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# Impact of long-term paper mill effluent irrigation on agricultural soil and crop plant

K. KALAICHELVI AND M. RAJESWARI

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**SUMMARY**

The effects of long-term effluent irrigation on agricultural soil and growth, biochemical constituents and yield of black gram were carried out under potted condition. The physico chemical properties of (pre and post harvest) soil samples studied *viz*., bulk density, soil respiration, water holding capacity, pH, EC, chlorides, nitrates, nitrogen, phosphorous, potassium and organic carbon registered increases with the increasing years of effluent irrigation of the soil. 2 years effluent irrigated soil supported higher growth rate such as shoot, root lengths and biomass and biochemical constituents such as chlorophyll, protein and soluble carbohydrates. However, significant decreases were observed in 15 years effluent irrigated soil. Maximum yield and seed nutrients were recorded in 2 and 5 years irrigated soil. Where as 15 years effluent irrigated soil showed significant decrease in yield and seed nutrients.

**Key words :** Black gram, Long term irrigation, Paper mill effluent, Microbial population

Water resource, the most vital of all resources, is adversely affected by increasing industrialization, urbanization and other developmental activities. Of these, the effluents discharged from industries normally considered as the major pollutant of soil. Among the different major industries, the paper industry is a notorious pollutor of the environment.

In India there are more than 305 paper mills with an installed capacity of 2.04 x $10^6$ tonnes of paper per annum which discharges waste water at the rate of 305 to 450 $m^3t^{-1}$ paper produced. Seshasayee Paper and Boards Limited paper mill, Pallipalayam, Tamil Nadu discharged 30 to 40 $MLd^{-1}$ of effluent everyday. The effluent is stored in a lagoon and used as irrigation water by near by farmers. It is necessary to study the impact of this effluents on crop system before they are recommended for agricultural irrigation. Several studies have been done on the impact of various industrial effluents on various crops (Mariappan and Rajan, 2002; Malla and Mohanty, 2005)

In the present investigation, attempt has been made to evaluate both the beneficial and adverse effects of long-term paper mill effluent irrigation on soil and growth of *Vigna mungo*(L) Hepper.

## MATERIALS AND METHODS

The long-term effects of effluent irrigation were studied in the agricultural fields which have received treated but undiluted paper mill effluent as irrigation water for varying periods, *viz*., 2, 5, 10 and 15 years. Soil obtained from $A_1$ (0-10cm) layer in these fields were filled in earthern pots. The field soil which never received effluent irrigation earlier served as control.

Soil physical characters *viz*., bulk density and maximum water holding capacity were determined by keen Raczkowski box. Soil pH was directly determined using a standard Elico pH meter. Chloride in the soil sample was estimated following titrimetric method described by Sundaresan (1979). Total phosphorus was estimated by Pemberton (1945) method,and total nitrogen by Jackson (1973) method. Nitrate nitrogen was estimated following phenol Di sulphonic acid method described by Anonymous (1981). Organic carbon was estimated by Piper (1944) method.

The healthy and uniform seeds of *Vigna mungo* (L.). Hepper were surface sterilized with 0.1% $HgCl_2$ and washed thoroughly. The pots were sown with healthy surface sterilized seeds at the rate of 10 seeds per pot and watered regularly. The plants were uprooted on 20$^{th}$ day after sowing. The measurement for length (Root and shoot) and biomass were made. Chlorophyll was estimated as per Yoshida *et al*. (1976). Protein estimation was done following Lowry *et al*. (1951) method. Total soluble carbohydrates was done following Clegg (1956) method. Yield parameters *viz*., pod length, number of seeds per pod, 1000 seeds weight, number of pods per plant and grain yield per plant were made. Seed protein was estimated using Lowry *et al*. (1951), total soluble carbohydrates by Clegg (1956) and reducing sugars by

**Correspondence to:**
**K. KALAICHELVI,** Department of Botany, Vellalar College for Women, ERODE (T.N.) INDIA
**Authors' affiliations:**
**M. RAJESWARI,** Department of Botany, Vellalar College for Women, ERODE (T.N.) INDIA