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Effect of Chlor-Alkali Solid Waste Effluent on Carbohydrate Content in Grain of A Little Millet Crop

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 carbohydrate content in grain was estimated following the method proposed by Hedge and Hofreiter (1962). Carbohydrate content in grain exhibited identical values in control, treatments - 1, 2 and 3. Treatment - 4 showed low values compared to control, treatments - 1, 2 and 3. Carbohydrate content did not show significant variation among the control and all treatments. This indicates that the carbohydrate content might not have been influenced by the application of solid waste even up to the highest concentration applied as in treatment - 4. The precipitation, atmospheric temperature, relative humidity, soil characteristics, soil amendment practices with modern improved technology do play vital role for no such variation of carbohydrate content in grain of the crop plant.

Keywords: Chlor-alkali Factory, Solid Waste Effluent, Little Millet, Carbohydrate

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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.

Review of Literature

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 the carbohydrate content of little millet crop.

Aim of the Study

The aim of this investigation is to find out the effect of chlor-alkali factory solid waste effluent on carbohydrate content in grain of a little millet crop with a view to waste management 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, 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 carbohydrate content of the sample was estimated following the Anthrone method proposed by Hedge and Hofreiter (1962).

Results and Discussion

The carbohydrate content (g per 100g of grain sample) exhibited identical values in control, treatments – 1, 2 and 3. Treatment - 4 showed lower values compared to control, treatments - 1, 2 and 3 (Table - 1). The identical values of carbohydrate in control, treatment - 1, 2 and 3 and less in treatment - 4 is probably due to effect of the solid waste applied in the field soil. Compared to rice and wheat (Table - 2) the millet showed a trend of rice > wheat > millet in carbohydrate content as reported by Gopalon **et al.** (1989).

Table – 1

Carbodydarte Content (g Per 100 g of Seed Samples) of little millet *(P. Sumatrense*) Grain in the Control and Various Treatments Exposed to Chlor-Alkali Solid Waste (Values are in Mean ± SD, n = 5 each)

Variable	Carbohydrate
Control	66.350 ± 0.550
Treatment - 1	66.474 ± 0.410
Treatment - 2	66.551 ± 0.773
Treatment - 3	67.068 ± 0.488
Treatment - 4	66.111 ± 0.264

Table – 2

Carbohydrate Content of Some Indian Foodstuffs (g Per 100g of Seed Samples).

Sources	Crop	Carbohydrate
Gopalon **et al.** (1989)	Rice (Milled)	78.2
	Wheat	71.2
	Finger millet	72.0
	Proso Millet	70.4
	Foxtail Millet	60.9
	Kodo millet	65.0
	Barnyard millet	65.5
	Little millet	67.0
This study	Little millet	
	Control	66.35
	Treatment - 1	66.47
	Treatment - 2	66.55
	Treatment - 3	67.07
	Treatment - 4	66.11

ANOVA test (Table - 3) pertaining to carbohydrate content in the control, treatments - 1, 2, 3 and 4 as well as in the control, treatments - 1, 2 and 3, did not show significant variation in either of the cases. It seems, the carbohydrate content has not been influenced by the application of solid waste even up to the highest concentration applied as in treatment - 4. Besides, the precipitation, atmospheric temperature, relative humidity and soil characteristics do play vital role in variation of carbohydrate content in grain of the crop plant.

Table – 3

ANOVA Test Pertaining To Amount of Carbohydrate Content in the Grain of *P. Sumatreance* in Control and Various Treatments Exposed to Chlor-Alkali Solid Waste Effluent.

Variable	Control with treatment – 1,2,3 and 4 (n = 25)	Control with treatment – 1,2 and 3 (n = 20)
Carbohydrate	F = 1.909(NS)	F = 1.214(NS)

NS = Not Significant, LSD = Least Significant Difference (p = 0.05)

Conclusion

The carbohydrate content in grain of little millet crop exosposed to chlor-alkali solid waste effluent revealed identical values in control, Treatment – 1, Treatment – 2, Treatment – 3 and treatment – 4. This indicates that the application of chlor-alkali solid waste effluent up to the concentration of 400g m^{-2} (treatment – 4) is not detrimental to the crop plant on carbohydrate content in grain. 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 play vital role in the detoxification of the solid waste effluent applied in the soil.

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