre (April-May, 2011) and post-monsoon seasons (Sept.-October, 2011) from various abstraction sources at various depths covering extensively cropped area. The same sampling process adopted in second year in 2012. Samples were collected in glass bottles while high density polypropylene bottles covered with aluminium foils. All the samples werestored in sampling kits maintained at 4°C and brought to the laboratory for detailed chemical analysis.

Result and Discussion

Quality of water for the irrigation purposes mainly depend on the salt content available in water its known as water salinity its represent through electrical conductivity (EC), and Sodium adsorption ratio (SAR). SAR represents the ratio of availability of sodium (Na^{++}), Calcium (Ca^{++}) and magnesium (Mg^{++}) in water. There is a general agreement that all irrigation waters, regardless of its source, contain considerable amounts of dissolved salts.

Ground water qality is an important source of water for the irrigation and drinking useses.ground water sources like deep tube well and shallow tube well water were collected from Beharampur, Murshidabad district in befor monsoon(April-May) and after monsoon(October-November) durind year 2011-2012.

1. Physico-chemicals characteristics of deep tube well water

The characteristics of deep tube well water are described (Table 1). The result of pH revealed that the value of the deep tub well were found in ranges between 7.17- 8.20 in pre-monsoon and 6.92-7.89 after monsoon in 2011 (Table 1).The pH of the deep tub well in second year in same water sours were found ranges 6.82- 8.34 in pre- monsoon and 6.65—8.13 after the post monsoon 2012 (Table 2).The water samples show the slightly alkaline in reaction in both year and season. The tables show the water is slightly saline in nature and the ranges of electrical conductivity are 0.50-0.76 dsm^{-1} in pre monsoon and 0.32-0.56 dsm^{-1} after the monsoon in 2011 (Table.2).In the next year electrical conductivity were found ranges between 0.37- 0.68 dsm^{-1} in pre monsoon and 0.22-0.49 dsm^{-1} after the monsoon 2012 (Table. 2).

The Sodium adsorption ratio (SAR) value were found the ranges between 1.3-3.8 in pre-monsoon and 1.0- 2.9 in post-monsoon 2011 (Table.1). The SAR values varies in next year in ranges between 2.8- 5.0 pre-monsoon and 2.3- 3.6 after the post-monsoon 2012 (Table 2). Residual sodium carbonate (RSC) wears the ranges between -139.02 to -105.45 in before-monsoon and-117.61 to 83.02 after the monsoon in 2011 (Table 1). The next year RSC values varies between -106.59 to -52.57 before monsoon and -117.61 to -83.02 after the monsoon in 2012 (Table. 2). RSC were found both year and season negative it means calcium and magnesium found dominant in water samples. The improvement of water quality after the monsoon was observed by the reducing the salinity and sodium content in water samples due to increasing the water content and dissolved the salt concentration of water (Choudhury *et al*., 2012). On the basis of the EC and SAR value of the deep tube well water were classify for irrigation purpose in class C2S1 before monsoon and class C2S1 after the monsoon 2011 (Table.5). In 2012 water quality of the deep water were found in before monsoon and C2S1 after the monsoon (Table.5). It's a suitable for the irrigation purposes.

2. Physico-chemicals characteristics of shallow tube well water

Shallow tub well water is a highest useable in agriculture system because of the it's required low input and low boring comparison to the deep tub well. Depth of the shallow tub well generally found is 100-150 fit in soil. The water samples collected in pre-monsoon (April-May) and post-monsoon (October-November) in 2011-2012. The pH of shallow tub well varies in the range between7.03- 7.47 in pre-monsoon and 6.81-7.31 after the post –monsoon in 2011 (Table 1). Second year the same sources of water samples pH varies ranges between 6.58- 7.86 in pre-monsoon and 6.32-7.59 after the post –monsoon in 2012 (Table.2).

Electrical conductivity of the water samples found in ranges between 0.64-0.69 dsm^{-1} in pre-monsoon and o.38-0.68 dsm^{-1} after post-monsoon in 2011(Table.1). Electrical conductivity of shallow tub well in next year varies in ranges between 0.42 -0.78 dsm^{-1} in pre-monsoon and 0.29-0.51 dsm^{-1} after the post monsoon in 2012 (Table.2).

Sodium adsorption ratio (SAR) of the shallow tube well varies between 2.0-4.0 in pre-monsoon and 1.3-3.3 after monsoon in 2011 (Table.1). Second year in dry season SAR values found rages between 2.3- 5.2 and 1.7-4.1 in post-monsoon 2012 (Table.2). Richards (1954) categorized the groundwater on the basis of SAR values (<10 as excellent; between 10-18 as good; 18-26 as fair; and >26 as poor quality). Residual sodium carbonate (RSC) of shallow tube well were observed ranges between -121.08 to -80.27 in pre-monsoon and after monsoon varies between -108.64 to 64.97 in 2011 (Table.1). RSC values in 2012 found ranges between -128.09 to -39.08 in pre monsoon and -103.29 to -28.64 (Table. 2) after the post-monsoon. RSC found negative in both year and season it means calcium and magnesium found dominant in water samples. Lokesh *et al.,* (2014). Irrigation water Quality of improves in both years after the monsoon due to the rain water it's dilute the concentration of the soluble salt Swati Nandi *et al.,* (2012). On the basis of the EC and SAR value of the Shallow tube well water classify for irrigation purpose in class C3S1 before monsoon and class C2S1 after the monsoon 2011 (Table.5). In 2012 water quality of the shallow water were found in class C2S1before monsoon and C2S1 after the monsoon (Table.5). Shallow tube well water were found moderately saline in nature before monsoon 2011 and 2012. Its slightly improve in after the monsoon due to the reduce the concentration of salts.

3. Physico-chemicals characteristics of Pond water

Pond water is collection of natural water like rain fall; this water is free form the soluble salt. In West Bengal maximum farmers formed a pond near the field they use pond for dual purpose. In west Bengal people use fish in a daily food habit so pond is good fish culture system and the also use pond water for the irrigation purposes. In research areas found many pond water body but I selected eight (8.0) pond water body and take water samples before and after monsoon in 2011 and 2012.The pH value of the selected water body found ranges between 6.74- 8.27 in pre monsoon and 6.10- 7.83 after the post monsoon 2011 (Table.3). pH value of pond water varies in 7.15-8.16 in pre-monsoon and 6.72-7.65 after the post monsoon in 2012 (Table.4). Electrical conductivity (EC) of the pond water samples were varies in ranges between 0.39- 0.70 dsm^{-1} in pre-monsoon and 0.30-0.34 after the post monsoon in 2011 (Table.3).In second year electrical conductivity of pond water samples varies between 0.28-0.62 dsm^{-1} in pre-monsoon and 0.12 -0.34 after the monsoon in 2012 (Table.4).

Sodium adsorption ratio (SAR) values varies in the pond ware samples between 1.3- 3.5 in pre- monsoon and 0.8 -2.2 after the post monsoon 2011(Table.3). SAR values of the pond water samples in second year were found reneges between 0.4-1.8 in pre- monsoon and 0.3-1.4 found after the post – monsoon 2012 (Table.4). Richards (1954) categorized the groundwater on the basis of SAR values (<10 as excellent; between 10-18 as good; 18-26 as fair; and >26 as poor quality). According to SAR and EC values of pond water samples in both year and both season found good for irrigation purposes comparison to the deep tube well and shallow tube well water. Residual sodium carbonate(RSC) of the pond water samples were found ranges between -68.61 to -57.66 in pre-monsoon and -87.85 to -70.72 after the post monsoon in 2011 (Table.3). RSC values of pond water in next year vary between the -108.57 to -72.32 in pre-monsoon and -77.93 to -50.59 after the post monsoon 2012 (Table.4). It means calcium and magnesium found dominant in both year and both season. On the basis of the EC and SAR value of the water pond water classify for irrigation purpose in class C1S1before monsoon and class C1S1 after the monsoon 2011(Table.5). In 2012 water quality of the pond water were found in class C2S1before monsoon and C1S1 after the monsoon (Table.5). Pond water were found good for irrigation both year and season.

4. Physico-chemicals characteristics of River water

River water is a important source of irrigation in ancient times many part of the India depend upon the rivers water. River water lifted through cannal and reaches the farmers field. Eight (8.0) rivers water samples were collected in different location in pre and post monsoon year 2011-2012. The physico-chemicals quality of water were analysed using standard method. The result show the analysed water samples pH of the water samples found ranges between 7.35-7.57 in pre-monsoon and 7.32-7.39 after the post monsoon 2011 (Table.3). In the second year pH of the pond water varies between the ranges 7.49 -8.15 in pre-monsoon and after monsoon pH values varies in ranges 7.25-7.51in 2012 (Table.4).

The electrical conductivity of the river water was found ranges between 0.32-0.38 dsm^{-1} in pre-monsoon and 0.24-0.31 dsm^{-1} after the post-monsoon in 2011(Table.3). Electrical conductivity of the pond water in second year were found ranges between the 0.34- 0.39 dsm^{-1} in pre-monsoon and 0.12-0.34 dsm^{-1} after the post monsoon in 2012(Table.4).

Sodium adsorption ratio (SAR) values of the river water found in ranges between 5.3-7.0 in pre monsoon and 4.9-5.7 in post- monsoon 2011 (Table.3). In the next year SAR of the river water samples were varies between 4.9-6.1 in pre-monsoon and 3.1-4.2 in post monsoon 2012 (Table.4). Richards (1954) categorized the groundwater on the basis of SAR values (<10 as excellent; between 10-18 as good; 18-26 as fair; and >26 as poor quality). Residual sodium carbonate of the river water samples were found negative in both year. The RSC values of the river water varies in the rages between -50.24 to -41.51 in pre monsoon and -37.62 to -28.09 after the monsoon 2011 (Table. 3). Second year of the RSC values of river water found ranges between -57.19 to –45.39 in pre-monsoon and -77.93 to -50.59 in post monsoon 2012 (Table.4). The value indicates the dominancy of Calcium and magnesium in water samples. Verma *et al.*, (2012).

If water quality of the river classify based on the Richards (1954) for the irrigation purpose, we find the river water before monsoon 2011 under the C1S1 class and also C1S1 class were found after the monsoon 2011 (Table.5). In 2012 river water quality for the irrigation use were found before monsoon is C2S1 class and C1S1 class after the monsoon 2012 (Table.5).

Table 1: Physico-chemicals property of ground water sources.

Quality parameters	Year-2011 (Before Monsoon)						Year-2011 (After Monsoon)					
	Deep tube			Shallow tub well			Deep tube			Shallow tub well		
	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D
pH	7.17	8.20	0.394	7.03	7.47	0.161	6.92	7.89	0.325	6.81	7.31	0.217
Ec (dsm^{-1})	0.50	0.76	0.088	0.64	0.93	0.103	0.32	0.56	0.080	0.38	0.63	0.083
BOD(mg/l)	0.10	0.40	0.112	0.11	0.24	0.045	0.32	0.88	0.184	0.18	0.38	0.069
COD(mg/l)	0.37	2.88	0.776	0.45	2.3	0.656	0.52	3.10	0.804	0.51	2.64	0.704
Cl^- (mg/l)	35.0	80.0	14.074	42.5	72.5	10.471	20.0	52.5	11.251	12.7	66.0	17.594
NO_3–(mg/l)	0.5	1.9	0.443	0.71	3.53	0.92	0.2	1.3	0.396	0.40	2.20	0.581
CO_3^{--}(mg/l)	0.00	0.0150	0.0049	0.0000	0.0055	0.0022	0.0	0.0	0.000	0.0	0.0	0.000
HCO_3^{--} (mg/l)	0.050	0.073	0.0082	0.050	0.074	0.0084	0.034	0.057	0.008	0.035	0.065	0.010
F^-(mg/l)	0.32	1.17	0.275	0.26	0.85	0.214	0.21	0.93	0.237	0.21	0.68	0.191
SO_4-(mg/l)	80.5	182.4	34.014	81.3	134.3	18.831	69.8	137.9	24.452	55.8	127.7	22.207
Hardness (mg/l)	231.3	340.7	33.670	192.7	286.0	29.802	108.7	248.7	43.177	122.7	227.3	37.776
Ca^{++}(mg/l)	51.6	76.2	8.978	43.6	73.7	10.919	59.1	75.4	5.880	24.8	72.1	15.306
Mg^{++}(mg/l)	37.9	65.1	8.164	36.3	59.2	7.222	8.3	42.3	10.724	20.9	47.5	9.877
Na^+(mg/l)	12.9	35.2	7.198	16.9	38.0	7.467	8.8	24.8	5.553	8.7	29.3	7.087
K^+ (mg/l)	2.1	2.6	0.162	3.5	4.8	0.444	1.6	2.5	0.287	3.1	4.1	0.411
SAR	1.3	3.8	0.850	2.0	4.0	0.785	1.0	2.9	0.664	1.3	3.3	0.780
RSC	-139.0	-105.4	11.452	-121.08	-80.27	12.054	-117.61	-83.02	11.169	-108.64	-57.97	14.930

Table 2: Physico-chemicals property of ground water sources.

Quality parameters	Year-2012 (Before Monsoon)						Year-2012 (After Monsoon)					
	Deep tube			Shallow tub well			Deep tube			Shallow tub well		
	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D
pH	6.82	8.34	0.325	6.58	7.86	0.375	6.65	8.13	0.488	6.32	7.59	0.38
Ec (dsm^{-1})	0.37	0.68	0.111	0.42	0.78	0.136	0.22	0.49	0.0917	0.29	0.51	0.084
BOD(mg/l)	0.14	0.36	0.184	0.18	0.43	0.086	0.16	0.61	0.134	0.20	0.45	0.086
COD(mg/l)	0.64	1.84	0.804	0.32	1.80	0.544	1.13	2.31	0.429	0.38	1.83	0.546
Cl^- (mg/l)	10.00	52.48	11.251	27.49	67.48	14.185	4.96	22.33	5.378	19.85	34.74	5.459
NO_3–(mg/l)	1.1	4.1	0.396	1.00	2.60	0.590	0.82	3.20	0.848	0.5	1.9	0.560
CO_3^- (mg/l)	0.0000	0.0075	0.000	0.000	0.005	0.002	0.00	0.00	0.000	0.000	0.000	0.000
HCO_3^{--} (mg/l)	0.0031	0.0153	0.008	0.0031	0.0244	0.008	0.0031	0.0092	0.002	0.0031	0.0122	0.004
F^-(mg/l)	0.16	0.76	0.237	0.08	0.49	0.136	0.09	0.41	0.133	0.06	0.46	0.134
SO_4- (mg/l)	85.3	173.6	24.452	59.46	154.27	34.538	62.51	138.21	28.339	38.5	126.4	31.081
Hardness (mg/l)	136.0	268.0	43.177	108.0	366.0	82.361	84.0	224.0	49.822	82.0	282.0	73.733
Ca^{++}(mg/l)	22.4	54.5	5.880	14.4	66.5	18.567	16.8	36.1	7.079	9.619	49.699	14.948
Mg^{++}(mg/l)	26.9	52.1	10.724	22.2	76.8	16.498	15.0	45.9	10.851	17.1	57.7	14.537
Na^+(mg/l)	22.4	36.4	5.553	14.36	29.8	5.570	15.98	20.8	1.611	10.1	20.5	3.445
K^+(mg/l)	1.5	4.6	0.287	1.1	4.1	0.978	1.6	2.5	0.287	0.5	3.1	0.807
SAR	2.8	5.0	0.664	2.3	5.2	0.945	2.3	3.6	0.468	1.7	4.1	0.795
RSC	-106.59	-52.57	11.169	-128.09	-39.08	32.746	-117.61	-83.02	11.169	-103.29	-28.64	29.035

Table 3: Physico-chemicals property of surface water sources.

Quality parameters	Year-2011 (Before Monsoon)						Year-2011 (After Monsoon)					
	Pond water			River water			Pond water			River water		
	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D
pH	6.74	8.27	0.580	7.35	7.57	0.076	6.10	7.83	0.551	7.32	7.39	0.029
EC (dsm^{-1})	0.24	0.32	0.027	0.32	0.38	0.020	0.18	0.25	0.023	0.24	0.31	0.026
BOD(mg/l)	1.38	4.22	0.957	1.12	1.3	0.061	1.75	5.12	1.103	1.20	1.40	0.076
COD(mg/l)	36.71	85.85	18.800	45.41	52.3	2.011	42.72	92.43	19.502	49.2	54.3	1.573
Cl^- (mg/l)	15.0	27.5	4.444	45.4	52.3	2.011	5.0	17.5	4.431	12.5	22.5	4.008
NO_3–(mg/l)	0.6	1.4	0.246	2.8	3.2	0.151	0.3	1.1	0.275	0.2	1.3	0.410
CO_3^{--} (mg/l)	0.000	0.006	0.002	0.001	0.007	0.002	0.0	0.0	0.000	0.0	0.0	0.000
HCO_3^{--} (mg/l)	0.037	0.067	0.010	0.024	0.044	0.006	0.019	0.038	0.007	0.0193	0.0417	0.008
F^-(mg/l)	0.27	0.93	0.236	0.03	0.34	0.111	0.12	0.65	0.195	0.01	0.27	0.086
SO_4– (mg/l)	13.1	61.6	16.325	36.5	48.1	4.206	10.3	42.3	12.207	32.9	38.9	1.956
Hardness (mg/l)	148.0	182.0	9.549	107.3	144.0	12.171	129.3	160.7	11.018	63.3	102.0	14.930
Ca^{++}(mg/l)	23.0	32.1	3.252	18.7	22.2	0.996	51.8	64.4	4.416	15.2	18.2	0.947
Mg^{++}(mg/l)	29.1	36.6	2.228	21.23	30.25	3.018	18.9	23.49	1.611	11.0	21.0	3.661
Na^+(mg/l)	8.4	24.6	5.335	29.51	38.99	3.486	6.6	18.2	4.037	24.8	28.4	1.412
K^+(mg/l)	2.2	6.1	1.405	3.5	4.9	0.533	1.5	4.6	1.214	2.8	4.3	0.512
SAR	1.3	3.5	0.789	5.3	7.0	0.593	0.8	2.2	0.502	4.9	5.7	0.207
RSC	-68.61	-57.66	3.860	-50.24	-41.51	2.941	-87.85	-70.72	6.023	-37.6	-28.1	3.674

Table 4: Physico-chemicals property of surface water sources.

Quality parameters	Year-2012 (Before Monsoon)						Year-2012 (After Monsoon)					
	Pond water			River water			Pond water			River water		
	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D	Min.	Max.	S.D
pH	7.15	8.16	7.83	7.49	8.15	0.205	6.52	7.65	0.411	7.25	7.51	0.091
Ec (dsm^{-1})	0.28	0.36	0.025	0.34	0.39	0.016	0.12	0.23	0.035	0.12	0.34	0.074
BOD(mg/l)	1.63	4.63	0.855	1.1	1.2	0.023	1.7	4.7	0.852	1.7	4.7	0.852
COD(mg/l)	32.85	92.5	18.052	32.8	52.3	6.047	34.3	98.4	19.153	34.3	98.4	19.153
Cl^- (mg/l)	15.0	32.5	6.122	22.5	37.5	4.817	7.4	24.8	6.186	7.4	24.8	6.186
NO_3–(mg/l)	1.5	4.3	1.043	0.56	0.74	0.060	0.74	2.1	0.510	0.74	2.1	0.510
CO_3^{--} (mg/l)	0.00	0.00	0.000	0.000	0.006	0.002	0.0	0.0	0.000	0.0	0.0	0.000
HCO_3^{--} (mg/l)	0.0061	0.0244	0.007	0.003	0.015	0.004	0.00305	0.0122	0.004	0.003	0.012	0.004
F^- (mg/l)	0.08	0.21	0.041	0.06	0.11	0.020	0.03	0.16	0.041	0.03	0.16	0.041
SO_4– (mg/l)	34.9	87.2	17.014	32.5	42.6	3.305	22.4	65.9	13.636	22.4	65.9	13.636
Hardness (mg/l)	212.0	368.0	63.588	124.0	150.0	8.940	138.0	248.0	44.693	138.0	248.0	44.693
Ca^{++} (mg/l)	14.4	52.1	11.753	20.0	27.3	2.307	10.42	34.47	7.331	10.4	34.5	7.331
Mg^{++} (mg/l)	40.5	83.8	17.715	25.4	31.1	1.951	27.2	58.0	12.112	27.2	58.0	12.112
Na^+ (mg/l)	2.9	13.4	3.795	31.6	36.2	1.483	2.2	8.2	2.129	2.2	8.2	2.129
K^+ (mg/l)	2.1	4.1	0.677	0.23	0.65	0.165	1.6	3.5	0.661	1.6	3.5	0.661
SAR	0.4	1.8	0.513	4.9	6.1	0.360	0.3	1.4	0.334	0.3	1.4	0.334
RSC	-108.57	-72.32	10.894	-57.19	-45.39	3.423	-77.93	-50.59	8.549	-77.93	-50.59	8.549

Table 5: Classification of Irrigation water quality on the basis ofEC and SAR.

Source of water	Before Monsoon 2011	After Monsoon 2011	Before Monsoon -2012	After Monsoon- 2012
Deep	C2S1	C2S1	C2S1	C2S1
Shallow	C3S1	C2S1	C2S1	C2S1
Pond	C1S1	C1S2	C2S1	C1S1
River	C1S1	C1S1	C2S1	C1S1

Summary and Conclusion

Irrigation water quality of the different sources like Deep tube well, Shallow tube well (Ground water) and Pond, Rive (Surface water) after the analysis of samples were found surface water source pond then river water was good quality of water for the irrigation purpose in before monsoon (C1S1-C2S1) and after monsoon (C1S1-C1S1) in 2011 and 2012. They have contain less soluble salt and safe for the irrigation use for any crops. They have no required any management practice before the use. In respect of the ground water like deep tube well and shallow tube well water were found high saline water before monsoon (C2S1-C3S1) in both years. Salinity of water high due to the high temperature, low water table, evaporation of soil moisture and accumulation of salt. Irrigation quality of the water after the monsoon (C2S1) improve due to the rain fall and its result infiltrate water in ground and improve water table and quality also.

Water sources of the Berhampur, was found good quality of irrigation water. Pond water is most suitable for the irrigation than river water in surface water sources. In ground water regarding deep tub well water were found better compare to the shallow tube well. Shallow tube well water was found highly saline water in both season and both year compare to all water resource use by farmers. But it's not more harmful according to soil salinity chart**.**

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