Experimental Paddy Farming With Clarified Paper Mill Effluent

SINGH J.P.*

ABSTRACT

Experimental paddy farming on a plot of five acres adjacent to a large integrated pulp and paper mill, was undertaken with Paper Mill Waste Water after primary treatment. Data regarding paddy yield and various useful information about requirement of water fertilisers. etc. is presented in the article. Soil test report after every crop is also presented. Observations show that in the ilrigation of paddy crop, clarified paper mill effluent with controlled pH and alkalinity gives as good results as irrigation with fresh water. The yield of paddy also was comparatively better with no untoward quality deterioration of the gain. Although in this case fresh water irrigation was not carried out, but the comparison was made with fhe crops of other farmers in neighbouring fields using fresh water for irrigation.

Before this full field scale trial was started on five acres plot the R&D Department of Sirpur Paper Mills has carried out sustained trials for more than five years in small plots of land with fresh water and mill effluent. That data is available in a separate article presented by R & D Department.

Disposal of liquid effluents from industrial plants has to keep in constant view the possible health hazard and immediate, as well as long-term, impact on surr-ounding environment. Unless the discharged effluent is treated to the prescribed degree with appropriate technology, it is bound to seriously effect both surface and underground water strata as well as the receiving media, viz. soil with possible physio-chemical alter-nation in it due to accumulation of foreign chemicals and inert matter. However, disposal of industrial effluents has considerable economic potential, since such disposal provides a perennial source of crop and tree irrigation. Viewed in National context, it becomes all the more important when total agricultural land in the counrry under regular irrigation is barely 30%.

Integrated pulp and paper manufacturing units are a major source of waste water generation; discharging in the range of 200 to 300 Cu.lit. per ton of paper pro-duced. In concrete terms, it means that a paper mill, wtth a production capacity of about 100 T/D generates waste water to the tune of 5 to 7.5 million gallons or about 25,000 M^3 to 35000 M^3 in 24 hours. This quan-tum of water can cover agricultural forest lands in the range of 1000 to 5000 Acres depending on the crop requirement of moisture for optimum growth and yield. This water requirement varies with maximum water requiring crops like paddy to medium water requiring varieties of plantation like eucalyptus, etc.

Experimental paddy farming with clarified effluent water from Sirpur Paper Mills has been undertaken since June, 1981 on a plot of 5 acres. adjacent to the mills. Some interesting observations and valuable data obtained during the above experiments are presented in this paper.

SPM is an integrated pulp and paper mill with a licensed capacity of 71,100 T/A. The mill manufactures about 170 T/D of various qualities of cultural and industrial varieties of paper and board, and uses as raw material bamboo, hardwood cotton linters and various grades of waste papers.

The mill is having its own pulping, based on Kraft pulping process with a modern chemical recovery plant and an electrolytic caustic chlorine plant, producing about 10 T/D of caustic. There is a captive electrical power generation plant also of about 15 MW capacity. The Mill is situated in Adilabad District of Andhra Pradesh and is about 300 KMs north of Hyderabad.

* Superintending Engineer, Sirpur Paper Mills Limited. Sirpur Kagnaznagar (Andhra Pradesh)

The Mill has a fullfledged Effluent Treatment Plant, based on conventional activated sludge process for treating mill effluent water before it is discharged into a a nala, which after traversing about 10 KM meets the Peddavagu and ultimately river Godavari after traversing about 200 KMs.

The mill intake of fresh water is about 11 MGD and waste water generated is of the order of 9.5 MGD. After extensive backwater reuse in various plants during the process of pulping and paper making, the excess waste water is brought to a single pumping complex. After passing through several screens for removal of floating and other debris, the waste water is pumped to the primary clarifier of 44 M dia for removal of suspended solids. The overflow from the above clarifier with a retention time of 3¼ hours is called clarified effluent and after necessary nutrient dosing taken to the aeration tank having a retention time of 8½ hrs. with 6 Nos. 75 HP aerators, followed by secondary clarification in a second 44 M dia clarifier. The underflows of primary clarifier are consolidated in a thickener before being taken to a rotary belt vacuum filter where the suspended solids are removed in the form of cake for eventual disposal as land fill. The various other overflows are circulated back into the system.

The use of fully treated effluent of a paper mill complex is a well established fact and discussed in details in various technical papers. However, for conducting feasibility trials for paddy cultivation, the clarified overflow water from primary clarifier was utilised.

A barren plot of land with an area of 5 acres was selected for conducting the experiment of paddy cultivation with the clarified mill effluent water. Twelve crops of various varieties of paddy such as General Mansoori, Basmati, ET 1444 etc. were raised in the field since June 1981 to December, 1986. Detailed data regarding total water requirement for each crop with the harvesting cycle, fertiliser/manure and pesticides requirements and the yields are collected and are given in Table—1. It can be seen from the above table that yield of paddy irrigated with calrified effluent water, works out except for special varieties, to 1.0 to 2.0 T/acre and is observed to be equivalent to that of paddy irrigated with fresh/river water in the surrounding area.

The soil was tested after each crop harvesting at Goverament soil testing laboratory, Adilabad. Summary of the above test results is presented in Table–2, from which it can be seen that no adverse effect is noticed on the composition of soil even after harvesting 10 crops irrigated with clarified effluent wate·.

Adilabad District gets its share of major rainfall of 220 mm from South West Monsoon between thh months of June to September (rainfall graph is given in Fig. I). Depending on the rain fall, the farmers in the region are able to raise single crop (Kharlf) of Jawar/Tuwar/ Till in a year. By providing the clarified effluent water for irrigation, it is estimated that two crops of paddy and one crop of sugarcane can be raised in the uncultivated lands. A scheme is worked out in Table-2 from which can be seen the high economic potential of irrigation undertaken wilh clarified effluent water in a water scarce area.

Fig. 1

NORMAL RAIN FALL OF SIRPUR KAGHAZ-NAGAR (ADILABAD 1051) IN YEAR

(Sou.ee : Bureau of Economics of Hyderabad 1977)

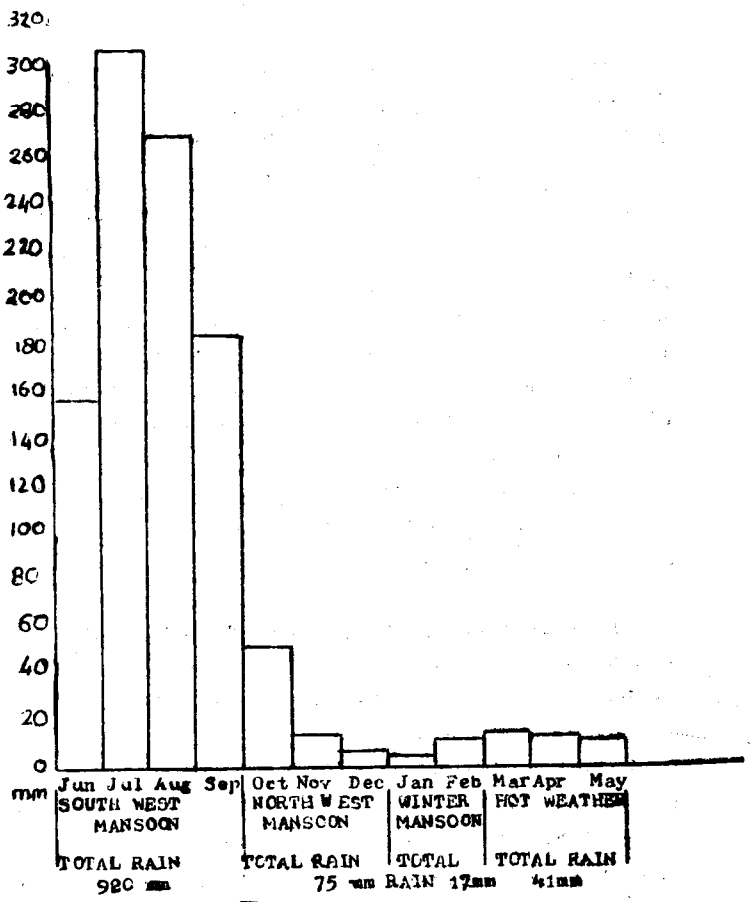

TABLE No. 1

EXPERIMENTAL PADDY FARMING IRRIGATED WITH SPM PRIMARY TESTED EFFLUENT ON 5 ACRES OF LAND

Sl. No.	Paddy Quality	No. of watering @ 160 M per Acre at a time	Crop duration from seedling to Harvesting No. of days	Seedling on	Harvested on	Yield in MT/Acre Paddy	Straw	Req. of manure/Acre Cattle Carts	DAP Kg	Urea Kg	Freq. of Pesticides spray	Remarks
1.	General Mansoori (1st Crop)	6 times	155	10-6-81	15-11-81	1.5	1.8	20	40	30 50	3 times	Normal yield.
2.	Telam Hamsa	12 ,,	110	12-1-82	1-5-82	1.7	1.8	—	,,	,,	3 ,,	Coarsepaddy
3.	General Mansoori	6 ,,	155	10-6-82	15-11-82	1.5	1.8	—	,,	,,	3 ,,	—
4.	ET 144 hybrid 2nd crop	12 ,,	110	12-1-83	1-4-83	1.8	1.85	—	,,	,,	3 ,,	ET 1444 is coarse variety but high yield
5.	a) Basmati (Kalagird)	6 ,,	155	10-6-83	14-11-83	0.9	1.8	20	,,	,,	2 ,,	Low yield variety but the best quality
	b) Pakistani Basumathi	6 ,,	155	—do—	—do—	1.0	1.2	—	,,	,,	2 ,,	—do—
	c) G. Mansoori	6 ,,	–do–	—do—	—do—	1.5	1.8	—	,,	,,	3 ,,	
6.	ET 1444	12 ,,	110	12-1-84	1-5-84	1.8	1.85	—	,,	,,	3 ,,	
7.	G. Mansoori	6 ,,	155	10-6-84	15-11-84	1.6	1.8	—	,,	,,	3 ,,	
8.	ET 1444	11 ,,	110	10-12-84	1-4-85	1.9	1.91	—	,,	,,	3 ,,	
9.	Samba Mansoori hybrid	6 ,,	155	1-6-85	5-11-85	1.9	1.91	20	40	,,	3 ,,	This paddy is having short straw & high yield. Best Quality
10.	ET 1444	11 ,,	110	1-12-85	20-3-86	2	2.1	—	,,	,,	3 ,,	
11.	Sambe Mansoori	6 ,,	155	1-6-86	5-11-86	2	2.1	—	,,	,,	3 ,,	
12.	ET-1444			1-12-86								Experiment is going on.

TABLE No. 2

Requirement of field for Paddy & sugarcane growth with 40900 Cu. Metres/day effluent effluent wit Water irrigation.

40900 M³/D effluent may irrigate 5400 Acres of Paddy cop and 2000 acres of sugar cane per annum.

Sl. No.	Period	Crop to be Harvested	Req. of Effluent water	Frequency of Irrigation	Total Area of field req. for consuming 40900 M3/DE. water	Avg yield of crop per Ac.	Total yield in field	Selling price of crop	Total income	Remarks
1.	From Ist June to 30th October	Ist Crop of paddy	170M³ per Ac	15day interval	3600 Acres	2 Ton	7200T	Rs 2000/- Tonne	Rs. 144 Lacs	**
	**Note : 360 persons will get full time job for taking care of farming.									
2.	From Ist Nov 15th February	2nd Crop Paddy	,,	7day interval	1800 Acres	2 Tonne	3600T	Rs.2000/- per Ton	Rs 72 Lacs	***
	***Note : 370000 men working days will be provided as part time work i.e. transplantation and harvesting etc.									
3,	From 20thFeb	Sugar cane	300 M³/ Acre	15 days interval	2000 Acres	30 Tons	60000T	Rs.250/- perTon	Rs.150/- Lacs	

TABLE No. 3

ANALYTICAL DATA OF SOIL SAMPLES OF SPM EXPERIMENTAL IRRIGATION PLOT USING CLARIFIED EFFLUENT

Sl. No.	Date sample taken	Name of the Laboratory	Texture	Hydrogen potency pH	Eleetricity Conductivity EC	Organic Carbon	Available Phosphates P_2O_5	Available Potash K_2O	Remarks
1.	25–11–82	Soil testing Lab Adilabad A.P.	Clay	7.0	1.1 Normal	High	∠1 low	2.48 medium	Soil testing after third crop.
2.	15–4–83	–do–	Clay	8.1	0.4 ,,	Medium	–do–	3 20 High	–do– 4th crop.
3.	20–11–13	–do–	–do–	8.0	0.8 ,,	High	–do–	4.16	–do– 5th crop.
4.	5–5–14	–do–	–do–	7.98	1.0 ,,	–do–	–do–	4.96	–do– 6th crop.
5.	20–11–84	–do–	–do–	7.2	0.9 ,,	–do–	–do–	4.25	–do– 7th crop.
6.	14–4–85	–do–	–do–	7.7	1.0 ,,	–do–	–do–	2.64	–do– 8th crop.
7.	16–11–85	–do–	–do–	7.8	0.8 ,,	–do–	–do–	3.25	–do– 9th crop.
8.	8–4–86	–do–	–do–	7.9	0.9 ,,	–do–	–do–	3.78	–do– 10th crop.

TABLE No. 4

CLARIFIED EFFLUENT BEING USED FOR EXPERIMENTAL PADDY IRRIGATION

pH	7.5 to 8.0
S.S.	140 — 150 Mg/L
C.O.D.	250 — 250 Mg/L
B.O.D. at 20°C (5 days Incubation)	150 — 200 Mg/L

CONCLUSIONS

From the above case studies conducted over a period of $5\frac{1}{2}$ years, it can be concluded that

(a) Growth of crop irrigated with primarily treated paper mill waste water is quite good with no untoward results.

(b) Use of Paper Mill Waste Water would mean considerable savings to the Paper Mill on terms of reduction in load of waste water for secondary and biological treatment.

(c) Extensive cultivation undertaken with such a waste water has considerable economic potential both in terms of crops grown and the employment opportunity.

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