AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 05 Issue: 03 March 2024 Article No: 15

Integrated Nutrient Management: A Long Term Solution

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SUMMARY

The increasing global food demand and the imperative for sustainable agricultural practices underscore the importance of Integrated Nutrient Management (INM). While chemical fertilization has historically boosted crop yields, injudicious use poses risks to soil and environmental health. INM offers a balanced approach, combining organic and inorganic sources to maintain soil fertility, enhance crop yields, and mitigate environmental impacts. Adoption of INM requires collaborative efforts among stakeholders, including farmers, researchers, and policymakers. By maximizing nutrient utilization, supporting organic fertilization, and improving soil health, INM ensures sustainable agriculture, meeting food demand while safeguarding the environment for future generations.

INTRODUCTION

Increased global food demand, as well as the need for an environmentally acceptable approach for a sustainable soil-plant-microbe-environmental system, necessitate special attention when it comes to agricultural productivity. Chemical fertilization is one approach to increase crop productivity as happened during the green revolution. Food grain output in India increased from 115.6 million tonnes in 1960-61 to over 281.37 million tonnes in 2018-19 because of chemical fertilization. Similarly, yearly fertilizer use jumped from 0.07 million tonnes in 1951-52 to over 25.95 million tonnes in 2016-17. But due to injudicious use of chemical fertilizers soil, plant, human and animal health are at stake. Also, increased soil compaction and widespread multi-nutrient deficits have emerged as important restrictions limiting crop productivity and farm income. Because a major rise in fertilizer consumption is unlikely soon for economic and environmental reasons, there is a need to improve nutrient use efficiency through integrated and balanced fertilizer. On the other hand, organic manures, are unable to fulfil all a crop's nutritional needs. Integrated nutrient management (INM) was created because of the aforesaid factors being taken into account. Plant performance and resource efficiency can be improved in a variety of ways with INM while also allowing for environmental and resource protection quality. With the use of advanced INM procedures, chemical fertilizer inputs are reduced, resulting in fewer human and environmental costs without any negative impact on crop production. Despite the potential of INM, widespread adoption requires concerted efforts from various stakeholders. Farmers need access to training and support to understand the nuances of INM practices and optimize their agricultural operations. Collaboration among scientific researchers, extension specialists, government agencies, and NGOs is essential to disseminate knowledge, facilitate technology transfer, and promote sustainable farming practices. Moreover, interdisciplinary cooperation across fields such as plant breeding, agronomy, soil science, and agricultural engineering is crucial to harness the full potential of INM. By integrating diverse expertise and perspectives, stakeholders can develop innovative solutions to address food security challenges while safeguarding environmental sustainability. The intensification of efforts by extension specialists, government agencies, and NGOs is paramount to promote the adoption of INM practices on a broader scale. These entities play a pivotal role in translating research findings into practical recommendations, fostering awareness, and creating supportive policy frameworks to incentivize sustainable agricultural practices.

Definition and Concept

Fertilizers are usually classified, according to the source driven into two main categories. The first one is the organic source (natural) and the second is inorganic source (mineral or synthetic or manmade). Integrated nutrient management (INM) is one of the agronomic practices aiming at the usage of the harmonious properties of both sources by making a combination that can be used for decreasing the enormous use of chemical fertilizers and accreting a balance between fertilizer inputs and crop nutrient requirement options, which can maintain the soil fertility, restore the soil health and continuous supply of plant with nutrient requirements to obtain an optimum level of yield production, maximize the profitability, and subsequently reduce the environmental pollution

The key components of the INM concept includes increasing the farmer's awareness about the valuable use of INM practices, inviting them to forget the excessive use of chemical fertilizers, and encouraging them to focus on long-term plan for sustainable agriculture. Moreover, farmers must have greater consideration for environmental impacts and producing safety food rather than only focusing on profit, which can be obtained. Constraints (Difficulties): Soil corrosion, mining, degradation, and also loss of fertility are the main reasons leading to irreversible decrease of plant production and huge damage for sustainable agriculture. Therefore, to sustain soil health and return soil productivity is an urgent need to overcome the problem of low soil productivity.

Principles of INM:

- Maximize soil nutrient utilization for agricultural productivity and resource efficiency.
- Match soil nutrient availability with crop demand spatially and temporally, optimizing fertilizer amounts and timing.
- Reduce nitrogen losses while increasing crop output, mitigating environmental impacts like nitrate leaching and emissions.
- Support organic fertilization for sustainability, incorporating practices like crop residue incorporation and conservation tillage for improved soil quality and carbon sequestration.

Table 1. Average Nutrient Composition of Some Organic Manures

Category	Sources	Nutrient content (%)		
		N	P_2O_5	K_2O
FYM/composts	Farmyard manure	0.5-10	0.15-0.20	0.5-0.6
	Poultry manure	2.9	2.9	2.3
	Urban compost	1.5-2.0	0.2	0.5
	Rural compost	0.5-1.0	0.2	0.5
	vermicompost	1.27	0.5	0.19
Biogas slurry	-	0.98	0.66	0.14
Sewage sludge	-	0.97	0.27	0.11
Animal waste	Cattle dung	0.3-0.4	0.10-0.15	0.15-0.20
	Cattle urine	0.80	0.01-0.02	0.5-0.7
	Sheep and goat dung	0.65	0.5	0.03
	Night soil	1.2-1.5	0.8	0.5
Oil cakes	Castor	5.5-5.8	1.8	1.0
	Coconut	3.0-3.2	1.8	1.7
	Neem	5.2	1.0	1.4
Animal meals	Horn and hoof	13.0	0.3-0.5	-
	Fish	4-10	3-9	1.8
	Raw bone	3-4	20.25	-

Ingredients of INM:

Fertilizers: Despite their significance, fertilizer use is insufficient and unbalanced, with emphasis on NPK and neglect of other nutrients. Fertilizer efficiency needs attention to bridge the nutrient supply gap.

Organic Manures: Traditional sources like compost and FYM remain vital, supplemented by urban compost, crop residues, and industrial by-products. These sources must be integrated based on availability and nutrient content.

Legumes: Legumes, due to their nitrogen-fixing capacity, are integral for soil fertility restoration. They contribute significantly when used as green manure, fodder, or grain crops, enhancing soil health and crop productivity.

Green Manures: Incorporating green biomass improves soil fertility, reduces leaching, and provides nitrogen, phosphorus, and potassium. Crops like sunnhemp and dhaincha are common choices, offering substantial nutrient benefits.

Crop Residues: Crop residues, though sometimes underutilized, can be valuable nutrient sources, especially in regions with mechanical harvesting. They contribute to nutrient supply and soil health when managed effectively.

Biofertilizers: Microbial products like Rhizobium, Azospirillum, and Azotobacter enhance soil fertility by fixing nitrogen and solubilizing phosphorus. They reduce fertilizer requirements and improve crop productivity, supporting sustainable agriculture.

Advantages of INM

- Systems can improve the soil nutrient natives and increase the solubility and availability of fertilizers to be used
- Use the harmonious behaviour of nutrient supplies and making them match with the crop requirements
- Offer the nutritional balance to the crops and lessen the aggressive effects resulting from the opposite impact between nutrient fractions and nutrient imbalance
- Advance and sustain the physiochemical and biological functions of soil properties
- Reduce the rate of soil degeneration, water, and ecosystem by enhancing carbon confiscation and decreasing nutrient losses to ground and surface water forms and/or to environment pollution
- Minimize higher total costs of production and raise the farmer's returns (increasing profitability)
- Improve the resistance to both biotic and abiotic stresses
- An effective method of agricultural practices to ensure healthy food, covering population food demands alongside with many soil and environmental impacts, especially in countries with rapid growth in population
- Additional benefits can also be gained; it does not only save the total costs at the satisfactory level with an increase in crop production but also can be easily practiced by farmers; therefore, it is considered one of the most promising techniques in line with the future needs
- INM can have positive effects on the susceptibility or plant resistance against many types of biotic and abiotic stresses
- Following INM will enable to explore a larger volume of soil in order to access water and nutrients; additionally, improved root development enables the plant to absorb water from deeper soil layers and then reflect an increase in the ability of crops toward drought resistance
- Changes in awareness of farmers toward the climate changes from season to season, which have greater ecological impacts in order to produce safe food rather than achieving higher yield aiming at attaining higher profit

The Impact of Integrated Nutrient Management (INM) on Soil Health and Properties is Multifaceted:

Soil Physical Properties: INM increases soil organic matter, impacting bulk density, soil structure, moisture retention, and infiltration rate. It reduces bulk density, improves aggregation, and increases porosity, enhancing water holding capacity and root growth.

Soil Chemical Properties: INM helps in conserving soil organic carbon (SOC) by increasing carbon inputs through crop residues and organic manures. It prevents SOC depletion associated with continuous agriculture and improves soil fertility by sustaining or increasing SOC content.

Biological Properties: INM positively influences soil microbial biomass, dehydrogenase activity, and enzyme activity. It enhances organic matter content, leading to increased microbial biomass and enzyme activity, indicating improved soil biological activity.

Soil Fertility: INM improves soil fertility by enhancing nutrient availability, reducing nitrogen losses via denitrification and leaching, and improving nutrient use efficiency by crops. It sustains high crop yields by providing a slower release of nutrients and better synchrony of crop nitrogen needs.

CONSLUSION

In conclusion, collaborative efforts by extension specialists, government agencies, and NGOs are crucial for scaling up INM practices. By translating research into action, raising awareness, and establishing supportive policies, INM can ensure sustainable agriculture. Embracing INM enables meeting food demand while preserving soil health, environmental integrity, and farmer livelihoods for future generations.

REFERENCES

Selim M M, 2020, Introduction to the integrated nutrient management strategies and their contribution to yield and soil properties. *International Journal of Agronmy*, https://doi.org/10.1155/2020/2821678.

Sharma T, Arya V M, Sharma V, Sharma J, Gulshan T, Bera A and Laskar Y, 2022, Integrated nutrient management: A long term approach towards sustainability. *International Journal of Plant and Soil Science*, 34(20):433-446.