

## **Influence of Rotation, Use of Organic and Inorganic Sources of Nutrients on Growth, Yield and Quality of *Eleusine coracana* (L.) Gaertn.**

**Pavan Kumar Goudar, B. K. Ramachandrappa,  
M. N. Thimmegowda, Sahoo S.**

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**Abstract** A field experiment was conducted during *kharif* 2013. The experiment was conducted in factorial RCBD with three factors comprised of 20 treatment combinations with two replications. Among different treatments, application of FYM at 10 MT/ha has recorded significantly higher grain yield (1761 kg/ha) compared to application of maize residues at 5 MT/ha (1365 kg/ha). Among two rotations, finger millet-groundnut rotation has given significantly higher grain yield (1783 kg/ha) over mono cropping of finger millet (1343 kg/ha). Among different nutrient sources, application of organic matter with 100% RDF has given significantly higher grain yield (2741 kg/ha) compared to absolute control (277 kg/ha). Among different treatments, application of FYM at 10 MT/ha, legume-cereal rotation, organic matter with 100% RDF have recorded higher Ca, Mg and popping per cent over other treatments.

**Keywords** Integrated nutrient management, Recommended dosage of fertilizer, Crop residue.

### **Introduction**

Finger millet due to its ability to withstand aberrant weather conditions makes its prominence in dry land areas. Intensive cropping lead to continuous mining of nutrients and ultimately resulted in deficiencies of micronutrients, reduced soil biological activity at last in to poor yields or even crop failures in certain cases. In order to maintain agricultural productivity side by side maintaining ecological balance, it is necessary to adopt integrated soil building practices for improving and stabilizing soil productivity alone and agricultural sustainability in whole. Along with increased production, the quality of produce is an important factor to be considered to meet the quality demands.

Because of nutrient recycling in crop rotation it is one of the important pillar of sustainable production systems. The practice of complete cereal rotation has shown its adverse effect on overall soil properties. A legume in a cropping sequence improves the soil fertility and consequently the productivity of succeeding crop. The present study was conducted with an aim to fulfill the requirement of sustainable and ecological production technique in finger millet.

### **Materials and Methods**

The investigation was carried out in the *kharif* season of 2013 at the AICRP on Dry Land Agriculture, Gandhi Krishi Vignana Kendra (GKVK), University of Agricultural Sciences, Bengaluru. The soil textural

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P. K. Goudar<sup>\*1</sup>, B. K. Ramachandrappa<sup>2</sup>, M. N. Thimmegowda<sup>2</sup>, Sahoo S.

<sup>1</sup>Department of Agronomy, <sup>2</sup>AICRP on Dry Land Agriculture UAS, GKVK Bengaluru 560065, India  
e-mail : pavankg77-coaagr@pau.edu

\*Correspondence

class of the experimental site was red sandy clay loam with 0.2 ds/m electrical conductivity, 0.45% organic carbon, pH of 5.25 and 173, 62 and 82 kg/ha of nitrogen, available phosphorus and available potassium, respectively. The study was a part of the long term manurial experiment with 35<sup>th</sup> crop cycle using factorial RCBD with three factors with three different levels replicated twice.

The first factor was source of organic matter with two levels ( $S_1$  :- FYM 10 MT/ha and  $S_2$  : maize residue 5 MT/ha) second factor was rotation system ( $R_1$  :- legume rotation and  $R_2$  :- mono cropping) and third factor was nutrient source with five levels (absolute control ( $T_1$ ), only organic matter ( $T_2$ ), 50% recommended dose of fertilizer + organic matter ( $T_3$ ), 100% recommended dose of fertilizer + organic matter ( $T_4$ ) and only recommended dose of fertilizer ( $T_5$ )).

The organic matter like FYM and maize residue were applied at the time of final ploughing, Urea, SSP and MOP were used as nutrient sources. Except 50% nitrogen which was top-dressed at tillering stage rest half nitrogen and full P and K was applied as basal dose. GPU-28 variety of finger millet was sown with 10 kg per ha at a spacing of 30 cm × 10 cm. The growth parameters were recorded at thirty days interval and yield parameters were recorded at 90 DAS and at harvest. The experimental data collected on various growth and yield components were subjected to Fisher's method of analysis of variance (ANOVA) as outlined by Gomez and Gomez [1] and data were compared with critical differences at a probability level of 5%.

## Results and Discussion

The different source of organic manure, rotation system and nutrient sources have significantly influenced all growth parameters. Among the different source of organic manures, application of 10 tonnes of FYM has shown significant influence on plant height (68.56 cm), LAI (1.44), total number of tillers/hill (4.25) and SPAD value (28.29) over maize residue at 5 MT/ha (62.51 cm, 1.15, 3.37 and 22.42 respectively). FYM supplies major nutrients slowly and for prolonged interval which might be the contributing factor for superior performance of FYM over the maize

residue application (Table 1). These results corroborate the findings of Dadhich and Gupta [2].

Among two rotation system, finger millet-groundnut rotation system resulted in significantly higher plant height (68.58 cm), LAI (1.36), total number of tillers per hill (4.09) and SPAD (26.32) over mono-cropped finger millet 62.49 cm, 1.23, 3.54 and 24.39 respectively). Cereal legume rotation system resulted in better growth parameters because of nitrogen fixation which was made available in the subsequent season in addition to the root biomass added apart from the improved soil health.

Application of organic matter + 100% recommended dose of fertilizer has resulted in significantly higher plant height (81.11 cm), LAI (2.61), higher number of tillers per hill (4.96) and SPAD (27.93). Whereas significantly lower growth parameters were recorded in absolute control (43.86 cm, 0.58, 2.63 and 21.67 respectively). 100% recommended dose of fertilizers in combination with organic matter supplied the required quantity of nutrients as well as improved the soil properties which were the main factors responsible for superior growth parameters in the recommended dosage of fertilizers with organic matter. FYM with legume rotation recorded significantly higher number of tillers/hill (4.36) than the maize residue with mono-cropping (2.93) in the interaction of organic source × rotation system.

Among the different interaction of organic source × nutrient source, the maize residue at 5 MT/ha with absolute control has recorded significantly lower leaf area index (0.55) and no of tillers/hill (2.30) than applying FYM at 10 MT/ha with the organic matter + 100% recommended dose of fertilizer (2.90 and 5.27 respectively). Interaction effect of rotation system and nutrient sources also has shown the significant difference in the leaf area index and no of tillers also. Different source of organic matter and rotation system and nutrient sources have significantly influenced the yield and yield parameters. Significantly higher ear head length (7.25 cm), grain weight/hill (9.10g) grain yield (1761 kg/ha) and straw yield (2672 kg/ha) were noticed in 10 MT of FYM/ha over maize residue 5 MT/ha 6.66 cm, 7.16, 2218 kg/ha and 1365 kg/ha, respectively. Finger millet grown in mono crop-

**Table 1.** Plant height, LAI, number of tiller/hill and SPAD values of finger millet at harvest as influenced by legume rotation, use of organic and inorganic sources of nutrients. S<sub>1</sub> : FYM 10 tonnes ha<sup>-1</sup>, S<sub>2</sub> : Maize residue 5 tonnes ha<sup>-1</sup>, R<sub>1</sub> : Finger millet – groundnut rotation, R<sub>2</sub> : Finger millet mono cropping, LAI : Leaf Area Index, T<sub>1</sub> : Absolute control, T<sub>2</sub> : Organic matter, T<sub>3</sub> : Organic matter + 50% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>4</sub> : Organic matter + 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>5</sub> : 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, NS : Non-significant.

Treatments	Plant height (cm)	LAI	Number of tiller/hill	SPAD	Treatments	Plant height (cm)	LAI	Number of tiller/hill	SPAD
Source of organic manure (S)					S <sub>2</sub> T <sub>4</sub>	79.21	2.33	4.65	23.72
S <sub>1</sub>	68.56	1.44	4.25	28.29	S <sub>2</sub> T <sub>5</sub>	71.43	0.70	1.63	21.92
S <sub>2</sub>	62.51	1.15	3.37	22.42	SEm ±	4.55	0.07	0.19	1.13
SEm ±	2.04	0.03	0.09	0.51	CD at 5%	NS	0.22	0.56	NS
CD at 5%	6.03	0.10	0.25	1.50	Interaction (R × T)				
Rotation system (R)					R <sub>1</sub> T <sub>1</sub>	49.23	0.62	2.78	22.02
R <sub>1</sub>	68.58	1.36	4.09	26.32	R <sub>1</sub> T <sub>2</sub>	62.68	0.70	4.47	26.98
R <sub>2</sub>	62.49	1.23	3.54	24.39	R <sub>1</sub> T <sub>3</sub>	71.43	1.98	4.60	27.23
SEm ±	2.04	0.03	0.00	0.51	R <sub>1</sub> T <sub>4</sub>	84.83	2.80	5.22	29.15
CD at 5%	6.03	0.10	0.25	1.50	R <sub>1</sub> T <sub>5</sub>	74.71	0.71	3.38	26.25
Nutrient source (T)					R <sub>2</sub> T <sub>1</sub>	38.49	0.55	2.48	21.33
T <sub>1</sub>	43.86	0.58	2.63	21.67	R <sub>2</sub> T <sub>2</sub>	55.91	0.64	4.17	23.67
T <sub>2</sub>	59.30	0.67	1.32	25.32	R <sub>2</sub> T <sub>3</sub>	70.32	1.63	4.49	25.72
T <sub>3</sub>	70.88	1.81	4.54	26.47	R <sub>2</sub> T <sub>4</sub>	77.39	2.43	4.70	26.71
T <sub>4</sub>	81.11	2.61	4.96	27.93	R <sub>2</sub> T <sub>5</sub>	70.34	0.88	1.87	24.51
T <sub>5</sub>	72.52	0.79	2.62	25.38	SEm ±	4.55	0.07	0.19	1.13
SEm ±	3.22	0.05	0.13	0.80	CD at 5%	NS	0.22	0.56	NS
CD at 5%	9.53	0.15	0.40	2.37	Interaction (S × R × T)				
Interaction (S×R)					S <sub>1</sub> R <sub>1</sub> T <sub>1</sub>	49.26	0.64	3.15	23.41
S <sub>1</sub> R <sub>1</sub>	71.48	1.48	4.36	29.40	S <sub>1</sub> R <sub>1</sub> T <sub>2</sub>	69.66	0.78	4.44	29.45
S <sub>1</sub> R <sub>2</sub>	65.64	1.39	4.14	27.18	S <sub>1</sub> R <sub>1</sub> T <sub>3</sub>	71.81	2.26	4.90	30.97
S <sub>1</sub> R <sub>3</sub>	65.68	1.24	3.81	23.25	S <sub>1</sub> R <sub>1</sub> T <sub>4</sub>	87.96	3.02	5.34	33.56
S <sub>2</sub> R <sub>2</sub>	59.34	1.06	2.93	21.59	S <sub>1</sub> R <sub>1</sub> T <sub>5</sub>	78.71	0.72	4.00	29.59
SEm ±	2.88	0.05	0.12	0.72	S <sub>1</sub> R <sub>2</sub> T <sub>1</sub>	43.17	0.58	2.75	22.95
CD at 5%	NS	NS	0.36	NS	S <sub>1</sub> R <sub>2</sub> T <sub>2</sub>	65.71	0.72	4.80	25.55
Interaction (S × T)					S <sub>1</sub> R <sub>2</sub> T <sub>3</sub>	72.76	1.83	4.74	28.61
S <sub>1</sub> T <sub>1</sub>	46.21	0.61	2.95	23.18	S <sub>1</sub> R <sub>2</sub> T <sub>4</sub>	78.06	2.78	5.20	30.70
S <sub>1</sub> T <sub>2</sub>	67.68	0.75	4.62	27.50	S <sub>1</sub> R <sub>2</sub> T <sub>5</sub>	68.51	1.06	3.24	28.11
S <sub>1</sub> T <sub>3</sub>	72.28	2.04	4.82	29.79	S <sub>2</sub> R <sub>1</sub> T <sub>1</sub>	49.21	0.59	2.40	20.62
S <sub>1</sub> T <sub>4</sub>	83.01	2.90	5.27	32.13	S <sub>2</sub> R <sub>1</sub> T <sub>2</sub>	55.71	0.62	4.50	24.51
S <sub>1</sub> T <sub>5</sub>	73.61	0.89	3.62	28.85	S <sub>2</sub> R <sub>1</sub> T <sub>3</sub>	71.06	1.71	4.30	23.49
S <sub>2</sub> T <sub>1</sub>	41.51	0.55	2.30	20.17	S <sub>2</sub> R <sub>1</sub> T <sub>4</sub>	81.71	2.59	5.10	24.73
S <sub>2</sub> T <sub>2</sub>	50.91	0.59	4.02	23.15	S <sub>2</sub> R <sub>1</sub> T <sub>5</sub>	70.71	0.70	2.75	22.91
S <sub>2</sub> T <sub>3</sub>	69.47	1.57	4.27	23.15	S <sub>2</sub> R <sub>2</sub> T <sub>1</sub>	33.81	0.51	2.20	19.72
					S <sub>2</sub> R <sub>2</sub> T <sub>2</sub>	46.11	0.56	3.54	21.78
					S <sub>2</sub> R <sub>2</sub> T <sub>3</sub>	67.89	1.44	4.24	22.82
					S <sub>2</sub> R <sub>2</sub> T <sub>4</sub>	76.71	2.08	4.20	22.71
					S <sub>2</sub> R <sub>2</sub> T <sub>5</sub>	72.16	0.69	0.50	20.92
					SEm ±	6.44	0.10	0.27	1.60
					CD at 5%	NS	NS	NS	NS

ping had significantly lower ear head length (6.62 cm), grain weight/hill (6.87 g), grain yield (1343 kg/ha) and straw yield (1990 kg/ha) than legume rotation which showed significantly higher yield paramaters (7.30 cm,

9.38 g, 1783 kg/ha and 2900 kg/ha respectively). Among different nutrient source significantly lower ear head length, grain weight/hill, grain yield and straw yield were observed in absolute control (6.44 cm, 4.75

**Table 2.** Ear head length, grain weight/hill, grain yield and straw yield of finger millet as influenced by legume rotation, use of organic and inorganic sources of nutrients. S<sub>1</sub> : FYM, S<sub>2</sub> : Maize residue, R<sub>1</sub> : Finger millet – groundnut rotation, R<sub>2</sub> : Finger millet mono cropping, T<sub>1</sub> : Absolute control, T<sub>2</sub> : Organic matter, T<sub>3</sub> : Organic matter + 50% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>4</sub> : Organic matter + 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>5</sub> : 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

Treatments	Ear head length (cm)	Grain weight/hill	Grain yield (kg/ha)	Straw yield (kg/ha)	Treatments	Ear head length (cm)	Grain weight/hill	Grain yield (kg/ha)	Straw yield (kg/ha)
Source of organic manure (S)					CD at 5%	NS	1.24	392	540
S <sub>1</sub>	7.25	9.10	1761	2672	Interaction (R × T)				
S <sub>2</sub>	6.62	6.87	1343	1990	R <sub>1</sub> T <sub>1</sub>	6.57	6.03	238	309
SEm ±	0.13	0.19	59	82	R <sub>1</sub> T <sub>2</sub>	6.89	9.30	1130	1571
CD at 5%	0.39	0.55	175	242	R <sub>1</sub> T <sub>3</sub>	7.52	8.83	2231	4093
Rotation system (R)					R <sub>1</sub> T <sub>4</sub>	8.23	11.65	3100	5322
R <sub>1</sub>	7.30	9.38	1783	2900	R <sub>1</sub> T <sub>5</sub>	7.29	11.10	2216	3206
R <sub>2</sub>	6.62	6.87	1343	1990	R <sub>2</sub> T <sub>1</sub>	6.30	3.48	217	203
SEm ±	0.13	0.19	59	82	R <sub>2</sub> T <sub>2</sub>	6.02	5.70	872	920
CD at 5%	0.39	0.55	175	242	R <sub>2</sub> T <sub>3</sub>	7.03	5.93	1648	2397
Treatments (T)					R <sub>2</sub> T <sub>4</sub>	7.61	10.50	2382	3874
T <sub>1</sub>	6.44	4.75	227	256	R <sub>2</sub> T <sub>5</sub>	6.13	8.75	1594	2555
T <sub>2</sub>	6.45	7.50	1001	1245	SEm ±	0.29	0.42	132	183
T <sub>3</sub>	7.27	7.38	1939	3245	CD at 5%	NS	NS	NS	540
T <sub>4</sub>	7.92	11.08	2741	4598	Interaction (S × R × T)				
T <sub>5</sub>	6.71	9.93	1905	2881	S <sub>1</sub> R <sub>1</sub> T <sub>1</sub>	6.84	6.55	320	391
SEm ±	0.21	0.30	94	129	S <sub>1</sub> R <sub>1</sub> T <sub>2</sub>	7.48	13.45	1796	2604
CD at 5%	0.62	0.88	277	382	S <sub>1</sub> R <sub>1</sub> T <sub>3</sub>	7.85	11.10	2378	4541
Interaction (S × R)					S <sub>1</sub> R <sub>1</sub> T <sub>4</sub>	8.95	12.90	3244	5143
S <sub>1</sub> R <sub>1</sub>	7.76	11.40	1959	3161	S <sub>1</sub> R <sub>1</sub> T <sub>5</sub>	7.67	13.20	2056	3125
S <sub>1</sub> R <sub>2</sub>	6.74	6.79	1562	2183	S <sub>1</sub> R <sub>2</sub> T <sub>1</sub>	6.55	2.05	345	326
S <sub>2</sub> R <sub>1</sub>	6.84	7.36	1607	2640	S <sub>1</sub> R <sub>2</sub> T <sub>2</sub>	6.20	5.75	1499	1514
S <sub>2</sub> R <sub>2</sub>	6.49	6.95	1123	1797	S <sub>1</sub> R <sub>2</sub> T <sub>3</sub>	7.15	4.35	1814	2596
SEm ±	0.19	0.26	84	115	S <sub>1</sub> R <sub>2</sub> T <sub>4</sub>	7.25	13.75	2448	3776
CD at 5%	NS	0.78	NS	NS	S <sub>1</sub> R <sub>2</sub> T <sub>5</sub>	6.55	8.55	1707	2702
Interaction (S × T)					S <sub>2</sub> R <sub>1</sub> T <sub>1</sub>	6.30	5.50	155	228
S <sub>1</sub> T <sub>1</sub>	6.70	4.30	333	358	S <sub>2</sub> R <sub>1</sub> T <sub>2</sub>	6.30	5.65	465	537
S <sub>1</sub> T <sub>2</sub>	6.84	9.35	1647	2059	S <sub>2</sub> R <sub>1</sub> T <sub>3</sub>	7.18	9.80	2083	3646
S <sub>1</sub> T <sub>3</sub>	7.50	7.73	2096	3569	S <sub>2</sub> R <sub>1</sub> T <sub>4</sub>	7.50	6.55	2957	5501
S <sub>1</sub> T <sub>4</sub>	8.10	13.38	2846	4460	S <sub>2</sub> R <sub>1</sub> T <sub>5</sub>	6.90	9.80	2376	3288
S <sub>1</sub> T <sub>5</sub>	7.11	10.73	1881	2913	S <sub>2</sub> R <sub>2</sub> T <sub>1</sub>	6.05	4.90	89	81
S <sub>2</sub> T <sub>1</sub>	6.18	5.20	122	155	S <sub>2</sub> R <sub>2</sub> T <sub>2</sub>	5.84	10.30	245	326
S <sub>2</sub> T <sub>2</sub>	6.07	5.65	355	431	S <sub>2</sub> R <sub>2</sub> T <sub>3</sub>	6.90	10.30	1482	2197
S <sub>2</sub> T <sub>3</sub>	7.04	7.03	1782	2921	S <sub>2</sub> R <sub>2</sub> T <sub>4</sub>	7.97	12.95	2316	3971
S <sub>2</sub> T <sub>4</sub>	7.73	8.78	2636	4736	S <sub>2</sub> R <sub>2</sub> T <sub>5</sub>	5.70	10.55	1482	2409
S <sub>2</sub> T <sub>5</sub>	6.30	9.13	1929	2848	SEm ±	0.42	0.59	187	258
SEm ±	0.29	0.42	132	183	CD at 5%	NS	1.75	NS	NS

g, 227 kg/ha and 256 kg/ha respectively). Whereas, 100% recommended dose of fertilizers + organic matter source has recorded significantly higher (Ear head length (7.92), grain weight/hill (11.08), grain yield (2741 kg/ha and straw yield 4598 kg/ha respectively). The better performance of FYM over maize residue, le-

gume rotation over mono cropping and recommended fertilizers with organic matter over control were mainly due to balanced and controlled supply of nutrients which have resulted in better growth parameters which have reflected on the improved yield parameters (Table 2) and yield. These results are in line

**Table 3.** Ca, Mg, protein (%) and popping (%) of finger millet grain as influenced by legume rotation use of organic and inorganic sources of nutrients. S<sub>1</sub> : FYM, S<sub>2</sub> : Maize residue, R<sub>1</sub> : Finger millet – groundnut rotation, R<sub>2</sub> : Finger millet mono cropping, T<sub>1</sub> : Absolute control, T<sub>2</sub> : Organic matter, T<sub>3</sub> : Organic matter + 50% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>4</sub> : Organic matter + 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, T<sub>5</sub> : 100% N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, NS : Non significant.

Treatments	Ca %	Mg %	Protein %	Popping %	Treatments	Ca %	Mg %	Protein %	Popping %
Source of organic manure (S)					Interaction (R × T)				
S <sub>1</sub>	0.99	1.01	1.04	50.91	R <sub>1</sub> T <sub>1</sub>	0.74	0.89	0.91	32.80
S <sub>2</sub>	0.83	0.83	1.07	43.84	T <sub>1</sub> T <sub>2</sub>	0.93	0.98	1.01	74.90
SEm ±	0.03	0.06	0.03	0.47	R <sub>1</sub> T <sub>3</sub>	1.06	1.15	1.18	52.95
CD at 5%	0.10	0.17	NS	1.39	R <sub>1</sub> T <sub>4</sub>	1.12	1.41	1.31	66.30
Rotation system (R)					R <sub>1</sub> T <sub>5</sub>	0.98	0.96	1.07	45.05
R <sub>1</sub>	0.96	1.08	1.10	54.40	R <sub>2</sub> T <sub>1</sub>	0.67	0.64	0.81	25.35
R <sub>2</sub>	0.86	0.76	1.01	40.35	R <sub>2</sub> T <sub>2</sub>	0.85	0.69	0.96	58.00
SEm ±	0.03	0.06	0.03	0.47	R <sub>2</sub> T <sub>3</sub>	0.86	0.84	1.14	35.25
CD at 5%	0.10	0.17	NS	1.39	R <sub>2</sub> T <sub>4</sub>	1.02	0.91	1.22	45.10
Treatments (T)					R <sub>2</sub> T <sub>5</sub>	0.89	0.73	0.95	38.05
T <sub>1</sub>	0.70	0.77	0.86	29.08	SEm ±	0.07	0.13	0.06	1.05
T <sub>2</sub>	0.89	0.83	0.99	66.45	CD at 5%	NS	NS	NS	3.11
T <sub>3</sub>	0.96	1.00	1.16	44.10	Interaction (S×R×T)				
T <sub>4</sub>	1.07	1.16	1.26	55.70	S <sub>1</sub> R <sub>1</sub> T <sub>1</sub>	0.78	0.93	0.87	34.60
T <sub>5</sub>	0.94	0.85	1.01	41.55	S <sub>1</sub> R <sub>1</sub> T <sub>2</sub>	0.99	0.95	1.03	79.40
SEm ±	0.05	0.09	0.05	0.74	S <sub>1</sub> R <sub>1</sub> T <sub>3</sub>	1.23	1.21	1.24	55.50
CD at 5%	0.16	0.27	0.13	2.20	S <sub>1</sub> R <sub>1</sub> T <sub>4</sub>	1.25	1.70	1.22	74.10
Interaction (S × R)					S <sub>1</sub> R <sub>1</sub> T <sub>5</sub>	1.06	1.00	1.09	46.90
S <sub>1</sub> R <sub>1</sub>	1.06	1.16	1.09	58.10	S <sub>1</sub> R <sub>2</sub> T <sub>1</sub>	0.70	0.74	0.74	26.60
S <sub>1</sub> R <sub>2</sub>	0.92	0.86	1.00	43.72	S <sub>1</sub> R <sub>2</sub> T <sub>2</sub>	0.88	0.72	1.05	65.20
S <sub>2</sub> R <sub>1</sub>	0.86	1.00	1.10	50.70	S <sub>1</sub> R <sub>2</sub> T <sub>3</sub>	0.92	0.93	1.09	39.40
S <sub>2</sub> R <sub>2</sub>	0.80	0.67	1.03	36.98	S <sub>1</sub> R <sub>2</sub> T <sub>4</sub>	1.12	1.04	1.18	47.40
SEm ±	0.5	0.08	0.04	0.66	S <sub>1</sub> R <sub>2</sub> T <sub>5</sub>	0.98	0.86	0.93	40.00
CD at 5%	NS	NS	NS	NS	S <sub>2</sub> R <sub>1</sub> T <sub>1</sub>	0.70	0.85	0.95	31.00
Interaction (S × T)					S <sub>2</sub> R <sub>1</sub> T <sub>2</sub>	0.86	1.01	0.99	70.40
S <sub>1</sub> T <sub>1</sub>	0.74	0.84	0.81	30.60	S <sub>2</sub> R <sub>1</sub> T <sub>3</sub>	0.88	1.08	1.12	50.40
S <sub>1</sub> T <sub>2</sub>	0.94	0.84	1.04	72.30	S <sub>2</sub> R <sub>1</sub> T <sub>4</sub>	0.98	1.13	1.40	58.50
S <sub>1</sub> T <sub>3</sub>	1.08	1.07	1.17	47.45	S <sub>2</sub> R <sub>1</sub> T <sub>5</sub>	0.90	0.93	1.05	43.20
S <sub>1</sub> T <sub>4</sub>	1.18	1.37	1.20	60.75	S <sub>2</sub> R <sub>2</sub> T <sub>1</sub>	0.64	0.54	0.87	24.10
S <sub>1</sub> T <sub>5</sub>	1.02	0.93	1.01	43.45	S <sub>2</sub> R <sub>2</sub> T <sub>2</sub>	0.82	0.65	0.87	50.80
S <sub>2</sub> T <sub>1</sub>	0.67	0.69	0.91	27.55	S <sub>2</sub> R <sub>2</sub> T <sub>3</sub>	0.81	0.75	1.18	31.10
S <sub>2</sub> T <sub>2</sub>	0.84	0.83	0.93	60.60	S <sub>2</sub> R <sub>2</sub> T <sub>4</sub>	0.93	0.78	1.26	42.80
S <sub>2</sub> T <sub>3</sub>	0.84	0.92	1.15	40.75	S <sub>2</sub> R <sub>2</sub> T <sub>5</sub>	0.81	0.61	0.97	36.10
S <sub>2</sub> T <sub>4</sub>	0.95	0.95	1.33	50.65	SE m ±	0.11	0.19	0.09	1.49
S <sub>2</sub> T <sub>5</sub>	0.85	0.77	1.01	39.65	CD at 5%	NS	NS	NS	4.40
SEm ±	0.07	0.13	0.06	1.05					
CD at 5%	NS	NS	NS	3.11					

with the results of Anil Kumar et al. [3] Jahkar et al. [4] and Ramamoorthy et al. [5].

In the interaction effect of organic source × nutrient source, FYM 10 MT/ha with organic matter + 100% RDF has recorded significantly higher ear head

length (8.10), grain weight/hill (13.38), grain yield (2846 kg/ha and straw yield 4460 kg/ha respectively) than maize residue 5 MT/ha<sup>-1</sup> + absolute control (6.30, 5.20, 122 kg/ha and 155 kg/ha respectively).

Except rotation system × nutrient sources all other interactions were found to be significant. Under in-

teractions of organic sources  $\times$  rotation system  $\times$  different nutrient sources, the highest grain weight/hill (13.75 g) was noticed in 100% recommended dose of fertilizer with FYM and legume rotation. However the least grain weight was noticed in maize residue with absolute control in mono-cropped finger millet (4.90 g).

Different source of organic matter and rotation system and nutrient sources have significantly influenced the quality parameters of finger millet. Incorporation of 10 MT of FYM/harecorded significantly higher Ca, Mg content and popping % (0.99, 1.01 and 50.91 respectively) than the maize residue at 5 MT/ha (0.83, 0.82 and 43.84 respectively). This was due to supply of micronutrients through FYM which was not possible in case of maize residue (Table 3). Crop grown in the legume rotation has significantly higher values of Ca, Mg and popping % (0.96, 1.08 and 54.40 respectively) than in mono cropping (0.86, 0.76 and 40.35 respectively) which was mainly attributed to the addition of legume biomass to the soil which supplied micronutrients as well as better supply of nitrogen which have enhanced crop growth and due to better crop growth, yield and quality parameter of grain. Significantly highest Ca, Mg and protein % of finger millet grain were observed in 100% recommended dose of fertilizer with organic matter application (1.07, 1.16 and 1.26 respectively) than the absolute control (0.70, 0.77 and 0.86 respectively). These higher quality parameters were due to inclusion of SSP for supply of phosphorus which has supplied 14% calcium in addition of phosphorous and caused higher calcium and magnesium uptake resulted in balanced nutrition of the crop.

Among different interaction between the sources of organic manures  $\times$  nutrient source, significantly higher popping % is noticed in FYM 10 MT/ha with organic matter (72.30) mainly due to healthier crop growth because of better nutrient supply to grain resulting in balanced nourished grains. Whereas, significantly lower popping % was observed in absolute control (30.60). Between different interaction of rotation and nutrient sources, legume rotation with the organic matter has recorded significantly higher popping % (74.90) because of proper supply of nutrients

by legume biomass as well as the atmospheric nitrogen fixation which has led to proper seed coat development resulting in the better popping % of grain as compared to mono cropping with absolute control (32.80%). Among different interaction between organic sources, rotation system and nutrient source, FYM at 10 MT/ha with a legume rotation and the 100% DRF has significantly higher popping % (79.40) whereas, mono cropping with absolute control had the least (24.10%). There was no significant difference noticed in Ca, Mg and protein content in organic source  $\times$  rotation system, organic sources  $\times$  nutrient sources, rotation system  $\times$  nutrient sources and organic sources  $\times$  rotation system  $\times$  nutrient sources in interactions.

The experimental results revealed that application of FYM 10 MT/ha has given higher grain and straw yield over the application of FYM at MT/ha. Among two rotation system legume cereal rotation system will provide the high yield because of improved soil health. The application of organic matter with 100% RDF has given higher yields over the absolute control. Among different interactions between the various factors application of FYM 10 MT/ha with finger millet groundnut rotation with organic matter and the 100% RDF will be considered as the better combination over the other interaction.

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