IMPACT OF WASTEWATER ON MICROBIOTA OF THE PLANT *SOLANUM MELONGENA* IN RAVER AREA OF KHANDESH REGION

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***Abstract*- The study was undertaken to know the quality of crops grown on wastewater in raver taluka of khandesh region throughout the year 2013-14. The experiment was performed by selecting brinjal (*Solanum melongena*) and were applied at recommended NPK dose of fertilizers for treatment. A pot culture experiment was conducted to study the soil characteristics with different percentage of dilution of wastewater *i.e.* 10%, 25%, 50%, 75% and 100% respectively to know its impact on growth parameters of the *Solanum melongena* plant. The wastewater of raver area which is used by the farmer for irrigation shows excessive BOD, COD and electrical conductivity. It is also known fact that, the wastewater reuse is currently necessary, but the study shows the feasible management practices are needed in order to implement sustainable reuse of wastewater and to contribute to the food security.**

Index Terms*- Wastewater, Raver area, Soil-plant-health and *Solanum melongena

I. INTRODUCTION

Jalgaon district of Khandesh region is situated in north western part of Maharashtra, the total area of the district is 11,765 sq.km. and comes in fraction of Survey of India degree sheets 46K, 46L, 46P, 55C, 55D, and 56O. The district is bordered on the north by Madhya Pradesh State, on the east by Buldhana, on the west by Nasik & Dhule district and in south Aurangabad district. The district headquarters is located at Jalgaon has 16 towns and 1519 villages. The major part of the district comes under Tapi basin which is the main river flowing through the district. Faizpur is located at 21.17°N 75.85°E. It has an average elevation of 226 meters (741 feet). Due to progressive industrial developmental actions and growing population, the resources are declining day by day throughout the district and encouraged to accept, reuse strategies to reduce the existing load on resources, instead of polluting them through releasing air, water and land pollution. The recycling of wastewater for agricultural irrigation purposes reduce the amount of water that needs to be pull out from water resources (USEPA, 1992). It is the necessity of the present period to think about the accessible urban wastewater discarding, wastewater agriculture practices, quality of water used for irrigation, the health impacts and the level of awareness among common people for wastewater related issues.

The present study deals with the appliance of domestic wastewater for irrigation and focused on impact of wastewater of raver area on soil properties and its influence on the plant growth parameters on *Solanum melongena* in an agricultural field of raver area in khandesh region.

II. MATERIAL AND METHODS

The wastewater samples were collected from raver area where the wastewater flow and lift by farmers for irrigation purpose. The cement and plastic pots was prepared by filling soil *i.e.* of 10 Kg of different sites selected in Raver area. The wastewater were lay in 5 pots each for 10%, 25%, 50%, 75% and 100% respectively. The experiment were carried out thrice and set in randomized design. After 10 days soil were sowed with ten seeds of brinjal (*Solanum melongena*) in each cement pot. The water was poured each alternate day up to 60 days. The soil and plants of respective doses and control were collected and measured physicochemical parameters by using standard method (NEERI, 1988) shoot length, weight, root length and weight was measured to know the impact of wastewater on soil-plant health in an Raver area of Khandesh region.

III. RESULT AND DISCUSSIONS

In the present investigation raver area soil were used for study to know the characteristics of soil with different doses of wastewater which is quoted in table 1 and graph 1. The pH is an important parameter due to its acidity and alkalinity ranges, which shows the availability of nutrients in soil. Dilution factor affects the alkalinity of soil pH with 75% dilution the soil shifted towards acidity. Many workers have studied the nutrient accessibility to improve at a available pH which improved plant growth and alteration in pH range from a specific boundary. The accessibility of nutrients in soil is reserved that affect the growth and improvement of plant (Brady and Weil, 2005). Electrical conductivity of soil improved over control and exhibit a negative relationship between amount of effluent concentration in soil and its electrical conductivity values. Increased electrical conductivity values towards higher effluent concentration may be due to the enhanced unusual salt concentration in soil. (Sandhu *et al.,* 2007) observed that potassium salts increased electrical conductivity of the soil. It may be recommended that the effluent load with high dose in soil increase the soil particle size, it may adversely impact on soil moisture content.

The present result observed that water holding capacity decrease when effluent amount of concentrations were higher in soil. It is concluded that the effluent salt concentration and organic substance made higher in soil with increased doses which declined number, size and quality of soil pore and it leads to determine the water holding capacity. Similar results were discuss by Ramulu, 2001 which describe that water holding capacity is limited to soil moisture and organic matter content.

Organic carbon content of soil increased significantly with the use of different doses to soil starting from 10 % to 100 % . Increased organic substance with high doses of effluent with soil resulted in soil sickness due to poor aeration and higher BOD. The similar results were observed by (Vinod Kumar *et.al.,* 2010 and Norwal, *et al.,* 1993). Total phosphate, Nitrate and Potassium in treated soil were increased in different doses of effluent *i.e*. 10%, 25%, 50%, 75% and 100% over control soil. Magnesium, Sodium and Calcium in treated soil with different doses of effluent exhibited a positive association with augmented sewage concentration. Similar findings were observed for paper industry effluent (Vinod *et al.,* 2010). When potassium ions absorbed by the colloids, it can disrupt some other ions (Miller and Turk, 2002). The sulphates and chloride are two ions observed a helpful relationship with increased doses of effluent in soil. These two anions might have contributed towards the salinity hazards associated with higher sewage doses. These conclusions confirmed with earlier reports of (Srivastava *et al.,* 2012) in the distillery sewage.

The current experimental results revealed that different concentration of effluent in soil (10%, 25%, 50%, 75% and 100%) enhanced different growth parameters (shoot length and weight and root length and weight) over control in 60 days old *Solanum melongena* plants. Shoot length of brinjal (*Solanum melongena*) plant was highest in 25 % effluent treatment soil over control *i.e.* 48 % followed by 25%, 50% and 75% and 10% treatment and their values were 33 %, 26 %,19 % and 10 % respectively. 100 % effluent treated plants were showed a decreased trend of shoot length *i.e.* 13 % over control. In Table-2 and graph-2 it has shown a similar growth observed in shoot fresh and dry weight but percentage of dry weight were more in compared with its fresh weight as quoted *Solanum melongena* germination of the other hand 25% and 75% of wastewater has shown positive effect on germination of the plants. The positive type of influence was observed in flowering and fruiting of the plant among various dilutions 50% was found to have better influence on germination, plumule formation and leaf dimensions. On the other hand 25% wastewater concentration was observed to impart overall beneficial influence on plant growth in terms of lower and fruit members over the control. The impact of wastewater of raver area in khandesh region on plant growth could be attributed to the presence of toxic materials excess on deficiency of micronutrients on soil porosity and aeration especially when the concentration of the wastewater is amplified. The helpful effect of wastewater on *Solanum melongena* in terms of root and shoot length in dimension of 10%, 25%, 50%, 75% and 100% could be due to the dilution inhibitory chemicals in the wastewater which may bring a depressive action on the plant growth (Somashekhar, *et.al.,* 1984, Thorat and Chaudhari, 2004 and Kulkarni, *et. al.,* 2006).

The composition of wastewater is quite variable depending upon the causative source, mode of collection and management provided. Although a large proportions of these wastewater is organic in nature and contains essential plant nutrients but occasionally toxic metals are also there in appreciable amounts. The sewage water contains large amount of nutrients and therefore could be utilized as a source of irrigation (Maiti, 1992) as evident by the results reported by (Sreeramulu, 1994, Tiwari and Misra,1996). Treated municipal wastewater to lucerne, maize, potato and wheat has potential to increase yield than control were recorded by (Juwarkar,1990, 1994).

In the present investigation it shows that the adverse effect of wastewater of raver area in khandesh region on the growth of crops in irrigated lands and also shows adverse effect on micro flora of the area. Nevertheless it is concluded from the study that suitable treatment such as dilution will bring down its toxic effects and it will make less harmful to the environment. In fact the wastewater which is use for the agricultural lands should be treat and then make use of wastewater for the plant growth or dilution can be used for agricultural purpose.

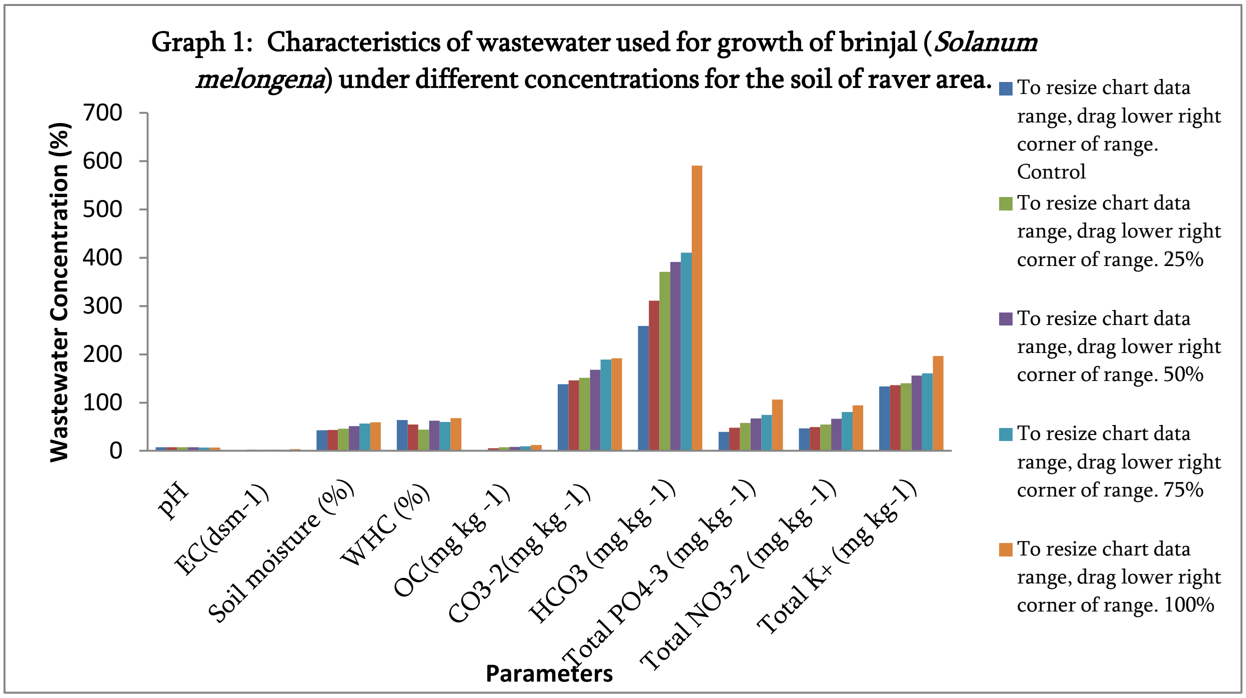
Table.1: Characteristics of wastewater used for growth of brinjal (*Solanum melongena*) under different concentrations for the soil of raver area.

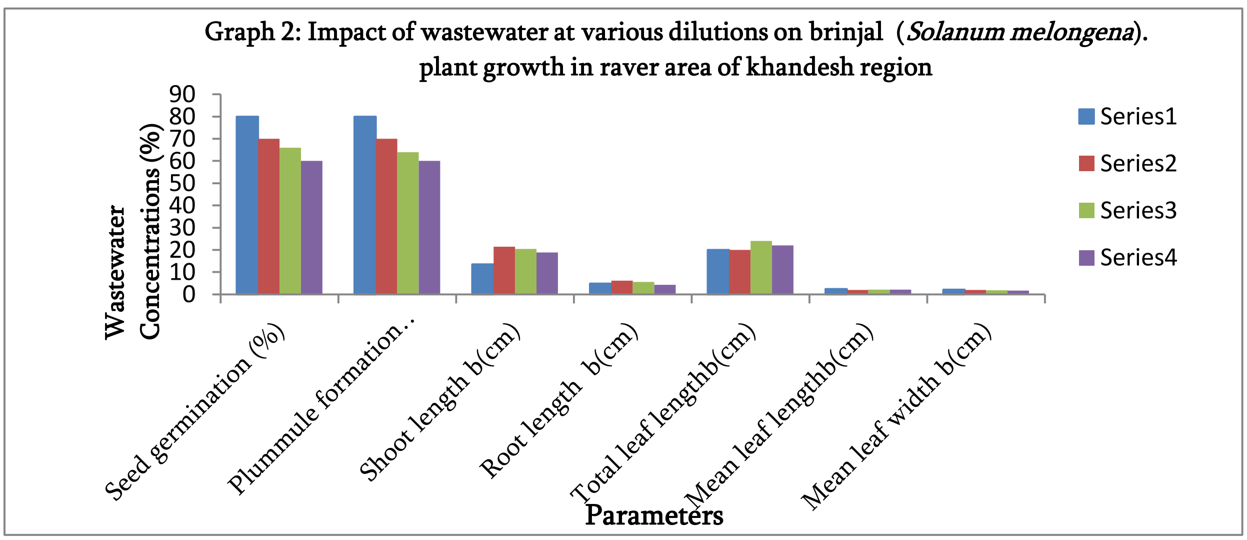
Parameters	Wastewater Concentration					
	Control	10%	25%	50%	75%	100%
pH	7.50 ± 0.18	7.72 ± 0.18	7.65 ± 0.12	7.82 ± 0.10	6.90 ± 0.60	6.92 ± 0.28
EC(dsm^{-1})	1.72 ± 0.21	2.17 ± 0.21	2.44 ± 0.67	2.15 ± 0.12	2.44 ± 0.32	3.33 ± 0.46
Soil moisture (%)	42.82 ± 0.80	43.12±0.28	46.23±0.62	51.12± 0.22	56.76± 0.18	59.53± 0.82
WHC (%)	64.12 ± 0.17	54.68 ± 0.80	44.30±0.18	62.35± 0.65	60.23± 0.19	68.16± 0.23
OC(mg kg^{-1})	1.12 ± 0.10	5.61 ± 0.18	7.78 ± 0.22	8.23 ± 0.44	9.82 ± 0.68	12.46 ± 0.28
CO_3^{-2}(mg kg^{-1})	138.08±0.23	146.23±0.24	151.18±0.52	168.13±0.34	189.46±0.22	192.11±0.12
HCO^3 (mg kg $-^1$)	258.41±0.12	311.23±0.62	370.54±0.33	391.47±0.16	410.33±0.12	590.42±0.62
Total $PO4^{-3}$ (mg kg^{-1})	39.14±0.17	48.28±0.12	58.19±0.28	67.36 ± 0.33	74.82 ± 0.20	106.62±0.12
Total NO_3^{-2} (mg kg^{-1})	46.43±0.52	49.16±0.33	54.29±0.72	66.65 ± 0.82	80.65 ± 0.19	94.54 ± 0.12
Total K+ (mg kg^{-1})	133.28±0.43	136.41±0.24	140.35±0.23	156.19±0.14	160.38±0.82	196.47±0.53
Na + (mg kg^{-1})	24.22 ± 0.20	28.32±0. 18	34.42±0.62	48.28 ± 0.10	58.67±0.74	66.43 ± 0.08
Mg^{2+} (mg kg^{-1})	2.23 ± 0.10	2.90 ± 0.18	3.10 ± 0.12	3.80 ± 0.18	4.96 ± 0.12	6.12 ± 0.82
Ca^{2+} (mg kg^{-1})	16.30 ± 0.20	20.34±0.10	24.34±0.10	28.45 ± 0.12	34.46 ± 0.10	64.18 ± 0.12
$SO4^{-2}$ (mg kg^{-1})	58.80 ± 0.12	62.48±0.18	66.12±0.18	71.60 ± 0.16	87.73±0.16	97.34±0.42
Cl - (mg kg^{-1})	86.12 ± 0.22	90.18±0.14	98.64±0.14	118.14±0.12	160.12±0.08	210.6 ± 0.05

Table No. 2: Impact of wastewater at various dilutions on brinjal (*Solanum melongena*). plant growth in raver area of khandesh region

Sr. No.	Parameters	Wastewater Concentrations (%)					
		Control	10	25	50	75	100
1	Seed germination (%)	80	70	66	60	36	08
2	Plummule formation (%)	80	70	64	60	36	08
3	Shoot length ^{b}(cm)	13.5± 0.81	21.5±0.50	20.5± 0.11	18.8±0.31	19.5±0.25	10.5±0.70
4	Root length ^{b}(cm)	4.80±0.90	6.2±0.05	5.6±0.13	4.26±0.14	4.12±0.26	4.10±0.58
5	Total leaf length^b(cm)	20±0.02	20±0.04	24±0.04	22±0.06	13±0.08	11±0.04
6	Mean leaf length^b(cm)	2.42±10	1.98±12	2.10±08	2.20±06	2.18±10	2.16±08
7	Mean leaf width ^{b}(cm)	2.10±08	2.02±08	1.84±06	1.76±04	1.68±06	1.48±08
8	Total number of flower ^{b}	32	22	18	16	11	07
9	Total number of fruits ^{b}	26	12	10	08	06	04

a=mean value of eight seeds; b=mean value of four plants





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