Effect of Enriched Bio Digested Bone Sludge Compost on Growth and Yield of Sugarcane

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Abstract- A field experiment was conducted at farmer's field in Varagurpet, Chidambaram taluk, Cuddalore district, Tamil Nadu during February 2021 to February 2022 to standardize the enriched bio digested bone sludge compost for maximizing the yield of sugarcane. It was observed that growth and yield components of sugarcane crop were remarkably influenced by application of various levels of bio digested bone sludge compost. Application of bone sludge compost @ 5 t ha^{-1} + pressmud compost @ 5 t ha^{-1} + balance N and K through fertilizers (T_8) proved its excellence by registering superior growth characters of sugarcane *viz.*, plant height, number of tillers clump^{-1} and dry matter production at various stages of observation and yield attributes *viz*., cane girth and single cane weight which resulted in higher cane yield of 185.12 kg ha^{-1}. Considering the results of the present investigation it can be concluded that application of bone sludge compost @ 5 t ha^{-1} + Pressmud compost @ 5 t ha^{-1} + balance N and K through fertilizers registered highest values in growth parameters, yield attributes and thumping yield in sugarcane.

Key words: Bone sludge compost, pressmud compost, phosphorus and poultry manure compost.

INTRODUCTION

In India, sugarcane is grown under diverse agro climatic situations covering an area of 4.86 m ha producing 399 million tonnes of sugarcane with an annual productivity of 82 t ha^{-1}. In Tamil Nadu, it is grown over an area of 0.13 million ha with production and productivity of 12.80 million tonnes and 102.73 t ha^{-1} respectively (Directorate of Economics and Statistics, 2020).

The declining trend of total production from the same land, diminishing response in increase of food grains to applied fertilizer nutrients are due to imbalanced, inappropriate and indiscriminate use of chemical fertilizers leading to heavy withdrawal of nutrients from the soil resulted in poor soil fertility besides, deterioration of soil health and degradation of land. There has been a steady decline not only in the productivity but also in recuperative capacity of soil (Yadav *et al*., 2013). Sustainable production could be achieved only when factors leading to continued maintenance of soil health are taken care of. Hence, the complimentary role of organics as supplements to chemical fertilizers are important for keeping the soil health in order to harness the potential yield in sugarcane (Lency, 2001).

Hence, an efficient nutrient management is an essential strategy for stability and increasing productivity of sugarcane. To explore the potentiality of sustainable use of organic and inorganic nutrient sources, there is an urgent need to test locally available alternative sources of energy such as bone sludge compost, pressmud compost, and poultry manure compost for increasing production of sugarcane and soil health as well. Hence, the present investigations were carried out to study the effect of bio digested bone sludge compost combined with locally available organic sources along with inorganic fertilizers and standardize them for maximizing the yield of sugarcane.

MATERIALS AND METHODS

A field experiment was conducted at farmer's field in Varagurpet, Chidambaram taluk, Cuddalore district, Tamil Nadu. The experimental field was geographically located at 11º24' N latitude and 79º44' E longitude at an altitude of + 5.79 m above mean sea

level. The soil of the experimental field is classified as *Udic Chromustert* (clay) according to FAO / UNESCO (1974). The initial analysis of the experimental soil concluded that clay with neutral in reaction (pH = 7.2), with low soluble salts (EC = 0.52 dS m^{-1}), low in available nitrogen (231 kg ha^{-1}), medium in available phosphorus (20.80 kg ha^{-1}) and high in available potassium (290 kg ha^{-1}). The experiment was laid out in randomized block design with 3 replications. There were altogether 10 number of treatments *viz*.,T_1 - Bone sludge compost @ 2.5 t ha^{-1} + balance N and K through fertilizers, T_2 - Bone sludge compost @ 5 t ha^{-1} + balance N and K through fertilizers, T_3 - Bone sludge compost @ 7.5 t ha^{-1} + balance N and K through fertilizers, T_4 - Bone sludge compost @ 10 t ha^{-1} + balance N and K through fertilizers, T_5 - BSC @ 2.5 t ha^{-1} + Poultry manure compost @ 2.5 t ha^{-1} + balance N and K through fertilizers, T_6 - BSC @ 2.5 t ha^{-1} + Pressmud compost @ 2.5 t ha^{-1} + balance N and K through fertilizers, T_7 - Pressmud compost @ 5t ha^{-1} + balance N and K through fertilizers, T_8 - BSC @ 5t ha^{-1} + Pressmud compost @ 5 t ha^{-1} + balance N and K through fertilizers, T_9 - FYM @ 12.5 t ha^{-1} + Recommended NPK ha^{-1} (Traditional farmers practice) and T_{10} - Control (No nutrient supply). Sugarcane variety CO 11015 was chosen for the study. Bone sludge compost, Pressmud compost, Poultry manure compost, Farm yard manure and chemical fertilizers were applied in the respective plots as per the treatment schedule. Pressmud compost, poultry manure compost and FYM were obtained from farm unit of Department of Agronomy, Faculty of agriculture, Annamalai University, Annamalai Nagar. Bone sludge compost used in this study was obtained from Pioneer Jellice India Pvt. Ltd., Cuddalore. The recommended set of good agricultural practices for cane was adopted and the cane was harvested. For the estimation of sugarcane yield twelve months old cane was cut at ground level individually and weighed for each plot and converted to hectare basis and expressed in tonnes ha^{-1}. The recorded data were analyzed statistically with analysis of variance using Agres software with a critical difference at 0.05 level of probability.

RESULTS AND DISCUSSION

Growth attributes

Application of bone sludge compost @ 5 t ha^{-1} + pressmud compost @ 5 t ha^{-1} + Balance N and K through fertilizers (T_8) remarkably excelled other treatments in the growth attributes of sugarcane by registering higher plant height (404.11 cm), number of tillers (12.75) and dry matter production (61.08 t ha^{-1}). Excellent vegetative growth and development resulted in maximum plant height of sugarcane was influenced by application of mineral fertilizers along with organic manures *viz*., bone sludge compost and pressmud compost which increased plant height significantly due to the stronger role of N in cell division, cell expansion and enlargement which ultimately accelerated the vegetative growth of sugarcane. This result is in concomitance with the findings of (Usman *et al.,* 2012). The combined application of inorganic and organic manures could have helped in steady and balanced availability of nutrients at all stages of crop growth which might have enabled the leaf area duration to extend, thereby providing an opportunity for the plants to increase the photosynthetic rate and better light interception which in turn resulted in more vegetative growth of plants and higher accumulation of dry matter. Nitrogen and phosphorus are released more slowly through degradation of bone sludge and the compounds are available for longer period. The organic matter from bone sludge has the potential to mineralize the nutrients quickly. The results were in close conformity with the findings of Umesh *et al.* (2018) and Joginder *et al*. (2019).

Table 1. Effect of bio digested bone sludge compost on growth attributes of sugarcane

Treatments	Plant height At harvest (cm)	No. of tillers $clump^{-1}$	Dry matter production (t ha^{-1})
T_1 - Bone Sludge Compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers	290.92	9.27	41.14
T_2- Bone Sludge Compost @ 5 t ha^{-1} + Balance N and K through fertilizers	310.81	9.82	43.59

T_3- Bone Sludge Compost @ 7.5 t ha^{-1} + Balance N and K through fertilizers	347.81	10.92	50.59
T_4 - Bone Sludge Compost @ 10 t ha^{-1} + Balance N and K through fertilizers	365.64	11.42	53.84
T_5 - Bone Sludge Compost @ 2.5 t ha^{-1} + Poultry manure compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers	370.34	11.62	54.96
T_6 - Bone Sludge Compost @ 2.5 t ha^{-1} + Pressmud compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers	387.56	12.20	58.13
T_7- Pressmud compost @ 5 t ha^{-1} + Balance N and K through fertilizers	328.76	10.32	47.26
T_8 - Bone Sludge Compost @ 5 t ha^{-1} + Pressmud compost @ 5 t ha^{-1}+ Balance N and K through fertilizers	404.11	12.75	61.08
T_9- Traditional farmers practice FYM @ 12.5 t ha^{-1} + Recommended NPK ha^{-1}	272.65	8.77	37.94
T_{10} - Control (No nutrient supply)	197.65	6.20	21.69
S.Em(±)	5.18	0.17	0.77
CD (P=0.05)	15.50	0.50	2.29

YIELD AND YIELD ATTRIBUTES

The yield and yield attributes of sugarcane *viz.*, number of millable cane, cane girth and single cane weight were significantly influenced due to bio digested bone sludge compost application. Among the treatments tested, the higher yield attributes *viz.*, number of millable canes (1.17), cane girth (3.37 cm), single cane weight (1.72 kg) and the higher cane yield of 185.12 t ha^{-1} was recorded in the treatment T_8 (Bone sludge compost @ 5 t ha^{-1} + pressmud compost @ 5 t ha^{-1} + balance N and K through fertilizers).The rapid decomposition of P rich bone sludge (9.96% P) which enhanced the availability of P in soil and encouraged the root development by which feeding surface was increased and helped to translocate more amounts of photosynthates towards the sink and that plays a major role in converting more soluble sugars into starch and subsequently increased number of millable cane and single cane weight. Similar results were also reported by Teshome *et al.* (2015) and Kadarwati (2020).

The higher cane yield might be due to the slow release and continuous availability of nutrients from bone sludge and pressmud compost which relatively added large amount of macro and micro nutrients especially P, Ca and Mg which involved in enzyme activities and impart physio-chemical and biological activities of soil resulting in more photosynthates assimilation and subsequent conversion of assimilates into yield attributes in larger fraction which which in turn appreciably improved the number of millable cane population, single cane weight leading to higher cane yields. Similar findings of balanced supply of nutrients by integrating organics with inorganics for better growth, yield attributes and yield of cane were with the results of the study of Joginder *et al.* (2019) and Abhishek *et al.* (2020).

Table 2. Effect of bio digested bone sludge compost on yield and yield attributes of sugarcane

Treatments	No. of millable cane ha^{-1} (lakhs)	Single cane weight (kg)	Cane yield (t ha^{-1})
T_1 - Bone Sludge Compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers	0.88	1.42	120.39
T_2- Bone Sludge Compost @ 5 t ha^{-1} + Balance N and K through fertilizers	0.93	1.47	130.66
T_3- Bone Sludge Compost @ 7.5 t ha^{-1} + Balance N and K through fertilizers	1.02	1.56	154.92
T_4 - Bone Sludge Compost @ 10 t ha^{-1} + Balance N and K through fertilizers	1.06	1.60	163.73
T_5 - Bone Sludge Compost @ 2.5 t ha^{-1} + Poultry manure	1.07	1.63	168.60

compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers			
T_6 - Bone Sludge Compost @ 2.5 t ha^{-1} + Pressmud compost @ 2.5 t ha^{-1} + Balance N and K through fertilizers	1.12	1.68	176.97
T_7-Pressmud compost @ 5 t ha^{-1} + Balance N and K through fertilizers	0.98	1.51	145.79
T_8 - Bone Sludge Compost @ 5 t ha^{-1} + Pressmud compost @ 5 t ha^{-1}+ Balance N and K through fertilizers	1.17	1.72	185.12
T_9- Traditional farmers practice FYM @ 12.5 t ha^{-1} + Recommended NPK ha^{-1}	0.84	1.38	105.64
T_{10} - Control (No nutrient supply)	0.56	0.97	56.50
S.Em(±)	0.013	0.012	2.70
CD (P=0.05)	0.04	0.04	8.07

CONCLUSION

Considering the above results of the present investigation, it can be concluded that application of bone sludge compost @ 5 t ha^{-1} + pressmud compost @ 5 t ha^{-1} + balance N and K through fertilizers imposed to sugarcane registered with the higher values in growth parameters, yield attributes and yield of sugarcane without affecting the soil fertility.

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