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Effect of Fungal Culture with Inorganic Nitrogen and Phosphate Fertilizers on Decomposition of Sugarcane Trash - A Recycling Technology

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Abstract **– After sugarcane harvesting, burning of sugarcane trash in Maharashtra, India is a regular and well known practice among farmers. Due to burning of the trash, the soil microflora kills, the environment gets polluted. As reports said that the % organic carbon in soil goes on decreasing day by day, the soil fertility also decreased. Instead of burning if the trash is buried at the same location for decomposition with certain treatments, the levels of N.P.K. will increase. Decomposition of sugarcane trash to convert it into good compost is cheap source of organic carbon for crop in soil. The present investigation was focused on natural decomposition of trash in the harvested area of sugarcane field. Trash was treated with Urea and single superphosphate followed by irrigation to enhance the decomposition process. After three days the trash was treated with fungal culture of *Aspergillus niger, Aspergillus awamori, Penicillium crysogenum,* & *Trichoderma viridae* along with organic compost. Within ninety days it was observed that, very good compost with 0.42% nitrogen, 0.11% phosphate, 0.32% potash, 0.36% organic carbon was developed as compared to control.**

Keywords **– Compost, Trash, Fungal Culture, Recycling Technology.**

I. INTRODUCTION

Organic composting is a nature's way of slowly recycling soil life; however the soil are getting depleted of the humus resources that have been slowly deposited by natural decomposing of the plant and animal waste. Sugar industries and its ancillary units in our country play a vital role in the economic development of the rural area. Indian sugar industries produce several bi products viz. press mud, bagasse, filter cake that contain high organic carbon, considerable amount of N, P, K and micronutrients which are essential for crop plant growth. PMC (press mud compost) is good source of organic fertilizers. The prizes of fertilizers are increasing day by day and marginal farmers do not possess purchasing power of costly inputs that include applying fertilizers in time.

There is serious problem of sugarcane trash burning in all over the world. One of the examples is from Philippine where, 64 % of the sugarcane trash is burned which causes loss of 3.02 billion kg of sugarcane trash [1], [2]. Farmers are still burning the trash after harvesting of sugarcane. The sugarcane trash burning in the field increases the temperature of farm soil. Increasing the temperature of the farm destroys the beneficial organisms found in soil such as Rhizobium, Azetobacter, Azospirillum, PSB bacteria etc [3] and loss of nutrients also [4]. When trash is burned, the nitrogen is lost as nitrous oxides. Burned cane trash leads to near total loss of N at an average of 44 kg N/ha/yr. Some of the P and 70-73% of K are also lost through burning [5], [6]. Therefore decomposition of trash is an alternative. The process of decomposition and stabilization of solid organic waste occurs in nature. Compost is defined as well rotted manure that contains decomposed organic matters. It contain higher amount of major nutrients. Compost is biological process, in which aerobic and anaerobic

microorganisms decompose organic matter and lower the ratio of carbon and nitrogen (C: N ratio). So it is urgent need to withdraw the burning habit of farmers by supporting the effective alternative. Sugarcane filter cake could be used directly as fertilizer [7]. Decomposition of sugarcane trash to enhance micronutrient and maintaining soil flora is a part of trash management. Van Antwerpen and Meyer (1998) various fertilizers and trash management treatments on soil macronutrients were reported earlier [8]. Filter cake decomposition requires more time [9]. So in the present study, some fungal organisms were used to decompose sugarcane trash.

II. MATERIALS AND METHODS

During this investigation we used sugarcane trash, urea, Single superphosphate and culture containing Aspergillus niger, Aspergillus awamori, Penicillium crysogenum, Trichoderma viridae having spore count $5x10^{-7}$ CFU/ gm. The separate pure cultures were grown in laboratory by using Czapac Dox medium. Broth culture of fungi was prepared. 75 ml of each culture was mixed with 700 gm of lignite powder gives 1 kg fungal culture. 8 kg such fungal culture was prepared for treatment. Three acre sugarcane harvested field with trash was taken for treatment and decomposition progress was checked. Two different treatments were used for decomposition.

Treatments

2.1. *Treatment 1*

In one acre area of harvested sugarcane field, 30 kg of nitrogen (in the form of urea) and 40 kg of phosphate (in the form of single superphosphate) was broadcasted over trash and field was irrigated. Simultaneously 4 kg of fungal culture was mixed in 500 kg of organic compost. 40% moisture was maintained by using water. After 3 days the mixture was also broadcasted over sugarcane trash. Later irrigation was done after 15 days interval.

2.2. *Treatment 2*

All practices were same as that of treatment 1 except nitrogen and phosphate fertilizers.

2.3. *Control*

All practices were same as that of treatment 1 except fungal culture, nitrogen and phosphate fertilizers.

III. RESULT AND DISCUSSION

The results were obtained after 90 days of decomposition. The good quality compost was formed which possessed following physical and chemical characteristics.

3.1. *Physical Characteristics:*

The rough trash was converted to fine textured compost. Color was also changed from gray to brown.

3.2. *Chemical:*

The trash treated with Urea, single superphosphate and fungal culture, showed better result than the trash treated with only culture and control (Trash only). The soil was analyzed along with decomposed trash. It was observed that the compost developed after the treatment with Urea, single superphosphate and fungal culture contained 0.42% N, 0.11% P, 0.32% K, 0.36% organic carbon and pH value of compost was 6.16.

The statistical analysis of data showed significant results for Nitrogen, Potassium, and Phosphorus (Table 1).

In treatment 1 and 2 the nitrogen was significantly increased by 5.41 and 13.51 % over control, respectively. In treatment 2 Phosphorus was decreased by 22.22 % while in treatment 1 it was increased by 22.22 % over control, while potassium was increased by 7.14 and 14.29 % over control, respectively. Organic carbon was neither increased nor decreased in treatment 2 while in treatment 1 it was decreased by 7.69 % over control. The results are supported by previous work carried out [10] where they mentioned that application of in-situ decomposed residues and by-products of industrial waste in combination with NPK enhanced the below and above ground biomass production, SOC stock and carbon pools. A controversial report was given [11]. They stated that Nutrient treatments did not affect trash decomposition or nutrient cycling in sugarcane agricultural environments field. There were highest carbon losses; Potassium was released in 85-93% of the total potassium while only 20% of the total nitrogen was released. The release of calcium and magnesium ranged from 40% to 60%, in sugarcane agricultural environments. There was no release of phosphorus. The higher nutrient release and sugarcane trash decomposition was due to greater decomposition of cellular contents. The results obtained from combining trash compost with chemical fertilizers on 50% basis was more helpful in improving the growth and yield of green chillies as compared to combining FYM in similar proportion [12]. Cane Trash, consisting of Sugarcane tops and leaves can potentially be converted into around 1kWh/kg, but is mostly burned in the field due to its bulkiness and its related high cost for collection/transportation. It it is conserved in the field, then as per conservation estimates, the bio energy potential of cane trash is around 9,475 GWh per year [13]. There for the present attempt of decomposition of sugarcane trash was made with certain additives for the benefit of farmers.

IV. CONCLUSION

The present findings conclude that, dry leaves turn into compost after treatment. Nitrogen, phosphorus, potash and organic matter are found in abundance in these leaves, which increase the fertility of soil. Further it was observed that in the treatment 1(Trash +N + P +Fungal Culture) better decomposition was observed over treatment 2 and control. The addition of Nitrogen source (Urea) and Phosphate source (Single superphosphate) enhanced decomposition and reduced the time of decomposition of sugarcane trash.

Table 1. Effect of Fungal Culture with Inorganic Nitrogen and Phoaphate Fertilizers on Decomposition of Sugarcane Trash.

Treatments	% N	%P	%K	% O.C.	pH of Compost
Control Trash only	0.37a+ 0.0004	0.09a+ 0.0004	0.28a+ 0.0005	0.39a+ 0.0005	5.82
Treatment 1 (Trash +N + P +Fungal Culture)	0.42c+ 0.0005 (13.51)	0.11c +0.0004 (22.22)	0.32c+ 0.0006 (14.29)	0.36+ 0.0004 (-7.69)	6.16
Treatment 2(Trash +culture)	0.39b+ 0.0005 (5.41)	0.07b+ 0.0003 (-22.22)	0.30b+ 0.0005 (7.14)	0.39a+ 0.0006 (0.00)	5.93
P value at 0.05%	6.99e-08	1.24e-06	7.27e-05	2.00e-04	
CD at 0.05%	8.10e-05	7.20e-04	9.40e-04	9.00e-04	

Data presented are mean of ten readings; value within the same column with different letters are significantly different at 0.05% p level by single factor ANOVA test followed by CD & Tukey's test. (Figures in parentheses indicate % increased (+) and % decreased (-) over control.

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