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The impact of sewage water on growth promotion and yield in wheat crop plants in Bilaspur city (C.G) India

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ABSTRACT

Experiments were conducted in Bilaspur city to study the effects of irrigating wheat (*Tritium aestivum, L.*) with sewage water (Treatment) and with tube (control) alone on wheat growth and grain yield. Wheat irrigated with sewage water produced taller plants, more long roots, more leaves and more tillers than did wheat grown with only tube well water. The data reveals that aboveground biomass, below ground biomass, total biomass and root/ shoot ratio was greater at the sewage irrigated sites than that at the tube well irrigated site. The data also reveals that numbers of ear head per plant, number of grains per ear head, weight of seeds, length and diameter of seeds, the grain yield and straw yield per hectare also more at the site with sewage irrigation than at the site with tube well water irrigation.

Key words- *Tritium aestivum L.,* Bilaspur city, sewage water, irrigation.

INTRODUCTION

One of the more serious problem faces by mankind today is the problem of water pollution. Municipalities are faced with the problem of how to achieve the best disposal of municipal waste water which is continually generated by municipal societies. In majority of the developing countries the municipal waste water is untreated and in India about 40 percent of it is applied on land for irrigation, while the rest is disposed into water bodies with a little or no treatment (Mohan Rao 1973, Bowonder 1983).

The present investigation shows that the sewage water can substitution a very cheap fertilizer thus cutting down the agricultural inputs. This aggresses well with the views of Conn (1970), Olisami and Rajanan (1971), King and Morris (1972), Bhairava *et. al.*(1978) and Sahai and Shrivastava (1986).

In recent years sewage water is being used for production of agriculture crops, Day *et.al*. (1975), Day *et.al*. (1979), Veer and Lata (1987), Chakraborti and Chakraborti (1988), Day and Thopson (1988) for wheat crop, Niyogi and Ray (1985) and Deshpande and Kaul (1991) for paddy crop, Cunningham *et. al*. (1975) and Sharma and Kansal (1984) for maize crop, Day and Tucker (1977) and Mays *et. al*. (1973) for sorghum, coker (1966) for barley crop, Day and Kikrpatrik (1973) for oat crop and Day *et. al*. (1981) for cotton crop.

Site description

The experimental site situated in an agricultural farm known as Ansari farm. The farm is situated nearly 5 k. m. south of Bilaspur city (25°5' N Latitude and 82°12'E Longitude) near C.G.E.B. colony, by the sites of Bilaspur-Raipur road. Treatment site is just by the site of tube well pump house and control site is nearly 25 meters from the pump house. The control site has an area of 0.29 hectare while the treatment site was 0.005 hectare.

MATERIAL AND METHODS

Growth and yield studies:-

Seeds of wheat were sown in treatment sites (i.e. being irrigation by sewage water) as well as control site (i.e. being irrigation by tube well water). The seeds were sown in rows at the rate of 100 kg. ha^{-1}. The distance between two rows was 15 to 20 cm. Growth and biomass characteristics were analysed 15 days interval and yield characteristics were analysed after final harvest. The various farm practise adopted in the cultivation of both the sites are indicated in table-1.

The experiment was conducted at Bilaspur city in the month of December 2015 to march 2016. The following parameter are taken (i) Plant height (ii) Root length (iii) Number of leaves per plant (iv) Number of tillers per plant (v) Aboveground biomass (vi) Belowground biomass (vii) Total biomass (viii) Root/Shoot Ratio (ix) Number of ear head per plant (x) Number of grain per ear head (xi) Grain length and diameter (xii) Grain yield (xiii) Straw yield.

RESULTS

Data pertaining to plant height of wheat at different stages of growth are presented in table- 2. The plant height, root length, number of leaves per plant, number of tillers per plant of treatment site was greater than that of control site.

The data revels that the aboveground biomass, belowground biomass, total biomass and root/shoot ratio (table-3, fig-1) was greater in the treatment site than that of control site. The data on grain yield attributes of wheat has been presented in table-4, reveals that the number of ear head per plant, number of grains per ear head, weight of 100 seeds, grain length and diameter, grain yield and straw yield higher in the wheat crop having sewage irrigation than that of tube well irrigation.

Table 1 : Farm practices adopted for wheat crop with sewage and tube well water

S. NO.	FARM PRACTICES		WHEAT
1	Date of sowing		03.12.15
2	Seed rate		100.00 kg. ha^{-1}
3	Fertilizers	(i) Basal dose	02.12.15
			205.00 kg. ha^{-1}
			Superphosphate
			60.00 kg. ha^{-1}
			Murrate of potash
		(Ii) Top dressing	
		(A) Tillering stage	31.12.15
			60.00 kg. ha^{-1} urea
		(B) Earing stage	
4	Irrigation		04.12.15
			31.12.15
			24.01.16
5	Harvest		25.03.16

Table 2 : Growth characteristics of wheat irrigated with tube well water (control) and sewage water (treatment) at successive growth stages.

Days after	parameter							
Sowing	Plant height(cm)		Root length (cm)		Number of leaves per plant		Number of tellers per plant	
	Control	treatment	Control	treatment	Control	Treatment	Control	Treatment
15	16.24 (0.12)	18.34 (0.32)	13.43 (0.15)	14.25 (0.20)	3.00 (0.00)	3.00 (0.00)	- -	- -
30	22.54 (0.12)	25.18 (1.20)	15.92 (1.95)	15.44 (1.88)	12.33 (1.90)	12.44 (3.03)	2.74 (0.26)	2.17 (0.37)
45	24.65 (3.52)	25.48 (2.78)	18.60 (0.50)	18.52 (0.24)	21.77 (3.22)	19.66 (1.88)	4.04 (1.00)	2.81 (0.40)
60	47.53 (2.59)	60.06 (3.69)	18.84 (3.09)	21.20 (3.93)	25.55 (2.02)	28.44 (0.68)	4.22 (0.86)	3.9 (0.65)
75	90.56 (6.48)	93.44 (2.81)	21.12 (2.43)	22.77 (0.74)	24.10 (4.19)	26.44) 4.87)	4.47 (0.87)	4.98 (1.19)
90	92.97 (1.32)	95.78 (4.78)	19.18 (5.65)	19.76 (0.33)	20.99 (2.05)	22.55 (3.85)	4.48 (0.62)	5.37 (0.54)
105	94.64 (4.18)	99.18 (3.62)	15.62 (0.56)	16.21 (0.57)	21.99 (6.08)	18.55 (3.86)	5.48 (2.20)	5.49 (0.52)
112	94.57 (2.01)	99.19 (2.62)	16.81 (0.55)	16.56 (0.19)	18.66 (1.51)	14.88 (1.03)	4.90 (1.48)	5.62 (0.28)

Values in parenthesises indicate S.D.

Table 3 : Standing crop biomass (g. m.-2) of aboveground, belowground, total biomass and root/shoot ratio of wheat irrigated with tube well water (control) and sewage water (treatment) at successive growth stages.

Days After	Control Site				Treatment Site			
Showing	Above Ground	Below Ground	Total	Root/Shoot Ratio	Above Ground	Below Ground	Total	Root/Shoot Ratio
15	9.93 (3.53)	1.20 (0.27)	11.13 (3.70)	0.13 (0.30)	10.74 (3.44)	1.88 (0.65)	12.62 (4.07)	0.18 (0.02)
30	45.47 (13.04)	5.98 (0.43)	51.45 (13.28)	0.13 (0.13)	45.10 (8.44)	17.98 (3.29)	63.08 (11.29)	0.40 (0.08)
45	209.78 (10.31)	57.94 (7.28)	267.72 (16.53)	0.28 (0.02)	223.98 (21.41)	78.55 (7.45)	302.53 (26.94)	0.35 (0.03)
60	419.71 (102.92)	117.73 (38.63)	537.44 (141.44)	0.28 (0.02)	639.61 (168.58)	141.92 (16.19)	781.53 (178.28)	0.22 (0.06)
75	975.46 (272.36)	162.40 (70.15)	1137.86 (131.43)	0.17 (0.13)	1040.53 (131.01)	136..00 (28.47)	1176.53 (198.31)	0.13 (0.01)
90	1624.26 (121.20)	153.81 (11.38)	1778.07 (130.97)	0.09 (0.01)	1725.86 (25.37)	166.45 (9.03)	1892.31 (25.81)	0.13 (0.01)
105	1988.26 (270.84)	123.73 (28.66)	2111.99 (295.31)	0.06 (0.01)	1985.86 (204.24)	154.66 (27.19)	2140.52 (199.00)	0.08 (0.02)
112	2053.95 (116.75)	78.40 (13.25)	2132.35 (126.46)	0.04 (0.01)	2091.05 (95.69)	107.20 (26.09)	2199.05 (119.25)	0.05 (0.01)

Values in parenthesises indicate S.D.

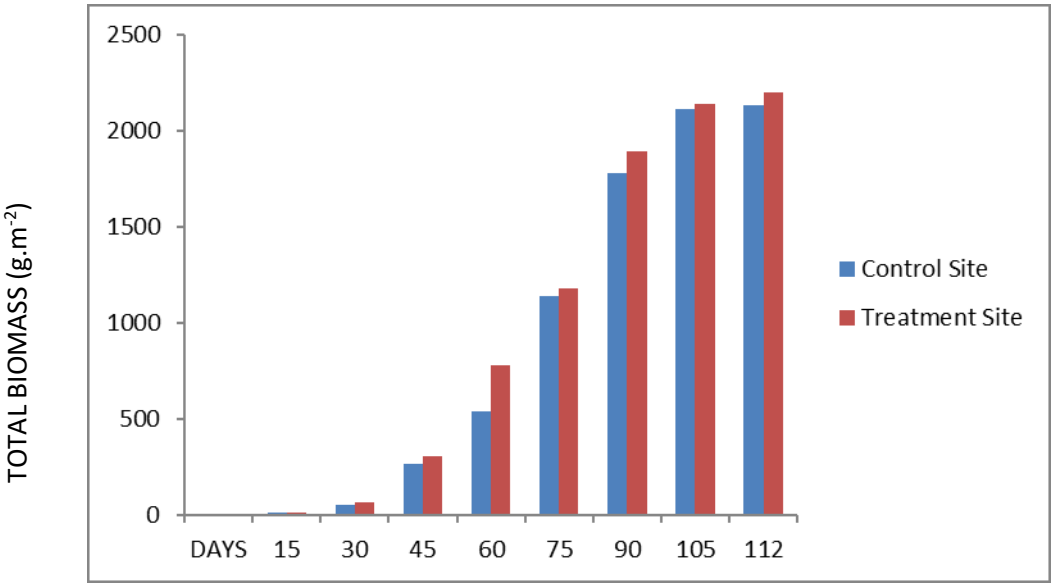

Fig 1: Total biomass of wheat at the control and treatment sites respectively

Table 4: Number of ear heads per plant and grains per ear head, weight of 100 seeds (gm) grain length (cm), grain diameter (cm) and economic yield (q.ha^{-1}) of wheat crop irrigated with tube well water (control) and sewage water (treatment)

		Wheat	
S. No.	**Parameters**	**Control**	**Treatment**
1	Number of ear head per plant	3.63 (1.63)	4.79 (0.2)
2	Grains per ear head	30.79 (2.50)	33.77 (2.07)
3	Weight of 100 seeds	5.13 (0.27)	5.18 (0.07)
4	Grains length	0.67 (0.01)	0.71 (0.04)
5	Grains diameter	0.35 (0.02)	0.36 (0.01)
6	Grain yield	70.66 (10.17)	74.00 (8.82)
7	Straw yield	134.74 (8.52)	135.19 (0.78)

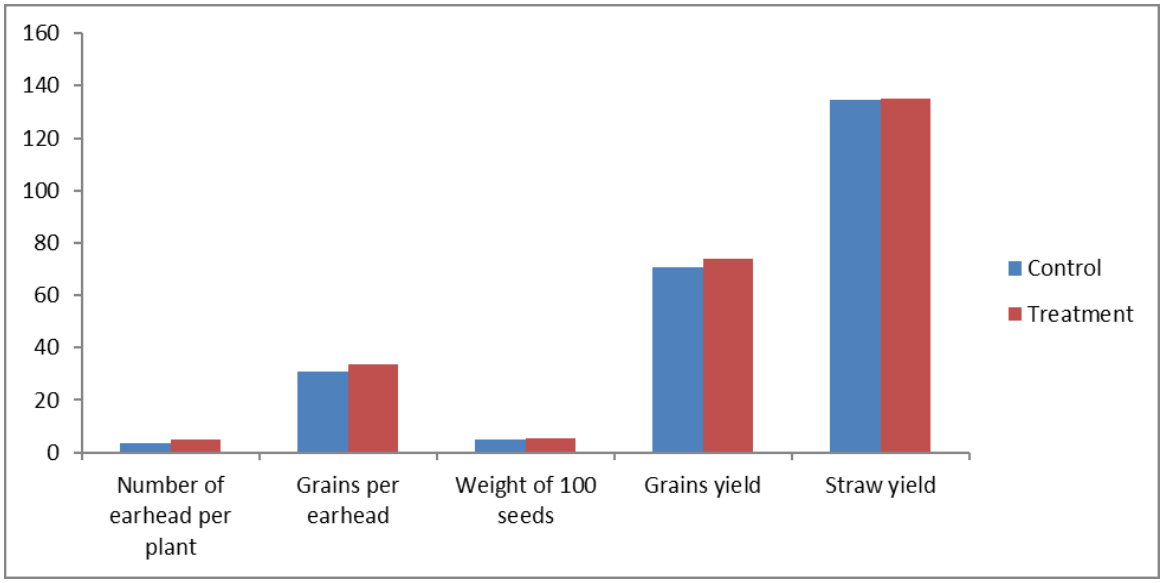

FIG – 2 number of earhead per plant and grains per earhead, weight of 100 seeds (gm), grain yield (q.ha^{-1}), Straw Yield (q.ha^{-1}).

CONTROL SITE **TREATMENT SITE**

Fig. 3 : WHEAT PLANT

DISCUSSION

The height of wheat plants continuously increased a successive growth stages. The increase of plant height and root length at the treatment site was greater than that of control it shows that the irrigation with sewage is beneficial for the relative growth of wheat crop, similar results have been reported by many researcher of India and elsewhere in the world like Coker (1966) in barley plant, Day et. al. (1975), Day et. al. (1979), in wheat crop, Day and Tucker (1977) in sorghum plant, Banerji and Kumar (1979) in *Daucus Carota* plant, Pratibha (1991) in coriander plant.

The number of tiller per plant in wheat crop increase continuously till the final harvest. The number of tillers was higher in the field with sewage irrigation, very similar to the present finding, day et. al. (1975), Day et. al. (1979), and Veer and Lata (1987) have also recorded higher number of tillers per plant of when irrigated with sewage than that of tube well water. Similar results have been obtained for barly (coker, 1966) and sorghum (Day and Tucker, 1977) also.

The aboveground biomass, belowground biomass and total biomass steadily increased till final harvest all the biomass were higher in the sewage irrigated field than that of tube well water irrigated filed the same has been obtained by Veer and Lata (1987), Singh et.al.(2012) in wheat crop, Banerji and Kumar (1979) in *Daucus Carota*, Sharma and Kansal (1984) for spinach and maize, Karunaichamy et. al.(1990) for *Brachiaria mutica*, *Banicum maxicum* and *Cyprus defformis* and singh and singh (1992) for lettuce.

The root/shoot ratio gives a good idea of the relative distribution of dry mater in the aboveground and belowground parts & there exists a definite mathematically definable relationship between two (young et. al. 1964, monk 1966 and Khokhar 1974). The root/shoot ratio in the wheat crop of both the sites increased in beginning then deceased continuously till the final harvest. The root/shoot ratio of wheat crop was higher at the treatment site than that of control site.

The number of ear head per plant and the number of grains per ear head of wheat at the treatment site higher than that of control. While working with wheat crop Day et. al. (1979) and Veer and Lata (1987) have recorded higher numbers of grains per panicle when irrigated with sewage water than that of tube well water. Day et. al. (1975) did not find higher number of grains per panicle of wheat crop with treated sewage water than tube well water.

The weight of 100 seeds of wheat crop irrigated with sewage was more than that of the seeds irrigated with tube well water. Day et. al. (1975), Day et. al. (1979) and Veer and Lata (1987) in Wheat, Tucker (1977) in Sorghum and Day et. al. (1981) in Cotton has recorded higher seeds weight irrigated with sewage water than irrigated with tube well water.

The grain yield of wheat crop was enhanced by sewage irrigation. The grain yield at the treatment site was

74.00 q. ha^{-1} and it was 70.66 q. ha^{-1} at the control site. Many researchers have reported higher grain yield of wheat when irrigated with sewage than tube well water. (Day et.al. 1975, and Day et. al. 1979). Chakraborti and Chakraborti, 1988 have reported reduction in grain yield of wheat when irrigated with sewage than irrigated with tube well water. Many more researches have reported higher production with sewage and they are Day and Tucker (1977) in Sorghum, Cunningham et. al. (1975) in maize and rye, Tripathi et. al.(1988) in potato tuber and Pratibha (1991) in coriander.

The straw yield in wheat crop was greater at the treatment site than that of control site, Very similar to the present findings, Mays et. al. (1973), Day et. al. (1979) in wheat, on the contrary Coker (1966) did not find any difference between barley straw production when irrigated with sewage and tube well water.

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