

Integrated Nutrient Management

In Floriculture

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The global floriculture business, worth more than Rs. 3.99 trillion is experiencing unprecedented challenges to ensure sustainability and environmental balance while serving the growing demand for high-quality commercial flowers. Soil degradation, water contamination and nutrient depletion are serious challenges that restricts the long-term survival of the global floriculture industry. Integrated fertilizer Management (INM) has emerged as a potential solution for addressing these concerns. Apart from the above benefits, it also increases fertilizer use efficiency and reduces environmental damage and degradation by involving combined use of organic and inorganic fertilizers. Adopting an INM approach allows the industry to minimize its environmental footprint, increase agricultural yields, quality.

India's soil nutritional status is severely poor, with widespread shortages in important macronutrients such as nitrogen, phosphorus and potassium. According to the Soil Health Card Scheme (2019), more than half of Indian soils are low in nitrogen, 40% in phosphorus and 20% in potassium. Micro-nutrient deficits, notably zinc and boron, are also common in our country. The most alarming fact is that the soil organic matter (SOM) levels of our nation are extremely low, averaging around 0.5%, resulting in poor soil structure, fertility and water retention capacity. This degradation is

mainly caused due to extensive farming, insufficient nutrient replenishment and climate change.

The poor nutritional condition of Indian soil has far-reaching implications for commercial flower production. This further leads to increased susceptibility to diseases and pests in weakened plants and further enhances expenditures in pesticides and fungicides applications. It indirectly favors higher water consumption because the poor soil structure and poor organic matter concentration diminish water-holding capacity. It causes higher fertilizer and input costs and causes environmental deterioration. Soil degradation reduces vase life of flowers, due to insufficient carbohydrate reserves, thereby impacting marketability and profitability. The most potent side effect of soil degradation is the loss of biodiversity and has a negative influence on beneficial microbes and pollinators.

On the other hand, INM provides a comprehensive solution to meet the issues of commercial flower cultivation by assuring balanced fertilizer application while reducing waste and environmental effect. Besides improving water-holding capacity, aeration, and nutrient cycling, it also improves soil health by increasing soil organic matter, structure, and biodiversity. INM leads to reduction of disease and pest susceptibility and improves flower output and quality. Apart from the above

benefits, INM promotes increased vase life which improves marketability and improves profitability and competitiveness for commercial flower growers. Most notably, INM supports beneficial microbes, pollinators, and ecosystem services to ensure long-term floriculture. Overall, it is an integrated synergistic approach connects soil, plants and environment in a sustainable manner.

There are different components of INM, among which organic manure, legumes, crop residues, fertilizers and bio-fertilizers are the major ones. Organic manures can be used as press mud, urban sludge and other agricultural wastes. Composts, yard manure, human excreta, urban waste, rural green waste and leftovers have historically been the most important manures for preserving soil fertility and yield stability. Besides these, other organic sources of nutrients such as food processing waste, oil cakes and urban and industrial wastes can also be used as organic manures to reduce dependency on chemical fertilizers.

Legumes due to symbiosis extract nitrogen from the atmosphere and restore soil fertility through green manuring. Crop residues can also be utilized as a source of nutrients, but fertilizers in optimum doses play an important role in rising farm productivity. We should try to use chemical fertilizers to the minimum by compensating them by organic sources to the extent that its not endangering our food security. In INM program, bio-fertilizers are very important as these contain active or dormant colonies of beneficial microbes for agriculture, that improves soil fertility through biological nitrogen fixation, phosphorus solubilization, mobilization, breakdown of agricultural waste and plant nutrient release. We should use them to supplement plant nutrients by foliar sprays and seed or sapling treatment.

INM gives flowers, the balanced combination of nutrients they need to get vigorous growth, bloom development and coloration. Also, flowers require regular harvesting which

depletes soil nutrients and therefore balanced replenishment of INM is essential for continued production. INM also guarantees that flowers receive the essential micro-nutrients like boron, copper and zinc essential for its quality blooms. In present era of water crisis, INM increases soil organic matter and increases water-holding capacity, thereby helping us to grow flowers with less water. Moreover, in areas where water is scarce, INM techniques like mulching and cover crops help us to conserve water.

Soil biota is often known as the index of soil fertility and INM encourages healthy soil microbes, which are vital for the cycling of nutrients, the prevention of disease and the general health of the soil. The rising demand for flowers is predicted to propel the Indian floriculture market's 5.8% compound annual growth rate (CAGR) between 2024 and 2034. Due to the rapidly expanding floricultural market as a result of growing global demand, we need to proportionally enhance our floricultural production, but not at the cost of environment. The government of India also financially supports such eco-friendly methods of cultivation through different initiatives. Sustainable methods as INM promise a bright future for the Indian commercial flower production industry.

For sustainable production of commercial flowers in India, the implementation of Integrated Nutrient Management (INM) techniques is crucial. It helps to create a more sustainable future of the floricultural sector by reducing its environmental impact, improve crop yields and quality. The future of integrated natural marketing (INM) in commercial flower cultivation in India appears bright, due to the government initiatives, market expansion, and growing consciousness of sustainable methods. We should take advantage of this opportunity to guarantee a flourishing and long-lasting floriculture sector for future generations. INM enhances and maintains the soil's biological, chemical, and physical processes.