

## SOIL TEST CROP RESPONSE STUDIES WITH ORGANIC AND INORGANIC NUTRIENTS-FINGER MILLET (*Eleusine coracana* G.)

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A soil test crop response trial was conducted on Inceptisol (mixed black-typic ustivercept) in Tamil Nadu Agricultural University farm, Coimbatore with finger millet Co. 11 (*Eleusine coracana* G.) and the comparative efficiency of different levels of organic and inorganic nutrients and their impact on yield, uptake and their efficiency have been studied. The effect of fertilizers indicated that grain and straw yields of finger millet were increased significantly upto 60 kg N and 20 kg P<sub>2</sub>O<sub>5</sub>/ha. while K application had no significant influence on grain yield. Organic manure incorporation enhanced the yield. The uptake was also enhanced considerably by the application of organic and inorganic nutrients. Added fertilizer nutrients and its positive effect in enhancing the fertilizer use efficiency/recovery and economy were well manifested at lower levels, while organic nutrients showed such effect only at higher levels of nutrients.

Finger Millet (*Eleusine coracana* G.) is an important staple food crop and it occupies an area of 2.7 million hectares with a total production of about 3 million tonnes. The crop is well adapted to very poor and marginal uplands, where other kharif crops cannot be grown successfully. Judicious use of fertilizers is one of the most important means to obtain higher yields. For efficient and economic use, it is necessary to have informations on the optimum doses of fertilizers and organics based on soil testing for different soils. Study on nutrient uptake and efficiency of added nutrients by the crop may be helpful guide, to the formulation in sound fertility evaluation programme. So this paper aims to find out the effect of different levels of organic and inorganic nutrients on yield and uptake of finger millet and their impact on nutrient efficiency/recovery and economy.

### MATERIALS AND METHODS

Soil test crop response field trial was conducted with finger millet-Co

11 at Tamil Nadu Agricultural University farm, Coimbatore on mixed black soil-Inceptisol (Typic Ustivercept) during 1983-84 in Rabi season. The soil of the experimental field was clay-loam and the soil reaction was slightly alkaline (pH 8.1), with low soluble salts (EC: 0.8 m. mhos/cm). CEC of the soil was 29.2 m.e/100 g. The chemical analysis revealed that the soil was low in KMnO<sub>4</sub>-N (245 kg/ha), medium in Olsen-P (12 kg/ha) and high in NH<sub>4</sub> OAC-K (1015 kg/ha). The design of the experiment was fractional factorial with 24 treatment combinations. Fertilizer doses included five levels of N (0, 30, 60, 90 and 120 kg/ha), four levels of P<sub>2</sub>O<sub>5</sub> (0, 20, 40 and 60 kg/ha), three levels of K<sub>2</sub>O (0, 10 and 20 kg/ha) and three levels of farm compost (0, 6, and 12 t/ha). The entire dose of P and K as super and MOP and farm compost were applied basally, while N was applied in two splits as urea. The pre-sowing soil samples were also analysed for alkaline KMnO<sub>4</sub>-N (Subbiah and Asija, 1956),

Olsen P (Olsen *et al.*, 1954) and NH<sub>4</sub> OAC-K (Stanford and English, 1949).

total uptake of nutrients, soil test value of treated plot, average soil contribution (C<sub>s</sub>) and fertilizer dose as follows :

The percent nutrient contribution from fertilizer was calculated from the

$$\text{Contribution from fertilizer nutrient (\%)} = \frac{\left\{ \begin{array}{c} \text{Total uptake of nutrient} \\ \text{in treated plot} \end{array} \right\} - \left\{ \begin{array}{c} \text{Soil test value} \\ \text{in treated plot} \end{array} \right\} \times C_s}{\text{Fertilizer nutrient dose}} \times 100$$

The per cent nutrient recovery (NR) is calculated based on Bartholomev and Clark (1965) as given below :

$$\text{NR (\%)} = \frac{\left\{ \begin{array}{c} \text{Nutrient uptake from} \\ \text{fertilizer treated plot} \end{array} \right\} - \text{Nutrient uptake from control plot}}{\text{Fertilizer nutrients dose}} \times 100$$

## RESULTS AND DISCUSSION

The grain and staw yields, uptake, nutrient recovery, efficiency and economy along with soil test values are given in Tables (1-3).

### a) Grain and Straw Yields

The results of the trial indicated that the application of nitrogen, phosphorus and farm compost increased the grain and straw yields considerably. Increasing N and P levels upto 60 and 20 kg/ha respectively had increased the yield significantly (Table 1). The highest grain and straw yields of 28.07 and 34.84 g/ha, respectively were obtained at 60 kg N/ha. The higher magnitude of response upto 60 kg N/ha levels may be due to the favourable effect of N on plant vegetative growth. Ramakrishna Reddy *et al* (1986) observed the economic optimum level of 75 kg N/ha for ragi. Kadrekar and Bhosale (1981) found that 50 and 100 kg N/ha. gave more yields than the control but was on par for ragi crop. Incorporation of farm compost had a

significant increase in yield upto 6 t/ha, whereas the application of K had no such effect on the yield of grain. The straw yield also exhibited a similar trend as that of grain yield.

### b) Uptake of nutrients

Increments of added N had a distinct effect on the N uptake by grain and straw. The removal of N was higher at 120 kg/ha than at other levels, Nitrogen applications of 30 to 120 kg/ha effected on uniform increase of uptake from 31.67 kg/ha to 51.94 kg/ha. However, for the production of grain yield higher uptake of N was useful only upto 60 kg N/ha and the rest could have been used for the vegetative growth. Similar results of N uptake due to increased N addition were also reported by Rao *et al.* (1986) and Sharma and Singh (1973). Similarly P and K additions improved the uptake of respective nutrients, Such influence was also observed with farm compost.

Table 1: Effect of inorganic nutrients and farm compost on finger millet yield

Sl. No.	N. leaves (kg/ha)	Yield (q/ha)		P <sub>2</sub> O <sub>5</sub> levels (kg/ha)	Yield (q/ha)		K <sub>2</sub> O levels (kg/ha)	Yield (q/ha)		FYM levels (t/ha)	Yield (q/ha)	
		Grain	Straw		Grain	Straw		Grain	Straw		Grain	Straw
1	0	16.67	25.49	0	24.08	31.70	0	32.74	39.41	0	16.67	25.49
2	30	23.40	31.03	20	27.49	34.77	10	25.32	33.02	6	19.14	27.41
3	60	28.07	34.84	40	24.25	31.87	20	24.84	32.28	12	20.31	28.25
4	90	25.41	32.85	60	24.84	32.28	—	—	—	—	—	—
5	120	26.18	33.55	—	—	—	—	—	—	—	—	—
C.D.		2.58	2.61		2.13	1.99		N.S.	3.58		2.43	N.S.

NS — Not significant

Table 2: Efficiency of added inorganics on finger millet.

Nomenclature : Typic Ustivertept  
 Series/order : Perianaickenpalayam/Inceptisol  
 Group : Mixed Black

Year : 1983-84  
 Season : Rabi  
 Variety : Co. 11

## i) Effect on N

N levels (kg/ha)	Grain yield (kg/ha)	Total N uptake (kg/ha)	KMnO <sub>4</sub> -N PS (kg/ha)	N recovery %	N efficiency %	Return (Rs/Re)
0	1667	21.51	208	—	—	—
30	2340	31.67	18	33.87	30.37	7.91
60	2807	42.31	35	34.67	29.99	6.70
90	2541	44.85	17	75.94	24.88	3.42
120	2618	51.94	239	25.36	22.67	2.79

## ii) Effect on P

P <sub>2</sub> O <sub>5</sub> levels (kg/ha)	Grain yield (kg/ha)	Total P uptake (kg/ha)	Olsen-P PS (kg/ha)	P recovery %	P efficiency %	Return (Rs/Re)
0	2408	3.93	19.74	—	—	—
20	2749	7.42	15.03	17.45	22.15	5.12
40	2425	7.02	18.30	7.73	8.45	0.13
60	2484	11.28	16.38	12.25	13.37	0.38

## iii) Effect of K

K <sub>2</sub> O levels (kg/ha)	Grain yield (kg/ha)	Total K uptake (kg/ha)	NH <sub>4</sub> OAC-K PS (kg/ha)	K recovery %	K efficiency %	Return (Rs/Re) †
0	3274	62.44	1008	—	—	—
10	2532	64.46	1028	20.20	7.20	—
20	2484	86.18	1042	118.00	107.90	—

Cost of Ragi grain : Rs. 1.80/kg  
 cost of N : Rs. 5.10/kg  
 P<sub>2</sub>O<sub>5</sub> : Rs. 6.00/kg  
 K<sub>2</sub>O : Rs. 2.11/kg

Rs/Re : Return in Rs/Rupee invested on fertilizer nutrients  
 SP : Pre-sowing.

Table 3 : Efficacy of added organic on finger millet

Nomenclature : Typic Ustiversept Year : 1983-84  
 Series/order : Perianaickenpalayam/Inceptisol Season : Ragi  
 Group : Mixed Black Variety : CO. 11

i) Effect on N

FYM levels (t/ha)	Grain yield (kg/ha)	Total N uptake (kg/ha)	KMnO <sub>4</sub> -N PS (kg/ha)	N-recovery %	N efficiency %	Return (Rs/Re)
0	1667	21.51	208	—	—	—
6	1914	24.56	224	9.68	4.44	1.48
12	2031	28.30	215	10.78	9.63	1.09

ii) Effect on P

FYM levels (t/ha)	Grain yield (kg/ha)	Total P uptake (kg/ha)	Olsen-P PS (kg/ha)	P recovery %	P efficiency %	Return (Rs/Re)
0	1667	2.35	10.14	—	—	—
6	1914	3.54	13.58	23.30	2.77	1.48
12	2031	3.61	11.90	5.96	2.91	1.09

iii) Effect on K

FYM levels (t/ha)	Grain yield (kg/ha)	Total K uptake (kg/ha)	NH <sub>4</sub> OAC-K PS (kg/ha)	K recovery %	K efficiency %	Return (Rs/Re)
0	1667	28.42	1002	—	—	—
6	1914	33.15	1019	12.88	11.47	1.48
12	2031	41.62	988	17.97	18.48	1.09

Cost of Ragi grain : Rs. 1.80/kg

Cost of FYM : Rs. 50/ton

Rs/Re : Return in Rs/Rupee invested on fertilizer nutrients

PS : Pre-sowing.

c) Nutrient recovery efficiency and economy

The recovery due to added N varied from 25.36 to 34.67 percent. The highest recovery of N was registered

at 60 kg N/ha level. The recovery of N is found to decrease with an increase in the dose of N. Nitrogen efficiency also showed a similar trend and the values ranged from 22.67 to 30.37 per cent (Table 2). The lowest recovery

and efficiency of were registered by the highest dose of N (120 kg/ha). The lower efficiency of fertilizer N at higher N application could be due to higher N losses associated with larger dressings. The highest return of Rs 7.91 was noticeable at 30 kg N/ha and it reduced drastically to 2.49 at highest N level of 120 kg/ha.

The recovery and the efficiency of added P were also showed a similar trend as that of N. The lowest P recovery and efficiency of 7.73 and 8.45 per cent respectively were observed at 40 kg P<sub>2</sub>O<sub>5</sub>/ha level. The highest return of Rs. 5.12 was observed at 20 kg P<sub>2</sub>O<sub>5</sub>/ha.

Increments of added farm compost generally increased the inorganic nutrient recovery/efficiency and also the return. This is because of the gradual release of nutrients by the organic manure.

From the study it can be concluded that an increase in the grain yield of finger millet was more prominent by the addition of 60 kg N, 20 kg P, O<sub>2</sub> and 6 tons farm compost/ha. Increment of added inorganic as well as organic nutrients enhanced the uptake by grain straw. The higher recovery/efficiency of added N and P were observed at lower levels and the highest return was also observed at the respective levels. Farm compost incorporation enhanced the recovery/efficiency of the nutrients considerably.

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