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Effects of treated wastewater and fresh water on growth and yield of tomato (*Lycopersicon esculentum*)

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■ **ABSTRACT :** Study was conducted to examine the effects of two sources of water on the growth of tomato (*Lycopersicon esculentum*) at Maharashtra in Jalgaon district. The sources of irrigation water were: treated wastewater and fresh water. The quality of these sources was monitored for a period of three months (2017). Samples from both of the source taken were sent to the laboratory for analysis. Each water source was used to irrigate tomatoes planted in the field using split plot design (SPD) as the experimental design for a period of three month. The treatments were two (treated wastewater and fresh water) with three replications. During the growing period, soil fertility status was monitored for a period of three months. During this period, plant height, number of flowers and fruits were determined. Here results shows that treated wastewater was also used for irrigation purpose and get 01-05 per cent less yield as compared to fresh water yield. So the wastewater with appropriate plant protection measures was found suitable for irrigation of tomato crop.

■ **KEY WORDS :** Tomato, Treated wastewater, Fresh water, Growth , Yield

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The very rapid urban growth of the last few decades has produced increasing demands for potable water. As a result of this growth and the associated industrialisation, near-urban surface water resources typically become either fully utilised or poor quality .The improved sanitation coverage in large cities with water-borne sewerage systems produces enormous volumes of wastewater for disposal. With the increasing scarcity of fresh water resources in arid and semi-arid regions, but ever-growing demand for more efficient food production for the expanding populations, much wider recognition is being given to wastewater as an important resource.

One solution to insufficient water supplies for agriculture that has been increasingly applied in the last decade is water reuse. Reuse of treated wastewater reduces effluent discharges into receiving waters and offers a reliable water supply for applications that do not require high quality water, thus. freeing up otherwise limited potable water resources. Wastewater reuse is advantageous formany reasons, including water scarcity in arid and semi-arid areas, the high energy cost of advanced wastewater treatments and the above mentioned surface water pollution due to direct discharge of wastewater effluents.

Tomato *(Lycopersion esculentum)* is a member of the family solanaceae. It is cultivated throughout the country. A major advantage of using wastewater is that

it contains high levels of nutrients, reducing the need for and cost of fertilization.Tomato tolerates a wide range of soils and climate. It does not like excessive humidity and high temperature. It requires well-drained soils with a high organic content.

Increase in tomato production is attempted through improved irrigation, introduction of high yielding varieties, improving the quality of irrigation water, addition of fertilizer and more efficient control of pests. According to Qasem and Judah (1985), the contribution from traditional farmers for tomato production is not optimal because most of them can not afford modern technology and expensive chemical inputs. It has seldom been possible to identify the right source of water for irrigating tomato in order to improve its production. This study is part of a research work conducted on the use of two sources of water for irrigation of tomato. The objective of this research work is to find effects of treated wastewater and fresh water on growth and yield of tomato (*Lycopersicon esculentum*).

METHODOLOGY

The study area:

The study was carried out at Maharashtra in Jalgaon district of Eastern Region.The experimental site was previously cropped to onion and had been left to fallow for one year.

Experimental design:

The split plot design (SPD) was used. Two water treatments namely: treated wastewater and fresh water were used. The size of the experimental unit was 6x3 m. There were nine plots for each main treatment of sizes 6x3 m with three replications. There were 80 plants on each plot with a total plant population of 4320. The plants were spaced 30x60 cm. Four plants on each plot were sampled and tagged with plastic material for data collection.

Land preparation:

The land was cleared and ploughed in December 2016. Harrowing was done in January 2017 to remove any unwanted weeds, debris and to level the land for good seedling establishment.

Planting materials:

The variety of tomato used was Syngenta 1389. Seeds were bought from a certified seed seller Syngenta seed company at Nasik.

Nursing and transplanting:

Tomato seeds were nursed on raised beds in January 2017.The seedlings were transplanted to the experimental field in the 3rd week.

Weeding:

Plants were kept free of weed by repeated hand weeding with hoes and cutlasses.

Data collection:

The plant growth and yield data were taken on the sampled tagged plants monthly for single trial. The following plant growth and yield parameters were measured.

Plant height:

The plant heights were measured with a tape from the base of the plant to the tip of the plant.

Number of leaves per plant:

The numbers of leaves were counted when the tomato started bearing leaves.

Number of branches per plant:

The numbers of branches were counted when the tomato started bearing branch.

Number of flowers per plant:

The numbers of flowers were counted when the tomato started bearing flowers.

Number of fruits per plant:

The numbers of fruits were counted when the plants started fruiting.

Fruit weight:

The fruit weights were determined after 45, 60 and 90 DAS of tomato using a weighing balance.

Irrigation scheduling:

Irrigation interval was one day; this was done from the day of transplanting to harvesting.

Method of analysis:

Analysis of variance (ANOVA) was conducted on

the data.

Treatments:

The treatments comprised irrigating with the following:

– Treated wastewater (W_1)

– Fresh water (W_2).

■ RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Plant height:

Mean plant height of the 15,30,60 and 90 DAS is shown in Fig. 1 the maximum height was obtained 30, 64, 110, 108 cm from tomato irrigated with fresh water in 15,30, 60 and 90 DAS . Tomato irrigated with treated wastewater in same days resulted minimum plant height is 23,53,97 and 96 cm. There were however, sightly differences between the mean plant heights in the both source of water.

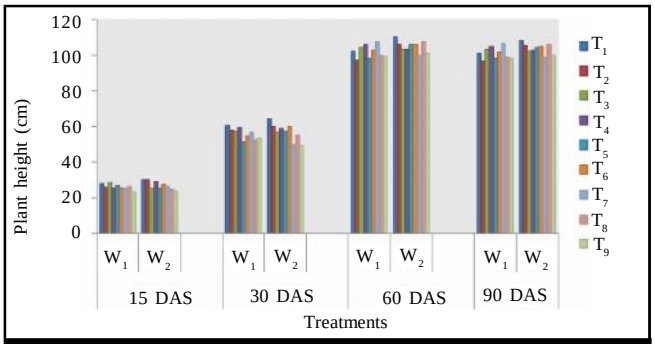

Fig. 1 : Plant height in cm

Number of leaves per plant:

Plants irrigated with T_1 recorded a higher mean number of leaves in each DAS of both water sources. The least mean number of leaves was obtained from plants irrigated with T_7,T_9. The mean number of leaves obtained by plants irrigated with W_2 was slightly higher

Table 1: Mean value of plant height

	15 DAS		30 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2	W_1	W_2
T_1	28	30	61	64	102	110	101	108
T_2	26	30	58	60	97	106	96	105
T_3	29	26	57	56	104	103	103	102
T_4	26	29	59	59	106	103	105	102
T_5	27	25	51	57	98	106	98	104
T_6	25	28	55	60	102	106	101	105
T_7	26	26	57	50	107	100	107	99
T_8	27	25	53	55	100	107	99	106
T_9	23	24	54	49	99	101	98	100

Table 2: Mean value of number of leaves per plant

	15 DAS		30 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2	W_1	W_2
T_1	34	36	114	116	121	134	128	131
T_2	33	34	98	112	115	132	113	129
T_3	36	29	101	91	121	120	118	117
T_4	30	36	93	104	114	133	112	130
T_5	32	28	91	94	115	124	114	122
T_6	31	33	86	102	115	134	113	132
T_7	34	33	102	67	127	114	124	112
T_8	30	28	79	90	112	117	112	118
T_9	28	29	95	72	114	115	115	117

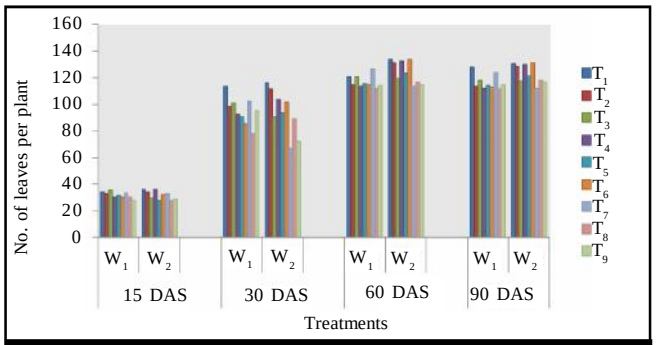

Fig. 2 : Number of leaves per plant

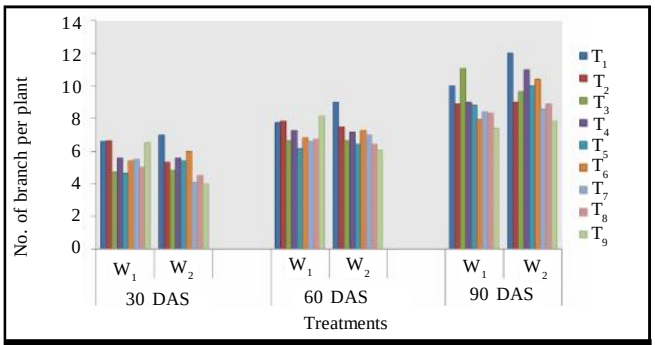

Fig. 3 : Number of branches per plant

from the plants irrigated with W_1 (Fig. 2).

Number of branch per plant:

Plants irrigated with W_2 recorded a higher mean number of branches than the plants irrigated with W_1. The least mean number of branch was obtained from plants irrigated with W_2T_7. The mean number of branches obtained by plants irrigated with W_1 and W_2 shows highest value is 11 and 12 in 90 DAS (Fig. 3).

Number of flowers:

Plants irrigated with W_1 and W_2 recorded a higher mean number of flowers in the plants irrigated with treatment T_1. The least mean number of flowers was obtained from plants irrigated with T_5. The mean number of flowers obtained by plants irrigated with W_2 was

Table 3: Mean value of number of branch per plant

	30 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2
T_1	7	7	8	9	10	12
T_2	7	5	8	8	9	9
T_3	5	5	7	7	11	10
T_4	6	6	7	7	9	11
T_5	5	5	6	6	9	10
T_6	5	6	7	7	8	10
T_7	6	4	7	7	8	9
T_8	5	5	7	6	8	9
T_9	7	4	8	6	7	8

Table 4 : Mean value of number of flowers per plant

	30 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2
T_1	11	11	19	20	20	21
T_2	7	11	17	20	19	20
T_3	6	7	16	18	17	18
T_4	6	11	18	20	18	20
T_5	5	7	17	17	17	17
T_6	7	10	18	20	19	20
T_7	8	8	19	19	18	19
T_8	7	7	18	18	18	19
T_9	9	7	20	18	20	20

slightly different from the plants irrigated with W_1 with all sub treatment (Fig. 4).

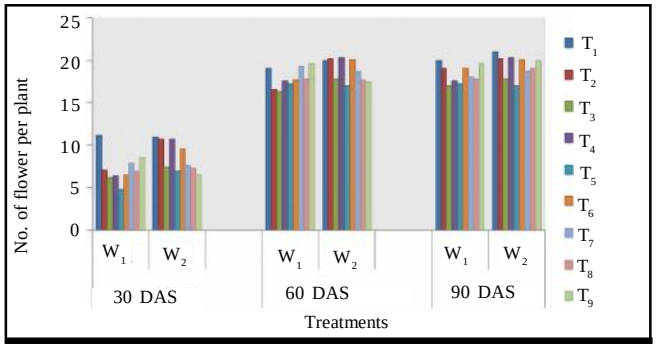

Fig. 4 : Number of flower per plant

Number of fruits:

Plants irrigated with T_1 recorded the highest mean number of fruits in both water source of W_1 and W_2 in 30,60 and 90 DAS.The maximum mean numbers was found 15 and the least number of fruits was 2.

Fruit weight:

The mean fruit weight was obtained from plants irrigated with both water source T_1. T_5 plants registered

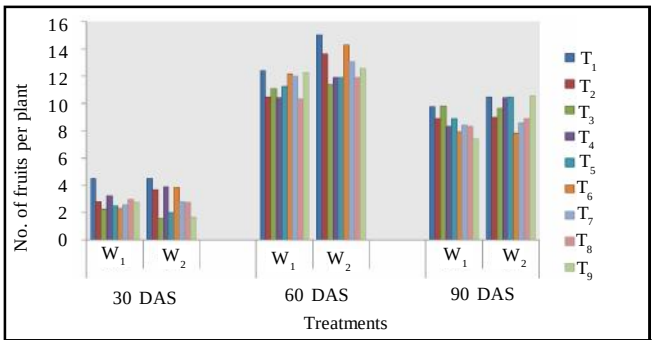

Fig. 5 : Number of fruits per plant

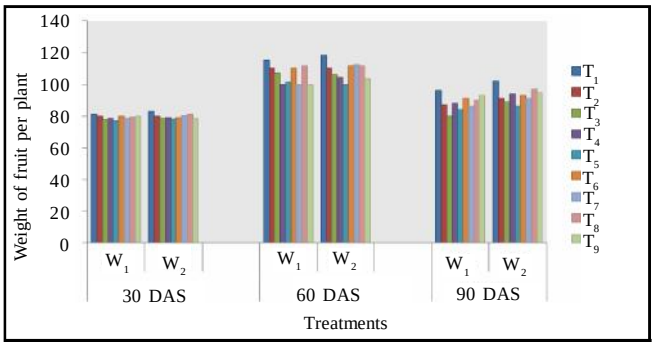

Fig. 6 : Weight of fruites per plant

Table 5: Mean value of number of fruits per plant

	30 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2
T_1	5	5	12	15	10	11
T_2	3	4	11	14	9	9
T_3	2	2	11	11	10	10
T_4	3	4	10	12	8	10
T_5	3	2	11	12	9	11
T_6	2	4	12	14	8	8
T_7	3	3	12	13	8	9
T_8	3	3	10	12	8	9
T_9	3	2	12	13	7	11

Table 6 : Mean value of weight of fruits per plant

	45 DAS		60 DAS		90 DAS	
	W_1	W_2	W_1	W_2	W_1	W_2
T_1	81	83	115	118	96	102
T_2	80	80	110	110	87	91
T_3	77	79	107	106	80	89
T_4	79	79	100	104	88	94
T_5	77	78	101	100	84	86
T_6	80	79	110	112	91	93
T_7	79	80	100	112	86	91
T_8	79	81	112	112	90	97
T_9	80	79	100	104	93	95

the least mean fruit weight in all DAS. The mean weights were sightly different. Similar work related to the present investigation was also carried out by Boamah (2004); Boamah *et al.* (2011); Hamilton *et al.* (1984) and Malash *et al.* (2005).

Conclusion:

No significant differences was found in the plant height, number of leaves, numbers of fruits, number of branch, number of flower and fruit weight. Among the treatments with treated wastewater and fresh water applied tomato irrigated with both source of water gives best result in T_1 treatment in all DAS. It was concluded that application of treated wastewater along with recommended plant protection measurse is best option for growing of tomato in fresh water scarcity areas.

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