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Utilization of Distillery Effluent in Decomposition of Green Manure and Its Effect on Growth, Physiology and Yield of *Oryza Sativa*l

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ABSTRACT

A study was carried out to observe the effect of distillery effluent on green manure and its effect on growth and physiology of Oryza sativa L. cv. Saka-4. The study revealed that 100 % distillery effluent with green manure (Sesbania aculeata) promoted the growth of plants which lead to the increase in their root – shoot ratio, number of tillers, spike density, bio mass per plant, net primary productivity, grain yield and chlorophyll content in comparison to 50 % distillery effluent and control.Thus beneficial effects of distillery effluent with green manure assimilated crops growth. Regular use of agricultural land exhaust the essential nutrients required for the plant growth from the soil therefore, it is a compulsory need to replenish and maintain a good structure of soil by green manuring.

Key Words – *Distillery effluent, Green Manure, Sesbania Aculeata, Oryza Sativa L., Soil Structure.*

INTRODUCTION

The chemical Intensive agriculture could not pass test of the good and safe agriculture as it affected almost everything around it. The most serious threat was to the health of soil, environment human health and the earth. The natural resources like soil, water and atmosphere are stabilized in the process of organic farming and there is regular improvement as appropriate crop rotation and green manuring are maintained.

Paddy makes good response immediately after green manuring insitu practice, sesbania aculeata and Sunnhemp are best suited crops for green manure in kharif season. Green manuring indirectly increases the phosphorus availability to the succeeding crop. They convert phosphorus applied in leguminous green manuring crop into organic form and phosphorus in organic form becomes more easily available after decomposition in soil.[1]

In recent years use of distillery effluent for ferti-irrigation in agriculture after treatment is favourable approach because effluent contains macro and micro nutrients which are useful for the growth of crops.[2]

Application of spent wash not only adds mineral N(NH4 N and NO3 N) to soil, but also promotes the[3] mineralization of soil organic N, thus resulting in large amounts of NH4 N and NO3 N in soil .In general among the plant nutrients, K was

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in larger amounts compared to N and P. Distillery spent wash contained large amount of K and SO4,followed by N and P.[4] However Ca, Mg and Cl are also present in appreciable amounts.[5] Thus it can be effectively used as source of plant nutrients and as soil amended agent.[6]

Main objective of the present investigation is to determine the role of distillery effluent to decompose thegreen manure as soil renovator for the sake of environment management.

EXPERIMENTAL

Materials and Methods

Distillery effluent was collected from distillery division of Simbhaoli Sugar Mills, Simbhaoli (Hapur) U.P. Partially treated effluent was used to decompose the green manure (Sesbania aculeata pers. Syn) for 45 days and then crop (*Oryza sativa* L.) was grown to observe its effect on germination, growth and yield in pot culture at Agriculture Research Farm of Kisan (P.G) college, Simbhaoli.

One month old plantlets of *Oryza sativa* L. (cv. Saka 4) were planted in pots with a diameter of 30 cm. Each pot contained 7 kg of soil which was green manured. Ten plantlets were planted in each pot but thinning was done & only three plants were left per pot. Data on yield parameters were recorded.

Pot experiment was carried out in 4 treatments in three replications as under.

T1 = GLM (Sesbania aculeata) + 100 % D.E

T2 = GLM (Sesbania aculeata) + 50% D.E

T3 = GLM (Sesbania aculeata) + Water Control

Shoot - Root Ratio was analysed by the following formula:-

$$\text{Shoot - Root Ratio} = \frac{\text{Dry weight of Shoot}}{\text{Dry weight of Root}}$$

Net Primary Productivity was calculated by dividing dry wt. of whole plant by plant age. Chlorophyll was estimated as per method given by Smith and Benitez.[7]

Data were computed and statically scrutinized for C.D at 5% level.

Spike density was determined as follows-

$$\text{Spike Density} = \frac{\text{Number of Spikelets in Spike}}{\text{Length of Spike (cm)}}$$

$$\text{Harvest Index} = \frac{\text{Weight of Seeds Spike}^{-1}}{\text{Phyomass of Plant}^{-1}} \times 100$$

RESULTS AND DISCUSSION

Physico -chemical and biological characteristics of treated distillery effluent from distillery were analysed (Table 1)

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Table 1: Physico -chemical and biological characteristic of spent wash, post methanated effluent (PME) Treated distillery effluent

Parameters	Range Values	PME
Ph	3.9-4.3	7.8
EC (ds/m-1)	30.5-45.2	14
Biochemical Oxygen Demand (BOD)	46100-96000	5000mg/L
Chemical Oxygen Demand (COD)	79000-87990	11200mg/L
Total Dissolved Soild (TDS)	1660-4200	28000mg/L
Total Solids (TSS)		2100mg/L
Nitrogen (N_2)	1660-4200	2160
Phosphorus (P_2O_5)	225-3038	22-30
Potassium (K_2O)	9600-17475	4000-6000
Calcium	2050-7000	200
Magnesium	1715-2100	178
Sodium	92-670	40
Sulphate	3240-3425	255
Chloride	72338-42096	685
SAR	5.0-7.3	328
Zinc (ppm)	3.5-10.4	4.42
Copper (ppm)	0.4-2.1	0.52
Manganese (ppm)	4.6-5.1	4.38
Gibberellic Acid	3245-49443	0.63
Indole acetic Acid	25-61	0.46

*All Values are in mg/L.

Table-II :- Effect of GLM and Distillery effluent on root & shoot length, fresh & dry weight of root & shoot of *Oryza sativa*L.

S.No	Particulars	DAS	T_1	T_2	T_3	Control
1	Root Length (cm)	45	2.8*	2.6*	2.4	2
		60	16.12*	15.1*	14.00*	10.02
		75	20.15*	19.00*	18.200*	16.1
		90	22.00*	20.18*	18.75	16.9
		105	24.00*	22.15*	20.8	18.7
		120	25.00*	23.12*	21.5	19
2	Shoot Length (cm)	45	illegible	illegible	illegible	illegible
		60	15.7*	12.3	11..66*	10.5
		75	20.1*	16.5*	14.6	13.77
		90	25.4*	23.8*	22.7*	19.3
		105	27.5*	25.6*	24.3	23
		120	30.2*	28.4*	26.3	25.1
3	Fresh Weight Of Root (mg)	45	0.072*	0.07*	0.068	0.064
		60	28.500*	27.5*	26.25	24
		75	32.000*	30.25*	29	26.25
		90	42.00*	40.375*	38.25*	27
		105	54.200*	45.85*	41.11*	32
		120	55.850*	48.35*	45.00*	35
4	Fresh Weight Of Shoot (mg)	45	0.582*	0.500*	0.45*	0.325
		60	32.02*	22.92*	20.874	19.83
		75	125.00*	120.055*	118.75	116.25
		90	175.00*	162.2*	154.0*	135.75
		105	225.00*	212*	210.5	205
		120	250.00*	240*	225	220
5	Dry Weight Of Root (mg)	45	0.024*	0.023*	0.022	0.021
		60	9.5*	9.16*	8..75	8
		75	10.66*	10.07*	9.66	8.75
		90	14.0*	13.45*	12.75	9
		105	18.08*	15.28*	13.703	10.66
		120	18.616*	16.116*	15	11.66
6	Dry Weight Of Shoot (mg)	45	0.194*	0.166*	0.158*	0.108
		60	10.673*	7.64*	6.958	6.61
		75	41.66*	40.01*	39.58	38.75
		90	58.3*	54.06*	51.3	45.25
		105	75.0*	70.66*	70.16	68.33
		120	83.3*	80.0*	75	73.3

*CD at 5% level.

T_1 = GLM + 100% D.E
T_2 = GLM + 50% D.E
T_3 = GLM + Water

GLM = Green Leaf Manure (Sesbania aculeata)
D.E = Distillery Effluent

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Table-III :- Effect of GLM and Distillery effluent on root & shoot ratio, tillering, growth index, N.P.P spike density and harvest index of *Oryza sativa* L.

S.No	Particulars	DAS	T_1	T_2	T_3	Control
1	Shoot Root Ratio	45	8.08*	7.21*	7.18*	5.14
		60	1.12	0.834	0.795	0.626
		75	3.96	3.93	3.09	3.068
		90	4.16	4.29	4.02	3.93
		105	4.94	4.62	4.04	4.01
		120	4.96	4.67	4.27	4.26
2	Tillering	45	4	33.5	3.5	2.5
		60	10	6	5	4
		75	15	12	10.2	6
		90	16	14	12	10
3	Growth Index	45	1.31*	1.17*	1.12*	1
		60	1.49*	1.27*	1.1*	1
		75	1.46*	1.2*	1.06	1
		90	1.31*	1.23*	1.17*	1
		105	1.19*	1.11*	1.05	1
		120	1.2*	1.13*	1.06	1
4	Net Primary Productivity (N.P.P)	45	0.0048*	0.0042*	0.004	0.002
		60	0.3362*	0.28*	0.26	0.024
		75	0.6976*	0.667*	0.656	0.633
		90	0.803*	0.75*	0.711	0.602
		105	0.886*	0.818*	0.798	0.752
		120	0.849*	0.8*	0.75	0.708
5	Spike Density	120	9.34*	8.17*	8.2*	7.6
6	Harvest Index	120	14.2*	12.326*	11.036	10.98

*CD at 5% level.

T_1 = GLM + 100% D.E
T_2 = GLM + 50% D.E
T_3 = GLM + Water

GLM = Green Leaf Manure (Sesbania aculeata)
D.E = Distillery Effluent

The results of treated distillery effluent and green leaf manure on root and shoot length were observed on *Oryza sativa* L. The root & shoot length is higher in T1 in *Oryza sativa* L. 90 DAS. It is affected by phosphorus directly or in-directly. The fresh wt. and dry wt. of *Oryza sativa* L .cv. Saka-4 increase in T1in comparison to T2 and T3 over Control (Table-II) The difference in total biomass per plant may be due to the effect of high salt conc. in soil vis-a-vis high osmotic pressure of the soil solution, less water and mineral absorption and reduced aeration of roots which affects various metabolic pathway of plant leading to dry matter production and this may be attributed to change in source and sink relationship.

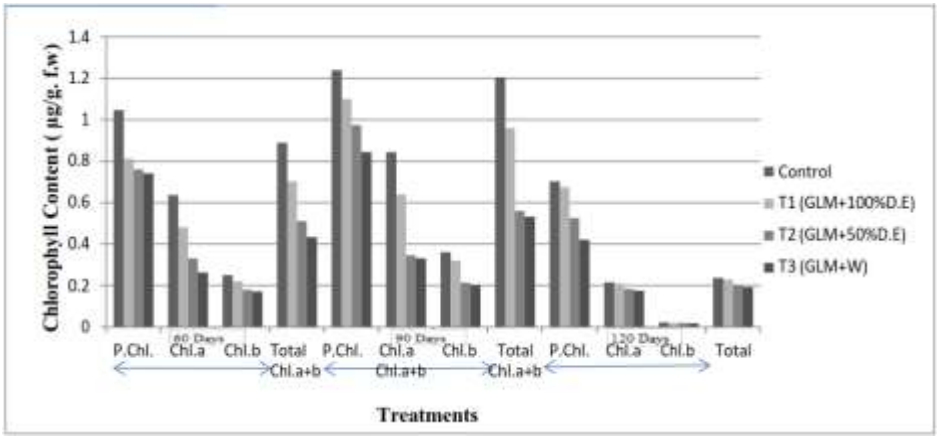

Fig. 1: Effect of GLM with Distillery Effluent on Chlorophyll Content of Oryza sativa L.

Number of tillers is very important in *Oryza sativa*L.cv.Saka -4. The highest number of tillers was observed in T1 in

comparison to T2 and T3 over control. Growth index and shoot-root ratio also followed the same trend. (Table III)

The Net Primary Productivity and spike density was recorded highest in T1 in *Oryza sativa* L. cv.Saka-4 (Table III). It is observed that increase in weight of seeds at T1 has been correlated in yield resembles to the increase in phytomass in root and shoot.

Evans & Lewin[8] attributed this reduction leading to the no. of length of panicles .The highest harvest index was recorded in T1 (Table III). The nutrients contributed through green manuring and nitrogen addition might be the reason for the increase in grain yield. These results are in agreement with the findings of Saha et. al.[9] and Islam et. al.[10] Several researchers have also reported the beneficial effects of distillery effluent in soil on the yield of wheat, rice, maize (Joshi et. al.)[11] Sorghum (Zalawadia and Raman)[12] and Onion (Zalawadia et. al.)[13]

In present investigation data on the maximum content revealed that T1 treatment in *Oryza sativa* L. Proto chl., chl.'a' , chl. 'b' and minimum content of chlorophylloccurred in green leaf manure and distillery effluent at 90 DAS. (Fig 1) The Chl. 'a ', Chl. 'b' and Total chl. on 90 DAS were influenced significantly by treatments and nutrients status. Similar findings were recorded by Sinha and Sakal.[14] The increase in chlorophyll content was probably due to the favourable effect of T1 in *Oryza sativa* L. our findings to be supported by Wankhede et. al.[15] The chl. 'a ', Chl. 'b' and Total chl. (a+b) increased with increasing content of nutrients recorded in T_1 and T_2 treatment. (Sharma & Bhandari)[16]

CONCLUSION

Thus, it is concluded that physiological effect of distillery effluent on decomposition of green manure (Sesbania aculeata) in GLM +100 % D.E and GLM +50 % DE on *Oryza sativa* revealed that GLM +100% DE enhanced growth and yield significantly due to available nutrients in soil and nutrient dynamics in residual soil helped in sustainable agriculture.

The beneficial effect of distillery effluent on crop production was exerted with green manure application. After treatment of distillery effluent with proper dilution and systematic application it would not cause any harm to soil and in some cases, the nutrients which are exhausted by the crop would be brought back to soil.

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