

## Effect of Enriched Vermicompost and Organic Foliar Spray on Growth and Yield of Proso millet (*Panicum miliaceum* L.)

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**ABSTRACT:** Food and nutrition scientist show more interest towards millets and its health effects on combating lifestyle diseases and now millets are regaining its importance on achieving nutrition security. Proso millet is a true millet of history that can grow well in many agro-climatic conditions. Though the chemical fertilizer increases the plant growth and vigour, hence meets the food security of the world but chemically produced plant will accumulate in the human body as toxic chemicals, which are very dangerous. Various researchers have investigated the possibility of augmenting vermicomposts with additional nutrient-rich organics (enriched vermicompost) as a remedy to the poor nutrient content of organic manures. The liquid organic solutions are the source of macronutrients, important micro nutrients, vital amino acids, growth stimulating factors like IAA, gibberellic acid and favourable microorganisms. Hence, the present study was carried out to study the effect of enriched vermicompost and organic foliar spray on growth and yield of proso millet at Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu. The experiment was laid out in Randomized Block Design (RBD) with thirteen treatments and three replications. Treatments consists of T<sub>1</sub>: 100% Vermicompost, T<sub>2</sub>: 100% Enriched vermicompost, T<sub>3</sub>: 100% Enriched vermicompost + 3% Humic Acid, T<sub>4</sub>: 75% Enriched vermicompost + 3% Humic Acid, T<sub>5</sub>: 100% Enriched vermicompost + 3% Sea weed extract, T<sub>6</sub>: 75% Enriched vermicompost + 3% Sea weed extract, T<sub>7</sub>: 100% Enriched vermicompost + 3% PPFM, T<sub>8</sub>: 75% Enriched vermicompost + 3% PPFM, T<sub>9</sub>: 100% Enriched vermicompost + 3% Panchagavya, T<sub>10</sub>: 75% Enriched vermicompost + 3% Panchagavya, T<sub>11</sub>: 100% Enriched vermicompost + 3% Vermiwash, T<sub>12</sub>: 75% Enriched vermicompost + 3% Vermiwash, T<sub>13</sub>: Control (no manure and foliar spray). The study revealed that among the different doses of enriched vermicompost and organic foliar nutrition, 100% enriched vermicompost + 3% sea weed extract recorded higher growth parameters viz., plant height, LAI, number of tillers and yield attributes, grain yield (2172 kg/ha) and straw yield (4085 kg/ha) of proso millet and it was comparable with 75% enriched vermicompost + 3% sea weed extract. The lowest grain (960 kg/ha) and straw yield (2100 kg/ha) were recorded in control without any vermicompost and foliar spray of nutrients which signifies the importance of application of enriched vermicompost and foliar nutrition in proso millet.

**Keywords:** Proso millet, Enriched vermicompost, Foliar spray, Growth, Yield.

### INTRODUCTION

Proso millet has multiple benefits when consumed as human food. Proso millet is rich in minerals, dietary fiber, polyphenols, vitamins, and proteins, which make it suitable for human food. Proso millet contain high lecithin which supports the neural health system. It is rich in micronutrients like niacin, B-complex vitamins, folic acid, and essential amino acids methionine and cysteine (Saurav *et al.*, 2019). In India, proso millet is largely grown in Madhya Pradesh, eastern Uttar Pradesh, Bihar, Tamil Nadu, Maharashtra, Andhra Pradesh and Karnataka. Proso millet is highly adapted to dryland cropping systems with high water use efficiency and short growing seasons. They can grow in marginal lands and can give a significant amount of

yield compared to major cereal crops. The crop is notable both for its extremely short life cycle, with some varieties producing grain only 60 days after planting, and its low water requirements, producing grain more efficiently per unit of moisture than any other grain species tested.

Much dependence on chemical fertilizers without adequate use of organic recycling has not only aggravated multi-nutrient deficiencies in soil plant system but also deteriorated soil health and is cause of main environmental pollution. Moreover, chemical fertilizers are becoming costlier input in agriculture because of increasing oil prices. Among the various organic manures commonly used vermicompost is one it has now been realized that the intensive use of chemicals in crop production has led to degradation of

land. Vermicompost plays a major role in improving growth and yield of different field crops. Benefits of compost application in agriculture mainly result from its content of organic matter, plant nutrients, promoting plant growth and inhibiting root pathogens/ soil-borne plant diseases (Ram Swaroop and Ramawatar 2012). Indhumathi *et al.* (2023) reported that the activities of vermicompost increased flower diameter and corolla length resulted in maximum individual flower weight. Organic manures, such as farmyard manure, compost, and vermicompost, are utilized as organic fertilizers to improve soil fertility and crop yield. However, the low nutrient content, bulkiness, less availability in the market, lack of awareness among farmers of their beneficial effects, and handling challenges of these organic manures discourage farmers from using them more frequently (Sindhu *et al.*, 2020 and Yatoo *et al.*, 2021). The amendment of cow manure and organic nutrient supplements results in producing mature and nutrient-enriched vermicompost suitable for sustainable agricultural production (Yatoo *et al.*, 2022). Foliar fertilization, also known as foliar feeding, encourages the delivery of nutrients, plant hormones, tonics and other helpful substances in solution form to different aerial parts of the plants, such as leaves, stems and other different plant parts, in order to achieve greater yield, quality, pest resistance, superior drought tolerance and to aid the plants recover from transplant shock, hail damage and various other weather immoderations (Sridhara *et al.*, 2022). Keeping this view, the present study was undertaken to study the effect of enriched vermicompost and organic foliar spray of nutrients on growth and yield of proso millet.

## MATERIALS AND METHODS

A field experiment was carried out during the *Kharif* season of 2022 under irrigated conditions, at the Eastern block of Agricultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore with a view to study the effect of enriched vermicompost and organic foliar spray of nutrients on proso millet. The experimental farm is situated at 11°N latitude and 76°E longitude and at an altitude of 426.7 m above the mean sea level (MSL). Agricultural College and Research Institute, Coimbatore is situated in the Western zone of Tamil Nadu state and receives fairly well distributed mean annual rainfall of 695.8 mm. The rainfall was erratic rainfall received during the cropping period. The maximum temperature ranged from 31°C to 38°C and the minimum temperature ranged from 22°C to 29°C was observed during the cropping period. The experiment was laid out in randomized block design with 13 treatments and were replicated thrice. The vermicompost was enriched using biofertilizer Azophos (1%) and Rock Phosphate (2%) and was kept for enrichment for 40 days with 60% moisture. The manurial value of enriched vermicompost was analysed and the quantity of compost required for the experiment was worked out based on equal N basis. Treatment details are as follows: T<sub>1</sub>: 100% Vermicompost, T<sub>2</sub>: 100% Enriched vermicompost, T<sub>3</sub>: 100% Enriched vermicompost + 3%

Humic Acid, T<sub>4</sub>: 75% Enriched vermicompost + 3% Humic Acid, T<sub>5</sub>: 100% Enriched vermicompost + 3% Sea weed extract, T<sub>6</sub>: 75% Enriched vermicompost + 3% Sea weed extract, T<sub>7</sub>: 100% Enriched vermicompost + 3% PPFM, T<sub>8</sub>: 75% Enriched vermicompost + 3% PPFM, T<sub>9</sub>: 100% Enriched vermicompost + 3% Panchagavya, T<sub>10</sub>: 75% Enriched vermicompost + 3% Panchagavya, T<sub>11</sub>: 100% Enriched vermicompost + 3% Vermiwash, T<sub>12</sub>: 75% Enriched vermicompost + 3% Vermiwash, T<sub>13</sub>: Control (no manure and foliar spray). The foliar spray of humic acid, sea weed extract, PPFM, panchagavya and vermiwash was given on 30 DAS and at 45 DAS. Plots were formed with a gross size of 5m × 4m. The proso millet variety ATL 1 was used for experiment. Observations were recorded from randomly selected 5 plants of each plot such as plant height, number of tillers plant<sup>-1</sup>, number of productive tillers plant<sup>-1</sup>, number of grains panicle<sup>-1</sup>, grain and straw yield (kg ha<sup>-1</sup>) of proso millet. Data collected from the experiment were analysed statistically using “Analysis of variance test” as a single factor analysis. The critical difference at 5% level of significance of different treatment over each other (Gomez and Gomez 1984).

## RESULTS AND DISCUSSION

### A. Effect on growth parameters

The experimental results observed that the application of enriched vermicompost and organic foliar nutrition were significantly influenced the different growth parameters of proso millet at different stages of growth (Table 1). The plant population is an important parameter from the point of determination of yield. The population of proso millet was counted at 15 DAS in various treatments. The data revealed that the effect of different treatments was found non-significant. However, the plant population ranged from 40-46 plants m<sup>-2</sup>. Plant height is an important character of the vegetative phase and indirectly influences the yield components. Plant height as a measure of crop growth was recorded at successive stages of crop growth *i.e.* 30, 60 DAS and at harvest. Application of 100% enriched vermicompost + sea weed extract (T<sub>5</sub>) recorded maximum plant height of 25.8 cm at 30 DAS, 66.3 cm at 60 DAS and 73.6 cm at harvest. The highest LAI at 60 DAS (1.64) and maximum number of tillers (14.0 per hill) were also noticed in 100% enriched vermicompost + sea weed extract (T<sub>5</sub>) over rest of the treatments and it was on par with 75% enriched vermicompost + sea weed extract (T<sub>6</sub>). The lowest growth parameters *viz.*, plant height at 30, 60 DAS and at harvest (21.2 cm, 57.3 cm and 58.5 cm respectively), LAI (0.95) and number of tillers (9.0 per hill) were recorded in control (T<sub>13</sub>). Further, the beneficial effect of enriched vermicompost and seaweed extract on plant growth might be due to attributed to the fact that the higher level of microbial population mineralized the macro and micronutrients during enriched vermicomposting and made available to crop plants for longer period. The similar finding were also supported by Singh (2015); Tyagi *et al.* (2016); Kumar *et al.* (2017); Muhammad *et al.* (2020); Singh *et al.* (2020).

**Table 1. Effect of enriched vermicompost and foliar spray on population and growth parameters of Proso millet.**

Treatments	Plant population (Plants m <sup>-2</sup> )	Plant height (cm)			LAI	Number of tillers plant <sup>-1</sup>
		15 DAS	30 DAS	60 DAS	Maturity	
T1: 100% Vermicompost	42	21.5	54.5	61.9	0.98	10.1
T2: 100% Enriched Vermicompost	44	23.5	55.8	62.8	1.03	10.4
T3: 100% Enriched Vermicompost + Humic acid	44	24.5	60.5	70.2	1.19	13.2
T4: 75% Enriched Vermicompost + Humic acid	43	22.4	59.3	68.8	1.12	11.4
T5: 100% Enriched Vermicompost + Seaweed extract	46	25.8	66.3	73.6	1.64	14.0
T6: 75% Enriched Vermicompost + Seaweed extract	45	25.3	65.7	72.9	1.39	13.7
T7: 100% Enriched Vermicompost + PPFM	42	21.6	57.3	65.4	1.04	11.2
T8: 75% Enriched Vermicompost + PPFM	42	21.3	56.4	64.9	1.02	11.2
T9: 100% Enriched Vermicompost + Panchakavya	44	21.5	65.1	71.5	1.20	12.1
T10: 75% Enriched Vermicompost + Panchakavya	44	24.9	64.8	70.8	1.12	12.0
T11: 100% Enriched Vermicompost + Vermiwash	42	22.5	57.5	64.2	1.19	10.4
T12: 75% Enriched Vermicompost + Vermiwash	41	22.0	58	63.8	1.16	10.6
T13: Control (no manure and foliar spray)	40	21.2	57.3	58.5	0.95	9.0
SEd	2.0	0.9	2.5	2.9	0.019	0.38
CD (p=0.05)	NS	1.83	5.1	5.9	0.042	0.82

### B. Effect on yield attributes

Effect of enriched vermicompost and organic foliar spray on yield attributes and yield of proso millet was presented in Table 2. A perusal of data indicated that the treatment T<sub>5</sub> (100% Enriched vermicompost + sea weed extract) was found the best treatment among all the treatments for the higher number of panicles (13.4 per plant) and it was followed by T<sub>6</sub> (12.3 panicles per plant) and T<sub>3</sub> (12 panicles per plant). However, the minimum number of panicles (6.8 per plant) was obtained in treatment T<sub>13</sub> (Control - no manure and foliar spray). The maximum length of the panicle (23.5 cm) and number of grains per panicle (378) was observed in the treatment T<sub>5</sub> and it was on par with T<sub>6</sub> and T<sub>9</sub>. This might be due to the enriched vermicompost have the potential for improving yield attributes of crops when added to soil. Where, it has humic acids and a combination of macro- and micro-nutrients and the uptake of the nutrients has a positive effect on plant nutrition, growth, photosynthesis and chlorophyll content of the leaves (Rekha *et al.*, 2018). Liquid extracts obtained from seaweeds have gained importance as foliar sprays for several crops because the extract contains growth promoting hormones,

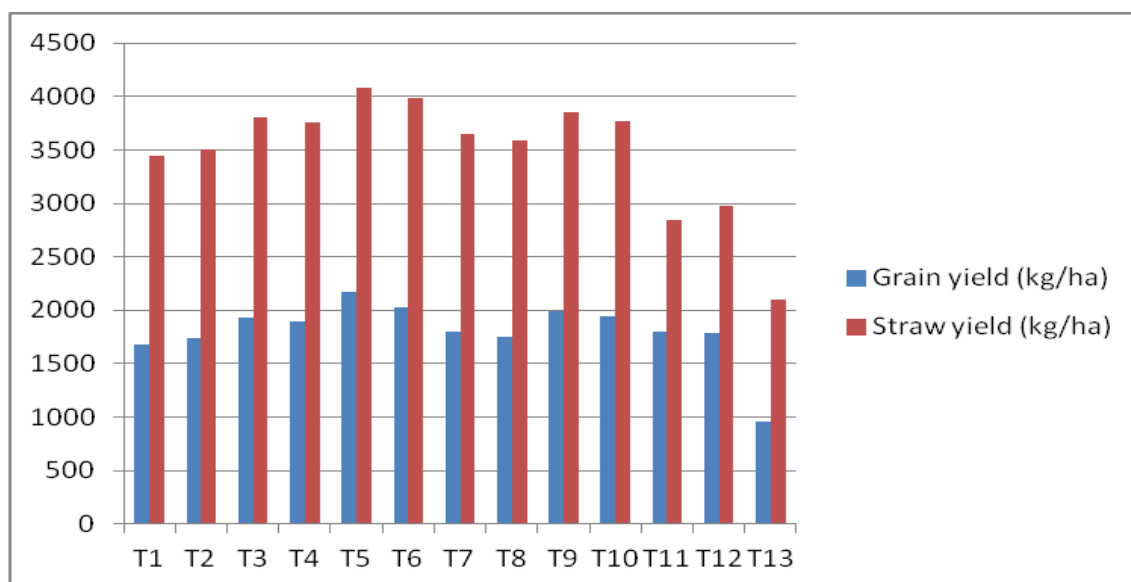
cytokinins, trace elements, vitamins (Strik *et al.*, 2004 and Mamatha *et al.*, 2007).

### C. Effect on yield

Effect of enriched vermicompost and organic foliar spray on grain and straw yield of proso millet was presented in Table 2 and Fig 1. The 100% application of enriched vermicompost with sea weed extract foliar spray (T<sub>5</sub>) was recorded higher grain yield of 2172 kg/ha and starw yield of 4085 kg/ha and it was at par with 75% enriched vermicompost + sea weed extract (T<sub>6</sub>) which recorded grain yield of 2031kg /ha and straw yield of 3985 kg/ha. These were followed by T<sub>9</sub> (100% Enriched vermicompost + panchakavya). Among all the treatments, lowest grain (960 kg/ha) and straw yield (2100 kg/ha) was recorded in the treatment T<sub>13</sub> (Control). This probably due to the application of enriched vermicompost and foliar spray of sea weed extract at critical stages of the crop were effectively absorbed and translocated to the developing panicle thereby producing more number of productive tillers and better filling in proso millet. These observations were also supported by the findings of Mohamed *et al.* (2016); Okee (2020); Ramveer *et al.* (2023).

**Table 2. Effect of enriched vermicompost and foliar spray on yield attributes and yield of prosomillet.**

Treatments	Number of panicles plant <sup>-1</sup>	Length of the panicle (cm)	Number of grains panicle <sup>-1</sup>	Grain yield (kg ha <sup>-1</sup> )	Straw yield (kg ha <sup>-1</sup> )
T <sub>1</sub> :100% Vermicompost	9.0	20.6	257	1680	3450
T <sub>2</sub> :100% Enriched Vermicompost	9.2	20.8	249	1735	3500
T <sub>3</sub> :100% Enriched Vermicompost + Humic acid	12.0	21.8	351	1935	3802
T <sub>4</sub> : 75% Enriched Vermicompost + Humic acid	10.7	21.7	342	1890	3759
T <sub>5</sub> :100% Enriched Vermicompost + Seaweed extract	13.4	23.5	378	2172	4085
T <sub>6</sub> :75% Enriched Vermicompost + Seaweed extract	12.3	23.2	365	2031	3985
T <sub>7</sub> :100% Enriched Vermicompost + PPFM	10.2	21.3	310	1805	3650
T <sub>8</sub> :75% Enriched Vermicompost + PPFM	10.0	21.3	297	1755	3589
T <sub>9</sub> : 100% Enriched Vermicompost + Panchakavya	11.0	22.5	354	1995	3850
T <sub>10</sub> :75% Enriched Vermicompost + Panchakavya	10.6	22.4	346	1945	3764
T <sub>11</sub> :100% Enriched Vermicompost + Vermiwash	9.5	20.8	285	1802	2850
T <sub>12</sub> : 75% Enriched Vermicompost + Vermiwash	9.0	20.2	280	1785	2972
T <sub>13</sub> : Control (no manure and foliar spray)	6.8	19.4	210	960	2100
SEd	0.17	1.04	11.8	80.6	136
CD (p=0.05)	0.34	2.15	26.4	175.2	294



**Fig. 1.** Effect of enriched vermicompost and foliar spray on grain and straw yield of prosomillet.

## CONCLUSIONS

It can be concluded from the result that the enriched vermicompost and organic foliar nutrition were significantly influenced the growth and yield of prosomillet and the treatment T<sub>5</sub> (100% Enriched vermicompost + sea weed extract) was found the best treatment among all the treatments and it gave the

maximum growth and yield, whereas it was comparable with T<sub>6</sub> (75% Enriched vermicompost + Sea weed extract). On the basis of the result obtained after completion of present investigation it was concluded that application of 100% enriched vermicompost on equal N basis along with foliar spray of 3% seaweed extract increases growth parameters and yield attributes, grain yield of prosomillet.

## FUTURE SCOPE

Future studies can be carried out to study the influence of enriched vermicompost and organic foliar spray on quality of prosomillet.

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**Conflict of Interest.** None.

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