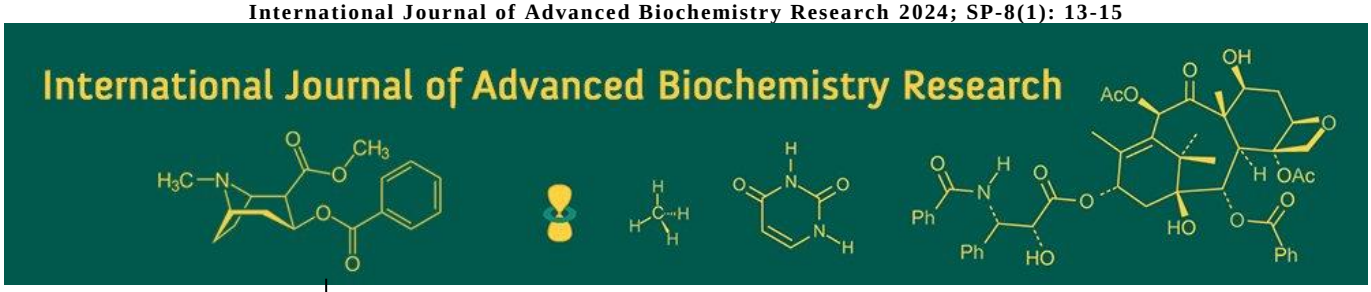

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AR Chavan
M.Sc. Student, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

RV Dhopavkar
Deputy Director of Research, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

VG Salvi
Ex. Head and Professor, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

VA Rajemahadik
Assistant Professor, Department of Agronomy, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

MM Kulkarni
Assistant Professor, Department of Fruit Science, College of Horticulture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

SB Dodake
Head, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Corresponding Author:
AR Chavan
M.Sc. Student, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, Ratnagiri, Maharashtra, India

Nutrient content of chilli (*Capsicum annuum* L.) as influenced by soil application of vermicompost and foliar spray of liquid organic sources

AR Chavan, RV Dhopavkar, VG Salvi, VA Rajemahadik, MM Kulkarni and SB Dodake

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Abstract
The field experiment was conducted during *rabi* season 2022 at Department of Agronomy, College of Agriculture, Dapoli, to evaluate the effectiveness of vermicompost and identify suitable organic sources for foliar application to chilli (*Capsicum annuum* L.) crops using various plant leaf extracts in organic farming practices on nutrient content of chilli. The field experiment was laid out in Randomized Block Design (RBD) comprising thirteen treatments replicated thrice. The result revealed that vermicompost and foliar application of liquid organic sources improved nitrogen, phosphorus, potassium and micronutrient (iron, copper, manganese, zinc) content of chilli with soil application of 100% vermicompost on N equivalent basis alongwith foliar spray of vermiwash @ 0.06% N content.

Keywords: Vermicompost, vermiwash, cow urine, leaf extracts, chilli

Introduction
Chilli (*Capsicum annuum* L.) is a unique and popular spice in the majority of the countries of the world and it is one of the most important commercial vegetable crops in the India. Due to heavy dose of chemical fertilizers, pesticides and plant growth regulators, the chemical residue remains in the soil and effect human and animal health also causing environmental pollution. In this regard there is a need to identify the suitable substitute in place of chemical fertilizers which are economically cheaper and ecofriendly. Vermicompost is product obtained from composting of organic waste into high quality manure with help the of the earthworms. Vermicompost has potential in crop nutrition because presence of plant growth regulators such as auxins, gibberellins and cytokinins of microbial origin and humic acid in appreciable quantities (Atiyeh *et al.* 2002*)* [3]. Liquid organic manures efficiently meet crop nutrient requirements and correct deficiencies in organic production systems having greater nutrient use efficiency (Shwetha, 2009) [16]. The liquid organic sources and plant leaf extract helps to maintain environmental health by reducing the level of pollution.
Cow urine is one of the ingredients of "Panchagavya" (urine, dung, milk, curd, and ghee) which control many diseases as it has many medicinal properties and it has ability to control fungal and bacterial diseases. Vermiwash is brownish–red liquid extract collected water pass through the vermiculture. Vermiwash is combination of earthworm mucous discharge, nutrients, micro-organisms and plant growth promoting material. Various experiments shown application of vermiwash improves plant health, yield and nutritional quality (Naidu *et al.* 2013) [10].
Moringa oleifera is a highly valued plant, seen in many countries of the tropics and subtropics. It has not only an impressive range of medicinal uses but also high nutritional value. (Abdalla, 2014) [1]. The moringa leaf extract (MLE) applied in the form of foliar application is more beneficial than soil applicatiom (Narang *et al.* 1997) [11]. *Glyricidia sepium* is multipurpose tree grown in humid and sub-humid areas and soil conditions, including acid and infertile soils. *Glyricidia sepium* is a promising green biomass producer for organic fertilizer production.
Waste decomposer culture had developed by National Centre of Organic Farming (NCOF) which is used to quick decomposition of organic waste, soil health improvement and as plant protection agent.

It is an association of micro-organism extracted from desi cow dung. Decomposer plays an important role in the flow of energy through an ecosystem. By releasing enzymes as well as organic acids, decomposer decomposes plant or crop residues in the field.

Additionally, liquid organic fertilizer can actively provide you with the following advantages in addition to many others. Keeping all these views in mind, it was decided to assess the efficacy of organics in chilli crop nutrition. Therefore, the present investigation entitled Nutrient content of chilli (*Capsicum annuum* L.) as influenced by soil application of vermicompost and foliar spray of liquid organic sources.

Materials and Methods

The present study was carried out at Department of Agronomy, College of Agriculture, Dr. BSKKV., Dapoli (MH) during rabi season of 2022-2023. The field experiment was laid out in Randomized Block Design (RBD) comprising thirteen treatments replicated thrice. The treatment T_1-100% RDN through Vermicompost (VC), T_2-T_1 + Foliar Spray of Cow urine @ 0.04% N content, T_3-T_1 + Foliar Spray of Cow urine @ 0.06% N content, T_4-T_1 + Foliar Spray of Vermiwash @ 0.04% N content, T_5-T_1 + Foliar Spray of Vermiwash @ 0.06% N content, T_6-T_1 + Foliar Spray of Moringa leaf extract (MLE) @ 0.04% N content (Silicone), T_7-T_1 + Foliar Spray of Moringa leaf extract (MLE) @ 0.06% N content (Silicone), T_8-T_1 + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.04% N content (Silicone), T_9-T_1 + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.06% N content (Silicone), T_{10}-T_1 + Foliar Spray of Moringa leaf extract (MLE) @ 0.04% N content (Waste decomposer), T_{11}-T_1 + Foliar Spray of Moringa leaf extract (MLE) @ 0.04% N content (Waste decomposer), T_{12}-T_1 + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.04% N content (Waste decomposer) and T_{13}-T_1 + Foliar Spray of Glyricidia leaf extract (GLE) @ 0.04% N content (Waste decomposer). The vermicompost was applied to soil on the basis of 100% recommended dose of nitrogen along with the foliar application of two levels of cow urine, vermiwash, moringa leaf extract and glyricidia leaf extract @ 0.04 and 0.06% N content was applied as foliar application at the 30, 60 and 90 days after transplanting of seedlings.

Statistical analysis

The experimental data was analyzed statistically by the technique of Analysis of Variance as applicable to Randomized block design. The significance of treatment difference was tested by 'F' (Variance ratio) test. Critical difference (CD) at 5% level of probability was worked out for comparison and statistical interpretation of the treatment means as outlined by Panse and Sukhatme (1967) [13].

Results and Discussion

Nutrient content

The results pertaining to nutrient content of the green chilli pod is presented in table 1. From the table it was observed that soil and foliar application of liquid organic sources had significant influence on nutrient content of green chilli pod.

Among different liquid organic sources, maximum N content of green chilli pod (1.25%) was recorded in treatment T_5 consisting 100% RDN through vermicompost alongwith foliar spray vermiwash @0.06% N content. The maximum total nitrogen content of chilli pod was found when 100% vermicompost applied on a N equivalent basis and 0.06% N content vermiwash was applied topically to the leaves. Similar findings were also made known by Tripathi and Bharadwaj (2004) [18], who showed that nitrogen present in the form of mucus, nitrogenous excretory chemicals, growth-stimulating hormones, and enzyme in vermiwash all contribute significantly to raising the N concentration of crops.

The significantly higher total phosphorus content (0.327%) in pod was recorded due to application of 100% RDN through vermicompost and foliar application of vermiwash @ 0.06% N content. The reason for this could be because during the vermicomposting process, the insoluble high molecular weight organic forms of phosphorus present in feed material that was used for vermicomposting, such as phospholipids, phytin, and phytic acid, were converted into low molecular weight inorganic forms, such as orthophosphate ions, when it goes through the earthworm gut and also by microbial decomposition, which leaches out from vegetables. The significantly maximum total potassium content (1.22%) of chilli was documented due to the treatment T_5. The treatment T_5 followed by T_3, T_4, T_6, T_7, T_8, and T_9 treatments. Further, the lower total potassium content (1.09%) of chilli was found in the T_1 treatment.

The significantly maximum total iron content (12.42 mg kg^{-1}) of chilli was noted due to the treatment T_5. The significantly higher total zinc content (24.08 mg kg^{-1}) pod of chilli was proved in the treatment T_5. The similar results were also stated by Hernandez *et al*. (2010) [6] and Yassen *et al*. (2020) [19], who recorded an increased in the zinc content of lettuce due to combined application of vermicompost and vermiwash.

It is obvious from the data that the treatment T_5 documented the significantly maximum total manganese content (39.76 mg kg^{-1}) in pod and it was at par with the treatments T_7, T_3, T_4, and T_2. The treatment T_5 recorded the significantly higher total copper content (16.13 mg kg^{-1}) of chilli and it was statistically at par with the treatments T_3, T_2 and T_7. In general, as compared to plant leaf extracts, the application of 100% RDN through vermicompost and foliar application of animal-origin organic sources, namely vermiwash and cow urine at greater concentrations (0.06% N content), recorded the maximum nutritional content of chilli. However, when compared to other plant leaf extracts, the foliar application of moringa leaf extract at a greater concentration (0.06% N content) recorded the highest level of nutritional content for chilli. The findings are consistent with those of Nogales *et al.* (2005) [12] and Hernandez *et al.* (2010) [6], who demonstrated an increase in total copper concentration as a result of foliar vermiwash treatment.

Table 1: Nutrient content of green chilli pod as influenced by by soil application of vermicompost and foliar spray of liquid organic sources

Treat. No.	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Iron (mg kg^{-1})	Zinc (mg kg^{-1})	Mangnese (mg kg^{-1})	Copper (mg kg^{-1})
T_1	0.98	0.234	1.09	8.44	17.93	27.96	11.86
T_2	1.09	0.269	1.12	10.49	20.50	33.93	15.23
T_3	1.18	0.270	1.19	11.14	21.43	35.81	15.26
T_4	1.23	0.321	1.17	11.09	21.50	35.06	13.96

T_5	1.25	0.327	1.22	12.42	24.08	39.76	16.13
T_6	1.06	0.259	1.18	9.77	21.25	32.15	13.93
T_7	1.17	0.280	1.20	10.38	22.06	38.00	14.56
T_8	1.16	0.260	1.16	9.83	21.14	30.83	13.76
T_9	1.15	0.305	1.15	9.96	21.90	30.63	14.23
T_{10}	1.05	0.257	1.13	9.42	19.80	29.33	13.50
T_{11}	1.07	0.259	1.12	9.72	20.36	30.63	13.66
T_{12}	1.03	0.243	1.10	8.91	19.12	28.23	13.33
T_{13}	1.04	0.244	1.10	9.34	19.33	29.33	13.46
Mean	1.11	0.27	1.15	10.07	20.80	32.44	14.07
S.E. (m)±	0.03	0.015	0.02	0.47	0.86	2.21	0.59
C.D. (P=0.05)	0.11	0.04	0.07	1.37	2.52	6.46	1.73

Conclusion

The treatment T_5 comprising 100% RDN through vermicompost and foliar spray of vermiwash @ 0.06% N content significantly improved nutrient content of green chilli pod.

Thus, the study revealed that the optimal combination for proper plant nutrition is the application of 100% recommended nitrogen dose through vermicompost and foliar spray of vermiwash @ 0.06 percent nitrogen content. This method enhances nutrient content of green chilli pod under organic farming practices in *Rabi* season on lateritic soils in the Konkan region.

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