Madras Agric. J. 92 (4-6) : 244-247 April-June 2005
https://doi.org/10.29321/MAJ.10.A00042

Impact of viscose pulp industry effluent and seed inoculants on cowpea yield and quality

M.SUGUNA DEVAKUMARI, P.S. RUPAVATHI AND K. ARUNA DEVI
Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore - 641 003.

Abstract: The effluent obtained from South India Viscose Industries Ltd., was analysed and found to be rich in organic matter, nitrogen, phosphorous, calcium, magnesium, trace elements and had EC below the critical limit fixed for irrigation. In order to assess the impact of viscose pulp industry effluent and *Rhizobium* and phosphobacteria seed inoculant on cowpea production, a pot culture study was conducted. From the study, it was concluded that, the germination percentage, number of nodules and yield and 100 seed weight were better under effluent irrigation along with Rhizobium + phosphobacteria seed treatment.

Keywords: Viscose pulp, effluent, Rhizobium, Phosphobacteria.

Introduction

Effluent irrigation has been practiced for centuries throughout the world. Land application of wastewater was preferred as an alternative for its disposal since soil was believed to have the capacity for decomposing the wastes and pollutants where organic materials were stabilized by the activities of soil microbes (Young *et al.*, 1981). Johnson and Ryder (1988) reported increased growth and nutrient composition in pasture due to pulp plant effluent irrigation. Swaminathan *et al.* (1992) concluded that, in groundnut seedling height and root length increased by 25% and 10% respectively, when irrigated with 20% South India Viscose Industries Ltd., effluent.

Symbiotic relationship between *Rhizobium* and leguminous plants, results in increased nitrogen availability to the crop. Phosphobacteria inoculation is generally followed to solubilize the phosphorus fixed in soil and make it available to the crop. Combined inoculation of *Rhizobium* and phosphate solubilizing bacteria resulted in increased yield of chick pea (Alagwadi and Gaur, 1988).

In order to assess the impact of viscose industry effluent irrigation and seed inoculation on cowpea quality and yield the present study was undertaken.

Materials and Methods

A pot culture experiment was conducted in the year 2001 - 2002 in Environmental Science Department, TNAU, using cowpea as test crop to assess the efficiency of effluent irrigation and seed inoculants in crop productivity. One set of pot was maintained under well water irrigation (M_1) and the other set was maintained under effluent irrigation (M_2). Each pot was filled with 2.5 kg of unieved red soil and 500 ml of water or effluent was added to achieve 50% saturation and the moisture content was maintained through out the experimental period. The following seed treatments were applied to both M_1 and M_2.

S_1 - Control (No seed treatment)
S_2 - Seed treatment with *Rhizobium*
S_3 - Seed treatment with phosphobacteria
S_4 - Seed treatment with *Rhizobium* + phosphobacteria

Table 1. Germination percentage and the number of nodules per plant as influenced by viscose industry effluent irrigation and seed treatments (M_1 = Well watered; M_2 = Effluent treated)

Treatments	Germination			Number of nodules / plant		
	M1	M2	Mean	M1	M2	Mean
S1 - Control	64	62	63	17.6	18.8	18.2
S2 - *Rhizobium*	86	80	83	16.4	19.4	17.9
S3 - Phosphobacteria	84	90	87	17.8	19.4	18.6
S4 - *Rhizobium* + phosphobacteria	88	96	92	19.0	22.4	20.7
Mean	80.5	82.0		17.7	20.0	
	SE(d)		CD (P = 0.05)	SE(d)		CD (P = 0.05)
M	2.40		4.89	0.41		0.83
S	3.40		6.91	0.58		1.18
MxS	4.80		9.77	0.82		1.67

Table 2. The 100 seed weight and total biomass as influenced by viscose industry effluent irrigation and seed treatments (M_1 = Well watered; M_2 = Effluent treated)

Treatments	100 Seed weight (g)			Total Biomass / (dry weight plant in g)		
	M1	M2	Mean	M1	M2	Mean
S1 - Control	7.81	8.02	7.92	19.32	20.68	20.00
S2 - *Rhizobium*	7.96	8.12	8.04	19.96	20.70	20.33
S3 - Phosphobacteria	7.90	7.72	8.31	20.08	23.58	21.83
S4 - *Rhizobium* + phosphobacteria	8.05	8.93	8.49	21.32	24.34	22.83
Mean	7.93	8.45		20.17	22.33.	
	SE(d)		CD (P = 0.05)	SE(d)		CD (P = 0.05)
M	0.07		0.14	0.38		0.78
S	0.10		0.19	0.54		1.10
MxS	0.14		0.27	0.77		1.56

Seeds of cowpea (variety CO-4) were obtained from Department of Pulses, TNAU, Coimbatore and soaked in water for 6 hours. Unhealthy and affected seeds were removed. One g of carrier based inoculum was first made into slurry by adding rice gruel of 0.5 ml. Ten g of seeds were mixed with the slurry to get a uniform coating on the seed. The treated seeds were shade dried for 30 min by spreading on a clean paper and sown.

The germination percentage, number and weight of nodules and 100 seed weight were observed and reported.

Results and Discussion

Effluent characteristics

The treated viscose pulp effluent was brown with a pH of 8.4 and EC of 2.6 dSm^{-1}. The suspended, dissolved and total solid contents were 764, 1044 and 1823 mg L^{-1}, respectively. The dissolved oxygen content of the effluent was 0.5 mg L^{-1}. The Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) were 175 and 1439 mg L^{-1}, respectively. The organic carbon content of the effluent was 1.4 per cent. The nutrient contents were 22.3, 3.8 and 13.4 mg L^{-1} of NH_4-N, P and K, respectively. The calcium and magnesium contents were 207 and 72 mg L^{-1} respectively. The sodium content of the effluent was 623 mg L^{-1}.

Growth characters of cowpea

The effect of SIV industries effluent on germination of cowpea and number of nodules per plant are presented in Table 1. Seed inoculation with *Rhizobium* + phosphobacteria (84) recorded the highest germination percentage of 92. The number of nodules per plant was higher (20.0) under effluent irrigation (M_2) than under well water irrigation (17.7). The seed inoculant *Rhizobium* + phosphobacteria (84) recorded the significantly higher number of nodules per plant (20.7) than control (18.2).

The effect of effluent irrigation and seed inoculation on 100 seed weight and total biomass of cowpea are presented in Table 2. Both the 100 seed weight and total biomass were significantly higher under effluent irrigation (M_2) and in seed inoculation with *Rhizobium* + phosphobacteria (S_4) than control (S_1).

Nutrient uptake by cowpea

The nitrogen and phosphorous content of the cowpea stover after harvest are presented in Table 3. Effluent irrigation (M^) recorded the highest N (3.32 per cent) and P (0.49 per cent) content in the stover compared to irrigation with well water. Regarding seed inoculant treatments, *Rhizobium* + Phosphobacterium combination contributed to higher N and P content in the stover.

Number of nodules, 100 seed weight, total biomass, N and P content of stover were maximum under effluent irrigation. This might be due to the increased availability of nutrients resulting in improved yield quality parameters. This was in agreement with the findings of Subramanyam *et al.* (1984). Similarly, combined application of *Rhizobium* and phosphobacteria enhanced the crop growth parameters due to the supply of both nitrogen and phosphorous to the crop by N fixing and P solubilizing organisms. Similar experimental results were obtained by several workers (Natarajan *et al.*, 1980 and Prabakaran *et al.*, 1996).

References

Alagawadi, A.R. and Gaur, A.C. (1988). Associative effect *of Rhizobium* and phosphate solubilizing bacteria on the yield and nutrient uptake of chickpea. *Plant Soil.*, **105:** 241-246.

Johnson, B. and Ryder, R. (1988). The disposal of pulp and paper mill effluents by spray irrigation on to farmland. In : Alternative Waste Treatment Systems. Bhamidimarii, R. (ed.) Elsevier Applied Science, London, P. 55-65.

Natarajan, T., Thangaraju, M. and Oblisami, G. (1980). Effect of combined inoculation of *Rhizobium* and phosphobacteria on French beans and pea. In : National Symposium on Biological Nitrogen Fixation in Relation