Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; SP2: 207-209

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In-situ sugarcane trash composting: A boon for soil fertility and cane yield (*Saccharum officinarum*)

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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 has been based on primary data collected from the sugarcane grower to highlight the constraints to this issue and to study the influence of in-situ sugarcane trash composting on soil fertility and cane yield. Traditional norms, lack of awareness on utilization of trash, lack of machinery and high cost of machinery emerged as the major reasons for the ongoing practice. The results of demonstrations on in-situ sugarcane trash composting in 10 farmers field shows that, in-stiu sugarcane trash composting has increased the organic carbon, available N, available P and available K content in soil from 0.42 to 0.45%, 317 to 331 kgha^{-1}, 14.5 to 16.1 kgha^{-1} and 520 to 551 kgha^{-1} respectively. The average cane yield of 92.5 tha^{-1} was recorded in demo field and it was 4.8 percent over control plot (88.3 kgha^{-1}). The economic analysis showed that the gross income increased to 4.7 percent with the benefit cost ratio of 2.99 over control plot. 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.

Keywords: Sugarcane trash, in-situ composting, constraints, environment, soil fertility, cane yield and farmers income

Introduction
Sugarcane is one of the important cash crops in India and play pivotal role in both agriculture and industrial economy of the country. India is one of the largest producers of sugar and is in close competition with Brazil for the top position. In India sugarcane is cultivated over an area of 4 million hectares and the production is estimated to be about 325 MT with the productivity of 70 tha^{-1}. In Tamil Nadu, sugarcane is cultivated in an area of 3.22 lakh hectares with an average productivity of 101.8 tha^{-1}. India needs to produce 320 MT of sugarcane to cater the crushing requirement of sugar factories operated in the country. Greater attention is given only in improving the sugarcane yield and not much awareness on sugarcane trash recycling and more labour cost for disposing the trash (Prasanthrajan Mohan and Duraisay Ponnusamy, 2011) [7]. Besides the loss of organic matter and plant nutrients, burning of crop residue also causes atmospheric pollution due to the emission of toxic gases such as methane, carbon dioxide that poses threat to humans and the ecosystem.

According to study conducted by Centre for Sustainable Agriculture, Hyderabad, the burning a tonne of straw has released 3 kg particle matter, 60 kg CO, 1460 kg of CO_2, 199 kg of ash and 2 kg of SO_2 in the air. Apart from this, the practice causes massive loss in soil both in term of nutrients and microorganisms. As per the study conducted by the Department of Soils, PAU, Ludhiyana in 2010, the nutrient losses by burning of sugarcane trash was estimated to be around 6-7 kg of N, 1-1.7 kg of P, 14-25 kg of K and 1.2-1.5 kg of S. This lead to an additional expenditure of Rs.150 crore per year to replenish the soil. Preservation of organic carbons is must as these boost the water holding capacity in the soil. About 38 lakh tonne of organic carbon is lost every year due to burning of soil and 32 kg of urea, 5.5 kg of DAP and 51 of potash per acre is lost (Mitchel *et al*., 2011) [5].

In Tiruchirapalli district of Tamil Nadu, sugarcane is cultivated in more than 3000 ha with an average productivity of 100 tonnes ha^{-1}. Though, a several training and awareness programmes were imposed on utilization of sugarcane trash by Krishi Vigyan Kendra, Sirugamani and state government, the burning of trash is still going. In-situ composting and sugarcane trash mulching can be a good alternate to mitigate the problems.

Though mulching and in-situ composting is better option for sugarcane trash management, but the time taken is little high. In recent years, integrated system of composting with bio inoculants and subsequent incorporation in field to overcome the problem is receiving worldwide attention (Sweta *et al*., 2010; Dahiya *et al*., 2003) [10, 3]. Microbial consortium such as effective microbes (EM) or Bio mineralizer are that capable of making a residue into valuable nutrient sources. Simple biotechnological process, which could provide a 'win-win' solution to tackle the problem of safe disposal of waste as well as the most needed plant nutrients for sustainable productivity is described. Keeping in view the above mentioned facts, the present study was undertaken to highlight the constraints in its management in Tiruchirappalli and to educate the farmers on influence of insitu sugarcane trash composting on soil fertility and cane yield through implementing special programme on demonstration of instiu sugarcane trash composting in farmers field.

Materials and Methods

A study was undertaken in sugarcane growing areas of Tiruhchirappalli district in Tamil Nadu. The villages covered under the study were Lalgudi, Mannachanallur and Manikandam Taluk in Tiruchirappalli district. The taluk and villages were selected purposively, where random sampling technique was followed to select the respondents. It was decided to draw samples from all categories of farmers i.e. small (< 2 ha), medium (2-4 ha) and large (>4 ha). The criteria of selection based on the consideration that the farmers were growing sugarcane continously and marked them to earn income. A random technique was followed to select 25 sugarcane growers from each group in each villages. The demonstration on instiu sugarcane trash composting and its influence on soil fertility and sugarcane yield was conducted at Kumulur village of Lalgudi block, Tiruchirappalli district under ICAR-Sponsored special programme sanctioned during 2017-18 in first ratoon sugarcane crop in 4.0 ha (10 demo). The demonstration was conducted after the harvest of cane crop during Rabi 2018. Sugarcane trash in the harvested field was crushed with off bearer cum trash mulcher, followed by 20 kg of TNAU Biominerlizer sprinkled over the trashes. Frequent irrigation was done to accelerate the composting process. The farmers practice of burning the trash after the harvest of sugarcane was considered as check plot. Initial and post harvest soil samples were collected from demo plot and check for analyzing soil nutrient status. Sugarcane yield and income was recorded to interpret the demonstrations.

Result and Discussion

Contraints in sugarcane trash utilization

The contraints in utilization of sugarcane trash for in-situ composting were diversified. Again the constraints diffères from individual to individual depending upon their social status, family, requirement, family obligation, cultural background and economic position. The responses were scored on 4 points scales fitting to the statements as very much (4), much (3) not so much (2) and not at all (1).

Table 1: Constraints in Sugarcane trash utilization

S. No.	Farmers attitude	S.F. M.S	M.F. M.S	B.F. M.S	Total MS
1.	Traditional norms	3.7	3.5	3.7	3.6
2.	Lack of awareness	3.5	3.2	3.6	3.4
3.	Timely non availability of inputs	3.4	3.5	3.4	3.4
4.	Lack of timely advice and guidance by extensional personnel	3.1	2.9	3.2	3.1
5.	In adequate training to famers	3.5	3.6	3.6	3.6
6.	Inadequate demonstration of new technology	3.6	3.7	3.0	3.4
7.	Deficiency in technical know-how	2.9	3.0	3.0	3.0
8.	Inadequate follow up service	2.5	2.7	2.6	2.6
9.	Lack of machinery	3.6	3.5	3.7	3.6
10.	High cost of technology	3.2	3.3	3.3	3.3
11.	Costly machines	3.5	3.1	3.4	3.3
12.	Labour shortage	3.1	3.1	3.0	3.1

M.F.-Marginal farmers, S.F. -Small farmers, B.F- Big farmers, M.S.-Mean score

Traditional norms, lack of awareness through inadequate training, lack of machinery and high cost of machinery were identified as major reasons on sugarcane trash utilization (Table 1). However, most of them were related to government actions that need to be stream lined to make use of sugarcane trash effectively. All farmers favoured its mixing in the soil. So it was found that all the sampled farmers were against burning of sugarcane trash in principle, but majority of them could not find any solution at an individual level and were seeking government assistance for disposing it off (Arya and Sahuh, 1984; Prasanthrajan Mohan and Duraisay Ponnusamy, 2011) [2, 7].

Effect of in-stiu sugarcane trash composting on soil fertility

Organic carbon (OC) content in soil is a key factor for its health and fertility. The positive impact of in-situ composting on soil organic carbon in soil was observed under demonstration (Table 2). The in-situ trash composting resulted in increased OC content of soil from 0.40 to 0.45 per cent, which amounts to an average increase of 7.1 per cent (Thorburn *et al*., 2001) [11]. Trash burning decreased the organic carbon content, such that at the end of first ratoon the organic carbon content was to 0.42 per cent compared to 0.40 percent in check. This might be due to loss of dry matter and carbon during the burning processes of trash. According to Mitchell *et al*., (2000) [6] depending on the severity of the fire, 77-97 per cent of the dry matter and carbon may be lost by burning sugarcane trash. On contrary, the retention of trash in the field will increase the organic carbon through decomposition process in the long term.

The positive influence on available soil nutrient status was observed in demo field (Table 2). This might be due to build up of N by in-situ composting of trash by microbes. Thorburn *et al*., (2001) [10] reported similar results of N buildup under crop residue management. Increased available P content in soil was observed in demo plot, while, the check plot recorded decreasing trend. This increased available P might be

attributed by bio mineralizer, which mobilizes the unavailable P content in the soil through production of organic acids and also P from trash. Considerable changes in available potassium (K) also recorded in demo plot. The effective management of trash results in increased potassium content as the trash is a rich source of K. The results are in accordance with the findings of Graham *et al*., (2000) [4].

Sugarcane yield

The average yield of first ratoon sugarcane crop was taken as base data to assess the impact of in-stiu sugarcane trash composting on sugarcane yield and income. The yield data revealed that the cane yield increased substantially in demo plot (92.5 tha^{-1}) compared to control plot (88.3 tha^{-1}) and the average increase in yield was 4.8 per cent. The increased cane yield might be due to increased soil nutrient status and over all positive effect of in-situ sugarcane trash composting on soil health. Thorburn *et al*., (2001) [11] also confirmed that the trash mulching sustains the sugarcane productivity and soil health.

Economics

Significant the highest net income of Rs. 157125/- and highest benefit: cost ratio 2.99 was recorded in the demo field. Based on the experiment it can be concluded that the in-situ sugarcane trash composting recorded more yield and profits. Similar trend was observed by Suma and Savitha (2015) [9].

Table 2: Influence of in-situ sugarcane trash composting on soil fertility, cane yield and economics

S. No.	Parameters	Initial*	Control*	Demo*	% increase*
1.	pH	8.3	8.3	8.1	-
2.	EC (dSm^{-1})	1.3	1.2	1.31	-
3.	Organic carbon	0.40	0.42	0.45	7.1
4.	Available nitrogen ($kgha^{-1}$)	309	317	331.9	4.7
5.	Available phosphorus($kgha^{-1}$)	13.8	14.5	17.1	17.9
6	Available potassium ($kgha^{-1}$)	526	540	554.3	2.6
7.	Yield (tha^{-1})	-	88.3	92.5	9.4
8.	Net income ($Rs.ha^{-1}$)	-	143665	157125	17.8
9.	BC Ratio (Rs.)	-	2.76	2.99	8.6

*Mean value of 10 locations

Conclusion

It was evident from the study that the major constraints like traditional norms, lack of awareness on technology and high cost of machinery were faced by the farmers. Thus there is a need to organize training programme, proper demonstration of improved technology to encourage the farmers for utilization of sugarcane trash so that the farmers become aware of the technology for utilization of sugarcane trash. It was evident that in-situ sugarcane trash composting had positive influence on soil fertility, yield of cane and income of the farmers. It is the right time to make them aware of the technologies for utilization of sugarcane trash and produce compost, which not only helps in protecting the environment, but also provide economic gain.

References

1. Arjinder Kaur. Crop residue in Punjab agriculture: Status and constraints. J Krishi Vigyan. 2017; 5(2):22-26.
2. Arya SRS, Sahuh SL. New technology of rainfed agriculture and identification of constraints on its adoption in mid hills of U.P. Agril situation in India. 1984; 39(7):487-496.
3. Dahiya Rita, R, Malik S, Jhorar BS. Effect of sugarcane trash and enriched sugarcane trash mulches on ratoon cane yield and soil properties. Journal of the Indian Society of Soil Science. 2003; 51(4):504-508.
4. Graham MH, Haynes RJ, Meyer JH. Changes in soil fertility induced by trash retention and fertiliser applications on the long-term trash management trial at Mount Edgecombe. Proceedings of the South African Sugar Technologists Association. 2000; 74:109-113.
5. Kaur A. Crop residue in Punjab agriculture -Status and constraints. J Kirshi Vigyan. 2017; 5(2):22-26
6. Mitchell RDJ, Thorburn PJ, Larsen P. Quantifying the loss of nutrients from the immediate area when sugarcane residues are burnt. Proceedings of the Australian Society of Sugar Cane Technologists. 2000; 22:206-211.
7. Prasanthrajan Mohan, Duraisamy Ponnusamy. Addressing the challenges of sugarcane trash decomposting through effective microbes. International conference on food engineering and biotechnology. IPCBEE. 2011; 9:229-233.
8. Samantrary SK, Prustry S, Raj RK. Constraints in vegetable production–experience of tribal vegetable growers. Indian Res. J Ext. Edu. 2009; 9(3):32-34.
9. Suma R, Savitha CM. Integrated Sugarcane Trash Management: A Novel Technology for Sustaining Soil Health and Sugarcane Yield. Advances in Crop Science and Technology. 2015; 3(1):160.
10. Sweta, Rahul Kmar, Singh BL, Verma Deepshikha. Integrating microbial composting and vermicomposting for effective utilization of by-product of sugarcane processing industries. J Bioremediation. 2010; 14(3):158-167.
11. Thorburn PJ, Robertson FA, Lisson SN, Biggs JS. Modeling decomposition of sugarcane surface residues and the impact on simulated yields. Sustainable Management of Soil Organic Matter, 2001, 74-82.