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# EVALUATING THE EFFICACY OF FOLIAR NUTRITION WITH COW URINE, VERMIWASH AND PLANT EXTRACTS FOR ENHANCED YIELD AND NUTRIENT UPTAKE IN CHILLI (*CAPSICUM ANNUUM* L.) CULTIVATION

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**ABSTRACT**

A two-year field investigation was conducted during the *Rabi* seasons of 2020-21 and 2021-22 in lateritic soil at the Department of Agronomy, College of Agriculture, Dapoli, India, to assess the influence of organic soil amendment and diverse foliar sprays on the yield and nutrient uptake of chilli pepper (*Capsicum annuum* L. cv. Sitara). A randomized block design with three replications and sixteen treatment combinations was employed. Treatments comprised soil application of vermicompost at 100% of the recommended nitrogen (N) dose and foliar application of cow urine, vermiwash, *Moringa* leaf extract, *Glyricidia* leaf extract, and *Pongamia* leaf extract at varying N concentrations (0.02%, 0.04% and 0.06%).

Vermicompost at 100% N equivalence and the highest vermiwash concentration (0.06% N) significantly ($p < 0.05$) increased green pod yield (11.88 and 17.29 t $ha^{-1}$) and fruit weight (252.89 and 249.15 g) per plant across both years. Furthermore, treatment $T_7$, comprising the application of 100% recommended nitrogen dose (RDN) through vermicompost along with foliar application of cow urine at 0.06% N content, exhibited significantly higher nitrogen (52.80 and 56.96 kg $ha^{-1}$), phosphorus (16.27 and 13.93 kg $ha^{-1}$) and potassium (58.46 and 60.42 kg $ha^{-1}$) uptake during the years 2020-21 and 2021-22, respectively. These results indicate the potential of foliar application of these organic inputs as sustainable alternatives for enhancing chilli production and nutrient uptake.

***Key words :*** Lateritic soil, Chilli, Vermicompost, Vermiwash, Foliar application, Yield, Nutrient uptake.

## Introduction

Chilli peppers (*Capsicum annuum* L.), a fiery spice igniting taste buds worldwide, face a scorching threat: conventional farming practices that undermine both environmental health and human well-being. Seeking a more sustainable flame, this study explores the potential of organic amendments as allies in chilli cultivation. We delve into the fertile ground of vermicompost, teeming with nutrients and microbial life and the invigorating foliar sprays of cow urine, vermiwash, *Moringa* leaf extract, *Glyricidia* leaf extract and *Pongamia* leaf extract. Each amendment offers unique benefits: vermicompost, a powerhouse of readily available nutrients; cow urine, a treasure trove of nitrogen, phosphorus and potassium; vermiwash, a cocktail of growth-promoting hormones and enzymes; *Moringa* leaf extract, rich in vitamins and micronutrients; *Glyricidia* leaf extract, a source of readily available nitrogen and organic matter and *Pongamia* leaf extract, brimming with beneficial phenolics and nutrients. This field experiment ignites a quest to understand how these organic amendments applied individually and in concert, influence the yield, quality, and key attributes of chilli peppers grown in lateritic soil. Our aim is not only to cultivate tastier harvests, but to discover sustainable solutions for chilli production, leaving a milder footprint on our planet.

## Materials and Methods

A field experiment was conducted during the *Rabi* seasons of 2020-21 and 2021-22 at the Department of Agronomy, College of Agriculture, Dapoli, India, utilizing the chilli cultivar Sitara. The crop was planted with a spacing of 60 cm x 45 cm in plots measuring 4.5 m x 3.0 m. A randomized block design (RBD) with three replications and sixteen treatment combinations was implemented. Plant leaf extracts were prepared using 1 kg dried leaves of *Glyricidia sepium*, *Pongamia pinnata* and *Moringa oleifera*, combined with a 3% silicone solution in 10 liters of water. Organic sources, namely cow urine, vermiwash and plant leaf extracts were analyzed for nutrient content and utilized for foliar spray according to treatment specifications and nitrogen concentration.

Observations were recorded by collecting green chilli fruits harvested from each plot at each picking, which were then immediately weighed. Data were aggregated and expressed as green pod yield (kg/plot) and chilli yield (t/ha). Similarly, the average weight of fruits per plant (g) was determined by harvesting fruits from five randomly tagged plants per plot at each picking. Chilli plants and fruits were collected at the harvest stage, oven-dried and analyzed for macro and micronutrient content. The plant samples were digested with concentrated $H_2SO_4$, and the total nitrogen content was determined using a Kjelplus apparatus (Tandon, 1993). Phosphorus was determined calorimetrically using a spectrophotometer at a wavelength of 420 nm (Jakson, 1973). Similarly, potassium content was estimated using the flame photometric method by feeding diluted diacid digested solution, as suggested by Piper (1966). Nutrient uptake was calculated by multiplying the nutrient content by biomass yield.

## Results and Discussion

The application of different organic sources significantly impacted green pod yield (Table 1). Both years (2020-21 and 2021-22) saw the highest yield (17.29 and 11.88 t/ha, respectively) with 100% N equivalent vermicompost and 0.06% N vermiwash foliar application ($T_7$). This increase might be attributed to soluble nutrient transfer and growth stimulants in vermiwash, triggering physiological processes like photosynthesis and cell division. Similar findings were reported by Tambe *et al*. (2015). Conversely, the lowest yield (10.26 and 12.25 t/ha) was observed in $T_{14}$ (100% RDN vermicompost with 0.02% N *Pongamia* leaf extract) and $T_1$ (100% RDN

**Table 1 :** Effect of soil and foliar application of different organic sources on weight of fruits per plant and green pod yield of chilli.

| Treat. no. | Treatment details | Weight of fruits plant$^{-1}$ (g) | | Green pod yield (t ha$^{-1}$) | |
|---|---|---|---|---|---|
| | | 2020-2021 | 2021-2022 | 2020-2021 | 2021-2022 |
| $T_1$ | 100% RDN through Vermicompost (VC) | 186.63 | 178.73 | 10.51 | 12.25 |
| $T_2$ | $T_1$ + Foliar Spray of Cow urine @ 0.02 % N content | 207.71 | 199.98 | 10.76 | 13.87 |
| $T_3$ | $T_1$ + Foliar Spray of Cow urine @ 0.04 % N content | 227.06 | 236.93 | 11.28 | 14.52 |
| $T_4$ | $T_1$ + Foliar Spray of Cow urine @ 0.06 % N content | 243.68 | 238.56 | 11.60 | 16.47 |
| $T_5$ | $T_1$ + Foliar Spray of Vermiwash @ 0.02 % N content | 214.75 | 200.40 | 10.53 | 14.16 |
| $T_6$ | $T_1$ + Foliar Spray of Vermiwash @ 0.04 % N content | 234.31 | 237.43 | 11.10 | 16.45 |
| $T_7$ | $T_1$ + Foliar Spray of Vermiwash @ 0.06 % N content | 252.89 | 249.15 | 11.88 | 17.29 |
| $T_8$ | $T_1$ + Foliar Spray of Moringa leaf extract (MLE) @ 0.02 % N content | 208.62 | 194.81 | 10.62 | 13.41 |
| $T_9$ | $T_1$ + Foliar Spray of Moringa leaf extract (MLE) @ 0.04 % N content | 222.80 | 209.30 | 10.77 | 14.01 |
| $T_{10}$ | $T_1$ + Foliar Spray of Moringa leaf extract (MLE) @ 0.06 % N content | 229.43 | 236.10 | 11.53 | 15.90 |
| $T_{11}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.02 % N content | 211.89 | 195.08 | 10.82 | 13.41 |
| $T_{12}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.04 % N content | 216.90 | 209.11 | 11.18 | 14.56 |
| $T_{13}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.06 % N content | 230.88 | 223.38 | 11.45 | 14.50 |
| $T_{14}$ | $T_1$ + Foliar Spray of Pongamia leaf extract (PLE) @ 0.02 % N content | 194.29 | 193.13 | 10.26 | 13.50 |
| $T_{15}$ | $T_1$ + Foliar Spray of Pongamia leaf extract (PLE) @ 0.04 % N content | 206.17 | 205.03 | 10.69 | 14.23 |
| $T_{16}$ | $T_1$ + Foliar Spray of Pongamia leaf extract (PLE) @ 0.06 % N content | 227.51 | 220.77 | 11.52 | 14.50 |
| | **Mean** | **219.72** | **214.24** | **11.03** | **14.56** |
| | **SEm ±** | **9.07** | **6.72** | **0.30** | **0.46** |
| | **C.D. P=0.05** | **26.19** | **19.40** | **0.84** | **1.49** |

**Table 2 :** Effect of soil and foliar application of different organic sources on nitrogen, phosphorus and potassium uptake (kg ha$^{-1}$) by chilli.

| Treat. no. | Treatment details | 2020-2021 | | | 2021-2022 | | |
|---|---|---|---|---|---|---|---|
| | | Nitrogen | Phosphorus | Potassium | Nitrogen | Phosphorus | Potassium |
| | | Kg ha$^{-1}$ | | | | | |
| $T_1$ | 100 % RDN through Vermicompost (VC) | 27.45 | 7.86 | 33.25 | 28.64 | 7.97 | 36.95 |
| $T_2$ | $T_1$ + Foliar Spray of Cow urine @ 0.02 % N content | 40.30 | 11.78 | 49.78 | 43.46 | 11.55 | 53.06 |
| $T_3$ | $T_1$ + Foliar Spray of Cow urine @ 0.04 % N content | 46.54 | 13.90 | 53.58 | 46.34 | 12.49 | 55.94 |
| $T_4$ | $T_1$ + Foliar spray of Cow urine @ 0.06 % N content | 52.66 | 15.84 | 56.45 | 49.23 | 13.34 | 58.41 |
| $T_5$ | $T_1$ + Foliar Spray of Vermiwash @ 0.02 % N content | 42.84 | 12.71 | 49.80 | 43.65 | 11.66 | 54.02 |
| $T_6$ | $T_1$ + Foliar Spray of Vermiwash @ 0.04 % N content | 46.70 | 14.10 | 54.13 | 48.38 | 13.02 | 56.85 |
| $T_7$ | $T_1$ + Foliar Spray of Vermiwash @ 0.06 % N content | 52.80 | 16.27 | 58.46 | 56.92 | 13.93 | 60.42 |
| $T_8$ | $T_1$ + Foliar Spray of Moringa leaf extract @ 0.02 % N content | 38.81 | 11.20 | 47.99 | 41.51 | 10.95 | 50.58 |
| $T_9$ | $T_1$ + Foliar Spray of Moringa leaf extract @ 0.04 % N content | 43.44 | 12.86 | 50.88 | 47.50 | 11.58 | 52.57 |
| $T_{10}$ | $T_1$ + Foliar Spray of Moringa leaf extract @ 0.06 % N content | 46.42 | 14.24 | 52.46 | 47.60 | 12.43 | 54.85 |
| $T_{11}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract @ 0.02 % N content | 34.81 | 10.67 | 40.98 | 35.47 | 9.83 | 44.77 |
| $T_{12}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract @ 0.04 % N content | 41.63 | 13.06 | 49.59 | 41.22 | 11.50 | 51.05 |
| $T_{13}$ | $T_1$ + Foliar Spray of Glyricidia leaf extract @ 0.06 % N content | 44.65 | 14.44 | 52.48 | 47.77 | 12.58 | 54.51 |
| $T_{14}$ | $T_1$ + Foliar Spray of Pongamia leaf extract @ 0.02 % N content | 31.07 | 10.75 | 39.42 | 37.70 | 9.09 | 43.49 |
| $T_{15}$ | $T_1$ + Foliar Spray of Pongamia leaf extract @ 0.04 % N content | 35.44 | 9.66 | 40.91 | 38.78 | 9.51 | 44.65 |
| $T_{16}$ | $T_1$ + Foliar Spray of Pongamia leaf extract @ 0.06 % N content | 37.40 | 11.68 | 43.41 | 40.17 | 10.20 | 46.44 |
| | **Mean** | **41.44** | **12.56** | **48.35** | **43.40** | **11.35** | **51.16** |
| | **SEm ±** | **1.96** | **0.55** | **1.79** | **1.93** | **0.92** | **1.20** |
| | **C.D. P=0.05** | **5.68** | **1.62** | **5.17** | **5.60** | **2.70** | **3.50** |

vermicompost alone), respectively. Similar to green pod yield, 100% N equivalent vermicompost and 0.06% N through vermiwash foliar application ($T_7$) recorded the highest fruit weight (252.89 and 249.15 g) during both years (Table 1). This could be due to the abundance of macro/micronutrients, humic/fulvic acids, and growth regulators in high-dose vermiwash, potentially boosting physiological processes and contributing to increased growth parameters. Ansari and Sukhraj (2010) reported similar observations in okra. The lowest fruit weight (186.63 and 178.73 g) was found in $T_1$ (100% N equivalent vermicompost alone).

The treatment $T_7$ consisting application of 100 per cent RDN through vermicompost along with foliar application of cow urine @ 0.06 per cent N content registered significantly higher nitrogen (52.80 and 56.96 kg $ha^{-1}$), phosphorus (16.27 and 13.93 kg $ha^{-1}$) and potassium (58.46 and 60.42 kg $ha^{-1}$) uptake during the years 2020-21 and 2021-22, respectively (Table 2). The application of 100 per cent vermicompost on N equivalent basis and foliar application of vermiwash @ 0.06 per cent N content recorded the maximum uptake of nitrogen by chilli, which might be due to the presence of auxins, cytokinins and gibberellins in vermiwash which might have elicited profuse root and shoot growth, which may enhanced more uptake of nutrients from the soil. The results are in line with Azizi *et al*. (2005), illustrated the combined application of vermicompost and vermiwash improved the uptake of nitrogen, phosphorus and potassium by *Ocimum basilicum* L. as compared to other treatments.

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