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DECOMPOSITION OF SUGARCANE HARVEST RESIDUE WITH DIFFERENT COMPOST CULTURES

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Abstract–This study was conducted by Krishi Vigyan Kendra, Bagalkot during 2020-21 and 2021-22 at Honnakatti village of Bagalkot and Mangalgudda village of Badami taluk respectively with ten sugarcane farmers. Three methods of trash decomposition were compared in this on farm testing. Farmers practice of retaining sugarcane trash/residue as technology option 1 (farmers practice), application of compost culture @ 6 kg /ac as technology option 2 (source: UAS Dharwad) and application of waste decomposer @200 lit/ac as technology option 3 (source: NCOF, Ghaziabad). The results of using three technological options (TO) over two years as on farm testing to decompose the sugarcane trash have been studied to study their impact. TO 1 being retention of Sugarcane trash, TO2 is application of compost culture @6kg/ac and TO3 is application of waste decomposer @200 l/ac. Among all the treatments it was found that, application of compost culture @ 6 kg /ac was proved to be better in enhancing organic carbon content of soil from 0.405 to 0.445, yield levels also increased from 100.57 to 110.7 t/ha, followed by use of waste decomposer and farmer's practice. Other parameters on Yield and economics were also computed using suitable statistical tools.

INTRODUCTION

Area under sugarcane in Bagalkot is increasing every year as the district is blessed with irrigation facility of three rivers namely Krishna, Ghataprabha and Malaprabha. According to the recent estimates, more than a lakh hectare is under sugarcane which consists of planted as well as ratoon cane it is next highest to Belgaum district in Karnataka with 12 active sugarcane crushing factories. The farmers in Bagalkot district usually burn the residues after harvesting the crop. Burning of sugarcane trash is a hazardous practice which has affected soil health, air, human health etc. leading to massive impact as well as monetary losses. Instead this sugarcane trash can be converted into compost. So far the management of trash is mainly through composting by the microbial consortium to decompose the trashes into valuable nutritious materials for soil health improvement and greenhouse gas reduction.

Sugarcane produces about 10 to 12 tonnes of dry leaves per hectare per crop. The detrashing is done on 5th and 7th month during its growth period. This trash contains 28.6%-organic carbon, 0.35 to 0.42% nitrogen, 0.04 to 0.15% phosphorus, 0.50 to 0.42% potassium. The sugarcane trash incorporation in the soil influences physical, chemical and biological properties of the soil. There is a reduction in soil EC, improvement in the water holding capacity, better soil aggregation and thereby improves porosity in the soil. Sugarcane trash incorporation reduces the bulk density of the soil and there is an increase in infiltration rate and decrease in penetration resistance. The direct incorporation of chopped trash increases the availability of nutrients leading to soil fertility. Sugarcane trash can be easily composted by using the fungi like *Trichurus, Aspergillus, Penicillium* and *Trichoderma.* Addition of rock phosphate and gypsum facilitates for quicker decomposition.

Therefore in-situ composting can be a good alternate to mitigate these problems. Some of the measures to deal with the problem can be creating awareness among the farmers about on and off farm utilization of sugarcane trash through training, demonstration, custom hiring of expensive machinery for chopping of stubble, technical follow up by extension personnel etc. Creating awareness among the farmers through mass media about eco loss and significance of the problem can be further help in handing the major concern on burning of sugarcane trash. This on farm testing was conducted with a broader perspective to promote organic farming and to assess the performance of compost cultures in trash decomposition in particular as appropriate composting technology which is economically viable, eco-friendly and socially acceptable is essential

This is considered as grown under the green cane trash blanket system where harvest residues (trash) are retained on the soil surface instead of being burnt. This is considered a more sustainable system, but relatively little is known about its effects on soil carbon (C) and nitrogen (N). As part of a study to understand the effects of trash retention on soil C and N dynamics, we measured the composition and decomposition of sugarcane trash in terms of dry matter (DM), C, and N in 5. Field experiments in contrasting climatic conditions in Queensland and New South Wales. The trash from newly harvested sugarcane contained large quantities of DM (7-12 t/ ha) and C (3-5 t/ha), which could be estimated from cane yield, and significant quantities of N (28-54 kg/ ha), which could not be predicted from cane yield. Trash quality was low (C : N ratio > 70) and it took a year for most of the trash to decompose. Cumulative thermal time was the variable most closely associated with cumulative DM and C decomposition. Variation in the rate of trash DM and C decomposition between sampling dates was partially related to temperature and rainfall at 2 of the 3 sites, but was considered to be influenced by other factors (such as soil, trash, and management) as much as by climate. There were 2 phases of decomposition: an early phase when C : N ratios were high and variable and net N loss or gain was not related to C loss; and a late phase when C : N ratios were much lower and similar across experiments and net N loss was related to C loss. The rate of N loss from trash during the first 12 months was slow (1 - 5 kg/ month), which would have been of little immediate significance for plant growth. The potential value of trash for soil N supply lies in cumulative effects over the medium-long term.

Sugarcane is a worldwide grown crop producing a large amount of residues in the form of molasses, bagasse and trash. The molasses and bagasse utilization technologies are well established and commercialized. Sugarcane trash (ST) is also a potential energy resource of biomass containing one-third energy that of sugarcane. However, its domestic applications are restricted due to lack of utilization awareness, technological impedance, harvesting difficulties and inadequate extension activities. (Powar *et al*, 2022)

Soil microbiota play a central role in decomposition of organic residue in soils, and the rate of this turnover can be increased by microbial enhancement using microbially enhanced compost extracts (Ingham 2005; Ryan 2003). Some of the fungal species known to aid in degradation of organic matter, and prevalent in mostsoils, are *Trichoderma* spp. and cellulose digesting brown rot fungi, such as *Coniophora prasinoides*, *C. puteana* (Highley, 1980) and *Cellulomonas* spp. (Lines-Kelly 2004). A compost extract from an inoculums source of compost which is likely to favour proliferation of relevant organisms (cellulolytic bacteria or fungi) may act to speed-up sugarcane trash decomposition. Some examples of dominant bacteria, such aslactic acid bacteria, *Bacillus* spp., *Micrococcus* spp., *Pseudomonas* spp., and dominant fungi, such as *Penicillium* spp., *Trichoderma* spp., *Aspergillus* spp., yeast, actinomycetes and *Streptomyces* spp. are reported in microbially enhanced compost extracts (Naidu *et al*. 2010).

MATERIALS AND METHODS

Compost cultures have been developed by various institutions and are available either in powder form, liquid form or in paste form (Which needs to be diluted with water). Hence, it was felt to assess the performance of these cultures.

This study was conducted by Krishi Vigyan Kendra, Bagalkot during 2020-21 and 2021-22 at Honnakatti village of Bagalkot and Mangalgudda village of Badami taluk respectively with ten sugarcane farmers. Three methods of trash decomposition were compared in this on farm testing. Farmers practice of retaining sugarcane trash/residue as technology option 1 (farmers practice), application of compost culture @ 6 kg /ac as technology option 2 (source: UAS Dharwad) and application of waste decomposer @200 lit/ac as technology option 3 (source: NCOF, Ghaziabad). Compost culture was applied to the trash after the harvest of cane where the trash is evenly spread on the fields after harvest be it mechanized or manual harvest. Farmers were advised to wet the trash spread over the field through sprinkler irrigation and the compost culture is sprinkled on the wet trash and then it is allowed to turn upside down. When all the trash is thoroughly wet, the culture is sprinkled and mulched with trash. It is mainly practiced in ratoon crop. While in waste decomposer culture, the microbial consortia was diluted with 200 l of water mixed with jaggery and allowed for five days and then it is applied to wet trash.

The time taken to convert trash into compost was also observed in terms of days to convert trash, organic content of soil before and after the application of cultures was also recorded. Yield and economics parameters such as cost of cultivation, gross returns and net return were calculated to arrive at conclusion.

RESULTS AND DISCUSSION

The results of on farm testing conducted during 2020-21 at Honnakatti revealed that, the organic content of the soil in farmers practice, application of waste decomposer and application of compost culture was 0.40 per cent, 0.43 per cent and 0.44 per cent respectively, similarly the yield levels were 99.4 t/ha, 109.50 and 105.9 t/ha respectively in T1, T2 and T3 respectively. The time taken to convert the trash into compost was 207, 98 and 140 days in T1, T2 and T3 respectively.

The cost of cultivation did not vary much as the application of compost culture and waste decomposer add around Rs. 1000 extra to the cost of cultivation. Gross return from T1, T2 and T3 were 238500, 262800 and 254100 respectively indicating the increased yield levels due to conversion of trash into compost which enhanced the yield levels i.e., about 10 t/ha in T2 and 6.5t/ha in T3. Accordingly the B:C ratio also indicated higher returns (1:3.30) from T2, 1:3.21 from T3 and 1:3.03 from T1 .

Similar trend was observed during 2021-22 also. The pooled data indicate that, about 10t/ha additional yield was obtained due to application of compost culture and about 6t/ha from application of waste decomposer.

The results of demonstrations on in-situ sugarcane trash composting in 10 farmers field shows that, in-situ sugarcane trash composting has increased the organic carbon, available N, available P and available K content in soil. The economic analysis showed that the gross income increased to 4.7 percent with the benefit cost ratio of 2.99 over control plot. Management of soil organic matter is critically important for sustaining the long-term productivity of cropped soils. Key components of such management include an effective system of crop residue management, appropriate cultivation practices, and fertilization regime that replace nutrients lost through crop harvesting (Follett *et al.* 1987). The concept of environmental sustainability demands that this be achieved without diminishing the quality of soil, air, and water resources in the wider environment. Sugarcane trash contains around 60% of the total above-ground plant N (Chapman *et al*. 1994) and when it is burnt, >70% of the carbon (C) and N are lost to the atmosphere (Mitchell *et al*., 2000). Consequently, with retention of trash, N and C may be accumulating in the soil. In the present study a small effort in this direction was made to assess the performance of compost cultures in decomposing the harvest residue of sugarcane.

Feedback on the technologies assessed, useful characters as well as constraints of technology revealed that, Waste decomposer is a good and economically affordable media to all the farmers. It is difficult to apply waste decomposer uniformly to the fields in large areas where sprinkler irrigation is adopted. While Socio-economic as well as administrative constraints for its adoption revealed that, uniform application of waste decomposer needs flood irrigation. Repeated multiplication of the waste decomposer culture is said to be not much efficient and waste decomposer culture is not available in local fertilizer shops. Maintaining

Table 1. The trends in composting

Parameters	2020-21			2021-22			Pooled data		
	T1	T2	T3	T1	T2	T3	T1	T2	T3
Yield (t/ha)	99.4	109.50	105.9	101.75	111.90	107.25	100.575	110.7	106.575
Time taken to convert trash to compost (DAT)	207	98	140	92	128	194	149.5	113	167
Organic carbon(%)	0.40	0.44	0.43	0.41	0.45	0.43	0.405	0.445	0.43
Cost of Cultivation (Rs./ha)	78579	79779	79379	83754	83354	82654	81166	81566	81016
Gross Return (Rs./ha)	238500	262800	254100	244200	268560	257400	241350	265680	255750
Net Return (Rs./ha)	159921	183021	174721	161546	184806	174046	160733	183913	174383
BC Ratio	3.03	3.30	3.21	2.96	3.21	3.09	2.99	3.255	3.15

optimum soil moisture requires more labours and even distribution of waste decomposer is difficult.

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