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Integrated Nutrient Management in Fruit Production

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Abstract

When it comes to fruit cultivation, nutrient management is of the utmost importance if one wants to acquire fruit of a good grade. Inappropriate nutrient management and indiscriminate use of chemical pesticides are both detrimental to the health of plants and the environment, as well as to the human beings who consume them. Because of the indiscriminate use of inorganic agrochemicals, the qualitative characteristics of a variety of fruits have been adversely affected. This has led to a decline in quality, which has decreased customer choice and resulted in lower returns for the producers. Not only can an excessive supply of inorganic nutrient sources, such as fertilizers, have a negative impact on the quality of the fruit and its overall productivity, but it also depletes the nutrient reserves that are present in the soil. However, INM is a method that contributes to the preservation of the soil's health. Integrated nutrient management, also known as INM, refers to the practice of applying all possible sources of nutrients, both organic and inorganic, to crop production at the same time. As a result, the INM assists the plants in satisfying their nutritional requirements while also restoring the fertility of the soil.

Key words : INM, Agrochemicals, Organic Fertilizers, Soil Health, Lower returns.

Fruits are very vital element of human diet. India is currently the second largest fruit grower in the world, behind China. The country leads the world in production of banana (25.7%), papaya (43.6%), and mango (40.4 %) (Gnanavel *et al*., 2019). India accounts for 13 percent of the world's total fruit output and possesses a diverse selection of fruit (Bairwa *et al*. 2012). The current fruit production in India only meets 46% of the overall demand (Dolker *et al*., 2017). However, although the production of fruits has expanded significantly over the course of the previous decade, there is still a significant disparity between the demand for fruits and the availability of fruits. In today's world, providing food for a growing population and ensuring their nutritional wellbeing is not only a difficult but also a tough vocation for rural communities. In addition to their position in beyond facts, fruits have a significant significance in the diets of humans. They provide a healthy dose of a variety of vitamins and minerals. Without them, the human body cannot acquire resistance or keep its health in normal working order. They also include oils, lipids, and proteins, all of which are utilized in various metabolic processes thanks to their composition.

The continued and excessive use of inorganic fertilizers as a source of nutrients in unbalanced quantities to improve fruit production has resulted in major issues, including economic inefficiency, environmental damage and in some cases, even harm the plants and those who consume them. These issues have led to the creation of serious problems. On the other hand, in order to satisfy the needs of the plants and bring about an increase in output, a substantial quantity of nutrients must be delivered to the soil. The ongoing production of crops will cause nutrient stores in the soil to deplete over time if effective nutrient

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management is not practiced. Because of the extensive depletion of the land, another major cause for concern is the viability of the soil's capacity to continue producing crops in the long term. Cumulative nutrient depletion, which occurs over time, results in a decline in soil fertility and output, which ultimately leads to soil degradation. Another reason to rethink the widespread application of inorganic fertilizers is the high expense of these products. Due to limited purchasing power and the detrimental impact that chemical fertilizers have on the health of the soil, there has been an increased emphasis placed on the usage of bio-fertilizers and organic matter in addition to inorganic fertilizers. All of these elements have combined to pique the interest of farmers in using the Integrated Nutrient Management system for the cultivation of fruit crops. This method also includes the implementation of creative strategy such as the utilization of deep fertilizer placement and the application of urea coatings, both of which are intended to improve plant uptake while also decreasing nutrient losses (Saikia *et al*., 2015).

Objectives of INM

The different objectives of integrated plant nutrient management are:

- To boost the availability of nutrients in the soil during growing season
- To lessen the need for inorganic fertilizer
- To balance the crop's need for nutrients with the supply of nutrients from all sources.
- To maximize the soil biosphere's functioning relative to a particular function
- Minimize nutrient losses by volatilization, denitrification, surface runoff, and leaching beyond the root zone (Sharma *et al*., 2018).

Need of INM in Fruit Crops

1. Reduced nutrient availability causes a decline in horticulture yield.
2. Accelerated occurrences of P, S, and Zn shortages due to increased N fertilizer use.
3. On acute P-deficient soils, N treatment alone depresses
4. Continuous use of nitrogen fertilizer is related with a decline in SOM.
5. Continuous use of acid-forming fertilizers will increase the soil's acidity.
6. Changing land use patterns from forest ecosystem to agro ecosystem are responsible for SOM depletion and soil fertility degradation.

To address the dual challenges of nutrient overload and nutrient depletion, INM, which comprises maintaining soil fertility to an optimal level for crop yield while obtaining the greatest benefit from all potential sources of plant nutrients, both organic and inorganic, in an integrated way, is critical (Aulakh, *et al*., 2010 & Aulakh and Adhya, 2005). This is because INM allows for the maximum benefit to be obtained from all possible sources of plant nutrients organic as well as inorganic. INM is especially beneficial to small-scale farmers who cannot afford to feed all of their crops with expensive chemical fertilizers (Meena *et al*., 2013, Singh *et al*., 2014).

Components of INM in fruit production

1. **Mineral Fertilizers:** These inorganic compounds are the sources of one or more of the nutrients that plants require. There are three categories for these:
    - **Straight fertilizers :** Those that solely provide a single nutrient, such as nitrogen, phosphorus, or potassium. For

example, murate of potash, single super phosphate, and other similar compounds.

- **Complex fertilizers :** Complex fertilizers are those that contain two or three primary nutrients, of which two primary nutrients are chemically combined. For example, ammonium phosphate, diammonium phosphate, etc.
- **Mixed Fertilizers :** These are physical mixtures of single-component fertilizers. They contain two or three essential nutrients in a predetermined ratio. E.g. – 19:19:19, 12:32:16, etc.

2. **Organic Manures :** These are the byproducts of organic matter's biological breakdown. They can be derived from either plant or animal waste. There are of two types:

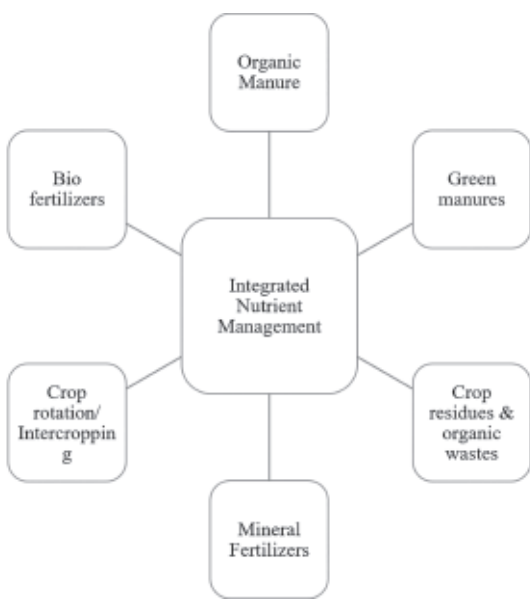
- **Bulky Organic Manure :** They possess a low concentration of nutrients and must be administered in big amounts. Examples include FYM, compost, chicken manure, sheep manure, and green manures, among others.
- **Concentrated organic manures :** They contain significantly more nutrients than bulky organic manures. For instance, oil cake, blood meal, etc.

The amount of organic matter in the soil increases with the addition of manure, which also improves soil structure or drainage in fine-textured clay soil, raises the WHC (water holding capacity of the soil), provides a source of nutrients that are released slowly, mitigates the effects of wind and water erosion, and stimulates the development of earthworms and other beneficial soil microorganisms (Rai, 2014).

3. **Crop residue :** It is the material remaining after crop harvesting and the byproducts of agricultural industry. E.g. - stalks, leaves, stems, bagasse, etc. These may be utilized to create compost.

4. **Crop rotation :** It is an essential method for maintaining a sufficient supply of nutrients. On the same plot of land, in order to prevent the soil from being depleted, successive plantings of different types of crops are carried out. For instance, bananas can be alternated with other crops such as rice, sugarcane, legumes, vegetables, and so on.

5. **Bio-fertilizers :** These are preparations that include either active or dormant cells of effective strains of microorganisms. These bacteria interact in the rhizosphere, which allows agricultural plants to more efficiently absorb nutrients. Biofertilizers that fix nitrogen, such as *Rhizobium*, *Azotobacter*, and *Azolla*, as well as biofertilizers that dissolve phosphate, such as Bacillus, *Aspergillus*, and *Pseudomonas*, are examples. The beneficial role of bio-fertilizers has been reported in fruit crops viz. strawberry (Kumar *et al*., 2019) and mango (Poonia *et al*., 2018).



Constraints of INM

In order to increase the output of subtropical fruit crops in India, integrated nutrient management is critical. This is because it is an excellent strategy for improving the physical, chemical, and biological qualities of the soil while simultaneously reducing the negative environmental impact of excessive inorganic fertilizer use. However, there are a number of barriers to fruit farmers adopting INM. These elements are described more below:

1. Organic matter contains a significant quantity of insoluble components like cellulose, hemi-cellulose, and lignin, among others, the process of organic matter's decomposition is slowed down, which causes challenges in terms of giving plants with the necessary nutrients at the appropriate time.

2. The availability of FYM is another key aspect that limits the usage of INM. Because there are fewer domesticated animals now than there used to be, Farmyard manure (FYM) is not as readily available to farmers as it previously was.

3. The vast majority of farmers are unaware of the new innovations in research and technology that are being developed in their field. Therefore, the usage of INM is limited due to their lack of awareness.

4. The vast majority of farmers favour using chemicals in their operations, and they are resistant to adopting more modern agricultural practices.

5. The practice of crop rotation, which is sometimes disregarded by farmers, plays a significant part in maintaining the availability of nutrients. For instance, the use of legumes in crop rotation helps to replenish the fertility of the soil. Farmers choose their crops based on what best meets their requirements.

6. Inorganic fertilizers are typically preferred by farmers since the manufacture of compost and the handling of bulky organic manures that only contain trace levels of beneficial plant nutrients is a very labor-intensive operation.

7. The fertilizer prescription in INM is not based on the results of any soil tests, despite the fact that various crops have varying nutrient requirements. If the soil has not been properly tested, it will be impossible to apply the crop with the necessary amount of fertilizer.

8. Farmers do not want to devote six to eight weeks of their time to produce a green manure crop for no financial reward. In addition, because the benefits of green manuring are not immediately apparent, most farmers would rather avoid using it (Sepehya *et al*., 2020).

Conclusion

A concerted effort to apply locally available components of INM, such as the rational and appropriate use of fertilizers and organics, will go a long way toward ensuring sustainable crop nutrition management in subtropical fruits. This will be accomplished by providing a sustainable crop nutrition management plan. Furthermore, because of the insufficient use of organic manures and the use of chemical fertilizers that are devoid of secondary or trace elements, more and more nutritional elements, such as magnesium, zinc, and boron, are likely to be key nutrient components of fruits in the future. In addition, fertilizer management should be based on cropping systems rather than a single crop in order to improve both the efficiency with which nutrients are used and the economics of the situation. As a result, integrated nutrient management is a soil fertility development technique that employs a planned combination

of bio fertilizers, inorganic fertilizers, and organic manures. When bio fertilizers, inorganic fertilizers, or organic manures are administered singly, this helps to protect the environment while also delivering higher crop yields.

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