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PADDY FIELDS IRRIGATION WATER CHEMICAL ANALYSIS FROM SRIKAKULAM DISTRICT ANDHRA PRADESH AND INDIA

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ABSTRACT

Irrigated water samples collected from cultivated paddy fields selected from the Srikakulam District, and Andhra Pradesh. Screened test for fit or unfit to further cultivation practice. Crop yield enhancement studies were conducted, in that connection samples were drawn from April 2022 to November 2023. To predict the influencing water parameters like EC and chemical parameters along with carbonates and bicarbonates etc., the highest paddy yield on average basis was recorded and fit to practice the cultivation. The present results given data suggests that the water used for irrigation fatherly not fit for cultivation practice because gradual increment of EC and physicochemical parameters. Henceforth treat the ground water, dilution with canal water and growing of salt tolerant crops. It is necessary to manage the soil structure on sustainable basis for obtaining optimum crop yield.

Key Words: EC, physicochemical parameters, canal water, dilution, crop, yield, sustainability, Rice.

INTRODUCTION

Water is a key molecule which has many duties of life and is principally achieved in two ways, one is surface water, includes streams, canals as well as fresh water lakes, rivers etc., ground water like borehole water and well water. It has ability to soak, dissolve, suspend and absorb various conditions. Therefore, overall in nature the availability of pure water is impossible, as it receives the contaminants from its surroundings and from the human beings, insects, and animals from the other anthropogenic sources. The groundwater is one of the major sources of drinking water (Nishanthiny et al., 2010). Further, it is major source of water for agriculture and industrial purposes. The quality of water deteriorates day by day due to urbanization, civilization, solid and liquid waste disposal management and human activities (Nouri et al., 2017). Along with this agricultural sector is the largest consumer of ground water and approximately one-half of the total crop water requirements.

Present area selected for examination comes under coastal area, the ground water quality of this area may change due to various reasons like salt water intrusion, tidal influx of river water, water loggin, domestic and industrial contamination etc., the effects of industrial effluents on the crops and soil ultimately affect the quality of surface and ground waters. The ground water quality variation problems can be understood only by regular monitoring of quality of water. Due to rapid urbanization, the quality of ground water may change further in future. Therefore, it was proposed to take up water quality monitoring. Total 21 samples collected from the srikakulam district of various places were analyzed for physicochemical assessment besides heavy metals assessment for evaluation of water quality. However, the ill effects of the industrial effluents cannot be set aside (Kosemani et al., 2017).

MATERIAL AND METHODS

Description of the area under study:

Water Sampling: The water samples were collected from the various irrigated land while crop is under growth conditions. The area being irrigated, the name of the farmer, address of the farmer and agricultural area owned by the farmer and GPS (Geographical Positioning System) location of the area, prevailing cropping pattern, and sampling date. The samples were collected in clean plastic bottles. The sampling bottles were rinsed thrice with the same water being sampled. The bottles were closed with the lids and labeled accurately.

Chemical Analysis:

The collected water samples were analyzed at Soil and Water Testing Laboratory for Research, to check the concentrations of the EC, pH, Ca^{+++} Mg^{++}, Na^{+}, CO_3^{-}, HCO_3^{-} and Cl^{-}. Then the sodium adsorption ratio (SAR) and residual sodium carbonate (RSC) were calculated by using the formulas given by (Richards, 1954).

RESULTS

Results obtained from the sample data were fit and one or two samples were considered to be unfit in future for irrigation. Significantly all the irrigated samples has shown good feasibility to fit the cultivation but not extended periods of usage of same results marginally fit for irrigation purposes according to the WHO standards.

Electrical conductivity ($dSm^{-}1$) status: Samples resulted EC values were ranged from 1649 to 512 (µs/m). All the water Samples were within the safe limits whereas, samples were fit and are marginally saline in nature, even though they are fit for irrigation.

Sulfates (SO_4), pH and Alkalinity:

As for the WHO standards of water, which contains less than 100mgL^{-1} sulfate are not toxic to the plant growth and development. More than 100 mg/L toxic to the plant growth and developmental process (Ghoraba et al., 2013). In the present study, the SO_4 ranges from 9 to 212 mgL^{-1} concentration were observed in the all samples analysis indicates the samples are more permissible and suitable for irrigation and except 21st and 5th sample stations has shown above permissible limits indicates the two samples are more prone to the plant growth and development comparatively with the remained tested sample stations of the Srikakulam district which were promotes the plant growth and development of the plant. pH was normal drinking water range according to the BSI. Adverse conditions of the water samples unfit for drinking but are suitable for irrigation purpose more or less. Cumulative affect shown in the majority of the samples having high EC. This condition is ahead responsible to be unfit for crop irrigation in future?

Effect on paddy yield: The highest yield was recorded in. This is because of the reason that most of the water samples from those areas were fit for irrigation in the year 2022. The lowest yield was observed in due to the high EC of waters in that area. Similarly, maximum rice yield was found in were observed and recorded.

DISCUSSION

Conductivity is defined as the current carrying capacity of water. Water with high salinity is toxic to plants and creates salinity hazards (Borecka et al., 2016) (Ogunfowokan et al., 2013). Soils with high levels of salinity are called saline soils (Pooja Shrivastava and Rajesh Kumar, (2015)). High concentrations of salt in the soil can result in a change of physiological appearance leads to the drought conditions (Kamran et al., 2019). That is, even though the field appears to have plenty of moisture, but the plants start wilting because the roots become unable to absorb the water(Isbell, 2016). Water salinity is usually measured by the TDS (total dissolved solids) or through EC (Electrical Conductivity). In present study most of the water was unfit in due to high electrical conductivity. Sodium Adsorption Ratio conveys the relative movement of sodium (Na^+) ions in the exchange reactions with the soil (Wakeel, Abdul, (2013)). This ratio processes the relative concentration of Na^+ to calcium and magnesium (Wang, 2013). When water with high SAR is applied to a soil, the sodium (Na+) in the water can dislocate the calcium (Ca^{+2}) and magnesium (Mg^{+2}) in the soil (Tanvir Rahman et al., 2017). It creates hindrance in developing the stable soil aggregates and in turn result damage to soil structure. This also result decline in the permeability and infiltration of water in the soil with concomitant decrease in crop yield.

Residual sodium carbonate (RSC) occurs in irrigation water when the carbonate (CO_3) plus bicarbonate (HCO_3) content exceeds the calcium (Ca) plus magnesium (Mg) content of the water (Naseem et al., 2010). The extended use of that water with high RSC for irrigation will lead to an accumulation of Na^+ in the soil. It will result.

1. Nonstop toxicity to plants, 2. Surplus soil salinity and sodicity and associated poor plant development, and 3. Where significant amount of silt or clay is available in the soil, loss of soil structure and associated decrease in soil permeability (Zaman, Shahid and Heng, (2018)).

In the he study area water with high RSC was found in many areas indicating sign of danger in future to the soil structure of these areas which in turn hamper the crop yield in future. Regular use of waters with high RSC (>2.5 meL^{-1}) leads to salt build up and which may hinder the air and water movement by clogging the soil pores (Arora,et al., 2012). Sulfite ions have very strong correlation with Mg. The pH and alkalinity are valuable characteristics that can greatly manipulate the suitability of water for irrigation purposes (Riaz et al., 2018). The normal pH ranges for irrigation water is 6.5 to 8.4. The alkalinity is imparted due to CO_3 and HCO_3 ions in the ground water (Poyen et al., 2018). More concentration of HCO_3 get combine with Ca and Mg and will precipitate as carbonates when the soil solution concentrates in drying condition (Cao et al., 2008). The application of water with high EC directly affects the crop yields (Kumar et al., 2017)

CONCLUSION: The present investigation suggests that various areas or stations were fit due to EC, alkalinity and chemical substances and salinity of the sample. It has been noticed that irrigation with poor quality water may cause salinity, specific ion toxicity or infiltration problems in the soil occurs and has shown adverse effects on crop production.

And also show the impact of usage of different agro ecological conditions and their salinity, sodicity or alkalinity hazards on soils would be formed in future.

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Statement showing the details of water samples chemical quality data

S.No.	pH	EC(µs/m)	TDS(mg/l)	HCO3(mg/l)	Cl(mg/l)	F(mg/l)	NO3(mg/l)	SO4(mg/l)	Na(mg/l)	K(mg/l)	Ca(mg/l)	Mg(mg/l)	TH(mg/l)
1	7.95	1649	543	216	65	0.14	32.16	38	206	38.16	28	101	201
2	7.84	846	732	184	95	0.42	7.52	31	51.02	2.64	42	123	58
3	8.51	512	612	95	112	0.48	8.12	41	801	8.46	21	21	101
4	8.61	1548	624	62	141	0.31	14.67	84	92	38	201	501	125
5	8.12	1284	842	64	168	0.52	31.65	101	30	1.24	6.94	191	501
6	8.49	948	231	121	152	0.32	23.49	12	18.64	3.84	32	76	58
7	8.62	946	384	84	127	0.41	9.84	58	91	72	41	84	64
8	8.14	1486	112	98	238	0.26	16.84	94	213	34	58	184	128
9	8.27	948	328	121	109	0.43	8.26	59	56	32.54	39	98	194
10	7.99	647	284	84	43	0.26	24.62	54	21.34	6.84	21	54	54
11	8.49	1184	624	92	306	0.32	16.84	58	201	464	32	182	421
12	8.46	849	462	138	69	0.21	58.02	24	74.62	12.84	84	112	201
13	8.26	948	394	124	76	0.23	32.08	12	42.54	32.57	62	89	65
14	8.46	1346	755	86	186	0.12	51.04	81	124.61	26	21	154	201
15	8.42	624	384	68	109.62	0.32	12.84	26	62.71	32	28	89	91
16	8.38	856	198	94	64	0.16	8.62	9	34.08	17.84	41	48	64
17	8.24	948	328	151	72	0.26	58.64	28	34.01	8.46	54	132	201
18	8.41	1238	684	196	212	0.31	37.46	61	164.85	94.62	67	154	64
19	8.24	946	489	201	189	0.11	19.56	12	112	10.51	26	167	184
20	8.61	1862	762	234	301	0.41	32.64	212	234	8.42	121	364	94
21	8.41	1276	362	148	208	0.29	20.46	39	121.04	12.46	61	201	184