

Stress of Pulp and Paper Manufacturing Plant Waste Water on the Yield Components of Wheat

Agrawal S.R., Chaturvedi Charu and Singh V.K.

ABSTRACT: *The work being reported here is about the effect of liquid effluent of a pulp and paper manufacturing plant at Faizabad on the yield components of the wheat, U.P. 262 and studies showed that the number of spikes per ear, number of grains per ear, grains weight per ear, ears weight per plant, grains yield per plant, Biological yield, Test weight and per cent Harvest Index reduced significantly with the increasing concentration of the effluent treatment in comparison to the healthy and control.*

INTRODUCTION

The increasing population, urbanization and industrialisation in the last few decades, have created the most serious problems of waste accumulation and environmental pollution.

There have, however, been very few studies on the scientific evaluation of this kind of treatment. In the present study the effect of pulp and paper mill waste on the yield components of the wheat (*Triticum aestivum* (L.) Var.

The pulp and paper mill waste is produced by the use of raw materials and chemicals in the process of paper manufacturing. The paper manufacturing process requires a large amount of water for washing, chipping and chemical recovery. Therefore, large amount of liquid effluent is discharged, the nature and composition of which depends on the type of paper produced and the size of the plant. There have, however, been very few studies on the scientific evaluation of this type of treatment. In the present study effect of a small scale paper mill effluent on the yield components of wheat (*Triticum aestivum* (L.) var. U.P. 262 has been investigated).

EXPERIMENTAL PLANNING

The effluent water was collected from three selected sites of a paper mill located in District Faizabad and its physico-chemical characteristics were studied (Table-1). The liquid effluent was diluted to different dilutions (25%, 50%, 75% and 100%) and kept in different containers to study the effect of its different concentrations on the wheat plant.

The experiment was conducted in earthen pots (Diameter 25.0 cm) lined with polythene bags. Each pot was filled with 8 Kg. well pulverized sandy loam soil. The seeds were surface sterilized with 1% solution of sodium hypochloride for 5 minutes before sowing. In each pot 15 seeds were sown and after germination, only four healthy and uniform plants were maintained in each pot. The control and the treatment sets were maintained separately. Three replicates of the control and three replicates of each concentrations (25%, 50%, 75% and 100%) were prepared. Each pot was irrigated with respective concentration of the

Department of Botany and Environmental Science,
K.S.S., P.G. College, Faizabad (U.P.)

effluent and the control with the distilled water. The experimental findings are presented in table no. 2 in the form of mean of three replicates.

Table-1.

Physico-Chemical characteristics of paper mill effluent. (Analysed as per methods recommended by: APHA, 1981, Trivedy and Goel, 1986)

Sl. No.	Parameters	Magnitude
1.	Colour	Brown
2.	Odour	Pungent
3.	Temperature	19.10°C - 39.62°C
4.	pH	7.4 - 8.5
5.	Conductivity	1.70 - 3.68 ms cm ⁻¹
6.	T.D.S.	1100 - 3110
7.	C.O.D.	2260 - 3520
8.	B.O.D.	240 - 1055
9.	Total Alkalinity as CaCO ₃	254 - 405
10.	Total Nitrogen	0.80 - 2.84
11.	Ammonia - N.	0.30 - 1.25
12.	Nitrate - N.	0.23 - 0.72
13.	Nitrite - N.	0.14 - 0.38
14.	Sulphate	32.2 - 201
15.	Phosphorous (P)	0.586 - 0.826
16.	Calcium	30.60 - 138.21
17.	Magnesium	10.70 - 70.64
18.	Potassium	8.50 - 30.46
19.	TOXIC METALS (ppm): Fe (3.13), Zn (5.64), Pb (0.35), Cu (1.72), Cd (0.02), Mn (0.31)	

All the values are in Mg/L., except Temp. pH and conductivity.

EXPERIMENTAL FINDINGS

The data presented in Table-2, shows that there is overall reduction in the yield components of the wheat plants due to effluent water treatment. It was found that this reduction continues to increase with the increasing concentration of the effluent treatment in comparison to the healthy control. Plants treated with 25% dilution of the effluent showed very little variation than the control plants, which were treated with distilled water. Maximum reduction was, however, noticed in the plants treated with 100% effluent. In the present investigation number of spikes per ear was reduced from 22.33 to 13.00, number of grains per ear was reduced from 65 to 43; grains weight per ear was lowered from 2.94 gm. to 1.97 gms; ear's weight plant lowered from 52.50 gms to 44.43 gms. in comparison to healthy control. The grain yield per plant was found 29.40 (gm / plant) in control where as it was reduced to 19.70 (gm / plant) in 100% effluent treated plants. Similarly, the biological yield was reduced from 63.23 (gm / plant) to 51.17 (gm / plant) 1000 grains weight was found to be 47.23 gms. in control plants and 26.20 gms. in 100% effluent treated ones. Therefore, the harvest index lowered from 46.47 percent to in control plants to 38.67 percent effluent treated plants.

DISCUSSION

A perusal of literature on yield studies of crop plant with reference to waste water irrigation shows that industrial effluent bring about considerable reduc-

Table-2.

Effect of pulp and paper industry effluent on Yield Components of wheat crop. (var. U.P. 262).

Sl. No.	OBSERVATIONS	Control	Mean of the three replicates			
			25%	50%	75%	100%
1.	No. of spikes / ear	22.33	21	18	15	13
2.	No. of grains / ear	65	61	58	46.66	43
3.	Grains Wt. / ear (in gm.)	2.94	2.81	2.66	2.15	1.97
4.	Ears Wt. / plant (in gm.)	52.50	51.01	50.15	47.50	44.43
5.	Grain yield / plant (gm. / plant)	29.40	28.16	26.63	21.50	19.70
6.	Biological yield (gm. / plant)	63.23	61.05	58.86	55.01	51.17
7.	Test Wt. (1000 grains Wt.)	47.23	45.50	40.02	30.43	26.20
8.	Harvest Index %	46.47	46.05	45.22	39.24	38.67

tion in the yield of the plants. Bisht and Agrawal (1980) on Zeamays, Agrawal et. al. (1984) on wheat and padmanabhan et. al. (1985) on fingermillete have found reduction in the growth and yield components due to effluent treatment. This reduction in yield is directly related to the reduction in metabolic activity and growth of the plant, because growth and yield are interrelated processes. The high value of COD over the BOD is the expression of the amount of dissolved oxygen which makes the effluent water unsuitable for the purpose of drinking and irrigation. Presence of foam in the effluent water is due to dissolved organic compounds in cleaning and sizing of paper. It gradually adheres on the surface of the soil and therefore hinders the gaseous exchange between the soil and external environment. Toxic metals like Iron, Zinc, Copper, Cadmium found in the effluent water studied are also responsible for reduction in the yield of plant. Beckett and Devis (1982), Mohapatra (1987) that higher conc. of copper and zinc makes the soil poisonous and unfit for the crop plants. Carlson et. al. (1975) Rachlin et. al. (1983) and stokes et. al. (1983) have all suggested that heavy metals collect in the plants tissues and interfere the enzymetic activity and therefore the whole metabolism is disturbed.

The reduction in the yield components of wheat due to waste water treatment can be taken as an indicator of the performance of this crop. Further studies are in progress.

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