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# Effect of Chlor-Alkali Solid Waste Effluent on Basal Area of A Little Millet Crop

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ABSTRACT

The little millet (*Panicum sumatrense* Rath ex. Roem and Schult) crop variety SS. 81-1, exposed to chlor-alkali solid waste effluent @ 100 g m$^{-2}$ (treatment - 1),200 g m $^{-2}$ (treatment - 2), 300 g m$^{-2}$ (treatment - 3) and 400 g m$^{-2}$ (treatment - 4) was studied in vivo at the Agriculture Research Station, Ankuspur in the District of Ganjam, Odisha at an interval of 15 days starting from 30 days after sowing (DAS) till harvest of the crop following the ICAR technology proposed by Seetharam (1994) with little modification depending upon the soil condition and climate of the locality. The basal area of little millet increases with the increase in sampling period in all control and treated beds. The area showed declined trend from control to treatment-1, treatment-2, treatment-3 and then to treatment-4 at the early stage of growth (30 DAS). Onwards, it followed a trend of control < treatment-1 < treatment-2 < treatment-3 > treatment-4 during 45 DAS, 60 DAS, 75 DAS and 87 DAS.

**KEYWORDS** Chlor-alkali factory, solid waste effluent, little millet, basal area.

### Introduction

Millet in general is the staple food of tribals and also of the labour class in the eastern part of the state of Odisha. The crop withstands heavy rain and drought condition to a considerable extent. *Panicum sumatrense,* formerly known as *Panicum miliari* is one of the typical minor millet crop grown widely on the hill tops, hill slopes and also in the hill bases. Recently cultivation of this crop has also been taken up in the plains. Compared to other small millet, *Panicum sumatrense* has some unusual features. It has the capacity to withstand drought and water logging to a considerable extent. It does not need crop protection measures. Basically it is free from pest. It does not require either irrigation or fertilizer and pesticide. Simply the tribals broadcast the seed by hand with the onset of first rain and harvest after 85-90 days.

### Literature Review

The degradation of environment due to industrial waste threatens the survival of living beings. Literature available revealed mostly the adverse effect of chlor-alkali solid waste on algae (Mishra **et al**. 1985, 1986), on fish (Shaw **et al.** 1985) and on rice (Nanda **et al.** 1993, 1994, 1996, Behera **et al.** 1995). So far as the little millet crop is concerned, some work has been done by Barik (2016) and Indian Council of Agricultural Research (ICAR, 1992-93, 1993-94, 1994-95, 1995-96 and 1996-97) under All India Coordinated Small Millet Improvement Project associated with various cooperative agencies for the development of crop productivity. Most of the investigation are confined to fodder and grain yield. However, no work has been done on the effect of chlor-alkali solid waste effluent on basal area of a little millet crop. Therefore, in this investigation an attempt has been made to study the basal area of a little millet crop exposed to various concentration of chlor-alkali solid waste effluent with a view to management of industrial waste in Agriculture.

### Study site and Environment

The experiment was conducted at the Agriculture Research Station (a Research farm of Orissa University of Agriculture and Technology, Bhubaneswar, Odisha), Ankuspur (l9°46'N; 94°21'E) situated at a distance of about 25 km from the Bay of Bengal Coast, Odisha.

The climate of the experimental site was monsoonal with three distinct seasons i.e. rainy (July to October), winter (November to February) and summer (March to June). Out of 863.65mm of rain recorded during the year, a maximum of 28.8 per cent was observed in June. The mean minimum and mean maximum atmospheric temperature recorded during the year were found to be normal. The mean minimum temperature ranged from 15.4°C (December) to 26.13°C (May) whereas the mean maximum showed a range of 27.6°C (December) to 37.81 °C (May).

The soil of the experimental site was found to be sandy (75%) and acidic (pH = 6.58) in nature. The phosphorus and potassium contents of the soil were high (i.e., 9.0 and 46.6 ppm respectively) whereas the amount of organic carbon (%) was very low (0.35%). The solid waste of chlor-alkali factory (M/s. Jayashree Chemicals) applied in the field soil was found to be alkaline (pH=8.06). Textural analysis showed almost nil of sand, silt and clay. The waste soil exhibited a medium range of phosphorus and potassium contents. The organic carbon (%) of the waste was of very low order (Barik, 2016)

### Materials and Methods

Twenty-five beds were prepared following the usual agricultural practice. Solid waste collected from the chlor-alkali factory was applied at the concentration of 100 g m$^{-2}$, 200 g m$^{-2}$, 300 g m$^{-2}$ and 400 g m$^{-2}$and marked as treatment -1, 2, 3 and 4 respectively. The soil was mixed thoroughly in each bed and leveled. Five beds for each concentration and control were maintained. ICAR technology proposed by Seetharam (1994) was employed for cropping with little modification depending upon the soil condition and climate of the locality. The sampling was made at an interval of 15 days starting from 30 days after sowing (DAS) till harvest of the crop. Five plants were selected randomly from each control and treatments. The number of basal tillers of each plant in all treatments and control beds were measured with the help of a screw gauge, averaged and incorporated in this investigation.

### Result and Discussion

Figure-1 represents the basal area (mm$^2$) of little millet exposed to various concentration of chlor-alkali solid waste effluent at different days after sowing (DAS). It was observed that, the basal area showed declining trend from control to treatment-1, treatment-2, treatment-3 and treatment-4 on 30 DAS. Thereafter, the area followed a trend of control < treatment-1 < treatment-2 < treatment-3 > treatment-4, starting from 45 DAS to 87 DAS (Harvest). Peak basal areas of 39.4 ± 1.084, 40.4 ± 0.822, 41.34 ± 0.654, 42.3 ± 1.283 and 41.34 ± 0.654 mm$^2$ ware observed in the control treatment-1, treatment-2, treatment-3 and treatment-4 respectively during 87days after sowing.

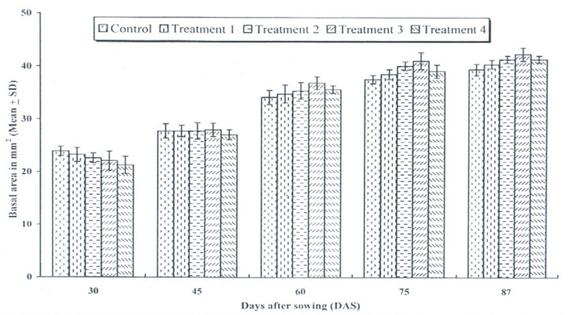


*Fig. - 8: Basal area in mm² (Mean ± SD) at different days after sowing*

**Fig 1 : Basal area in mm² (Mean ± SD) at different days after sowing.**

The declining trend of basal area from control to treatments during 30 DAS showed a little fluctuation in result that might be due to the influence of waste soil concentration applied in the field. The rain fall at the early growth period could perhaps have diluted the waste soil concentration. Thereafter, the result followed increasing trend from control to treatment-1, treatment-2 and attained a peak in treatment-3 during 45 DAS, 60 DAS, 75 DAS and 87 DAS. In treatment-4, the value decreased considerably which might be due to increase in waste soil concentration in soil.

The variance ratio test (Table-1) relating to basal area of a little millet in control and all treated beds at 30 DAS, 45 DAS and 60 days after showing did not show significant difference. However during 45 DAS and 87 DAS, highly significant 'F' values were found. This reveals the adverse effects of chlor-alkali solid waste effluent on basal area of little plant at the later stages of growth.

**Table-1 : Variance ratio test on the basal area of a little millet crop (*Panicum sumatrense,* Variety : SS. 81-1) exposed to solid waste effluent at different days after sowing (n=25) along with F Values, Least Significant Difference (LSD) at 0.05p.**

| Days after sowing | Basal Area (mm²) | |
|---|---|---|
| 30 | F=2.543 , NS | |
| 45 | F=0.474 , NS | |
| 60 | F=2.558 , NS | |
| 75 | F=7.023** | LSD = 1.54 |
| 87 | F=8.939*** | LSD = 1.102 |

** ≤ 0.01, *** ≤ 0.001 NS = Not Significant,

## Conclusion
The chlor-alkali solid waste effluent at the concentration of 100 g m $^{-2}$, 200 g m$^{-2}$ and 300 g m$^{-2}$ applied in field soil in Treatment-1, Treatment-2 and treatment-3 respectively might not have affected the basal area of little millet crop. Moreover, the concentration of waste soil (400 g m$^{-2}$) applied in treatment-4 might be detrimental for crop growth. As a result, less basal area has been observed in treatment-4 compared to treatment-3. However, this concentration of chlor-alkali solid waste effluent applied in the field would vary from place to place and also from crop to crop because of climatic variation of the place and also the genetic set up of the crop. Besides, the soil quality and soil amendment practices with modern improved technology also played major role in the detoxification of chlor-alkali solid waste effluent applied in the field soil.

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