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Integrated Nutrient Management, Their Contribution to Crop Yield, Soil Properties and Environment

(*Kamlesh Gurjar[1], Rajesh Samota[2], Tejpal Piploda[3] and Mangi Lal[4] and Koushal Kishor Bijarnia[5])

[1]Department of Extension Education, Agriculture University, Jodhpur, Rajasthan
[2]Dept. of Soil Science and Agricultural Chemistry, ANDUAT Kumarganj, Ayodhya, UP
[3]Department of Agronomy, MPUA&T, Udaipur, Rajasthan
[4]Department of Vegetable Science, NAU, Navsari, Gujarat
[5]Department of Agronomy, HAU, Hisar, Haryana
*Corresponding Author's email: kamleshgurjar0962@gmail.com

Abstract

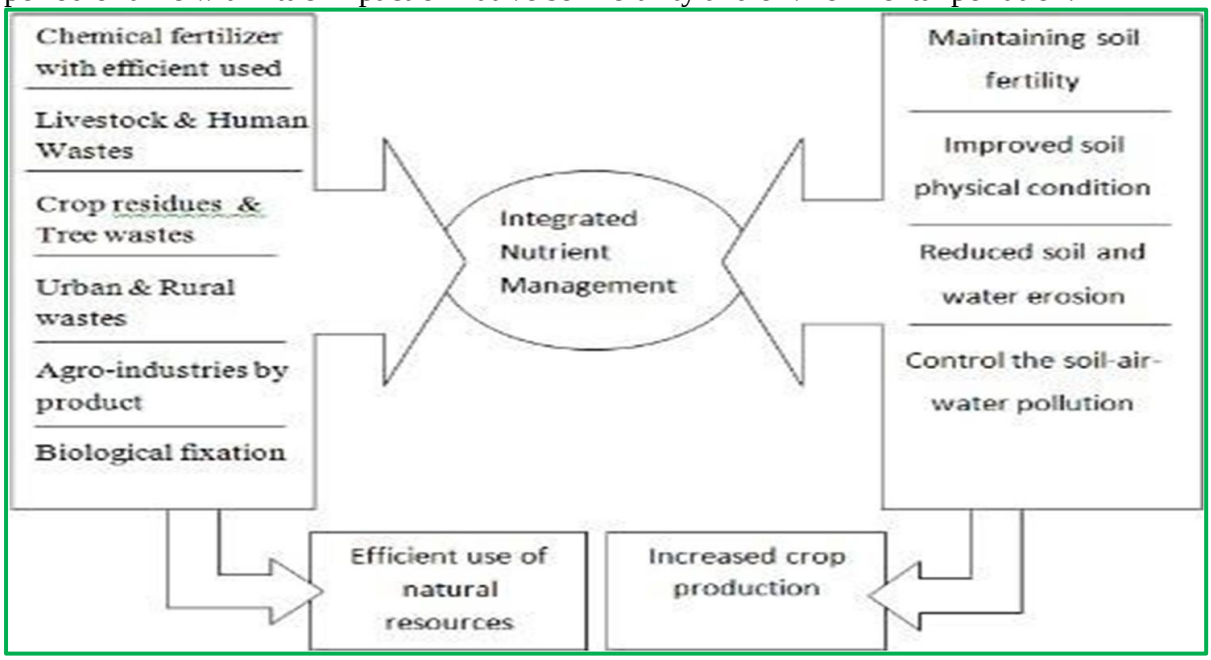
Integrated nutrient management (INM) has been a popular sector of study for increasing food demands of a growing human population and the need for environmentally friendly agricultural practices. INM has multifarious potential for the improvement of plant performance and resource efficiency while also allow the protection of the environment and resource quality. INM acts as a source of energy, organic carbon, available nitrogen and other macro-micro essential nutrients for the growth of soil microbes and improvement of physical properties of soil, and also have prominent residual effect on subsequent crops. So, the key component of the INM goal is to reach the eco-friendly practice through the balanced properties of both sources by making a combination that can be used for decreasing the enormous use of chemical fertilizers and formation a balance between fertilizer inputs and crop nutrient requirement, maintaining the soil fertility, optimizing the level of yield, maximizing the profitability, and subsequently reducing the environmental pollution. Ultimately, INM is a implement that can offer good options and economic choices to supply plants with a adequate amount of nutrients in need and can also reduce total costs, create favorable soil physiochemical conditions and healthy environment, protect the soil nutrient balance.

Introduction

The agricultural period has transformed from resource mortification to resource sustaining technology and applications, enabling assistance for improving crop output in addition to nourishing soil health for future generations. Integrated nutrient management is a technique used to make nutrients more accessible and most effective for maintaining high yields without exposing soil native nutrients or contaminating the environment. It combines specific microbes with sufficient and balanced amounts of organic and inorganic fertilizers. INM is capable of acting as the motivating force and supporting strategies to turn marginal land into productive land. INM uses manures, chemical fertilizers, and biological agents to improve soil health and sustain crop production. Without having any negative effects on the environment or results, it may meet the nutrient requirements of the crop and lessen the restriction of nutrient insufficiency. The finest suggestion for more efficient resource use and crop production at a lower cost is INM. Additionally, INM is helpful for marginal and small-

scale farmers that lack the resources to provide all crop nutrients through pricey chemical fertilization. Through the addition of these nutrients, their mobilization from unavailable to available forms and an increase in their uptake by crops, the use of integrated nutrition management techniques can alleviate all key nutrient deficits. In the past, nutrient management had been driven by the desire to maximize productivity. But in order to increase productivity, stop on- site soil deterioration, and keep the usage of applied fertilizers off-site to a minimum, today's sustainable nutrient management practices are required. INM is a technique thatstrives to enhance production quality while preserving the environment for future generations.

The main goal of the INM is to change farmers' knowledge of environmentally friendly practices (organic farming system) for producing healthy food free of pollutants and ensuring satisfactory financial returns while also maintaining economic yield for a long period of time with little impact on native soil fertility and environmental pollution.



Concept of INM

INM stands for Integrated Nutrient Management, or the intelligent, effective, and integrated use of all available sources of organic, inorganic, and biological components in farming systems that are ecologically sound and economically superior. With the goal of synchronizing nutrient demand by the crop and its release in the environment, it optimizes all aspects of nutrient cycle, including N, P, K, and other macro-micronutrient inputs and outputs. In order to boost agricultural output and reduce land degradation, it also tries to improve soil conditions by enhancing its physical, chemical, biological, and hydrological characteristics.

The main objective of integrated nutrient management techniques is to partially replace chemical fertilizers with organic compost, which is more environmentally friendly and sustainable, in order to reduce soil degradation, increase crop yield, and save the environment. INM methods can assist in replacing chemical fertilizers completely or partially as well as in motivating farmers to compost agricultural waste in order to create a more long-lasting, cost-effective, and environmentally friendly alternative product. The use of farmyard manures, natural and mineral fertilizers, soil additives, crop residues, farm waste residue recycling, agro forestry, green manures, and compost are just a few ideas that might be considered under INM techniques.

Relationship of INM with other factors:-

- INM in relation to macro and micronutrients of plants,
- INM in relation to environmental concern and food requirements, INM in relation to soil structure and water use,
- INM in relation to plant growth and crop yield,
- INM in relation to succeeding crops.

Components of INM

The main goal of the INM is to find the most functional and homogeneous combination possible. This combination should promote good management, effective fertilizer targeting, adequate and sustained use of fertilizer quantity and quality, and easy uptake by plants for increased yield without compromising the environment or harming the soil's natural nutrients. The following are key elements of integrated nutrient management:

1. Integration of crops that restore soil fertility, such as green manures and legumes.
2. Recycling of crop leftovers
3. Use of organic manures such as FYM, compost, vermicompost,biogas, slurry, chicken manure, biological composts, press mud cakes, and phospho-compost is method.
4. Utilizing a biological agent is option.
5. Effective genotypes.
6. Balanced application of fertilizer nutrients in accordance with crop needs and desired yields.

Principles of INM

Main principles are:-

- Using all potential sources of nutrients to maximize their input - Careful consideration must be given to all potential sources of nutrients that may be employed as nutrient implements in nutrient input programmed design to maximize nutrient-use effectiveness and yield generation.
- Spatial and temporal coordination of soil nutrient supply and crop demand - Soil balance refers to the types and concentrations of nutrients in the root zone that are available to meet crop needs.
- Reducing nutrient losses as much as possible, primarily in the intensive agriculture system. Considering all aspects of the plant/nutrient connection in order to achieve high yield production, which is the primary goal and the main result of the application of integrated nutrient management, water use efficiency, grain dominance, high financial return, and sustainability.
- Produce nutritious food that is devoid of pollutants and chemical residues, which is safer and healthier than food that is traditionally produced using just synthetic fertilizers.
- Implementing INM practices in the root zone, where the key interactions between plants and soil take place, acts as a "bottleneck" to regulate nutrient oxidation, solubility, availability, and release to plant roots as well as absorption. Through increasing the activity of soil microorganisms, such an exercise can maximize biological opportunities.

Advantages of INM

- INM can enhance the solubility and availability of fertilizers to be employed in soil and in
- cropping systems, as well as the native soil nutrients.
- Make use of the enticing behavior of nutrient supplies and matching them to crop demand.
- Provide the crops with a nutritional balance and lessen the negative impacts brought on by the interaction between nutrient imbalance and nutrient fractions.

- Enhance and maintain the biological and physiochemical qualities of soil. Slow down the rate of soil deterioration, water pollution, and ecosystem degradation by increasing carbon sequestration and reducing nutrient losses to ground- and surface-water forms.
- Reduce increased production costs overall and boost farmer returns (increasing profitability).
- Boost the ability to withstand biotic and biotic stressors.
- An efficient system of agricultural methods to provide wholesome food, meeting population food demands as well as numerous repercussions on the soil and the environment, especially in nations where the population is expanding quickly.
- There are additional advantages as well; it not only increases crop production while lowering total expenses to an acceptable level; it is also simple for farmers to use, making it one of the best strategies for the demands of the future.
- Plant susceptibility to or tolerance to a variety of biotic and abiotic stressors can be improved by INM. By using INM, it will be possible to examine a broader area of the soil in search of water and nutrients.
- In addition, better root growth will allow plants to take water from deeper soil layers, which will improve crops ability to withstand drought.
- Farmers changing understanding of seasonal climate variations that have significant ecological effects in order to provide safe food rather than maximizing yield in an effort to increase profit.

Strategies for development of INM

- Combining soil and plant analysis,
- Fine-tuning to local environmental conditions,
- Mechanization due to severe labour shortages,
- Conservation tillage and rainwater harvesting technologies,
- Recycling of organic nutrient flows,
- New technological advancements,
- Appropriate policy interventions are just a few of the factors that need to be considered.

Conclusion

In order to optimize nutrient inputs, all feasible sources of plant nutrients are used. Additionally, the soil nutrient supply and crop demand are matched spatially and temporally, and nitrogen losses are decreased while crop yield is increased. Multiple instances of integrated nutrition management can be found. Its effectiveness largely hinges on the ability and desire of farm households to make investments in soil fertility. As there is a demand-driven approach for big to marginal and small size farm holding farmers, the technique modified for INM should also be site-specific and must be adjusted to local circumstances. Finally, the focus of agricultural experts and farmers must be directed toward an easy-to-implement integrated nutrient management technique, which is a legal option, a practical method that farmers can easily implement, and one that is also environmentally friendly. This technique can reduce the demand for fertilizers while increasing yield production, improving quality, and maintaining a benefit that is satisfactory.