Andhra Pradesh J Agril. Sci : 10(4): 269-273, 2024

EFFECT OF ORGANIC NUTRIENT MANAGEMENT PRACTICES ON GROWTH AND YIELD OF FOXTAIL MILLET

P. ADITYA KAMAL*, Y. REDDI RAMU, N. SUNITHA, B. SANTHOSH AND V. CHANDRIKA

Department of Agronomy, S.V. Agricultural College, ANGRAU, Tirupati-517 502.

Date of Receipt: 29-07-2024 Date of Acceptance: 22-12-2024

ABSTRACT

A field experiment was conducted during *kharif,* 2023 on sandy loam soils of S.V. Agricultural College Farm, Tirupati to know that the effect of organic nutrition in foxtail millet. The experiment was laid out in a randomized block design and replicated thrice. The results of the experiment indicated that plant height, leaf area index, grain and straw yield were recorded with 100 per cent RDF (40-20-0 kg N, P_2O_5 and K_2O ha^{-1}), was significantly higher compared to rest of the treatments. Among organic nutrient management practices, 50 per cent N through FYM + two sprays of panchagavya @3 per cent at panicle initiation and flowering stage recorded significantly higher plant height, leaf area index, grain and straw yield compared to rest of organic nutrient management practices tired. Significantly lower plant height, leaf area index, grain and straw yield were recorded with control..

KEYWORDS: Foxtail millet, Recommended dose of fertilizer, Panchagavya, Seaweed extract.

INTRODUCTION

The use of chemical fertilizers has increased food grain production but introduced problems such as diminishing crop output and sustainability concerns. Rising fertilizer costs have led India to promote organic farming, which maximizes crop productivity by enhancing ecological processes with fewer external inputs (Shukla *et al*., 2011). Organic farming emphasizes locally accessible agro-inputs and minimizes synthetic agrochemicals.

In India, small millets are grown on 4.23 lakh ha, producing 3.75 lakh tonnes with a productivity of 885 kg ha^{-1}. In Andhra Pradesh, small millets occupy 0.14 lakh ha, producing 0.11 lakh tonnes with a productivity of 786 kg ha^{-1} (APEDA, 2021-22). Foxtail millet, one of the oldest millets, is a nutritional powerhouse with a low glycemic index of 50.8, making it suitable for diabetics. Per 100 g, it contains 12.3 g protein, 4.3 g fat, 60.9 g carbohydrates, and 8.0 g fiber (Vanithasri *et al*., 2012).

Organic manures provide more nutrients and beneficia lmicrobe sbu tca nb eles sefficien tdu et onutrient loss. Foliar feeding of nutrients, such as FYM combined with organic liquids like panchgavya, cow urine, vermi wash, fish amino acid, and seaweed extract, can offer cost-effective, eco-friendly nutrient management.

In India's climate-changing environment, organic millet-based farming can ensure nutrient-dense food security. Research is needed on using local manure to grow foxtail millet without chemical fertilizers, aiming to reduce pollution and sustain long-term soil productivity. Current agricultural research focuses on developing ecologically sound, biologically sustainable, and socioeconomically viable technologies. Millets can address micronutrient deficiencies, and efficient crop nutrition can enhance productivity. However, scientific information on organic nutrient management in foxtail millet is lacking. Thus, the present investigation aims to identify suitable organic nutrient management practices for foxtail millet.

MATERIAL AND METHODS

The present investigation was carried out at S.V. Agricultural College Farm, Tirupati campus of Acharya N.G. Ranga Agricultural university which is in the Southern Agro-climatic Zone of Andhra Pradesh. The experiment was laid out in a randomized block design and replicated thrice. There are nine treatments *viz.,* Control (T_1), 100 per cent RDF (40- 20- 0 kg N, P_2O_5 and K_2O ha^{-1}) (T_2), 100 per cent N through FYM (T_3), 50 per cent N through FYM + water spray (T_4), 50 per cent N through FYM + cow urine @ 5 per cent (T_5), 50 per cent N through FYM vermiwash @ 5 per cent (T_6), 50 per cent N through FYM + sea weed extract @ 1per cent (T_7), 50 per cent N through FYM + fish amino acid @ 3 per cent (T_8) and 50 per cent N through FYM + panchagavya @ 3%(T_9). FYM was applied based on per cent of nitrogen content. Foliar spraying was done twice at panicle initiation and flowering stage of the crop.

Plant height was recorded from five randomly tagged plants at different intervals *viz*., 20, 40, 60 DAS and at harvest. It was measured from the base of the plant to the tip of the longest leaf up to panicle initiation stage and later on it was measured from the base of the plant to the tip of the panicle and mean was expressed in cm. Five plants were selected outside the net plot area, leaving the extreme border row, for destructive sampling to generate data on leaf area at different stages of crop growth. Leaf area of five destructively sampled plants from border

Plant height of foxtail millet showed a progressive increase as the crop advanced towards maturity. At all the stages of plant growth, the tallest plants were observed with the application of 100 per cent recommended dose of fertilizers (RDF) compared to organic nutrient management practices. This increase in height might be due to the rapid release and availability of nutrients,

*Corresponding author, E-mail: adhip2851@gmail.com

rows was recorded at 20, 40, 60 DAS and at harvest especially nitrogen, which is a critical component of by using LI-COR model, LI-300 leaf area meter with protoplasm and plays a significant role in cell division transparent conveyor belt and electronic digital display. and elongation. The enhanced plant height with 100 per After computing the leaf area (cm^2), leaf area index was cent RDF (T_2) can also be attributed to improved sugar calculated by using the following formula as suggested translocation and increased turgor pressure within the by Watson (1952). plant cells, leading to cell enlargement and multiplication leading to higher plant height (Thesiya *et al*., 2019).

$$LAI = \frac{\text{Leaf area } (cm^2)}{\text{Unit land area } (cm^2)}$$

Crop was harvested at physiological maturity. The grain and straw yield obtained from the net plot area including the grain of the sampled plants was thoroughly sundried, weighed and expressed in kg ha^{-1}. The data collected on plant height, leaf area index, grain and straw yield, were analyzed statistically following the procedure given by Panse and Sukhatme (1978) wherever the treatment differences were significant, critical differences were worked out at 5 per cent probability level. Treatment differences that were not significant are denoted as NS.

RESULTS AND DISCUSSION

Data pertaining to the plant height, leaf area index and yield as influenced varied by organic foliar nutrition.

Plant height

At all the stages of observation *viz.,* 20, 40, 60 DAS and at harvest. the highest plant height was recorded with soil application of 100 per cent RDF (T_2), which was significantly superior over the rest of the treatments tried.

Among the organic nutrient management practices tried application of 50 per cent N through FYM + panchagavya @ 3 per cent (T_9) recorded higher plant height, followed by 50 per cent N through FYM + seaweed extract @ 1 per cent (T_7), 50 per cent N through FYM + vermiwash @ 5 per cent (T_6), 50 per cent N through FYM + fish amino acid @ 3 per cent (T_8), 50 per cent N through FYM + cow urine @ 5 per cent (T_5) and 100 per cent N through FYM (T_3), which were comparable among themselves. Except at 20 DAS where it was comparable with rest of treatments tried except control (T_1). Significantly the lowest plant height was recorded with control (T_1).

Among organic nutrient management practices tried, higher plant height recorded with 50 per cent N through FYM + panchagavya (T_9), might be due to better translocation of nutrients, which enhanced cell division and cell elongation. Panchagavya helps in the production of growth promoting substances like auxins and gibberellins, which might have helped in the accerlation of plant height. The results are in conformity with Priya and Sathyamoorthi (2019) and Aravind *et al.* (2020). The lowest plant height with control (T_1) might be due to the poor nutrient status of the soil. Sreenivasa *et al.* (2010) reported the presence of many beneficial microorganisms *viz.*, nitrogen fixers, phosphorus solubilizers, actinomycetes and fungi in panchagavya.

Leaf Area Index

The higher leaf area index of foxtail millet was recorded with application of 100 per cent RDF (T_2) which was significantly superior over rest of the treatments tried at all the stages of observations.

Among the organic nutrient management practices tried, application of 50 per cent N through FYM + panchagavya @ 3 per cent (T_9) recorded higher leaf area index over rest of the organic nutrient management practices. LAI recorded with application of 50 per cent N through FYM + seaweed extract @ 1 per cent (T_7), 50 per cent N through FYM + vermiwash @ 5 per cent (T_6), 50 per cent N through FYM + fish amino acid @ 3 per cent (T_8), 50 per cent N through FYM + cow urine @ 5 per cent (T_5) and 100 per cent N through FYM (T_3), was comparable among them, except at 20 DAS where it was comparable with rest of the treatments tried except control (T_1). Significantly the lowest LAI was recorded with control (T_1).

Leaf area index is a measure of leaf area produced per unit land area. The increase in leaf area index with application of 100 per cent RDF (T_2) might be due to the

Table 1. Plant height (cm) of foxtail millet at different growth stages as influenced by organic nutrient management practices

Treatments	20 DAS	40 DAS	60 DAS	At harvest
T_1 : Control	27.5	36.0	68	78
T_2 : 100% RDF (40-20-0 kg N, P_2O_5 and K_2O ha^{-1})	42.5	74.0	105	118
T_3 : 100% N through FYM	32.1	56.7	84	95
T_4 : 50% N through FYM + Water spray	31.6	47.2	76	86
T_5 : 50% N through FYM + Cow urine @ 5%	31.4	57.0	85	97
T_6 : 50% N through FYM + Vermi wash @ 5%	31.0	59.5	87	98

T_7 : 50% N through FYM + Sea weed extract @ 1%	31.8	62.0	89	100
T_8 : 50% N through FYM + Fish amino acid @ 3%	31.0	58.4	86	98
T_9 : 50% N through FYM + Panchagavya @ 3%	33.5	67.9	96	109
SEm±	1.12	1.94	2.1	2.4
CD (P= 0.05)	3.3	5.1	6	7

readily availability of nutrients there by higher uptake by crop, which have favorable effect on cell division and elongation, which might have resulted in production of more number of large sized leaves, which in turn responsible for higher leaf area index. Similar findings were also reported by Ullasa *et al*. (2017) and Thesiya *et al*. (2019).

In the context of organic nutrient management practices, the increase in Leaf Area Index (LAI) may be attributed to improved assimilate transport, leading to healthier growth characterized by bright green with larger leaves. The higher LAI values observed with Panchagavya spray can be explained by the presence of microbial metabolites, which facilitate stomatal opening for extended periods, both under optimal and sub optimal conditions during the crop growth period. This enhanced stomatal activity resulted in an increased Co_2 intake, thereby larger source (leaves). These results are in consistent with findings of Panchal *et al*. (2017) and Priya and Sathyamoorthi (2019).

Further, significant increase in LAI with application of panchagavya might be due to availability of growth promoting substance in addition to huge microbial population in panchagavya, thus when applied to the crop as foliar spray trigger the plant growth (Patel *et al*., 2021).

Grain and straw yield

Different organic nutrient management practices exerted significant influence on grain straw yield of foxtail millet. Significantly the highest grain and straw yield of foxtail millet was noticed with 100 per cent RDF (T_2). Among the organic nutrient management practices tried 50 per cent N through FYM + panchagavya @ 3 per cent (T_9) noticed with higher grain and straw yield, followed by 50 per cent N through FYM + seaweed extract @ 1 per cent (T_7), 50 per cent N through FYM + vermiwash @ 5 per cent (T_6), 50 per cent N through FYM + fish amino acid @ 3 per cent (T_8), 50 per cent N through FYM + cow urine @ 5 per cent (T_5) and 100 per cent N through FYM (T_3), which were statistically comparable among themselves. Significantly the lowest grain straw yield was noticed with control (T_1).

The higher concentration of nutrient ions in the soil with applying 100 per cent recommended dose of fertilizer (T_2), have resulted in higher grain and straw yield. Further it might have contributed to improved root activity, high physiological efficiency, better vegetative growth, higher dry matter, better yield attributes which in turn resulted higher grain and straw yield. These results are in conformity with those of Mubeena *et al*. (2019) and Vineetha *et al*. (2024).

Table 2. Leaf area index of foxtail millet at different growth stages as influenced by organic nutrient management practices

Treatments	20 DAS	40 DAS	60 DAS	At harvest
T_1 : Control	0.18	0.92	1.30	1.17
T_2 : 100% RDF (40-20-0 kg N, P_2O_5 and K_2O ha^{-1})	0.26	1.44	1.90	1.75
T_3 : 100% N through FYM	0.23	1.12	1.55	1.37
T_4 : 50% N through FYM + Water spray	0.22	1.03	1.42	1.29
T_5 : 50% N through FYM + Cow urine @ 5%	0.21	1.13	1.57	1.45
T_6 : 50% N through FYM + Vermi wash @ 5%	0.23	1.18	1.62	1.49
T_7 : 50% N through FYM + Sea weed extract @ 1%	0.22	1.21	1.64	1.51
T_8 : 50% N through FYM + Fish amino acid @ 3%	0.22	1.15	1.61	1.47
T_9 : 50% N through FYM + Panchagavya @ 3%	0.23	1.31	1.77	1.64
SEm±	0.007	0.031	0.038	0.034
CD (P= 0.05)	0.02	0.10	0.12	0.11

Table 3. Grain and straw yield of foxtail millet at different growth stages as influenced by organic nutrient management practices

Treatments		Grain yield	Straw yield
T_1 : Control		350	896
T_2 : 100% RDF (40-20-0 kg N, P_2O_5 and K_2O ha^{-1})		1052	1795
T_3 : 100% N through FYM		586	1060
T_4 : 50% N through FYM + Water spray		487	979
T_5 : 50% N through FYM + Cow urine @ 5%		587	1075
T_6 : 50% N through FYM + Vermi wash @ 5%		621	1090
T_7 : 50% N through FYM + Sea weed extract @ 1%		658	1154
T_8 : 50% N through FYM + Fish amino acid @ 3%		594	1080
T_9 : 50% N through FYM + Panchagavya @ 3%		740	1295
	SEm±	24.9	26.3
	CD (P= 0.05)	75	79

The enhanced release of growth-promoting substances by microbes in panchagavya may have contributed to increased leaf area and promoting higher net photosynthesis. This facilitated greater soluble protein production and enhanced RUBP carboxylase activity in the carbon cycle, resulting higher biological yield. Additionally, Farm Yard Manure (FYM) might have improved soil biochemical properties and boosted beneficial microorganism activity, prolonging nutrient availability. These factors collectively benefited growth,

dry matter and economic yield. Similar results were reported by Priya and Satyamoorthi. (2019) and Javiya *et al*. (2019). However, the deflated stature of growth parameters with control (T_1) resulted in the lowest grain and straw yield.

From the results of the present study, it is concluded that highest plant height, leaf area index and economic yield realized could be with application of 40-20-0 kg N, P_2O_5 and K_2O ha^{-1} (RDF) through fertilizers. Among organic nutrient management practices tried, 50 per cent N through FYM + foliar spray of panchagavya @ 3 per cent at panicle initiation & flowering stage (T_9) proved to be the best with higher plant height, Leaf area index and economic yield of foxtail millet in Southern Agro-climatic Zone of Andhra Pradesh. At present in the context of climate change and decline in soil health application of 50 per cent N through FYM @ 3.3 t ha^{-1} along with foliar spray of panchagavya is found to be the sustainable nutrient management strategies for organic foxtail millet production.

LITERATURE CITED

APEDA (Agriculture and Processed food products Export Development Authority) state wise millet production report, 2021-22.

Aravind, A.S., Kumar, S.N., Hemalatha, M and Paramasivan, M. 2020. Influence of organic supplements on growth and yield of finger millet (*Eleusine coracana* L.). *Journal of Pharmacognosy*

Panse, V.G and Sukhatme, P.V. 1985. *Statistical Methods for Agricultural Workers*. ICAR, New Delhi. 100-174.

Patel, S.P., Malve, S.H., Chavda, M.H and Vala, Y.B. 2021. Effect of panchagavya and jeevamrut on growth, yield attributes and yield of summer pearl millet. *The Pharma Innovation Journal*. 10(12): 105-109.

Priya, G and Sathyamoorthi, K. 2019. Influence of organic manures on the growth and yield of foxtail millet (*Setaria italica* (L.) Beavu). Chemical Science Review and Letters. 8(29): 114- 117.

Shukla, A., Patel B.R., Patel A.N and Patel, A.R. 2011. Organic farming for sustainable agriculture. *Kisan world*. 38(3): 39-42.

Sreenivasa, M.N., Nagaraj, M., Naik and Bhat, S.N. 2010. Beejamrutha: A source for beneficial bacteria. *Karnataka Journal of Agricultural Sciences*.17 (3): 72-77.

Thesiya, N.M., Dobariya, J.B. and Patel, J.G., 2019. Effect of integrated nutrient management on growth and yield parameters of kharif little millet under little millet-green gram cropping sequence. *Internationa Journal of Pure and Applied Biosciences*. *7*(3): 294-298.

Vanithasri, J., Kanchana, S., Hemalatha, G., Vanniarajan,

and Phytochemistry. 9(3): 1564-1567.

Javiya, P.P., Mathukia, R.K., Kaneria, S.C and Rupareliya, V.V. 2019. Effect of various cow-based bio-enhancers and botanicals on growth, yield and quality of organic wheat. *International Journal of Chemical studies.* 7(3): 3193-3196.

Mubeena, P., Halepyati, A.S and Chittapur, B.M. 2019. Effect of date of sowing and nutrient management on nutrient uptake and yield of foxtail millet (*Setaria italica* L.). *International Journal of Bio-resource and Stress Management*. 10(1):092-095.

Panchal, P., Patel, H.P., Patel, A.G and Desai, A. 2017. Effect of panchagavya on growth, yield and economics of chick pea (*Cicer arietinum*). *International Journal of Chemical Studies*. 5(2): 265-267.

C and Sahulhameed, M. 2012. Role of millets and its importance in new millinium. *International Journal of Food Science & Technology*. 2(1): 35-47.

Vineetha, S.B., Singh, S., Hepsibha, M and Christina, B.B., 2024. Effec to fnutrien tmanagemen to ngrowth and yield of foxtail millet. *Journal of Experimental Agriculture International*. 46(6): 398-403.

Watson, D.J. 1952. The physiological basis of variation in yield. *Advances in Agronomy*. 6: 103-109.