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Studies on organic production of head lettuce (*Lactuca sativa* L)

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ABSTRACT

A field experiment was conducted during Rabi 2025 at the Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani, to evaluate the effect of different organic nutrient sources and biostimulants on yield attributes and yield of head lettuce. Thirteen treatment combinations involving farmyard manure (FYM), vermicompost, Azophos biofertilizer, humic acid, vermiwash and seaweed extract were evaluated in a randomized block design with three replications. Yield-related observations included whole-plant fresh weight, head weight, root weight, head yield per plot, gross yield and marketable yield. Vermicompost 6 t ha⁻¹ + Azophos + humic acid (*T*₇) recorded the highest whole-plant fresh weight (672.13 g plant⁻¹), head weight (615.20 g plant⁻¹), head yield (12.30 kg plot⁻¹), gross yield (497.88 q ha⁻¹) and marketable yield (455.70 q ha⁻¹). Vermicompost 6 t ha⁻¹ + Azophos + seaweed extract (*T*₉) ranked next for several yield attributes. Root weight was statistically non-significant, although *T*₈ recorded the highest numerical value (15.53 g plant⁻¹). The results indicate that integrated application of vermicompost, Azophos and humic acid was particularly effective in enhancing head weight and marketable yield of head lettuce under the conditions of the study.

Keywords: *Lactuca sativa*, Head lettuce, Yield attributes, Vermicompost, Azophos, Humic acid, Seaweed extract, Marketable yield

Introduction

Lettuce (*Lactuca sativa* L.) is an important salad vegetable cultivated primarily for its edible leaves and compact head. Among the different lettuce types, head or iceberg lettuce is valued for its firm head and marketable fresh produce. Yield in head lettuce is closely associated with head development, fresh biomass accumulation and final head weight.

Organic nutrient management provides an alternative approach for supplying nutrients while maintaining soil biological activity. Vermicompost supplies nutrients in relatively available forms and may improve plant growth and biomass accumulation through its nutrient content and biologically active constituents (Atiyeh *et al.*, 2002) [1]. Biofertilizers can complement organic nutrient sources by improving nutrient acquisition, while biostimulants such as humic substances, vermiwash and seaweed extracts may influence nutrient-use efficiency and crop development.

Previous studies have reported beneficial effects of integrated organic nutrient management on lettuce yield. Chatterjee (2015) [2] reported that FYM, vermicompost and biofertilizer combinations influenced yield-attributing characters and head fresh weight. Saha *et al.* (2020) [3] evaluated thirteen combinations of organic manure, Azophos and biostimulants and reported the highest head weight and yield with vermicompost + Azophos + humic acid, while vermicompost + Azophos + seaweed extract produced superior vegetative traits. The present investigation was therefore undertaken to assess the effect of FYM, vermicompost, Azophos and selected biostimulants on yield attributes and yield of head lettuce under the agro-climatic conditions of Latur.

Materials and methods

Experimental site and crop

The experiment entitled “Studies on organic production of Head lettuce (*Lactuca sativa* L.)” was conducted during Rabi 2025 at the Instructional-Cum-Research Farm, Department of Horticulture, College of Agriculture, Latur, VNMKV, Parbhani, Maharashtra, India. Iceberg head lettuce was used as the experimental crop. Seed was sown on 10 November 2025 and healthy seedlings were transplanted following nursery establishment.

Experimental design and treatments

The experiment was laid out in a randomized block design with 13 treatments and three replications. FYM and vermicompost were incorporated before transplanting according to treatment. Azophos biofertilizer was applied as a root dip for 30 min before transplanting at 250 ml L⁻¹. Humic acid (2 ml L⁻¹), vermiwash (10 ml L⁻¹) and seaweed extract (2 ml L⁻¹) were applied as foliar sprays at 30, 45 and 60 days after transplanting (DAT).

Table 1. Experimental treatment details.

Treatment	Nutrient combination
T ₁	FYM 10 t ha ⁻¹ + 100% RDF (80:50:50 kg N:P:K ha ⁻¹) – control
T ₂	FYM 20 t ha ⁻¹ + Azophos
T ₃	T ₂ + humic acid
T ₄	T ₂ + vermiwash
T ₅	T ₂ + seaweed extract
T ₆	Vermicompost 6 t ha ⁻¹ + Azophos
T ₇	T ₆ + humic acid
T ₈	T ₆ + vermiwash
T ₉	T ₆ + seaweed extract
T ₁₀	FYM 10 t ha ⁻¹ + vermicompost 3 t ha ⁻¹ + Azophos
T ₁₁	T ₁₀ + humic acid
T ₁₂	T ₁₀ + vermiwash
T ₁₃	T ₁₀ + seaweed extract

Yield observations and statistical analysis

Yield-related observations were recorded at the appropriate stages of crop development. Days to head formation and days to maturity were recorded as phenological indicators associated with harvest readiness. Whole-plant fresh weight, head weight and root weight were recorded in grams per plant. Head yield per plot was recorded in kilograms and converted to gross and marketable yield per hectare. The data were subjected to analysis of variance appropriate for randomized block design, and treatment means were compared using the critical difference at the 5% level of significance following standard procedures for agricultural experiments (Panse *et al.*, 2000) [4].

Results and discussion

Fresh weight of whole plant

Whole-plant fresh weight differed significantly among treatments. T₇ recorded the highest fresh weight (672.13 g plant⁻¹), followed by T₉ (619.60 g) and T₁₀ (617.27 g), whereas T₂ recorded the lowest value (498.07 g plant⁻¹). The greater fresh biomass under T₇ may be attributed to improved nutrient availability and uptake under the combined application of vermicompost, Azophos and humic acid. The result is consistent with the general response reported for integrated organic nutrient management in lettuce, where organic manure and biofertilizer combinations improved biomass and yield-related traits. Besas *et al.* (2020) [5] and Sriwichan *et al.* (2026) [6] reported beneficial effects of FYM, vermicompost and Azophos combinations on yield-attributing characters of lettuce.

Head weight

Head weight was significantly influenced by the treatments. The maximum head weight was recorded under T₇ (615.20 g plant⁻¹), followed by T₉ (568.00 g) and T₁₀ (561.40 g), whereas T₂ recorded the minimum (436.67 g plant⁻¹). The higher head weight under T₇ indicates greater accumulation of assimilates in the marketable head under the combined influence of vermicompost, Azophos and humic acid. Saha *et al.* (2020) [3] and Mohammed *et al.* (2022) [7] similarly reported maximum head weight with vermicompost 6 t ha⁻¹ + Azophos + humic acid.

Root weight

Root weight was statistically non-significant among the treatments. The highest numerical root weight was recorded under T₈ (15.53 g plant⁻¹), followed by T₁₂ (15.37 g) and T₉ (15.13 g), whereas T₁ recorded the lowest numerical value (13.87 g plant⁻¹). Since the treatment effect was non-significant, the numerical differences in root weight should not be interpreted as statistically distinct responses.

Head yield per plot

Head yield per plot was significantly influenced by the nutrient treatments. T₇ recorded the highest head yield (12.30 kg plot⁻¹), followed by T₉ (11.36 kg) and T₁₀ (11.23 kg), while T₂ recorded the lowest yield (8.73 kg plot⁻¹). The superior performance of T₇ was consistent with its higher whole-plant fresh weight and head weight, indicating that the greater biomass accumulation was translated into higher head yield. The present findings are in close agreement with the findings of Saha *et al.* (2020) [3] and Mohammed *et al.* (2022) [7]

Table 2. Effect of organic nutrient sources on yield attributes and yield of head lettuce

Treatment	Fresh weight (g/plant)	Head weight (g/plant)	Root weight (g/plant)	Head yield/plot (kg)	Gross yield (q/ha)	Marketable yield (q/ha)
T ₁	574.40	478.93	13.87	9.58	425.48	354.77
T ₂	498.07	436.67	14.43	8.73	368.94	323.46
T ₃	547.33	516.47	14.67	10.95	382.57	405.43
T ₄	610.27	552.67	15.20	11.05	452.05	409.38
T ₅	570.73	503.13	14.43	10.06	422.77	372.69
T ₆	601.27	446.47	14.73	8.93	445.88	330.72
T ₇	672.13	615.20	14.70	12.30	497.88	455.70
T ₈	597.93	545.53	15.53	10.91	442.91	404.10
T ₉	619.60	568.00	15.13	11.36	458.96	420.74
T ₁₀	617.27	561.40	14.47	11.23	457.23	415.85
T ₁₁	553.87	506.60	14.33	10.13	410.27	375.26
T ₁₂	520.07	508.27	15.37	10.17	385.23	376.49
T ₁₃	523.27	473.00	14.70	9.46	387.60	350.37
SEM ±	13.90	12.84	0.43	0.26	10.09	9.69
CD (P = 0.05)	40.57	37.47	NS	0.76	29.45	28.28

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Gross yield

Gross yield differed significantly among treatments. The maximum gross yield was recorded under T₇ (497.88 q ha⁻¹), followed by T₉ (458.96 q ha⁻¹) and T₁₀ (457.23 q ha⁻¹), whereas T₂ recorded the minimum gross yield (368.94 q ha⁻¹). The higher yield under T₇ can be associated with its superior head weight and head yield per plot. Similar improvements in lettuce productivity through vermicompost, biofertilizer and biostimulant combinations have been reported by Saha *et al.* (2020) [3].

Marketable yield

Marketable yield was also significantly influenced by treatments. T₇ recorded the highest marketable yield (455.70 q ha⁻¹), followed by T₉ (420.74 q ha⁻¹) and T₁₀ (415.85 q ha⁻¹). The lowest marketable yield was recorded under T₂ (323.46 q ha⁻¹). The greater marketable production under T₇ reflects its higher head weight and head yield per plot, demonstrating that the treatment was effective in producing a larger proportion of harvestable head biomass.

Conclusion

The present investigation demonstrated that organic nutrient sources combined with Azophos and foliar biostimulants significantly affected yield attributes and yield of head lettuce. Vermicompost 6 t ha⁻¹ + Azophos + humic acid (T₇) produced the highest whole-plant fresh weight, head weight, head yield per plot, gross yield and marketable yield. Root weight was not significantly influenced by the treatments. The superior yield performance of T₇ was associated with greater fresh biomass and head weight, indicating the potential of vermicompost-based integrated nutrient management with humic acid for improving head lettuce productivity under the conditions of the present study.

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