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INFLUENCE OF LIQUID ORGANIC MANURES ON NUTRIENT CONTENT AND NUTRIENT STATUS IN FINGER MILLET (*Eleucine coracana* L.) GROWN ON *ALFISOLS*

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ABSTRACT
A field study was conducted to study the effect of liquid organic manures- jeevamrutha and panchagavya on nutrient and nutrient status of finger millet at Research Institute on Organic Farming (RIOF), University of Agricultural Sciences, Karnataka, India during *kharif* 2016. The study was carried out in factorial RCBD with Jeevamrutha as factor A and Panchagavya as factor B and was replicated thrice with 12 treatment combinations. The nutrient content and nutrient status levels were greatly influenced by different levels of jeevamrutha and panchagavya in finger millet. Among the jeevamrutha levels, higher N, P and K content in finger millet was found to be maximum in jeevamrutha at 1000 l ha^{-1} (2.79, 0.58 and 1.92% respectively). Among the panchagavya levels, higher N, P and K content in finger millet was found to be associated with foliar application of panchagavya @ 7.5% (2.59, 0.55 and 1.92 respectively at harvest). Application of jeevamrutha and panchagavya influenced the available plant nutrients (nitrogen, phosphorous and potassium) status in the soil after harvest of finger millet. The results of the field study indicated the beneficial role of jeevamrutha and panchagavya in improving the nutrient content of grain as well soil fertility status.

KEY WORDS: Jeevamrutha, panchagavya, nutrient content, nutrient status, finger millet.

INTRODUCTION
Finger millet (*Eleusine coracana* L. Gaertn) is one of the important rainfed crop and is widely cultivated in dry tracts of red soil in Southern Karnataka under constrained resources. It is one of the important millet crops grown for grain and fodder purpose under varied agro-climatic conditions. Excess and imbalanced use of nutrients has caused nutrient mining from the soil, deteriorated crop productivity and ultimately soil health. The cost of inorganic fertilizers is increasing enormously to an extent that they are out of reach of small and marginal farmers. Due to this, the small farmer's affordability for chemical fertilizers has decreased substantially. Under these circumstances, replenishment of nutrients to soil through organic methods is to be given utmost importance. Organic farming in recent years is gaining importance due to realization of inherent advantages. In organic farming, although nutrients are supplied through use of conventional farm based products like organic manures, crop residues for sustaining crop production and also maintaining dynamic soil nutrient status, there is an increasing demand for organic liquid formulations like jeevamrutha and panchagavya which are claimed as improvised nutrient supply materials which help in quick build-up of soil fertility through enhanced activity of soil microflora and fauna (Devakumar *et al.,* 2008). These have the properties of both fertilizer and biopesticide and play a key role in promoting growth and providing immunity to plant system. Despite many advantages with organic liquid formulations they have not been exploited extensively in crop production and more so in cowpea crop. Keeping these facts in view, the present study was carried out with an objective to explore the influence of liquid organic formulations on nutrient status in finger millet.

MATERIALS AND METHODS
A field study was conducted during *kharif* 2016 at organic farming Research and Demonstration Block of Research Institute on Organic Farming, University of Agricultural Sciences, Bengaluru. Karnataka, India. The variety used was PR 202 with spacing of 30x15 cm. The experiment was laid out in factorial randomized complete block design (FRCBD) with jeevamrutha and panchagavya as two factors and are tried at three (0, 500 l ha^{-1} and 1000 l ha^{-1}) and four levels (0, 2.5%, 5% and 7.5%)), respectively. The 12 treatment combinations were replicated thrice and tried in FRCBD. Jeevamrutha was applied through soil and panchagavya was applied as foliar spray. The recommended farmyard manure at 10 t ha^{-1} plus 100 kg N equivalent was applied to all plots three weeks before transplanting and incorporated into the soil. Jeevamrutha as soil application and panchagavya as foliar spray were applied at 20, 40 and 60 days after transplanting and were prepared using standard procedures. Irrigation was provided at 10-15 days interval depending on the stage of crop and soil condition. Representative soil samples were collected randomly from the experimental site at 10-15 cm depth before and after the experimentation. Available nitrogen in the soil was determined through alkaline potassium permanganate method (Subbaiah and Asija, 1956). Available phosphorus in soil was extracted with the help of Bray's No. 1 extract and the extracted phosphorus was estimated by ascorbic

acid method (Jackson, 1973). Available potassium in soil was determined by flame photometric method. Nitrogen, phosphorus and potassium contents in plant samples were determined using standard Experimental data collected were subjected to statistical analysis by adopting Fisher's method of analysis of variance (ANOVA) as outlined by Gomez and Gomez (1984). Critical difference (CD) values were calculated whenever the 'F' test was found significant at 5% level.

RESULTS AND DISCUSSION

Effect of jeevamrutha and panchagavya on soil health

Soil physico- chemical properties

Soil physical and chemical properties such as organic carbon, pH and electrical conductivity were significantly influenced by application of jeevamrutha and panchagavya. Application of jeevamrutha @1000 lha^{-1}recorded significantly higher organic carbon content (0.63%), neutral pH (6.54) and higher electrical conductivity (0.090 dS m^{-1}). Application of panchagavya @7.5% recorded significantly higher organic carbon content (0.60%), neutral pH (6.45) and higher EC (0.082 dS m^{-1}). This significant change might be due to increased microbial population which have caused for decomposition of FYM leading to ultimate change in physico-chemical properties of soil.

Effect of jeevamrutha and panchagavya on nutrient content of finger millet

The nutrient content of finger millet was significantly influenced by application of both jeevamrutha and panchagavya. Among the jeevamrutha levels, higher N, P and K content in finger millet was found to be maximum in jeevamrutha at 1000 l ha^{-1} (2.79, 0.58 and 1.92% respectively) (Table 1). This might be due to increased availability of nutrients due to build up of soil micro flora resulting in increased bacteria, fungi, actinomycetes, P-solubilizer and N fixer population in the soil. Similar results were found with Brijesh Singh (2008) observed that application of jeevamrutha, beejamrutha and panchagavya recorded significantly higher N, P and K per cent in the dry chilli fruit which might be due to supply of nutrients through liquid manures having beneficial microbes and enzymes. Naveen Kumar (2008) showed that, application of FYM @ 12.5 t ha^{-1}+ biodigester liquid manure equivalent to 30 kg ha^{-1} given higher NPK uptake (178, 44.9, 122 kg ha^{-1}) in transplanted rice. These results are in agreement with the findings of Suresh Naik (2011); Siddaram (2012).

Among the panchagavya levels, higher N, P and K content in finger millet was found to be associated with foliar application of panchagavya @ 7.5% (2.59, 0.55 and 1.92 respectively at harvest). This might be due to quick build up of soil microflora and fauna which has consequently increased the enzymatic activity and helped inmineralization, solubilisation of native and applied nutrients and making them available in the soil for plant uptake. Panchagavya contains macro and micronutrients as well as growth regulators like auxins and GA which helped in producing higher biomass and better recovery of N and P in plant. Similar findings have been reported by Beaulah (2001) and Kumawat *et al.* (2009). Bioactive substances produced by beneficial microorganisms present in panchagavya favourably influenced the regulation of stomata, which also enhanced the uptake of nutrients by cowpea. Similar findings were also reported by Shivakumar and Ponnusami (2011).

Effect of jeevamrutha and panchagavya on soil fertility status

Application of jeevamrutha and panchagavya influenced the available plant nutrients (nitrogen, phosphorous and potassium) status in the soil after harvest of finger millet (Table 2). Among the jeevamrutha levels, application of jeevamrutha @ 1000 lha^{-1}recorded significantly higher available nutrient *viz*., N, P and K in the soil and panchagavya application at 7.5% recorded significantly higher available nutrient in the soil compared to control. Jeevamrutha is a fermented liquid product rather than source of nutrients, containing huge quantity of microbial load which enhances soil bio-mass upon its application to soil even at very lesser rate as it act as a tonic to soil besides improving soil health. Kiran (2014) reported that application of beejamrutha along with jeevamrutha, vermicompost equivalent to 50% RDN and panchagavya at 3% recorded significantly higher available nitrogen (190.40 kg ha^{-1}) when compared to application of beejamrutha and jeevamrutha alone (158.27 kg ha^{-1}).

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TABLE 1: Effect of jeevamrutha and panchagavya on nutrient content (%) of finger millet at harvest

Jeevamrutha levels (litres ha^{-1})	Nutrient content (%) — Panchagavya levels (Per cent)														
	Nitrogen content (%)					Phosphorus content (%)					Potassium content (%)				
	0	2.5	5	7.5	Mean	0	2.5	5	7.5	Mean	0	2.5	5	7.5	Mean
0	2.05	2.13	2.18	2.23	2.15	0.42	0.45	0.47	0.48	0.46	1.51	1.56	1.57	1.60	1.56
500	2.29	2.45	2.48	2.62	2.46	0.50	0.51	0.52	0.54	0.52	1.68	1.71	1.76	1.81	1.74
1000	2.66	2.75	2.83	2.93	2.79	0.56	0.57	0.58	0.62	0.58	1.87	1.89	1.95	1.99	1.92
Mean	2.33	2.44	2.50	2.59		0.49	0.51	0.52	0.55		1.68	1.72	1.76	1.92	

	S.Em ±	CD at 5%	S.Em ±	CD at 5%	S.Em ±	CD at 5%
Jeevamrutha	0.049	0.143	0.011	0.033	0.022	0.066
Panchagavya	0.056	0.165	0.013	0.038	0.026	0.076
J X P	0.098	NS	0.022	NS	0.045	NS

DAT- Days after transplanting, NS- Non significant

TABLE 2: Available nitrogen, phosphorous and potassium (kg ha^{-1}) in soil after harvest of finger millet as influenced different levels of jeevamrutha and panchagavya

Jeevamrutha levels (litres ha^{-1})	Panchagavya levels (per cent)														
	Available N					Available phosphorous (P_2O_5)					Available Potassium (K_2O)				
	0	2.5	5	7.5	Mean	0	2.5	5	7.5	Mean	0	2.5	5	7.5	Mean
0	325.6	330.6	334.4	338.0	332.1	37	38.0	40.0	44.16	39.79	184.0	185.0	187.3	189.0	186.3
500	341.6	342.6	343.8	347.6	343.9	45.0	46.5	48.6	51.2	47.80	191.0	192.3	194.3	196.3	193.5
1000	352.6	355.0	355.6	359.0	355.5	52.0	52.3	56.0	57.0	54.50	199.3	202.6	203.6.6	206.0	202.9
Mean	339.9	342.7	344.6	348.2		44.6	45.6	48.2	51.0		191.4	193.3	195.1	197.1	

	S.Em ±	CD at 5%	S.Em ±	CD at 5%	S.Em ±	CD at 5%
Jeevamrutha	1.437	4.215	1.223	3.586	1.199	3.516
Panchagavya	1.659	4.867	1.412	4.141	1.384	4.060
J X P	2.879	NS	2.446	NS	2.398	NS

NS- Non significant