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ECOLOGICAL ANALYSIS OF A LITTLE MILLET CROP ECOSYSTEM EXPOSED TO CHLOR-ALKALI SOLID WASTE EFFLUENT, I. LIVE GREEN 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. ICAR technology was followed for cropping with little modification depending upon the soil condition and climate of the locality. Short term harvest method was employed for the determination of various compartmental biomass (dry weight) values. The productivity of live green compartment was determined by taking the increment value of concerned biomass from the successive sampling period and was expressed in g m^{-2}. The live green production in control and all treated beds followed an increasing trend from 30 DAS to 45 DAS then to 60 DAS and peaked at 75 DAS. There was decrease in live green value at 87 DAS. Compared to control, treatment - 1,2,3 revealed an increasing trend, Treatment-4 showed less value to those observed in trearment-3 bed during 45,60,75 and 87 DAS, whereas a gradual declining trend was observed from control to treatment – 1,2,3 and 4 at 30 days after sowing.

Keywords : Chlor-alkali factory, little millet, live green production, solid waste effluent.

I.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.

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II.LITERATURE REVIEW

The degradation of environment due to industrial waste is a global concern. The adverse effects of chlor-alkali solid waste on algae were studied by Mishra **et al**., 1985 [1], 1986[2]; on fish by Shaw **et al.,** 1985[3] and on rice by Nanda **et al.,** 1993[4], 1994[5], 1996[6] and Behera **et al.,** 1995[7]. Some work has been reported on the primary productivity of groundnut by Sahu **et al**. 1981[8] and Sundermoorty & Lakshamanachary, 1989[9]; maize by Khohar, 1981[10; barely by Hojokinen, 1990[11]; onion by Saraf, 1994[12]; mungbean by Keshan, 1994[13]; rice and wheat by Chaturvedi, 1996[14]; on vegetable crop by Leelavani, 1996[15] and many more. So far as the little millet crop is concerned, some work has been done by Barik, 2016[16] and Indian Council of Agricultural Research, lCAR, 1992-93[17], 1993-94[18], 1994-95[19], 1995-96[20] and 1996-97[21]) 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 live green 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.

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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[23] 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[23] 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 live green parts were collected carefully, separated and were first dried at room temperature and then transferred to oven for drying at 80^0C for 48 hours and weighed The productivity of live green 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

Figure -1 represents the live green production in control and 4 treated beds. It was observed that the production in control and all treated beds increased from 30 days after sowing to 45 DAS, then to 60 DAS and peaked at 75 DAS. There was decrease in live green value at 87 DAS. Peak live green production was found to be 447.656 ± 13.424, 458.609 ± 8.965, 472.767 ± 10.734, 488.867 ± 5.023 and 463.681 ± 11.885 in control, treatment – 1,2,3 and 4 respectively at 75 DAS. Compared to control, treatment – 1,2,3 showed an increasing trend whereas treatment – 4 showed a lower value to that observed in treatment – 3 bed during 45,60, 75 and 87 DAS. Moreover a declining trend from control to treatment – 1,2,3 and 4 was observed at the early stage of growth (30 DAS).

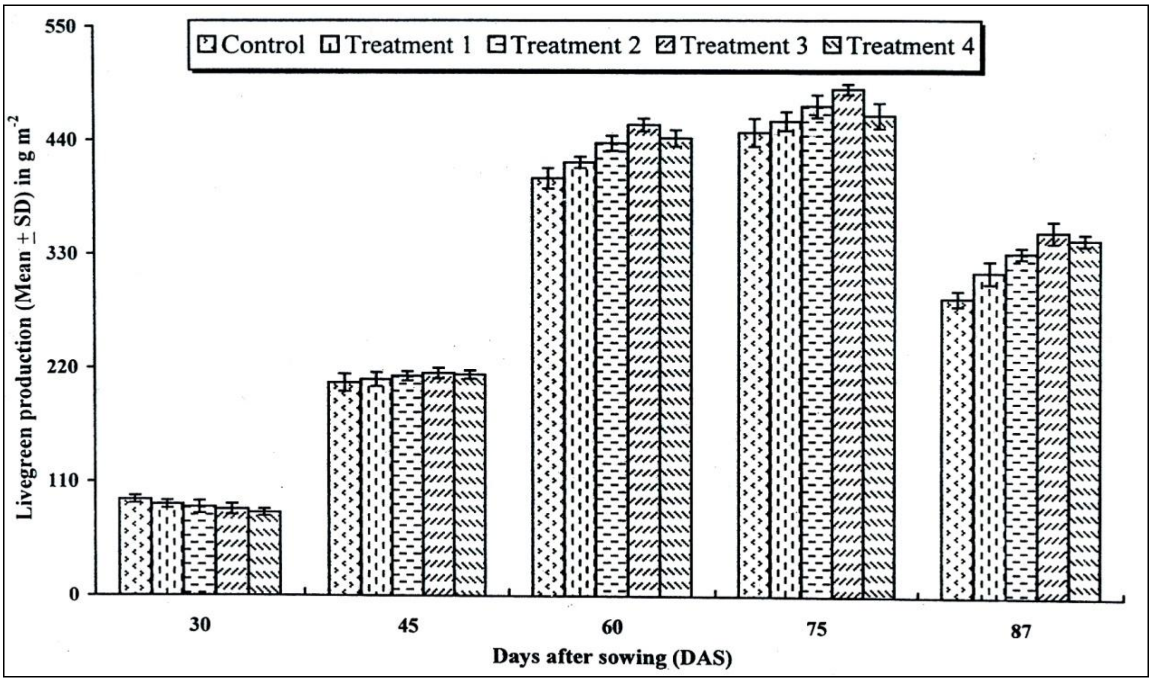

Fig 1 :- Live green production (mean ± SD) in g m^{-2} at different days after sowing

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Increase in live green production from 30 DAS to 75 DAS in all the beds was mostly due to the foliar initiation. However, the gradual increase in production value from control to treatment-1, treatment-2 and treatment -3 might be due to the influence of solid waste at 45 DAS, 60 DAS and at 75 DAS. The concentration applied in case of treatment -4 was perhaps higher than the threshold value and thus affected the crop under such amended soil. This caused reduction in green production to some extent. During early stage of growth i.e. 30 DAS, green production declined from control to treatment-1, 2, 3 and became less in treatment - 4 which might be due to the toxicity of waste soil concentration applied in field soil. The precipitation after 30 DAS, probably reduced the toxicity of solid waste as a result of which an increasing trend from control to treatment-3 was observed during 45 DAS, 60 DAS and 75 DAS, whereas the drying of foliage caused successive reduction in green values in all beds at 87 days after sowing.

Analysis of variance test (Table -1) pertaining to live green production showed a high significant F value ($P \leq 0.001$) at 60 DAS, 75 DAS and at 87 days after sowing whereas no significant variation was observed at early stage of growth (i.e. 30 DAS and 45 DAS). This revealed that the concentration of chlor-alkali solid waste effluent applied in the field soil might not be detrimental to live green production at the later stage of sampling period (i.e. during 60 DAS, 75 DAS and 87 days after sowing).

Table-1 : Variance ratio test (F) on live green 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	0.611 (NS)	-
45	1.757 (NS)	-
60	35.545***	10.246
75	13.211***	12.81
87	68.747***	9.38

***** ≤ 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 live green 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 live green 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.

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