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YIELD AND NUTRIENT UPTAKE OF FINGER MILLET (*Eleusine coracana* (L.) Gaertn.) AS INFLUENCED BY ORGANIC NUTRIENT MANAGEMENT PRACTICES

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ABSTRACT

A field experiment entitled "Yield and nutrient uptake of finger millet (*Eleusine coracana* (L.) Gaertn.) as influenced by organic nutrient management practices" was conducted at S. V. Agricultural College Farm, Tirupati, Acharya N. G. Ranga Agricultural University, Andhra Pradesh, India during *rabi*, 2021-22. The experiment was laidout in split-plot design and replicated thrice. The treatments consisted of four organic manures *viz.,* M_1: 100% N through Farmyard manure, M_2: 100% N through Poultry manure, M_3: 100% N through Sheep manure and M_4: 100% N through Vermicompost, assigned to main plots, five foliar sprays *viz.,* F_1: Water spray, F_2: Waste decomposer, F_3: Panchagavya @ 3%, F_4: Jeevamrutha @ 10% allotted to sub plots. Among the different organic manures, application of 100% N through poultry manure resulted in significantly higher grain yield, straw yield and nutrient uptake over rest of the treatments tried. Foliar application of waste decomposer recorded significantly higher grain yield, straw yield and nutrient (N, P and K) uptake by finger millet. The interaction between the organic manures and foliar sprays was not statistically traceable.

KEYWORDS: Finger millet, Organic manures and Foliar sprays.

INTRODUCTION

In the recent times, millets have gained popularity due to their high nutritional value, well-documented health advantages, adaptability to a variety of environments, sustainability to low-input agriculture and feasibility for growing organically. The majority of millet crops are native to India and are known as "Nutri-Cereals" because they provide the vital nutrients needed for normal human body functioning. Nearly 97% of millets are produced in the developing countries, within the semi-arid tropics of Asia and Africa.

Finger millet being rich in calcium, iron and protein with a balanced amino acid profile and lower glycemic index offers plausible health benefits and thus referred as a miracle grain. Recently it is re-emerging as a vital dietary food crop owing to increased public awareness due to it's nutritional value. Finger millet is a versatile climate resilient crop with wider adaptability to adverse weather conditions with low input requirement, which made it an outstanding subsistence food crop.

The information on sustainable productivity of finger millet with use of organic manures *viz*., poultry manure, farmyard manure, sheep manure and vermicompost in finger millet is essential. The soil is loosing its productivity over years making the farming more miserable. In order to bring back the productivity of soil, there is a need to improve physical, chemical and biological properties of soil. Organic farming is being advocated as an alternate farming system for sustainable agriculture. A stage has reached that supplementary and complementary role of organic materials is being felt once again for sustainable agriculture and to keep the soil health.

To compensate the slow release of nutrients from the bulky organic manures, foliar nutrition provides an excellent way for absorption of nutrients as it can be applied directly to the site of metabolism through translocation of nutrients during peak periods of crop growth. Plants absorb nutrients more efficiently through their stomata in the leaves than through root absorption, thus organic foliar supplementation is safe to crop (Sujatha *et al*., 2016). As a result, using appropriately formulated foliar sprays such as waste decomposer, panchagavya and jeevamrutha are the best ways to ameliorate the micronutrient deficiencies encountered in organic cultivation. They are proved to contain macro, micronutrients, essential amino acids, growth promoting

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factors like IAA, GA and rich in microbial diversity. Variety of beneficial microorganisms present in the foliar sprays may activate biological reactions to restore soil fertility, further acting as plant growth stimulants (Swaminathan, 2005 and Sreenivasa *et al.*, 2011).

MATERIALS AND METHODS

A field experiment entitled "Yield and nutrient uptake of finger millet (E*leusine coracana* (L.) Gaertn.) as influenced by organic nutrient management practices" was conducted during *rabi,* 2021-22 at dryland farm of S.V. Agricultural College, Tirupati, Acharya N. G. Ranga Agricultural University, which is located in the Southern Agro-Climatic Zone of Andhra Pradesh, which is geographically located at 13.5°N latitude and 79.5°E longitude and at an altitude of 182.9 m above the mean sea level. The soil of experimental field was sandy loam in texture, neutral in reaction, low in organic carbon (0.26%) and available nitrogen (194 kg ha^{-1}), medium in available phosphorus (27 kg ha^{-1}) and available potassium (204 kg ha^{-1}). The experiment was laidout in a split-plot design with three replications. The treatments include four organic manure levels *viz.,* M_1: 100% N through Farmyard manure, M_2: 100% N through Poultry manure, M_3: 100% N through Sheep manure and M_4: 100% N through Vermicompost assigned to main plots and five foliar sprays *viz.,* F_1: Water spray, F_2: Waste decomposer, F_3: Panchagavya @ 3% spray and F_4: Jeevamrutha @ 10% at 20, 40 and 60 DAT allotted to sub plots. The crop was sown at 25 cm x 10 cm spacing with a seed rate of 5 kg ha^{-1}. The variety Tirumala was sown on 25th of November and recommended dose of the fertilizer 60 kg N: 30 kg P_2O_5: 20 K_2O ha^{-1} was applied. All the other recommended management practices were also adopted as per the crop requirement. The collected data was statistically analyzed following the analysis of variance for split-plot design as given by Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

GRAIN YIELD

Among the organic manures, soil application of 100% N through poultry manure (M_2) recorded significantly highest grain yield followed by 100% N through vermicompost (M_4), which was however comparable with 100% N through farmyard manure (M_1). Significantly lowest grain yield of finger millet was recorded with soil application of 100% N through sheep manure (M_3).

The highest grain yield recorded with application of poultry manure (M_2) might be due to higher concentration of macro and micronutrients in conjunction with steady nutrient release throughout the crop growth period. Poultry manure produces more humic acid, which form water soluble chelated phosphorus, which might have helped in easy release of phosphorus to the crop, which in turn resulted in increased grain yield. These results are in conformity with those of Jagadeesha *et al*. (2010), Sangeetha *et al*. (2013), Prakash *et al*. (2018), Priya and Satyamoorthi (2019), Aravind *et al*. (2020) and Ledhan *et al*. (2021).

Among the organic foliar sprays, application of waste decomposer (F_2) recorded significantly the highest grain yield, followed by jeevamrutha @ 10% (F_4), which was however, comparable with panchagavya @ 3% (F_3).

Foliar application of waste decomposer resulted in increased absorption and translocation of nutrients, which might have resulted in increased grain yield. Waste decomposer is a promising tool for achieving good quality crop and high yield as it is having microorganisms, which secrets primary metabolites including polyketides and alkanes. Besides this, it also produces glucanase, which trigger defence mechanism and thus, ultimately resulted in higher grain yield. The lowest grain yield was recorded with water spray due to the non-availability of nutrients. The lowest grain yield recorded with water spray (F_1) might be due to poor source sink relationship owing to inadequate supply of nutrients. These results are in conformity with (Meena, 2021).

STRAW YIELD

Among the organic manures, soil application of 100% N through poultry manure (M_2) recorded significantly higher straw yield of finger millet, followed by 100% N through vermicompost (M_4), which was comparable with 100% N through farmyard manure (M_1). Soil application of 100% N through sheep manure (M_3) recorded significantly lowest straw yield of finger millet.

The highest straw yield associated with application of 100% N through poultry manure (M_2) might be due to better availability of NPK and micronutrients in poultry manure, which might have enhanced the plant activity thereby higher dry matter, which in turn resulted in higher straw yield. These results are in conformity with those of Gawade *et al*. (2013), Pallavi *et al*. (2016) and

Table 1. Yield and nutrient uptake of finger millet at harvest as influenced by organic manures and foliar sprays

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Nitrogen uptake (kg ha^{-1})	Phosphorus uptake (kg ha^{-1})	Potassium uptake (kg ha^{-1})
Organic manures (M)					
M_1 : 100% N through Farmyard manure	1306	2294	87.8	24.3	85.3
M_2 : 100% N through Poultry manure	1388	2439	105	29.6	102
M_3 : 100% N through Sheep manure	1217	2162	73.8	19.3	71.8
M_4 : 100% N through Vermicompost	1315	2309	90.8	25.8	91.7
SEm±	19	36	1.93	0.65	2.08
CD (P = 0.05)	67	125	6.8	2.3	7.3
Foliar sprays (F)					
F_1 : Water spray	1214	2054	77	20.9	75.6
F_2 : Waste Decomposer	1440	2585	103	28.2	98.6
F_3 : Panchagavya @ 3%	1284	2267	86.2	24.4	86.3
F_4 : Jeevamrutham @ 10%	1289	2327	90.5	25.5	90.4
SEm±	23	71	2.71	0.61	2.00
CD (P = 0.05)	67	209	7.9	1.8	5.9
Organic manures (M) × Foliar sprays (F)					
M at F					
SEm±	38	128	5.07	1.24	4.04
CD (P = 0.05)	NS	NS	NS	NS	NS
F at M					
SEm±	44	173	3.87	1.30	4.16
CD (P = 0.05)	NS	NS	NS	NS	NS

Reddy *et al*. (2021).

Among the organic foliar sprays, application of waste decomposer (F_2) recorded significantly the highest straw yield in finger millet. The straw yield recorded with application of jeevamrutha @ 10% (F_4) and panchagavya @ 3% (F_3) were comparable with each other. The lowest straw yield in finger millet was recorded with water spray (F_1).

The highest straw yield was recorded with foliar spray of waste decomposer (F_2) might be due to rise in microbial count in the soil thus enabling the environment congenial for release of nutrients and enzymes by decomposing the crop residue, thereby enhancing plant activity, which in turn resulted in better plant stand, more LAI, higher dry matter production and ultimately resulted higher straw yield (NCOF, Ghaziabad).

NUTRIENT UPTAKE

During the study, among the organic manures, significantly highest nutrient (nitrogen, phosphorus and potassium) uptake by plant was observed with application of 100% N through poultry manure (M_2). Application of 100% N through vermicompost (M_4) and 100% N through farmyard manure (M_1) were the next best nutrient uptake treatments and were comparable with each other. The lowest nutrient uptake was recorded with application 100% N through sheep manure (M_3).

The higher nutrient uptake in poultry manure was due to the fact that it produces more humic acid, which form water soluble chelated phosphorus, which helped in easy release of phosphorus to the crop. It helps in supplying the nutrients in soluble form for a quite longer period by not allowing the entire soluble form to come in contact with soil and other inorganic constituents, thereby minimizing fixation and precipitation of nutrients. Probably adequate supply of nutrients could have resulted in higher uptake of nutrients. These findings are in agreement with Hossain *et al*. (2010), Sangeetha *et al*. (2013), Prakash *et al*. (2018) and Nayak *et al*. (2020). Further, organic manures reduced the loss of nutrients through leaching and made available to plant, which created a balancing effect on supply of nitrogen, phosphorus and potassium.

Application of poultry manure could have released the nutrients slowly into the soil solution to match the required absorption pattern of finger millet. Similar findings are also reported by Devegowda (1997) and opined that poultry manure contain higher concentration of macro and micronutrients that contributed to the higher availability and uptake of nutrients than farmyard manure, vermicompost and sheep manure.

Among the foliar sprays, significantly the highest nutrient uptake was observed with waste decomposer (F_2) followed by jeevamrutha @ 10% (F_4), which was however, comparable with panchagavya @ 3% (F_3). Significantly the lowest nutrient uptake was noticed with water spray (F_1).

The increase in uptake of nutrients with foliar spray of waste decomposer is due to the fact that it contains beneficial microorganisms along with plant growth stimulating substances and nutrients, which might have increased the biological efficiency of the crop plants and thereby creating the better source and sink relationship, which might have contributed for greater absorption and translocation of nutrients (NCOF, Ghaziabad).

In conclusion, the present investigation revealed that higher productivity of finger millet and soil health could be obtained with the application of 100% N through poultry manure along with foliar spraying of waste decomposer at 20, 40 and 60 DAT during *rabi* in Southern Agro-Climatic Zone of Andhra Pradesh.

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