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Microbial Composting of Press mud and Its Impact on Soil Productivity for sugarcane

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Abstract

A field trial was set up at U. P. Council of Sugarcane Research Farm, Shahjahanpur, U.P. (INDIA) during 2007-2010 to assess the impact of decomposed pressmud (organic matter) on soil productivity for Sugarcane yield and quality. Four replicates of 5 treatments: control (no amendment), 2/3 RDN through inorganic source, 100% RDN through inorganic source, 1/3 RDN through biocompost + 2/3 RDN through inorganic source and 1/3 RDN through biocompost. The data showed that sugarcane yield and other quality parameters were influenced by the different treatments. Its impact on soil productivity was found that 1/3 of recommended dose of nitrogen given by the biocompost plus 2/3 by inorganic source gave more than 10 percent higher sugarcane yield over 100 percent recommended dose of nitrogen through inorganic source. Slight improvement in juice quality was also observed in biocompost application.

Key Words: Pressmud, Recommended Dose of Nitrogen, yield and quality of Sugarcane.

Introduction

Nowadays with the continuous use of higher doses of chemical fertilizers and plant protection chemicals, our soils have been gradually badly degraded. It has destroyed stable traditional ecosystem of the soil (Palaniappan and Annadurai, 1999). There is a need to encourage more productive, cost efficient and ecofriendly farming system (Bhattacharya and Gehlot 2003). The use of organic manure has been time tested production input for improving the sustainable productivity of soil. Composting of organic waste like crop residues, animal wastes, vegetable wastes etc, is a traditional practice being adopted by our farmer since ancient times. The conventional method of composting yields low quality of compost and that too in a very long period (8 to 10 months). Keeping in view these facts a new efficient microbial technology for composting has been developed by U.P. council of sugarcane research. It takes the period for composting only 60 to 75 days and improves the quality of compost considerably. This technology involves the employment of the cellulolytic culture inoculants named organodecomposer for quick initial microbial decomposition followed by enrichment with biofertilizers.

Sugar mill based by product like presumed is produced in bulk quantity (about millions tons per year) in India (Jambhekar 1992). U.P. it self produces about more than 5.0 million tons of pressmud every year. Its disposal is a costly problem to millers and if stored. It pollutes the atmosphere in the vicinity (James and Hasibuan 2002). It is one of the best sources of organic matter to replenish the soil. The use of fresh or partial decomposed pressmud gives rise to the incidence of diseases and pests. With these views, efforts were made to recycle the pressmud through composting with use of above technology and to evaluate its nutritional and microbial values. The efficacy of biocompost application on soil productivity was also studied in a field experiment.

MATERIALS AND METHODS

BIOCOMPOSING TECHNOLOGY

Preparation of inoculums

The inoculums was prepared by suspending one kg of carrier based cellulolytic culture inoculants (developed by U.P.C.S.R. Shahjahanpur) with 100 kg of cattle dung in 500 liters of water for 1 ton of composting material particularly organic wastes.

Enrichment inoculums

Nitrogen fixing (Azotobacter) and Phosphate solubilizing bacteria (PSB) biofertilizers were used for enrichment during the process of composting @ 0.5 kg of each for one ton of composting material.

Activators

To accelerate the microbial activities 8 kg urea +10 kg single super phosphate were used for each ton of composting material hence these are the requirements of micro-organisms to enhance their activities at initial stage.

Raw material

Fresh pressmud (SPM) was used as major raw material.

Pressmud composting process

Pressmud is soft spongy amorphous and dark brown to brownish white material containing fibre sugar coagulated colloids including cane wax albuminoids inorganic salts and soil particles. The composition varies depending upon the quality of canes crushed and the process followed for the clarification of cane juice in a sugar factory (Kumar and Mishra, 1991 and Yadav, 2001).

The range of different constituents of pressmud (sulphitation) is given below-

S. No.	Constituents	Percent
1	Fiber	15 – 30
2	Crude wax and fat (lipid)	5 - 14
3	Crude protein	5 - 15
4	Total ash	9 - 20
5	Sio 2	4-10
6	CaO	1-4
7	MgO	0.5-1.5
8	Total N	1.0-3.1
9	Total P	06-3.6
10	Total K	0.3-1.8
11	Sulphur	2-3
12	Organic carbon	35-40

The composting of pressmud was done in pit. The depth of the pit was kept 1 m. high 1.5 m wide and 5 m length. This size was sufficient for composting of 2 tones of pressmud. The first layer of 5cm at the bottom most was spread of dry leaves, weeds, sugarcane trash or other crop residues followed by top dressing of mineral fertilizers over it. The second layer of 15cm of fresh pressmud was spread on it followed by inoculation with cellulolytic culture inoculants (well suspended with cattle dung in water). This process was repeated till the height reaches to 1m. The moisture level in the whole process was maintained up to 60% by sprinklity of water. At last, the pit was covered with the paste prepared with soil, cattle –dung and weeds (equal amount of each) the turnings were given at fortnightly interval to promote aeration and to maintain optimum moisture and temperature. The pit was covered after each turning.

Enrichment

The enrichment with carrier based N fixing and P solubilizing biofertilizer was done at the time of 2nd turning (after 30 days) 500gm of each biofertilizer per ton of composting material. The inoculation was done through sprinkling the suspension of biofertilizers in water.

Control

Corresponding control was also maintained in another pit for comparison in which inoculation with cellulolytic culture inoculants and enrichment with biofertilizer was not followed.

Maturity

The compost of inoculated pit became ready within 75 days. The compost of both the pits was analyzed for their nutritional and microbial values (Table -1).

A field experiment was conducted to study the impact of biocompost application sugarcane crop

1. 2/3 RDN through inorganic source.

2. 100% RDN through inorganic source.

3. 1/3 RDN through biocompost + 2/3 RDN through inorganic source.

4. 1/3 RDN through biocompost.

5. Control (no amendments).

Replication	Four
Plot size	6x 5.4 sq m
Design	Randomized Block Design
Varieties	Cos 767, CoS 96268, CoS 8436, CoSe 97264

Observations Recorded

The data on yield and quality of sugarcane was recorded at 10 month of crop (February).

Result and Discussion

The results are summarized given in table - 2.

Biocomposting Technology

It is evident from the table that the compost produced by inoculation with cellulolytic culture and enriched with biofertilizers was having low organic carbon percent (24.25) as compared with no inoculation (30.0). Concomitant with decrease in organic carbon in inoculated, the nitrogen percent was increased (1.72) whereas in uninoculated it was 1.20. Relatively the C: N ratio was also narrowed (14.10) in inoculated as compared to control (25.0). Likewise other nutrients like phosphate, potash, sulphur, iron, zinc and copper percent in inoculated compost were higher than the uninoculated compost. The microbial value was about 8 times higher in inoculated and enriched compost as compared to control. The beneficial effect of cellulolytic culture and enrichment with biofertilizers has already been reported by Gaur et. Al, (1982) and Gaur (1987) with crop residues and by Tiwari. et. Al, (1989) with dairy farms wastes.

Impact of Biocompost Application On Yield And Quality Of Sugarcane

It is clear from the experiment results at Sugarcane Research Institute, Shahjahanpur (Table- 2) that 1/3 RDN through biocompost +2/3 RDN through inorganic source gave significantly higher yield (> 10%) against 100 percent RDN through inorganic source. Furthermore, the 1/3 RDN through biocompost alone (without any other dose of RDN) gave significantly higher yield over control (>25 %). Slight improvement in juice quality was also observed in the treatments with biocompost application.

Table1. Effect of Microbial Techniques of Composting On the Quality of Biocompost (Pressmud)

S.No.	Nutrients value (percent)	Microbial technique (inoculated)	Control (uninoculated)
1.	Organic carbon	24.25	30.0
2.	Nitrogen	1.72	1.20
3.	C : N ratio	14.1	25.0
4.	Phosphate	1.56	1.04
5.	Potash	1.25	0.90
6.	Sulphur	1.58	1.28
7.	Iron	0.27	0.18
8.	Zinc	0.42	0.26
9.	Copper	0.012	0.006
10.	Mirobial value	5.5x 106/g	8x 105/g

Table2. Effect of Biocompost Application On yield and quality of sugarcane early (Cos 767, CoS 97264) and mid-late (CoS 8436, CoS 96268) varieties.

S.No	Treatments	Yield t/ha				Sucrose%
		CoS 767	CoS 96268	CoS 8436	CoS 97264	
1	2/3RDN through inorganic	62.37				17.16

2	100% RDN through inorganic	70.87				17.15
3	1/3 RDN through biocompost + 2/3 through inorganic	78.23				17.18
4	1/3 RDN through biocompost alone	56.25				17.20
5	Control (no input)	44.44				17.14
	SE	2.714				0.0211
	CD	6.25				NS.3
	CV	5.32				0.150

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