Available online at www.jpsscientificpublications.com
Volume – 2; Issue - 5; Year – 2016; Page: 747 – 751
DOI: 10.21276.iajmr.2016.2.5.4

Indo – Asian Journal of Multidisciplinary Research (IAJMR)
ISSN: 2454-1370

RESPONSE OF COMPOSTS AND INDUSTRIAL WASTES ON YIELD, YIELD COMPONENTS AND QUALITY OF SUGARCANE

D. Venkatakrishnan*,
Department of Soil Science and Agricultural Chemistry, Annamalai University, Annamalai Nagar – 608 002, Tamil Nadu, India

Abstract

Sugar industry in the country is the most viable and vibrant sector. It is imperative that average cane productivity can be improved. The proper application of fertilizers is the main crop production factor. Therefore, the concept of integrating all sources of plant nutrients made into a productive system to supplement nutrient mining in the soil. Field experiment was conducted in farmer's field of clay loam soil at Periyanellikollai village at Chidambaram taluk, Cuddalore district, Tamil Nadu. The soil was low in available N, medium in available P and medium in available K. In plant crop experiment, treatments consisted 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} and T_{14} – NPK alone (Recommended dose of fertilizer). All the plots received recommended dose of inorganic fertilizers. The design followed was Randomized Block Design (RBD). The treatments were replicated thrice. The highest value of individual cane weight was 1.40 kg $cane^{-1}$, number of millable cane was 127.53 (× 1000 ha^{-1}) cane yield was 166.85 t ha^{-1}, juice quality (Brix – 21.3 %, pol – 19.13 % Commercial Cane Sugar – 13.33 %) and Sugar yield of 22.62 t ha^{-1} were recorded in T_3 (Seasoned Pressmud @ 25 t ha^{-1} + Enriched Gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1}).

Key words: FYM, Seasoned Pressmud, Biocompost, Fly ash, Enriched Gypsum and Zinc Sulphate.

1. Introduction

India is the second largest producer of sugarcane with 35 million farmers cultivating 4 Mha of land and the production of 277.8 Mt of cane per year. In India 2.2% of total cropped area is occupied by sugarcane. The productivity is 66.93 t ha^{-1} with a recovery of 9.92% sugar (Agricultural Statistics at a Glance 2010). Integrated nutrient management (INM) involves the integrated use of mineral fertilizers 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 to crop quality of soil health. The present study was designed to find out the effect of soil and nutrient management practices involving organics industrial by products and fertilizers on yield attributes, cane yield and quality of sugar cane.

*Corresponding author: **D. Venkatakrishnan**
E. mail: mahemasree@yahoo.co.in
Received: 05.07.2016; *Revised*: 02.08.2016;
Accepted: 30.08.2016.

2. Materials and Methods

The field experiment was conducted in farmer's field in Periyanellikollai village (clay loam) of Chidambaram taluk, Cuddalore district, Tamil Nadu. The soil properties are given in Table 1. 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). Doses fixed for various treatments are based on the current recommendation prevailing in this part of region. Well matured canes fit for milling were counted in each experimental plot, in each experiment and expressed in thousands per hectare.

Table – 1: Properties of experimental field

Properties	Value
Coarse sand (%)	20
Fine sand (%)	13
Silt (%)	38
Clay (%)	29
Textural class	Clay loam
pH	8.51
EC (dSm^{-1})	1.20
Organic carbon (g kg^{-1})	6.50
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 mean values of five millable canes which were labelled to record cane weight in kg. The cane harvested from each experimental plot was weighed in kg per plot, computed and expressed as tonnes per hectare. The juice samples extracted by small mill in the laboratory and three canes selected at random at harvest of crop were filtered to remove the suspended extraneous materials and analysed. The brix reading of the filtered juice samples were recorded with the help of hand refractometers. The pol per cent readings of the filtrates were recorded with the help of polarimeter. The values of commercial cane sugar per cent were calculated by using the following formula CCS (%) = 1.022 S – 0.292 B; S = Sucrose per cent; B = Corrected brix per cent.

Sugar yield (t ha^{-1})

$$\text{Sugar yield (t ha}^{-1}) = \frac{\text{CCS per cent} \times \text{Cane yield (t ha}^{-1})}{100}$$

3. Results and Discussion

Individual cane weight (kg)

The height value of individual cane weight was observed with seasoned pressmud @ 25 t ha^{-1} + Enriched gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1} (T_3) registered cane weight of 1.40 kg $cane^{-1}$ (Fig. 1). The increase in yield characters of sugarcane due to integrated application of pressmud and inorganic fertilizers might be attributed. Individual cane weight was exerted by seasoned pressmud. This is an agreement with the findings of Dey *et al.* (1997).

Millable cane (× 1000 ha^{-1})

The treatment integrating Seasoned Pressmud @ 25 t ha^{-1} + Enriched Gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1} (T_3) significantly excelled all other treatments recorded 127.53 (×1000 ha^{-1}) millable cane (Fig. 2). Soil being deficient in zinc responded well to the application of zinc sulphate which caused increase in crop growth and ultimately on the improved number of millable canes. Improvement in NMC due to Zinc Sulphate application was reported by Jayabal *et al.* (1991) and Rakkiyappan *et al.* (2005).

Plant cane yield

The highest cane yield 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} (Table 2). The increase in sugarcane yield due to application of organic manures can be attributed to the increased availability of all major nutrients into soil. The increase in yield of cane with varying levels of application of organic sources with inorganics has been reported by Bangar *et al.* (1995).

Table - 2: 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 Flyash)	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.Ed.	5.22
CD (p = 0.05)	10.73

Quality parameters

Incorporation of seasoned pressmud @ 25 t ha^{-1} + Enriched Gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1} (T_5) registered the highest brix per cent of 21.3, pol per cent of 19.13, CCS per cent of 13.33 and sugar yield of 22.62 t ha^{-1} (Table - 3). This indicates that the juice quality parameters *viz.*, Brix, Sucrose and CCS per cent were significantly influenced by Zn nutrition. It is true that if the balance of oxidation: reduction process had tilted, the accumulation of sucrose in cane was impaired. Undesirable products like fatty acids, waxes and gats are formed during oxidation process and high molecular substances like starch and cellulose and formed during reduction process.

Table – 3: Influence of Composts and Industrial by products on quality parameters

Treatments	Brix (%)	Pol (%)	Commercial Cane Sugar (%)	Sugar yield (t ha^{-1})
T_1 (Seasoned pressmud)	19.98	18.25	12.81	19.75
T_2 (Seasoned pressmud + Enriched Gypsum)	20.65	19.08	13.45	22.10
T_3 (Seasoned pressmud + Enriched Gypsum + $ZnSO_4$)	21.30	19.13	13.33	22.62
T_4 (Seasoned pressmud + Lignite Flyash)	20.15	18.76	13.28	21.25
T_5 (Vvermicompost + Seasoned Pressmud)	21.08	19.10	13.36	22.29
T_6 (Vermicompost+ Enriched Gypsum)	18.36	16.75	11.75	16.99
T_7 (Vermicompost + Enriched Gypsum + $ZnSO_4$)	18.65	17.22	12.15	18.04
T_8 (Vermicompost + Lignite Fly ash)	18.16	16.05	11.10	14.77
T_9 (Biocompost)	17.90	16.01	11.13	14.54
T_{10} (Biocompost + Enriched Gypsum)	18.42	17.02	12.01	17.37
T_{11} (Biocompost + Enriched Gypsum + $ZnSO_4$)	19.19	17.95	12.74	19.19
T_{12} (Biocompost + Lignite Fly ash)	18.26	16.25	11.27	15.26
T_{13} (Farm Yard Manure)	17.75	15.95	11.26	14.14
T_{14} (Recommended dose of fertilizer)	17.02	15.89	11.11	13.70
Mean	19.05	17.38	12.19	17.99
S.Ed.	0.68	0.62	0.43	0.65
CD (p = 0.05)	1.39	1.27	0.89	1.33

It is clearly evident that optimum maintenance of oxidation -reduction process is required in accumulation of sucrose in canes (Veluchamy *et al.*, 1994). Increase in sugar yield

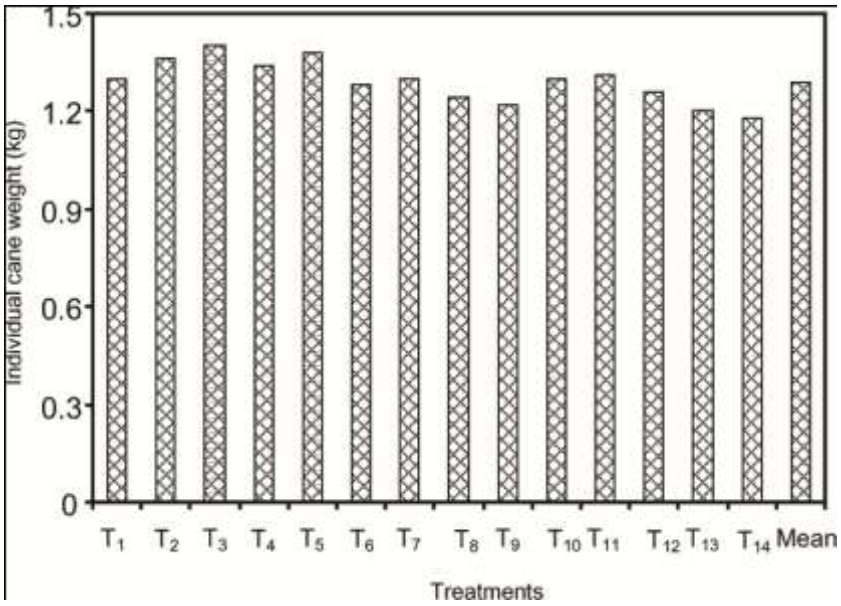

Fig. 1. Influence of composts and industrial by-products on individual cane weight (kg)

T_1 – Seasoned Pressmud; T_2 – Seasoned Pressmud + Enriched Gypsum; T_3 – Seasoned Pressmud + Enriched Gypsum + $ZnSO_4$); T_4 – Seasoned Pressmud + Lignite Fly ash; T_5 – Vermicompost + Seasoned Pressmud; T_6 – Vermicompost + Enriched Gypsum; T_7 – Vermicompost + Enriched Gypsum + $ZnSO_4$; T_8 – Vermicompost + Lignite Fly ash; T_9 – Biocompost; T_{10} – Biocompost + Enriched Gypsum; T_{11} – Biocompost + Enriched Gypsum; T_{12} – Biocompost + Lignite Fly ash; T_{13} – Farm Yard Manure; T_{14} – Recommended dose of fertilizer

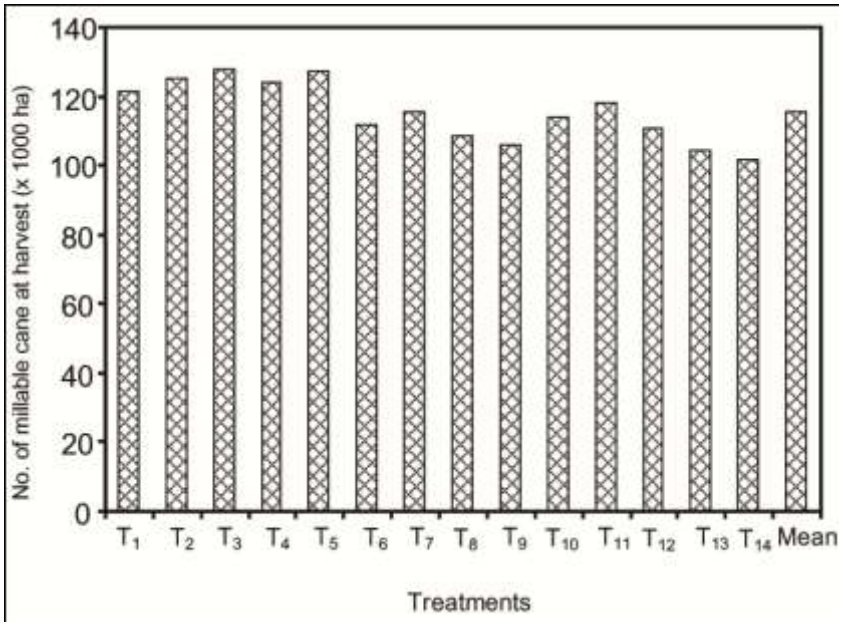

Fig. 2. Influence of composts and industrial by-products on number of millable cane at harvest (× 1000 ha^{-1})

T_1 – Seasoned Pressmud; T_2 – Seasoned Pressmud + Enriched Gypsum; T_3 – Seasoned Pressmud + Enriched Gypsum + $ZnSO_4$); T_4 – Seasoned Pressmud + Lignite Fly ash; T_5 – Vermicompost + Seasoned Pressmud; T_6 – Vermicompost + Enriched Gypsum; T_7 – Vermicompost + Enriched Gypsum + $ZnSO_4$; T_8 – Vermicompost + Lignite Fly ash; T_9 – Biocompost; T_{10} – Biocompost + Enriched Gypsum; T_{11} – Biocompost + Enriched Gypsum; T_{12} – Biocompost + Lignite Fly ash; T_{13} – Farm Yard Manure; T_{14} – Recommended dose of fertilizer.

due to application of zinc sulphate is due to high number of millable canes, length, girth and single cane weight and finally cane yield (Rakkiyappan *et al.*, 2005).

4. Conclusion

The present study indicates that the basal application of Seasoned Pressmud @ 25 t ha^{-1} + Enriched Gypsum @ 1 t ha^{-1} + $ZnSO_4$ @ 37.5 kg ha^{-1} (T_3) is the best INM combination for sustained sugarcane productivity yield attributes and quality on the clay loam soil.

5. References

1) Agricultural Statistics at a Glance. 2010. Ministry of Agriculture, Government of India.
2) Bangar, K. S., M. Ashok and S. L. Namdeo. 1995. Sugar yield, nitrogen and pressmud cake application in black clay soils. *Indian Journal of Sugarcane Technology*, 11 (2): 136 - 141.
3) Dey, P. L., S. N. Singh, S. K. Buragohain and M. P. Borthakur. 1997. Integrated effect of organic and inorganic fertilizers for cane yield and sugar production in spring planted sugarcane. *Indian Sugar*, 46 (3): 279 - 282.
4) Jayabal, V., N. Tamilselvan and S. E. Shah. 1991. Effect of Zinc and boron on the yield and quality of sugarcane. *Coop. Sug.*, 22 (10): 659 - 660.
5) Rakkiyappan, P., J. Indirajith, R. Radhamani and S. Thangavelu. 2005. Effect of Zinc on yield and quality of sugarcane. *Journal of Agricultural Research and Management*, 4: 80 - 81.
6) Veluchamy, M., A. Muthukrishnan, S. Sivakumar and M. Vijayaram. 1994. Influence of zinc and iron micronutrients on yield and quality of sugarcane. *Fertilizer News*, 39 (7): 39 - 41.