Research Article

Reuse and impact of Jain fruit industry waste water on agricultural environment in Jalgaon area

Rahul R. Rajput[1*], Sanjay N. Patil[1], S T Ingle[1], Abhijit B. Joshi[2], Sharad Dugad[2]

[1]School of Environmental and Earth Sciences, North Maharashtra University, Jalgaon, Maharashtra, INDIA.
[2]Jain Irrigation System Limited, Jalgaon, Maharashtra, INDIA.
Email: rahul1268@gmail.com

Abstract

The present study was carried out to investigate the use of treated Industrial waste water for Crops and its effect on Soil. The Maize crop (Zea Mays L.) were irrigated with Treated Fruit Waste water (TFWW) and Bore Well Fresh Water (BWFW). Drip irrigation system was used for this study, five split plots was design for each water treatments. Five plots irrigated with TFWW and Five plots irrigated with BWFW. The results showed that the irrigation with TFWW increased soil Nutrients as Mg, Ca, Mn, Ca, fertilizer elements N, P, and K and some heavy metals such as Cu, Zn, Fe, Ni slightly increased in TFWW. No difference observed in plant population and plant height of crops were used TFWW. Maintenance of Drip irrigation system is must for TFWW. Treated Industrial waste water may be utilized for Agricultural purposes.

Keywords: waste water, agricultural environment.

[*]**Address for Correspondence:**
Rahul R. Rajput, School of Environmental and Earth Sciences, North Maharashtra University, Jalgaon, Maharashtra, INDIA.
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INTRODUCTION

Increasing the demand of water for Drinking, Agricultural and Industrial purposes, at the same time population growth also increasing at a high rate, the need for increased agricultural production is apparent (Khaskhoussy, K., Hachicha, M., Kahlaoui, B., Messoudi-Nefzi, B., Rejeb, A., Jouzdan,(2013)). For agricultural purpose treated wastewater being used in many countries as a reliable source of water. (Pescod, M. 1992), (Takashi A (1994). Majority of industries are water based and a considerable volume of waste water is discharged to the environment either treated or inadequately treated leading to the problem of surface and ground water pollution. Advancements in the effectiveness and reliability of wastewater treatment technologies have improved the capacity to produce recycled water that can serve as an alternative water source in addition in meeting water quality protection and abatement requirements (Beula S. Challam and S.S. Chaturvedi 2013). Increasing fresh water scarcity, the high cost of chemical fertilizers, high nutrients in wastewater (Rattan, R.K., Datta, S.P., Singh, A.K., Chhonkar, P.K., Suribabu, K.,(2001)) the high cost of advanced treatment required for other applications and the availability of wastewater near agricultural lands. Wastewater possesses different biological, physical and chemical effects on the environment. In order to apply the wastewater for irrigation it should obtain the certain criteria of qualification after treatment, for parameters such as electrical conductivity (EC), total dissolved solids (TDS),(APHA.,1998, 20TH edition.) and sodium adsorption ratio (SAR).Suspended materials and organic matters are also other parameters, which might be considered before application of wastewater to agricultural lands. The principal processes which affect the physical properties of the soil by using the wastewater

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are the salt contents and the suspended solids. (J. Abedi - Koupai, B. Mostafazadeh-Fard, M. Afyuni, M.R. Bagheri). Reuse of treated wastewater requires effective treatment to protect public health; it is the most critical issue in reuse of treated wastewater (WHO, 1989). In agricultural sector treated wastewater is alternate source with effective treatments on wastewater. Haruvy N (2006).

MATERIAL AND METHODS

This experiment was conducted in Jain irrigation, during January 2014 to April 2014. 10km from Jalgaon city, the mean maximum and minimum temperatures 41.3 ^{0}C and 18.9 ^{0}C respectively, with mean relative humidity of 78.5 per cent were recorded during the period of experimentation. Soil texture of the experimental conducted site is sandy clay-loam. The raised beds of 1.2 m x 10 m were prepared for sowing maize seeds. Total area under experiment was about 1000 m2. There were five replications for each treatment; each replication was having area about 100m^2. Then the layout was taken up and drip system was installed. Variety- Dekalb Pinacle (Hybrid Maize). The experiment was laid out by using Split Plot Design with total two treatments and sub-treatments. Treatments and Sub treatments were replicated five times to minimize the error in the experiment. The daily water requirement for maize crop was calculated considering the age of the crop and evapotranspiration. After knowing the daily water requirement, the time of operating the drip system is decided depending on the flow capacity of drip system. The field was irrigated with 14.4 litres/m^2/day of Treated Fruit waste water and Bore well Fresh water.

Table 1: Initial Characteristics of the soil.

Soil Parameters	Available at Field
Available Nitrogen (Kg/ha)-N	161.8
Available Phosphorus (Kg/ha)-P	2.54
Exchangeable Potassium(Kg/ha)-K	127.4
Exchangeable Calcium (%)-Ca	0.13
Exchangeable Magnesium (%) Mg	0.072
Available Iron (ppm)-Fe	4.76
Available Manganese (ppm)-Mn	4
Available Zinc (ppm)-Zn	0.36
Available Copper (ppm)-Cu	2.52
Available Sulphur (ppm)-S	8
Boron (ppm)-B	0

Soil samples were collected from different experimental plots at depths of 20 cm.

Emitter Discharge Calculation

Emitter discharge was measured by using the catch can method. After every 15 days the emitter performance was measured and recorded. At random 20 NPC (Non Pressure Compensating) drippers were selected for the measurement of the discharge in every replication. Emitter discharge was measured for 3 min and converted hourly. Pressure was 1.2 Kg/cm² in the system.

Plant Height

Plant height was measured from ground level to tip of the top most leaf before tasseling and to the tip of the tassel after tasseling of every tagged plant and expressed in cm. Plant height was measured and recorded after every 15 day it growth and performance.

Table 2: Chemical properties of BWFW and TFWW

Water Parameters	BWFW	TFWW
pH	6.99	8.15
Electrical Conductivity (mS/cm)-EC	1.54	2.64
Total Dissolved Solid (ppm)-TDS	1124	1601.00
Calcium (ppm)-Ca	193.98	51.50
Magnesium (ppm)-Mg	24.54	42.83
Chloride (ppm)-Cl	271.2	206.00
Sulphate (ppm)-SO2	56.64	40.10
Sodium (ppm)-Na	84.4	321.83
Potassium (ppm)-K	1.6	63.33
Biological Oxygen Demand BOD (ppm)	0	70.83
Carbonates (ppm)-Co3	33.6	65.00
Bicarbonates (ppm)-Hco3	395.3	1116.83
Nitrate (ppm)-Ni	0	0.13
Iron (ppm)-Fe	0	0.28

BWFW=Bore well fresh water, TFWW=Treated fruit waste water

Plant population

Numbers of seeds sown per plot were counted to know the plant population. The seeds were sown by dibbling method and 7th Days the germination.

Design and Layout of the experimental field

Drip irrigation for maize was designed carefully by analysis of the design capacity, optimum size of pipelines, discharge rate of drippers, capacity of filter and pump capacity. Maize is closed spaced crop having a spacing 30 cm x 40 cm. The operating pressure in the main pipe of the drip system was maintained as 1.2kpa. This pressure head was sufficient for irrigating the experimental area with a paired row crop system by drip irrigation. Water was pumped through 2.5 hp motor and conveyed to the field via water meter, sand filter and disc filter through PVC pipes, excess water was bypassed in tank itself. Emitter clogging was measured after every 30 days.

RESULTS AND DISCUSSION

At 15 Days, the effect of different water treatments on plant height was noted maximum under fresh water (NPC – 23.52 cm), followed by Fruit water (NPC -25.15cm). Only 30 Days the fruit water has shown good results in the plant height (NPC – 41.47 cm) followed by fresh water (39.77 cm). The plant height of maize doesn't have much more variation in the height under different treatments of crop growth stages.

Table 3: Effect of different water treatments on plant height at various stages of plant growth. TFWW= Treated Fruit Waste Water, BFWW= Bore Well Fresh Water and NPC= Non Pressure compensating Drip line.

Treatment	Sub Treatment	Average Plant height in Cm				
		15 Days	30 Days	60 Days	90 Days	105 Days
TFWW	NPC	25.15	41.47	225.43	255.80	260
BWFW	NPC	23.52	39.77	235.67	257.80	263

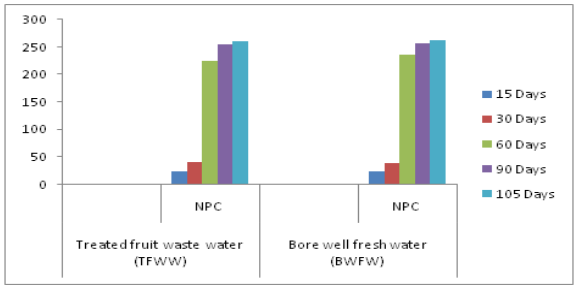

Figure 1: Height of Maize Crops at Different Days (Height in Cm)

Table 4: Effect of different water treatments on plant population of Maize crop after germination

Treatment	Sub Treatment	Replications				
		R1	R2	R3	R4	R5
TFWW	NPC	579	589	582	584	585
BWFW	NPC	579	582	590	585	587

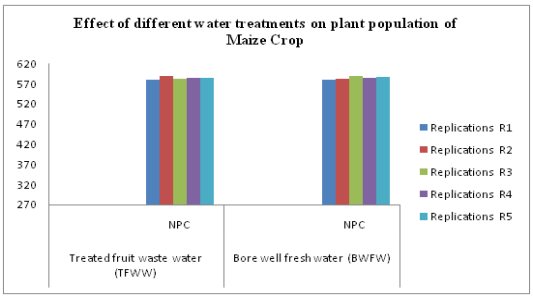

Figure 2: Plant Population of Maize Crops

In the plant population used with Treated Fruit waste water and Bore Well Fresh Water doesn't much more variation observed in Plant population. (Table No-4)

Table **5:** Effect of different water treatments on soil properties of Maize Crops

Soil Parameters	BWFW	TFWW
Available Nitrogen (Kg/ha)-N	315.75	343
Available Phosphorus (Kg/ha)-P	88.25	102
Exchangeable Potassium(Kg/ha)-K	421	523
Exchangeable Calcium (%)-Ca	0.16	0.17
Exchangeable Magnesium (%) Mg	0.15	0.16
Available Iron (ppm)-Fe	11	13.5
Available Manganese (ppm)-Mn	7	7.75
Available Zinc (ppm)-Zn	1.12	1.27
Available Copper (ppm)-Cu	3.5	3.65
Available Sulphur (ppm)-S	65.75	83.75
Boron (ppm)-B	0.35	0.41

Initial Characteristics of the soil was present in Table No 1. The analysis of soil shows the Increased Fertilizer elements, micro and heavy elements in soil respectively such as Nitrogen, Phosphorus, Potassium, Boron, Calcium, Magnesium, Iron, Copper and Zinc. Emitter discharge was measured by using the catch can method.

Doesn't much more discharge variation observed during experiment under Bore well fresh water and Treated fruit waste water. Treated wastewater showed no effect on the Plant population and Height of Maize growing season.

CONCLUSION

The reuse of treated waste water from fruit processing plant was shown positive results for growth of Maize crops. In Treated Fruit waste water rich in N, P, and K, some heavy metals such as Cu, Zn, Fe, and Ni increased in TFWW. Micro nutrients Mg, Ca, Mn, and Ca observed in Treated Fruit Waste Water positively. Treated waste water may be utilized for agricultural sector as an alternate source. Fresh water can be saved for human consumption.

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