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INTEGRATED NUTRIENT MANAGEMENT OF HORTICULTURE CROPS

PINKY GOYAL[a1], PUSHPENDRA KUMAR[b], ANITA VERMA[c], KRISHAN KUMAR SINGH[d] AND S.K. MEHTA[e]

[abc]School of Agriculture Science, Dr. K.N. Modi University, Newai, Tonk, Rajasthan, India
[de]Department of Horticulture, School of Agriculture Science, Career Point University, Kota, Rajasthan, India

ABSTRACT

Integrated Nutrient Management refers to the maintenance of soil fertility and of plant nutrient supply at an optimum level for sustaining the desired productivity through optimization of the benefits from all possible sources of organic, inorganic and biological components in an integrated manner. INM combines inorganic, organic and biological sources of nutrients in a judicious and efficient way into ecologically sound and economically viable farming systems. Inorganic fertilizers of interest for balanced nutrition today include – urea, DAP, MOP, gypsum, agribor/borax, zinc sulphate and others to meet equivalent amounts of nutrients. Organic fertilizers include prominently – Vermicompost, FYM, poultry manure, green manuring, and bone-meal. Biological fertilizers include mainly – VAM, PSM and nitrogen-fixing bacteria. There are various components of plant nutrients for INM which can be applied in an integrated way: Inorganic fertilizers, Organic Fertilizers, Green manure crops, Crop residues, Crop rotation, and Bio fertilizers. Advantages of INM: Enhances the availability of applied as well as native soil nutrients. Synchronizes the nutrient demand of the crop with nutrient supply from native and applied sources. Provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance. Improves and sustains the physical, chemical and biological functioning of soil. Minimizes the deterioration of soil, water and ecosystem by promoting carbon sequestration, reducing nutrient losses to ground and surface water bodies and to atmosphere.

KEYWORDS: INM, Manure, Fertilizer, Horticulture Crops, Yield

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Principles of INM

- Maximize the use of organic material
- Ensure access to inorganic fertilizer and improve the efficiency of its use
- Minimize losses of plant nutrients

Goals 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 residue etc.
- To utilize the potential benefits of green manures, leguminous crops and biofertilizers.
- To prevent degradation of the environment.
- To meet the social and economic aspirations of the farmers without harming the natural resource base of the agricultural production
- To maintain or enhance soil productivity through balanced use of mineral fertilizers combined with organic and biological sources of plant nutrients
- To improve the efficiency of plant nutrients, thus limiting losses to the environment
- To improve physical conditions of soils

Advantages of INM

- Enhances the availability of applied as well as native soil nutrients
- Synchronizes the nutrient demand of the crop with nutrient supply from native and applied sources.
- Provides balanced nutrition to crops and minimizes the antagonistic effects resulting from hidden deficiencies and nutrient imbalance.

[1]**Corresponding author**

- Improves and sustains the physical, chemical and biological functioning of soil.
- Minimizes the deterioration of soil, water and ecosystem by promoting carbon sequestration, reducing nutrient losses to ground and surface water bodies and to atmosphere

Constraints of in

- Non-availability of FYM
- Difficulties in growing green manure crops
- Non-availability of biofertilizers
- Non-availability of soil testing facilities
- High cost of chemical fertilizers
- Non-availability of water
- Lack of knowledge and poor advisory services
- Non-availability of improved seeds
- Soil conditions
- Non-availability of credit facilities

Basic components of Integrated Nutrient Management

There are various components of plant nutrients for INM which can be applied in an integrated way:

- Inorganic fertilizers
- Organic Fertilizers
- Green manure crops
- Crop residues
- crop rotation
- Bio fertilizers

Inorganic Fertilizers

Inorganic fertilizers are rich in nutrients. They are required in less quantity to supply nutrients as compared to organic manures. But continuous use of chemical fertilizers deteriorates the soil conditions. Therefore, inorganic fertilizers should be accompanied by organic / bio fertilizers. E.g.-Urea, DAP, MOP, Gypsum, Borax, Zinc sulphate, SSP etc.

Organic Fertilizers

FYM- FYM is prepared basically using cow dung, cow urine, waste straw and other dairy wastes. It is highly useful and is rich in nutrients.

Nutritional status of FYM (%)

- N-0.5,
- P-0.25,
- K-0.40,
- Ca-0.08,
- S-0.02,
- Zn-0.004,
- Cu-0.0003
- Mn-0.007,
- Fe-0.45

Vermicompost

Vermicompost is the final product of composting organic material using different types of worms, such as red wigglers (EiseniaFetida) or earthworms, to create a homogenized blend of decomposed vegetable and food waste, bedding materials and manure. Vermicompost, similarly known as worm castings or worm manure, enriches the soil and can be used as a high grade natural, organic fertilizer.

Composition

Nutrient Element	Vermicompost (%)	Garden Compost (%)
Organic Carbon	9.8-13.4	12.2
Nitrogen	0.51-1.61	0.8
Phosphorus	0.19-1.02	0.35
Potassium	0.15-0.73	0.48
Calcium	1.18-7.61	2.27
Magnesium	0.093-0.568	0.57
Sodium	0.058-0.158	<0.01
Zinc	0.0042-0.110	0.0012
Copper	0.0026-0.0048	0.0017
Iron	0.2050-1.3313	1.1690
Manganese	0.0105-0.2038	0.0414

Other Organic Manures

Sheep and Goat Manure-The droppings of sheep and goats contain higher nutrients than farmyard manure and compost. On an average, the manure contains 3 % N, 1% P_2O_5 and 2% K_2O.

Poultry Manure-The excreta of birds ferment very quickly. If left exposed, 50 % of its nitrogen is lost within 30 days. The average nutrient content is 3.03% N; 2.63% P_2O_5 and 1.4% K_2O.

Bio Fertilizers

'Biofertilizer' is a substance which contains living microorganism which, when applied to seed, plant surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant.

Green Manuring

Using Green Manure and the cover crops which are incorporated into the soil when they are still green are called as green manures. Green manure crops: Alfa-alfa, Cowpea, Fenugreek, mustard, Sesbania, Sunnhamp, Soybean.

Crop Rotation

Crop rotation is the practice of growing a series of dissimilar/different types of crops in the same area in sequential seasons.

Advantages

- Rotation of crops improves the fertility of the soil and hence, brings about an increase in the production of food grains.
- Rotation of crops helps in saving on nitrogenous fertilizers, because leguminous plants grown during the rotation of crops can fix atmospheric nitrogen in the soil with the help of nitrogen fixing bacteria.
- Rotation of crops helps in weed control and pest control. This is because weeds and pests are very choosy about the host crop plant, which they attack. When the crop is changed the cycle is broken. Hence, pesticide cost is reduced.
- Crop rotation adds diversity to an operation.

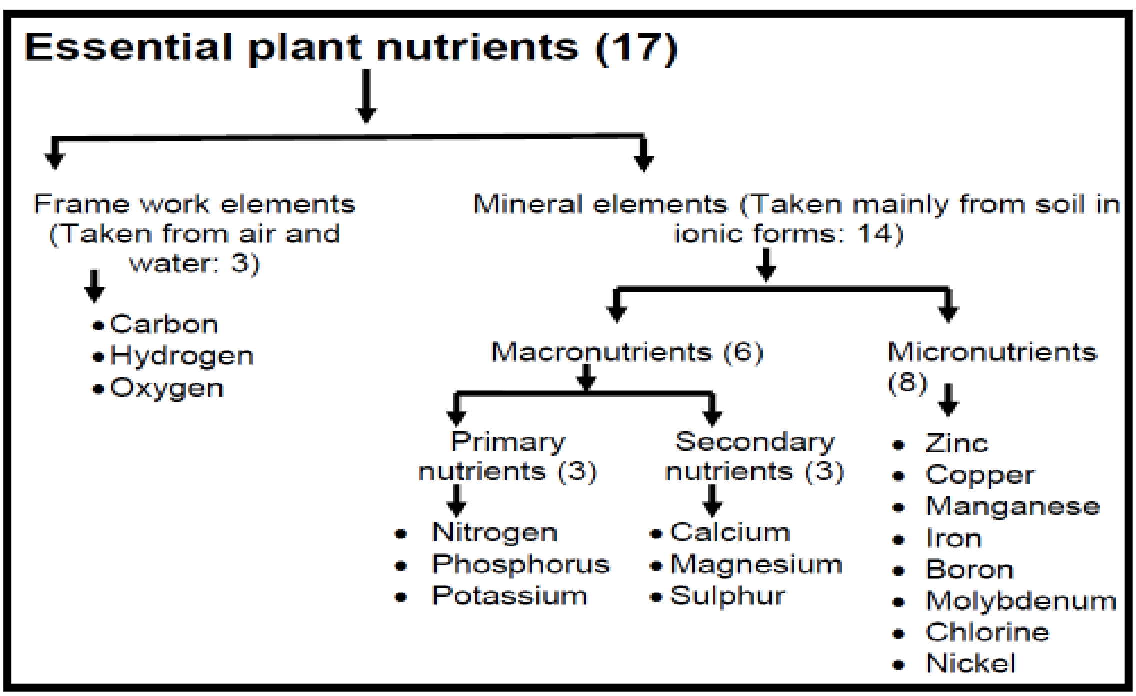
Nutrients

- Nutrients absorbed by the plants from the soil are called mineral nutrients , they are derived from the minerals.
- The importance of mineral as nutrient for sustaining plant growth and development, and proper metabolic activities.

Criteria of Essentiality

- The function of element must not be replaceable by another mineral element
- The element must be directly involved in plant metabolism.
- A given plants must be enable to complete its life cycle in the absence of mineral element.

Classification of Essential Plant Nutrients



Diagnosing the Mineral Nutrition Status of Fruit Crops

Fruit growers have three main tools to use in evaluating the mineral nutrition status of their plantings.

These are:

- Examine visual symptoms exhibited by leaves, stems, and fruit.
- Analyzing leaf tissue and.
- Testing the soil.

Used together properly these are powerful tools that can be used to prevent nutrient deficiencies or toxicities as well as to assess current fertility management practices.

Modern Approaches in Mango

Singh and Rajput (1976) reported that the various levels of ZnSO4 increased the length of terminal shoot, number of leaves and leaf area per shoot of mango tree. An experiment on the foliar applications of Zn (0.1, 0.2 and 0.4%), Fe (0.1, 0.2 and 0.4%) and B (0.1, 0.2 and 0.4%) indicated that both Zinc and Boron promoted vegetative growth in terms of plant height, trunk girth and spread of young plants.

Singh et al. (2017) observed that the experiment was laid out in Randomized Block Design with factorial concept with three levels of soil application viz., S1 (control), S2 (200 g/tree multi micronutrient Grade V) and S3 (400 g/tree multi micronutrient Grade-V) and three level of foliar application viz., F1 (control), F2 (1% Spray of multi micronutrient Grade-IV) and F3 (2% Spray of multi micronutrient Grade-IV) and replicated thrice. Multi micronutrients were sprayed at three stages i.e.at flower bud initiation, at full bloom stage and at pea stage. In present investigation significantly maximum fruit weight (186.38 g), fruit volume (162.86 cc), numbers of fruits per tree (353.00), fruit yield of fruits per tree (62.99 kg), fruit yield per hectare (9.84 tonne) and fruit retention per panicle (4.00) were recorded under the treatment F2 (1% spray of multi micronutrient Grade-IV).

Results revealed that the treatment T5 (RDF + foliar spray of 0.4% zinc sulphate + copper sulphate (0.2%) + Borax (0.2%), spraying at just before flowering and marble stage of fruit growth recorded the highest number of fruits/tree (240.67) and fruit yield (6.41 t./ha). Further, the treatment T4 (RDF + foliar spray of 0.4% zinc sulphate + boric acid (0.2%) spraying at just before flowering and marble stage of fruit growth recorded the highest T.S.S (19.35 0B) and lowest acidity (0.13%)(Haldavnekar et al. 2018).

Citrus

Citrus is a nutrient -loving plant and about 15 elements have been known to have important role to play for proper growth and development of citrus in addition to the major nutrients like N, P, K, Ca, Mg, S citrus require micro nutrients Zinc, Cu, Mn, Fe, B, Mo, etc. Inadequate plant nutrition causes serious disorders in citrus and may eventually lead to decline of the orchards.

Extensive work has been done on citrus nutrition and the mineral nutrition of citrus has been throughly that reviewed about 18 tons of citrus fruit remove about 21 kg N,5kg P,41 kg K 19 kg Ca ,3.6 kg Mg , 2.3 kg S ,40g B ,9 g Cu ,50 g Iron , 13 g Mn and 13 g Zn.

The effect of foliar application of bio-regulators and nutrients on growth and yield of lemon (Citrus limon Burma.) cv. Pant Lemon-1. On the basis of overall performance of treatments on growth and yield characters of fruits, it can be concluded that the maximum values for fruit set (3.12%), days to maturity (148.23), yield of fruits (39.25kg) per plant have been obtained maximum with minimum fruit drop (33.58%) under GA3 (20 ppm), minimum fruit cracking was found under NAA 50 ppm, while minimum number of seeds (10.48) per fruit and minimum seed weight (0.580gm) per fruit under GA3 (10 ppm) treatment. However, the maximum number of fruits (403.27) per plant and maximum pulp: seed ratio (20.89) was recorded under NAA (10 ppm) foliar application (Bhatt et al. 2016).

Modern Approaches in Grape

Kumar et al. (1988) reported that among the different concentrations of ZnSO4 (0.2, 0.3 and 0.4%), concentration of 0.2% gave the maximum juice, TSS and acidity percent. All concentrations of ZnSO4 were found better than control. The maximum TSS, total sugars as well as reducing and non-reducing sugars were found with the spray of 0.2% ZnSO4 followed by its higher concentration 0.4% (Kumar and Pathak, 1992). Prabu and Singaram (2001) reported that the application of ZnSO4 at 0.5% + borax at 0.2% through foliage increased the TSS, reducing sugars, many reducing sugars, total sugars and sugar acid ratio and reduced acidity.

Modern Approaches in Litchi

Different doses of zinc sulphate (ZnSO4) @ 0.4%, 0.6%, and 0.8%; Borax @ 0.2%, 0.4% and 0.6% along with control were sprayed on new growth flushes before initiation of inflorescence, whereas 2, 4-D @ 10 ppm, 20 ppm and 30ppm; GA3 @25 ppm, 50 ppm and 75 ppm were sprayed after fruit setting in Dehradun litchi. Results shows that the maximum fruit set (78.15%), fruit retention (60.17%), fruit length (5.6cm), breadth (5.0cm), fruit weight (25.90gm), fruit yield(158.73kg/tree), pulp weight(22.19gm), pulp stone ratio(9.44), TSS(22.96°Brix) and sugars (18.52%) with minimum fruit cracking(2%), stone weight(2.35gm), peel weight(1.36gm) and acidity(0.4%) were recorded with 0.4% borax application followed by 50ppm GA3 (Kaur, 2017).

CONCLUSION

It is concluded that INM of horticulture crops is an important management practice .There is an urgent need to adopt an integrated nutrient supply and management system for promoting efficient and balanced use of plant nutrients. While the main emphasis was given on increasing the proper and balanced used of mineral fertilizers, the role of organic manure, biofertilizer, green manuring and recycling of organic wastes should be considered supplementary and not substitutable.

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