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Integrated nutrient management: A step towards sustainability

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ARTICLE ID: 050

Introduction

The fertilizers are being used inclusively in inappropriate manner: more fertilization causes environmental pollution in many countries like India, China, Western Europe, North America, even as under utilization it causes soil mining. Presently, as 4R nutrient principles are being used widely for improving the fertilizer use efficiency with the right placement, the right source, at the right rate and at the right time. A wide range of agronomic practices including coating of fertilizers, deep placement, precision & row application to reduce nutrient losses, slow release and timely availability of nutrients to plant are pursued to maintain health of soil. In addition, several soil and plant nutrient management practices to improve the fertility of soil, which includes integrated nutrient management (INM), involves the conjunctive usage of organic sources and chemical fertilizers.

Integrated nutrient management (INM)

System of INM encourages collective use of fertilizers from organic sources (organic manures, crop residues, bio fertilizers, green manuring etc.) along with chemical fertilizers.

Components of INM:

Organic manures

"Organic manures" the word itself provides us the meaning that these are the manures which don't have any type of chemicals in it. These are made up of decomposed materials and have good amount of nutrients in them. Some of the examples are farm yard manure (FYM), vermin-compost, bone meal, blood meal, green manures, compost prepared from decomposed crop residues and farm wastes etc.

Advantages:

- Improve organic matter of soil.

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- Releases the nutrients in that form which could be easily utilized by crops.
- Improves water holding capacity of soil.
- Due to decomposition releases organic acids in soil the nutrients provided to the plants are easily taken up by them.

Sources of organic manures:

- Refuse of farm and its related agro industries.
- FYM, droppings, crop waste, residues, sewage, sludge, industrial waste.

Types of organic manures:

Bulky organic manures

Farm yard manure (FYM):

- Farm yard manure is prepared by mixing cow dung, cow urine, dried litter, refuse of the field such as straw.
- It is a very high source of nutrients.
- Mixing of cow dung and cow urine provides a balanced nutrition to the plants.
- Potassium and Phosphorus provided to plants through FYM is same as that as that from inorganic sources.
- Its application increases the fertility of soil.

Green manure

These are the specific type of plants which help in improving the fertility of soil when grown in that field or incorporated inside the field at the stage when they are green. It is obtained by following two ways:

- By growing green manure crops such as sunhemp, cowpea etc.
- By collecting leaves which are green in colour from areas other than field such as forest, bunds. For example leaves of neem, gliricidia, etc.

Green manuring

It refers to the procedure of improving the fertility of soil by growing specific type of crop on that soil and incorporating them in the field at their maximum maturity stage or

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incorporating the green leaves of specific trees collected from forests or areas other than field.

Green manure crops

These are the crops that are used in green manuring. Examples of such crops are: *Sesbania aculeate*, *Crotalaria juncea*, *Sesbania rostrata*, cowpea, cluster bean.

Advantages of green manuring:

- It adds organic matter (OM) and nitrogen (N) in the soil.
- As the plants which are grown for green manuring have deep rooted system, they help in uplifting the nutrients from lower layers to the above layers of soil.
- It increases nutrient availability due to production of CO_2 and organic acids during decomposition.
- Soil structure is also improved.
- Water holding capacity is increased.
- Soil loss due to erosion is reduced.
- Help in reduction in proliferation of weeds and weed growth.
- Alkali soils are also reclaimed.
- Reduction in the population of root knots nematodes

Compost

Organic material which is well rotten is known as compost. It contains 0.5 %, 0.15 % and 0.5 % of N, P_2O_5 and K_2O, respectively.

Importance of composting:

- After rottening it is very light in weight
- High temperature of compost kills pathogen, weed seeds.
- Handling of manure is improved.
- Reduced pollution.

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- Soil attains equilibrium with the fully matured compost.
- It provides conditioning to the soil.

Vermi-compost

It is a form of organic manure which is prepared with the help of earthworms activity which generally live in our environment. It is generally the excreta of earthworm which they provide us after eating the biomass.

Sewage and sludge

Nowadays the human excreta is refused from the cities in various channels which consists of solid waste known as sewage and the liquid portion as sludge. It contains 3-6%N, 2 % P_2O_5 and 1% K_2O.

Sheep and goat manures

The excreta of sheep and goats is said to have various beneficial properties to the soil as it contains 3.0 %, 1.0 % and 2.0 % of N, P_2O_5 and K_2O, respectively.

Poultry manure

This type of manure contains the excreta of birds which shows very quick decomposition and contains 3.03%, 2.63 %and 1.4 % of N, P_2O_5 and K_2O, respectively.

Concentrated organic manures

These manures are said to have very high amount of nutrients in them in regards of other available manures. For example oilcakes, blood meal, fish meal and meat meal.

Oil cake

The refuse from the oilseeds is taken and dried to form a cake like substance which is known as oil cakes. These cakes are said to have a good amount of nutrients present in them and are being used as soil nutrient enhancers. These are of two types:

- **Edible oil cakes:** As the name suggests these types of oilcakes can be given to the cattles as well. For example groundnut cake, coconut cake etc.,

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- **Non edible oil cakes:** These types of oilcakes are not good for the consumption of cattles and other animals. For example castor cake, neem cake etc.

Both of them are used as manures to improve the nutrient concentration of the soil. After 8-11 days of application these oilcakes the mineralizations of these oilcakes provide a good amount of nutrients to the soil. For their quick and easy absorption by the plants these oilcakes must be applied in crumbled or powdered form to the soil.

Blood Meal

Slaughter houses refuse which include blood contains good amount of nitrogen and can be used as a fertilizer for the soil after its proper drying, this type of fertilizer is known as blood meal.

Fish meal

It is another commercial product mostly made from fish that are not generally used for human consumption; a small portion is made from the bones and left over from processing fish used for human consumption. The fish and leftover fish material is dried and then are made into powder form so that it can be easily applied in the soil.

Bio-fertilizers

The term 'Bio' in bio fertilizers itself refers to the living organisms. It consists of specific microorganisms which are good for the soil and help in increasing the nutrient content of the soil which includes fixation of atmospheric nitrogen or solubilization of phosphorus present in the soil or by stimulating plant growth through synthesis of growth promoting substance. Bio-fertilizers which are based on renewable energy source are eco-friendly and can also help in reducing the use of various chemical fertilizers which are very costly.

- Bio-fertilizers such as *rhizobium* culture is an effective source of N supply to leguminous corps. Phosphate solubilizing bacteria *viz.*, *Bacillus aspergillus* help in making available soil P to the crops and increase the solubility of indigenous sources of P like rock phosphate.

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- Bio-fertilizers are eco-friendly in nature and cause no harm to the soil as well as environment. Various bio-fertilizers are being used nowadays to enrich the soil with nutrients.
- Wheat, maize, mustard, cotton, potato and other vegetable crops are being grown along with the use of *Azotobacter*.
- Sorghum, millets, maize, sugarcane and wheat have been seen with grown using *Azospirillum*.
- Paddy crop which is grown in upland and low-land conditions are inoculated with *Nostoc* or *Anabaena* which help in fixing the atmospheric nitrogen and improving the nitrogen content of the soil.

Conclusion:

Application of chemical fertilizers, insecticides and pesticides is deteriorating the soil quality and are responsible for serious health consequences of human beings too. Application of nutrients from diverse sources help in maintaining soil health and plays significant role in augmenting the population of beneficial microorganisms. Therefore, in order to fulfil the food requirement of increasing world's population and to keep our natural resources sustained for better future, integrated nutrient management can be a useful strategy.