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LOW-COST ORGANIC FARMING COMPONENTS

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The organic farming system in India is not new and is being followed since ancient times. It is a method of a farming system which primarily aimed at cultivating the land and raising crops in such a way, as to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution-free environment. With the increase in population, our compulsion would be not only to stabilize agricultural production but to increase it further in a sustainable manner. The scientists have realized that the 'Green Revolution' with high input use has reached a plateau and is now sustained with diminishing return of falling dividends. Thus, a natural balance needs to be maintained at all costs for the existence of life and property. The obvious choice for that would be more relevant in the present era when these agrochemicals which are produced from fossil fuel and are not renewable and are diminishing in availability. It may also cost heavily on our foreign exchange in future.

So; for sustained agriculture, organic farming is the only option. But there are few misconceptions in farmers regarding the higher cost of the components of organic farming. But there are low-cost components that can be used in organic farming effectively.

Components of Organic Farming

Major components of organic farming are crop rotation, maintenance and enhancement of soil fertility through biological nitrogen fixation, the addition of organic manure and use of soil microorganisms, crop residues, bio-pesticide, biogas slurry, waste, etc. Vermiculture has become a major component in biological farming, which is found to be effective in enhancing soil fertility and producing large numbers of horticultural crops in a sustainable manner. The various low-cost components of organic farming have been discussed in detail below:

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1. **Crop rotation:**

It is a systematic arrangement for the growing of different crops in a more or less regular sequence on the same land covering a period of two years or more. The selection of optimal crop rotation is important for successful sustainable agriculture. Crop rotation is very important. Soil fertility management, weed, insect, and disease control. Legumes are essential in any rotation and should be 30 to 50 percent of the land. Mixed cropping, pasture, and livestock system are desirable or even essential for the success of sustainable agriculture. For proper crop rotation, no specific cost is required to adopt this technology.

2. **Crop Residue:**

In India, there is a great potential for utilization of crop residues/ straw of some of the major cereals and pulses. About 50% of the crop residues are utilized as animal fed, the rest could be very well utilized for recycling of nutrients. Adequate care is required to use the residues after proper composting with efficient microbial inoculants. While the incorporation of crop residues e.g. Wheat and Rice straw, as such or inoculated with fungal species had beneficial effects on crop yields and important in Physico-chemical properties of soil.

3. **Organic manure:**

The organic manure is derived from biological sources like plant, animal and human residues. Organic manure act in many ways in augmenting crop growth and soil productivity. The direct effect of organic manure relates to the uptake of humic substances or its decomposition products affecting favourably the growth and yield of plants. Indirectly, it augments the beneficial soil microorganisms and their activities and thus increases the availability of major and minor plant nutrients.

1. **a) Bulky organic manure:** It generally contains fewer amounts of plant nutrients as compared to concentrated organic manure. It includes FYM, compost and Green manure.

- **FYM:** It refers to the well-decomposed mixture of dung, urine, farm litter and left over or used up materials from roughages or fodder fed to the cattle. The waste material of cattle shed consisting of dung and urine soaked in the refuse is collected and placed in trenches about 6 m long, 2 m wide and 1 m deep. Each trench is filled up to a height of about 0.5 m above the ground level and plastered over with slurry cow dung and earth. The material is allowed to decompose undisturbed 3-4 months for anaerobic

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microorganism for completion of fermentation. FYM becomes ready to apply after 3-4 months. Well-rotted FYM contains 0.5% N, 0.2% P205 and 0.5% K2O.

- **Compost:** Large quantities of waste material are available as vegetable refuse, farm litter, such as weeds, stubble, bhusa, sugarcane trash, Sewage sludge and animal waste in houses and in areas like human and industrial refuse; therefore, excreta can be converted into useful compost manure by conserving and subjecting these to a controlled process of anaerobic decomposition. Compost is used in the same way as FYM and is good for application to all soils and all crops.
- **Green Manuring:** It is a practice of ploughing or turning into the soil undercomposed green plant tissues for the purpose of improving physical structure as well as the fertility of the soil. From time immemorial turning in a green crop for improvement of the conditions of the soil has been a popular farming practice. Green Manuring, wherever feasible, is the principal supplementary means of adding organic matter to the soil. It consists of the growing of quick growing crop and ploughing it under to incorporate it into the soil. The green manure crop supplies organic matter as well as additional nitrogen, particularly if it is a legume crop, which has the ability to fix nitrogen from the air with the help of its root-nodule bacteria. A leguminous crop producing 25 tones of green matter per hectare will add about 60 to 90 kg of nitrogen when ploughed under. This amount would equal an application of 3 to 10 tones of FYM on the basis of organic matter and its nitrogen contribution. The green manure crops also exercise a protective action against erosion and leaching. The most commonly used green manuring crops are: Sunhemp (Crotalaria juncea), Dhaincha (Sesbania aculeata), Cluster bean (Cyamopsis tetragonoloba), Senji (Melilotus parviflora), Cowpea (Vigna catjang, Vigna sinensis), Berseem (Trifolium alexandrium).

4) Biofertilizers:

It has been observed that there is decline in crop yield due to continuous apply of inorganic fertilizers. Therefore, increasing need is being felt to integrate nutrient supply with organic sources to restore the health of soil. Bio-fertilizer offers an economically attractive and ecologically sound means of reducing external inputs and improving the quality and quantity of internal sources. Bio-fertilizer is microorganism's culture capable of fixing atmospheric nitrogen when suitable crops are inoculated with them. The main inputs are microorganisms,

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which are capable of mobilizing nutritive elements from non-usable form to usable form through biological process. These are less expensive, eco-friendly and sustainable. The beneficial microorganisms in the soil that are greater significance to horticultural situations are biological nitrogen fixers, phosphate solubilisers and mycorrhizal fungi. The Biofertilizers containing biological nitrogen-fixing organism are of utmost importance in agriculture in view of the following advantages:

- They help in the establishment and growth of crop plants and trees.
- They enhance biomass production and grain yields by 10-20%.
- They are useful in sustainable agriculture & suitable for organic farming.
- They play an important role in Agroforestry / silvipastoral systems.

Types of Biofertilizers: There are two types of bio-fertilizers.

1. **Symbiotic N-fixation:** These are Rhizobium culture of various strains which multiply in roots of suitable legumes and fix nitrogen symbiotically. Almost 50% demands of N are met by these microorganisms in legumes.

- **Rhizobium:** It is the most widely used biofertilizers, which colonizes the roots of specific legumes to form tumours like growths called rot nodules. It is these nodules that act as factories of ammonia production. The Rhizobium legume association can fix upto 100-300 kg N/ha in one crop season.

2. **Asymbiotic N-fixation:** This includes Azotobacter, Azospirillium, BGA, Azolla and Mycorrhizae, which also fixes atmospheric N in a suitable soil medium. They grow on decomposing soil organic matter and produce nitrogen compounds for their own growth and development, besides leaving significant amount of N in the surroundings.

- **Azotobacter:** Application of Azotobactor has been found to increase the yields of wheat, rice, maize, pearl millet and sorghum by 0-30% over control. The beneficial effect of Azotobactor biofertilizers on cereals, millets, vegetables, cotton and sugarcane under both irrigated and rainfed field conditions have been substantiated and documented (Pandey and Sushil Kumar, 1989). Apart from nitrogen this organism is also capable of producing antibacterial and anti-fungal compounds, hormones and siderophores.
- **Azospirillium:** It is an important bacterium, which colonize the root zones and fix nitrogen in loose association with plants. The crops which response to Azospirillum is

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maize, barley, oats, sorghum, pearl millet and forage crop. Azospirillum applications increase gain productivity of cereals by 5-20%, of millets by 30% and of fodder by over 50%.

- **Blue Green Algae:** The utilization of blue-green algae as biofertilizers for rice is very promising. Recent researches have shown that algae also help to reduce soil alkalinity and this opens up possibilities for bio-reclamation of such inhospitable environments.
- **Azolla:** A small floating fern, Azolla is commonly seen in low land fields and in shallow fresh water bodies. This fern harbours blue-green algae, anabaena azollae. The Azolla anabaena association is a live floating nitrogen factory using energy from photosynthesis to fix atmospheric nitrogen amounting to 100-150 kg N/ha/year from about 40-64 tones of biomass (Hamdi, 1982; Singh, 1988).
- **Mycorrhizae:** Mycorrhizae are the symbiotic association of fungi with roots of Vascular plants. The main advantage of Mycorrhizae to the host plants lies in the extension of the penetration zone of the root fungus system in the soil, facilitating an increased phosphorous uptake. In many cases the Mycorrhizae have been shown to markedly improve the growth of plants. In India, the beneficial effects of Vascular-arbuscular Mycorrhizae (V AM) have been observed in fruit crops like citrus, papaya and litchi. Recent studies showed the possibility of domesticating Mycorrhizae in agricultural system (Hayman, 1982; Tilak, 1987).

5) Vermicompost:

It is organic manure produced by the activity of earthworms. Compost is made with the use of earthworms that generally live in soil, eat biomass and excrete it in digested form. It is generally estimated that 1800 worms which is an ideal population for one sq. meter can feed on 80 tones of humus per year. These are rich in macro and micronutrients, vitamins, growth hormones and immobilized microflora. The average nutrient content of vermicompost is much higher than that of FYM. It contains 1.60% N, 5.04% P_2O and 0.80% K_2O with small quantities of micronutrients. Application of vermicompost facilitates easy availability of essential plant nutrients to crop.