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Studies On Sewage Water Treatments On Yield And Economics Of Maize

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ABSTRACT
The present experiment entitled "Effect of sewage water management on yield and quality of maize" was conducted during rabi season of 2016-17 in Horticulture Section, College of Agriculture, Nagpur, with an aim to studies on sewage water treatments on yield and economics of maize in randomized block design with three replications. The treatments included (T_1) Recommended irrigation with normal water, (T_2) Three irrigations with untreated sewage water, (T_3) Three irrigations with treated sewage water, (T_4) Four irrigations with untreated sewage water, (T_5) Four irrigations with treated sewage water, (T_6) Five irrigations with untreated sewage water and (T_7) Five irrigations with treated sewage water and crop was applied with recommended NPK dose of fertilizer. The results of the study indicated that five irrigations with treated sewage water treatment (T_7) recorded higher yield and yield attributes characters viz., grain yield plant^{-1}, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1}. Five irrigations with treated sewage water treatment is suitable quantity of irrigation for highest NMR (Rs.40623 ha^{-1}) and highest GMR (Rs. 70023 ha^{-1}) while Recommended irrigation with normal water is best treatment in concern of B:C ratio.
Key words: Maize, normal water, treated sewage water and untreated sewage water

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INTRODUCTION

Maize (*Zea mays* L.) is one of the important cereal crop of the world, known as "Queen of cereals" due to its great importance in human and animal diet, very efficient utilizer of solar energy and has immense potential for higher yield.

Maize is known for its wider adaptability and multipurpose uses as food, feed, fodder and industrial products. More than 35 products of daily use are derived from maize It content about 12 per cent protein, 8 per cent oil, 70 per cent CHO, 2.3 per cent crude fibre, 10.4 per cent albumins and 1.4 per cent ash [5]. In India, maize is cultivated in over 9185.3 thousand ha with a production of 24172.6 thousand tonnes having average productivity of 2632 kg ha-1 [1]. Among the major maize producing state Andhra Pradesh tops the list with a contribution of 21.81% to the total India maize production. In Vidarbha, the maize is grown on 80 thousand ha with a production of 192 thousand tonnes and productivity is 2448 kg kg ha-1 [2] during kharif season.

The availability of water is not uniformly distributed across the country and the gap between demand and supply is widening every day with rapid industrialization and urbanization. To reduce this gap, management and conservation of available water resources are being top priority for quite some time. Sewage water is known to be a potential source of irrigation which can ensure the reuse water sources especially in area where rainfall is scanty. Sewage water can be broadly classified in three categories, viz., untreated or raw, primary treated and secondary treated sewage. There are large amount of organic substances in the domestic sewage, and they are considered as the fertilizers to improve the growth of crops. The use of sewage water as a source of irrigation in agriculture, in general and in assessment of sewage irrigateted land system in particular around Nagpur has enough scope for study. Hence this studies on sewage water treatments on yield and economics of maize was conducted.

MATERIALS AND METHODS

A field experiment was conducted at Horticultural farm, College of Agriculture, Nagpur during *rabi* season of 2016-17. The experiment was laid out in randomized block design with three replications. The

treatments consists of (T_1) Recommended irrigation with normal water, (T_2) Three irrigations with untreated sewage water, (T_3) Three irrigations with treated sewage water, (T_4) Four irrigations with untreated sewage water, (T_5) Four irrigations with treated sewage water, (T_6) Five irrigations with untreated sewage water, (T_7) Five irrigations with treated sewage water. The soil of experimental plot was clayey in texture, low in available nitrogen (271.5 kg ha^{-1}), medium in phosphorus (15.70 kg ha^{-1}) and organic carbon (0.60 %) and very high in available potash (360.3 kg ha^{-1}) and slightly alkaline in reaction (pH 7.76).

The crop variety PKVM- Shatak was used with gross plot size of 4.2 m × 4.2 m and net plot size of 3.0 m × 3.0 m. Full dose of phosphorus, potassium and half dose of nitrogen were applied at sowing and remaining half dose of N was applied at 30 DAS In order to represent the plot, five plants of maize from each net plot were selected randomly, labeled properly. The yield and yield attributing characters *viz.,* grain yield $plant^{-1}$, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1} were recorded. The gross monetary and net monrtary returns along with B:C ratio were calculated.

Phytorid sewage treatment plant

Nag nalla is passing from the college farm where the continuous sewage water is flowing. For utilization of sewage water for irrigation to agricultural crops the sewage treatment plant using phytorid technology was constructed .This is wetland technology in which the treatment of sewage is possible by physical, chemical and biological way as per the technology of National Environmental Engineering Research Institute.

The treatment plant of 100 M^3/day capacity was designed in which inlet tank 50 m^3 capacity was provided .The design has hexagonal type in which the sewage was passed through various phytorid beds and finally collected at the outlet tank. The treatment operation takes place due to gravity .The phytorid beds was about 200 M^3 filled by gravel filter media in which the the aquatic plants which are helpful in dissolving oxygen in the water and also the lifter of heavy metals has been grown for obtaining the treated water. The plant species like Kena, Pothas, Typha and Bamboo were grown and established over the filter media. The sewage from the nalla was lifted in the inlet tank and the water from the outlet tank after 24 hours is used for irrigation. The treated water has no smell, no dirty colour, reduce pH and five times less BOD and COD. The total soluble salts as indicated from the EC value is also under permissible limit, i.e. 1 dS m^{-1}. It was safe for the irrigation to the plants. The experimental data were subjected to statistical test by following Analysis of Variance Technique suggested by Panse and Sukhatme [6] where, variance ratio ('F' value) was significant, critical difference (CD) values at 5% level of probability were computed for making treatment comparisons.

RESULTS AND DISCUSSION

Effect of sewage water management on yield attributes

The data pertaining to various yield attributes viz., grain yield $plant^{-1}$, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1} as influenced by different sewage water management treatments are presented in table 1. Grain yield $plant^{-1}$, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1} were significantly more in five irrigations with treated sewage water (T_7) followed by Recommended irrigations with normal water (T_1) and five irrigations with treated sewage water (T_6). Three irrigations with untreated sewage water (T_2) recorded least grain yield $plant^{-1}$, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1} while five irrigations with treated sewage water (T_7) recorded maximum grain yield $plant^{-1}$, test weight, grain yield kg ha^{-1} and fodder yield kg ha^{-1}. The increase in maize yield attributes might be due to increase of treated wastewater application rate causing higher nutrient inputs, higher uptake and accumulation of nutrients, mainly of N and P and occurrence of macro and micronutrients in the effluent which can neutralize the undesirable effect of high Na concentrations in treated wastewater which leading to more grain and fodder yield.

Sanai and Shayegan [8] found that spray irrigation with secondary treated municipal waste water to maize, potato, lucern and wheat increased their yield over controls. Yaryan [9] studied the effects of irrigation with treated wastewater, well water and irrigation systems on the yield of sugar beet, corn and sunflower and properties of soil. They obtained that the yield of sunflower and corn was higher under treated wastewater treatment, compared to well water treatment. Esmaillan *et al.* [3] result illustrated that application of treated waste water increased grain yield and yield component of maize corn compared with well water, significantly and maximum increased of yield component was observed in 1000-grain weight. Nahhal *et al.* [4] found that biomass of Chinese cabbage and corn grown in plots irrigated with treated waste water was higher than those grown in plots irrigated with fresh water. These results indicate the ability of TWW supplying the necessary nutrients for plant growth.

Patel *et al.* [7] revealed that the irrigation with Paper Mill treated effluent significantly increased the fresh and dry biomass yield of all test crops (wheat, cabbage, green gram and groundnut) as well as wheat

equivalent yield compared to best available water. Challam and Chaturvedi [2] found that yield of maize increased significantly with 100% treated dairy effluent as compared to 50%, 10% treated dairy effluent and control and also concluded that treated dairy effluent may be used for irrigation purposes. They suggested that the increase in maize yield resulted due to increase of treated wastewater application rate causing higher nutrient inputs, higher uptake and accumulation of nutrients, mainly of N and P and occurrence of macro and micronutrients in the effluent which can neutralize the undesirable effect of high Na concentrations intreated wastewater.

Table 1. Effect of different sewage water management on yield of maize

Treatment	Grain yield plant^{-1} (g)	Test weight (g)	Grain yield (kg ha^{-1})	fodder yield (kg ha^{-1})
T_1: Recommended irrigation with normal water	72.52	24.96	4169	6295
T_2: Three irrigations with untreated sewage water	58.78	23.11	3528	4974
T_3: Three irrigations with treated sewage water	61.48	23.02	3751	5369
T_4: Four irrigations with untreated sewage water	64.04	23.04	3866	5482
T_5: Four irrigations with treated sewage water	66.69	23.62	3887	5583
T_6: Five irrigations with untreated sewage water	70.67	24.16	4126	6189
T_7: Five irrigations with treated sewage water	79.34	25.10	4404	6693
SE (m)	4.04	0.72	166.75	336.96
CD at 5%	12.45	NS	513.85	1038.37
GM	67.64	23.85	3961.57	5797.85

Table 2. Effect of different sewage water management on economics

Treatment	Cost of cultivation (Rs. ha^{-1})	Gross monetary returns (Rs. ha^{-1})	Net monetary returns (Rs. ha^{-1})	B:C Ratio
T_1: Recommended irrigation with normal water	27400	66245	38845	2.41
T_2: Three irrigations with untreated sewage water	26600	55707	29107	2.09
T_3: Three irrigations with treated sewage water	27800	59308	31508	2.13
T_4: Four irrigations with untreated sewage water	27000	61075	34075	2.26
T_5: Four irrigations with treated sewage water	28600	61478	32878	2.15
T_6: Five irrigations with untreated sewage water	27400	65521	38121	2.23
T_7: Five irrigations with treated sewage water	29400	70023	40623	2.38
SE (m)	-	2454	2454	-
CD at 5%	-	7561	7561	-
GM	27743	62765	35022	2.24

Effect of sewage water management on economics

The data pertaining to economics viz., gross monetary return, net monetary return, and B:C ratio as influenced by different sewage water management treatments are presented in table 2.

Perusal of the data indicated that, gross monetary return and net monetary return were significantly more in five irrigations with treated sewage water (T_7) followed by Recommended irrigations with normal water (T_1) and five irrigations with treated sewage water (T_6). Three irrigations with untreated sewage water (T_2) recorded least gross monetary return and net monetary return while five irrigations with treated sewage water (T_7) recorded maximum gross monetary return and net monetary return.

The highest B:C Ratio was recorded in treatment Recommended irrigation with normal water (T_1) followed by Five irrigations with treated sewage water (T_7) and Five irrigations with untreated sewage water (T_6). Three irrigations with untreated sewage water (T_2) recorded lowest B:C Ratio.

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