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Evaluation of Physico-Chemical Properties of Soil using Treated Sewage Water for Irrigation of Swarn Rekha River, Gwalior (M.P.)

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Abstract: The concern of this study is to determine the quality of soil when irrigated using treated domestic waste water comparison with soil irrigated with groundwater. Use of sewage water for irrigation improved physico- chemical properties and fertility status in soil.

Sewage water contains nutrients essential for plant growth Thus, about three type of soil sample collected from cultivated site is natural soil sample, soil sample irrigated with domestic waste water and sample irrigated with ground water and various parameter were analyzed ie, pH , EC,OC,N,P,K.

The results indicated that pH of soil decreased from 7.7 in soil using ground water to 7.2 in soil using waste water. Physicochemical properties of soil irrigated with waste water were higher, with averages of 0.42 ds/m ,0.66% ,269.8kg/ha ,18.0kg/ha, 367.2.6kg/ha.

when compared to those irrigated with ground water 0.38 ds/m ,0.53%,203.1kg/ha, 10.48 kg/ha, 277.6kg/ha, respectively for EC,OC, N, P and K. finding that use of domestic waste water increased the soil fertility and crop growth as compared to application of ground water.

Keywords: Domestic waste water, physico-chemical properties (N, P, K, pH, EC, OC).

I. INTRODUCTION

The growth of towns, cities, and development of industries leads to problem of disposal of sewage, Industrial and domestic effluents are either used or disposed off on land for irrigation purposes. Sewage is rich in organic matter and other nutrients. The practice of use of domestic sewage in farming is becoming beneficial as the demand of water is increasing.

In Due to industrial development and the growth of population, the availability of water decreases day by day. In this increase in the population has led to increased demand of water and the increased generation of waste- water. sewage is a major load on water bodies and its incorrect disposal promotes growth of toxic algae which affect the aquatic life. So management of waste water is a big deal for us.

Reuse of waste water is best way to reduce the sewage load ,which ultimate aim of wastewater management and protection of the environment. Sewage is rich with soil nutrients like nitrogen phosphorus potassium and organic matter. which can be utilized by the plant in production and make it organic instead of chemical fertilizer use.

A. Objective

1) The main objective of this study is to determine the physico-chemical properties of soil using waste water.
2) Analyze ground water and waste water characteristics as per Indian Standards and find which water is most suitable for irrigation.
3) Analyze the variation of physic-chemical properties of soil at different location at same site.
4) Analyze the soil profile according to depth and find that which soil layer is more fertile up to depth of 0.6m.

II. METHODOLOGY

The objective of this work is the evaluation of physicochemical properties of soil using waste water and compare with ground water irrigation. the experimental work has been designed and is presented here.

A. *Work plan: An overview*

Samples were collected from two sites which is 400 m apart. At different depth (0-.15,0.15-0.30,0.30-0.45,0.45-0.60)in meter to find in depth variation also and characterize for parameter pH, electrical conductivity, organic carbon, nitrogen, potassium and phosphorus for each soil sample irrigated with waste water and ground water.

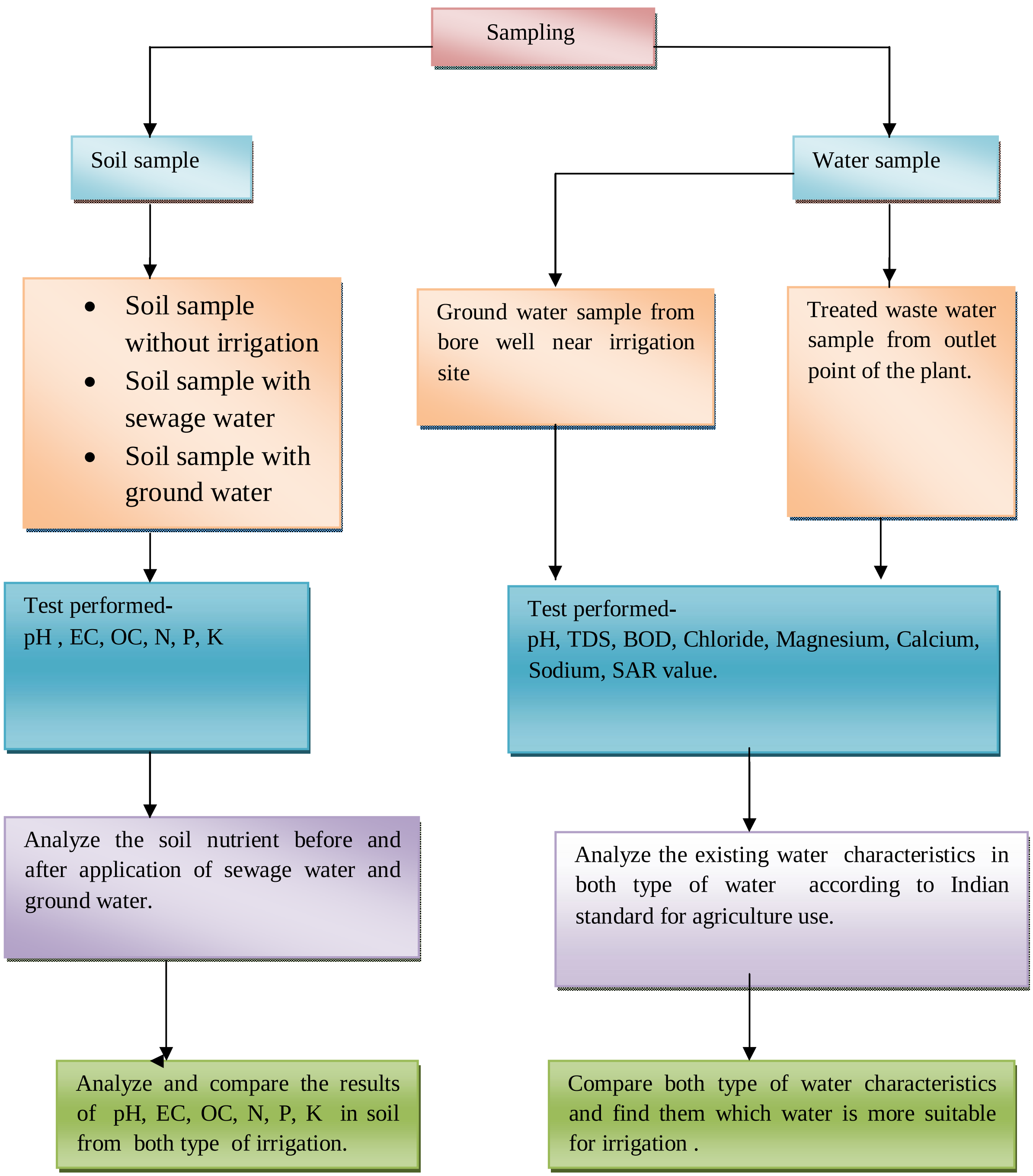

Fig. 1 Flow chart of methodology

B. Waste water treatment plant: An overview

1 MLD sewage treatment plant(Baijatal treatment plant)is located in jal vihar near motimahal in Gwalior city.swarn rekha river sewage is treated in the plant so that can be used for other purpose and disposed safely.its work on the MBBR technology and high efficient for BOD removal. It has various units.

1) MBBR
2) Tubesettling
3) Supernatant tank
4) MMF tank
5) Chlorination tank

C. Sampling Procedure

The setting up of a sampling process to evaluation of characteristics of ground water and waste water. Then evaluating the physicochemical properties of soil. Various factors were considered in sampling process which is, total no. of sample , type of sample, sampling point for water and ground water, selection of location for collecting soil sample, quantity of sample to analyze the various parameter. three type of soil sample are collected from site.

1) Natural soil sample without irrigation
2) Soil sample with sewage water irrigation
3) Soil sample with ground water irrigation

Two type of water sample also collected from the site 1:Treated sewage water sample from outlet point

2. Ground water sample nearest to the irrigation site.

D. Test Performed

Following tests were performed on soil and waste water:

1) Soil parameters (EC,OC, N, P, K & pH) before applying wastewater.
2) Determining pH, chloride content, total dissolved solids, chloride, calcium. Magnesium, sodium and BOD of both ground water and waste water sample.
3) Soil parameters(EC,OC, N, P, K & pH) of two soil sample after application of waste water.
4) Soil parameters(EC,OC, N, P, K & pH) of two soil sample after application ground water.

III. OBSERVATIONS AND RESULTS

In this study, first we are analyzed the physiochemical characteristics of waste water Table 1 and the physicochemical characteristics of ground water Table 2. The soil parameters were analyzed before applying sewage water in table 3 . comparison of physic chemical properties of soil using waste water and ground water irrigation are shown in table 4,5,6,7,8,9 respectively for pH, EC,OC,N,P,K. Table 10 shows the mean value of physicochemical properties in each type of soil sample.

Table 1 waste water characteristics used in irrigation

N0	Test	Result	Std. as per environment protection rule1986	FAO guidelines for irrigation use
1	pH	7.3	5.5-9.0	6.5-8.5
2	TDS	1200	2100	450-2000
3	BOD	90.1	100	-
4	Chloride	261.5	600	-
5	Calcium	68.2	-	75
6	Magnesium	24.4	-	30
7	Sodium	41.5	-	-
8	SAR value	6.1	<10	-

*All parameter are in mg/l except pH and SAR.

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Table 2 Ground water characteristics used in irrigation

N0.	Test	Results	IS as per 10500:1991	WHO Std. 2011
1	pH	7.8	8.5	7.0-8.5
2	TDS	120	500	600
3	BOD	25.5	30	-
4	Chloride	290	250	-
5	Calcium	45.5	-	100
6	Magnesium	26.1	-	30
7	Sodium	48.1	-	50
8	SAR value	8.21	<10	-

*All parameters are in mg/l except pH and SAR

Table 3 soil nutrients without irrigation.

No.	Test	Results
1	pH	7.4
2	EC (ds/m)	0.31
3	OC (%)	0.40
4	N(kg/ha)	101.2
5	P(kg?ha)	6.4
6	K(kg/ha)	205.1

Table 4 pH variation using ground water and waste water

pH						
site	Depth m.	Ground water	Waste water	site	Ground water	Waste water
100 m.	0.0-0.15	7.6	6.9	500 m.	7.7	7.0
	0.15-0.30	7.6	7.2		7.6	7.7
	0.30-0.45	7.7	7.2		7.8	7.5
	0.45-0.60	7.8	7.3		7.8	7.4

Table 5 Variation of EC using ground water and waste water

Electrical conductivity (ds/m)						
site	depth	Ground water	Waste water	site	Ground water	Waste water
100 m	0.0-0.15	0.37	0.51	500 m	0.54	0.71
	0.15-0.30	0.34	0.33		0.37	0.44
	0.30-0.45	0.36	0.31		0.42	0.43
	0.45-0.60	0.31	0.27		0.39	0.40

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Table 6 variation of OC using ground water and waste water

Organic carbon (%)						
site	depth	Ground water	Waste water	site	Ground water	Waste water
100 m	0.0-0.15	0.55	0.67	500 m	0.54	0.66
	0.15-0.30	0.54	0.67		0.53	0.65
	0.30-0.45	0.54	0.66		0.53	0.68
	0.45-0.60	0.52	0.64		0.51	0.70

Table 7 Variation of N using ground water and waste water

Nitrogen (kg/ha)						
site	depth	Ground water	Waste water	site	Ground water	Waste water
100 m	0.0-0.15	206.2	340.0	500 m	205.2	335.0
	0.15-0.30	202.5	251.2		201.5	251.2
	0.30-0.45	202.5	249.2		200.5	247.2
	0.45-0.60	204.0	247.5		203.0	237.5

Table 8 Variation of p using ground water and waste water

Phosphorus (kg/ha)						
site	depth	Ground water	Waste water	site	Ground water	Waste water
100 m	0.0-0.15	15.3	19.3	500 m	14.3	21.1
	0.15-0.30	7.4	16.6		7.3	19.1
	0.30-0.45	11.1	16.3		10.1	19.3
	0.45-0.60	9.3	15.7		9.1	17.2

Table 9 variation of k using ground water and waste water

Potassium (kg/ha)						
site	depth	Ground water	Waste water	site	Ground water	Waste water
100 m	0.0-0.15	300.1	370.7	500 m	301.2	380.7
	0.15-0.30	247.5	357.2		246.2	362.2
	0.30-0.45	286.7	365.2		285.2	360.2
	0.45-0.60	278.8	369.2		275.8	372.2

Fig 2 Representation of pH in both soil sample

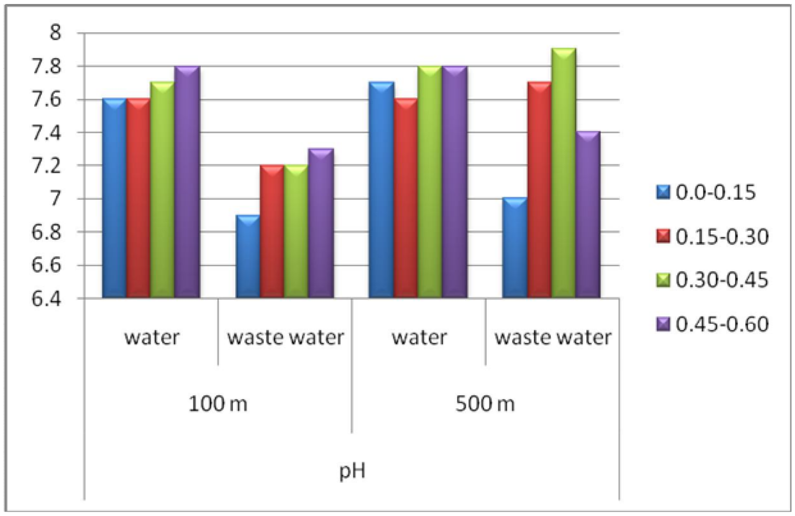

Fig 3 Representation of EC(ds/m) in both soil sample

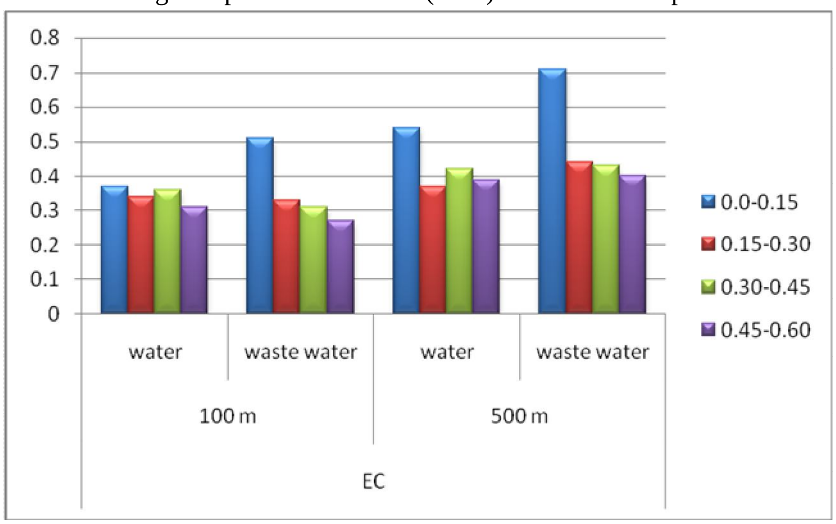

Fig 4 Representation of OC(%) in both soil sample

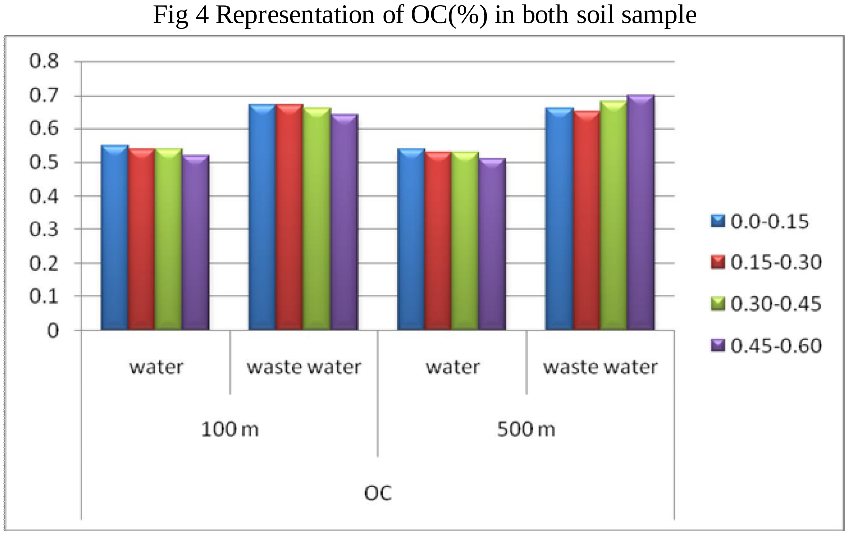

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Fig 5 Representation of N(kg/ha) in both soil sample

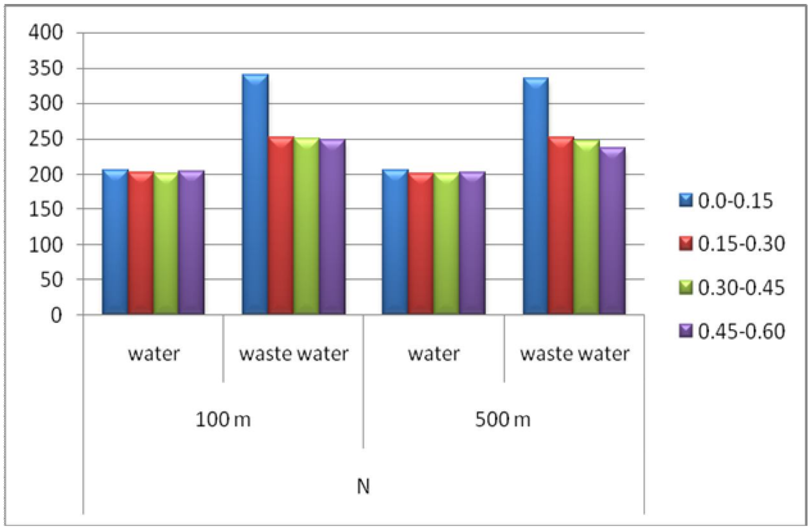


Fig 6 Representation of P(kg/ha) in both soil sample

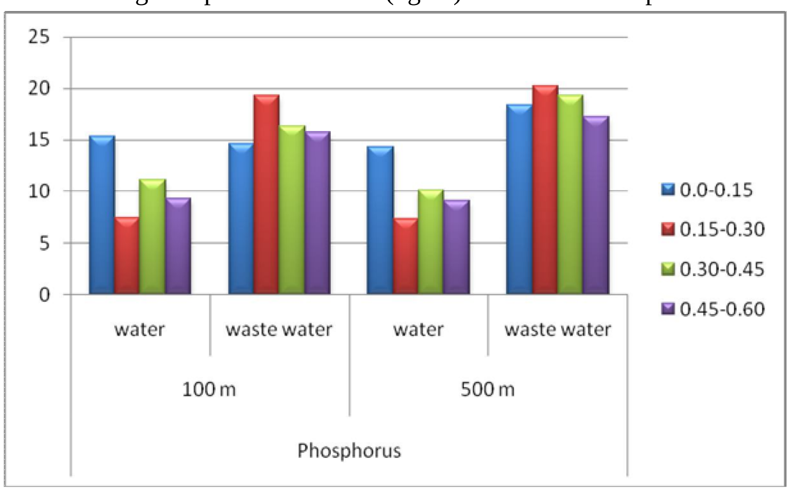


Fig 7 Representation of k(kg/ha) in both soil sample

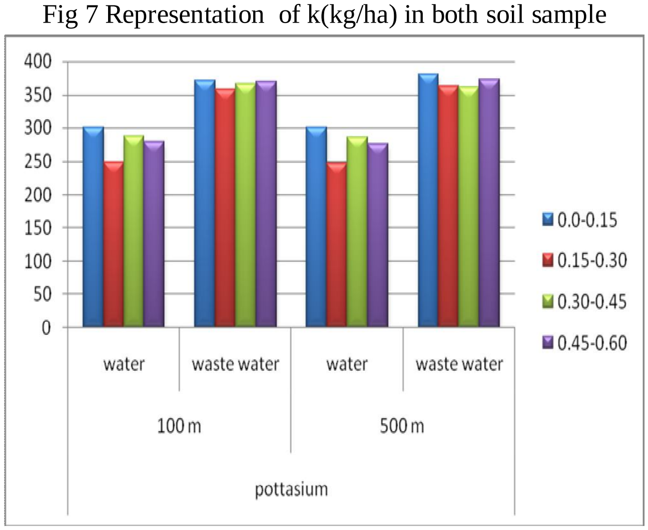


Table 10 mean value of physic-chemical properties of each sample

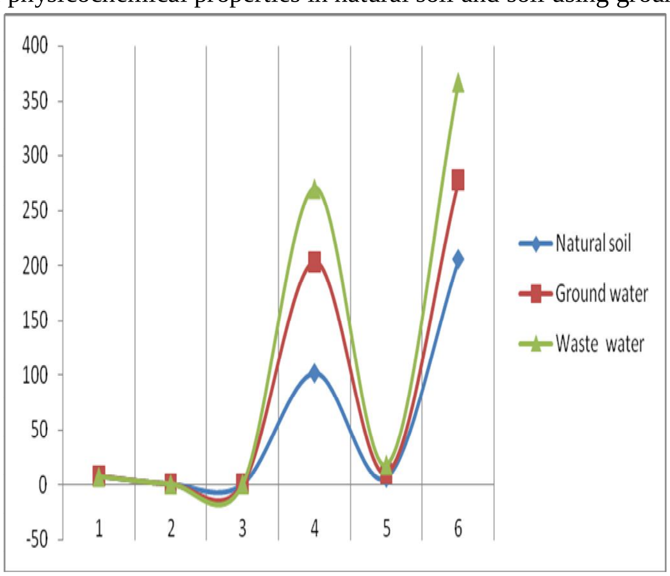
No.	test	limits	Natural soil	Ground water	Waste water
1	pH		7.4	7.7	7.2
2	EC	Ds/m	0.31	0.38	0.42
3	OC	%	0.40	0.53	0.66
4	N	Kg/h	101.2	203.1	269.8
5	P	Kg/h	6.4	10.48	18.0
6	K	Kg/h	205.1	277.6	367.2

A. Results

From above observation it is found that –

1) *pH*- In fig 2 it is found that pH is decreased in both site using waste water compared to ground water. In depth, Slight variation shown in site 500 m from treatment plant pH value first decrease then increased which shows that in depth pH changes from acidic to alkaline.
2) *Electrical Conductivity*- Fig. 3 shows that EC is higher in waste water irrigation then the ground water irrigation. higher electrical conductivity shown in site 2 which is 500 m.
3) In depth variation same phenomenon showed in both site first increase then decrease in waste water irrigation.
4) *Organic Matter*- In fig 4 it is observe that waste water irrigation gives higher organic carbon to soil instead of ground water irrigation .In depth variation higher difference is not shown in both site.
5) *Nitrogen*- Fig 5 shows that higher amount of concentration of nitrogen represented on both site at a top layer of soil which is 0.0-0.15 m. using waste water compared to ground water irrigation
6) *Phosphorus*- Fig 6 shows that phosphorus concentration is high in waste water irrigation then the ground water use. In depth variation a different phenomenon is shown in results that phosphorus content increases slightly then decrease. Higher amount of phosphorus concentration is received at second layer of soil which depth is 0.15-0.30 m.

Fig.8 representation of physicochemical properties in natural soil and soil using ground water , waste water.



1-pH 2-EC 3-OC 4-N 5-P 6-K

7) *Potassium*- Fig 7 represented potassium concentration in both type of soil. From results found that higher concentration of potassium received from soil irrigated with waste water. In depth variation same trend is followed by both site.

IV. CONCLUSION

1) Whole research shows that the soil parameter significantly affected by application of sewage water. domestic sewage water increases the soil fertility of soil in compared to ground water.
2) Higher concentration of N,P,K found on top (0.15m) layer of soil.
3) EC of soil increase in waste water application and soil comes under low salinity.
4) Higher organic carbon content found in waste water application which is directly responsible for increase the fertility and permeability of soil.
5) Waste water application decreases the soil pH and makes soil alkaline to acidic.
6) In depth variation it is found that top layer of soil 0.0-0.3m is more fertile then the lower layer.

A. *Future Scope of Study*

1) Microbial analysis is not consider in our study for better quality of waste water this can be consider.
2) We are using two site for research for more deeper study we can use more site which covers large area along the waste disposal canal and find the flowing effect like self purification of water and check the variation in results.
3) We can analyze micro nutrient and heavy metals like zinc , copper , iron, lead, cadmium, chromium nickel and find that's effect on soil fertility and crop growth.
4) We can analyze the effect of waste water on chemical composition and growth of the plant.

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