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Effect of urban compost on yield of seasonal-sugarcane in *Vertic inceptisol*

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Abstract
Field experiment was conducted during the year January 2020 – January 2021 at Post Graduate Institute Research Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri (M.S.) to study the effect of urban compost on yield of *seasonal*-sugarcane in *Vertic inceptisol.*
The field experiment was laid out in randomized block design and incubation study was done in completely randomized design with three replications and eight treatments. There were five levels of nitrogen 0, 25, 50, 75 and 100% of recommended dose of nutrients (RDF) with 100% P_2O_5, 100% K_2O along with organic manures *viz.,* FYM and urban compost.
The application of 75% N through urban compost and remaining 25% N through urea, with recommended dose 115 kg P_2O_5 and 115 kg K_2O ha^{-1} in *seasonal*-sugarcane significantly increased cane and CCS yield followed by GRDF, 100% N through Urban compost and 50% N through Urban Compost + 50% N through Urea. Yield attributing characters *viz.,* no. of tillers, total cane height, Millable cane height, no. of Millable canes, girth and length of internodes, yield of cane and CCS were significantly higher in 75% N through urban compost + 25% N through urea (T_6) treatment.
In view of the economics, Application of 75% nitrogen through urban compost and remaining 25% nitrogen through urea along with recommended dose of phosphorus@115 kg ha^{-1} + potassium@115 kg ha^{-1} to *seasonal* - sugarcane found beneficial for increase in growth parameters (millable cane height, total plant height, tillers, No. of millable cane, number, length and girth of internodes), uptake of macro & micro nutrients, nutrient use efficiency, net returns and yield of sugarcane grown in *Vertic Inceptisol*. However, the treatment of 25-50%N through urban compost and remaining 75-50% N through urea along with recommended dose of P and K to *seasonal* -sugarcane found beneficial for increased in agronomic efficiency and B:C ratio of *seasonal* –sugarcane.

Keywords: Urban compost, sugarcane, yield, *Vertic Inceptisol*

Introduction
Sugarcane is an economically important cash crop in Indian agriculture, accounting for 47.53 lakh hectares of gross cultivated area (Anonymous, 2020-21) and 5.7 percent of total agricultural GDP on average during the last five years (www.eagri.tnau.ac.in/eagri50/AGRO301). There are 716 sugar plants in India (cooperative - 326, private - 347, and public - 43), of which 526 are operational and have a daily sugar production capacity of 3843 tonnes (Anonymous, 2018). It is the second-largest agro-based industrial sector (5.7% of agriculture GDP) next only to cotton textile (6% of agriculture GDP). Sugarcane industries are directly responsible for a large number of jobs in the rural economy. Sugarcane species such as *Saccharum barberi* originated in India. Sugarcane is the world's primary source of white crystal sugar, contributing nearly 80% of global sugar output. More than 11.43 million hectares of sugarcane land are under cultivation in Maharashtra, producing 101.59 million tonnes of sugarcane with an 81.53 t ha^{-1} yield. (Singh, 2020) [14].
India contributes roughly 18.18 percent of global sugarcane production and 17% of global sugar production, and is the world's second-largest sugarcane producer, after only Brazil (FAO statistics, 2019) [5]. Maharashtra is a leading state, second only to Uttar Pradesh in cane production with the most co-operative and private sugar factories. The sugarcane industry in Maharashtra is the second largest agro-based industry in the state, second only to cotton, in terms of improvements and desired changes in the social, economic, educational, and political sectors in rural areas.
Climate change is likely to have a significant impact on sugarcane output, with up to a 20% drop in sugarcane productivity estimated for each degree of temperature increase, regardless of where sugarcane is cultivated (Sivanappan, 2012) [15].

The best climatic environment for growth is a hot climate with enough moisture. Ripening is defined as the accumulation of sucrose content in the internodes of basal to apical leaves (Shukla, *et al.,* 2018). However, the Maharashtra state was affected by severe drought in 2015-16, which hampered sugarcane and sugar production, and national sugar production fell to around 25.1 million tonnes (Sugarcane in India, 2015-16). As a result of the fluctuating trend in sugar production, the development of climate-resilient technologies must be prioritised in order to sustain crop yield and sugar production.

Intensive cultivations, which generate a steady decline in soil organic carbon, are strongly connected to the degradation of soil health and the increased risk of erosion. Because of the need to reduce disposal costs, recycle nutrient components, and increase the organic matter content of soils, agronomic exploitation of organic wastes such as animal effluents, sewage-sludge, and composts has been rising (Martens *et al.*, 1992) [9]. When compared to other countries with similar environmental conditions, our country's sugarcane yield is significantly lower. This could be attributed to a variable of variety, the most significant of which is fertiliser usage balance, which results in low yield. Sugarcane is a heavy-feeding crop that consumes the majority of the soil's essential nutrients, raising production costs (Nawaz *et al.,* 2017) [12]. Sugarcane cultivation necessitates proper fertigation with sufficient nitrogen, phosphorus, and potassium fertiliser.

Organic amendments have the potential to improve the long-term viability of agricultural output on mineral soils, however the impact of organic amendments on nitrogenous fertilizer requirements must be established. This results can be used to assess the efficacy of organic amendments and alter nitrogen applications in addition to specific amendments (Mabry McCray *et al.*, 2017) [11]. Organic amendments may also boost the availability of soil nutrients (such as nitrogen) for plant growth (Rezaei Rashti *et al.*, 2017) [13].

Pollution is caused by a variety of organic wastes. When garbage, sewage, and industrial pollutants are piled up or inadequately disposed of, they endanger the health of humans, plants, and animals. Detergents, water softeners, borates, phosphates, and other salts are abundant in sewage. If untreated sewage is put over agricultural fields, it will damage plant development. Dilution of sewage to a proportion of 1:1000 will make it safe for growing vegetables and crops. Organic waste can be used or disposed of in a number of ways, including (i) burning, (ii) composting, (iii) recycling, and (iv) reuse as animal feed.

Sewage is a liquid waste that differs widely in intensity and makeup from town to town, as well as in the habits of various communities. Bathroom and kitchen wastes are common in metropolitan areas. Domestic sewage is relatively absent from chemicals that could be harmful to plants. At only higher doses, synthetic detergents are harmful to plant growth. However, if industrial effluents are mixed with home sewage, various harmful compounds may be introduced into the sewage, depending on the type of industry. Uncontrolled disposal of sewage and other liquid wastes originating from home water consumption, industrial wastes containing a range of contaminants, agricultural effluents from animal husbandry, and drainage of irrigation water and urban run off are the most common causes of soil pollution (Le Riche, 1969) [8]. In addition to rising sewage production due to population expansion, per capita waste water production is increasing as well, reaching 600 litres per day per person across many cities. At the same time, it contains a lot of organic and mineral contaminants, up to 10 litres of wet sludge per person per day or around 50 kg of dry solids per year (WHO Scientific Group on the Treatment and Disposal of wastes, 1967) [17]. Decomposable organic matter in domestic and municipal sewage causes a demand on the oxygen resources of receiving waterways.

Soil amendment with urban solid waste compost made from organic wastes such as household trash offers a management method that could help to prevent soil organic matter loss. Furthermore, the recycling and subsequent use of organic wastes in soil reflect an attempt to address the major environmental issues created by residue accumulation (Courtney and Mullen, 2008) [6].

Many researches (Garcia-Gomez *et al.*, 2002; Soumare *et al.*, 2003) [7, 16] have demonstrated that applying mature compost at a moderate rate promotes plant growth and soil physical qualities, as well as increasing available soil nutrient levels. Previous research found that adding compost to soil increased organic matter (Melero *et al.*, 2007) [10].

The review of above studies in respect of various organic sources, there is a need to study the effect of urban waste compost on long-duration crops like sugarcane to examine the alternate source of FYM and its impact on soil health.

Material and Methods

Details of field experiment

The representative plant samples were collected plot wise of experimental plot. The experiment was laid out in a randomized block design with 8 treatments and 3 replications. The gross plot size was 3.6m. x 3.2m. and net plot size was 3.15m. x 3.0m. The recommended inter row spacing of 120 x 60 cm was adopted. The general recommended fertilizer dose of wheat is 250:115:115 kg ha-1 N, P_2O_5 and K_2O respectively along with FYM @20 t ha^{-1}. All the nutrients, Urban Compost and FYM were added in soil as per treatment. The treatment comprised of:

Tr. No.	Treatments
T_1	Absolute control
T_2	Only FYM @ 20 t ha^{-1}
T_3	Only urban compost @ 20 t ha^{-1}
T_4	GRDF (250:115:115:: N:P_2O_5:K_2O kg ha^{-1} + 20 t ha^{-1} FYM)
T_5	100% N through Urban compost
T_6	75% N through Urban compost + 25% N through Urea
T_7	50% N through Urban compost + 50% N through Urea
T_8	25% N through Urban compost + 75% N through Urea

Healthy sugarcane setts of variety CoM.-0265, recently released by university obtained from Soil Science and Agril. Chemistry Department, M.P.K.V, Rahuri. The recommended dose of fertilizers for Seasonal- Sugarcane was 250:115:115 kg ha^{-1} N, P_2O_5 and K_2O. The N was given through urea, urban compost and FYM, P_2O_5 through single super phosphate and K_2O through muriate of potash in respective treatments, however N was given @ 25%, 50%, 75% and 100% kg ha^{-1} through urea and *vice-versa* through urban compost, respectively. Organic manures *i.e*. farm yard manure was given @ 20 t ha^{-1} and urban compost was given @ 20 t ha^{-1} to the T_2 and T_3 treatments, except T_1 treatment (Absolute control). In order to study the yield and yield attributing characters of seasonal-sugarcane at different stages.

Results and Discussion

Application of compost and inorganic fertilizer combination recorded highest yield of sugarcane which are presented in table 1. The cane yield of sugarcane was significantly increased (213.77 t ha^{-1}) in the treatment T_6 (75% N through urban compost + 25% N through urea) over T_1, T_2, T_3 and T_8. However, treatments of T_4, T_5 and T_7 (200.18, 206.20 and 204.86 t ha^{-1}, respectively) were at par with treatment T_6.

The top yield of sugarcane was significantly increased (38.46 t ha^{-1}) in the treatment T_6 (75% N through urban compost + 25% N through urea) over T_1 and T_2. However, treatments of T_3, T_4, T_5, T_7 and T_8 (31.97, 36.30, 34.47, 37.81 and 35.87 t ha^{-1}, respectively) were at par with treatment of T_6.

The CCS yield was significantly increased (23.68 t ha^{-1}) in the treatment T_6 (75% N through urban compost + 25% N through urea) over T_1, T_2 and T_3. However, treatments of T_4, T_5, T_7 and T_8 were at par.

Nawaz *et al.*, (2016) [19] also supported that the enhanced sugarcane production obtained with integrated nutrients supply, which was mostly owing to their positive effect on various yield contributing features such as height, number of tillers, and internodes.

Table 1: Effect of urban compost on Cane, top and CCS Yield of Seasonal-Sugarcane

Tr. No.	Treatment	Yield (t ha^{-1})		
		Cane	Top	CCS
T_1	Absolute Control	116.33	23.08	12.29
T_2	Only FYM@20 t ha^{-1}	136.49	26.86	14.44
T_3	Only urban compost @20 t ha^{-1}	188.88	31.67	20.20
T_4	GRDF(250:115:115:: N:P_2O_5:K_2O + 20 t ha^{-1} FYM)	200.18	36.30	21.90
T_5	100% N through Urban compost	206.20	34.47	22.79
T_6	75% N through Urban compost + 25% N through Urea	213.77	38.46	23.68
T_7	50% N through Urban compost + 50% N through Urea	204.86	37.81	22.76
T_8	25% N through Urban compost + 75% N through Urea	198.03	35.87	22.09
	$S.E_m$ (±)	4.63	2.34	0.71
	CD at 5%	14.02	7.08	2.15

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