Vol. 3 Issue-10, June 2023 (e-ISSN: 2582-8223)

Integrated Nutrient Management: Components, Advantages and Disadvantages

Bhawna Soni*[1] and Nachiketa[2]
*[1]M.Sc. Scholar, Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, Uttar Pradesh, India.
[2]M.Sc. Scholar, Department of Agronomy, Naini Agricultural institute, SHUATS, Prayagraj, Uttar Pradesh, India.

ARTICLE ID: 47

Abstract

Soil fertility maintenance demands judicious use of inorganic and organic nutrient resources. The increasing food demands of a growing population, as well as the necessity for an environmentally benign approach to sustainable agricultural advancement, necessitate careful thought while addressing the issue of crop productivity enhancement. To address these issues, integrated nutrition management (INM) plays a critical role, and is seen as a reassuring technique for dealing with such challenges. INM has the ambidextrous capability to advance plant performance and resource effectiveness while also ensuring environmental security and resource quality. This review delves into the concepts, goals, techniques, principles, and applications of INM in agriculture.Several studies have found that INM increases crop yields by 8-150% when compared to standard practises, improves water-use efficiency, and farmer economic returns, all while improving grain quality, soil health, and sustainability. Numerous methods and assessments for speedy advancement of INM are also anticipated and debated. Solid and strong evidence suggests that INM practise could be a novel and environmentally benign method to universal sustainable agriculture.

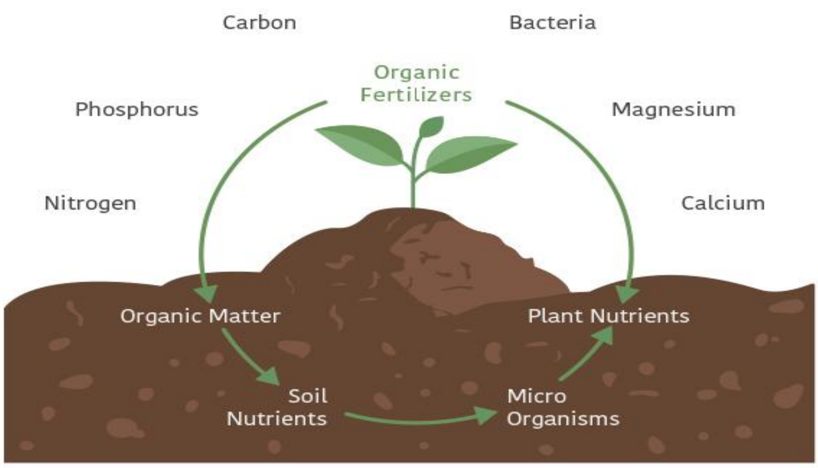
Keywords: integrated nutrient management, organic fertilizer, chemical fertilizer bio-fertilizer.

Introduction

Integrated nutrient supply, utilisation, or management systems (INM) include all major plant nutrition supplies must be supplied, used, or supervised in an efficient and cautious manner, including chemical fertilisers in conjunction with animal manures, compost, and green manures. Legumes in cropping systems, bio-fertilizers, crop residues or recyclable trash, and other locally accessible nutrient resources are used to improve soil fertility, health, and production. The combined supply and use of plant nutrients from chemical fertilisers and organic manures has been shown to provide larger crop yields than when each is applied separately.This increase in crop productivity results from their mutual and harmonious effect, which helps to advance the chemical, physical, and biological protagonists of soil and, as a result, the soil organic matter and nutrient standing; to a large extent well-adjusted nutrient supply to crops of cropping systems, and with no or negligible poisonous effect on the environment, if any.

The primary goal of integrated nutrient supply and management is to provide, as much as possible, neutral nutrient supply to crop that retains and enhances soil fertility health for long-term high productivity. Because plant nutrient sources differ significantly in terms of nutrient substances, delivery efficiency or fascination, positional availability, crop specificity, farmer appropriateness, and so on, their applicable combination(s) to a production approach for optimal and equilibrium nutrient supply differs depending on land utilisation, environmental, social, and economic circumstances. Fertilisers and manures are critical contributions of improved technology that promote a 50 to 60% increase in food grain productivity in India, regardless of soil and agro-ecological zone. Increased production, however, is unlikely in the absence of an integrated supply and utilisation of plant nutrients from chemical fertilisers and organic sources. The HYV generates remarkable yield gains by converting the chemical energy of fertilisers and manures into biomass with a greater grain: straw ration. Fertiliser use is the best technique for land conservation in land-scarce countries like India. However, under this technique, it would have been necessary to plant nearly 2-3 times as much land in cereals to create the same amount of food grains.

The Integrated Plant Nutrient System (IPNS) is a blend of organic and inorganic fertilisers that can be used to reduce the use of chemical fertilisers by establishing a balance between fertiliser inputs and crop nutrient requirements, thereby maintaining soil fertility, restoring soil health, and continuously providing plants with nutrient requirements Selim (2018); Zhang *et al.* (2013). Bilkis *et al*. (2017) found that using PM and VC-based INPS techniques boosted yield, nitrogen uptake, and soil fertility in the Boro-Fallow-T. Aman cropping pattern. Saha*et al*. (2010) discovered that adding NPK fertilisers, organic manure, lime, and biofertilizers increased soil organic carbon (SOC), aggregate stability, moisture-retention capacity, and infiltration rate while decreasing BD Chaudhry *et al.* (2016) found that biochar combined with 50% of the standard NPK dose was the most efficient at improving soil physicochemical parameters such as BD, particle density, porosity, pH, EC, organic matter, SOC, total N, accessible P, K, soil microbial biomass C, and soil microbial biomass N at 0-30 cm depth. The effectiveness of nutrients can be enhanced by combining organic manures and chemical fertilisers Kumar *et al.* (2020).The slow and progressive release of N from organic manure is preferable to mono chemical fertilisation for increasing NUE, grain yield, and rice quality Ahmed *et al.* (2015).



Components of Integrated Nutrient Management

Integrated Nutrient Management (INM) is a comprehensive method to nutrient management in agriculture that attempts to maximise fertiliser use efficiency, improve soil fertility, and encourage long-term crop production. It entails combining several nutrient sources and management practises to suit the crop's nutrient needs while minimising environmental effect. The following are the essential components of Integrated Nutrient Management, along with descriptions of each:

a. Soil Testing and Nutrient Diagnosis: The first stage in INM is to analyse soil samples to evaluate nutrient status, pH, organic matter concentration, and other essential soil parameters. Nutrient analysis identifies specific nutrient deficits or imbalances in the soil, allowing for more focused fertiliser treatment. FAQ (2006).
b. Organic Manures and Crop Residues: Organic manures including farmyard manure, compost, and green manure are rich in nutrients and organic materials. They promote soil structure, nutrient availability, and moisture retention. To improve soil fertility,

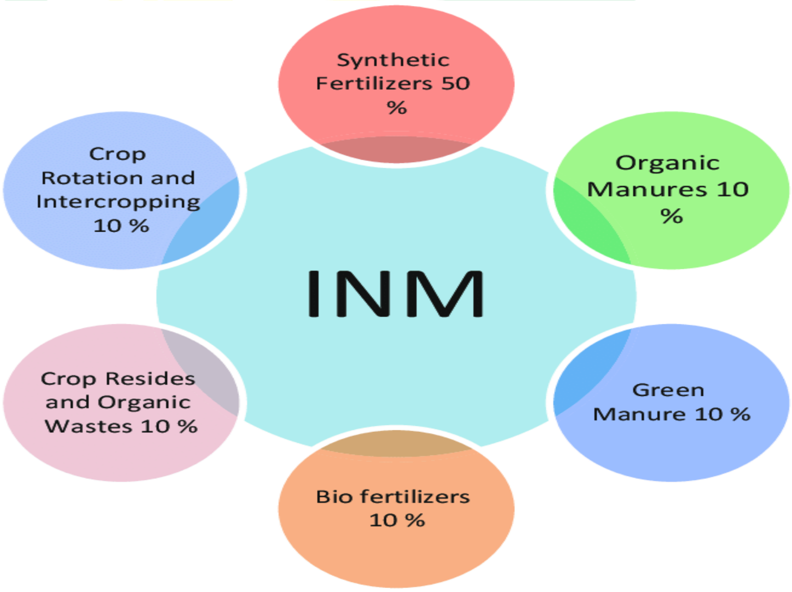
JUST AGRICULTURE
multidisciplinary e-Newsletter

crop leftovers such as stalks and leaves can be mixed into the soil or used as mulch. FAQ (2006).

c. Chemical Fertilisers: Chemical fertilisers give crops with critical nutrients in easily accessible forms. INM emphasises the application of fertilisers in a balanced and prudent manner based on soil test recommendations and crop nutrient requirements. Fertiliser applications are customised to specific nutrient requirements, minimising nutrient waste and potential environmental damage.FAQ (2014).

d. Integrated Nutrient Supply:INM emphasises the integration of several nutrient sources, such as organic manures, chemical fertilisers, and biofertilizers, to give crops with a balanced and diverse nutrient supply. This method ensures a complete nutrition supply that meets the crop's needs throughout the growth phases.FAQ (2012).

e. Biofertilizers: Biofertilizers are live microorganisms that improve nutrient availability and plant development. Nitrogen-fixing bacteria (e.g., Rhizobium, Azotobacter), phosphate-solubilizing bacteria, and mycorrhizal fungi are among them. Biofertilizers can be applied directly to soil or seed, boosting long-term nutrient cycling and decreasing reliance on synthetic.



Advantages of Integrated Nutrient Management

a. **Improved Nutrient Use Efficiency:** INM encourages the wise and balanced use of nutrient sources such as organic manures, chemical fertilisers, and biofertilizers. INM techniques have been proven in studies to greatly enhance fertiliser use efficiency, ensuring that nutrients are supplied in the correct amounts and at the right time to meet crop demands (Kumar *et al.* 2016; Islam *et al*. 2019). As a result, nutrient losses are minimised, crop nutrient uptake is raised, and nutrient utilisation is optimised.

b. **Enhanced Soil Fertility and Health:** Organic manures and biofertilizers are integrated into INM to promote soil fertility and health. Organic manures help to increase soil organic matter, which improves nutrient retention, soil structure, and water-holding capacity (Kumar *et al*. 2016; Islam *et al*. 2019). Nitrogen-fixing bacteria and mycorrhizal fungi, for example, improve nutrient availability and uptake by plants, hence boosting soil Fertility (Goswami *Et Al*. 2016).

c. **Sustainable Crop Production:** INM Practises Boost Long-Term Crop Performance By Supplying A Complete And Balanced Nutrient Supply. According To Research, INM Techniques Result In Higher Agricultural Yields Than Standard Nutrient Management Practises (Islam *Et Al.* 2020). INM's Blend Of Organic And Inorganic Nutrient Sources Optimises Nutrient Availability To Crops At All Phases Of Growth, Promoting Improved Growth, Development, And Production.

d. **Environmental Benefits:** INM aids the environment by lowering nutrient losses and the risk for water and soil pollution. Proper nutrient management based on soil testing and crop nutrient requirements reduces the need for excessive chemical fertiliser use, lowering the risk of nutrient runoff and leaching Islam *et al.* (2020). The incorporation of organic manures and biofertilizers into INM reduces reliance on synthetic fertilisers, hence contributing to more sustainable farming practises (Kumar *et al*. 2016; Goswami *et al*. 2016).

e. **Economic Viability:** Farmers have found INM practises to be economically viable and financially rewarding. According to research, INM techniques can lead to enhanced profitability, lower input costs, and higher returns on investment (Kumar *et al.* 2016). The higher crop yields and optimised utilisation of nutrient sources linked with INM contribute to better economic outcomes for farmers.

Disadvantages of Integrated Nutrient Management

a. **Complex Decision-Making Process:** Implementing INM necessitates careful decision-making and nutrition management knowledge. It entails taking into account a variety of parameters, including soil fertility, crop nutrient requirements, and the optimal combination and timing of fertiliser supplies. Farmers, particularly those with little access to technical expertise and resources, may find this complexity problematic (Kumar et al., 2016).

b. **Limited Availability and Accessibility of Inputs:** Organic manures, biofertilizers, and high-quality chemical fertilisers might be hard to come by, especially in remote locations or areas with poor infrastructure. Limited access to these inputs can stymie INM practise acceptance and execution (Sharma et al., 2019).

c. **Cost Considerations:** Organic manures, biofertilizers, and specialised soil testing can be more expensive than traditional nutrient management practises that rely mainly on chemical fertilisers. Some farmers, particularly those with limited resources, may face financial constraints as a result of the initial investment and ongoing expenses connected with INM (Islam et al., 2020).

d. **Technical Knowledge and Training:** Farmers must have access to enough technical knowledge and training in order to successfully implement INM. They must grasp nutrient management principles, the selection and application of various fertiliser sources, and the interpretation of soil test data. Adoption of INM practises can be hampered by a lack of sufficient training and knowledge (Goswami et al., 2016).

e. **Time and Labor Intensive:** INM practises, such as the production and application of organic manures, may necessitate more time and labour than traditional practises. The use of bio fertilizers and the management of several nutrient sources might add complexity and increase farmer workload (Sharma et al., 2019).

Conclusion

Integrated Nutrient Management (INM) is a holistic method to optimising nutrient supply to crops that includes soil testing and nutrient diagnostics, organic manures and crop residues, chemical fertilisers, and bio fertilizers. This comprehensive strategy has various advantages. INM, on the other hand, has some drawbacks and challenges. Despite these obstacles, the benefits of INM, such as increased fertiliser usage efficiency, greater soil fertility, and sustainable crop production, exceeds the drawback. INM may contribute to more sustainable and ecologically friendly agriculture with the right information, training, and assistance. To maximise the benefits of INM and assure its general acceptance in agricultural systems, additional research and studies must focus on addressing the problems and perfecting its application.

Refrences

Ahmed S., Humphreys E., Salim M., Chauhan B.S. Growth, yield and nitrogen use efficiency of dry-seeded rice as influenced by nitrogen and seed rates in Bangladesh. *Field Crops Res.* 2015;186:18–31. doi: 10.1016/j.fcr.2015.11.001.

Bilkis S., Islam M.R., Jahiruddin M., Rahman M.M. Integrated Use of Manure and Fertilizers Increases Rice Yield, Nutrient Uptake and Soil Fertility in the Boro-Fallow-T. Aman Rice Cropping Pattern. *SAARC J. Agric.* 2017;15:147–161. doi: 10.3329/sja.v15i2.35159.

Chaudhry U.K., Shahzad S., Naqqash M.N., Saboor A., Abbas M.S., Saeed F., Yaqoob S. Integration of biochar and chemical fertilizer to enhance quality of soil and wheat crop (*Triticum aestivum* L.) *J. Biodiv. Environ. Sci.* 2016;9:348–358.

FAO. (2006). Guidelines for soil description. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/3/a-a0541e.pdf

FAO. (2012). Integrated Plant Nutrient Management in Sub-Saharan Africa: From Concept to Practice. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/3/i2810e/i2810e.pdf

FAO. (2014). Good Agricultural Practices for Nutrient Management. Food and Agriculture Organization of the United Nations. Retrieved from http://www.fao.org/3/i3768e/i3768e.pdf

Goswami, S., Deka, R. L., & Deka, M. K. (2016). Integrated nutrient management in rice: A review. Indian Journal of Agricultural Sciences, 86(7), 851-859.

Islam, M. R., Uddin, M. N., & Hossain, M. M. (2019). Integrated nutrient management practices for sustainable crop production. Journal of Agriculture and Environment for International Development, 113(1), 33-44.

Islam, M. T., Rahman, M. M., &Hassanuzzaman, M. (2020). Review on integrated nutrient management: Concepts and implementation strategies. American Journal of Experimental Agriculture, 40(5), 22-37.

Kumar R., Naresh R.K., Shipra Y., Chandra M.S. Influence of Balanced Fertilization on Productivity, Nutrient Use Efficiency and Profitability of Rice in Inceptisol: A

Review. *Int. J. Curr. Microbiol. Appl. Sci.* 2020;9:568–590. doi: 10.20546/ijcmas.2020.901.063.

Kumar, S., Gautam, S., Kumar, R., & Chauhan, R. K. (2016). Integrated nutrient management: A review. Journal of Soil and Water Conservation, 15(2), 131-140.

Saha R., Mishra V.K., Majumdar B., Laxminarayan K., Ghosh P.K. Effect of Integrated Nutrient Management on Soil Physical Properties and Crop Productivity under a Maize (*Zea mays*)–Mustard (*Brassica campestris*) Cropping Sequence in Acidic Soils of Northeast India. *Commun. Soil Sci. Plant Anal.* 2010;41:2187–2200. doi: 10.1080/00103624.2010.504799.

Selim M. Potential role of cropping system and integrated nutrient management on nutrients uptake and utilization by maize grown in calcareous soil. *Egyp. J. Agron.* 2018;40:297–312. doi: 10.21608/agro.2018.6277.1134.

Sharma, V., Kumar, V., Kaur, P., Singh, R., & Sharma, M. (2019). Integrated nutrient management: a comprehensive review. Journal of Soil and Water Conservation, 18(4), 331-340.

Zhang H.L., Lal R., Zhao X., Xue J.F., Chen F. Opportunities and challenges of soil carbon sequestration by conservation agriculture in China. *Advan. Agron.* 2014;124:1–36.