

# ROLE OF INTEGRATED NUTRIENT MANAGEMENT IN SUSTAINABLE AGRICULTURE

## Abstract

Green farming has demonstrated that fertilizers improve the yield of grain crops like wheat and rice like magic. It alters farming techniques. Since the dawn of time, farmers have relied solely on fertilizers and have neglected to practice sustainable farming. Due to the high alert status of population increase, loss of soil fertility, and scarcity of arable land, all of which could have a significant impact on agricultural yield and productivity, a change in agronomic approaches is urgently needed. Diverse sources of plant nutrients are combined to minimize nutrient depletion, maintain soil health, and boost crop output. INM, or integrated nutrition management, is the name of this procedure. The present objective of agriculture is to boost agricultural output and productivity while preserving the wellbeing of human.

**Keywords:** Integrated nutrient Management, crop nutrition, nutrient management, soil health

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## **I. INTRODUCTION**

Population growth increases the need for food, which must be supplied. Farmers are concerned about an imbalance or the exclusive use of synthetic fertilizers because they believe that using too many chemicals to increase causes the health of the soil to decline, harms natural resources, and makes it harder to supply the demand for healthful food worldwide. In such a developing environment, it is challenging to meet the total food demand. To overcome this problem, farmers have resorted to the excessive use of particular inputs like chemical fertilizers and pesticides, which have already begun to harm the environment. Since the introduction of fertilizer use, the influence of crop fertilization with inorganic fertilizers has been considerable in worldwide agriculture (Hossain and Singh, 2000). Given the unsettling state of the world's population and the scarcity of available land, increased agricultural productivity and production are necessary to end hunger. The control of soil fertility is the most crucial aspect for increasing crop yield. There will be intense pressure on farmers to employ chemical fertilizers to boost the fertility of the soil, which will require more financial investment and raise the cost of output. Although the use of chemical fertilizers and high yielding varieties (HYV) increases agricultural output and productivity, this strategy ultimately fails. A lack of various other micronutrients is caused by the unbalanced application of chemical fertilizer over an extended time, according to soil study from numerous sites.

All of the aforementioned problems draw attention away from integrated nutrition management. INM stands for integrated resource management, which entails the coordinated control of all sources of organic, inorganic, and biological materials in order to maintain soil fertility and plant nutrient delivery at the ideal level for sustaining the desired production. The efficient use of all nutrient sources, including organic sources, recyclable wastes, mineral fertilizers, and bio-fertilizers, should therefore be promoted by integrated nutrient management (Roy et al., 2006). Integrated nutrient management (INM) integrates the use of both natural and synthetic soil nutrients to increase agricultural production and protect soil productivity for future generations (FAO, 1995). A balanced supply of fertilizers is necessary to promote plant development, boost agricultural output, and enhance soil quality. Finding the most effective and uniform combination that may produce good management and effective fertilizer is the primary goal of INM.

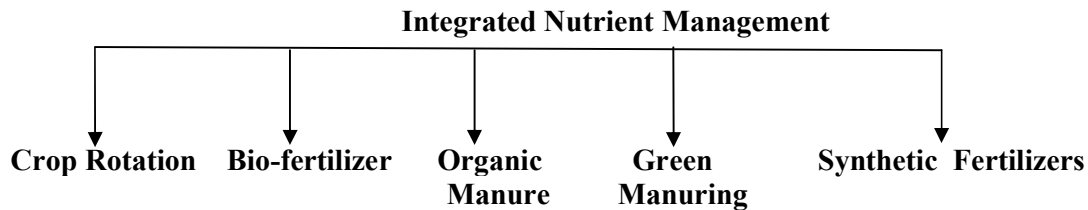
In today's intensive agriculture systems, no one source of plant nutrients, including chemical fertilizers, organic manures, crop residues, and bio-fertilizers, can supply all the nutrients a crop requires (Mahajan and Gupta, 2009). According to research findings (Selim and Al-Owied, 2017; Selim, 2018), integrated nutrient management (INM) is a technique that can provide plants with macro- and micronutrients while also reducing their reliance on chemical fertilizers that are purchased externally and promoting soil health. The addition of organic manures has a significant impact on the physical characteristics of soil structure (Das et al., 2014). INM lessens the demand for synthetic fertilizer, and it reduces demand and balances fertilizer use to lower production costs.

## **II. WHAT IS INTEGRATED NUTRIENT MANAGEMENT**

An strategy called integrated nutrient management (INM) aims to boost agricultural output while preserving the environment for future generations. The fundamental idea behind

integrated nutrient management (INM) or integrated plant nutrition management (IPNM) is the maximization of the advantages from all potential sources to maintain the soil health and plant nutrient supply at an optimal level for maintaining the target production. Crop residues, N 2-fixing crops (like pulses like green gram, black gram, etc. and oilseeds like soybean, groundnut, etc.), crop rotations, and bio-fertilizers appropriate to the system of land use and ecological, social, and economic condition are all necessary components.

### 1. Component of INM



**2. Crop Rotation:** Growing several crops in succession on the same plot of land improves soil health, maximizes nutrients in the soil, and lessens insect and weed pressure. This method is known as crop rotation.

#### Advantage

- Improved nutrient uptake by plants and increased soil fertility.
- They also include less insect, disease, and weed pressure on fields
- Increased crop output and reduced risk of crop failure.
- Efficient use of natural resources

### III. BIO-FERTILIZERS

Each sort of beneficial microorganism, such as bacteria, algae, or fungi, is present in these biologically active inputs, and they all have different capacities and purposes. Approximately several bio-fertilizer kinds.

#### 1. Blue-Green Algae:

- Blue-green algae, often known as cyanobacteria, are nitrogen-fixing photosynthetic algae that can live freely in damp and marshy environments.
- Algae of a blue-green color are known by that term, but they can also be purple, brown, or red.
- They are simple to prepare on the farm, but they can only be used to grow rice while the field is submerged, and they can't tolerate acidic soils.

**2. Azolla:** Azolla, a free-floating water fern, can be mass-produced on farms like blue-green algae and is a renewable bio-fertilizer that fixes nitrogen in conjunction with a certain kind of cyanobacteria. Its capacity to reproduce quickly allows it to suffocate and control weeds in (flooded) rice fields. It is a good source of nitrogen and, upon decomposition, a source of several micronutrients. Azolla is also employed as a high-quality feed for livestock and poultry as well as a green manure.

**3. Phosphate-Breaking Micro-Organisms:** These are a category of bacteria and fungi, such as VAM, that can degrade insoluble phosphates so that crops can use them. Considering that just a third of the phosphorus in soil is used by organisms, as the remainder is insoluble, it is actually accessible to the crop.

**4. Care should be taken while using Bio-fertilizer**

- They require sufficient organic matter in the soil to be of any great benefit.
- Bio-fertilizers produced by commercial units is the issue of using micro-organisms native to another area or region.

**IV. ORGANIC MANURES**

Organic manures are produced from animal and plant waste and are used in large amounts since they contain few plant nutrients in complicated form. The nutrients in organic manures are released for plant absorption as they deteriorate due to the action of microbes. Application of organic manures to the soil improves soil health in addition to providing plant nutrients. Since farmers cannot currently afford fertilizers due to their higher pricing, it is a very good substitute for inorganic fertilizers. Organic manures come in a variety of forms, including farmyard manure (FYM), compost, vermicompost, chicken manures, pig manures, oil cake, and more

**Table 1: Nutrient content of different organic manures (source from Mahajan et al., 2007)**

Organic Manure	Nutrient Content %		
	N	P2O5	K2O
<b>A. Bulk manures</b>			
FYM	0.5	0.2	0.5
Farm compost	0.5	0.15	0.5
Poultry manure	3.03	2.63	1.4
Vermicompost	1	0.8	0.8
<b>B. Concentrated organic manures</b>			
Neem cake	5.22	1.08	1.48
Linseed cake	5.56	1.44	1.28
Groundnut cake	7.29	1.53	1.33
Safflower oil cake	7.88	2.20	1.92
Cotton oil cake	6.5	2.89	2.17
Fish manure	4-9	3-9	0.3-1.5

**V. GREEN MANURING**

Green manures are crops raised expressly to be added back to the soil, either directly or after being removed and composted, in order to create and maintain soil fertility and structure, however they may also serve other purposes.

**1. Importance of Green Manuring**

- Bringing crop nutrients up from lower soil profiles;

- Increasing soil organic matter and structure;
- Providing nitrogen and other nutrients for a subsequent crop;
- Preventing the leaching of soluble nutrients from the soil;
- Providing ground cover to prevent damage to soil structure;
- Smothering weeds and inhibiting the growth of weed seedlings.

## 2. Types of Green Manure Crop

- **Green manuring In-Situ:** Any crop or plant (generally leguminous) grown and ploughed in situ is called green manuring in situ.

E.g.: Sesbania (*Sesbania speciosa*), Dhaindia (*Sesbania aculeate*), Sunhemp (*Crotalaria juncea*), Phillipesara (*Phaseolus trilobus*), Cowpea (*Vigna anguiculata*), Green gram/Mungbean (*Vigna radiata*), Black gram (*Vigna mungo*), Berseem (*Trifolium alexandrinum*) etc.

- **Green Leaf Manuring:** Consists of gathering green biomass (tender leaves and twigs) from nearby location (bunds, field boundaries) and adding it to the soil.

E.g.: Cassia auriculata, Neem (*Azadiracta indica*), Glyricidia (*Glyricidia maculate*), Leucaena leucocephala, Cassia tora, Tephrosia purpurea, Vitex nigundo, Karanj (*Pongamia glabra*), Calotropis (*Calotropis gigantea*) etc.,.

## VI. SYNTHETIC FERTILIZERS

In the present day, fertilizers are a crucial tool or input for enhanced agricultural production. The fundamental reason for this is that they help to sustain soil fertility and increase crop output. The following are a few benefits of chemical fertilizers: The use of balanced fertilization, however, based on soil test recommendations increases the fertilizer use efficiency and pays back to the farmer more profit per rupee invested. Chemical fertilizers are less bulky in nature and can be easily transported, and time and labor costs can be saved. They are simple and quick sources of plant nutrients, contain nutrients in higher and definite concentrations compared to other sources (Mahajan and Gupta, 2009)

### 1. Goal of INM

- To maintain soil productivity
- To ensure productive and sustainable agriculture.
- To reduce expenditure on costs of purchased inputs by using farm manure and crop residues etc. To utilize the potential benefit of green manure, leguminous crops and bio fertilizers.
- To prevent degradation of environment
- To meet the social and economical aspiration of the farmers without harming the natural resource base of agricultural production.

## 2. Constrain in Adapting INM

- Limited Availability and Accessibility of Inputs
- Difficulties growing green manure crops.
- Time and Labor Intensive
- Lack of knowledge and poor advisory services.
- Complex process

## VII. CONCLUSION

In the past two decades, INM practice has been steadily abandoned in favor of an excessive reliance on chemical fertilizers in order to attain food security with diminishing land and other resources. It is common knowledge that soil is the primary factor in agriculture. The primary factor affecting the output and productivity of the crop is the soil's nutritional status. Due to its considerable potential for fulfilling the rising nutrient needs of intensive agriculture, the time is now for adoption of the integrated nutrient management technique. It can also assist in preserving production sustainability without lowering the standard of the environment for plants. It plays a significant part in sustainable agriculture, which is the application of contemporary techniques to meet the needs for food and fiber in the present and the future in a way that compromises the future use of essential resources like water and soil. INM is the best way to sustain through sustainable agriculture in order to fill the consumer's basket with high-quality food, meet the demand for food from an expanding population, and protect the environment.

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