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# Nutrient Management Practices in Organic Farming

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## Introduction

What is organic agriculture?

- An ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity.
- It is based on minimal use of off-farm inputs and on management practices that restore, maintain or enhance ecological harmony.
- The primary goal of organic agriculture is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people.
- In simple words, it is a practice that does not use or limited the use of any chemical fertilizers, pesticides, growth regulators and genetically modified organisms (GMOs).

## Background of Organic Agriculture in India

- Organic farming in Indian context is not an uncommon word itself.
- Over a century, resource poor farmers are doing such practices in **traditional way** which is similar to organic farming and **farmers' knowledge and skills** about organic farming would be positive point for promoting organic farming in India.
- Besides, the ecological advantages have proved that India has **potential to produce** quality organic fruits, vegetables, tea, coffee, cardamom, vegetable seeds, mushroom, honey and medicinal plants & herbs.
- In the past, the conventional agricultural practices focused on short-term productivity goal and paid little attention to available local resources both natural and human endowments.

## Nutrient management in organic farming

The management of nutrients in organic farming systems presents a formidable challenge, as the use of inorganic fertilizers is not permitted.

- Therefore organic must optimize a range of soil, crop rotation and manure managements to ensure a nutrient supply which will guarantee **optimum crop yields** and **minimize losses to the environment.**
- To achieve this objective, an appreciation of the **nutrient cycles** in **farming systems** is essential which is possible through various practices.

## Nutrient management practices

Crop rotation, Cover cropping, Addition of compost/FYM, Application of green manures, Application of crop residues, Supplemental application of organically approved amendments, Animal manures and Use of biofertilizers

## Crop rotation

- The practice of growing a sequence of plant species on the same land.
- One of the very basic building blocks of organic farming systems.
- The crop rotation in organic farming must provide the soil fertility required for maintaining productivity and it must prevent problems with weeds, pests and diseases.
- A proper sequence of crops in time and space and through the use of $N_2$ fixing crops and cover crops.

## Cover cropping

- Pivotal parts of every organic farmer's management scheme.
- They are crucial to the **main goals** of building **soil health and preventing soil erosion.**
- Tools for **increasing fertility** and **controlling weeds**, **pathogens** and **insects** in organic crops.
- Non leguminous cover crops, typically grasses or small grains, do not fix nitrogen but can be effective in recovering mineralized nitrogen from soil after crops are harvested.
- When legume or grass cover crops are killed and incorporated into the soil, living microorganisms in the soil go to work to decompose plant residues.
- The biomass nitrogen is mineralized and converted first to ammonium ($NH_4$) and then to nitrate compounds ($NO_3$) that plant roots can take up and use.

## Addition of Compost/FYM

- A biological process that requires careful monitoring of air and moisture levels in compost piles or windrows to produce specific temperature ranges that promote the growth of beneficial microorganisms.
- The regular addition of compost is one of the best ways **to enhance soil organic and humic content**, which helps to build a **fertile soil structure.**
- Populations of microorganisms that make soil come alive with productivity and enable plants to battle diseases and pests thrive in such an environment.
- A way to recycle manures and plant residues that otherwise might present some environmental problems.
- Soil with 4% OM contains 4000 lbs total nitrogen/acre

## Application of Green manures

A practice of ploughing or turning into the soil, undecomposed green plant tissues for the purpose of improving the soil fertility.

**Objective:** To add an organic matter into the soil and thus, enrich it with 'N' which is most important and deficient nutrient.

## Types of green manuring

1. Green manuring *in-situ*: When green manure crops are grown in the field itself either as a pure crop or as intercrop with the main crop and buried in the same field, it is known as Green manuring *In-situ.* E.g.: Sannhemp, Dhaicha, Pillipesara, Shervi, Urd, Mung, Cowpea, Berseem, Senji, etc.
2. Green leaf manuring: It refers to turning into the soil green leaves and tender green twigs collected from shrubs and trees grown on bunds, waste lands and nearby forest area. E.g.: Glyricidia, wild Dhaicha, Karanj.

## Application of crop residues

- ⇨ Serve as soil cover and organic manure.
- ⇨ Both the amounts produced and their nature varies between crop types.
- ⇨ For example, cereal straw contains only around 35 kg N/ha and has a wide C:N ratio, compared with more than 150 kg N/ha for some vegetable residues, with a narrow C:N ratio.
- ⇨ The narrow C:N ratio of green leafy residues means that N is released much more rapidly than from cereal straw.

## Supplemental application of organically approved amendments

- ⇨ Soil amendments are also known as **conditioners**.
- ⇨ Improve soils structure and ultimately its ability to deliver water, air, and nutrients to plants.
- ⇨ Encourage nutrient recycling by developing the innate structure of a soil.
- ⇨ Organic amendments are the safest and most effective means to promoting soil fertility.

  For acidic condition: Apply lime but depends on crop rotation and soil conditions.

  For alkali condition: Apply gypsum

## Animal manures

- ⇨ Poultry and animal manures also provide nutrients to the plants.
- ⇨ Fresh manure, especially slurry and poultry manure, contains considerable proportion of N in readily available (principally ammonium-N) forms, which can be easily and rapidly lost to the atmosphere.
- ⇨ Animals and poultry should be fed with organic feeds.
- ⇨ High organic matter and macro nutrients

## Bio-fertilizers

- ⇨ One of the important components of **integrated nutrient management**

- **Cost effective** and **renewable source** of plant nutrients to supplement the chemical fertilizers for sustainable agriculture
- Accelerate certain microbial processes in the soil which augment the extent of **availability of nutrients** in a form easily assimilated by plants.
- Several microorganisms and their association with crop plants are being exploited in the production of biofertilizers.

| Sr. No. | Groups | Examples |
|---|---|---|
| **N2 fixing Biofertilizers** | | |
| 1 | Free-living | Azotobacter, Beijerinkia, Clostridium, Klebsiella, Anabaena, Nostoc, |
| 2 | Symbiotic | Rhizobium, Frankia, Anabaena azollae |
| 3 | Associative Symbiotic | Azospirillum |
| **P Solubilizing Biofertilizers** | | |
| 1 | Bacteria | *Bacillus megaterium* var. phosphaticum, *Bacillus subtilis* , *Bacillus circulans*, *Pseudomonas striata* |
| 2 | Fungi | Penicilliumsp, Aspergillusawamori |
| **P Mobilizing Biofertilizers** | | |
| 1 | Arbuscularmycorrhiza | Glomus sp., Gigaspora sp., Acaulospora sp., Scutellospora sp. & Sclerocystissp |
| 2 | Ectomycorrhiza | Laccaria sp., Pisolithus sp., Boletus sp., Amanita sp. |
| 3 | Ericoid mycorrhizae | Pezizellaericae |
| 4 | Biofertilizers for Micro nutrients | Orchid mycorrhiza, *Rhizoctonia solani* |
| **Biofertilizers for Micro nutrients** | | |
| 1 | Silicate and Zinc solubilizers | Bacillus sp. |
| **Plant Growth Promoting Rhizobacteria** | | |
| 1 | Pseudomonas | *Pseudomonas fluorescens* |

## Conclusion

- Optimizing soil 'health' is the foundation of organic agriculture.
- Emphasis being placed on maintaining high levels of soil biological activity and organic matter, coupled with balanced / optimum nutrient levels.
- Organics aims to 'feed the soil to feed the crop' by maintaining soil biology and nutrients at optimum levels throughout the rotation rather than the non-organic approach of applying nutrients to feed the current crop to maximize yield.
- Organics therefore takes a long term, whole farm / systems approach to nutrient management based on regular soil tests and nutrient budgets to determine when soil nutrients must be replaced.