**Integrated Nutrient Management (INM): Meaning, Principles, Goals and Components**

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**ABSTRACT**

The world is moving towards precision agriculture and precision dairy farming. Precision Dairy Farming is the use of technologies to measure physiological, and production indicators on individual animals to improve management strategies and farm performance. Farming drones provide one of the most efficient ways for farmers to monitor their livestock. Livestock Farmers can use drones to obtain an aerial overview of the area in which they keep their livestock or the pasture area in which the livestock are allowed grazing Drones can be employed to monitor livestock, assess crop health, assess drought conditions, and even to apply pesticides Drones fitted with a high definition camera can provide clear, concise image, while with a thermal imaging software will allow you to pick up areas of heat across your livestock.

**INTRODUCTION**

Integrated nutrient management is the combined application of chemical fertilizers along with organic resource materials like organic manures, green manures, bi-fertilizers and other organic decomposable materials for crop production. IPNS is ecologically, socially and economically viable and environment friendly which can be
practiced by farmers to derive higher productivity with simultaneously maintaining soil fertility. Integrated nutrient management encourages the use of on-farm organics, thus it saves on the cost of fertilizers for crop production. It involves proper combination of chemical fertilizers, organic manure, crop, residues, N₂-fixing crops (like pulses such as rice bean, Black gram, other pulses and oilseeds such as soybean and bio-fertilizers suitable to the system of land use and ecological, social and economic conditions. The cropping system rather than an individual crop, and farming system rather than an individual field, is the focus of attention in this approach for development INM practices for various categories. The basic concept of INM is the maintenance of soil fertility, sustainable agricultural productivity and improving profitability through judicious and efficient use of fertilizers as mentioned.

**Principles Underlying INM System**

Six basic principles of sustainable INM system laid out by Dennis Greenland (quoted by Meelu, 1996) include:

1. Nutrients removed by crops must be returned to the soil.
2. Soil physical conditions should be maintained and upgraded.
3. Organic carbon levels of soils should be maintained and enhanced.
4. Build-up of abiotic stress should be minimal.
5. Degradation of land occurring due to soil erosion must be controlled.
6. Soil quality with respect to soil acidity, salinity and sodicity or toxic elements build-up must be minimized.

**Goals of INM:**

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

**Components of the INM:**

Fertilizers, organic manures, legumes, crop residues and biofertilizers are the main ingredients of INM.

1. **Fertilizers**

Fertilizers continued to be the most important ingredient of INM. The dependence on fertilizers has been increasing constantly because of the need to supply large amounts of nutrients in intensive cropping with high productivity. Domestic fertilizer production is inadequate to meet the requirements and the situation is not likely to improve in the near future. On the other hand, constraints like global price hike of fertilizers and raw materials would not permit fertilizer import in large quantities leading to a big gap between supply and consumption. While organics and biofertilizers are expected to bridge a part of this gap, efficient use of fertilizers in narrowing the nutrient supply gap also needs greater emphasis. Utilization of fertilizer nutrients by the crops vary from 30-50% in case of N, 15-20% in case of P and less than 5% in case of micronutrients. Thus, a substantial amount of applied nutrients is lost through various pathways. Enhancing NUE therefore, be a prioritized area of research for restoration and improvement of soil health and minimizing the cost of crop production.
2. Organic Manures

Organic manures like urban compost, FYM, crop residues, human excreta, city refuse, rural compost, sewage-sludge, press mud and other agro-industrial wastes have large nutrient potential. Compost and FYM have traditionally been the most important manures for maintaining soil fertility and ensuring yield stability. Other potential organic sources of nutrients such as non-edible oil cakes and wastes from food processing industry are also there. Moreover, there are several industrial by-products and municipal wastes with fair nutrient potential. However, these nutrient carriers have not been properly evaluated to establish their fertilizer equivalents. There is need to integrate these sources depending on their availability in different crops and cropping systems.

3. Legumes

Legumes have a long-standing history of being soil fertility restorers due to their ability to obtain N from the atmosphere in symbiosis with Rhizobia. Legumes could provide an important ingredient of INM when grown for grain or fodder in a cropping system, or when introduced for green manuring. Legumes grown as green manure, forage or grain crops improved the productivity of rice-wheat cropping system (RWCS) and rejuvenated soil fertility (Yadav et al., 2000)

4. Crop Residues

Crop residues have several competitive uses and may not be always available as an ingredient of INM, yet in the regions like North-West India where mechanical harvesting is practiced, a sizeable quantity of residues is left in the field, which can form a part of nutrient supply. There are large amounts of residues of other crops like potato, sugarcane, vegetables, etc., which are practically wasted in most cases. Although cereal crop residues are valuable cattle feed, these could be used to supplement the fertilizers wherever available in excess of local needs. Stubbles left in the field in traditional harvesting methods range from 0.45 to 1.5t/ha in case of different crops. When mechanical harvesting is done, this amount is much greater. Stubbles of coarse cereals like sorghum, maize, pearl millet etc. which are difficult are normally collected and burnt during land preparation causing significant loss of plant nutrients.

5. Biofertilizers

Biofertilizers are the materials containing living or latent cells of agriculturally beneficial microorganisms that play an important role in improving soil fertility and crop productivity due to their capacity to fix atmospheric N, solubilize/mobilize P and decompose farm waste resulting in the release of plant nutrients. The extent of benefits from these microorganisms depends on their number and efficiency which, however, is governed by a large of soil and environmental factors.

Advantages of Integrated Nutrient Management

INM enables the adaptation of plant nutrition and soil fertility management in farming systems to site characteristics, taking advantage of the combined and harmonious use of organic and inorganic nutrient resources to serve the concurrent needs of food production and economic, environmental and social viability. INM empowers farmers by increasing their technical expertise and decision-making capacity. It also promotes changes in land use, crop rotations, and interactions between forestry, livestock and cropping systems as part of agricultural intensification and diversification.

Disadvantages of Integrated Nutrient Management

As well as facilitating adaptation to climate change in the agriculture sector, the INM approach is also sensitive to changes in climatic conditions and could produce negative effects if soil and crop nutrients are not monitored systematically and changes to fertilizer
practices made accordingly. In the case of small-scale farmers, the cost of fertilizers may represent too high a proportion of the total variable cost of production thus ruling out inorganic fertilizer as a feasible option.

References


