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Response of finger millet (*Eluesine coracana.L.*) to organic and inorganic sources of nutrients under rainfed condition

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Finger millet (*Eluesine coracana.L.*) is an important dry land millet crop and ranks third in importance among millets in India. after sorghum and pearl millet. Finger millet is a staple food for working class and diabetic patients due to its better nutritional quality. The grains are rich in calcium and iron and known for its slow releasing pattern of sugar in to blood stream, there by it is recommended for diabetic patients. Continuous use of chemical fertilizers and plant protection chemicals in post green revolution scenario had greatly affected the physical, chemical and biological properties of soil. This had resulted in reduced yield levels in all the food crops. In order to sustain the yield level in concurrence with soil health is one of the utmost important subject in the current situation. In recent years emphasis on conjunctive use of organic and inorganic sources of nutrients has assumed greater dimension.

The experiment was conducted at Regional Research Station, GKVK Campus Bangalore. The experimental site was fairly uniform with gentle slope towards western side. The soil was red sandy loam and belongs to order alfisol, vijayapura series. The organic matter content of soil was low (0.48%), pH 5.5 and EC is 0.04 dSm^{-1}.The soil was low in available nitrogen (268.38 kg/ha) medium in available phosphorous (35.3 kg/ha) and medium in available potassium (229.81 kg/ha). Horse gram was grown in the previous year *Rabi* season. The cropping season recorded well distributed of rainfall (564.5 mm) over 33 rainy days through out the cropping season.

The experiment was laid out in Randomized Block Design with three replications. There were ten treatments among which T_1-T_6 carries only different organic manures applied at different rates based on nitrogen equivalent. Details of the treatments were furnished in Table.1.

Table.1 Details of the treatments

Treatment No.	Manure /fertilizer	Quantity applied kg/ha)
T_1	Farm yard manure	5952
T_2	Biogas slurry	4098
T_3	Poultry manure	2702
T_4	City waste compost	2857
T_5	Agrimagic	3378
T_6	Green manure	6493
T_7	100%RDF	50:40:25 NPK
T_8	100%RDF+ FYM	50:40:25 NPK + FYM @ 7.5 t /ha
T_9	100% NK	50: 25 NK
T_{10}	Absolute control	-

The blast resistant finger millet CV GPU-28 was sown on 17 August 2003 at a spacing 30 **x** 10cm and the treatments were implemented accordingly. The seed rate was 10.0 Kg / ha. After care operations were carried out as per the package of practice to establish a good crop stand .The crop was harvested on 12th December 2003 (112days). The biometric observations on various growth and yield parameters were recorded at 30,60,90 days after sowing (DAS) and at harvest. After harvest, the soil and plant samples were collected from each treatment to study the nutrient uptake pattern and to workout nutrient balance sheet

The combined application of organic and inorganic manures significantly increased the growth and yield of finger millet. Application of 100% RDF+ FYM @ 7.5 t/ha (T_8) produced significantly higher grain yield (3660 kg/ ha) and straw yield (6610 kg/ha)

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over rest of the treatments. Among the treatments receiving the organic manures alone (T_1 to T_6), poultry manure @ 3 tons /ha recorded significantly higher grain and straw yield (2970 and 6010 kg/ha.) compared to other treatments .This higher yield levels may be attributed to superiority of nutrient status and better response of finges millet to poultry manure compared to other organic manures. Maximum grain yield in T_8 (100% RDF + FYM) has been further attributed to higher grain yield per ear head (2.9g) and grain yield per plant (13.8 g) (Table.2). Higher total dry matter production was also noticed in T_8 (41.80 g/plant). This higher total dry matter production was attributed to better plant growth , which resulted in higher dry matter accumulation in leaves and stem at earlier growth stages and better translocation to ear head during later stages .Higher dry matter production in leaf (5.5 g /plant) , stem (16.20 g /plant)and at ear head (25.10 g /plant) were noticed due to application of 100% RDF + FYM. Results of the current study are in conformity with earlier results of Arunachalam *et al.* (1995) .

Soil nitrogen balance increased with increase in application of nitrogen through different organics and inorganic fertilizers might be attributed due to addition of more nitrogen into soil and its slow release through out the crop growth period which might have minimized the nitrogen loss. Higher nitrogen loss (100.5 kg/ha) was observed under city waste compost .it was due to lower crop removal and total quantity may not be mineralized during crop growth period .Lowest nitrogen loss was observed in poultry manure (24.1 kg/ ha). With increase in dose of manures and fertilizers, loss of nitrogen increased which was due to the fact that when the nutrients released at a rate exceeding the plants need then losses through leaching, volatilization and denitrification occurs. The results of the current study are in conformity with earlier findings of Purushotham *et al.*, (1990) Significantly higher residual phosphorus was observed due to application 100% DRF + FYM (105.1 kg/ has) fallowed by poultry manure (36.3kg / ha^{-1}) might be attributed to more phosphorus added to soil due to application of farm yard manure alone or in combination with fertilizer net negative balance was observed which might be due to addition of more phosphorus to the soil as compared to crop uptake and all the added P_2O_5 was not been mineralized during the crop growth period and some amount of P_2O_5 fixed in the soil .Similar results were also reported by Muthuswamy *et al.* (1990) and Basavaraju and Rao (1997)

Higher residual potassium recorded due to application of 100% RDF + FYM might be attributed to increased level of potassium added to soil and its retention .In the soil as it is a cation, lowest loss of K_2O was observed under green manure (14.0 kg has) and poultry manure compost (18.3 kg/ has) might be due to better synchrony in nutrient release and uptake of nutrient by finger millet. However, application of 100% RDF + FYM recorded net gain (46.5 kg/ has) might be due to more addition from both the sources of nutrients This result substantiate the effect of conjunctive use of organic manures with inorganic fertilizer in building active pools of nutrients and also maintains consistent supply of nutrient for proper growth. Thus combined use of both organics and inorganic in right proportion was necessary for sustaining and enhancing the productivity. Higher yield, soil fertility and productivity can be sustained by following integrated nutrient management approach in finger millet .There by application of recommended dose of fertilizer (50:40:25 NPK kg /ha) along with 7.5 tonne of farm yard manure is recommended to realize higher yield in finger millet grown under rainfed condition **.**

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Table 2: Effect of different treatments on dry matter production, grain weight , grain yield and straw yield of finger millet.

Treatment	Total Dry matter production (g/plant)				Grain weight / ear head (g)	Grain yield /plant (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
	Leaf	Stem	Ear head	Total dry matter				
T_1 : Farm Yard Manure	4.2	13.0	16.8	34.9	2.1	9.1	2300	5720
T_2 : Biogas slurry	4.0	12.4	15.0	32.4	2.0	9.0	2240	5580
T_3 : Poultry manure compost	4.5	13.8	16.9	35.2	2.3	10.3	2970	6010
T_4 : City waste compost	4.2	12.1	15.0	31.8	2.0	9.0	2260	5690
T_5 : Agrimagic	3.0	10.2	13.0	26.2	1.8	7.9	1800	5002
T_6 : Green manure	4.1	12.0	15.8	31.9	2.0	8.8	2200	5400
$T_{7:}$ 100%RDF	5.0	14.1	17.8	36.9	2.6	11.8	3200	6300
$T_{8:}$ 100%RDF+ 7.5t FYM	5.5	16.2	25.1	41.8	2.9	13.8	3660	6610
$T_{9:}$ 100%NK an	4.2	13.2	16.8	34.2	2.3	10.0	2680	5980
T_{10} : Absolute control	2.1	6.2	11.1	19.4	1.2	8.00	1400	3600
S. Em (±)	**0.76**	**1.47**	**1.55**	**1.64**	**0.042**	**0.272**	**73.03**	**90.83**
LSD (P=0.05)	**2.26**	**4.37**	**4.62**	**4.86**	**0.125**	**0.809**	**217.20**	**270.14**

Table 3: Balance sheet of nitrogen, phosphorus and potassium, after at harvest under different treatments.

Treatment	Initial status (kg/ha)			Addition NPK (kg/ha)			Crop removal (kg/ha)			Expected balance (kg/ha)			Actual balance (kg/ha)			Net gain /loss (kg/ha)		
	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O	N	P_2O_5	K_2O
T1	268	35	229	50	82.6	48	97.4	16.2	66.6	220.6	100.8	211	170.6	130.5	120.5	-50.0	29.7	-92.6
T2	268	35	229	50	57.2	43.4	90.0	15.2	63.5	228.0	76.3	208.4	145.9	98.0	99	-82.0	21.9	-109.4
T3	268	35	229	50	124	49.4	106.4	18.2	74.6	211.6	140	203.4	187.5	144.5	135.1	-24.1	3.7	68.3
T4	268	35	229	50	60	44.8	52.9	15.9	66.4	265.1	79.1	206.6	164.6	87	117.0	-10.5	7.9	-89.6
T5	268	35	229	50	---	18.6	72.1	10.7	51.2	245.9	24.3	195.8	138.5	70	78.5	-107.4	45.7	-117.3
T6	268	35	229	50	29	27	87.1	15.4	61.9	230.9	48.6	194.1	140.1	95	130.1	-90	46.4	-64.0
T7	268	35	229	50	40	25	113.3	21.4	82.9	204.7	53.6	171.1	178.4	150.5	138.0	-26.3	96.9	-33.1
T8	268	35	229	173	242	144	124.4	26.4	94.3	316.6	250.6	278.7	254.9	165.5	150.3	-61.7	85.1	-128.4
T9	268	35	229	50	---	25	105.8	11.5	72.9	212.2	23.5	181.1	140.0	105.5	108.0	-72.2	82.0	-93.1
T10	268	35	229	--	----	---	54.0	9.3	36.6	214.0	25.7	193	125.0	85	70.9	-89.0	59.3	-122.1