Chapter - 24
Fortification: Components of Organic Agriculture

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Introduction

Fortification of a component means to increase its efficacy so that the soil is enriched from basic, macro and micronutrients to well development and growth of crop and enhance the biological activities inside the soil as well as enhance the efficiency of crop competitors controlling measures (bio-herbicide etc.).

We live in an era of increasing crop production based on food demand, evenly nutrients and other agricultural resources are increasing that causing soil degradation and environmental pollutions (air, water etc.) are at their peak *(Anonymous).* For its solution, important steps taken by the Central and State government like organic farming, use of Indigenous Technology Knowledge (ITKs) etc. but for its expansion, it is necessary for the farmer to engage in organic farming. At present, farmers are not taking any interest in organic farming, this is justified because the components or resources of organic farming are bulky as well as the farmer has to spend a lot of time to prepare the means and it is also very less in practice.

Fortification of compost and Farm Yard Manure (FYM)

Composts become fortified compost after nutrient enrichment and blending with Plant growth-promoting rhizobacteria (PGPR), presence of PGPR in the rhizosphere significantly increases plant growth and yield under nitrogen limiting conditions. This new technology can certify the lower application rates of compost (300-500 Kg/ha as compared to the normal application of 1-2 tonnes/ha) and can reduce up to 50 % of the recommended dose of inorganic fertilizers *(Anwar 2015).* In addition, the compost can also be fortified with plant growth promoters like cytokinin, gibberellins (GA) etc. which promote the growth of plants. India has enough potential for providing the nutrients through animal excreta base organic manures, Indian farmers have enough animal excreta, but hardly few farmers utilized it as processed or form of compost. Remains farmers just apply it in the field without taking care

as immature and un-decomposed material, which is high in temperature resulting in non-nutritive residues leading to release of harmful pathogenic microbes, besides that such immature material application with a wide C: N ratio negatively affects productivity due to created deficiency of nitrogen in the soil as well as promote the infestation of disease and insect-pest.

For FYM low quality organic materials *e.g.* maize stover or wheat straw with a wide C: N ratio are desirable for preparing fortified compost. The procedure for fortifying such organic materials is: to abridge crop residues into 30-45 cm lengths to increase their surface area. Spread the chopped material in five consecutive layers of 30 cm high by 2.0 m wide into winrows 25 m long (500 kg in each layer). At every 30 cm layer, evenly broadcast 3.75 kg DAP (or any other nitrogen-bearing fertilizer) and rock-phosphate for fortification lowering the C: N ratio from 80 to about 12. Apply 1.0 kg of organic soil equally as a "starter inoculants". FYM, sugarcane mill filter mud or pond sediments are the best materials for this purpose. Apply 20 liters of water at the same height to increase the solubility of fertilizers and to moisten the stover for microbial activity. Repeat steps 1 to 5 until the 25 m winrows are 1.5 m in height. Turning compost is important as it checks for proper mixing, wetting, aeration and decomposition (ICAR 2016).

Fortification of Vermicompost

Vermicompost is a worthful organic fertilizer and soil stabilizer used in the production of high-value crops and also in organic agriculture. Vermicompost is produced by the nonfeasance of organic feed by the function of earthworms (soil fauna). It is generally accepted as a rich source of plant nutrients thus increasing the value of the vermicompost product through fortification with micronutrients like Fe, Zn, Cu and Mn. Generally, soil organic matter is deficient in humic acid and is mainly insoluble in acidic soil. The earthworm canal is the place of production of bonafide humic acids which are discretely from the polysaccharide humic acid. In the way of fortification, in the method of preparing vermicompost we separate the earthworm from the compost by strainer in the last resultant made normal vermicompost but if the earthworm is not separate from the compost and applies as it as in the soil so long as the earthworm live gum secreted in form of mucoproteins that help to stabilize pore space distribution. And on death, its cast and dead tissue become available on about 60 to 90 kg N/ha.

Fortification of green manure

Green manure practices boost nitrogen supply. Green manuring practices not only improve nitrogen saving but also have many other essential/beneficial

effects on the soil environment. It can be reduced up to 50-75 % of the recommended dose of inorganic fertilizers in the rice field. Mostly, leguminous (Sesbania, cowpea and sunhemp) are used as green manuring crops for those having a narrow C: N ratio. Green manuring promotes the number of nutrients when the following actions are performed: Soil incorporation before 7 to 14 days sowing main crop, mostly green manuring of Cowpea and others have 45 days old gave better result, selection of green manuring crop based on soil texture for example: in coarse-textured soil dhaincha (Sesbania spp.) green manure more effective. Green manure influences the availability of the nutrients through its favorable effects on the oxidation-reduction regime, pH and increased chelation capacity.

Fortification of Biofertilizer

Biofertilizers are the substances that contain living tissue of the micro-organism that has capable to mobilise nutrients from non-usable forms through a biological process. Rhizobium, Azospirillium and Azotobactor are some biofertilizers that have been used as seed inoculation. The Rhizobium in legumes symbiotically meets more than 80% N needs of legume crops and increases the yield of crops by 10-15%. Biofertilizers have been prepared for a large number of vegetable crops and their use enhanced 8-21% yield of aboveground crops and 25-50% yield of underground crops as well as increased nutrient use efficiency by 12-36% of Nitrogen, 18-29% of Phosphorus, 9-15% of Potassium (Kalium) and 16-18% Sulphur *(AINP on Biofertilizers Res. Report, 2004-07, IISS, Bhopal).* From the point of view of fortification, we prefer mixed biofertilizers like BIOMIX are used as a combination of N fixers, PGPR (plant growth-promoting rhizobacteria) as P solubilizer, has been found to promote the growth of cereals, legumes and oilseeds better than their special application. As we have seen above that the aboveground crop yield is decreased compared to underground crops in response to biofertilizer, so for this we can increase the crop yield as well as the efficiency of biofertilizer through foliar application.

Fortification of Bio-herbicide

Bioherbicides are herbicides consisting of phytotoxins, pathogens, and other microbes used as biological weed control. Bioherbicides may be compounds and secondary metabolites derived from pathogen (fungi, bacteria and virus); or phytotoxic plant residues, extracts or single compounds derived from other plant species/competitive plants *e.g.* Paragrass is highly competitive to the growth of *Typha sp.* Its fortification can be done by using specific/targeted bio-agent for weed control in our crop some noteworthy

example is the destruction of *Lantana camera* with the help of *Teleonemia scruplosa* and successful control of *Parthenium hysterophorus* has been reported with the help of Mexican beetle *Zygogramma bicolorata (ICAR 2016)*. Some other examples of bioherbicide are DeVine-Citrus, Collego-Rice, Biopolaris-Rice and Wheat (Reddy 2014).

Advantages of fortification

- The overall costs of fortification are extremely low; the price increase is approximately 1 to 2 per cent of the total component value.
- Fortified components have more effective than genuine component.
- Provides nutrition without any change in characteristics of the component.
- Increase the solubility of phosphatic fertilizers.
- Reduce the quantity of applied compost or vermicompost.
- Its not required extra labor or wages or capital.
- This can be done very easily.
- It does not have any detrimental effect on the crops.

References

ICAR (2016). Handbook of Agriculture, Soil fertility, Fertilizers and Integrated Nutrients use. Reddy, SR (2020). Principles of Organic Farming, Organic Nutrient Resources.

Reddy, SR (2014). Principles of Agronomy, Weed Management.

Anwar A. 2015. 'Fortification of Compost Through Microbes and Inorganic Fertilizer in Cereal- Legume Intercropping System'. Ph.D. thesis. Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi, Pakistan.