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ORIGINAL ARTICLE **OPEN ACCESS**

Combined Application of Sugarcane Pressmud and Biocompost on Growth And Yield Of Finger Millet

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ABSTRACT
A field trial was carried out at M/s Sri Chamundeshwari Sugars Ltd., Bharathinagar, Maddur taluk, Mandya District located in Southern Dry Zone of Karnataka during 2016-2017 to assess the impact of pressmud and bio compost on finger millet growth and yield components. The experiment consists of threereplicates with 8 treatments. The results of the experiment revealed that significantly higher plant height (cm) and number of tillers plant^{-1} in at different plant growth stages @ 30, 60 and at harvest of finger millet was in recorded with the application of RDF+ Biocompost @10 t ha^{-1} compared to control and was on par with the application of RDF+ Pressmud @10 t ha^{-1}.Application of RDF + biocompost @ 10 t ha^{-1}recorded significantly higher grain (3625 kg ha^{-1}) and straw yield (6363 kg ha^{-1}) followed by other treatments which received different doses of pressmud and biocompost along with recommend dose of fertilizers compared to control. Form the study it can be concluded that application of sugarcane pressmud or bio compost @ 10 t ha^{-1}along with recommended NPK would be the nutrient recommendation for finger millet in Southern Dry Zone of Karnataka.
Key words:*Pressmud, biocompost, plant growth and yield parameters.*

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INTRODUCTION

present is a rising apprehension among the scientific group of people, environmentalists and policy makers about the safe disposal of the large amounts of organic wastes produced worldwide. Urbanization, industrialization, increasing food demand for growing human population, intensive use of relatively easily available and inexpensive chemical fertilizers and economic force are adding to the production and build-up of large amounts of organic wastes. In India ,a few organic wastes such as farm waste, city waste(sewage and sludge), poultry litter and industrial wastes (pressmud, biocompost, food, sugar, cotton and rice industry) are recycled back by applying back to agricultural land but a significant amount of organic wastes. As a result recycling organic wastes by applying on to agricultural land seems to /s Sri Chamundeshwari Sugars Ltd., Bharathinagar, Maddur taluk, Mandya District located in Southern Dry Zone of Karnataka dumping place for organic wastes. Organic waste such as pressmud or filter cake is a by-product of sugar factories and characterized as asoft, spongy, amorphous and dark brown to brownish material.

Pressmud is reported to be a valuable resource of plant nutrients and may therefore affect physical, chemical and biological properties of a soil [23, 12, 7, 13, 14, 16, 18, 22]. Razzaq [25] reported that continuous land application of sugarcane filter cake to agricultural crops for 5-6 years is likely to improve soil health by adding sulfur (S) and organic matter to soil. Therefore, land application of pressmud is becoming a common farm practice in the sub-continent countries of Pakistan and India. Nutrients availability and maize growth yields increased with increasing nitrogen and pressmud rates [3]. Memon [13] reported that the raw pressmud had depressing effect on dry matter yieldof maize, and that the benefit of previously applied pressmud was obvious in the succeeding wheat crop.

Finger millet is commonly called as "Nutritious millet" as the grains are nutritionally superior to many cereals providing fair amount of proteins, minerals, calcium and vitamins in abundance to the people. It is the cheapest and preferred food crop of economically suppressed but physically hard working people. It is appreciated by the people, because it can digest slowly thereby furnish energy for hard work

throughout the day. In view of these facts, the present investigation entitled "Effect of sugar industry solid wastes on soil properties, growth and yield of finger millet" was carried out at M/s Sri Chamundeshwari Sugars Ltd., Bharathinagar, Maddur taluk, Mandya District located in Southern Dry Zone of Karnataka, it produces around 3 tons pressmud out of the 100 tons crushing capacity of sugarcane. The experiment was under taken with the following objectives,

MATERIAL AND METHODS

M/s Sri Chamundeshwari Sugars Ltd., Bharathinagar,Maddur taluk, Mandya District located in Southern Dry Zone of Karnataka has the capacity to crush 5000 tonnes of cane per day, produces three tons of pressmud per 100 tons crushed sugar cane. Pressmud and biocompost are mostly used as aorganic source for increasing soil fertility and nutrient content of soil and improves soil physical, chemical and biological properties of soil. Sugarcane press mud is the residue left over after the filtration of sugarcane juice. Biocompost is produced by mixing pressmud and spent wash in the ratio of 1:2.5 and that is used as soil amendment and nutrient source for the crop growth and soil quality. Pressmud and biocompost were analyzed for pH, electrical conductivity, total nitrogen, phosphorus, potassium, sulphur, calcium, magnesium, micronutrients (Zn, Cu, Fe, Mn & B) and heavy metals content by following standard procedures (Table 1).

Table 1: Physical and chemical properties of pressmud and bio compost

Parameters	Pressmud	Bio compost
	content	
Physical properties		
Bulk density (Mg m^{-3})	1.04	1.08
Maximum water holding capacity (%)	60.21	63.35
Chemical properties		
pH	6.50	7.30
Electrical conductivity (dS m^{-1})	2.90	3.10
Organic carbon (%)	35.08	44.07
Total Nitrogen (%)	1.8	2.22
Total Phosphorus (%)	1.02	1.5
Total Potassium (%)	1.28	1.83
Total Calcium (%)	10.25	8.15
Total Magnesium (%)	3.20	2.10
Sulphur (mg kg^{-1})	30	34.21
Sodium (%)	0.42	0.30
Total -Iron (mg kg^{-1})	1202	1242
Total -Copper (mg kg^{-1})	77.40	71.60
Total -Manganese (mg kg^{-1})	253.20	566.40
Total -Zinc (mg kg^{-1})	119.40	157.20
Heavy metals		
Pb (mg kg^{-1})	ND	ND
Cd (mg kg^{-1})	ND	ND
Cr (mg kg^{-1})	ND	ND
Ni (mg kg^{-1})	0.42	0.21

Note: ND- Not detected

The pressmud and bio compost pre-digested with nitric acid and subsequently digested with di acid. The digest was diluted and used for analysis of different elements except nitrogen (N was digested using digestion mixture and distilled).

field trial to assess the different rates of pressmud and bio compost on yield and growth parameters of finger millet was conducted at M/s Sri Chamundeshwari Sugars Ltd., Bharathinagar, Maddur taluk, Mandya District located in Southern Dry Zone of Karnataka during 2016-2017 to assess the impact of pressmud and bio compost on finger millet growth and yield components. The experiment consists of three replicates with 8 treatments in RCBD. Twenty-four field plots, each plot of 4.2 x 3.5 m^2 area were set up in soil, Pressmud and bio compost applied along with the inorganic fertilizers of package of practice were applied to appropriate plots. Finger millet transplanted 25 days of nursery seedlings with the spacing in rows (with 10 cm space and row to row distance of30 cm) on *Kharif*-2017, Variety GPU 28.

Preparation of nursery and raising of seedlings

Raised dry nursery beds were prepared and seeds were broadcasted on the beds and covered with thin layer of soil + FYM mixture. Water was sprinkled with help of rose-can. After 10 days of sowing, 150 g of

urea, 50 g SSP and 50 g MOP were applied by broadcasting and 25 days old seedlings were transplanted in the experimental plots.

Land preparation

The land was brought to fine tilth

Imposition of treatments

Pressmud, biocompost and well decomposed FYM were applied three weeks prior to transplanting of finger millet seedlings as per treatments. The required quantity of fertilizers as per treatment was added, 50 per cent N and 100 per cent P & K was added as basal dose. The remaining N dose was added three weeks later.

Weed management

After transplanting, hand weeding was done at 30 and 60 days, earthing up was done at 45 days after transplanting.

Harvesting and threshing

The crop was harvested at physiological maturity. Two rows on all the sides of each plot were harvested as border rows and the remaining rows were treated as net plot. Grain and straw of each plot were sun dried and weighed separately and computed on hectare basis (Plate 3 and 4).

Biometric observations were recorded at 30, 60 DAT and at harvest like Plant height, Number of tillers $hill^{-1}$ and Yield parameters like No. of productive tillers $hill^{-1}$, No. of fingers per ear head, Finger length (cm), 1000 grain weight (gm), Grain yield (kg ha^{-1}) and Straw yield (kg ha^{-1}) and the analyses and interpretation of the data was done adopting Fisher's method and variance technique as given by Gomez and Gomez [5]. The level of significance used in 'F' and 't' test was 5 % probability and wherever 'F' test was found significant, the 't' test was performed to estimate critical differences among various treatments.

RESULTS AND DISCUSSION

Plant growth parameters

The data on plant height, number of tillers $plant^{-1}$ of finger millet as influenced by application of varied levels of pressmud and bio compost at different growth stages are presented in the (Table 2).

Plant height

Plant height recorded significant difference at all stages of finger millet. Higher plant height was observed in treatment T_3 (RDF + bio compost @ 10 t ha^{-1}). Plant height differed significantly at 30 DAT, 60 DAT and at harvest due to application of varied levels of pressmud and bio compost (Table 17). The plant height was lower in control(21.80, 58.70 and 78.73 cm at 30, 60 DAT and at harvest respectively) Significantly higher plant height (37.83 cm, 92.73cm and 111.83 cm at 30, 60DAT and at harvest, respectively was recorded in treatment T_3 (RDF + bio compost @ 10 t ha^{-1}) was on par with T_2 (RDF + pressmud @ 10 t ha^{-1}) which recorded 34.90 cm, 90.43cm and 110.13cm at 30, 60DAT and at harvest. At 60 DAT and at harvest plant height in treatment T_8 was on par with T_3 POP (RDF + FYM).

These results are in accordance with [16, 17], who reported increase plant height in lentil crop due to pressmud application. Increased availability of nutrients in soil due to mineralization of organic nutrient sources and inorganic fertilizers could have triggered cell elongation and multiplication resulting in high growth rate of shoot in turn plant height of finger millet compare to control. Similar results were obtained by Ashwini *et al.* [2].

Number of tillers per hill

Number of tillers per hill recorded significant difference at different growth stages of finger millet (Table 17). Higher number of tillers per hill at all stages of crop growth were observed in the treatment T_3 (RDF + bio compost @ 10 t ha^{-1}) (1.73, 3.67 and 3.73 at 30, 60 DAT and at harvest respectively). Treatment T_2 (RDF+ pressmud @ 10 t ha^{-1}) was on par with T_3 (1.53, 3.47 and 3.47 at 30, 60 DAT and at harvest respectively) and lower number of tillers per hill was recorded in T_1 control(0.57, 1.87 and 1.87 30, 60 DAT and at harvest respectively). The results were consistent with the findings of Rai *et al.* (2004) reported that organic wastes enhanced plant growth favourably due to supply of nutrients from pressmud and bio compost.

These results are in accordance with the findings of Kalaivanan and Omar Hattab [8] and [9] who revealed that application of 10 t ha^{-1} of enriched pressmud compost to rice crop (hybrid ADTRH 1) recorded higher growth parameters - plant height (92.2 cm) and number of tillers (628 m^{-2}). Similarly, Korai *et al*. [11] revealed that there were pronounced positive effects of adding bio compost, as well as N on plant height and dry weight of maize. The sugar industry compost (1124 kg ha^{-1}) + NPK (42:28:28 kg ha^{-1}) increased growth parameters of sugarcane crop such as plant height (cm), number of tillers, leaf area index, leaf area duration and total dry matter Selvamurugan *et al.* [27].

Yield and yield parameters

Data on number of ear heads per hill, number of fingers per head, finger length, test weight, grain yield and straw yield at harvest of finger millet differed significantly due to varied levels of pressmud and bio compost with recommended dose of chemical fertilizers and FYM (Table 3).

Number of productive ear heads per hill

Increasing doses of pressmud and bio compost resulted in increased productive ear heads per hill. Treatment T_3 (RDF + bio compost @ 10 t ha^{-1}) recorded significantly higher number of ear heads per hill (4.27). Significantly lower number of ear heads per hill were recorded in T_1 control (2.33). All other treatment recorded an increase in number of productive ear heads.

Increased plant height and number of tillers resulted in increase in productive ear heads. This was mainly due to higher photosynthetic efficiency and net assimilation, which helped in increasing the overall growth of the plant. All the treatments except control recorded higher number of effective tillers which might be due to higher and balanced availability of nutrients to the plants. Similar results were recorded by Murali and Setty [15].

Number of fingers per head and finger length

Increase in finger per head and finger length was recorded with increasing in rates of pressmud and bio compost application. Treatment T_3 (RDF + bio compost @ 10 t ha^{-1}) recorded significantly higher number of fingers per head and finger length, (9.60, 7.22 respectively). While, significantly lower number of fingers per head, finger length, were recorded in control (T_1) (6.47 and 6.32 respectively)

Gangadhar Nanda [4] reported that the combined application of organic matter and chemical fertilizers increased number of fingers and finger length of finger millet.

Test weight (1000 grain weight)

Data pertaining to 1000 grain weight of finger millet as influenced by different levels organics are presented in (Table 4).

Data revealed that 1000 grain weight varied from 2.99 g (T_1: absolute control) to 3.44 g T_2 (RDF+ pressmud 10 t ha^{-1}). With each increment in the level of pressmud and bio compost the 1000 grain weight of finger millet increased significantly.

It is evident from the results that organics when applied with chemical fertilizers increased the weight of 1000-grain to a considerable extent and the influence of organic manure was prominent in this study. Gangadhar Nanda [4] also reported that the performance of organic and inorganic fertilizers together was good in increasing the of 1000-grain weight

Grain yield and straw yield

Data on finger millet grain and straw yield differed significantly due to varied levels of pressmud and bio compost application (Table 4).

Grain and straw increased with increasing levels of pressmud and bio compost when applied along with recommended doses of chemical fertilizers. Significantly higher grain and straw yield was recorded in T_3 (RDF + biocompost@10tha^{-1})(3625.14 kg ha^{-1} and 6363.63kg ha^{-1} respectively), followed by T_2, T_5, T_6 and T_8 treatments which received different doses of pressmud and bio compost along with recommend dose of fertilizers.

Lower grain and straw yield were obtained in T_1 (control) with (2840.91 and 4751.68 kg ha^{-1} grain and straw yield respectively). These results are in line with that of Jamil *et al.* [7], Al-Mustafa *et al.* [1] and Oloya and Tagwira, [19] who reported more grains and enhanced grain weight with different doses pressmud.

The positive effect on yield and yield parameters due to use of pressmud and bio compost, along with chemical fertilizers might be due to improvement in the availability of plant nutrients and balanced supply of nutrients through organic manures and inorganic fertilizers resulting in better growth and development of crop, increased fertile ear heads, number of grains per ear head and test weight which led to increased grain and straw yield of finger millet. Similar results were observed on application of sulphitation and carbonation pressmud cakes each @ 20 t ha^{-1} which increased cane yield by 15.6 and 9.5 per cent respectively compared to control [10]. Said Ghulam *et al.* [26], Rangaraj *et al*. [13] and Selvamurugan *et al.* [27] reported that application of NPK along with bio compost @ 5 t ha^{-1} recorded maximum number of productive tillers per plant, finger length, number of fingers per plant and 1000 grain weight in finger millet. Therefore, the response was higher with the combined application of RDF and bio compost.

Higher and lower growth parameters due to the treatment are reflected on the yield and yield parameters of finger millet. These results are in conformity with those of Raundal *et al.* [24], who found significant increase in dry matter yield due to application of macronutrients and organic wastes.

The present study revealed that finger millet crop growth and yield was better due to recommended dose of NPK + bio compost 10 t ha^{-1} and followed by NPK + pressmud 10 t ha^{-1} compared to all the other treatments which clearly indicated that pressmud and bio compost are good source of plant nutrients.

Table 2: Growth parameters of finger millet at different intervals as influenced by sugarcane pressmud and bio compost

Treatments		Plant height (cm)			Number of tillers per hill		
		30 DAT	60 DAT	At harvest	30 DAT	60 DAT	At harvest
T_1	Absolute control	21.80	58.70	78.73	0.57	1.87	1.87
T_2	RDF + pressmud @ 10 t ha^{-1}	34.90	90.43	110.13	1.53	3.47	3.47
T_3	RDF + bio compost @ 10 t ha^{-1}	37.83	92.73	111.83	1.73	3.67	3.73
T_4	50% RDF + 50% N through pressmud	32.20	86.80	98.50	1.27	3.13	3.17
T_5	50 % RDF + 50% N through bio compost	33.50	84.73	105.23	0.87	3.10	3.27
T_6	75 % RDF + 25 % N through pressmud	31.20	77.63	94.70	0.87	3.00	3.00
T_7	75 % RDF + 25 % N through bio compost	30.20	90.40	103.30	1.13	3.17	3.13
T_8	POP (RDF + FYM)	35.77	89.83	105.40	1.33	3.47	3.43
	S. Em. ±	**0.523**	**0.501**	**1.369**	**0.049**	**0.069**	**0.054**
	CD @ 5%	**1.587**	**1.520**	**4.153**	**0.149**	**0.209**	**0.163**

DAT – Days after transplanting
RDF- Recommended dose of fertilizer
FYM- Farm yard manure
POP- Package of practice

Table 3:Number of ear heads per hill, Number of fingers per head, Fingers length (cm)of finger millet crop as influenced by different treatments

Treatments		Number of productive ear heads per hill	Number of fingers per head	Fingers length (cm)
T_1	Absolute control	2.33	6.47	6.32
T_2	RDF + pressmud @ 10 t ha^{-1}	4.20	9.40	7.04
T_3	RDF + bio compost @ 10 t ha^{-1}	4.27	9.60	7.22
T_4	50% RDF + 50% N through pressmud	3.93	9.20	6.96
T_5	50 % RDF + 50% N through bio compost	3.67	9.40	6.74
T_6	75 % RDF + 25 % N through pressmud	3.60	9.07	6.89
T_7	75 % RDF + 25 % N through bio compost	3.70	9.10	7.01
T_8	POP (RDF + FYM)	4.00	9.23	6.80
	S. Em. ±	**0.068**	**0.125**	**0.045**
	CD @ 5%	**0.206**	**0.376**	**0.135**

Table 4:Test weight (g), Grain yield (kg ha^{-1}), Straw yield (kg ha^{-1}) and Harvest index (%) of finger millet crop as influenced by different treatments

Treatments		Test weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Harvest index (%)
T_1	Absolute control	2.99	2840.91	4751.68	37.39
T_2	RDF + pressmud @ 10 t ha^{-1}	3.44	3594.27	6285.07	37.64
T_3	RDF + bio compost @ 10 t ha^{-1}	3.44	3625.14	6363.63	36.28
T_4	50% RDF + 50% N through pressmud	3.36	3310.88	6106.05	35.24
T_5	50 % RDF + 50% N through bio compost	3.38	3361.39	6004.48	36.02
T_6	75 % RDF + 25 % N through pressmud	3.24	3395.06	5911.89	36.61
T_7	75 % RDF + 25 % N through bio compost	3.36	3263.18	5956.78	34.17
T_8	POP (RDF + FYM)	3.38	3330.52	6050.50	35.56
	S. Em. ±	**0.131**	**102.644**	**290.868**	**1.255**
	CD @ 5%	**0.394**	**311.34**	**882.256**	**NS**

Harvest index

Harvest index of finger millet is presented in (Table 4).

Data indicated that harvest index of finger millet was not significantly influenced by graded levels nutrients and different organic source. There was a proportionate increase in both grain and straw yields

with increased level of nitrogen. Similar results were obtained by Patil and Shete [20]. The data on harvest index of lentil was not significantly affected by either NPK or pressmud treatments. All the treatments displayed almost similar harvest index in the range of 34.4 to 41.1 per cent.

CONCLUSION

Significantly higher plant height (cm) and number of tillers plant^{-1} finger millet in recorded with T_3 (RDF+ Biocompost 10 t ha^{-1}) compared to control and was on par with T_2 (RDF+ Pressmud 10 t ha^{-1}). Application of RDF + biocompost @ 10 t ha^{-1}recorded significantly higher grain (3625kg ha^{-1}) and straw yield (6363 kg ha^{-1}) followed by T_2, T_5, T_6 and T_8 treatments which received different doses of pressmud and biocompost along with recommend dose of fertilizers compared to control

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