IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
e ISSN-0976-593X Volume **11** | Issue 2 | July, 2016 | 359-363

DOI: 10.15740/HAS/IJPS/11.2/359-363
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RESEARCH ARTICLE

Response of manures and industrial by-products for cane yield and post harvest NPK status

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SUMMARY

Field experiment was conducted in clay loam soil at Periyanellicollai village at Chidambaram taluka, Cuddalore district, Tamil Nadu. The soil of Periyanellikollai was classified as *Typic Haplustert* comes under Kondal series having sandy loam texture. The available nutrient status was low in N, medium in P and K. The treatments considered of T_1 – Seasoned pressmud @ 25 t ha^{-1}, T_2 – T_1 + Enriched gypsum @ 1 t ha^{-1}, T_3 – T_2 + $ZnSO_4$ @ 37.5 kg ha^{-1}, T_4 – T_1 + Lignite fly ash @ 25 t ha^{-1}, T_5 – T_1 + Vermicompost @ 5 t ha^{-1}, T_6 – Vermicompost @ 5 t ha^{-1} + enriched gypsum @ 1 t ha^{-1}, T_7 – T_6 + $ZnSO_4$ @ 37.5 kg ha^{-1}, T_8 – Vermicompost @ 5 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}, T_9 – Biocompost @ 5 t ha^{-1}, T_{10}-T_9 + Enriched gypsum @ 1 t ha^{-1}, T_{11} – T_{10} + $ZnSO_4$ @ 37.5 kg ha^{-1}, T_{12} – T_9 + Lignite fly ash @ 25 t ha^{-1}, T_{13} – FYM @ 10 t ha^{-1}, T_{14} – recommended dose of fertilizer. All the plots were applied with recommended of dose of fertilizers 275:62.5:150 of N, P_2O_5 and K_2O kg ha^{-1}. The highest cane yield of 169.74 t ha^{-1} was obtained with T_3 received seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1}. The highest content of post harvest nitrogen (278 kg ha^{-1}) and post harvest phosphorus (19.3 kg ha^{-1}) was maximum T_3 receiving seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1}. The post harvest available potassium (156.4 kg ha^{-1}) was recorded in treatment T_4 (Seasoned pressmud @ 25 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}).

Key Words : Seasoned pressmud, Enriched gypsum, $ZnSO_4$, Lignite fly ash, Yield

How to cite this article : Venkatakrishnan, D. (2016). Response of manures and industrial by-products for cane yield and post harvest NPK status . *Internat. J. Plant Sci.*, **11** (2): 359-363, **DOI: 10.15740/HAS/IJPS/11.2/359-363**.

Article chronicle : Received : 05.02.2016; **Revised :** 01.06.2016; **Accepted :** 28.06.2016

India is the second largest producer of sugarcane cultivating 5.09 million ha of land the production of 347.7 million tonnes of cane per year. In India 2.2 per cent of total cropped area is occupies by sugarcane. The productivity is 68.34 t ha^{-1} (Agricultural Statistics at a Glance, 2013). The country's requirements by 2025 A.D. has been projected at 625 mt which means that there is need to raise the productivity of sugarcane and sustain the same (Sundara, 1998). Integrated nutrient management (INM), involves the integrated use of mineral fertilizer together with organic manures/industrial agricultural wastes in suitable combination complementing each other to optimize input use and maximize production and sustain the same without impairing the crop quality of soil health. It enables gainful utilization of wastes or under utilized renewable resources. The present study was designed to find out the effect of soil and nutrient management practices involving organics, by-product and fertilizers on yield of

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sugarcane and also post harvest N, P and K status.

MATERIAL AND METHODS

The field experiment was conducted in farmers field in Periyanellikollai village (clay loam) of Chidambaram taluk, Cuddalore district, Tamil Nadu. Soil properties are given in Table A.

Table A : Initial soil properties of experimental field

Properties	Value
Coarse sand (%)	20
Fine sand (%)	12
Silt (%)	38
Clay (%)	29
Textural class	Clay loam
Taxonomical classification	*Typic Haplustert*
pH	8.5
EC (dSm^{-1})	1.2
Organic carbon ($g\ kg^{-1}$)	6.5
CEC [c mol (P^+) kg^{-1}]	31.5
$KMnO_4$-N ($kg\ ha^{-1}$)	264.9
Olsen-P ($kg\ ha^{-1}$)	16.5
NH_4OAc – K ($kg\ ha^{-1}$)	138.25

The experiment was laid out in a Randomized Block Design in the year 2014. The treatments includes T_1– Seasoned pressmud @ 25 t ha^{-1}, T_2 – Seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1}; T_3 – Seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + zinc sulphate @ 37.5 kg ha^{-1}, T_4 – Seasoned pressmud @ 25 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}, T_5 – Vermicompost @ 5 t ha^{-1} + seasoned pressmud @ 25 t ha^{-1}, T_6 – Vermicompost @ 5 t ha^{-1} + enriched gypsum @ 1 t ha^{-1}; T_7 – Vermicompost @ 5 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + zinc sulphate @ 37.5 kg ha^{-1}, T_8 – Vermicompost @ 5 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}, T_9 – Biocompost @ 5 t ha^{-1}, T_{10} – Biocompost @ 5 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + zinc sulphate @ 37.5 kg ha^{-1}, T_{12} – Biocompost @ 5 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}, T_{13} – Farm yard manure @ 10 t ha^{-1}, T_{14} – NPK alone (RDF). All plots received recommended dose of inorganic fertilizers. The cane harvested from each experiment was weighed and expressed at tonnes per hectare (t ha^{-1}). The post harvest soil samples were collected from each experimental plot after harvest of crops at 0-15 cm depth soil samples shade-dried, ground and sieved through 2 mm sieve were used for analysis by following the standard procedures. The composition of seasoned pressmud, enriched gypsum, FYM, biocompost, lignite fly ash are furnished in Table B.

Table B : NPK content of materials

Materials	N	P	K
Seasoned pressmud (%)	1.26	38.3	1.46
Enriched gypsum (%)	1.3	3.85	1.5
FYM (%)	0.79	0.92	0.80
Biocompost (%)	2.0	2.0	3.0
Lignite fly ash ($mg\ kg^{-1}$)	0.28	–	4.3

RESULTS AND DISCUSSION

The results of individual and joint scaling test obtained in this investigation are :

Plant cane yield

Cane yield varied from 121.75 to 169.74 t ha^{-1} (Table 1). Among the treatments, the highest cane yield of 169.74 t ha^{-1} was obtained with T_3 receiving seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1}. The increase sugarcane yield due to application of organic manures can be attributed to the increased availability of all major nutrients in the soil. In sugarcane cultivation the cane yield is the ultimate product that decider the benefit accrued out of it. The higher response of sugarcane due to the application of organic manures may be attributed to the availability of plant nutrients in manifolds by the solubilizing effect of the decomposing manures with steady release of plant nutrients over longer periods, resulted in higher cane yields. The combined application of gypsum with pressmud might have improved the infiltration rate and water stable aggregates and ultimately the crop yield. Further, in any reclamation package of study soils, drainage is an important component for the removal of the soluble salts from the rhizosphere. Gypsum is applied to ameliorate salt affected soils, the reaction takes place and loss of exchangeable (Na^+) occurs and calcium will take the place of sodium on exchange complex. Similar results were observed by Patil *et al.* (2004). The application of manures such as seasoned pressmud, FYM and biocompost might have improved the physical conditions of soil by reducing bulk density and increasing soil macropore for better root proliferation with consequent increase in DMP (Patil and Shingate, 1981) and finally reflected on cane yield. This is in agreement with the findings of Shankaraiah and Kalyanamurthy (2005). The appreciable increase in cane yield due to

addition of seasoned pressmud is attributes for improvement in various growth and yield attributes such as height, weight and girth of millable cane at harvest. These findings are in accordance with the findings of Indirajith (1995) and Srivastava *et al.* (2006).The reasons for increased yield could be ascribed to the direct influence on zinc availability for crop uptake besides role of zinc in the synthesis of tryptophan and production of auxin and IAA which help in cell division and elongation (Singh *et al.*, 2000). Veluchamy *et al.* (1994) recorded yield improvements upto 60 kg $ZnSO_4$ ha^{-1}. Bangar *et al.* (1991) reported increase in cane yield due to 50 kg

Table 1 : Influence of composts and industrial by products on cane yield (t ha^{-1})

Treatments	Cane yield (t ha^{-1})
T_1 – Seasoned pressmud	154.25
T_2 – Seasoned pressmud + enriched gypsum	164.20
T_3 – Seasoned pressmud + enriched gypsum + $ZnSO_4$	169.74
T_4 – Seasoned pressmud + lignite fly ash	160.03
T_5 – Vermicompost + seasoned pressmud	166.85
T_6 – Vermicompost+ enriched gypsum	139.02
T_7 – Vermicompost + enriched gypsum + $ZnSO_4$	148.52
T_8 – Vermicompost + lignite fly ash	133.10
T_9 – Biocompost	130.70
T_{10} – Biocompost + enriched gypsum	144.64
T_{11} – Biocompost + enriched gypsum + $ZnSO_4$	150.67
T_{12} – Biocompost + lignite fly ash	135.41
T_{13} – Farm yard manure	127.36
T_{14} – Recommended dose of fertilizer	121.75
Mean	146.56
S.E.±	5.22
C.D. (P = 0.05)	10.73

Post harvest available N, P and K

Table 2 : Influence of composts and industrial by products on post harvest available nitrogen, phosphorus and potassium

Treatments	Post harvest available N (kg ha^{-1})	Post harvest available P (kg ha^{-1})	Post harvest available K (kg ha^{-1})
T_1	271	18.2	132.4
T_2	275	18.7	134.1
T_3	278	19.3	130.7
T_4	274	18.5	156.4
T_5	277	18.8	138.6
T_6	259	17.7	125.2
T_7	262	17.0	128.0
T_8	254	16.1	147.1
T_9	251	14.8	123.8
T_{10}	260	17.9	126.4
T_{11}	264	17.3	130.2
T_{12}	258	16.5	150.2
T_{13}	253	15.2	124.6
T_{14}	249	14.1	119.8
Mean	236.15	17.14	131.27
S.E.±	9.38	0.61	4.65
C.D. (P = 0.05)	19.30	1.25	9.57

$ZnSO_4$ ha^{-1} and Rakkiyappan *et al.* (2007) also stated that improvement in cane yield is due to 25 kg $ZnSO_4$ ha^{-1}.

The data on post-harvest soil, N, P and K presented in Table 2. The treatment (T_3). Seasoned pressmud @ 25 t ha^{-1} + enriched gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1} was associated with maximum post harvest available N (278 kg ha^{-1}), post harvest available P (19.3 kg ha^{-1}). In order to maintain the soil fertility and sustainable production, organic and industrial by-products play a vital role as they are sources of plant nutrients which are liberated in available form during mineralization. It is known that incorporation of organic matter helps in the stabilization of pH and resists the fluctuation of pH due to management practices. The post harvest soil status was reduced in the recommended dose of fertilizers applied treatment plot compared to initial values in all the experiments conducted. This might be due to the uptake of nutrients from the soil by crop. The increased nitrogen due to seasoned pressmud could be attributed to the steady mineralization of nitrogen from the stable nitrogen component of manures during the course of decomposition. The reports are in conformity with the findings of More (1994) and Varalakshmi *et al.* (2005). Application of zinc sulphate with seasoned pressmud was found to be superior in improving soil nitrogen (Indirajith, 1995). The increased availability of phosphorus with organic could be ascribed to other solubilizing effect of native soils phosphorus and consequent contribution to labile pool. The specific effect of manures in combination with inorganic fertilizers was in conformity with results of Bokthiar *et al.* (2001) and Jayamani (1992). At post harvest stage (Table 2) maximum available potassium (156.4 kg ha^{-1}) was recorded in treatment T_4 (Seasoned pressmud @ 25 t ha^{-1} + lignite fly ash @ 25 t ha^{-1}). The increase in available potassium content of post harvest soil with lignite fly ash application might be due to release of potassium present in lignite fly ash treatments. Similar results were also made by Ramasubramonian and Chandrasekaran (2001).

Conclusion :

The present study indicates that basal application of seasoned pressmud @ 25 t ha^{-1} + enriched gypsum 1 t ha^{-1} + zinc sulphate @ 37.5 kg ha^{-1} along with recommended dose of fertilizer (T_3) is the best. INM combination of sustained sugarcane productivity and soil fertility for N and P status an clay loam soil. The post harvest available K were maximum in the treatment seasoned pressmud @ 25 t ha^{-1} + lignite fly ash 25 t ha^{-1} along with NPK (T_4).

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