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Effect of Sugar Industry Effluent on Yield and Productivity of *Lycopersicon esculentum* Mill. Var. Navodaya

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ABSTRACT

Sugar industry is an agro-based industry that's why it was propose to study the effect of sugar industry effluent on productivity, as irrigation medium in different dilution i.e., 20 per cent (T₁), 40 per cent (T₂), 60 per cent (T₃), 80 per cent (T₄) and 100 per cent (T₅). The nutrient element generally present in the effluent are phosphorous, zinc, magnesium, iron etc. productivity per plant is affected with the irrigation of sugar industry effluent. Treatment T₁, T₂, and T₃ showed significantly increase by 32.21 per cent, 59.12 per cent and 98.16 per cent respectively as compare to the control crop.

Key words: Sugar industry effluent, *Lycopersicon esculentum* Mill., Var. Navodaya, Fruit productivity

Tomato is one of the most popular and important commodities in the world. It is widely cultivated in tropical, sub-tropical and temperate climates and ranks the third in term of world vegetable production [1]. It is regarded as the most vital vegetable after onion and pepper [2]. It is often referred as "The Poor Man Orange" because of its high vitamin contents, Malic acid and Citric acid contents [3]. Tomato is one of the low-calorie vegetables just 18 calories per 100 grams. It is very low in fat content and has zero cholesterol level. They are excellent source of antioxidant, dietary fibers, minerals and vitamins. Dieticians often recommend Tomatoes in cholesterol controlling and weight loss diet programs. The anti-oxidants present in tomatoes are protective against cancer. Total Oxygen Radical Absorbent capacity (ORAC) in Tomato is above 3.67 μ mol TE per 100 grams (micro mol Trolox Equivalent). Lycopene which is the red coloured pigment found in Tomatoes is a hydrocarbon with extended conjugated double bond as the carotenoids [4]. Lycopene is a falconoid antioxidants found in Tomatoes. As a fat-soluble compound, lycopene has a similar absorption property as dietary fat. In the stomach and duodenum, lycopene will separate from the food matrix and subsequently dissolve in the lipid phase [5]. Dietary supplementation or adequate intake of lycopene and Vitamin A rich foods is beneficial in asthmatic and rheumatoid arthritis patients and has been reported to be safe when used as food additive [6]. The red colour of Tomato perhaps due to lycopene pigmentation this antioxidant along with carotenoids may help to protect cell from harmful free radicals. Lycopene protects the skin from ultra violet rays it is a very good source of vitamin A.

A fresh Tomato is very rich in potassium. Potassium is an important component of cell fluid that helps in controlling heart rate and blood pressure caused by sodium.

Industrialization, urbanization and population explosion are major factors which are responsible for environmental pollution and degradation. India with a fast industrial growth is also facing pollution problems of a significant magnitude. Beside air pollution, the liquid wastes produced by industries are resulting into deterioration of the environment. Several rivers are receiving heavy amount of industrial effluents with highly toxic hazardous chemicals [7]. The agricultural production is heavily affected by the reckless discharge of these effluents as farmers generally used these effluents in irrigation due to scarcity of irrigational water. A number of industries are running at present which play a significant role in the national economy, Sugar industry is one of them. Sugar industry is the second largest agro-based industry of our country [8]. Uttar Pradesh with about 103 Sugar industries contributes to the major parts of the total production of the sugar. A considerable amount of water is used in sugar industries and subsequently a large volume of effluent of medium pollution range is discharge.

Sugar industry effluent is light brown to black in colour. It is characterized by high pH value, suspended solids, COD, BOD, chlorides, sulphates, low dissolved oxygen and heavy metals like manganese, copper, zinc, cadmium, lead and mercury which affect the producers especially green plants [9]. The farmers near these industries irrigate their crops of cereals, oils, pulses, vegetables etc. In arid and semi-arid region of our country where scarcity of water is limiting factors in agriculture, the Sugar industry effluent is used for irrigation purposes by farmers [10]. Seeing the economic significance of Tomatoes and hazardous effect of Sugar industry effluent, which is a common industry of Purvanchal. It is therefore, proposed to study the impact of Sugar industry effluent on productivity and nutritional status of *Lycopersicon esculentum*

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Mill. var. Navodaya, as the effluent contain some important nutrient along with several toxic substances.

MATERIALS AND METHODS

This field experiment was designed to study the effect of sugar industry effluent on productivity of *Lycopersicon esculentum* Mill. Var. Navodaya. The experiment was carried out in factorial randomized block design in Botanical research field of Shibli National P. G. College, Azamgarh. Each small plot measured 1 × 1 sq. meters. The healthy and uniform seeds were selected for sowing. Mercuric chloride solution of 0.1 per cent was used for surface sterilization of seeds. It takes 7 to 9 weeks from sowing to produce dark green, 4 to 6 inch tall seedling. The crop was raised by transplanting the seedling in the experimental plots. The optimum spacing was 50 × 50 cm. The plots were irrigated with five different concentrations i.e.,

20, 40, 60, 80 and 100 per cent concentration of sugar industry effluent named as T₁, T₂, T₃, T₄ and T₅ treatments respectively. A control crop was also grown and irrigated with tap water only designated as control crop (T₀). Five replicates from each treatment were made (Table). Weeding was done as required. Nutritional contents were also observed from fruit.

RESULTS AND DISCUSSION

Number of fruits per plant significantly increases in T₁, T₂ and T₃ treatments by 16.44, 28.66 and 28.89 per cent respectively over control crop (Table 1). Maximum increase was recorded in T₃ treatment that is at 60 per cent concentration of sugar industry effluent. Treatments T₄ and T₅ was found to be toxic. Number of fruits per plant significantly decreases in T₄ and T₅ treatments and it was 8.22 and 26.67 per cent respectively as compared to control (Table 1).

Table 1 Comparison of the mean values of yield characters in between control and treated populations of *Lycopersicon esculentum* Mill. var Navodaya

Characters'	T ₀	T ₁	T ₂	T ₃	T ₄	T ₅	CD
Number of fruits per plant	36±1.01 (13-25)	41.92±1.38 (15-29)	46.32±0.46 (20-29)	46.4±0.46 (19-26)	33.04±0.31 (13-20)	5.168±0.04 (1-5)	1.96
Weight of fruit (gm)	54.51±0.78 (30-75)	61.89±1.40 (23-91)	67.38±2.65 (36-98)	83.79±2.49 (43-120)	42.93±0.99 (20-78)	40.58±0.63 (25-65)	0.24

Statistical comparison between the mean values of weight of fruit was affected with the effect of different concentration sugar industry effluent. The treatments T₁, T₂ and T₃ showed significant increase in the weight of the fruit and it was 13.54, 23.61 and 53.71 per cent respectively as compared to control crop (Table 1). Maximum increase was found in T₃ treatment. Treatment T₄ and T₅ showed toxic effect on the weight of the fruit and was decreased by 21.24 and 25.55 per cent respectively as compared to control crop (Table 1). All the increase or decreases in weight of the fruits of *Lycopersicon esculentum* Mill. var Navodaya when irrigated with different

concentration of sugar industry effluent were statistically significant (Table 1).

Effect of different concentration of sugar industry effluent on productivity of *Lycopersicon esculentum* Mill. var. Navodaya fruits were studied (Table 2). Productivity per plant is also affected with the irrigation of sugar industry effluent. Treatments T₁, T₂ and T₃ showed an increase by 32.21 percent, 59.12 per cent and 98.165 per cent respectively as compared to control crop (Table 2). The treatment T₄ and T₅ showed a decrease of productivity by 27.72 per cent and 89.39 per cent over to control crop (Table 2).

Table 2 Statistical comparison between the mean values of productivity per plant in *Lycopersicon esculentum* Mill. var. Navodaya irrigated with different concentration of sugar industry effluent

Treatments	Replicates					Mean	Total
	R ₁	R ₂	R ₃	R ₄	R ₅		
T ₀	1.85	1.99	1.89	2.16	1.90	1.96	9.81
T ₁	2.17	2.79	2.38	2.48	2.60	2.48	12.43
T ₂	2.98	3.13	2.99	3.31	3.15	3.11	15.58
T ₃	3.84	4.17	3.83	3.64	3.95	3.88	19.44
T ₄	1.38	1.35	1.46	1.44	1.44	1.41	7.09
T ₅	0.213	0.20	0.22	0.19	0.21	0.20	1.04
Total	12.45	13.66	12.79	13.23	13.27	-	

M.SS between treatment = 7.19

M.SS between replicates = 2.25

M.SS Error = 0.13

C.D. = 0.49

T₀: Control population irrigated with tap water

T₁: Population irrigated with 20 per cent concentration of sugar industry effluent

T₂: Population irrigated with 40 per cent concentration of sugar industry effluent

T₃: Population irrigated with 60 per cent concentration of sugar industry effluent

T₄: Population irrigated with 80 per cent concentration of sugar industry effluent

T₅: Population irrigated with 100 per cent concentration of sugar industry effluent

Yield characters of *L. esculentum* Mill. Var. Navodaya are affected with the irrigation of suitable concentration of sugar industry effluent and maximum enhancement were recorded in T₃ treatment where plant were irrigated with 60 per

cent concentration of sugar industry effluent. Similar types of finding have been reported to increase in number of flowers per plant by the use of foam industry effluent [11]. similar result in yield characters by using Tannery waste on sweet corn [12].

Fruiting is a very complex character and dependent on physico-biochemical and vegetative characters. A number of factors determining the productivity of the crop such as pollen fertility, number of flowers per inflorescence, number of inflorescence per plant, diameter of flower, number of fruits per plant, size and weight of fruits etc. In experiments 1, 2, 3 and 4 the number and weight of fruits per plant increased significantly resulting in enhancement of fruits productivity per plant with the irrigational effect of 60 per cent concentration of sugar industry effluent. Several other workers have also been reported similar type of observation on different crops and different effluents [11-18]. Enhancement of productivity in sweet corn by the effect of Tannery effluent was reported [12]. Effect of Biogas slurry effluent in ground nut was studied [13]. Reported the increase in number of pods per plant and total yield in ground nut. Increase in yield of banana with the effect of distillery effluent [14]. Increase in the yield of sugar cane with the effect of distillery-based compost at certain concentration was reported by [15]. Effect of foam industry effluent on *Lense esculanta* Var. Malika was studied by [11], they reported increase in number of pods per plants. [19] Reported increase in the yield of *Oryza sativa* with the effect of paper factory

sludge. [16] Reported significant increase in gram productivity (Q/ha) and oil yield in varieties of *Brassica campestris* i.e., variety varuna-69 and Laha-101. Enhancement in almost all the yield characters in *Pisum sativum* L. Var. Aparna by the effect of sugar industry effluent was reported [17]. Positive response of sugar industry effluent on productivity of tomato was reported [20].

CONCLUSION

A study was made to observe the effect of different dilution of sugar industry effluent on plant productivity and chemical composition of *Lycopersicon esculentum* Mill. var. Navodaya. The characters considered for the study were fruit productivity per plant. Sugar industry effluent was applied as irrigation medium in different concentration i.e., 20 per cent (T₁), 40 per cent (T₂), 60 per cent (T₃), 80 per cent (T₄), and 100 per cent (T₅). A control crop was also grown side by side which was irrigated with tap water. Maximum fruit productivity was recorded in T₃ treatment where crop was irrigated with 60 per cent concentration of Sugar industry effluent on Tomato (*Lycopersicon esculentum* Mill. var. Navodaya).

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