Original Research Article

Effect of organic nutrient sources on economics, soil micro nutrient status and microbial growth of Ragi under guni method of cultivation

Abstract

A field experiment was conducted during the *kharif*-2019 at the farmers field of Mylandahalli in Chikkaballapuradistict of Karnataka, to study the effect of organic nutrient sources on soil micro nutrient status, microbial countand economics of finger millet under guni method. The trial was framed out in randomized blocked design with twelve treatments reproduced thrice. The results of different organic nutrient sources were showed that supplement of sericulture waste compost (SWC) @ 50% N eq. + Enriched biodigested liquid manure (EBDLM) @ 50% N eq. ha^{-1} + panchagavya (PG) spray @ 3% (T_9) had a significant effect on micro nutrient status in soil and their values were statistically higher than all the other treatments. The findings of study reported that supplement of sericulture waste compost (SWC) @ 50% N eq. + Enriched biodigested liquid manure (EBDLM) @ 50% N eq. ha^{-1} + panchagavya (PG) spray @ 3% (T_9) recorded significantly higher Diethylenetriaminepentaacetic acid (DTPA) extractable iron, zinc, manganese and copper in soil. Likewise, the same treatment had recorded significantly superior in population of bacteria (49.96 colony forming units (CFU) x 10^6 g^{-1}), fungi (27.36 CFU x 10^3 g^{-1}) and actinomycetes (14.44 CFU x 10^3 g^{-1}) were noticed compared to others andfound to be highest economic returns during cropping period of *kharif* 2019.

Keywords: Iron, zinc, copper, manganese, bacteria, fungi, actinomycetes

Abbreviations

EBDLM: Enriched bio-digested liquid manure; **BDLM**: Bio-digested liquid manure **SWC**: sericulture waste compost; **FYM**: Farm yard manure; **VC**: Vermi compost; **PG**: Panchagavya; **RDF**: Recommended dose of fertilizer; **LSD**: Least significant difference; **CD**: Critical difference; **₹ /ha**: Rupees per hectare; **kg/ha**: Kilo grams per hectare; **NPK**: Nitrogen, Phosphorus, Potassium; **°C**: Degree Celsius; **mm**: millimetre; **@**: at the rate; **%**: Percent; **NS:** Non-significant; **cm**: centimetre; **m**: metre; **B: C ratio**: Benefit cost ratio; **N eq. ha^{-1}**: Nitrogen equivalent per hectare; **VW:**Vermi wash; **t/ha**: tones per hectare

Introduction

In recent energy crisis, hike in the prices of the inorganic fertilizers and declining soil health and productivity necessitate the use of organic manures compulsorily in agricultural crop production. The continuous use of inorganic fertilizers under intensive cropping system has caused widespread deficiency of secondary and micronutrients in soil (Jagadeesha*et al.*, 2019). Green revolution brought about a great change in Indian agriculture, which was rightly termed as "from begging bowl to bread basket". This was mainly achieved with high yielding, fertilizer responsive crop cultivars and increased fertilizer use led to deterioration of land and soil health there by slowly reduced the productivity (Mukesh Kumar Pandey *et al.*, 2008).Millets exhibits the unique characteristics among cereals. India is the world's foremost producer of several millets. Among them, finger millet (*Eleusine coracana* L.) contributes about 85 per cent of total production (Sakamma*et al.*, 2018). It is grown in Jharkhand, Maharashtra, Tamil Nadu, Uttaranchal Karnataka, Andhra Pradesh and Orissa in an extent of 11.63 lakh tones with a potential of 16.91 lack tones and a productivity of 1454 kg ha^{-1}. Karnataka is one of the principle maker of Ragi in India and cultivated in 8.12 lakh tones with an annual yield of 11.48 lakh tons, where as in terms of productivity Tamil Nadu leads the highest with maximum value of 2967 kg ha^{-1} (INDIASTAT, 2023-24).

Finger millet made as prominent dry land crop due in part to its remarkable ability to tolerate extreme weather conditions such as drought and other climatic variations. Among the finger millet seeding techniques, broadcasting and random transplanting are the most widely used. However, adhering to these tenets results in an uneven plant distribution, which intensifies competition for nutrients and moisture (Shashikala *et al.*, 2021).A new method called ‘Guni’ or ‘Guli’ with wider establishing and spot application of farm yard manure has been established in finger millet in line with “System of Crop Intensification”.In current times have seen farmers in the Karnataka districts of Kolar, Bengaluru rural, and Haveri employed A new method called ‘Guni’ or ‘Guli’ with wider establishing and spot application of farm yard manure has been established in finger millet in line with “System of Crop Intensification” (Hebbal *et al*., 2018).

In the wake of green revolution, our agriculture is dependent mostly on chemical fertilizers which leads to the degradation of soil fertility. In order to overcome this problem, enhancing the ragi productivity through organic nutrient management has became a mandate (Prabavathi *et al*., 2023).By incorporating organic materials into the soil, it improves the soil physical properties, such as structure, stability of its aggregates, ability to withhold water, drainage, aeration, and root penetration, as well as its chemical properties, such as its nutrient content, composition, and pH (Murphy *et al*., 2015). Organic manures have a profound effect on improving soil physical, chemical and biological properties and enhancing productivity of crops (Maitra, 2020). Organic manures contain enormous population of bacteria, actinomycetes and fungi. Hence, the application of organic manure helps the microorganisms to build up better soil structure, N-fixation and phosphorus solubilization (Chavan *et al*., 2018).

Among several ways of farming, organic farming is an important farming method which improves the soil fertility for sustainable crop production. Use of different organic manures such as farm yard manure (FYM), sericulture waste compost (SWC), bio-digested liquid organic manure (BDLM), enriched bio-digested liquid organic manure (EBDLM), cow urine, panchagavya (PG) and vermiwash (VW) are known to have multiple advantages that improve soil health, yield and quality of product. FYM have traditionally been used by farmers, as it supplies all macro nutritents (N, P, K, Ca, Mg, S) and micro nutrients (Fe, Mn, Cu, Zn) essential for plant growth (Meena *et al.*, 2018). Vermiwash is a rich source of soluble plant nutrients and contains earthworm secretions and enzymes that can promote crop growth (Asha *et al.,* 2016). Panchagavya considered to be a highly effective liquid organic manure blended with five products which has multiple functions and can effectively supplement to chemical fertilizer (Upadhyay *et al*., 2018). It supplies both micro and macro nutrients which enhances the fertilizer use efficiency and reduce the cost of cultivation.

Micronutrients are essential for the growth of plants and animals. Micronutrient deficiencies in soil not only limit the crop production but also have negative effects on human nutrition and health (Govindaraj *et al*., 2011). Similarly, excessive agro-ecosystem inputs of micronutrients such as iron (Fe), manganese (Mn), copper (Cu), and zinc (Zn), which are heavy metals, can possibly lead to toxicity in plants and animals and consequently pose a threat to human health through the food chain (Prashant *et al*., 2019). Micronutrient does not mean that they are less important to plants than other nutrients. Each essential element only when can perform its role in plant nutrition properly that other necessary elements are available in balanced ratios for plant.Keeping the aforesaid information in view, the present research was designed to develop a sustainable nutrient management strategy in order to determine soil micro nutrient status and microbial count underguni method of finger millet cultivation.

Material and methods

Field trial was carried out in *Kharif* 2019 at the farmer field of Mylandahalli in Chikkaballapuradistict of Karnataka. The twelve treatments in the research were arranged in a randomized block design, and was duplicated thrice. ML-365 variety was used in the trial and transplanted @ spacing of 0.6 m x 0.6 m. Treatments used in the research were T_1: FYM @ 100% N eq. ha^{-1}, T_2: SWC @ 100% N eq. ha^{-1}, T_3: BDLM @ 100% N eq. ha^{-1}, T_4: EBDLM @ 100% N eq. ha^{-1}, T_5: Cow urine @ 100% N eq. ha^{-1}, T_6: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + VW spray @ 3%, T_7: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + PG spray @ 3%, T_8: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + VW spray @ 3%, T_9: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + PG spray @ 3%, T_{10}: SWC @ 50% N eq. + Cow urine @ 50% N eq. ha^{-1} + VW spray @ 3%, T_{11}: SWC @ 50% N eq. + Cow urine @ 50% N eq.+ PG spray @ 3% and T_{12}: Recommended FYM (10 t) + 100:50:50 kg NPK ha^{-1}. The raised nursery beds were set up, gaging 3.0 m x 1.5 m and 10 cm high. On the beds, one kilogram of seeds was dispersed per acre. With the Guni method, each plot was levelled evenly, and at 0.6 × 0.6 m intersection, tiny gunis or scoops were manually prepared with a spade. Two seedlings per guni were planted in each of the plots after twenty-one days after transplanting the seedlings. In 100% RDF treatment (T_{12}), urea, single super phosphate and muriate of potash were used to augment the nutrients (100:50:50 kg NPK ha^{-1}). The nutrient composition of various organic manures used in the experiment were included in Table 1.

Initial analysis of soil

Prior to crop planting, a composite soil sample was extracted from the experimental plot, delving to a depth of 15cm. Subsequently, this sample underwent analysis to ascertain the soil physical and chemical attributes, with additional details available in Table 2.

Application of PG, VW and treatment imposition

Three per cent PG and VW solutions were prepared by mixing 30 ml of each panchagavyain 1000 ml of water separately. Three per cent panchagavya for T_7, T_9, T_{11} and vermiwash for T_6, T_8, and T_{10} was sprayed at 45 and 60 DAT.

Inorganic fertilizers

The recommended dose of nutrients *i.e.*, 100-50-50 kg N, P_2O_5 and K_2O ha^{-1} were supplied through urea, single super phosphate and muriate of potash respectively in 100 per cent RDF (T_{12}) treatment. The entire quantity of phosphorus and potassium and half of the nitrogen were applied as basal at the time of transplanting. The remaining quantity of nitrogen was applied as top dressing at 30 days after transplanting (DAT).

Table 1. Initial chemical properties of soil from experimental site and methods used for analysis

Sl. No	Particulars	Mean	Status	Methods

		values		
1 Physical composition				
1	Particle size distribution			
	a) Coarse sand (%)	36.10	-	International pipette method (Piper, 1966)
	b) Fine sand (%)	28.60	-	
	c) Silt (%)	6.50	-	
	d) Clay (%)	28.80	-	
	Textural class	Sandy loam	-	
2	WHC (%)	38.6	-	Keen's cup method (Piper, 1966)
3	Bulk density (Mg m^{-3})	1.43	-	Core sampler method (Piper, 1966)
II Chemical properties				
1	Soil pH (1:2.5)	7.41	Neutral	Potentiometric method (Piper, 1966)
2	Electrical conductivity (1:2.5) (dS m^{-1})	0.13	Normal	Conductometry method (Jackson, 1973)
4	Organic carbon (%)	0.38	Low	Walkely and Black's wet oxidation method (Jackson, 1973)
5	Available nitrogen (kg ha^{-1})	312.54	Medium	Alkaline potassium permanganate method (Subbiah and Asija, 1959)
6	Available phosphorus (kg ha^{-1})	32.98	Medium	Bray's method (Jackson, 1973)
7	Available potassium (kg ha^{-1})	195.70	Medium	Flame photometry method (Jackson, 1973)
8	Available Fe (mg kg^{-1})	10.29	Sufficient	DTPA Extractable method (Lindsay and Norvell, 1978)
9	Available Zn (mg kg^{-1})	1.98	Sufficient	
10	Available Mn (mg kg^{-1})	9.05	Sufficient	
11	Available Cu (mg kg^{-1})	1.83	Sufficient	

Soil micro nutrient status

Soil available micronutrients were extracted by shaking the soil with 0.005 M DTPA (Diethylene –triaminepenta acetic acid) solution and micronutrients in extract were estimated by atomic absorption spectrophotometer (Lindsay and Norvell, 1978).

Analysis and Enumeration of soil microbial populations

Soil microbial populations were enumerated from the soil samples (0-15 cm depth). The soil samples collected were mixed thoroughly and were subjected to serial dilution (one gram of soil in 100 ml of distilled water). The enumeration of microorganisms was done after culturing these organisms using various media by standard dilution plate technique (Wollum, 1982). The media used for bacteria was agar, Martins Rose Bengal agar with streptomycin sulphate used for fungi and Kusters agar used for actinomycetes. The number of colonies were counted manually and multiplied by the dilution factor for the concerned group of microorganisms and expressed as number of colonies per gram of soil.

Economics

Cost of cultivation

In computing the economics, different variable cost items were considered. The cost includes seed cost, land preparation, different manures, fertilizers and labour charges were calculated according to local prices. The price of finger millet grain and straw were obtained in the market at the time of harvest and price was used for further calculation of gross returns. Whereas, net returns were worked out by subtracting the total cost of cultivation from gross income.The benefit cost ratio was calculated by following the formula as given below.

$$\text{B:C ratio} = \frac{\text{Gross returns (} \quad \text{ha}^{-1}\text{)}}{\text{Cost of cultivation (} \quad \text{ha}^{-1}\text{)}}$$

Statistical analysis and interpretation of data.

Data obtained in this experiment were subjected to statistical analysis adopting Fisher's method of 'analysis of variance' as out lined by Gomez and Gomez (1984). The level of significance used in 'F' test was given at five per cent.

Results and Discussion

Soil micro nutrient status after harvest of finger millet (ppm)

Data on DTPA extractable iron, zinc, manganese and copper in soil after harvest of crop as influenced by various organic nutrient sources is presented in Table 3.DTPA extractable available iron (15.78 ppm), zinc (4.01 ppm), manganese (14.20 ppm) and copper (3.76 ppm) were significantly higher with SWC @ 50 % N eq. + EBDLM @ 50 % N eq. ha^{-1} + PG @ 3% (T_9) followed by T_8 (15.02, 3.94, 13.52 and 3.69 ppm iron, zinc, manganese and copper, respectively),T_7 (14.67, 3.65, 13.20 and 3.42 ppm iron, zinc, manganese and copper, respectively) and T_6 (14.33,3.30, 12.90 and 3.33 ppm iron, zinc, manganese and copper, respectively), which were on par to each other. While, significantly lower available iron (9.58 ppm), zinc (1.81 ppm), manganese (8.62 ppm) and copper (1.69 ppm) were noticed with recommended FYM (10 t ha^{-1}) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1} (T_{12}).

Chaudhari*et al*. (2024) reported that significant increase in DTPA extractable zinc content in organic manure treated plots over no manure which revealed the fact that buildup of organic matter under continuous manuring possibly resulted in higher DTPA extractable Zn content. Increase in nutrient content in organic manure treated plots may be attributed to the slow release of nutrients from manures after mineralization and its chelating effect, which maintains regular supply of all micro nutrients (Rajinder and Mandeep, 2007). These results suggest that the use of various organic fertilizers facilitates the availability of various micro nutrients balancing the plant needs. Prashanth*et al*. (2019) reported that the incorporation of organic manures brought about a remarkable improvement in the availability of native and micronutrient cation in soil form stable complexes with organic ligands that decreased their susceptibility to adsorption, fixation or precipitation in the soil. The addition of organic manures which might have resulted in the formation of such metal organic complexes of higher availability.

Biological properties

Soil microbial population viz., bacteria, fungi and actinomycetes fluctuated in soils due to different organic nutrient sources. Organic matter in soil plays an important role in supplying nutrients to plants by a process called mineralization but under tropical conditions, the soil organic matter gets depleted faster due to rapid oxidation process (Jagadeesha*et al*. (2019). However, the rate of mineralization depends on rate of microbial activity, which in turn varies with kind of organic matter used (Table 4).

Among different treatments, significantly higher population of bacteria (49.96 CFU x 10^6 g^{-1}), fungi (27.36 CFU x 10^3 g^{-1}) and actinomycetes (14.44 CFU x 10^3 g^{-1}) were noticed with the treatment SWC @ 50 % N eq. + EBDLM @ 50 % N eq. ha^{-1} + PG spray @ 3 %(T_9) which was comparable withT_8 (48.30 CFU x 10^6 g^{-1}, 26.51 CFU x 10^3 g^{-1}, and 13.69 CFU x 10^3 $g^{-1}$of soil),T_7 (46.18 CFU x 10^6 g^{-1}, 24.40 CFU x 10^3 g^{-1} and 13.66 CFU x 10^3 $g^{-1}$of soil) and T_6 (44.68 CFU x 10^6 g^{-1}, 23.10 CFU x 10^3 g^{-1} and 13.45 CFU x 10^3 $g^{-1}$of soil) , respectively with bacteria, fungi and actinomycetes. Whereas, recommended FYM (10 t ha^{-1}) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1} (T_{12}) noticed significantly lower bacterial population (21.13 CFU x 10^6 g^{-1}, 15.20 CFU x 10^3 g^{-1} and 6.46 CFU x 10^3 $g^{-1}$of soil, respectively).

Among the microbial population relatively more bacteria in soil because of the availability of simpler carbon compounds for growth of the bacteria and constant activity throughout the crop growth period. The increase in fungal population in treatments amended with different organic substrates was due to synergistic effect in supplying nutrients to microorganisms as these organic manures had higher nutrient composition. This could be due to actinomycetes prefer neutral or alkaline pH and are able to degrade relatively complex organic substances. Similar results were found by Jagadeesha*et al*. (2019).Application of enriched bio-digested liquid organic manure have encouraged soil microflora due to higher multiplication rate of cells by microflora. The increase of microbes in soil was earlier reported by Salkinkop*et al*. (2008) that enhancedbeneficialmicrobes in soil due to application of panchagavya along with compost in coffee.Laksmipathi (2012) and Ananda (2017) reported higher microbes with the application of enriched bio-digested liquid organic manure in finger millet.

Economic returns

The different organic manure application showed considerable variation in economics (Table 5). Application of organic manures alone resulted in lowest cost of cultivation, highest net return and B: C ratio. This is because of the lower cost of cultivation due to relatively cheaper organic manures containing most of the plant nutrients as compared to inorganic fertilizers alone.

Higher B: C ratio (2.16) was obtained with the application ofSWC @ 50 % N eq. + EBDLM @ 50 % N eq. ha^{-1} + PG spray @ 3% (T_9) followed by T_3 (2.09) and T_8 (2.08). Itcould be due to the low cost of cultivation and higher net returnwith the application of SWC @ 50 % N eq. + EBDLM @ 50 % N eq. ha^{-1} + PG spray @ 3%(Table 5). While, application with recommended FYM (10 t ha^{-1}) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1} (T_{12})recorded lowest B: C ratio (1.24) despite medium returns dueto relatively higher cost of cultivation. The net returns (₹ 73,830 ha^{-1})got higher with the treatment *i.e*., application of SWC @ 50 % N eq. + EBDLM @ 50 % N eq. ha^{-1} + PG spray @ 3 % (T_9) as influenced by various organic nutrient sources. Whereas, recommended FYM (10 t ha^{-1}) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1} (T_{12}) recorded lower net returns (₹ 12,065 ha^{-1}).

Higher returns and profit of one rupee investment was attributed combining augmenting of enriched bio-digested liquid manure combine with pancha-gavya by Ananda, 2017; Prakasha *et al*. (2018). Because the crop was not subjected to nitrogen stress during any stage and because nutrients were applied organically, vegetative development was enhanced and yield characteristics and yield rose, all of which contributed to higher gross returns and net returns (Radha *et al.,* 2019). The higher benefit: cost ratio in conjuctive application of nutrients might be due to higher gross returns over rest of the treatments less cost of cultivation and optimum grain and straw yield. These results were in conformity with those earlier reported by Triveni *et al.,* 2018. Further,Umesh and Shankar(2013) found that application of N throughorganic manure not only reduced the cost of cultivation, but alsoresulted in higher grain yield thereby increasing the net returns.

Conclusion

In conclusion, that supplementation of SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + Panchagavya spray @ 3% was found to be effective as organic manure enhancing productivity of soil and micronutrient content in the soil was increased.Further, these manures are also cost effective and a potential substitute for chemical fertilizers to replenishing nutrient requirement of crops and found to be sustainable.This technology can be well adopted by farmers because liquid organic manures are easily prepared by using available farm inputs which improve soil health and productivity of the finger millet.

Disclaimer

Authors are hereby declared that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT,*etc*) and text-to-image generators have been used during writing or editing of manuscripts.

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Table 2: Nutrient composition of different organic manures used in the experiment

Sl.No.	Particulars	SWC	FYM	BDLM	EBDLM	CU	VW	PG	Method employed
1.	**pH (1:25)**	8.13	8.24	8.30	8.20	7.40	6.70	6.09	Potentiometer (Piper, 1966)
2.	**EC (1:25)(dSm^{-1})**	2.75	0.18	0.11	0.26	4.70	2.90	3.06	Conductivity bridge (Jackson, 1973)
3.	**Organic carbon (%)**	28.76	10.78	0.81	1.13	3.44	0.43	0.78	Walkely and Black Wet oxidation method (Jackson, 1973)
4.	**Total Nitrogen(%)**	7.35	0.51	0.96	1.31	0.49	0.03	0.07	Modified Microkjeldhal method (Jackson,1973)
5.	**Total Phosphorus (%)**	0.94	0.27	0.21	0.42	0.08	0.01	0.04	Vanadomolybdate yellow colour method (Jackson,1973)
6.	**Total Potassium(%)**	0.98	0.48	0.30	0.58	0.48	0.02	0.05	Flame photometer (Jackson,1973)

Table 3: Micro nutrient status (ppm) of soil after harvest of finger millet crop under guni method as influenced by various organic nutrient sources

Treatments	Fe	Zn	Mn	Cu
T_1: FYM @ 100% N eq. ha^{-1}	11.02	2.33	9.92	2.18
T_2: SWC @ 100% N eq. ha^{-1}	11.98	2.78	10.78	2.60
T_3: BDLM @100% N eq. ha^{-1}	13.52	2.98	12.17	2.79
T_4: EBDLM @ 100% N eq. ha^{-1}	14.10	3.10	12.69	2.91
T_5: Cow urine @ 100% N eq. ha^{-1}	10.75	2.15	9.68	2.01
T_6: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	14.33	3.30	12.90	3.33
T_7: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	14.67	3.65	13.20	3.42
T_8: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	15.02	3.94	13.52	3.69
T_9: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	15.78	4.01	14.20	3.76
T_{10}: SWC @ 50% N eq. + Cow urine@ 50% N eq. ha^{-1} + VW spray @ 3%	11.56	2.52	10.40	2.36
T_{11}:SWC @ 50% N eq. + Cow urine @ 50% N eq. ha^{-1} + PG spray @ 3%	12.02	2.80	10.82	2.62
T_{12}: Recommended FYM (10 t) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1}	9.58	1.81	8.62	1.69
S.Em±	**0.55**	**0.25**	**0.49**	**0.15**
C.D at 5 %	**1.60**	**0.73**	**1.44**	**0.44**

Note: FYM @ 10 t $ha^{-1}$was applied for all the treatments except T_{12} and foliar application of VW & PG at 45 and 60 DAT.
FYM: Farm Yard Manure; SWC: Sericulture Waste Compost; BDLM: Bio-Digested Liquid Manure; EBDLM: Enriched Bio-Digested Liquid Manure; VW: Vermiwash; PG: Panchagavya and DAT: Days After Transplanting

Table 4: Microbial population in soil after harvest of finger millet crop under guni method as influenced by various organic nutrient sources

Treatments	Population of General microflora (CFU g^{-1} soil)		
	Bacteria (No X 10^6)	**Fungi (No X 10^3)**	**Actinomycetes (No X 10^3)**
T_1: FYM @ 100% N eq. ha^{-1}	29.34	18.13	9.86
T_2: SWC @ 100% N eq. ha^{-1}	32.57	19.20	11.53
T_3: BDLM @100% N eq. ha^{-1}	39.52	20.17	12.84
T_4: EBDLM @ 100% N eq. ha^{-1}	43.25	21.50	13.00
T_5: Cow urine @ 100% N eq. ha^{-1}	27.42	17.88	8.13
T_6: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	44.68	23.10	13.45
T_7: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	46.18	24.40	13.66
T_8: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	48.30	26.51	13.69
T_9: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	49.96	27.36	14.44
T_{10}: SWC @ 50% N eq. + Cow urine@ 50% N eq. ha^{-1} + VW spray @ 3%	31.62	18.82	10.93
T_{11}: SWC @ 50% N eq. + Cow urine @ 50% N eq. ha^{-1} + PG spray @ 3%	36.22	19.86	12.05
T_{12}: Recommended FYM (10 t) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1}	21.13	15.20	6.46
S.Em±	**1.86**	**1.49**	**0.43**
C.D at 5 %	**5.45**	**4.37**	**1.26**

Note: FYM @ 10 t $ha^{-1}$was applied for all the treatments except T_{12} and foliar application of VW & PG at 45 and 60 DAT.
FYM: Farm Yard Manure; SWC: Sericulture Waste Compost; BDLM: Bio-Digested Liquid Manure; EBDLM: Enriched Bio-Digested Liquid Manure; VW: Vermiwash, PG: Panchagavya and DAT: Days After Transplanting

Table 5: Economics of finger millet crop under guni method as influenced by various organic nutrient sources

Treatments	Cost of cultivation (₹ ha^{-1})	Gross return (₹ ha^{-1})	Net return (₹ ha^{-1})	B: C ratio
T_1: FYM @ 100% N eq. ha^{-1}	72860	105804	32944	1.45
T_2: SWC @ 100% N eq. ha^{-1}	63860	110357	46497	1.73
T_3: BDLM @100% N eq. ha^{-1}	55110	115188	60078	2.09
T_4: EBDLM @ 100% N eq. ha^{-1}	56494	119349	62855	2.11
T_5: Cow urine @ 100% N eq. ha^{-1}	57023	104036	47012	1.82
T_6: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	64209	122319	58110	1.91
T_7: SWC @ 50% N eq. + BDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	62859	131456	68597	2.00
T_8: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + VW spray @ 3%	64901	135261	70360	2.08
T_9: SWC @ 50% N eq. + EBDLM @ 50% N eq. ha^{-1} + PG spray @ 3%	63551	137381	73830	2.16
T_{10}: SWC @ 50% N eq. + Cow urine@ 50% N eq. ha^{-1} + VW spray @ 3%	65165	109418	44252	1.68
T_{11}: SWC @ 50% N eq. + Cow urine @ 50% N eq. ha^{-1} + PG spray @ 3%	63815	113292	49477	1.78
T_{12}: Recommended FYM (10 t) + 100:50:50 kg N: P_2O_5: K_2O ha^{-1}	51115	63180	12065	1.24

Note: FYM @ 10 t ha^{-1} was applied for all the treatments except T_{12} and foliar application of VW & PG at 45 and 60 DAT.
FYM: Farm Yard Manure; SWC: Sericulture Waste Compost; BDLM: Bio-Digested Liquid Manure; EBDLM: Enriched Bio-Digested Liquid Manure; VW: Vermiwash, PG: Panchagavya and DAT: Days After Transplanting