# ECOLOGICAL ANALYSIS OF A LITTLE MILLET CROP ECOSYSTEM EXPOSED TO CHLOR-ALKALI SOLID WASTE EFFLUENT, STANDING DEAD PRODUCTION

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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. Short term harvest method proposed by Odum (1960) was employed for the determination of various compartmental biomass values. The productivity of standing dead compartment was determined by taking the increment value of concerned biomass from the successive sampling period and was expressed in g $m^{-2}$. The standing dead production in control and all treated beds increased with the increase in sampling period and attained a peak at harvest (87 DAS). Treatments showed high production compared to control following a trend of control < treatment -1< treatment -2< treatment -3 > treatment -4 in all sampling dates. Standing dead production was not found at 30 DAS neither in control nor in treatment beds.*

***Keywords : Chlor-Alkali Factory, Solid Waste Effluent, Little Millet, Standing Dead Production.***

## I INTRODUCTION

Millet in general is the staple food of tribal's 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.

## II LITERATURE REVIEW

The degradation of environment due to industrial waste threatens the survival of living beings. Literature available revealed mostly the adverse effects 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). Some work has been reported on the primary productivity of groundnut by Sahu **et al**. (1981) and Sundermoorty & Lakshamanachary (1989), maize by Khohar (1981), barely by Hojokinen (1990), onion by Saraf (1994), mungbean by Keshan (1994), rice and wheat by Chaturvedi (1996), on vegetable crop by Leelavani (1996) and many more. So far as the little millet crop is concerned, some work has been done by Barik (2016) and Indian Council of Agricultural Research (lCAR, 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. In all agricultural studies, emphasis is given on production of economic return. However in plant ecology studies production includes all the compartments (i.e. live green, standing dead and grain) including belowground parts. This type of study is seldom made by agriculture workers. Most of the investigation is confined to fodder and grain yield only. Further, no work has been reported on the effect of chlor-alkali solid waste effluent on the primary productivity of little millet crop. Therefore, in this study an attempt was made to assess the productivity of standing dead compartment of a little millet *(Penicum sumatrense)* crop (variety SS. 81-1) exposed to various concentration of chlor-alkali solid waste effluent with a view to management of industrial waste in Agriculture.

### 2.1 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)

## III 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. Short term harvest method proposed by Odum (1960) was employed for the determination of various compartmental biomass values. Five quadrates of 50cm x 50cm size were harvested randomly in each bed and brought to the laboratory. The standing dead parts were collected carefully, separated and were first dried at room temperature and then transferred to oven for drying at $80^0$C for 48 hours and weighed The productivity of standing dead compartment was determined by taking the increment value of concerned biomass from the successive sampling period and was expressed in g $m^{-2}$. The sampling was made at an interval of 15 days starting from 30 days after sowing (DAS) till harvest of the crop.

## IV RESULT AND DISCUSSION

The standing dead production in control and all treated beds showed increasing trend from 45 DAS to 60 DAS then to 75 DAS and attained a peak at 87 DAS. Treatments showed higher production values compared to control. An increasing trend of standing dead i.e. control to treatment – 1 to treatment -2 then to treatment -3 was observed, thereafter the value got reduced in treatment -4 in almost all the sampling periods starting from 45 DAS to 87 days after sowing . Standing dead production was not found at 30 DAS in any of the beds (Fig.1).

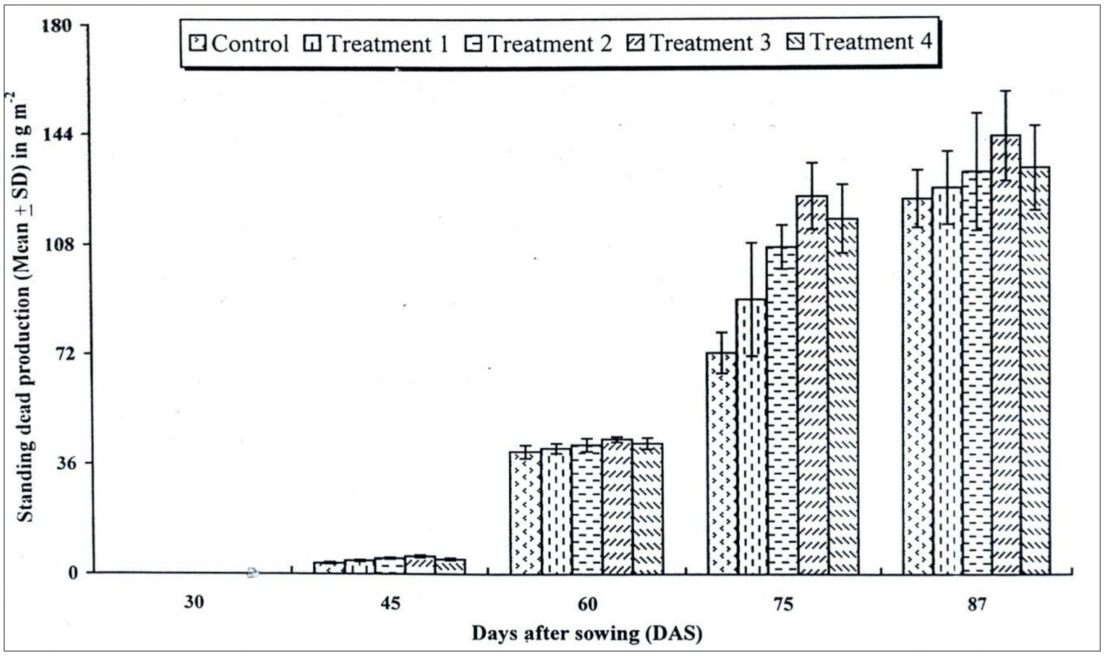

**Fig 1 :- Standing dead production (mean ± SD) in g $m^{-2}$ at different days after sowing**

The increasing trend observed in the control and four treated beds during successive days after sowing was perhaps due to drying up of green foliage. Increase in concentration of solid waste could have caused gradual increase in standing dead production value in treatment-1,2 and 3 compared to control. As the plants were primarily in the initial growing stage, no dead production of significant quantity was available at 30 DAS.

Analysis of variance test (Table -1) pertaining to standing dead production showed significant F values at 45 DAS ($P \leq 0.001$), 60 DAS ($P \leq 0.05$) and at 75 days after sowing ($P \leq 0.001$) whereas no significant variation was observed at 87 DAS, This revealed that the concentration of chlor-alkali solid waste effluent applied in the field soil might not be detrimental to standing dead production during 45 DAS, 60 DAS and 75 DAS.

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

| Days after sowing | 'F' Values | LSD |
|---|---|---|
| 30 | - | - |
| 45 | 35.580*** | 0.438 |
| 60 | 3.644* | 2.449 |
| 75 | 16.511*** | 15.301 |
| 87 | 2.052 (NS) | - |

*** ≤ 0.05, *** ≤ 0.001, NS = Not Significant,**

## V 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 standing dead production 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 amount of standing dead production was 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.

## VI ACKNOWLEDGEMENTS

The author gratefully acknowledges the financial assistance extended by University Grants Commission (U.G.C.), New Delhi. Thanks are due, to Prof. B.N. Misra (Retd.), Prof. M.K. Misra (Retd.) and Prof. A.K.

Panigrahi (Emeritus Prof.), Department of Botany, Berhampur University, Berhampur, Odisha for their co-operation throughout the progress of this investigation. The author is also indebted to Dr. R.C. Misra (Sr. Breeder and Officer in- charge), Dr. H.K. Mohapatra (Entomologist), Dr. S. Panda (Pathologist), Dr. B.K. Jena (Agronomist) and Mr. S.N. Biswal (Field Asst.) of Agriculture Research Station, Ankuspur for providing necessary help throughout the cropping.

**REFERENCES**

1. Barik, K.L. (2016), Effect of chlor-alkali solid waste effluent on the fodder and grain yield of a little millet crop. The Global J. Environ. Sci. and Research, 3 (1), 85-88.
2. Behera, M., B. Padhy and B. Patra (l995), Effect of industrial effluent on seed germination and seedling growth of rice (*Oryza sativa* L). Neo Botanica, 3 (1&2), 7-12.
3. Chaturvedi, S.S. (1996). Eco-behavior of some crops under waste water irrigation. Ph.D. Thesis, Banaras Hindu University, Varanasi, India
4. Hojokinen, R. (1990). Effects of phosphorus precipitation chemicals on characteristics and agricultural velue of municipal sewage sludge. 2. Effect of sewage sludge on yield, element contents and uptake by spring barley. Acta agric. Scand., 40 (2), 131-140.
5. ICAR (1992-93), All India coordinated small millet improvement project, Annual Report, Indian Council of Agricultural Research and Cooperating Agencies, Bangalore.
6. ICAR (1993-94), All India coordinated small millet improvement project, Annual Report, Indian Council of Agricultural Research and Cooperating Agencies, Bangalore.
7. ICAR (1994-95), All India coordinated small millet improvement project, Annual Report, Indian Council of Agricultural Research and Cooperating Agencies, Bangalore.
8. ICAR (1995-96), All India coordinated small millet improvement project, Annual Report, Indian Council of Agricultural Research and Cooperating Agencies, Bangalore.
9. ICAR (1996-97), All India coordinated small millet improvement project, Annual Report, Indian Council of Agricultural Research and Cooperating Agencies, Bangalore.
10. Keshan, U. (1994). Cadmium phytotoxicity and its influence on some morphological, biochemical and ultrastructual characteristics of Mungbean (*Vigna radiata* L. Wilczek) in relation to productivity. Ph. D. Thesis, University of Calcuttal, Calcutta.
11. Khokhar, M.F.K. (1981). Biomass, productivity and growth analysis of maize. Trop. Ecol., Silver Jubilee Symposium abs. p. 120.
12. Leelavani, A. (1996). Studies on toxicity of some heavy metals with reference to flyash application in some vegetable crops. Ph. D. Thesis, Berhampur University, Berhampur, Orissa.
13. Mishra, B.B., D.R. Nanda and B.N. Misra (1985), Reclamation with blue-green algae; Mercury uptake by algae cultured in solid waste of a chIor-alkali factory and its effect on growth and pigmentation, J. Environ. Biol., 6 (4), 223-231.

14. Mishra, B.B., D.R. Nanda and B.N. Misra (1986), Reclamation with blue-green algae; Changes in free amino acid content of algae exposed to solid waste of a Chlor - alkali factory, Microb. Lett., 33, 139-142.

15. Nanda, D.R., B.B. Mishra and B.N. Misra (1993), Effect of solid waste from a Chlor-alkali factory on rice plants; Mercury accumulation and changes in biochemical variables, J. Environ. Studies, 45,23-28.
16. Nanda, D.R., B.B. Mishra and B.N. Misra (1994), Changes in bio- chemical variables of a crop plant exposed to saturated solid waste extract from a Chlor-alkaJi factory, Mendel, 11 (3 & 4), 151-152.
17. Nanda, D.R., B.B. Mishra and B.N. Misra (1996), Effect of solid waste from a Chlor-alkali factory on accumulation of mercury and changes in biomass of rice roots, Oryza., 33, 51-54.
18. Odum, E.P. (1960). Organic production and turnover in old field succession. Ecology, 41. 39-49.
19. Sahu, S.N., R.S. Dwivedi and D.D. Misra (1981). Net primary productivity of groundnut under agro-ecosystem. Trop. Ecol., Silver Jubilee Symp., p. 217.
20. Saraf. R.K. (1994). Efficacy of herbicides for weed control in kharif Onion (*Allium cepa.* L) in Satpura Plateau of Madhya Pradesh. Ph. D Thesis, Dr. Hari Singh Gour Vishwavidyalaya, Sagar, Madhya Pradesh.
21. Seetharam, A. (1994), Technology for increasing finger millet and other small millets production in India, Project Coordination Cell, All India Coordinated Small Millet Improvement Project, Indian Council of Agricultural Research, GKVK Campus, Bangalore.
22. Shaw, B.P., A. Sahu and A.K. Panigrahi (1985), Residual mercury concentration in brain, liver and muscle of contaminated fish collected from an estuary near a caustic-chlorine industry, Curr. Sci., 54 (16), 810-812.
23. Sundermoorthy , P. and A.S. Lakshamanachary (1989). Effect of alum treated effluent and activated sludge process treated effluent on growth parameter and yield of groundnut. Proc. 76th Indian Sci. Cong. Madurai, Section -IV, Abst., p. 246.