Original Research Article

Growth and yield of finger millet as influenced by tillage and organic nutrient management under finger millet-french bean cropping system

ABSTRACT

A field experiment on 'Growth, yield attributes and yield of finger millet as influenced by tillage and organic nutrient management' conducted at Agronomical Research Farm, Birsa Agricultural University, Kanke, Ranchi, Jharkhand during 2020-21 and 2021-22. The experiment laid out in a split-plot design with three replication. The experiment consisted of four main plot treatments *viz*., conventional tillage – conventional tillage (CT – CT), conventional tillage – zero tillage (CT – ZT), zero tillage – conventional tillage (ZT – CT) and zero tillage – zero tillage (ZT - ZT) and subplot has four treatments with different sources of organic nutrient management *viz*., 100% N through FYM, 100% N through vermicompost, 50% N through FYM + 50% N through vermicompost and 75% N through FYM + 25% N through vermicompost. Significantly highest value of number of tillers (121.15), leaf area index at 90 DAS (2.65), dry matter accumulation at maturity (865.61 g/m^2), crop growth rate at 90-maturity (9.47 g/m^2/day), number of effective tillers (112.96), number of fingers/ear (6.66), number of grains/ear (1085.26), ear weight (6.59 g), grain (23.90 q/ha) and straw yield (38.85 q/ha) were observed in conventional tillage- conventional tillage. Among organic source, 100% N through VC gave significant maximum value of number of tillers (121.37), leaf area index at 90 DAS (2.67), dry matter accumulation at maturity (873.36 g/m^2), crop growth rate at 90-maturity (9.67 g/m^2/day), number of effective tillers (113.12), number of fingers/ear (6.76), number of grains/ear (1094.19), ear weight (6.61 g), grain (24.25 q/ha) and straw yield (38.93 q/ha).

Keywords: *Finger millet, tillage, organic nutrient, growth, yield attributes, yield*

Introduction

Millets have gained attention due to inherent quality of surviving even in stress condition. Among various small millets, finger millet (*Eleusine coracana* L. *Gaertn*) is an important small millet crop grown in India and has the pride of place in having highest productivity. It is usually used for preparation of flour, pudding, porridge and roti in India (Chaturvedi, R. and S. Srivastava, 2008). It is also used for malting and brewing. It is beneficial in osteoporosis, weight loss, activates insulin to reduce diabetes, enhances metabolism, reduces cholesterol and so on. It is cultivated in an area of 1.14 M ha with total production of 1.82 MT and an average productivity of 1601 kg/ha. Jharkhand state has good agro-ecological condition for finger millet production. It is grown over an area of 14.3 thousand ha with an annual production of 9.2 thousand tonne and an average productivity of 644 kg/ha (Annual Progress Report: 2017-18, ICAR-AICRP on Small Millets; 2015-16).

Among several factors responsible for lower productivity, tillage practice and improper nutrient management are the major factors. Tillage practice would enhance and maintain natural resource base through compliance of interrelated principles and with other good production management practices of plant nutrition (Abrol and Sangar, 2006). Traditional agriculture involves intensive tillage and responsible for soil erosion problems,

Comment [H1]: ? use DAS

Comment [H2]: Expand no standard abbreviation for vermicopmost surface and underground water pollution, and more consumption of irrigation water (Wolff and Stein, 1998). Further, implicated land resource degradation, low energy efficiency and contributes to global warming (Boatman et al., 1999). Hence, the conservation tillage is an effective alternative way to cultivate annual and perennial crop-based systems and with crop residue management to have a soil cover.

Comment [H3]: ITALICS

Along with this, in the present scenario, interest has been generated in environmentally sustainable agricultural practices to decrease negative impacts resulting from inefficient use of chemical fertilizers. The excessive use of chemical fertilizer causes pollution, decreases soil fertility and also pollution of groundwater (Hernandez et al., 2010). Replacing the chemical fertilizers by the organic amendments is very important for sustainability of agriculture production and maintain of soil fertility (Parakash and Prasad, 2000).Organic source like FYM and vermicompost quality are the most essential criterion in recycling organic waste and utilization in agriculture as organic amendments, they can meet the nutrient requirements of agriculture crops and significantly reduce the use of chemical fertilizers (Mavaddati et al., 2010). Therefore, considering the above facts, the present study was planned and executed accordingly.

Comment [H4]: INEFFICEIENT OR IMBALANCE

Materials and Method

The experiment entitled, 'Growth, yield attributes and yield of finger millet as influenced by tillage and organic nutrient management' was conducted in Agronomical Research Farm of the Birsa Agricultural University, Kanke, Ranchi (23^0 17' N latitude, 85^0 10' E longitude and 625.22 m above mean sea level), Jharkhand during 2020-21 and 2021-22. The experiment was laid out in a split-plot design with three replication. The experiment consisted of four main plot treatments *viz*., conventional tillage – conventional tillage (CT – CT), conventional tillage – zero tillage (CT – ZT), zero tillage – conventional tillage (ZT – CT) and zero tillage – zero tillage (ZT - ZT) and subplot has four treatments with different sources of organic nutrient management *viz*., 100% N through FYM, 100% N through vermicompost, 50% N through FYM + 50% N through vermicompost and 75% N through FYM + 25% N through vermicompost. Finger millet and french bean (for vegetable purpose) variety taken for cultivation were BBM 10 and Swarna Priya respectively. Seed rate for finger millet and french bean were 10 and 80 kg/ha respectively. Recommended dose of nitrogen (RDN) for finger millet and french bean were 40 and 140 kg/ha respectively. The source of organic nutrients were FYM and vermicompost. Sowing of finger millet was done on 26^{th} June 2020 and 18^{th} June 2021 with row-to-row spacing of 30 cm and plant to plant 10 cm spacing was maintained after thinning. Fifteen days prior to sowing of green french bean, the organic nutrients were manually incorporated into the soil. Green french bean was sown on 13^{th} Nov 2020 and 06^{th} Nov 2021 with row-to-row spacing of 40 cm and plant-to-plant spacing of 10 cm. Both crops were sown in east-west direction in both the years.

The texture of soil (0-15 cm of depth) was sandy loam. Mechanical analysis was done by Hydrometer method, bulk density by core sampler method, permanent wilting point and field capacity by pressure plate method, pH and EC by pH and EC meter, organic carbon by Walkley & Black method, available nitrogen by Alkaline permanganate method, available phosphorus by Bray's P_1 method, available potassium by Flame photometer method and

Comment [H5]: POOTENTIOMETER AND CUDUCTIVITY BRIDGE microbial count by Pour plate techniques. The soils were acidic, medium in organic carbon, low in available nitrogen, medium in available phosphorous and potassium. The maximum and minimum temperature ranged from 26.8 to 36.8ºC and from 4.0 to 24.1ºC respectively during 2020-21. During second season (2021-22) it ranged from 21.0 to 34.2ºC and from 3.6 to 25.2ºC respectively. Rainfall varied from 0 to 185.8 mm and from 0 to 229.4 mm in first and second season respectively. Agricultural operations and practices were applied as recommended for the crop. The finger millet crop was harvested on 28th Oct 2020 in first year and on 19th Oct 2021 in second year. While in case of french bean it was harvest on 18th Feb 2021 and on 9th Feb 2022 in first and second year respectively. Data on soil parameters were recorded as per normal procedure.

Result and Discussion

Growth parameters

Plant population/m^2 at 15 DAS

Data on population count of finger millet were recorded at 15 DAS are presented in Table 1. The effect of treatments on population count was found to be non - significant in pooled data. Maximum number of plants (32.18 /m^2) were recorded in CT-CT treatment. The minimum number of plants were recorded under ZT-ZT treatment (29.37 /m^2). Whereas, in case of organic nutrient management 100% N through VC gave the maximum population count (32.67 /m^2) and minimum in 100% N through FYM (29.06 /m^2). Interaction effect of tillage and organic nutrient management were found non significant.

Number of tillers/m^2 at harvest

Data pertaining to number of tillers/m^2 at harvest of finger millet as influenced by different tillage practices have been presented in Table 1. At maturity, tillage operation CT-CT produced maximum number of tillers/m^2 at harvest (121.15) which was significantly superior to ZT-CT (114.05) and ZT-ZT (111.29). Minimum value of number of tillers/m^2 at harvest (111.29) was observed under ZT-ZT treatment. Treatment CT-CT was remained *at par* with CT-ZT treatment (119.10).

Further, different organic source also influenced number of tillers of finger millet which increased significantly with different nutrient combination. Significantly highest number of tillers/m^2 at harvest (121.37) was recorded under 100% N through VC as compared to 100% N through FYM (110.91) but remain at par with 50% N FYM + 50% N VC (117.48) and 75% N FYM + 25% N VC (115.81). Interaction of tillage and organic nutrient management had no significant effect on number of tillers/m^2 at harvest. This obviously reflected the fact that sowing of finger millet was done properly and uniformly in each treatment using healthy and viable seeds to maintain better germination, emergence and crop stand per unit area. The same finding was reported by Harikesh *et al.*, (2017) and Roy, A. K. (2018).

Leaf area index (LAI)

Pooled data for leaf area index (LAI) of finger millet recorded at 30 DAS, 60 DAS and 90 DAS have been presented in Table 2. The data clearly showed that leaf area index of finger millet gradually increased with the age of finger millet crop. It was observed that maximum acceleration in growth of leaf area during 30 to 60 days after sowing. Thereafter it increased to 90 DAS but less in comparison to 60 DAS.

At 30 DAS, a critical study of the data revealed that different treatments of tillage practice and organic nutrient management had no significant effect on leaf area index. The highest value of leaf area index was recorded in CT-CT (0.66). ZT-ZT treatment was found with lowest value (0.61) of leaf area index. While organic nutrient management performed best in 100% N through VC (0.67) and 100% N through FYM (0.60) reported with lowest value of leaf area index.

Leaf area index at 60 DAS, significantly registered highest value (1.61) in CT-CT being at par with CT-ZT (1.59) but it showed significant superiority over ZT-CT (1.45) and ZT-ZT (1.43). Moreover, organic nutrient management significantly indicated the maximum leaf area index in 100% N through VC (1.62) which was followed by 50% N FYM + 50% N VC (1.57) and 75% N FYM + 25% N VC (1.48) while significantly reflected its superiority over 100% N through FYM (1.40).

Significantly maximum leaf area index was observed in CT-CT (2.65) in comparison to ZT-CT (2.50) and ZT-ZT (2.48) at 90 DAS however, failed to cause significant variation with CT-ZT (2.62). Among different organic nutrient sources 100% N through VC (2.67) proved its superiority over 100% N through FYM (2.46) but remained at par with 50% N FYM + 50% N VC (2.60) and 75% N FYM + 25% N VC (2.53).

Conventional tillage recorded higher crop growth because tillage is known to create favourable physical conditions for seed germination and seedling emergence. Vermicompost enables plants to synthesize food for growth, development and yield. It is fact that quantity of available nutrients absorbed (more) by plant is utilized to synthesize protein by combining with sugars manufactured in green leaves (Rekha *et al.* 2018).

Dry matter accumulation (g/m^2)

Tillage and organic nutrient management adopted in present study resulted in significant differences in dry matter accumulation which were recorded at 30, 60, 90 and at maturity have been presented in Table 3. It is evident from the data that the dry matter accumulation increased as the growth progressed and the values being maximum at harvest.

It is apparent from the pooled data (Table 3) that dry matter accumulation was not significantly influenced by tillage and organic nutrient management at 30 DAS. CT-CT (48.90 g/m^2) produced maximum dry matter accumulation at 30 DAS with minimum value (45.69 g/m^2) observed in ZT-ZT. On the other hand, organic nutrient sources ranged from maximum value of 49.41 g/m^2 in 100% N through VC to minimum value of 45.51 g/m^2 in 100% N through FYM.

Significant response or improvement in dry matter was elicited in Table 3 which revealed that pooled data of dry matter accumulation was maximum (282.01 g/m^2) in CT-CT as compared to ZT-CT (268.17 g/m^2) and ZT-ZT (266.33 g/m^2) while remain at par with CT-ZT (278.49 g/m^2) at 60 DAS. Experimentation of data further revealed that among organic sources 100% N through VC gave maximum (283.23 g/m^2) dry matter accumulation being at par with 50% N through FYM + 50% N through VC (275.71 g/m^2) and 75% N through FYM + 25% N through VC (271.66 g/m^2) while significantly superior to 100% N through FYM

(264.40 g/m^2). Interaction between these two factors i.e. tillage and organic nutrient management were found non significant at 60 DAS.

At 90 DAS, trend of increase in dry matter accumulation among different treatments of tillage practice and organic nutrient management was noticed similar as at 60 DAS. Value of dry matter accumulation was statistically found maximum (581.58 g/m^2) in CT-CT which was comparable to ZT-CT (547.72 g/m^2) and ZT-ZT (545.33 g/m^2) whereas, statistically at par with CT-ZT (574.43 g/m^2). In case of organic nutrient management 100% N through VC produced maximum dry matter (583.32 g/m^2), which was found to be significantly better than ZT-CT (569.20 g/m^2) and ZT-ZT (557.76 g/m^2). Lowest value was observed in use of alone source i.e. 100% N through FYM (538.78 g/m^2) amongst organic nutrient management. No interaction effect was observed between the these two factors at 90 DAS.

Based on the current study among all the tillage treatments, treatment CT-CT recorded maximum (865.61 g/m^2) dry matter accumulation at maturity. Treatment CT-CT was remained at par with CT-ZT (845.02 g/m^2) but statistically superior to rest of the treatments i.e. ZT-CT (800.88 g/m^2) and ZT-ZT (763.58 g/m^2). Addition to this organic nutrient management was obtained higher in 100% N through VC (873.36 g/m^2) followed by 50% N through FYM + 50% N through VC (841.33 g/m2) and 75% N through FYM + 25% N through VC (818.83 g/m^2) but significantly superior over rest of the treatment.

This might be due to cementing action of polysaccharides and other organic compounds released during the decomposition of organic matter supplied through vermicompost, provided better soil environment thus leading to taller plants, increased number of leaves, tillers and in turn the final yield. This is parallel with the findings of Ullasa *et al*., (2020).

Crop growth rate

Crop growth rate is a very important character in influencing the plant growth which was significantly enhanced by tillage and organic nutrient management. Analysis of the data on crop growth rate is presented in Table . Crop growth rate was recorded at 0-30 DAS, 30-60 DAS, 60-90 DAS, 90 DAS-at maturity. The data revealed that the crop growth rate increased from interval of 0-30 days after sowing to 60-90 DAS. After 60-90 DAS crop growth rate declined (i.e. at maturity).

It is apparent from the data (Table 4) that the tillage operation exerted significant influence on crop growth rate at all the growth stages except 0-30 DAS. At the interval of 0-30 DAS treatment CT-CT recorded maximum (1.63 g/m^2/day) crop growth rate but minimum under ZT-ZT (1.52 g/m^2/day). Application of organic nutrients i.e. 100% N through VC gave higher (1.65 g/m^2/day) crop growth rate and lower in 100% N through VC (1.52 g/m^2/day).

Perusal of data (Table 4) revealed that at the interval of 30-60 DAS significantly maximum (7.77 g/m^2/day) crop growth rate was observed in treatment CT-CT that was being at par with CT-ZT (7.69 g/m^2/day) whereas, significantly superior over ZT-CT (7.38 g/m^2/day) and ZT-ZT (7.36 g/m^2/day). Along with this organic nutrient 100% N through VC significantly showed maximum (7.79 g/m^2/day) crop growth rate compared to 100% N through FYM (7.30 g/m^2/day) and being at par with rest of the treatments.

At the interval of 60-90 DAS, crop growth rate was statistically maximum (9.98 g/m^2/day) in treatment CT-CT. It was at par with treatments like CT-ZT (9.87 g/m^2/day).

This treatment was significantly superior over ZT-CT (9.32 g/m^2/day) and ZT-ZT (9.30 g/m^2/day). Application of 100% N through VC indicated statistically highest (10.00 g/m^2/day) crop growth rate that was remain at par with 50% N FYM + 50% N VC (9.78 g/m^2/day) and 75% N FYM + 25% N VC (9.54 g/m^2/day) but significantly superior over 100% N through FYM (9.15 g/m^2/day).

Table 4 showed that crop growth rate was recorded highest (9.47 g/m^2/day) in treatment CT-CT at 90 DAS- at maturity. It was remained at par with CT-ZT (9.02 g/m^2/day) and superior over ZT-CT (8.44 g/m^2/day) and ZT-ZT (7.27 g/m^2/day). Summary of data also revealed that crop growth rate was maximum (9.67 g/m^2/day) in treatment in 100% N through VC at 90 DAS - to maturity statistically followed by 50 % N through FYM + 50% N through VC (9.07 g/m^2/day) and 75% N FYM + 25% N VC (8.70 g/m^2/day) however, statistically superior over 100% N through FYM (6.76 g/m^2/day).

The reason behind the best performance of 100% N through VC was as demonstrated scientifically that microbes like fungi, bacteria, yeasts, actinomycetes, algae are capable of producing auxins, gibberellins in appreciable quantity during vermicomposting (Arancon *et al.*, 2004).

Yield attributes

Effective tillers/m^2

Pooled data (Table 5) revealed that different tillage practice and its integration with organic sources viz. FYM and VC significantly influenced the number of effective tillers/m^2 of finger millet crop. Treatment CT-CT recorded maximum number of effective tillers/m^2 (112.96) which was significantly higher than ZT-CT (106.19) and ZT-ZT (103.55) but remained comparable to treatment CT-ZT (110.98). Again, 100% N through VC was noticed with maximum value (113.12) of number of effective tillers which was significantly *at par* with 50% N through FYM + 50% N through VC (109.44) and 75% N through FYM + 25% N through VC (107.87) in comparison to 100% N through FYM (103.24).

Number of fingers/ear

Number of fingers/ear (Table 5) was recorded significantly maximum (6.66) under CT-CT than number of fingers/ear under ZT-CT and ZT-ZT tillage practice (6.45 & 6.38, respectively). On the other hand, organic nutrient management such as 100% N through VC was found to be significantly better than FYM alone and produced maximum number of fingers/ear of 6.76 which was followed by 50% N FYM + 50% N VC (6.57) and 75% N FYM + 25% N VC (6.44). Values were observed the lowest in use of alone source of FYM i.e. 100% N through FYM (6.25) amongst the organic nutrient managements. Interaction between tillage and organic nutrient management was observed to be non significant.

Number of grains/ear

The parameters like number of grains/ear in shown in Table 5 revealed that this parameter was significantly influenced by tillage practice. Maximum (1085.26) number of grains/ear was observed in CT-CT and minimum (918.68) number of grains/ear was reported in ZT-ZT. Percentage increase in number of grains/ear from CT-ZT to CT-CT was 1.75%, CT-CT treatments was at par with CT-ZT but significantly superior to percentage increase from ZT-CT to CT-CT and from ZT-ZT to CT-CT 11.53% and 18.13% respectively. Interaction effects were found non significant.

Number of ear weight (g)

Scanning of the pooled data related to the number of ear weight presented in Table 5 indicated that among all treatments of tillage activity, CT-CT produced the maximum number of ear weight (6.59) which was significantly superior to ZT-CT (6.10 g) and ZT-ZT (5.98 g) but remained at par with CT-ZT (6.35 g). However, significant increase (6.61 g) was observed with the application of organic source like 100% N through VC in comparison to 100% N through FYM (5.96 g) while at par with 50% N FYM + 50% N VC (6.27 g) and 75% N FYM + 25% N VC (6.18 g). It was observed that effects of interaction were non significant.

1000 grain weight (g)

1000 grain weight (g) was non-significantly affected by tillage practice. It was recorded (Table 6) maximum (3.19 g) with CT-CT treatment and minimum (3.13 g) in ZT-ZT treatments. In case of organic nutrient management, 100% N through VC was found to be significantly better than other nutrient managements and produced maximum test weight of 3.24 g. The lowest (3.09 g) thousand grain weight was observed in 100% N through FYM. Interaction between tillage and organic nutrient management was observed to be non significant.

The higher yield attributes under conventional tillage were due to improved growth parameters. Study of Raina *et al.*, (2013) implied that the application of vermicompost @ 3 t/ha + N @ 60 kg/ha produced maximum herb and essential oil yield.

Yield (q/ha)

Grain yield (q/ha)

It is clear from pooled data (Table 6) that the application of CT-CT treatment produced maximum grain yield (23.90 q/ha) which was significantly higher than ZT-CT (21.18 q/ha) and ZT-ZT (19.87 q/ha) but remained at par with CT-ZT (22.95 q/ha). Among organic nutrient management, 100% N through VC produced maximum (24.25 q/ha) grain yield which was comparable to 100% N through FYM (18.72 q/ha) whereas, remained at par with 50% N through FYM + 50% N through VC (22.80 q/ha) and 75% N FYM + 25% N VC (22.14 q/ha). Interaction effect of tillage and organic nutrient management failed to cause any significant difference.

Straw yield (q/ha)

Analysis of pooled data (Table 6) revealed that straw yield of finger millet was significantly influenced by different tillage practice. The highest straw yield (38.85 q/ha) was recorded with CT-CT treatment, which was significantly superior to ZT-CT (37.01 q/ha) and ZT-ZT (35.35 q/ha) but remained at par with CT-ZT (38.18 q/ha). Supply of organic nutrient like 100% N through VC gave higher value (38.93 q/ha) of straw yield followed by 50% N through FYM + 50% N through VC (38.88 q/ha) and 75% N through FYM + 25% N through

VC (38.04 q/ha) but indicated its superiority to 100% N through FYM (33.54 q/ha). Interaction effect of tillage and organic nutrient management was found negligible.

Higher grain and straw yield under CT-CT is might be due to better yield attributes. These results are in concurrence with Saha *et al.*, (2010). On the other hand organic manures not only supply nutrients, but also bring an improvement towards physical properties of soil and thereby improving nutrient and water holding capacity (Dhanushkodi and Kannathasan 2012).

Harvest index

Scanning of the pooled data presented in Table 6 revealed that the harvest index of finger millet was neither significantly influenced by tillage and organic nutrient management nor by their interaction. The highest harvest index (37.92 %) was recorded with the CT-CT in combination with the application of 100% N through VC (38.32 %). Treatment combination ZT-ZT and 100% N through FYM produced lowest harvest index (36.02% and 35.88 % respectively) among all treatment combinations.

Conclusion

Hence concluded, in view of the results obtained from the present investigation, conventional tillage–conventional tillage could make considerable increase in number of tillers, leaf area index, dry matter accumulation, crop growth rate, number of effective tillers, number of fingers/ear, number of grains/ear, ear weight, grain and straw yield of finger millet. Among different organic source 100% N through VC should be applied for higher productivity of finger millet.

Table 1. Plant population and number of tillers of finger millet as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	Plant Population /m^2 at 15 DAS			No. of Tillers/m^2 at Harvest		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	31.59	32.76	32.18	120.50	121.79	121.15
CT-ZT	30.35	31.91	31.13	118.64	119.55	119.10
ZT-CT	29.60	30.63	30.12	112.83	115.26	114.05
ZT-ZT	28.78	29.96	29.37	109.75	112.83	111.29
SEm±	1.19	1.04	0.84	1.74	1.22	1.37
CD (P=0.05)	NS	NS	NS	7.31	5.13	5.76
B. Organic Nutrient Management						
100% N through FYM	28.40	29.72	29.06	109.48	112.34	110.91
100% N through Vermicompost	32.04	33.30	32.67	120.68	122.07	121.37
50% N FYM + 50% N Vermicompost	30.75	32.18	31.46	116.57	118.39	117.48
75% N FYM + 25% N Vermicompost	29.13	30.08	29.60	114.99	116.64	115.81
SEm±	1.08	1.06	0.81	2.78	2.65	2.49
CD (P=0.05)	NS	NS	NS	9.41	8.98	8.43

CV %	12.49	11.71	9.18	8.35	7.84	7.42
Interaction (A x B)						
SEm±	2.22	2.11	1.64	5.13	4.76	4.53
CD (P=0.05)	NS	NS	NS	NS	NS	NS

Table 2. Leaf area index of finger millet at various growth stages as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	**LAI at 30 DAS**			**LAI at 60 DAS**			**LAI at 90 DAS**		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	0.62	0.70	0.66	1.57	1.65	1.61	2.60	2.70	2.65
CT-ZT	0.60	0.69	0.64	1.55	1.62	1.59	2.57	2.67	2.62
ZT-CT	0.58	0.66	0.62	1.41	1.49	1.45	2.45	2.55	2.50
ZT-ZT	0.57	0.65	0.61	1.39	1.46	1.43	2.43	2.53	2.48
SEm±	0.02	0.02	0.02	0.04	0.04	0.04	0.03	0.03	0.03
CD (P=0.05)	NS	NS	NS	0.15	0.16	0.15	0.13	0.12	0.13
B. Organic Nutrient Management									
100% N through FYM	0.56	0.64	0.60	1.36	1.44	1.40	2.41	2.51	2.46
100% N through Vermicompost	0.63	0.71	0.67	1.58	1.66	1.62	2.62	2.72	2.67
50% N FYM + 50% N Vermicompost	0.61	0.70	0.66	1.54	1.61	1.57	2.55	2.65	2.60
75% N FYM + 25% N Vermicompost	0.57	0.66	0.61	1.44	1.52	1.48	2.48	2.58	2.53
SEm±	0.02	0.02	0.02	0.04	0.04	0.04	0.06	0.06	0.06
CD (P=0.05)	NS	NS	NS	0.14	0.15	0.14	0.19	0.19	0.19
CV %	11.94	10.46	9.98	9.32	9.75	9.32	7.55	7.46	7.40
Interaction (A x B)									
SEm±	0.04	0.04	0.04	0.08	0.08	0.08	0.10	0.10	0.10
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. Dry matter accumulation of finger millet at various growth stages as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	DMA at 30 DAS (g/m^2)			DMA at 60 DAS (g/m^2)			DMA at 90 DAS (g/m^2)			DMA at Maturity (g/m^2)		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	48.64	49.17	48.90	281.08	282.95	282.01	580.08	583.06	581.58	863.82	867.39	865.61
CT-ZT	47.37	48.08	47.73	277.83	279.14	278.49	573.75	575.11	574.43	843.70	846.35	845.02
ZT-CT	46.53	47.12	46.83	267.67	268.68	268.17	546.33	549.10	547.72	799.16	802.60	800.88
ZT-ZT	45.51	45.86	45.69	266.08	266.58	266.33	544.50	546.15	545.33	761.87	765.28	763.58
SEm±	0.75	1.49	0.81	1.92	3.71	2.40	7.76	3.80	2.94	12.05	3.89	6.25
CD (P=0.05)	NS	NS	NS	8.08	15.58	10.10	32.61	15.94	12.35	50.63	16.32	26.26
B. Organic Nutrient Management												
100% N through FYM	45.30	45.71	45.51	264.08	264.72	264.40	537.33	540.22	538.78	739.82	743.32	741.57
100% N through Vermicompost	49.24	49.58	49.41	282.92	283.55	283.23	582.67	583.96	583.32	871.81	874.90	873.36
50% N FYM + 50% N Vermicompost	47.49	48.16	47.82	274.83	276.59	275.71	568.00	570.40	569.20	839.57	843.09	841.33
75% N FYM + 25% N Vermicompost	46.03	46.78	46.41	270.83	272.49	271.66	556.67	558.85	557.76	817.35	820.31	818.83
SEm±	1.27	1.84	1.25	5.53	5.50	4.25	12.14	11.44	6.63	19.21	17.30	14.46
CD (P=0.05)	NS	NS	NS	18.75	18.66	18.69	41.02	38.66	39.04	64.91	58.47	60.86
CV %	9.39	13.43	9.16	7.12	7.01	7.03	7.49	7.03	7.19	8.14	7.30	7.65
Interaction (A x B)												
SEm±	2.33	3.53	2.31	9.77	10.23	9.95	22.41	20.17	20.89	35.38	30.21	31.92
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 4. Crop growth rate of finger millet at various growth stages as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	CGR at 0-30 DAS ($g/m^2/day$)			CGR at 30-60 DAS ($g/m^2/day$)			CGR at 60-90 DAS ($g/m^2/day$)			CGR at 90-Maturity DAS ($g/m^2/day$)		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	1.62	1.64	1.63	7.75	7.79	7.77	9.97	10.00	9.98	9.46	9.48	9.47
CT-ZT	1.58	1.60	1.59	7.68	7.70	7.69	9.86	9.87	9.87	9.00	9.04	9.02
ZT-CT	1.55	1.57	1.56	7.37	7.39	7.38	9.29	9.35	9.32	8.43	8.45	8.44
ZT-ZT	1.52	1.53	1.52	7.35	7.36	7.36	9.28	9.32	9.30	7.25	7.30	7.27
SEm±	0.03	0.05	0.02	0.08	0.09	0.06	0.06	0.12	0.08	0.24	0.22	0.16
CD (P=0.05)	NS	NS	NS	0.34	0.39	0.24	0.24	0.51	0.34	1.01	0.92	0.68
B. Organic Nutrient Management												
100% N through FYM	1.51	1.52	1.52	7.29	7.30	7.30	9.11	9.18	9.15	6.75	6.77	6.76
100% N through Vermicompost	1.64	1.65	1.65	7.79	7.80	7.79	9.99	10.01	10.00	9.64	9.70	9.67
50% N FYM + 50% N Vermicompost	1.58	1.61	1.60	7.58	7.61	7.60	9.77	9.79	9.78	9.05	9.09	9.07
75% N FYM + 25% N Vermicompost	1.53	1.56	1.55	7.49	7.52	7.51	9.53	9.55	9.54	8.69	8.72	8.70
SEm±	0.05	0.06	0.04	0.15	0.15	0.12	0.25	0.24	0.16	0.29	0.43	0.30
CD (P=0.05)	NS	NS	NS	0.49	0.49	0.39	0.85	0.79	0.81	0.98	1.45	1.02
CV %	10.09	13.38	8.51	7.02	7.06	6.92	9.08	8.45	8.66	11.80	17.35	12.20
Interaction (A x B)												
SEm±	0.08	0.12	0.07	0.27	0.27	0.21	0.44	0.44	0.43	0.56	0.78	0.55
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 5. Yield attributes of finger millet as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	No of Effective tillers/m^2			No of Fingers/Ear			No of Grains/Ear			Ear Weight (g)		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	112.22	113.70	112.96	6.59	6.74	6.66	1074.40	1096.13	1085.26	6.50	6.68	6.59
CT-ZT	110.38	111.57	110.98	6.47	6.60	6.53	1059.90	1073.30	1066.60	6.28	6.43	6.35
ZT-CT	104.87	107.50	106.19	6.39	6.50	6.45	957.21	988.94	973.07	6.03	6.17	6.10
ZT-ZT	101.90	105.19	103.55	6.32	6.44	6.38	906.98	930.37	918.68	5.92	6.05	5.98
SEm±	1.64	1.40	1.39	0.05	0.04	0.04	21.53	25.26	16.96	0.11	0.12	0.11
CD (P=0.05)	6.87	5.88	5.83	0.19	0.18	0.18	90.39	106.04	71.21	0.46	0.49	0.48
B. Organic Nutrient Management												
100% N through FYM	101.76	104.72	103.24	6.20	6.31	6.25	878.02	904.75	891.39	5.90	6.03	5.96
100% N through Vermicompost	112.28	113.96	113.12	6.69	6.84	6.76	1080.82	1107.55	1094.19	6.53	6.70	6.61
50% N FYM + 50% N Vermicompost	108.42	110.47	109.44	6.51	6.63	6.57	1040.89	1067.62	1054.26	6.20	6.34	6.27
75% N FYM + 25% N Vermicompost	106.93	108.80	107.87	6.38	6.50	6.44	998.74	1008.81	1003.77	6.11	6.26	6.18
SEm±	2.62	2.50	2.35	0.14	0.15	0.14	26.99	29.19	26.54	0.13	0.14	0.13
CD (P=0.05)	8.85	8.46	7.94	0.47	0.51	0.49	91.26	98.72	89.73	0.43	0.47	0.45
CV %	8.44	7.91	7.50	7.50	7.89	7.68	9.35	9.89	9.09	7.12	7.61	7.36
Interaction (A x B)												
SEm±	4.82	4.55	4.30	0.25	0.26	0.25	51.46	56.52	48.99	0.25	0.27	0.26
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 6. Thousand grain weight, grain and straw yield and harvest index of finger millet as influenced by tillage and organic nutrient management in finger millet – french bean cropping System

A. Tillage Practice	**1000 Grain Weight (g)**			**Grain Yield (q/ha)**			**Straw Yield (q/ha)**			**Harvest Index (%)**		
	2020	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**	**2020**	**2021**	**Pooled**
CT-CT	3.14	3.24	3.19	23.35	24.45	23.90	38.12	39.57	38.85	37.80	38.03	37.92
CT-ZT	3.12	3.22	3.17	22.24	23.66	22.95	37.46	38.90	38.18	37.31	37.74	37.52
ZT-CT	3.10	3.20	3.15	20.58	21.77	21.18	36.30	37.73	37.01	36.30	36.73	36.51
ZT-ZT	3.08	3.18	3.13	19.25	20.50	19.87	34.64	36.06	35.35	35.75	36.29	36.02
SEm±	0.07	0.06	0.06	0.40	0.51	0.33	0.39	0.36	0.37	0.59	0.61	0.48
CD (P=0.05)	NS	NS	NS	2.06	2.13	1.39	1.65	1.49	1.56	NS	NS	NS
B. Organic Nutrient Management												
100% N through FYM	3.04	3.14	3.09	18.18	19.25	18.72	32.82	34.25	33.54	35.71	36.05	35.88
100% N through Vermicompost	3.19	3.29	3.24	23.71	24.79	24.25	38.22	39.65	38.93	38.27	38.37	38.32
50% N FYM + 50% N Vermicompost	3.12	3.22	3.17	22.06	23.54	22.80	38.16	39.60	38.88	36.63	37.31	36.97
75% N FYM + 25% N Vermicompost	3.09	3.19	3.14	21.48	22.80	22.14	37.32	38.76	38.04	36.56	37.06	36.81
SEm±	0.09	0.08	0.09	0.57	0.59	0.45	1.15	1.10	1.12	1.01	0.95	0.89
CD (P=0.05)	NS	NS	NS	2.85	2.00	1.51	3.90	3.72	3.80	NS	NS	NS
CV %	10.27	8.92	9.53	9.29	9.08	7.06	10.91	10.01	10.43	9.47	8.83	8.32
Interaction (A x B)												
SEm±	0.17	0.16	0.16	1.07	1.15	0.84	2.04	1.94	1.98	1.84	1.75	1.61
CD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

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