E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2025; 8(2): 313-315
Received: 15-11-2024
Accepted: 19-12-2024

Ligang Rose
Research Scholar, School of Agriculture, Dev Bhoomi Uttarakhand University, Uttarakhand, India

Gargi Shekhar
Assistant Professor, School of Agriculture, Dev Bhoomi Uttarakhand University, Uttarakhand, India

Suman Tripathi
Professor, School of Agriculture, Dev Bhoomi Uttarakhand University, Uttarakhand, India

Corresponding Author:
Gargi Shekhar
Assistant Professor, School of Agriculture, Dev Bhoomi Uttarakhand University, Uttarakhand, India

Performance of integrated nutrient management on nutrient uptake, growth and yield parameters of lentil (*Lens culinaris* L.) crop and on soil properties: A review

Ligang Rose, Gargi Shekhar and Suman Tripathi

DOI: https://www.doi.org/10.33545/2618060X.2025.v8.i2e.2582

Abstract
The accelerating use of chemical fertilizers has become a serious concern for its detrimental effect on environment as well as on health of living beings. Many farmers struggle with the high cost of fertilizers and their unavailability in certain regions. Farmers relying on sole nutrient source faces its drawback in terms of productivity, as relying on only chemical fertilizer causes nutrient imbalance and relying on only organic manure cannot fulfill the yield demand, thus resulting in low productivity and soil degradation. INM is the best sustainable option for obtaining high yield while maintaining soil health by applying a combinations of different nutrients sources; chemical, organic and biofertilizer, in an appropriate amount to provide nutrients to as well as enhance the soil properties which is crucial for crop production. Hence, this review shows the importance of INM in agriculture and particularly on its effects on different parameters of production of lentil crop.

Keywords: Integrated nutrient management, lentil, nutrient uptake, growth and yield regulators

Introduction
One of the most important legume crops is lentil, providing an excellent source of diet, containing protein, carbohydrates, fiber, vitamins and minerals (Costa *et al*., 2006) [6]. Lentil being the versatile ingredient are used in variety of culinary creations out of which Dal is the most common dish in India. Lentil does not only provide nourishment to human beings but also helps in maintaining soil health and fertility by fixing the atmospheric nitrogen. The importance of lentil is well recorded for its dual role as feed for livestock, food for human beings and farming patterns of India (Dahal and Bag, 2022) [5].
One of the most important legume crops is lentil, providing an excellent source of diet, containing protein, carbohydrates, fiber, vitamins and minerals (Costa *et al*., 2006) [6]. Lentil being the versatile ingredient are used in variety of culinary creations out of which Dal is the most common dish in India. Lentil does not only provide nourishment to human beings but also helps in maintaining soil health and fertility by fixing the atmospheric nitrogen. The importance of lentil is well recorded for its dual role as feed for livestock, food for human beings and farming patterns of India (Dahal and Bag, 2022) [5].
An integrated nutrient management practice; combination of different nutrient sources such as organic, inorganic and biofertilizer is crucial for maintaining soil health, environment and increasing crop growth and yield attributes (Tan *et al*., 2005) [21]. Incorporating organic matter in soil has the ability to restore soil physiochemical properties and are environmentally friendly, cheap, readily available and act as a source of nutrients (Selim *et al*., 2020, Gangwar *et al*., 2006) [18, 9]. The addition of organic manure increases organic carbon, aggregate stability, moisture retention capacity and also increases infiltration rate of the surface while reducing bulk density (Sarkar *et al*., 2003) [20]. The limitation of organic matter falls out when applied solely to the soil in terms of keeping up with the produce demand. Therefore, practicing Integrated Nutrient Management could be the best option for maintaining, restoring soil health and increase the productivity of crops on a sustainable basis (Guerena *et al*., 2016) [11]. The combined application of synthetic, organic and biofertilizer is socially, economically and ecologically

viable and has potential in enhancing the productivity of the crop (Meena and Vishnuvardhan, 2021) [16].

Effect of Integrated Nutrient management on soil

Since ancient times it is known that incorporating organic manure restores soil health by enhancing their properties. Inoculating biofertilizer like rhizobium enhances microbial activity which fix atmospheric nitrogen and add nutrient content to the soil. While analyzing different soil sample from two different agricultural field; conventional and organic, Yoganathan *et al*., (2017) [14] found that incorporating organic fertilizer improved soil fertility by increasing total nitrogen, total carbon and ammonium concentration, it also increased the actinomycetes and bacterial population where as chemical fertilizer remarkably increased fungal richness. The integrated application of NPK with Molybdenum, Boron, Zinc, Sulphur results in higher nutrient accumulation and maintain soil fertility (Sahu *et al*., 2017) [10]. Integrating NPK with vermicompost also results in improving physical, chemical and biological properties of soil (Math *et al*., 2018) [8]. The combination of FYM and chemical fertilizer (Urea and DAP) when applied by Dhuppar *et al*., (2013) [19] showed improved soil physical and biological characteristics. When an experiment was conducted by Singh *et al*., (2018) [12], he found that integrated application of organic and inorganic sources of nutrients improved availability of soil nutrient status (NPK), soil organic carbon content, dehydrogenase and microbial biomass and carbon activity.

Effect of Integrated Nutrient Management in nutrient uptake

Integrating inorganic fertilizer with biofertilizer increases the nutrient uptake in lentil crop (Sahu *et al*., 2017) [10]. He also reported that the uptake of nitrogen in lentil crop was increased when applied integrated source of micronutrients, macronutrients along with Sulphur. The uptake of nutrients like Nitrogen, Phosphorus, Zinc and Molybdenum by lentil was maximized by 91.55kg/ha when applied with different nutrient sources, such as, recommended dose of NPK, 25kg/ha ZnSO4 and inoculating seed with Rhizobium, PSB and Ammonium molybdate kg/ha (Tiwari *et al*., 2018) [3].

Effect of Integrated Nutrient Management in crop growth parameters

Applying integrated nutrient sources such as Vermicompost, Azotobacter and Chemical fertilizer increases the leaf area index, net assimilation rate, chlorophyll content, dry matter and protein content of the lentil crop (Chowdary *et al*., 2023) [2]. Plant when treated with recommended dose of NPK, ZnSO4, biofertilizer and ammonium molybdate results in increased plant height, number of primary branches and secondary branches (Singh *et al*., 2018) [12]. Similar resulted was reported by Tiwari *et al*., (2018) [3], when he applied nutrient combination of NPK, ZnSO4, Rhizobium, PSB and Ammonium molybdate on lentil field, the plant showed maximum plant height and also the number of root nodules were increased. This treatment accelerated the rate of photosynthesis, cell division, assimilation and vegetative growth. The combined application of FYM (5t/ha), vermicompost (2t/ha), PSB and rhizobium gives higher plant height of 67.12cm, higher number of leaves per plant (52.03), higher number of branches (13.99), higher number of root nodule per plant (28.30) and LAI of 4.02 in cow pea (Yadav *et al*., 2019) [4]. Moreover, combining poultry manure with biofertilizer also provides similar results; increased plant height of 55.50cm, number of leaves per plant (19.65), number of primary branches per plant (7.62) and number of root nodules (18.78) at harvest of legume crop (green gram) (Perli *et al*., 2022) [22].

Effect of Integrated Nutrient Management in crop yield attributes

Integrating nutrient sources like chemical fertilizer (NPK @ 37:5:75 kg/ha) with organic manure (vermicompost @ 2t/ha) and spray of DAP at flowering stage provides higher number of pods per plant and higher 100 seed weight (Math *et al*., 2018) [8]. A field experiment was conducted in Dehradun by Anjali and Verma (2023) to study the impact of integrated nutrient management on lentil growth and yield, the result concluded that the combine application of NPK with PSB and Rhizobium produced highest number of pods per plant and highest number of seeds per pod, it also increased the crop's net absorption rate. Another legume crop (chickpea) showed similar response to integrated application of FYM, castor cake, rhizobium, azotobacter and PSB by providing higher grain yield, straw yield, harvest index and seed index (Shukla *et al*., 2013) [17]. Similar response to Integrated Nutrient Management on lentil crop on account of yield parameters were observed by Tiwari *et al*., (2018) [3], Math *et al*., (2018) [8] and Singh *et al*., (2018) [12].

Conclusion

Adaptation to Integrated Nutrient Management should be prioritized during crop production to achieve maximum production and to ensure soil sustainability. Combining organic sources such as chemical, organic and biofertilizer optimizes nutrient availability, improves soil structure and enhances microbial activity. Researchers reported that practicing INM has led to increase lentil yield, improved grain quality and better nutrient efficiency. Moreover, these practices contribute to long term soil sustainability by minimizing nutrient depletion, reducing environmental pollution and ensuring steady supply of essential nutrients.

Acknowledgement

The authors would like to express their gratitude to Dev Bhoomi Uttarakhand University for their valuable support and guidance during the preparation of this review. We also acknowledge the contributions of researchers whose work has laid the foundation for this paper.

References

1. Adhya TK, Shukla AK, Panda D. Nitrogen losses, N-use efficiency, N-management and rice-based cropping system. Bulletin no.2: ING Bulletins on Regional Assessment of Reactive Nitrogen. 2010.
2. Chowdary AV, Saini N, Kumar A, Kumar S, Ballabh J, Bhatt SS, *et al*. Influence of integrated nutrient management on physiological parameters of lentil (*Lens culinaris* Medik.). [Internet]. 2023. Available from: https://doi.org/10.14719/pst.2124
3. Tiwari AK, Prakash V, Ahmad A, Singh RP. Effect of biofertilizers and micronutrients on nutrient uptake, growth, yield, and yield attributes of lentil (*Lens culinaris* L.). Int J Curr Microbiol Appl Sci. 2018;7(1):[page numbers]. ISSN: 2319-7706.
4. Yadav AK, Naleeni R, Dashrath S. Effect of organic manures and biofertilizers on growth and yield parameters of cowpea (*Vigna unguiculata* (L.) Walp.). J Pharmacogn Phytochem. 2019;8(2):271-274.
5. Dahal B, Ghosh Bag A. Effect of integrated nutrient

management on different parameters of lentil: A review. Commun Soil Sci Plant Anal. 2022. DOI: 10.1080/00103624.2022.2137188.
6. Costa GE, Monici KQ, Reis S, Oliveira AC. Chemical composition, dietary fiber, and resistant starch contents of raw and cooked pea, common bean, chickpea, and lentil legumes. Food Chem. 2006;94:327-330.
7. Fertilizer Association of India (FAI). Fertilizers statistics 2019-2020, 65th edition. New Delhi: The Fertilizer Association of India; 2020.
8. Math G, Balol G, Jaggal L. Integrated nutrient management in lentil. Int J Chem Stud. 2018;6(6):201-202.
9. Gangwar K, Singh K, Sharma S, Tomar O. Alternative tillage and crop residue management in wheat after rice in sandy loam soils of Indo-Gangetic plains. Soil Tillage Res. 2006;88:242-252.
10. Sahu G, Chatterjee N, Ghosh GK. Integrated nutrient management in lentil (*Lens culinaris* Medikus) in red and lateritic soil of West Bengal. Bull Env Pharmacol Life Sci. 2017;6(4):55-62.
11. Güereña DT, Kimetu J, Riha S, Neufeldt H, Lehmann J. Maize productivity dynamics in response to mineral nutrient additions and legacy organic soil inputs of contrasting quality. Field Crops Res. 2016;188:113-120.
12. Singh G, Visk HK, Aggarwal N, Gupta RK, Khanna V. Symbiotic parameters, growth, nutrient accumulation, productivity, and profitability as influenced by integrated nutrient management in lentil (*Lens culinaris*). Arch Agron Soil Sci. 2018;DOI: 10.1080/03650340.2018.1506102.
13. Hepperly P, Lotter D, Ulsh CZ, Seidel R, Reider C. Compost, manure and synthetic fertilizer influences crop yields, soil properties, nitrate leaching, and crop nutrient content. Compost Sci Util. 2009;17:117-126.
14. Yoganathan K, Ganesh P, Tamizhazhagan V. Impact of organic and conventional (chemical) fertilization on soil quality and its seasonal variation. Int J Zool Appl Biosci. 2017;2(6):348-355.
15. Kumari A, Verma H. Performance of integrated nutrient management for yield and net income of lentil (*Lens culinaris* Medik). Pantnagar J Res. 2023;21(2):[page numbers].
16. Meena M, Vishnuvardhan RK. A review on integrated nutrient management for sustainable agriculture. Int J Anal Exp Modal Anal. 2021;8:541-551.
17. Shukla M, Patel RH, Verma R, Deewan P, Dotaniya ML. Effect of bio-organics and chemical fertilizers on growth and yield of chickpea (*Cicer arietinum* L.) under middle Gujarat conditions. Vegetos. 2013;26(1):183-187.
18. Selim MM. Introduction to the integrated nutrient management strategies and their contribution to yield and soil properties. [Internet]. 2020. Available from: https://doi.org/10.1155/2020/2821678.
19. Dhuppar P, Biyan SC, Chintapalli B, Rao DS. Studies on the response of lentil crop to integrated nutrient management practices at Agra (Western U.P). Crop Res. 2013;45(1, 2 & 3):188-191.
20. Sarkar S, Singh SR, Singh RP. The effect of organic and inorganic fertilizer on soil physical condition and the productivity of rice-lentil cropping sequence in India. J Agric Sci. 2003;140(4):419-425.
21. Tan ZX, Lal R, Wiebe KD. Global soil nutrient depletion and yield reduction. J Sustain Agric. 2005;26(1):123-146.
22. Perli VH, Tomar SS, Gummadala KR, Deepsikha, Kaushik M. Influence of organic manures and bio-fertilizers on the growth and yield of green gram (*Vigna radiata* L.). Pharma Innov J. 2022;11(6):141-144.