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Impact of Sugar Industry Effluent on Productivity of Tomato (*Lycopersicon esculentum* Mill. Var. Navodaya)

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ABSTRACT

Five concentrations of sugar industry effluent was given in irrigation medium i.e. 20 per cent as T_1, 40 per cent T_2, 60 per cent as T_3, 80 per cent as T_4 and 100 per cent as T_5. The yield characters' studied the diameter of flower, length of anther, pollen fertility, number of flowers per inflorescence, number of inflorescence per plant, number of fruits per plant, diameter of fruit, number of seeds per fruits, average of fruit and productivity per plant. Diameter of flower was found to increase with the treatment of sugar industry effluent and maximum increase was recorded as 7.49 per cent in T_3 treatment. Maximum increase in the length of anther was noted as 23.53 per cent in T3 treatment. Pollen fertility was almost unaffected with the treatment of sugar industry effluent a little increase of 3.47 per cent was recorded in T_2 treatment. Number of flower per inflorescence was also found to increase and maximum increase was recorded in T_3 treatment and it was 15.69 per cent as compared to control. Number of inflorescence per plant was also affected with the treatment of sugar industry effluent and T_3 treatment where plant received 60 per cent concentration of sugar industry effluent showed maximum increase of 22.07 per cent as compared to control. Number of fruits per inflorescence was found to increase with the increase of concentration of sugar industry effluent and maximum increase was recorded in T_3 treatment and it was 28.89 per cent as compared to control. Diameter of fruit was found to increase and maximum increase was noted as 22.13 per cent over control in T_3 treatment. Number of seeds per fruit and average weight of the fruit were also found to increase with the increase of sugar industry effluent up to 60 per cent and maximum increase was recorded as 29.66 per cent and 53.71 per cent respectively, over control. Fruit productivity per plant was found to be affected by the treatment of sugar industry effluent and maximum increase of 98.16 per cent was recorded in T_3 treatment. It was observed that T_3 treatment where plants were irrigated with 60 per cent concentration of sugar industry effluent was to found to enhance

the maximum in almost all the yield parameters taken in to consideration. It is concluded that the concentration up to 60 per cent favours the yield characteristics of lycopersicon esculentum Mill. Var. Navodaya. The concentration above 60 per cent showed toxic effect on almost all the yield parameter including fruit productivity of tomato crop.

Keywords : Sugar industry effluent, Lycopersicon esculentum Mill. Var. Navodaya, Treatment (T_0, T1, T_2, T_3, T_4, & T_5), Yield characters.

I. INTRODUCTION

Progress of any country is measured by its industrial development, which resulted in to industrial revolution all over the world. India with fast industrial growth is also facing pollution problem of a significant magnitude. The liquid base (effluents) produces by industries are resulting into degradation of environment. Several rivers of the world are receiving heavy amount of industrial effluents, with highly toxic chemicals (Mathur, 1975). It makes water bodies foul smelling unpleasant, turbid and unfit for life of living organism including plants. Agricultural production is mostly affected by the reckless discharge of these effluents. Farmer use these effluents for irrigation due to scarcity of irrigational water. Sugar industry effluent is the second largest industry of our country next to the textile (Rachel & Sequira, 2010). Reckless release of Sugar industry effluent on land or into natural water bodies, exposing serious pollution problem in India (Srivastava & Sahai, 1987). The pollution due to industries is increasing day by day. A huge amount of water is used in sugar industry and subsequently a large amount of effluent of medium pollution range is discharged. Sugar industry effluent is light brown to black in colour it is charecterised by high pH value, suspended solids, COD, BOD, Chloride, Sulphates, low dissolve oxygen and heavy metals, like Manganese, Copper, Zinc, Lead, and Mercury which affected primary producers specially green plants (Ajmal and khan, 1983). Farmers in the vicinity of these industries irrigate their crops of cereals, pulses, oils, vegetables etc. by the polluted water. Beside the hazardous elements, effluents also contain some useful elements like Nitrogen, Phosphorous, and Potassium. Some effluents at a particular dilution are found to be beneficial for irrigation (Taghavi and Vora, 1994). In our country sugar industry effluent is used for irrigation by farmers (Singh, et al, 1985). Therefore, it is necessary to know that impact of sugar industry effluent on agricultural crops.

The Tomato (*lycopersicon esculentum* Mill. Var. Navodaya) is one of the most popular as well as important commodities in the world; about 20 million metric tons of Tomatoes are produced each year on world basis United State, Italy, and Spain are the leading producer of the crops. Tomato is often referred as “The poor man’s orange” because of its high vitamin, malic acid, and citric acid content (Salunkhe et al, 1974). Seeing the nutritional value of Tomato and its global demands, the present experiment was conducted to study the effect of sugar industry effluent on productivity of Lycopersicon esculentum Mill. Var. Navodaya.

II. MATERIALS AND METHODS

The seeds of *Lycopersicon esculentum* Mill. Var. Navodaya was obtained from government agricultural office, Azamgarh and sugar industry effluent was obtained from Sahkari Chini Mil Sathiyaon, Azamgarh.

The experiment was carried out at research field, Shibli National P.G. College, Azamgarh in factorial randomized block designs. The crop irrigated with different concentration of sugar industry effluent (20, 40, 60, 80 and 100 per cent named as T_1, T_2, T_3, T_4 and T_5 treatments) respectively. A control experiment was grown side by side where the crop was irrigated with tap water only and named asT_0 treatment. Several reproductive parameters including productivity per plant were studied and compared with control. The yield characters studied were the diameter of flower, length of anther, pollen fertility, number of flower per inflorescence, number of inflorescence per plant, number of fruits per plants, diameter of fruits, number of seeds per fruits, weight of fruits, productivity per plants.

III. RESULTS AND DISCUSSIONS

An experiment was conducted on the effect of different concentration of sugar industry effluent on reproductive parameters of *Lycopersicon esculentum* Mill. Var Navodaya. The parameters were diameter of flower, length of anther, pollen fertility, number of flowers per inflorescence, number of inflorescence per plant, number of fruits per plant, diameter of fruit, number of seeds per fruit, weight of fruit, fruit productivity per plant. A comparative statistical analysis of the mean value has been made, and the resultant data represented in Table.

The significant increase was noted in the diameter of flower in T_3 treatment and it was 7.49 percent as compared to control. Treatment T_4 & T_5 were showed the toxic effect to the diameter of flower and decreases the diameter by 0.229 & 8.38 percent respectively. Length of anther was affected with the effect of different concentration of sugar industry effluent and the increase was recorded in treatment T_1, T_2&T_3 by 9.94, 12.40 and 23.53 percent respectively, over control. The maximum increase was recorded in T_3 treatment. The treatment T_4 &T_5 showed toxic effect on the length of anther, a decrease was noted by 7.75, and 14.83 per cent as compared with to control crop. The pollen fertility was found to be unaffected with the treatment of sugar industry effluent although a little increase of 3.47 per cent was recorded in T_2 treatment. The number of flowers per inflorescence was found to be affected with the treatment of different concentration of sugar industry effluents. An increase in treatments T_1, T_2, and T_3 was recorded as 2.49, 6.59, & 15.69 per cent respectively as compared to control (Table). The treatment T_4 & T_5 were showed the toxicity to the number of flower per inflorescence, found to be decrease the number by 17.29 &19.79 per cent respectively, the maximum decrease was recorded in T_5 treatment as compared to control. The other reproductive parameter i.e., number of inflorescence per plant was also found to be affected with irrigation of sugar industry effluent. It increases up to 60 per cent concentration and above 60 per cent concentration was found to be toxic for number of inflorescence per plant. Maximum increase was recorded at 22.09 per cent as compared to control in T3 treatment. Statistical analysis showed a significant increase of 5.52, 19.63 & 22.09 per cent in T1, T2 and T3 treatments over control respectively. Treatment T_4 &T_5 was found to reduce the number of inflorescence per plant by 7.97 and 71.78 per cent respectively and a significant decrease was recorded in T_5 treatment by 71.78 per cent (Table). The number of fruits per plant was also affected with the effect of different concentration of sugar industry effluent. All the treatment that is treatment T_1, T_2 and T_3 showed that the number of fruit increase with the increase of different concentration of sugar industry effluent up to the 60 per cent concentration. It has been recorded that the treatment T1 increases by 16.44 per cent, T_2

by 28.67 per cent and T_3 by 28.89 per cent respectively, as compared to control. On the other hand, the treatment T_4 & T_5 showed the toxic effect on the number of fruits per plant of *lycopersicon esculentum* Mill. Var. Navodaya, and it was 8.22 and 85.64 per cent respectively and statistical analysis revealed the significant decrease in treatment T_5. The diameter of fruit was found to increase with the increasing concentration of sugar industry effluent up to T_3, the increase was recorded as in Treatment T_1 by 9.10, T_2 by 22.12 and in T_3 22.132 per cent as compared to control. In treatment T_4 and T_5, a decrease was recorded in diameter of fruit by 0.4228 percent and 17.61 per cent respectively. The numbers of seed per fruit was also affected with the irrigation of different concentration of sugar industry effluent. The treatments T_1, T_2, & T_3 showed an increase of 12.29 per cent, 17.42 per cent and 29.66 per cent respectively. The maximum increase was recorded in T_3 treatment that is significant. The treatment T_4 and T_5 showed a decrease of 5.185 & 9.34 per cent respectively as compared to control. The other parameter like weight of the fruit also affected, with the effect of increasing concentration of sugar industry effluent. An increase of 13.55, 23.61 and 53.71 per cent in T_1, T_2, & T_3 treatment respectively as compared to control crop. The maximum increase was recorded in T_3 treatment, which was significant. The treatment T_4 and T_5 decreases the weight of fruit by 21.24 & 25.55 per cent respectively. The fruit productivity per plant was found to increase with increase of concentration of sugar industry effluent in irrigation medium up to 60 per cent i.e. T3 treatment. The concentration above 60 per cent decreases the fruit productivity. Significant increase of 59.12 per cent and 98.16 per cent was recorded in T2 and T3 treatment. A significant decrease of 89.40 per cent was recorded in T5 treatment.

Increase in almost all the yield parameters with the application of sugar industry effluent indicated that its proper dilution (60 percent) can be used as liquid fertilizer for such type of crop especially *lycopersicon esculentum* Mill. Var. Navodaya. Moreover, can minimize the pollution load in our environment. Similar type of observation have been reported by some other workers like Rahate et al, 1990, Devrajan and Oblisamy (1994), Rampal and Dorjey (2001), Kumar (2004) etc. Stomberg et al, (1984) reported that the total yield of sweet corn was highest with the treatment of tannery waste. Rahate et al, (1990) reported increase in the yield per plant and pod number of groundnut with the effect of biogas slurry effluent. Devrajan & Oblisamey, (1994) reported highest yield of banana with the irrigation of sugar industry effluent. Rajannan et al, (1998) reported in the yield of sugarcane with the effect of distillery-based compost at certain concentration. Rampal and Dorjey, (2001) reported that the number of pods per plant in lens esculentum Moench. Var. Malica increases with the treatment of foam industry effluent. Karmakar et al, (2001) reported highest yield of rice with the effect of paper factory sludge. Kumar, (2004) reported enhancement in grain productivity (Q/ha) and oil yield in two high yielding varieties of *Brassica campestris*. Sugar industry effluent contain about 80 mg per liter magnesium which has a direct role in protein synthesis as it is involve in the binding of ribosomal sub-particles. Although the excessive amount of magnesium is injurious to the plants causing rolling and curling of leaves and necrosis at the tip of the leaf. Magnesium plays an important role in the formation of chlorophyll. It is also involve in enzymatic reaction. Copper is require by the plant in very small amount 2 - 7.5 ppm and is toxic to the plant beyond certain concentration. It helps in biosynthesis of chlorophyll. Copper is also a component of enzyme L-gulono-oxidase involved in the synthesis of ascorbic acid that is why the presence

of copper in trace amount in sugar industry effluent may favour the productivity of *lycopersicon esculentum* Mill. Var. Navodaya.

Table 1 - Statistical comparison of the mean values of yield characters in between control and treated populations of Lycopersicon esculentum Mill. Var. Navodaya

S.NO.	Characters'	T_0	T_1	T_2	T_3	T_4	T_5	CD
1	Diameter of flower (cm)	2.4448 ±0.08068 (1.5-3.5))	2.46 ±0.08611 (1-3.9)	2.5024 ±0.12317 (1.5-3.6)	2.628 ±.12866 (1.5-4)	2.4392 ±0.12176 (1.2-3.5)	2.24 ±0.16992 (1.2-3.5)	0.080
2	Length of anther (mm)	6.7088 ±0.1902 (4-9)	7.376 ±0.038 (5-9)	7.5408 ±0.1004 (4.5-9.5)	8.2872 ±0.175 (5.5-10)	6.1888 ±0.1502 (4-8.5)	5.7136 ±0.1154 (4-7)	1.85
3	Pollen fertility (%)	74.65 ±0.79114 (60-8605)	71.9193 ±0.5216 (60-81.63)	77.24 ±1.08967 (60-92.77)	74.9426 ±1.29301 (59.29-95.31)	69.3625 ±0.56267 (58-78.57)	59.9225 ±0.8868 (48-70)	2.005
4	Number of Flowers/ inflorescence	4.488 ±0.2424 (2-8)	4.6 ±0.2945 (1-8)	4.784 ±0.3844 (2-10)	5.192 ±0.2809 (2-9)	3.712 ±0.2394 (1-7)	3.6 ±0.158841 (1-7)	3.312
5	Numberofinflorescence/plant	6.52 ±1.135 (2-12)	6.88 ±0.887 (3-14)	7.8 ±0.978 (2-14)	7.96 ±0.584 (4-12)	6 ±0.341 (2-9)	1.84 ±0.289 (0-5)	1.104
6	Number of fruits /plant	18 ±1.016 (13-25)	20.96 ±1.386 (15-29)	23.16 ±0.463 (20-29)	23.2 ±0.462 (19-26)	16.52 ±0.317 (13-20)	2.584 ±0.048 (1-5)	1.032
7	Diameter of fruit (cm)	13.624 ±0.21043 (9.5-18.5)	14.864 ±0.26279 (8.3-19.5)	16.6384 ±0.25879 (10.2-19.6)	16.6392 ±0.2834 (12.3-20)	13.5664 ±0.30124 (5-16.8)	11.2248 ±0.23488 (8.3-14.2)	0.3082
8	Number of seeds / fruit	41.192 ±0.5854 (19-67)	46.256 ±1.7794 (9-74)	48.368 ±1.9851 (18-80)	53.408 ±2.0884 (20-80)	39.056 ±1.1398 (17-67)	37.344 ±2.5389 (10-80)	2.8742
9	Weight of fruit (gm)	54.512 ±0.7804 (30-75)	61.896 ±1.4071 (23-91)	67.384 ±2.6505 (36-98)	83.792 ±2.4928 (43-120)	42.936 ±0.9977 (20-78)	40.584 ±0.6304 (25-65	0.234
10	Productivity / Plant (Kg)	0.981	1.297	1.561	1.944	0.709	0.104	

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.

IV. CONCLUSION

On the basis of experimental result. It is concluded that the sugar industry effluent which is a medium range pollutant and pollute our water bodies in nearby area of sugar industry and is toxic for the growth and development of crop plants if irrigated by that water. This effluent can be used as liquid fertilizer for the growth and development of crops like lycopersicon esculentum Mill. Var. Navodaya in proper dilution. It has recorded that 60 per cent concentration of sugar industry effluent enhance the maximum growth & productivity of Lycopersicon esculentum Mill. Var. Navodaya and it was 98.16 percent as compared to control.

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VI. REFERENCES

[1]. Ajmal, M. and Khan, A.U., 1983. Effect of sugar factory effluent on soil and crop plants. Env. Pollution (Ser. A), 30:135-141.

[2]. Devrajan, L. and Oblisamy, G. 1994. Performance of Banana (Poovan) Under Distillery Effluent irrigation. South Indian Horticulture, 42 (5) : 324-326.

[3]. Karmakar, S.; Mitra, B.N. and Bhosh, B.N. 2001. Effect of Paper Factory Sludge on Yield and Nutrient Uptake of Rice (oryza sativa) Indian J.Agr.Sci.,71 (11) :695- 697.

[4]. Kumar, 2004. Ph.D. Thesis submitted to V.B.S. Purvanchal University, Jaunpur, (U.P.) India.

[5]. Mathur, R. B. L. 1975. Cited from hand book of cane sugar Technology (reprint 1986). Oxford and IBH Publishing company Co.

[6]. Rachel J, and D. E. Sequeira, 2010. Total Geography 10 (Ed- 2014) Morning Star Publication, New Delhi.

[7]. Rahate, R. B.; Thosar, V. R. and Mahajan, A. G. 1990. Manurial efficiency of Biogas Effluent Slurry on Growth and yield of Groundnut Crop (Arachis hypogea Linn.) Phule Pragati, 14 (2) : 197-200.

[8]. Rajannan, G.; Parvin banu, K.S. and Ramaswami, P. P. 1998. Utilization of Distillery Effluent Based Compost for Crop Production and Economization of Fertilizer Use. Indian J. Env. Health, 40 (3) : 289 – 294.

[9]. Rampal, P.K. and Dorjey, P. 2001. Studies on the Effect of Foam Industry on Lense esculentus Moench Var. Malica. Indian journal Environ. Protection, 21 (1) : 14 - 17.

[10]. Salunkhe, D. K.; Jadhav, S. J. and Yu M.H. 1974. Quality and nutritional composition of tomato fruit as influenced by certain biochemical and physiological changes QuaI. plant. - H.Fds.hum.Nutr. XXIV, 1/2 : 85-113.

[11]. Srivastava, N. and Sahai, R. 1987. Effect of Distillery wastes on the Performance of Cicer arietinum L. Environ. Pollut. , 43 (2) : 91 -102.

[12]. Stomberg, A. L.; Hemphill, D. D.; J. R. and Volk, V. V. 1984. Yield and Element Concentration of Sweet Corn Grow on Tannery Wastes Amended Soil. J. Env. Qual., 13 (1) : 162 – 166.

[13]. Taghavi, S. M. and Vora, A. B. 1994. Effect of Industrial Effluent on Germination and Growth Development of Guar Seed (var.PNB) J. Environ Biol., 15 (3) : 209 – 212.

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