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# Effect of Chlor-Alkali Solid Waste Effluent on Plant Height 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 height of the plant/shoot length gradually increased with increase in the days after sowing and attained maximum values on 87 DAS in both control and treatments. The plant height in each of the treatments showed more or less similar values as compared to the control on the $30^{th}$ day after sowing. Thereafter the plant height followed a trend, control < treatment-1 < treatment-2 < treatment -3 > treatment -4 at successive sampling periods i.e. on 45 DAS, 60 DAS, 75 DAS and at the time of harvest of the crop (87 DAS).

**Keywords:** Chlor-Alkali Factory, Solid Waste Effluent, Little Millet, Plant Height

**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 also 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.

**Aim of the Study**

The aim of this investigation is to find out the effect of chlor-alkali factory solid waste effluent on plant height of a little millet crop with a view to waste management in Agriculture.

**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 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 this investigation is confined to fodder and grain yield. However, no work has been done on the effect of chlor-alkali solid waste effluent on plant height of little millet crop.

**Study Site and Environment**

The experiment was conducted at the Agriculture Research Station (a Research farm of Orissa University of Agriculture and Technology, Bhubanswar, 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 experimental 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 mean maximum showed a range of 27.6°C (December) to 37.81 °C (May).

The soil 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 with a 30 days period after sowing till the harvest of the crop. The height of the plant/shoot length was measured from the root–stem transition region to the leaf tip/panicle tip (which was maximum). Five plants were selected randomly from each control and treatments. Plant height was measured in cm and averaged.

**Results and Discussion**

The height of the plant increased gradually with increase in the days after sowing (DAS) and attained peak on the 87 DAS. Plant height on 45, 60, 75 and 87 DAS showed high values in treatment-3 whereas these values were slightly low in treatment -4 compared to treatment-3. The plant height in each of the treatment revealed an increasing trend from treatment-1 to treatment-3 and then the height decreased in treatment-4. However, the plant height exhibited almost similar values in control and all treatments on 30 DAS. A maximum height of 122.8 ± 2.582, 126.2 ± 2.028, 133.9 ± 2.994, 137.0 ± 2.292 and 130.4 ± 2.461 were observed in the control, treatment -1, 2, 3 and 4 respectively on 87 DAS i.e. at the time of harvest (Fig.1).

The results of ANOVA test pertaining to plant height is presented in Table-1. It is observed that the F value gradually increases with the increase in the growth period i.e. from 30 DAS to 45 DAS then to 60 DAS, 75 DAS and becomes maximum at 87 DAS, as a result the level of significance is also of high order (0.001p level). This variation in the plant height is probably due to the influence of chlor-alkali soiled waste effluent applied in the soil.

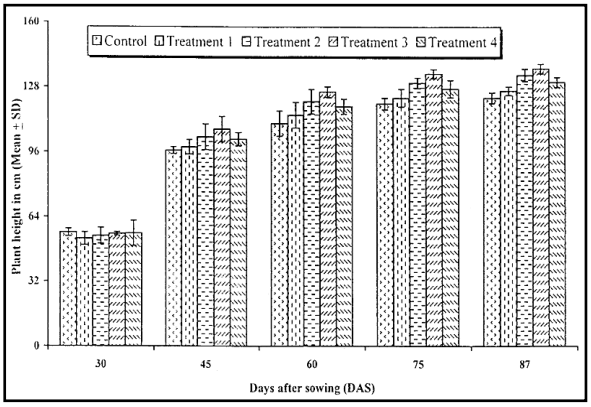


**Fig.-1**

**Plant Height in Cm (Mean ± SD) at Different Days after Sowing.**

**Table-1**

**Variance Ratio test on the Plant Height of Little Millet Crop (*P. sumatrense*) Variety, SS. 81-1 in Control and four Treatments at Different Days after Sowing (n=25).**

| Days after Sowing (DAS) | Plant hight (cm) |
|---|---|
| 30 DAS | F=0.478 NS |
| 45 DAS | F=5.023**LSD=5.554 |
| 60 DAS | F=6.691**LSD=6.912 |
| 75 DAS | F=15.079***LSD=4.554 |
| 87 DAS | F=23.428***LSD=3.54 |

**< 0.01p, ***< 0.001, NS=Not Significant, LSD= Least Significant Difference (p=0.05)

The plant height of little millet (local variety) in various climatic regions reported by ICAR (1996-97) when compared with the present findings (Table-2) reveal that the plant height of local variety of Pandirimamidi and Rasthakuntabai in the state of Andhra Pradesh and Waghai in the state of Gujurat exhibit high values whereas the area i.e. Kanke in Bihar; Hanumanamatti in Karnataka; Dindori, Jagadalpur and Rewa in Madhya Pradesh and Coimbatore in Tamil Nadu show lower plant height.

**Table-2**

**Plant Height (cm) of Little Millet (local variety) at Various Climatic Regions.**

| Sources | State (s) | Location (s) | Plant Height (cm) |
|---|---|---|---|
| ICAR (1996-97) | Andhra Pradesh | Pandirimamidi | 147.0 |
| | | Rasthakuntabai | 182.0 |
| | Bihar | Kanke | 110.0 |
| | Gujurat | Dahod | 132.0 |
| | | Waghai | 165.0 |
| | Karnataka | Hanumanamatti | 94.0 |
| | Madhya Pradesh | Dindori | 101.0 |
| | | Jagadalpur | 118.0 |
| | | Rewa | 118.0 |
| | Orissa | Berhampur | 121.0 |
| | Tamil Nadu | Coimbatore | 103.0 |
| This Study | Orissa | Berhampur-Control | 122.8 |
| | | Treatment-1 | 126.2 |
| | | Treatment-2 | 133.9 |
| | | Treatment-3 | 137.0 |
| | | Treatment-4 | 130.4 |

## Conclusion

In this investigation, particularly during early stage of sampling (30 DAS) the plant height among the control and treatments showed a little fluctuation in results that might have been due to the influence of chlor-alkali solid waste effluent concentration applied in the soil. The rainfall at the successive growth period could, perhaps, have diluted the waste soil concentration, so that the results followed some how, an 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 that might be due to the influence of waste soil concentration in soil. The results thus reveled that the chlor-alkali solid waste effluent applied in treatment-4 might be higher than the crop tolerance limit.

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