Growth and Yield of Finger millet as influenced by organic nutrient management

**ABSTRACT**

A field experiment was conducted during *rabi* 2023-24 at Agricultural College Farm, Naira, Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The experiment was laid out in a split-plot design and replicated thrice. The finger millet variety Indravathi (CFMV 1) was tested in the present experiment. At all the crop growth stages, significantly the tallest plants**,** more number of tillers plant-1, highest dry matter production and higher leaf area index were recorded with application of 100% RDF (60:30:30 NPK kg ha-1) (M1) followed by application of 50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure was comparable with treatment (M1). Application of 100% RDN through Poultry manure (M3) recorded the lowest growth parameters. Regarding the yield attributes, significantly the higher number of ears m-2, earhead length, earhead weight, number of fingers earhead-1 and test weight were obtained with application of 100% RDF (60:30:30 NPK kg ha-1) (M1) followed by application of 50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure, which was in parity with (M1). While the lowest values of yield attributes were obtained with application of 100 % RDN through poultry manure (M3). Among the foliar sprays, significantly higher values of the yield attributes were obtained with application of Panchagavya @ 3% over rest of the treatments.

**Key words:** Recommended dose of nitrogen, Poultry manure, Finger millet, Vermiwash and Panchagavya, Drymatter production.

**INTRODUCTION**

Finger millet is a key small millet crop, predominantly cultivated in regions with erratic rainfall and marginal soils. In India, Finger millet is the third most important millet, next to sorghum and pearl millet, grown over an area of 10.37 lakh hectares with an annual production of 13.86 lakh tonnes and productivity of 1336 kg ha-1. Karnataka is the leading Finger millet producer in India followed by Tamilnadu and Maharashtra states. In Andhra Pradesh, it is cultivated in an area of 27,000 hectares with a production of 33,000 tonnes having productivity of 1222 kg ha-1 (Directorate of Agriculture and Farmers’ Welfare, 2023-24).

Organic farming, which prohibits the use of synthetic fertilizers and chemicals, offers an alternative approach. In organic systems, crop nutrient requirements are met through organic inputs and biological processes. This method prioritizes the restoration and maintenance of soil fertility and health, promoting sustainability over the long term. Farmers are increasingly recognizing the benefits of organic farming in terms of improved soil quality, enhanced sustainability and long-term productivity. By diversifying and making better use of these resources, farmers can improve soil fertility, reduce dependence on external inputs and move towards more sustainable farming systems.

To address the slow release of nutrients from bulky organic manures, foliar nutrition offers an effective solution by providing nutrients directly to the site of metabolism. This allows for the translocation of nutrients during peak periods of crop growth, promoting more efficient absorption through the leaves, where plants are often able to absorb nutrients more effectively than through their roots. As a result, organic foliar supplementation is considered safe for crops (Sujatha *et al.,* 2016). Various types of foliar sprays, such as vermiwash, panchagavya and jeevamrutham have proven to be excellent means of addressing micronutrient deficiencies in organic farming. Additionally, they contain a diverse range of micro-organisms that not only support plant growth but also help restore soil fertility by activating biological reactions. This microbial diversity in the foliar sprays acts as a plant growth stimulant, enhancing crop productivity and resilience (Swaminathan, 2005 & Sreenivasa *et al.,* 2011).

**MATERIALS AND METHODS**

A field experiment was conducted during *rabi* 2023-24 at Agricultural College Farm, Naira, Acharya N.G. Ranga Agricultural University, Andhra Pradesh. The soils of the experimental site were sandy clay loam in texture, neutral in reaction, low in organic carbon (0.49%) and available nitrogen (221 kg ha-1), medium in phosphorus (22.7 kg ha-1) and potassium (245 kg ha-1) having 7.2 soil pH with EC 0.25 dS m-1.

The experiment was laid out in a split-plot design and replicated thrice. The treatments consisted of three (inorganic and organic) nutrient sources *viz* M1: 100% RDF (60:30:30 NPK kg ha-1), M2: 50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure and M3: 100% RDN through Poultry manure assigned to main plots, four foliar sprays *viz.,* S1: Liquid *Azospirillum*+PSB+KRB+ZnSB@1.25 L ha-1 biofertilizer consortium by root dipping at transplanting, S2: Vermiwash spraying twice @ 5% at tillering and flowering stages, S3: Panchagavya spraying twice @ 3% at tillering and flowering stages and S4: Jeevamrutham spraying twice @ 10% at tillering and PI stages were allotted to sub plots. The finger millet variety Indravathi (CFMV 1) was tested in the present experiment.

Plant height of five tagged plants was measured from the base of the plant to the tip of top most leaf at 20 and 50 DAT, whereas up to the fingers at maturity and the mean plant height was expressed in cm. The number of tillers were counted from each tagged plant at 20, 50 DAT and at harvest in each net plot and the mean value was expressed as number of tillers plant-1. Five plants were collected at random from the border rows leaving the extreme row at 20, 50 DAT and at maturity for estimation of dry matter production of crop. Plants were sundried and latter oven dried at 60oC, to a constant weight. The oven dry weight of all the five plants was taken and dry matter production for hectare was worked out and expressed in kg ha-1. Leaf area from the five destructively sampled plants was measured at 20, 50 DAT and at maturity using LI-COR Model, LI-3100 C leaf area meter with transparent conveyer belt having electronic digital display and expressed in cm2. Leaf area index was calculated by the following formula (Watson, 1952).

**RESULTS AND DISCUSSION**

The biometric observations with regard to plant height, leaf area index, dry matter production and number of tillers plant-1 were recorded at periodical intervals *viz*., 20, 50 DAT and at harvest. Plant height of the finger millet tends to increase progressively with advance in the age of the crop up to the harvest. Plant heights recorded at different growth stages i.e., 20, 50 DAT and at harvest varied significantly due to the application of organic, inorganic sources and foliar sprays but the interaction between organic manures and foliar sprays were not statistically traceable.

Among the organic and inorganic sources of fertilizers, soil application of 100 % RDF (60:30:30 NPK kg ha-1) recorded significantly the highest plant height which was statistically at par with 50% RDF (60:30:30 NPK kg ha-1) + 50% RDN through Poultry manure. The plant height of finger millet was lowest with soil application of 100 % N through Poultry manure at 20 DAT, 50 DAT and at maturity. Among the organic foliar sprays significantly higher plant height at 20DAT recorded with the application of Liquid *Azospirillum*+PSB+KRB+ZnSB@1.25 L ha-1 biofertilizer consortium by root dipping at transplanting and the lowest was observed with Jeevamrutham spraying @ 10%. At 50 DAT and at maturity significantly the tallest plants were observed with the application of Panchagavya @ 3% (S3) statistically at par with the application of Liquid *Azospirillum*+PSB+KRB+ZnSB@1.25 L ha-1 bio fertilizer consortium by root dipping at transplanting (S1) which was however, comparable with jeevamrutha @ 10 % (S4), while the shortest plants were noticed with Vermiwash spraying twice @ 5% (S4). Applying organic liquid manures, particularly Panchagavya might help the plants to absorb nutrients and move them around for longer shoots and synthesis of new leaves. Plant height and leaf number plant–1 may have increased as a result of cell division and multiplication aided by an adequate nitrogen supply. Additionally, it is possible that these mixtures produced a variety of micronutrients that helped finger millet to flourish (Biswas and Das, 2024).

At 20 DAT and 50 DAT leaf area index does not show any significant variation with soil application of organic and inorganic sources of fertilizers. However at maturity significant higher values were recorded with 100% RDF (60:30:30 NPK kg ha-1) (M1) is at par with50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure (M2). The lowest values were observed with 100% RDN through Poultry manure (M3). Significantly higher values of leaf area index was noticed with application of Liquid *Azospirillum*+PSB+KRB+ZnSB@1.25 L ha-1biofertilizer consortium by root dipping at transplanting(S1) at 20 DAT, while the lowest was registered with Vermiwash spraying twice @ 5% at tillering and flowering stages(S2). At 50 DAT and at maturity there was no significant difference among the liquid organic manures on leaf area index.

Drymatter production has significant difference among the organic and inorganic sources, at 20 DAT, 50 DAT and at maturity application of 100% RDF (60:30:30 NPK kg ha-1) (M1) recorded significantly the highest Drymatter production and grain yield which were at par with 50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure (M2).The lowest Drymatter production and grain yield of finger millet was recorded with soil application of 100% RDN through Poultry manure (M3) may be attributed to superiority of nutrient status and better response of finger millet. These results are in conformity with those of Govindappa *et al*. (2009).

 Among the organic foliar sprays, at 20 DAT Liquid *Azospirillum* + PSB + KRB + ZnSB@1.25 L ha-1 biofertilizer consortium by root dipping at transplanting (S1) significantly recorded highest yield. At 50 DAT and at maturity application of Panchagavya spraying twice @ 3% at tillering and flowering stages (S3) recorded significantly the highest Drymatter production and grain yield, followed by Vermiwash spraying twice @ 5% at tillering and flowering stages (S2), which was however comparable with Jeevamrutham spraying twice @ 10% at tillering and PI stages (S4). The lowest grain yield recorded with Liquid *Azospirillum* + PSB + KRB + ZnSB@1.25 L ha-1 biofertilizer consortium by root dipping at transplanting (S1) might be due to poor source sink relationship owing to inadequate supply of nutrients. It may have increased nutrient translocation and absorption throughout the plant and into the soil. Increased root development and nutrient intake, particularly of nitrogen, may enhance chlorophyll content for increased photosynthetic efficiency, which will result in a larger production of dry matter and the transfer of dry matter from vegetative to reproductive portions. These results are in line with the results of Biswas *et al.,* 2020.

**Conclusions:**

 Application of 100% RDF (60:30:30 NPK kg ha-1) recorded significantly higher growth parameters and yield over the rest of the nutrient treatments. Among the organic nutrient foliar sprays, foliar application of Panchagavya spraying twice @ 3% at tillering and flowering stages was found to be the best over other three organic foliar sprays tried under organic finger millet cultivation.

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| **Treatments** | **Plant height (cm) at** | **Leaf area index** | **Drymatter production (Kg/ha)** | **Yield****(Kg/ha)** |
| **20 DAT** | **50 DAT** | **Maturity** | **20 DAT** | **50 DAT** | **Maturity** | **20 DAT** | **50 DAT** | **Maturity** |  |
| **Fertilizer levels (RDF:60:30:30 kg ha-1)**  |  |  |  |  |  |  |  |
| M1: 100% RDF (60:30:30 NPK kg ha-1) | 26.41 | 58.50 | 88.78 | 1.90 | 3.97 | 3.33 | 1556 | 3398 | 5594 | 1889 |
| M2: 50% RDF (NPK kg ha-1) + 50% RDN through Poultry manure | 25.04 | 55.22 | 85.09 | 1.80 | 3.94 | 3.04 | 1486 | 3233 | 5455 | 1757 |
| M3: 100% RDN through Poultry manure | 23.64 | 50.84 | 75.03 | 1.78 | 3.76 | 2.93 | 1420 | 3043 | 4930 | 1607 |
| **SEm (±)** | 0.51 | 1.25 | 1.67 | 0.06 | 0.11 | 0.08 | 26 | 67 | 114 | 36 |
| **CD *(p=0.05)*** | 2.01 | 4.90 | 6.58 | NS | NS | 0.31 | 101 | 264 | 447 | 143 |
| **CV (%)** | 7.10 | 7.91 | 6.99 | 11.14 | 9.52 | 9.34 | 6.00 | 7.23 | 7.40 | 7.20 |
| **Four liquid organic manures** |  |  |  |  |  |  |  |
| S1: Liquid *Azospirillum*+PSB+KRB+ZnSB@1.25 L ha-1biofertilizer consortium by root dipping at transplanting | 28.15 | 55.82 | 78.42 | 1.94 | 3.85 | 2.90 | 1605 | 3121 | 4855 | 1570 |
| S2: Vermiwash spraying twice @ 5% at tillering and flowering stages  | 24.27 | 54.74 | 85.05 | 1.83 | 3.88 | 3.15 | 1443 | 3153 | 5389 | 1747 |
| S3: Panchagavya spraying twice @ 3% at tillering and flowering stages | 24.60 | 56.50 | 88.43 | 1.84 | 3.98 | 3.29 | 1496 | 3480 | 5869 | 1983 |
| S4: Jeevamrutham spraying twice @ 10% at tillering and PI stages | 23.11 | 51.69 | 79.96 | 1.71 | 3.86 | 3.07 | 1405 | 3145 | 5191 | 1705 |
| **SEm (±)** | 0.66 | 0.98 | 1.67 | 0.08 | 0.08 | 0.10 | 26 | 95 | 184 | 46 |
| **CD *(p=0.05)*** | 1.96 | 2.91 | 4.97 | 0.25 | NS | NS | 101 | 282 | 545 | 137 |
| **CV (%)** | 7.90 | 5.38 | 6.05 | 13.53 | 6.05 | 9.21 | 6.00 | 8.82 | 10.34 | 7.92 |
| **Interaction** |  |  |  |  |  |  |  |
| **S at M** |  |  |  |  |  |  |  |
| **SEm (±)** | 1.14 | 1.70 | 2.90 | 0.14 | 0.14 | 0.16 | 60 | 164 | 318 | 80 |
| **CD *(p=0.05)*** | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| **M at S** |  |  |  |  |  |  |  |
| **SEm (±)** | 1.11 | 1.93 | 3.02 | 0.14 | 0.16 | 0.17 | 58 | 157 | 298 | 78 |
| **CD *(p=0.05)*** | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

**Table 1. Plant height, Leaf area index, Drymatter production and yield of finger millet as influenced by different organic, inorganic sources and foliar sprays**