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Impact of combined effluents on growth and yield of wheat crop in Samba (J&K)

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Abstract

The study area consists of a Reference site and two Polluted sites which are distinguished by virtue of the nature of combined effluent received by wheat (*Triticum aestivum*) grown in the agricultural fields. All the growth and yield parameters *viz*; Average spike weight per plant, Average number of grains per spike, Average weight of grains per spike, Average shoot length, Average biomass per plant with spike and Average weight per grain of wheat at Polluted site II exhibited increase in comparison to the Reference site while Average spike weight per plant, Average number of grains per spike and Average weight of grains per spike at Polluted site I exhibited a decrease in comparison to the Reference site. This is attributed to the fact that at Polluted site II there is direct mixing of combined effluent into the irrigation canal leading to dilution of combined effluent which is used for irrigating the agricultural fields whereas at Polluted site I there is lateral seepage of combined effluents from the drain carrying effluents into the agricultural fields. Hence, combined effluent in diluted form is showing stimulatory effect on wheat and vice-versa.

Key words: Combined effluent, direct mixing, lateral seepage, Triticum aestivum

Introduction

It is quite aptly said that environment and development must go hand in hand for the bigger good of mankind. The yardstick for measuring development of an area is largely considered to be industrial growth but there is no yardstick in place for measuring the environmental health. This implies that in the real sense there is none to own the toxic wastes generated from the industrial sprawl. The wastes are indiscriminately released into the environment either in the untreated or partially treated state which causes colossal damage to the vitals of our environment in the long run (Bhutiani *et al.,* 2016). Untreated or allegedly treated effluents have increased the level of surface water pollution up to 20 times the safe level in 22 critically polluted areas of the country (Singh and Chandel, 2006). Industrial clusters in the vicinity of habitation area or agricultural fields further worsen the situation as the human beings get directly exposed to the toxic pollutants. Similarly crop plants and the seasonal vegetation irrigated with polluted water show impact on growth and yield parameters. Chandra *et al.*, 2009 reported the accumulation and distribution of toxic metals in wheat and Indian mustard irrigated with untreated distillery and tannery effluents which posed health hazards for environment, humans and animals. Waste water is also a resource that can be applied for productive uses since it contains nutrients that have the potential for use in agriculture and other activities (Hussain *et al.*, 2001) .Irrigation of crop fields with waste water transfers a wide variety of elements into the soil. Some elements such as Nitrogen, Phosphorus and Potassium are important plant nutrients and are growth promoting. Industrial effluents on the other hand are of varied nature and long term irrigation with such industrial effluents increases soil conductivity, organic carbon content as well as heavy metal accumulation in the soil due to the presence of appreciable amounts of cations, anions and heavy metals in the effluents. Heavy metals accumulate in the soil, enter the food chain through plants and go on accumulating in the higher trophic levels due to biomagnification. A study to investigate the toxic effects of certain heavy metals on the plant growth and grain yield of wheat revealed that heavy metals brought about

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significant reduction in both the parameters (Athar and Ahmad, 2002). Apart from water pollution, there is a growing water scarcity and deterioration in water quality in many parts of India (TERI, 2003). Thus in context of reduced freshwater availability, declining water quality and water pollution from inadequately treated effluents there is an urgent need for efficient water management. The land application and irrigation utilization of industrial effluents in agricultural crops is an option. However, the detailed studies on these aspects are very much needed on the scientific use of industrial effluents for irrigation. The utilization of industrial waste water has generated interest in recent times. Most crops have given higher potential yields with waste water irrigation, reduced the need for chemical fertilizer thereby resulting in net cost savings to the farmers. In the present study an attempt has been made to assess the, "Impact of combined effluents (industrial as well as sewage) on the growth and yield of Wheat (*Triticum aestivum*) in Samba (J&K)."

Material and Methods

The study area was divided into three Reference sites (R1-R3) where the crop plants were irrigated with water from the irrigation canal having no pollution by combined effluent and three Polluted sites (PIa-PIc) having lateral seepage of combined effluent from drain adjoining the agricultural fields and three Polluted sites (PId-PIf) where crop plants were irrigated by irrigation canal water after getting contaminated by combined effluent. The following growth and yield parameters were studied.

Average Shoot length: Average shoot length of plant was assessed at the time of harvesting by measuring the shoot length of 30 plants, taken randomly each from polluted and reference sites, using standardized scale after uprooting.

Biomass: Average biomass of plant with spike was assessed at the time of harvesting by randomly weighing 30 uprooted plants, taken randomly each from polluted and reference sites, after drying in oven for 72 hours at 650 C.

Yield of plants: Average spike weight per plant, Average number of grains per spike and Average weight of grains per spike on dry weight basis were calculated in 30 uprooted plants separately, taken randomly each from polluted and reference sites, to determine and compare the yield of wheat crop.

Table 1. Impact of combined effluent on growth and yield of *Triticum aestivum* in Samba (J&K).

Sites	Avg. Shoot length (cm)	Avg. Biomass/plant with spike (g)	Avg. Spike wt./Plant (g)	Avg. no. of grains/Spike	Avg.total wt. of grains/Spike (g)	Avg.wt.per grain (mg)
R 1	77.2±10.008 (62-90)	3.331±1.336 (1.72-5.69)	2.044±0.899 (1.04-3.75)	37.7±16.330 (21-71)	1.561±0.759 (0.67-3.02)	41.30±0.009 (0.02-0.052)
R 2	67.5±6.553 (62-79)	2.52±1.013 (1.72-4.96)	1.56±0.647 (1.04-3.09)	33.5±11.787 (22-61)	1.083±0.521 (0.67-2.31)	32.03±0.0059 (0.022-0.0403)
R 3	64.6±10.178 (52-80)	2.916±1.456 (1.26-4.64)	1.686±0.876 (0.66-2.55)	42.3±16.593 (19-70)	1.161±0.700 (0.38-2.6)	27.22±0.006 (0.015-0.0371)
PIa	72.9±5.195 (64-82)	2.299±0.484 (1.57-3.2)	1.032±0.260 (0.66-1.46)	31.4±7.441 (23-43)	0.668±0.233 (0.38-1.13)	21.85±0.004 (0.0148-0.026)
PIb	86±6.073 (76-95)	3.793±0.857 (2.12-4.96)	2.247±0.516 (1.19-3.02)	41.4±9.406 (21-54)	1.761±0.419 (0.92-2.34)	43.05±0.003 (0.036-0.046)
PIc	78.1±3.984 (70-82)	2.945±0.647 (1.76-3.85)	1.672±0.435 (0.87-2.3)	30±7.423 (16-41)	1.33±0.557 (0.57-2.58)	44.88±0.008 (0.034-0.062)
PId	79.2±3.938 (73-85)	3.655±0.722 (2.39-4.49)	1.862±0.501 (1.26-2.59)	36.4±11.117 (23-55)	1.387±0.423 (0.85-1.96)	38.75±0.003 (0.035-0.046)
PIe	78.8±4.157 (70-85)	3.74±1.288 (2.2-6.77)	2.065±0.956 (0.87-4.51)	42.1±13.110 (28-66)	1.415±0.808 (0.55-3.44)	33.95±0.0108 (0.019-0.052)
PIf	83.3±4.595 (79-93)	5.684±1.294 (3.62-7.3)	3.375±0.849 (1.87-4.39)	62±7.817 (52-77)	2.517±0.845 (1.15-3.89)	40.85±0.0101 (0.0221-0.050)

Results and Discussion

Growth and yield parameters viz; Average spike weight per plant, Average number of grains per spike and Average weight of grains per spike were seen to follow a declining trend at Polluted site I as compared to the Reference site which is largely attributed to the fact that Polluted site I receives more concentrated form of combined effluent through lateral seepage from the effluent drain passing through the agricultural fields and the habitation area (Fig:1 and 2). Hence, combined effluent in a more concentrated form has exhibited an inhibitory effect on the said parameters. This is substantiated by the fact that higher concentration of industrial effluent had deleterious effect on growth and biochemical status of wheat seedlings (Wahid *et al.*, 2004).

Table 2: Average Impact of combined effluent on growth and yield parameters at reference and polluted sites.

Sites	Avg. shoot length(cm)	Avg. biomass per plant with spike(g)	Avg. spike wt. per plant(g)	Avg. no. of grains per spike	Avg .total wt. of grains per spike(g)	Avg. wt. per grain(mg)
Reference site	69.76±6.59	2.92±0.40	1.76±0.25	37.83±4.40	1.26±0.25	33.51±7.82
Polluted site (a-c)	79±6.59	3.01±0.74	1.65±0.60	34.26±6.21	1.25±0.55	36.59±12.58
Polluted site (d-f)	80.43±2.49	4.35±1.14	2.43±0.82	46.83±13.44	1.77±0.64	37.85±3.87

The same growth and yield parameters show an increase at Polluted site II which is commensurate with the fact that Polluted site II receives combined effluents diluted with the water of the irrigation canal and hence a lower concentration of combined effluent is showing a stimulatory effect on the said yield parameters. Growth and yield parameters *viz*; Average shoots length, Average biomass per plant with spike and Average weight per grain followed an increasing trend from Reference site to Polluted site II. Highest values for these growth and yield parameters were exhibited at Polluted site II.

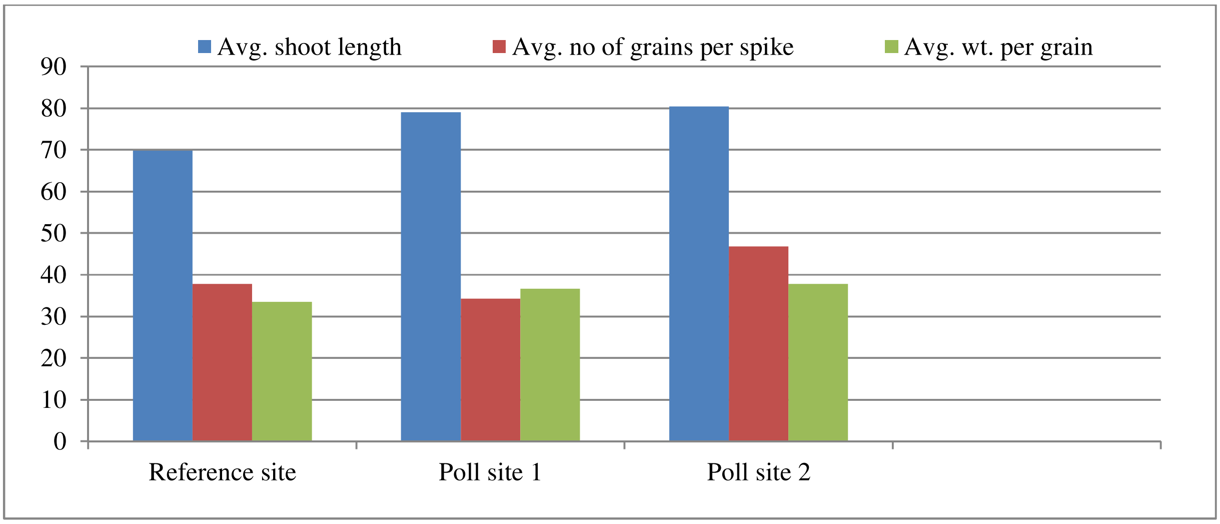

Fig 1. Average values site-wise of growth and yield parameters.

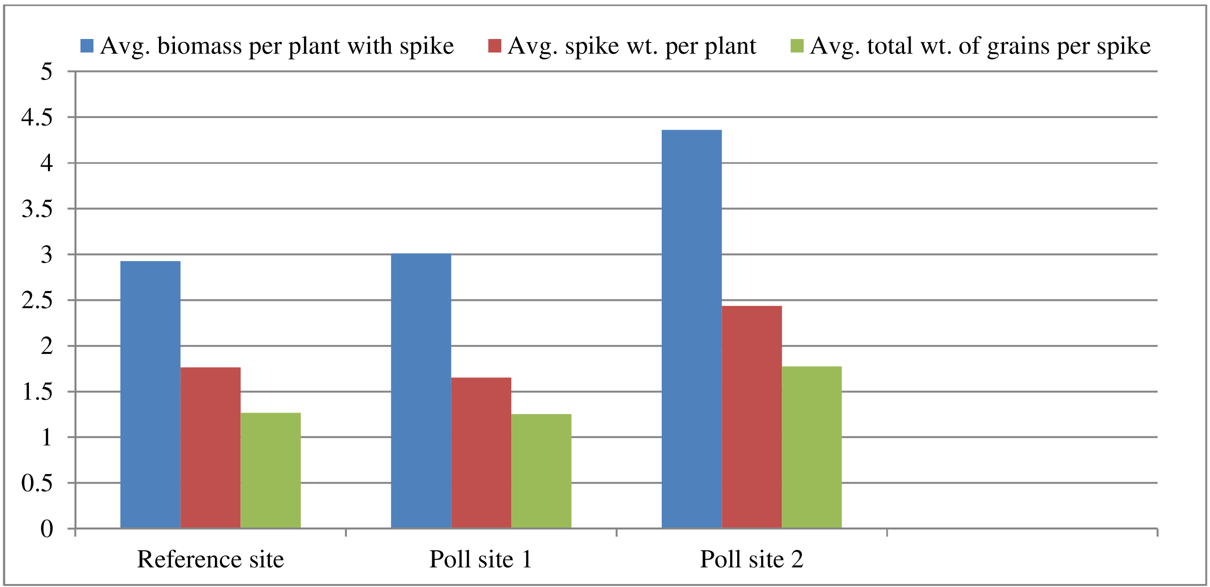

Fig 2. Average values site-wise of growth and yield parameters.

This suggests that combined effluent in the diluted form exerts a stimulatory effect whereas a more concentrated form of combined effluent causes inhibition of growth and yield parameters in wheat. This is supported by the findings of Ale *et al.*,(2008) who reported that the effect of effluent on seed germination, seedling growth, fresh weight and dry weight of seedlings of wheat and rice crops was completely inhibitory at higher concentrations (10%,25%) whereas lower concentrations (1%,5%) were found stimulatory and reached up to the level of control. Further, Saini *et al.*, (2014) demonstrated that a concentration of 25% and 50% of the sugar mill effluent had stimulatory effect on germination rate and growth patterns of wheat and maize whereas concentration beyond 50% had inhibitory effect.

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