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Assessment of the effect of low-input sustainable agricultural practices on growth, yield, and profitability of lettuce (*Lactuca sativa* L.)

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Abstract
The present study was conducted to evaluate the impact of different levels of Jeevamrit and Ghanjeevamrit on the growth, yield, quality, and profitability of lettuce under low-input sustainable agriculture (LISA) conditions in the mid-hills of Himachal Pradesh. A factorial randomized block design was employed, with nine treatment combinations. The results revealed that higher doses of Jeevamrit and Ghanjeevamrit significantly improved all measured parameters. The maximum number of leaves (31.32), leaf length (23.90 cm), and iron content (2.40 mg/100 g) were recorded in treatment T_9. Similarly, T_9 also produced the highest head weight (587.41 g) and marketable yield (22.57 t/ha), resulting in the maximum benefit-cost ratio (3.26). On the contrary, the lowest performance was observed in T_1, with only 25.52 leaves, 16.68 cm leaf length, 1.96 mg/100 g iron content, 392.21 g head weight, 15.77 t/ha yield, and 2.33 B:C ratio. These findings indicate that the integrated use of higher levels of Jeevamrit and Ghanjeevamrit can significantly enhance lettuce productivity and profitability, making them promising components for sustainable nutrient management in Low-Input Sustainable Agricultural farming system.

Keywords: Lettuce, Jeevamrit, Ghanjeevamrit, yield, quality, sustainability

Introduction

Lettuce (*Lactuca sativa* L.) is an increasingly important leafy vegetable crop cultivated for its tender, edible foliage and high nutritional value. It is widely appreciated for its richness in vitamins A, C, and K, minerals, antioxidants, and dietary fibre, making it a staple in health-conscious diets across the globe. Lettuce has garnered a central role in human nutrition as it combines pleasing organoleptic properties with rich content of nutraceutical compounds (Kim *et al.* 2016) [10]. Lettuce also has several health benefits such as it lowers cholesterol levels, possessing anti-inflammatory, antioxidant, antimicrobial, and anti-cancer properties, improves insomnia, and controlling anxiety (Khare, 2004) [9]. The crop's short growth cycle, adaptability to various agro-climatic zones, and expanding market demand have made it a preferred choice among vegetable growers, especially in regions with cooler climates such as the mid-hills of Himachal Pradesh.

In recent years, there has been a growing concern about the sustainability of intensive farming practices that heavily rely on chemical fertilizers and pesticides. These inputs, while boosting productivity in the short term, often lead to soil degradation, groundwater contamination, and a decline in soil microbial activity over time. As a result, researchers, policymakers, and farmers are increasingly turning toward alternative farming systems that prioritize ecological balance, soil health, and long-term productivity. In this regard, there is a need to identify a suitable substitute in place of chemical fertilizers which are economically cheaper and eco-friendly (Verma *et al.* 2018) [24].

Low-Input Sustainable Agriculture is one such approach that promotes the use of on-farm, biologically active inputs to reduce dependency on external synthetic materials. LISA aims to enhance crop productivity through ecologically sound practices that are economically viable and socially acceptable. Among the natural inputs commonly used in LISA-based systems are Jeevamrit and Ghanjeevamrit which are natural fermented bio-formulations prepared using cow dung, cow urine, jaggery, pulse flour, and native soil.

These inputs are believed to stimulate microbial populations in the soil, improve nutrient availability, and enhance plant health by creating a favourable rhizospheric environment which in turn has a positive effect on crops (Boraiah *et al.* 2017) [2].

Despite increasing anecdotal support for these inputs, scientific evidence regarding their impact on the growth, yield, and quality of leafy vegetables like lettuce remains limited. Furthermore, most of the existing studies focus on cereal or fruit crops, leaving a gap in understanding their role in short-duration leafy vegetables. Therefore, the present investigation was undertaken to evaluate the effect of Jeevamrit and Ghanjeevamrit on the agronomic performance and quality characteristics of lettuce grown under low-input sustainable agricultural conditions.

In this context, a study was conducted to evaluate the impact of Jeevamrit and Ghanjeevamrit on the growth, yield, and quality parameters of lettuce under low-input sustainable agricultural conditions. The experiment aimed to provide scientific evidence on the effectiveness of these indigenous inputs in enhancing crop performance without the use of synthetic chemicals. The results generated from this research offer important insights into the role of bio-inputs in promoting sustainable lettuce cultivation, and they may serve as a reference for farmers, researchers, and policymakers advocating for eco-friendly and resource-efficient farming practices.

Materials and Methods

The study was undertaken at experimental farm of Horticultural Research & Training Station and KVK, Kandaghat, Solan (HP). The experiment was comprising of nine treatments having randomized block design and three replications (Table 1). 'Roman' cultivar of Lettuce was planted to check the performance of different treatment combinations understudy. Field was prepared and levelled thoroughly. Calculated quantity of Ghanjeevamrit were applied in individual plots as per treatment requirements and drenching with Jeevamrit was done at weekly interval. Saptadhanyakur and Sour butter milk spray was done at weekly interval. Seedlings were uprooted and transplanted in field at a spacing of 45 × 30 cm after one month of sowing of seed in the nursery. Five randomly plants were selected to record the observations in each plot for all the characters under study viz. number of leaves per plant, leaf length (cm), Iron content (mg/100 g), head weight (g) and yield per hectare (tonnes/ha). For proper interpretation, the experimental data of all parameters was subjected to statistical analysis. Standard procedure given for randomized block design by Panse and Sukhatme (1967) [14] were followed for the statistical analysis of data with respect to growth, yield and quality parameters.

Table 1: Details of Treatments understudy

Treatment	Treatment Details
T_1	No Ghanjeevamrit or Jeevamrit (Control)
T_2	Ghanjeevamrit @ 0.5 t/ha + No Jeevamrit application
T_3	Ghanjeevamrit @ 0.5 t/ha + Jeevamrit application (Drenching @ 5%)
T_4	Ghanjeevamrit @ 0.5 t/ha + Jeevamrit application (Drenching @ 10%)
T_5	Ghanjeevamrit @ 0.5 t/ha + Jeevamrit application (Drenching @ 15%)
T_6	Ghanjeevamrit @ 1t/ha + No Jeevamrit application
T_7	Ghanjeevamrit @ 1t/ha + Jeevamrit application (Drenching @ 5%)
T_8	Ghanjeevamrit @ 1t/ha + Jeevamrit application (Drenching @ 10%)
T_9	Ghanjeevamrit @ 1t/ha + Jeevamrit application (Drenching @ 15%)

*Saptadhanyakur and Sour butter milk (Spray @ 3%) were applied in all treatments at weekly interval Except T_1 (Control)

Plate 1: Healthy crop stand

Results and Discussions

A. Growth and Quality

The results of the investigation indicated significant variation among treatments in terms of growth and quality parameters of lettuce. Among all treatments, T_9 recorded the maximum number of leaves (31.32), which was statistically at par with T_8 (31.06) and T_5 (30.41), indicating their superior performance in promoting vegetative growth. Other treatments exhibited comparatively lower values, with T_1 (25.52) showing the minimum number of leaves per plant. A similar trend was observed for leaf length, where the maximum leaf length was recorded under T_9 (23.90 cm), which was statistically at par with T_8 (23.47 cm). All other treatments, including T_5 (22.50 cm), T_7 (22.46 cm), and T_6 (21.24 cm), though better than the control, remained significantly inferior to T_9 and T_8. The minimum leaf length was recorded under control treatment T_1 (16.68 cm), highlighting the impact of inputs applied under advanced treatments. As far as iron content is concerned, T_9 again proved to be the most effective treatment, recording the highest iron content (2.40 mg/100 g), which was statistically at par with T_8 (2.36 mg/100 g). All other treatments showed significantly lower values, with T_1 (1.96 mg/100 g) recording the least. These results clearly demonstrate the beneficial impact of improved natural input combinations, particularly under T_8 and T_9, in enhancing both the vegetative growth and nutritional quality of lettuce.

The increase in the number of leaves per plant can be attributed to the application of Ghanjeevamrit and natural liquid formulations, which not only supply essential nutrients like nitrogen, phosphorus, and potassium but also enhance overall soil health. These inputs help convert unavailable forms of elemental nitrogen, bound phosphates, micronutrients, and decomposed plant residues into absorbable forms, thereby improving nutrient uptake. This enhanced nutrient availability likely strengthened the source-sink relationship within the plant, leading to improved growth parameters. Similar findings have been reported by Islam *et al.* (2012) [8], Michael *et al.* (2012) [11], Moreira *et al.* (2014) [12], Siddappa (2015) [29], and Rather *et al.* (2018) [16].

Additionally, the significant combined effects observed between these nutrient sources highlight the importance of their combined application for achieving superior growth responses. This might be due to the continuous nutrient availability to the plants by the use of Ghanjeevamrit and natural liquid manures which are slow releasing nutrient sources. This was found to be in accordance with findings of Hasan and Solaiman (2013) [7], Caliskan *et al.* (2014) [4] and Sevinc *et al.* (2018) [17]. This might also be attributed to favourable effect of organic sources on microbial activity and root proliferation in soil which caused solubilising effect on native nitrogen, phosphorus, potassium and other nutrients available in the soil (Yadav *et al.*, 2017) [25]. Jeevamrit activates many species of living organism which release phytohormones and may stimulate the plant growth and absorption of nutrients which plays a significant role in promoting the growth and development of plants (Yoldas *et al.*, 2011) [26].

The presence of beneficial microorganisms in Jeevamrit and Ghanjeevamrit can be attributed to their nutrient-rich constituents such as cow dung, cow urine, legume flour, and jaggery. These ingredients provide a wide range of macro- and micronutrients, vitamins, essential amino acids, and growth-promoting substances like indole acetic acid (IAA) and gibberellic acid. Together, these components create a favourable environment for microbial proliferation, which directly contributes to enhanced plant growth and development. These findings are supported by the observations of Pathak (2017) [15] and Singh (2020) [20].

Table 2: Effect of different treatment combinations on number of leaves, leaf length and iron content

Treatment	Number of Leaves	Leaf Length (cm)	Iron Content (mg/100 g)
T_1	25.52	16.68	1.96
T_2	28.77	19.58	2.13
T_3	29.65	20.50	2.17
T_4	29.74	21.18	2.24
T_5	30.41	22.50	2.32
T_6	29.29	21.24	2.28
T_7	29.66	22.46	2.31
T_8	31.06	23.47	2.36
T_9	31.32	23.90	2.40
MEAN	29.49	21.28	2.24
$CD_{(0.05)}$	1.16	0.73	0.05
CV	3.35	2.93	2.00

B. Yield and Profitability

The results indicated that treatments had positive influence on yield and profitability-related parameters of lettuce. The highest head weight was recorded in treatment T_9 (587.41 g), which was statistically at par with T_8 (578.87 g), T_7 (548.86 g), and T_5 (561.91 g). These treatments performed significantly better than the others, while the minimum head weight was recorded in T_1 (392.21 g). A similar pattern was reflected in yield per hectare. The highest yield was observed under T_9 (22.57 t/ha), which was statistically at par with T_8 (21.48 t/ha) and T_7 (21.14 t/ha). These treatments showed clear superiority over others in terms of productivity. Moderate yields were recorded under T_5 (20.78 t/ha), T_6 (20.43 t/ha), and T_4 (20.19 t/ha), which were significantly lower than the top-performing treatments but higher than the untreated control T_1 (15.77 t/ha). In terms of economic returns, the benefit-cost ratio followed the same trend. The highest B:C ratio was observed in T_9 (3.26) followed by T_8 (3.17) and T_7 (3.08). These treatments yielded the highest economic benefit per unit cost of cultivation. The lowest B:C ratio was recorded in T_1 (2.33). These findings clearly suggest that treatments T_7, T_8, and T_9 not only enhanced yield attributes but also significantly improved profitability.

Table 3: Effect of different treatment combinations on head weight, yield and benefit cost ratio

Treatment	Number of Leaves	Leaf Length (cm)	Iron Content (mg/100 g)
T_1	25.52	16.68	1.96
T_2	28.77	19.58	2.13
T_3	29.65	20.50	2.17
T_4	29.74	21.18	2.24
T_5	30.41	22.50	2.32
T_6	29.29	21.24	2.28
T_7	29.66	22.46	2.31
T_8	31.06	23.47	2.36
T_9	31.32	23.90	2.40
MEAN	29.49	21.28	2.24
$CD_{(0.05)}$	1.16	0.73	0.05
CV	3.35	2.93	2.00

The increased yield in T_9 could also be ascribed to increase in yield attributes (number of leaves, fresh leaf weight, leaf length and leaf breadth) that ultimately resulted in a healthy plant growth and development and in turn to yield (Sharma *et al.*, 2013 and Singh *et al.*, 2018) [18, 22]. Increased crop yield might also be attributed to beneficial effects of higher rate of Jeevamrit, Ghanjeevamrit and other natural farming practices, which has reflected in the form of more number of leaves per plant and higher yield per plant (Singh, 2020) [20]. Palekar (2006) [3] reported the beneficial effects of Jeevamrit which was attributed to huge quantity of microbial load and growth hormones which in turn might have enhanced the soil biomass, thereby sustaining the availability and uptake of applied as well as native soil nutrients which ultimately have resulted in better growth and yield of crop.

The application of organic sources might have significantly enhanced the availability of native and applied macro and micro nutrients in the soil, which results in increased yield (Srimathi, 2015) [23]. Similar findings were reported by Akhter *et al.* (2012) [1] and Ghuge *et al.* (2007) [6]. Improvement of soil structures such as larger soil pores due to the application organic amendments might have enhanced root development and ability of the roots to absorb water and nutrients (Bradi and Weil, 2010). The application of Ghanjeevamrit and natural liquid manures is beneficial in a way that they acts as a storehouse of several macro and micronutrients which are released during the process of mineralization. Liquid manures also help in stimulating the activity of microorganisms by increased populations of bacteria, fungi, actinomycetes, N fixers and P-solubilizers. These microorganisms make the plant nutrients readily available to the crop which enhances the soil biomass thereby sustaining the availability and uptake of applied as well as native soil nutrients. The combined application of organic and natural liquid manures enhances the growth and yield attributing parameters due to the slow release of nutrients throughout the growing period of crop and also improves the soil physico-chemical and mineralogical properties which in turn increase the fertility status of the soil. Hence, Ghanjeevamrit and natural liquid manures are efficient natural substitutes for obtaining higher yield besides improving the nutrient status of the soil. Similar findings have been reported by Palekar (2006) [13], Devakumar *et al.* (2018) [5] and Singh *et al.* (2012) [21].

Conclusion

The present investigation clearly establishes the efficacy of Low-Input Sustainable Agricultural Practices like Jeevamrit and Ghanjeevamrit in enhancing the growth, nutrient content, yield and economic returns of lettuce under mid-hill conditions. The treatments involving higher doses of these inputs consistently recorded significantly superior results across all five key parameters: number of leaves, leaf length, iron content, head weight, and total yield per hectare. The improvement in vegetative growth can be attributed to the synergistic effects of the biologically active compounds and beneficial microorganisms present in these formulations, which enhanced nutrient availability and promoted better physiological functioning of the plants. Notably, the iron content in lettuce heads was also improved, indicating enhanced micronutrient uptake due to the increased microbial activity in the rhizosphere. Furthermore, the economic analysis revealed that the treatments receiving higher levels of Jeevamrit and Ghanjeevamrit achieved a markedly better benefit-cost ratio, thereby confirming their financial feasibility for adoption by farmers.

These results underscore the potential of natural input-based low-input sustainable agriculture practices not only for improving crop productivity and quality but also for ensuring long-term soil health and economic sustainability. The study strongly advocates for the integration of such biological formulations into mainstream vegetable production systems.

References

1. Akhter S, Sen R, Jaime A, Silva T, Haque A, Noor S. Efficacy of vermicompost to improve soil health, yield and nutrient uptake of cauliflower in grey terrace soil of Bangladesh. Dynamic Soil, Dynamic Plant. 2012;6:103-109.
2. Boraiah B, Deva Kumar N, Shubha S, Palanna KB. Effect of panchagavya, jeevamrutha and cow urine on beneficial microorganisms and yield of capsicum (*Capsicum annuum* L. var. *grossum*). International Journal of Current Microbiology and Applied Sciences. 2017;6:3226-3234.
3. Brady NC, Weil RR. The nature and properties of soil. New Jersey: Prentice Hall Inc.; 2010.
4. Caliskan S, Yetisir H, Karanlik S. Combined use of green manure and farmyard manure allows better nutrition of organic lettuce. Notulae Botanicae Horti Agrobotanici Cluj-Napoca. 2014;42:248-254.
5. Devakumar N, Lavanya G, Rao GGE. Influence of jeevamrutha and panchagavya on beneficial soil microbial population and yield of organic field bean (*Dolichos lablab* L.). Mysore Journal of Agricultural Sciences. 2018;52(4):790-795.
6. Ghuge TD, Gore AK, Jadhav SB. Effect of organic and inorganic nutrient sources on growth, yield and quality of cabbage. Journal of Soils and Crops. 2007;17:89-92.
7. Hasan MR, Solaiman HM. Efficacy of organic and inorganic fertilizers on the growth of *Brassica oleracea* L. (cabbage). International Journal of Agricultural Crop Science. 2012;5:34-43.
8. Islam SMD, Ahmed A, Mahmud S, Tushar TR, Khanom S. Effects of organic fertilizer on the growth and yield of lettuce (*Lactuca sativa* L.) used as vegetables. International Journal of Agricultural Science and Research. 2012;2:116-128.
9. Khare CP. Indian herbal remedies: Rational western therapy, ayurvedic, and other traditional usage, Botany. Germany: Springer Science & Business Media; 2004.
10. Kim MJ, Moon Y, Tou JC, Mou B, Waterland NL. Nutritional value, bioactive compounds and health benefits of lettuce (*Lactuca sativa* L.). Journal of Food Composition and Analysis. 2016;49:19-34.
11. Michael TM, Bekhumusa M, Mbokazi KP, Tajudeen OO. Effects of kraal manure, chicken manure and inorganic fertilizer on growth and yield of lettuce (*Lactuca sativa* L. var. *Commander*) in a semi-arid environment. Horticulture Department, University of Swaziland; 2012. p. 58-62.
12. Moreira MA, Santos CAP, Lucas AAT, Bianchini FG, de Souza IM, Viegas PRA. Lettuce production according to different sources of organic matter and soil cover. International Journal of Agricultural Sciences. 2014;5:99-105.
13. Palekar S. Shoonya Bandovalada Naisargika Krushi. Bangalore: Agri Prakashana; 2006.
14. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: Indian Council of Agricultural Research; 1967. p. 157-165.
15. Pathak S. Integrated nutrient management studies in garlic. M.Sc. Thesis, Department of Vegetable Science, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan; 2017. 97 p.
16. Rather AM, Jabeen N, Bhat TA, Parray EA, Hajam MA, Wani MA, Bhat IA. Effect of organic manures and bio-fertilizers on growth and yield of lettuce. The Pharma Innovation Journal. 2018;7:75-77.
17. Sevinc A, Funda EA, Solmaz Y, Caktu E, Adiloglu A. Effect of vermicompost on the growth and yield of lettuce plant (*Lactuca sativa* L. var. *crispa*). International Journal of Plant & Soil Science. 2018;21:1-5.
18. Sharma GD, Thakur R, Raj S, Kauraw DL, Kulhare PS. Impact of integrated nutrient management on yield of wheat, nutrient uptake and soil fertility in a *Typic Haplustert*. The Bioscan. 2013;9:1053-1058.

19. Siddappa. Use of jeevamrutha and farm yard manure on growth and yield of field bean (*Dolichos lablab* L.). M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Bangalore, Karnataka, India; 2015. 87 p.
20. Singh AK. Effect of nitrogen and phosphorus on growth and curd yield of cauliflower var. Snowball-16 under cold arid region of Ladakh. Haryana Journal of Horticultural Sciences. 2020;33:127-129.
21. Singh G, Sekhon HS, Harpreet K. Effect of farmyard manure, vermicompost and chemical nutrients on growth and yields of chickpea (*Cicer arietinum* L.). International Journal of Agricultural Research. 2012;7:93-99.
22. Singh SK, Singh DK, Singh PK, Partap T. Effect of integrated nutrient management on growth, quality, yield and economics of cauliflower (*Brassica oleracea* var. *botrytis* L.). Bulletin of Environment, Pharmacology and Life Sciences. 2018;7:8-11.
23. Srimathi S. Effects of organic nutrient and bioregulators on growth and yield of cauliflower. International Journal of Plant Sciences. 2015;10:53-56.
24. Verma S, Babu A, Patel A, Singh SK, Pradhan SS, Verma SK. Significance of vermiwash on crop production: A review. Journal of Pharmacognosy and Phytochemistry. 2018;7:297-301.
25. Yadav AL, Vishawakarma G, Kumar A, Singh A, Kumar S. Effect of integrated nutrient management on physico-chemical properties of beal (*Aegle marmelos* C.). Indian Journal of Current Microbiology and Applied Sciences. 2017;6:287-296.
26. Yoldas F, Ceylan S, Mordogan N, Esetlili BC. Effect of organic and inorganic fertilizers on yield and mineral content of onion. African Journal of Biotechnology. 2011;10:11488-11492.