STUDY OF DIFFERENT DECOMPOSERS WITH BIOCHAR IN SUGARCANE TRASH MANAGEMENT FOR ENHANCING RATOON SUGAR CANE (*Saccharum officinarum*. L.) YIELD

Abstract:

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. The present study aimed Assessing of different decomposers with biochar in sugarcane trash management for enhancing ratoon sugar cane yield at farmers field. Average of two years in data in table revealed that yield, economics of soil properties and nutrients. It is observed that. Average of two years root length 4.83cm and Sugarcane yield 97.92 t/ha recorded higher yield with application of Compost Culture 15 kg/ha and biochar 1 t/ha with retention of Sugarcane trash residue followed by application of liquid discomposure 15lit/ ha with biochar 1 ton/ha (93.79t/ha) compared to farmer practice if burning of trash in field itself Same trend followed economics which is 18.23% increase over the farmer practice (trash burning) and same trend followed in economics and available of nutrients

Keywords: Sugarcane, Biochar, Seed cane yield, trash burning

Introduction

" Sugarcane is the oldest crop known to mankind which is a major cash crop of tropical and sub tropical regions. It plays a decisive role in the economy of sugarcane growing countries. India is the second largest producer of sugarcane in the world provides major source of sugar and wider variety of raw materials for sugar and its allied industries. As a C4 plant type, sugarcane have high potential of accumulating crop biomass up to 381 t/ha sugar. Sugarcane plant - ratoon system is very common in subtropical regions of India that produce sugarcane trash around 8-10 t ha^{-1}. The millable cane is being supplied to sugar mill after detrashing. It is the biggest challenge for the farmers to handle with huge amount of trash left in the field left after crop harvest. In India sugarcane trash generate about 2% of the total crop residues with a total amount of 93 Mt. The data on crop residue generated, residue surplus and burnt annually in different

states of India indicates that about 140.84 Mt of crop residue are surplus and about 92.81 Mt of crop residues are being burnt across the India annually" (Pandey, 2018). "The large portion of the residues is burnt on-farm. Burning of residue causing pollution to the atmosphere and creating many health problems for soil and living life. Indian farmers in sub tropical region are taking only one to two ratoon crops" (Hariyono et al., 2020; Adeel and Jadhav, 2024; Surendran et al., 2026). "The continuous plant - ratoon system increased soil compaction, reduced soil fertility and cane yield. Several researchers have emphasized the benefits of predominantly agricultural techniques such as mulching of crop residue, green manuring, and agro forestry efficiently and having positive influence on crop productivity and in the maintenance of farming system sustainable under tropical and sub-tropical climatic conditions" (Yadav and Yaduvanshi, 2001)]. "Sugarcane yields in India have remained steady in recent years, and productivity has decreased due to a decrease in soil organic matter content" (Singh et al. 2007). "Sugarcane straw decomposition is a key process to investigate in order to guide management decisions, because it controls nutrient mineralization, contributes to GHG emissions to the atmosphere, and provides substrate for soil organic matter (SOM). Several factors directly or indirectly affect the decomposition rate, with the most important being the amount and quality of straw, edaphoclimatic conditions, and management practice. It is the oldest crop known to mankind which is a major cash crop of tropical and subtropical regions. It plays a decisive role in the economy of sugarcane growing countries. India is the second largest producer of sugarcane in the world provides major source of sugar and wider variety of raw materials for sugar and its allied industries. As a C4 plant type, sugarcane have high potential of accumulating crop biomass up to 381 t/ha sugar content up to 14.5 per cent and it also produces 10 to 12 t of dry matter ha-1, which could be obtained from the detrashed dried sugarcane leaves on 5th and 7th months. The detrashing operation would also facilitate easier adoption varied intercultural operations in grown up sugarcane crop" (Hariyono et al., 2020). In addition, the studies by Srivastava *et al.*, (2024) revealed that the cane trash contains 68 per cent of organic matter, 0.42 per cent of nitrogen, 0.15 per cent of phosphorous, 0.57 per cent of potassium, 0.48 per cent of calcium and 0.12 per cent of magnesium and 25.7, 2045 and 236.4 ppm of zinc, iron and manganese respectively (Annual Report, 2020). However, conventionally the cane trashes are burnt after harvest which results in inadequate plant population, environmental pollution through carbon generation and exhaustion. Hence, utilization of available cane trash through viable, appropriate

and economical decomposition technology it could be effectively utilized for sustainable productivity of sugarcane.

Methodology

Krishi Vigyan Kendra for Haveri district of Karnataka state is situated in Hanumanamatti. It organized various activities mandated by Indian Council of Agricultural Research (ICAR), New Delhi *viz.* On-farm testing (OFT) during 2020-21 and 2021-22 was conducted on specific identified problem to come up with the result that which of the technologies tested is more suitable to the resources available in the district and cost effective. This is a form of participatory study where farmers' perspective is given most importance. To conduct this trial, the Ranebennuru block of Chodyanapura village was chosen based on the maximum area under sugarcane cultivation. The farmers were randomly selected by adopting simple random sampling technique with the consideration of cultivation sugarcane crop with trash burning common practice for affecting soil health and lack of knowledge on sugarcane trash composting. Totally the trial was conduct in three farmers' field. Accordingly University of Agriculture science, Dharwad developed compost culture was taken as for assessment, with farmer practice technology option TO1- Burning of trash/residue (Farmer practices),TO2 - Retention of residue & apple. of compost culture @15 kg/ha. Along with 1 tonn of bio char ha, TO3-Retention of residue + appln. of Waste decomposer 10 lit/ ha along with 1 tonn of bio char per ha is the consortium of microorganisms recommended for composting all the agro-wastes. For one ton of trash, 15 kg inoculums are recommended per ha. "Waste decomposer was released from National Centre for Organic and Natural Farming. The waste decomposer contains beneficial microorganisms from cow urine dung for soil health reviver. It can be used for quick composting from organic waste, soil health improvement and as plant protection agent. These two decomposer were given to the selected farmers to practice in their field under on farming practices. As part of this programme, the demonstrations, on and off campus training programmes were also organized for the beneficiaries to explain about how to prepare the sugarcane trashes and apply the various decomposer in trashes and what are all the other procedures to be followed in decomposing method" (Hariyono et al., 2020).

Results & discussion

The data on ratoon crop revealed that various trash management techniques significantly increased numbers of tillers, plant height, Tiller population and cane yield in trash decomposing treatments as compared to no trash (Control). The result of assessment of different Compost Culture along with biochar for management of Sugarcane trash for ratoon sugarcane yield Average of two years (2020-21 and 2021-22) in maintained in table perusal of the data in table revealed that yield economics of soil properties and nutrients. It is observed that. Average of two years Plant height at harvest 212.40 (cm), Tiller population 95.67 (000 / ha), root length 4.83cm and Sugarcane yield 97.92 t/ha recorded higher yield with application of Compost Culture 15 kg/ha and biochar 1 t/ha with retention of Sugarcane trash residue followed by application of liquid discomposure 15lit/ ha with biochar 1 ton/ha (93.79t/ha) compared to farmer practice if burning of trash in field itself Same trend followed economics which is 18.23% increase over the farmer practice (trash burning) (Table-2). Gross income (₹ . 2,35,008 / ha) and net income Rs. 1,73,078/ ha and B:C ratio 3.80 same trend as followed are confirming with those of Yadav *et. al*. (2014). This is due to application of biochar-inoculant along with biochar ensured Substantial accumulation of essential of nutrients, Key major responsible for all Physiological activities favoring early crop vigor growth and better Crop establishment in terms of augmented yield improvement.. The reasoning could be due to additional incorporation of organic rich bio-char in combination of compost culture positive influence on varied soil-physic-chemical characteristics and also results in considerable addition of macro and micro nutrients for effective growth and establishment of Sugarcane crop. Available Nitrogen (386.5 kg / ha), Available P_2O_5 (39.8 kg / ha), Available K_2O (205 kg/ha), Available Zn (0.65 ppm / ha), Available Fe (2.82 ppm / ha). Soil organic carbon and available Macro and Micro nutrients was average of two years increasing trends might have been attributed to better decomposition of trash by soil microbes under improved nutrition results Zhang *et al*. (2024) also reported benefits in soil-fertility status with crop-residue incorporation(Table 2.)

Observations	TO1 Burning of trash/residue (Farmer practices)	TO2 Retention of residue & apple. of compost culture @15 kg/ha along with 10 tonnes bio char	TO3 Retention of residue + appln. of liquid decomposer 10 Lit along with 10 tonnes bio char
Plant height at harvest 212.40	197.83	212.40	204.70

Table: 1: Available nutrients (kg/ha) for assessing of different decomposers with Bio char in sugarcane Trash management for enhancing ratoon sugar cane yield (Average of two years)

(cm)			
Tiller population 95.67 (000 / ha)	88.85	95.67	91.71
Root length4.83 (cm)	3.41	4.83	4.54
Cane yield 97.92 (t/ha)	86.71	97.92	93.79
Gross Cost (Rs./ha)	2,08,104/-	2,35,008/-	2,25,096/-
Cost of Cultivation (Rs./ha)	57,930/-	61,930/-	60,255/-
Net Return (Rs./ha)	1,50,170/-	1,73,078/-	1,64,841/-
B : C ratio	3.59	3.80	3.73
Increased yield (%)	-	12.92	8.16

Table 2: Study of different compost with biochar in sugarcane trash management on yield and economics for enhancing ratoon sugar cane yield (Average of two years)

Observations	**Initial Soil properties (After harvest of plant cone)**	**TO1 Burning of trash/residue (Farmer practices)**	**TO2 Retention of residue & apple. of compost culture @ 15 kg/ha and 1 tonn bio char/ha**	**TO3 Retention of residue + appln. of 10 lit liquid decomposer with 1 tonn bio char/ha**
Texture	Clay loam	Clay loam	Clay loam	Clay loam
pH (1.2.5)	8.20	8.23	8.05	8.10
EC (Ds/m)	1.50	1.67	1.42	1.46
OC (%)	0.54	0.42	0.72	0.70
Available N (kg/ha)	344.6	312.4	386.5	355.6
Available P_2O_5 (kg/ha)	35.8	31.8	39.8	37.6
Available K_2O (kg/ha)	201.0	191.7	205.6	202.5
Available Zn (ppm)	0.42	0.46	0.65	0.62
Available Fe (ppm)	1.95	1.85	2.82	2.79

Conclusion

Sugarcane straw decomposition is an important process to study in order to guide management decisions since it regulates nutrient mineralization, contributes to GHG emissions into the atmosphere, and serves as a substrate for soil organic matter. Several factors influence decomposition rate, the most important of which are straw quantity and quality, edaphoclimatic conditions, and management approach.

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