A) ORGANIC FARMING

Lecture No. 1

Organic Farming – Introduction, Concept, Advantages and Disadvantages, Relevance in Present Context, Organic Production Requirements.

Introduction :

- During the Green Revolution era, the excessive and inappropriate use of the pesticides and fertilizers has led to a contamination of food, water and fibre in several countries, and thus resulting in overall deterioration in soil health and environmental quality.
- The Green Revolution has increased agriculture production substantially but simultaneously the issue of sustainability has become increasingly prominent.
- The growth rate of land productivity has come down.
- Such concerns and problems posed by modern day agriculture gave birth to new concepts in farming such as **Organic Farming.**

Definition :

Organic Farming :

"Organic Farming is a holistic production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycle and soil biological activity."

OR

"Organic Farming is production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives."

OR

"Organic Farming is a holistic system whose primary goal is to optimize the health and productivity of interdependent communities of soil life, plants, animals and people."

Concept of Organic Farming :

The term 'Organic' is not directly related to type of inputs used, but refers to the concept of the farm as an organism, in which all the component parts i.e. soil mineral, organic matters, micro-organisms, plants, animals and humans interact in a coherent manners.

Organic Farming is considered to be a self-sustaining system of agriculture and also attractive alternative to high input chemical based production system.

This system maintains the soil productivity and controls the pest and diseases by enhancing natural process and cycles in harmony with natural environment.

This production system avoids or largely excludes the use of synthetic fertilizers, growth regulators; livestock feed additives and genetically modified crops (G.M.O.).

Organic farming system solely depends on the use of on-farm and off-farm crop residues, organic wastes, animal manures, green manures, crop rotations, incorporating legumes and biological pest and disease controls to maintain soil productivity.

The philosophy is to feed the soil rather than the crops to maintain soil health.

So the objective of environmental, social and economic sustainability lies at the heart of organic farming.

.....

Why to go for Organic Farming?
OR
Advantages of Organic Farming

The excessive use of fertilizers and insufficient use of organic has led to decrease in soil fertility and health.

Air and water pollution has become serious.

Agricultural chemicals including pesticides, harmones and antibiotics leave resides in soil that eventually get into the food chain causing the health and environmental problems (mainly various forms of cancer and reduced bodily immunity).

As a result of modern agriculture several farmers got debt-laden, that's why farmers committing suicide in growing numbers with every passing year.

But Organic Farming has the capability to take care of each of these problems.

Organic Farming greatly helps a farmer to become self sufficient in his requirements for agro inputs and reduce his costs.

Advantages :

1) It helps to maintain environment health by reducing the level of pollution.
2) It reduces the human and animal health hazards by reducing the level of residues in the product.
3) It helps in keeping agricultural production at a sustainable level.
4) It reduces the cost of agricultural production and also improves the soil health.
5) Improve soil physical & chemical properties
6) optimal conditions in the soil for high yield & good quality crops
7) Improve plant-growth physiological activities
8) Reduce the need of purchase inputs
9) organic foodhas increasing consumer demand
10) organically grown plants are more resistant to disease & pest (ii) provide healthier & nutritionally

5) It ensures optimum utilization of natural resources for short-term benefit and helps in conserving them for future generation.
6) It not only saves energy for both animal and machine, but also reduces risk of crop failure.
7) It improves the soil physical properties such as granulation, good tilth, good aeration, easy root penetration and improves water holding capacity and reduce erosion.
8) It improves the soil's chemical properties such as supply and retention of soil nutrients, reduces nutrient loss into water bodies and environment and promotes favorable chemical reactions.
9) Organically grown crops are believed to provide more healthy and nutritionally superior food for man and animals than those grown with commercial fertilizers.
10) It encourages and enhances the biological cycles within farming system.
11) It maintains and increases the long-term fertility of soils.

Myths or challenges (disadvantages) attached to Organic farming: (Constraints) :

1) Yields in organic farming are less than chemical farming.
   In case of chemical farm converting to organic however, there is often a loss in yield and it takes a few years to attain higher productivity. (Fear of drop in productivity).
2) We can not supply enough nutrients by using composts / organic amendments.
3) Difficult to achieve food production target.
4) No consistency in implementing organic farming.
5) Quality of organic resources is many times remains doubtful, further no control on marketing of industrial organic manure.
6) No guidelines available for organic policy, establishment of organic farms, certification, marketing of organic produce, standards etc.
7) Pest control through organic means is another challenge in farming.
8) Difficulties in obtaining reliable information on domestic and international market for organic products are another obstacle.

Relevance in present context / Status of Organic Farming :

At present farmers are widely adopting the traditionally prepared organic inputs for raising the different high value crops.

Following are the organic preparation used as a input for raising the different crops.

① write in brief regarding different preparati
used as input for organically raising crops

1) Bijamrit: For seed treatment.

About 10 to 15 kg soil from underneath Baniyan tree + 10 kg cow dung + 250 gm cow ghee + 500 gm honey + water – slurry is used for treating the seeds.

2) Jivamrit : For foliar application / irrigation.

10 kg cow dung + 10 litre Urine + 2 kg Jaggery + 2 kg pulse flour + 25-30 gm Biofertilizers or soil + 200 lit. Water, mix it well, ferment the same for 5 to 6 days and then use it for 0.40 ha area.

3) Amritpani : For foliar spray / through irrigation.

10 kg cow dung + 250 gm cow ghee + 500 gm honey or jaggery + 200 lit. Water, mix thoroughly and use it for 0.40 ha. area.

4) Varmiwash : For foliar spray.

Plastic drum(50-60 lit. capacity) with the small hole at bottom, cover the hole with the pieces of bricks and course sand, cover it with mesh. Fill it with half decomposed cow dung, add 1 kg earthworm and add 1 lit. Water daily. Collect the drain out fluid. Use this fluid for foliar spray @ 1 lit. in 50 lit. of water, it will supply the nutrients and also useful for the plant protection purpose.

5) Dashparni ark : For preparations of dashpasni ark use.

1 kg leaves of neem, custard apple, Beshram, Nirgudi, Karanj, Ghaneri, white dhatura, Jathropha, Korphad, Adulsa / Castor, add 20 lit. Cow urine in the plastic drum for fermentation for eight days. Filter the extract and use @1 lit. extract in 10 litre water for plant protection.

The organic farming movement in India is led by the members of **"International Federation of Organic Agriculture Movements" (IFOAM) (1972) with its headquarters at Bonn (Germany).**

Its members in India is **All India Federation of Organic Farming (AIFOF).** AIFOF works on lines similar to other international agencies. It has the necessary infrastructure for the purpose of approval and granting the license to farmers or the producers, allowing them to use **"Certified Organic"** as a symbol of their production.

APEDA : In India, **"Agriculture and the Processed Food Products Expert Development Authority"** is the key accreditation agency.

The National Programme for the Organic Production (NPOP) was initiated by the Govt. of India in May 2000 for specially looking at all the issues associated with the Organic Farming.

The Govt. of India is also taking keen interest in promoting the Organic Farming and has set up a **National Institute of Organic Farming (NIOF) at Ghaziabad, H.P.**,

As per the report published by APEDA (2005-06), more than 25,000 farms with an area of 1.18 lakh hectors in India have been certified as Organic Farm

INM → An intensive but suitable combined use of ... organic source of Nutrients

① It helps to restore & sustain soil fertility & crop. prod.
② checks emerging deficiency of nutrients other than NPK
③ favourable effects phy. chem. bio. environmental of soil

with **3.47 lakh** metric tons of production. Out of total organic produce, **15037 metric tons** were exported earning **Rs. 516.29 crores.**

Table 1. Major organic agriculture adopting countries and India's position 2003.

Sr. No.	Country	Organic Area (ha)	% of total agriculture area	Numbers of organic farmers
01	Australia	105,00,000	2.31	1380
02	Argentina	31,92,000	1.89	1900
03	Italy	12,30,000	7.49	56,440
04	USA	9,50,000	0.23	9949
05	United Kingdom	6,79,631	3.96	3981
06	Uruguay	6,78,481	4.00	334
07	Germany	6,32,165	3.70	14,703
08	Spain	4,85,079	1.66	15,607
09	Canada	4,30,600	0.58	3236
10	France	4,19,750	1.40	10364
11	India	41,000	0.03	5661
	Total	228,11,267		3,98,804

Organic Production Requirement:

1)Neem Seed:

The current demand for quality neem seed is approximately 1,85,000 tonnes as against a supply of 1,50,000 tonnes.

Biological I.N. Management :-

1) It means the judicious & interactive / combine use of different organic resources of nutrients for agricultural production has proved superior to the use of each source seperately
2) It helps to restore soil fertility & crop productivity.
3) Helps to check the emerging deficiency of nutrients other than N P K
4) favourably it effects the physical, chemical & biological environment of soils

Components

① organic manures → fym, compost, greenm, V.compost, oil cake, animal
② Biofertilizer → Azotobacter, Azospirillium, Azolla, BGA, Rhizobium, phos
③ cropping system → Crop rotation, Intercropping, mixed cropping, sequential cropping
④ mulching →

① Describe the types of organic inputs used in organic farming & describe organic manure

② Enlist- all the organic sources of plant nutrients

Lecture No. 2

Biological Intensive Nutrient Management : Organic Manures : FYM, Compost, Vermi Composting, Green Manuring, Bio-fertilizers.

- A goal is to increase organic matter and nutrients to a more healthy level in the soil. It is well recognized fact that soil organic matters is of fundamental importance in soil fertility. It is also a store house of all essential plant nutrients and provide energy material for the soil organisms.
- Although amount of soil organic matters in soil of India is relatively low (ranging from 0.1 to 1.0% and typically less than 0.5%)
- Its influence on soil fertility and physical condition is of great significance.
- Organic manures and crop residues are important sources of plant nutrients.
- Livestock manure is traditionally a key fertilizer in Organic Farming. It is most effectively used in combination with others sustainable practices like Green manuring, Biofertilizers, etc.

Organic Manures (Types)

1) Farm Yard Manure:

- This is only available input to the farmers.
- It is well known that FYM improves the soil physical properties by improving soil aggregation, aeration and water holding capacity.
- From the research conducted during past years, it is recommended that it is essential to add 20 t. of fym / ha. before planting, for good crop growth and maintaining the soil health.

A) Animal / Bird Origin :

Animal	% N	% P_2O_5	% K_2O
Dairy Cow	0.57	0.25	0.62
Sheep / Goat	1.44	0.50	1.21
Chicken	1.00	0.80	0.39

B) Urine :

It is extremely valuable manure as it contains a higher proportion of nitrogen. Urine should not be used fresh but kept for a few days then diluted at a ratio of 1 to 4 with water and then we can apply.

C) Poultry Manure :

- The excretion of birds contains both solid and liquid parts and hence there is no urine loss.
- The decomposition rate of poultry manure is very quick.
- The fresh dropping contains 75% moisture, 1.5% nitrogen, 1.2% Phosphorus and 0.5% Potassium.
- When it is used as a fresh manure, it affects the land / crop by creating local alkalinity.

manures are plant & animal wastes that are used as sources of plant nutrients they release nutrients after their decomposition are called organic manure.

① soil amendments → Gypsum

② Explain term manure classify manures on the basis

- Therefore it is always better to preserve the nutrients by mixing with suitable amendments and appropriate microbes.

D) Bone Meal :

It contains nitrogen but its value is more for its Phosphorus and Calcium content.

E) Blood Meal :

This is concentrated organic manure and it is high in nitrogen.

2) Plant Origin :

Oil cakes :

The oil cake after extraction of oil could be used in agriculture.

Besides having high amount of plant nutrients, most of them contains alkaloids which inhibit the nitrification process of N in soil (Neem Cake).

Nutrient Content of Organic Manures :

Sr. No.	Organic Manure	N %	P_2O_5 %	K_2O %
1	FYM	0.5-1.5	0.4-0.8	0.5-1.9
2	Green Manure	0.5-0.7	0.1-0.2	0.6-0.8
3	Caster Cake	5.5-5.8	1.8-1.9	1.0-1.1
4	Neem Cake	5.2-5.3	1.0-1.1	1.4-1.5
5	Mahua Cake	2.5-2.6	0.1-0.9	1.8-1.9
6	Karanj Cake	2.5-2.6	0.9-1.0	1.3-1.4
7	Safflower Cake	4.8-4.9	1.4-1.5	1.2-1.3
8	Cotton Seed Cake	3.9-4.0	1.8-1.9	1.6-1.7
9	Groundnut Cake	7.0-7.2	1.5-1.6	1.2-1.4
10	Cotton Seed Cake (decort)	6.4-6.5	2.8-2.9	2.1-2.2

Composts : Two groups of compost : 1) Rural Compost 2) Urban Compost.

- Composting is a process of converting crop / vegetable and animal waste to a quickly utilizable condition for improving and maintaining soil fertility.
- These are produced through the action of Micro-organisms on wastes.
- Wastes may be leaves, roots and stubbles, crop residues, straw, hedge clippings, weeds, saw dust, kitchen wastes etc.
- In this process waste materials undergo intensive decomposition under medium-high temperatures in heaps or pits with adequate moisture.
- It requires 3-6 months.

Vermicompost :

The term 'Vermicomposting' means the use of earthworms for composting organic residues.

"The collection of vermicast along with microbially degraded organic compost is called Vermicompost."

Earthworms can consume practically all kinds of organic matters and they can eat as much as their own body wt per day.

In Vermicomposting process, the potentiality of microorganisms and earthworms is collectively exploited to obtain nutrient rich compost.

Vermicomposting Process : It involves following steps:

1) Selection of species:

Suitable species : *Esenia foetida. Eudrillus eugineae*

2) Selection and preparation of site:

Care : Enough organic material should be available in close vicinity on regular basis.

- Suitable containers / tanks or large composting beds are available preferably under sheds.
- Easy availability of earthworm species.
- Basic facilities for pretreatment of composting material are ready.
- Dimension : Length 3-10 m., Breadth 75-90 cm. height 30-60 cm., Distance between two beds : 75 cm.

3) Vermicomposting raw material:

- All biologically degradable and decomposable non-toxic organic matter is used in vermicomposting.
- Animal dung, agricultural waste, forestry waste, city leaf litter biogas slurry etc.

4) Vermicomposting Process: Steps involved preparation

Sorting and cleaning of organic waste

↓

Chopping

↓

Pretreatment

↓

Preparation of bed and layering of bedding material

↓

Put cow dung layer

↓

Put alternate layers of feed material and cow dung till 60 cm

↓

Allow for decomposition

↓

After temp. comes down inoculate with earthworm

↓

Put partly digested feed layer

↓

Harvest first flush of compost after 30 days and layer out

Another fresh layer

↓

Separation and sieving of vermicompost

Benefits of Vermicompost :

1) Supplying NPK, micronutrients and growth harmones
2) Neutralizes highly acidic or basic soils
3) Increases water retention power of the soil.
4) The product has a better luster, taste and keeping quality.
5) Vermicompost influences the physical and chemical as well as the biological properties of soil.
6) It improves the soil pH and reduces soil salinity.
7) Increasing Immunity against pest attack.
8) It increases porosity, aeration and infilteration.
9) It converts normal soil into rich "Living Soil".
10) Humic acid like components in vermicompost enhances the availability of both native and added micronutrients in soil.

Nutrient profile of the vermicompost in comparison to FYM.

Nutrient	Vermicompost	FYM
N %	1.6	0.5
P_2O_5 %	0.7	0.2
K_2O %	0.8	0.5
Ca %	0.5	0.9
Mg %	0.2	0.2
Fe (ppm)	175.0	146.5
Mn (ppm)	96.5	69.0
Zn (ppm)	24.5	14.5
Cu (ppm)	5.0	2.8
Cin (ppm)	15.5	31.3

.....

Green Manuring :

"It is the practice of turning into the soil, undecomposed green plant tissues for improving the structure as well as fertility of the soil".

Fast growing leguminous crops viz. Dhaincha, Sannhemp and Glericidia are used as a green manure crops, which are mainly used to improve soil fertility and soil physical properties.

It is one of the most effective and **environmentally sound method** of organic farming which minimize the use of chemical fertilizers.

An ideal green manure should posses the following traits (criteria / characteristics) :

1) It should be capable of producing large quantity of green manuring material in a short period.
2) It should be sufficient, quick growing and preferably legume.

3) It should be tolerant to drought, flood and adverse temp.
4) It should be quickly decomposable.
5) It should have low water requirement.

Advantages of Green Manuring :

1) It adds green matter and N to soil and stimulates activity of soil micro-organisms.
2) It improves the structure of the soil.
3) It increases the availability of certain nutrients like P_2O_5, Ca, Mn and Fe.
4) It also suppresses the weed growth.
5) It helps in reclamation of saline and alkaline soils.
6) Increases humus contents of soil.

Addition of plant nutrients through green manuring:

Sr. No.	Crops	Average yield of green manure (mt ha^{-1})	N %	N added (kg ha^{-1})
1	Sannhemp	9.96	0.48	75.0
2	Dhaincha	9.40	0.42	68.9
3	Green gram	3.76	0.53	34.6
4	Cow pea	7.05	0.49	50.4
5	Guar	9.40	0.34	55.0
6	Berseem	7.29	0.43	54.0

.....

1) Nitrogenous biofertilizers
a) symbiotic
① Rhizobium ② Azolla ③ Frankia
b) asymbiotic
Beijerinkia [redacted] ① [redacted] ② [redacted]
③ [redacted]
c) Associative symbiotic
Azospirillum
d) Non symbiotic
Azotobacter
Blue green algae

Phospho bio fertilizers
1) P. solubilisers & mineralisers
2) P absorbers

Biofertilizers are the products containing living cells of micro-organisms that have the ability to mobilize nutrients from non usable form through biological process.

Lecture No. 3

Biofertilizers :

"Biofertilizers are cultures of micro-organism used for inoculating seed, seedlings and soil".

"Microbial Biofertilizers are biologically active inputs and contain one or more types of beneficial micro-organisms such as bacteria, algae or fungi".

Biofertilizers are ecofriendly, low cost inputs playing a significant role in improving quality of agricultural produce and **sustaining the productivity** over a longer period of time.

Biofertilizers mobilize plant nutrients from unavailable form to available form through biological process.

Thus they increase the availability of plant nutrients.

They also improve the crop growth, yield and quality by producing **harmones.**

Rhizobia:

Rhizobia is a group of bacteria that fixes nitrogen in association with the roots of leguminous crops.

Rhizobia can fix 40-120 kgs of N per acre annually depending upon the crop.

Every leguminous crop requires a specific *Rhizobium* species.

Azotobacter :

They are **free living nitrogen fixers** and can be used for all types of upland crops but cannot survive in wetland condition.

In soils of poor fertility and organic matters azotobactes need to be regularly applied.

Azospirillum : ① spirilaceae, chemoheterotropic & associative symbiotic producting growth equlating substemce & fix 20-40 kg N/ha.

They are ② **not free-living** and live inside **plant roots** where they fix nitrogen and can be used in wetland conditions. ③ Application increased mineral & water uptake, root develop vegetative growth, rice, millets, maize, wheat, sorgh.

Acetobactor :

- Endophytic N_2 fixer mainly used in sugar rich crops like sugarcane, sugarbeet.
- Saves **40-50 %** nitrogen in sugarcane crop.
- Rate @ 4kg / acre.

Blue-Green Algae :

- These are **free-living, nitrogen fixing photosynthetic algae** that are found in wet and marshy conditions.
- It can be used only for rice cultivation when the field is flooded.

Advantages

1) supplement to chemical fertilizers, replaces 25-30% fertilizer equivalent fertilizer cost & increase grain yield by 10 to 20%.
2) No harmful effect on plant growth & soil fertility
3) secret some fungistatic & antibiotic like substemce helps to reduce

Azolla :

- Azolla is a **free-floating water fern** that **fixes nitrogen** in association with a specific species of *Cyanobacteria*.
- It is a good source of nitrogen and on decomposition a source of various micro-nurients as well.

Phosphate Solubilizing micro-organisms (Bacteria) (PSB) :

These are a group of bacteria and fungi, capable of breaking down insoluble phosphates to make them available to crops i.e. for increasing the availability of Phosphorous PSB @ 2.5 kg / ha are utilized.

Vasicular - Azbuscular Mycorrhiza (VAM) :

- Mycorrhiza is a sweeping term for a number of species of fungi which **form a symbiotic** association with the plant root system.
- Plants with VAM colonies are capable of higher uptakes of nutrients and water.
- VAM plays an important role in improving uptake of poorly mobile nutrients.
- VAM strands acts as **root extensions** and bring up water and nutrients from **lateral and vertical** distances where the plant root system does not reach. (10 kg / ha is sufficient).

Recommendations:

a) For pulses and legume oil seeds : **Rhizobia** : 250 gm / 10 kg of seed as seed treatment.

b) For non-legume crops such as Wheat, Sorghum, Maize, Cotton, Mustard : **Azotobactor** : 250 gm / 10 kg of seed as seed treatment.

c) For Jute : **Azospirillium** : 250 gm / 10 kg of seed as seed treatment.

d) Vegetables like tomato, brinjal, chilli, cabbage, cauliflower etc : **Azotobactor / Azospirillium** : 2 kg / acre as seeding root dip for 8 – 10 hrs.

e) Potato, Ginger, Turmeric, Sugarcane and Paddy : **Azotobactor / Azospirillium** : 4 kg / acre mixed with compost and applied as soil treatment.

f) Sugarcane : Use **Acetobactor** 4 kg / acre as seed set dipping.

Methods of Application :

1) **Seed treatment :** 250 gm / 10 kg of seed.

2) **Dipping of seedlings :** Dip the roots of seedlings in the suspension (2 kg biofertilizers and sufficient qt. Of water) for 30-40 minutes, before transplanting.

3) Mix 4 kg of biofertilizers in 200 kg of compost and leave it overnight. Apply this mixture in the soil at the time of sowing or planting.

Ad

a) incidence of certain diseases & increase disease resistance
b) Help in mineralisation of plant nutrients
c) -11- decomposition of plant residues
d) -11- in stimulating plant growth & expanded root system
e) Suitable in organic farming
f) useful in sustainable agriculture
g) Eco-friendly & Non pollutants

① Define bio-fertilizers & describe its different forms
② —"— state various types of biofertilizers & explain nitrogenous biofertilizer
③ Advantages & disadvantages
④ classify the different biological nitrogen fixing system found in nature with suitable example

Precautions :

1) Store biofertilizers packets in cool and dry place away from direct sunlight and heat.
2) Use the packet before expiry.
3) Do not mix with chemicals.

Definition :

Biofertilizers :

Biofertilizers are the preparation containing live or latent cells of efficient strains of micro-organism, which when inoculated into the soil provide essential nutrients to plants either by working symbiotically with plants or through solubilization of soil nutrients such as Phosphorous.

.....

1) Alkaline soil ⇒ pH. range. 7.4 to 9.1
1) Sugarcane press mud use 2nd year onwards
2) more effective for, gypsum, sulphuric acid, nitric acid, aluminium sulphate, ferric sulphate
3) 4 ton of SPM @ 2.0 t/ha⁻¹ as gypsum (applied @ 0.75 ha⁻¹ from second year & onwards in saline-alkali soils
4) Increase yield, physical properties
5) soil pH. 9.0 SPM addition 2.0 t/ha, pH, EC

2) ① molasses by-product of sugar industry
② molasses @ 5.0 t/ha & press mud @ 2.5 t/ha
③ Molasses & press mud produces organic acid in soil & neutralise alkalinity & calcium helpful to P. exchange in fixation

Lecture No. 4

Recycling of Organic Residues

- The recycling of various forms of residues has the advantage of converting surplus farm wastes into useful products.
- Which meets nutrient requirements of crops besides maintaining the soil productivity and improving the overall ecological balance.
- Some organic residues are relatively slow in decomposition, they increases **the soil productivity** by improving soil fertility to some extent and **soil physical condition** to large extent.
- Since most recyclable wastes are organic, they directly add **organic matters** and the plant nutrients contained in it.
- Organic recyclable wastes includes - crop residues, animal wastes, farm / industrial wastes, municipal and sewage wastes.

Crop Residues :

- Residues left out after the harvest of the economic portion.
- The crop residues can be recycled by the way of incorporation of compost making or mulch material.
- The availability of crop residues has been estimated to be **355.7 million** tonnes.
- ¾ fourth of the total residues are produced by rice, wheat and oilseed crops.
- The remaining ¼ are from sugarcane and sorghum.
- A sizable portion of the crop residues i.e. about 2/3 is fed to animals in India and only remaining 1/3 is available for the incorporation into the soil.

Sugarcane Trash Compost :

- The composted trash contains higher content of N (1.09 %) with reduced C:N ratio (20:1)
- **Per** ha availability of trash is about 6-8 t (overall country about 19-38 million tonnes)

Green Manuring Crops :

- Under the organic farming system, this practice is widely utilized for not only improving the nutrient and organic matter supply but also to manage weeds and pests.
- Improvement in soil **properties** and **productivity** due to the incorporation of green manure crops are observed in soils under the different agro-ecological zones.
- The most commonly grown green manure crops are Dhaincha and Sannhemp.
- It is having the potential to provide 4-5 t per ha. of dry biomass and 80-100 kg of N per ha. within 50-60 days of plant growth,

Biogas Slurry :

- Organic manures from animal wastes are very important nutrient sources in building up soil fertility.

Factors affecting decomposition of crop residue
① size of the residue ② Time of incorporation ③ Amount of residue ④ Decomposition of repeatedly added crop residue
⑤ Decomposition of residue by micro & microorganisms
⑥ —"— of residue in tropical / subtropical soil.

- Its dry slurry contains about 1.8 % N, 1.10 % P_2O_5 and 1.50 % K_2O.

Industrial Wastes :

Agro-Industrial wastes : Now a days Agro based industries and processing industries are developing fast.

Wastes generated during the processing of agricultural products can be recycled advantageously to the soil for improving the nutrient availability.

Sugar Industry Wastes : Industrial by-products like spent wash from distilleries and molasses and press mud from sugar factories have good manurial value.

At present almost all the distilleries have started co-composting of press mud with spent wash.

About 5-5.5 million tones of press mud is being produced in India annually, having potential to generate about 3-4 million tones of manure with very high nutrient content.

Recommendation - 10 tonnes/ha.

Risk husk (0.3 : 0.2 : 0.3 % N, P_2O_5 and K_2O) it should be incorporated into the wet soil.

Fruits and Vegetables produce waste : Agricultural waste. - (w)

India produces around 33 millions of fruits and 50 million tones of vegetables annually.

It is roughly estimated that 10 to 15 % of total produce is available either as **residues or biological wastes** for recycling in the agriculture.

In addition, the processing of fruits and vegetables result in the production of 5 million tones of solid wastes approximately.

Plantation crops wastes :

The Plantation and the spice crops are important commercial crops grown in Assam, Kerala, Karnataka, T.N.

The large quantities of bio-degradable wastes viz. coir dust, husk, dried leaves, coffee husk, tea wastes, oil palm wastes, etc are available for recycling the organic matters and nutrients.

Vericompost :

The nutrient content of vericompost is much higher than that of FYM.

The C:N ratio of vericompost is much lower than FYM.

Municipal and Sewage Wastes :

- This is one of the imps. Component of organic wastes.
- The municipal refuses containing 0.5 % N, 0.3 % P_2O_5 and 0.3 % K_2O.
- Sewage and sludge is also available for recycling.
- Such organic wastes can be used carefully, it may contain metals thus hazards to plants, animals and human beings.

Bio-cultures :

N fixing bacteria : Azotobacter, Azospirillum, Azolla, BGA and Rhizobium.

PSB : Bacillus, Sudomonus, Aspegilus, Penecilium, Mycorhiza, etc.

.....

Lecture No. 5

Integrated Pest, Disease and Weed Management

- Use of Bio-control agents, Bio-pesticides, Pheromones, Trap crops, Bird perches, Weed management:
- The organic crop management with biological devices could satisfy the actual needs of important components of Bio-intensive Integrated Pest Management (BIPM).
- Cultural control, mechanical control, use of parasites, predators and microbial pesticides are highly potential components of organic plant protection.
- In India after 1975, researchers have proved that 70-80 % major pests of major crops could be suppressed by bio-control.

Integrated Management :

"The suitable combination of all preventive, mechanical, cultural and biological methods for minimizing infestation below the level of economic injury."

Integrated approach consist of -

1) Follow the preventive measures for minimizing introduction and further spread.
2) Deep ploughing of soil during summer.
3) Always keep the orchards / farm clean and avoid crowding of trees.
4) Follow the good crop rotation.
5) Use well decomposed fym / compost.
6) Adopt intercropping of suitable crop as per planting season.
7) Adopt mulching of organic mulch material / polythene.
8) Adopt all cultural and mechanical methods to control weed / pest / diseases like hand weeding, digging, sickling, burning, tillage operation, summer fallow, solarisation, water management etc.
9) Remove and destroy the affected fruits/plants.
10) Remove flowering weeds specially of composite family.
11) Bagging of fruits with muslin cloth, paper or polythene papers with sufficient aeration provision.
12) Avoid water logging and keep soil aerated.

Use of Bio-control Agents :

Parasitoids and predators :

Various parasitoids and predators are available naturally and could be nourished, protected and made available by planting refugia crops viz. maize and cow pea around the main crop.

Some of the examples :

Sr. No.	Bioagent	Bioagent group	Doses/ha.	Target pest
1	*Trichogramma chilonis* (tomato /brinjal / okra / cauliflower)	Egg parasitoid	5 Tricocards	Shoot and fruit borer
2	*Cryptolaemus montrouziery*	Predator	150 beetles	Mealy bugs on fruit crops
3	*Epiricania melanoleuca*	Egg parasitoid	5000 pupae	Sugarcane pyrilla
4	*Conobathra aphidivora*	Predator	1000 larvae / pupae	Sugarcane wolly aphid
5	*Chrysoperla carnae*	Predator	1000 adults	Sucking pests (aphids/whitefly)
6	*Zygogramma biclorata*	Leaf feeder	500 beetles	Congress weed
7	*Neochetina bruchi*	Leaf feeder	5 weevils / sq.mt.	Water hyacinth
8	*Crocidosoma lantana*			Lantana camera

Bio-pesticides :

- Bio-pesticides (microbial pesticides) are practically most viable tools of biological management of pests and indispensable in organic plant protection.
- **"Bio-pesticides are formulated products using pest pathogenic microbes which intervene in the life cycle of the insect pests and kill them by causing diseases."**
- At present their formulations contain pathogenic bacteria, viruses and fungi as bio-ingredient with carrier and adjuvants.
- Neem based preparation is also included in bio-pesticide.

1) Bacterial Bio-pesticides :

***Bacillus thrungiensis* (Bt) :**

- It is the most successful bio-insecticide contributing 80 % share in the world.
- It causes mouth and body paralysis, mostly leading to death of insects.
- Bt. proteins are completely legitimate pesticides for use on organic farming.
- This bio-pesticide is recommended @ 1g/lit. or 1ml/lit. for the control of various lepidopterous pests.

2) Viral Bio-pesticides :

***Nuclear Polyhedrosis Virus* (NPV) :**

- This virus has been identified to infect *Helicoverpa armigera* which is polyphagous pest.
- The virus has been isolated from infected *Helicoverpa larvae* collected from field and being cultured in the laboratory.
- It is available in the liquid formulation and recommended @ 1ml/lit. for the control of *Helicoverpa armigera* on various crops.

3) Fungal Bio-pesticides :

***Beauveria bassiana* :**

- Many of the lepidopterous insect pests viz. shoot and fruit bores, spodoptera are controlled by using this micro-organism.
- The recommended dose is 4 gm/lit.

Verticillium lecanii :

- This bio-agent is recommended for the control of sucking pests viz. aphids, whitefly, thrips and mites etc.
- The recommended dose is 4 gm/lit.

Metarhizium anisopliae :

- It also controls the lepidopterous insect pests.

Tricoderma Viride :

- This micro-organism was most thorcughly and widely studied for their antagonistic activities towards soil borne harmful soil pathogens.
- Different species of *Trichoderma* under field conditions were reported to control a large numbers of wilt pathogens.
- This is recommended as soil application with organic matters viz. fym, vermicompost or neem cake @ 6.25 kg/ha or drenching @ 5 g/lit. of water.
- This is recommended as seed treatment @ 5 g/kg seed.

Paecilomyces liliacae :

This micro-organism is being utilized along with *Tricoderma* species as a mixed formulation for the control of phytophagous nematodes.

4) Neem Seed Kernel Extract (NSKE) :

- It is the only botanical pesticide widely used in organic cultivation.
- The main active principle of neem is azadirechtin and tetranotriterpenoids.
- It exhibits antifeedants, insect repellent and insect sterilization properties.
- 5 % NSKE is recommended for the control of sucking pests and fruit borer.

Pheromone traps :

- The concept of using Pheromone traps is to monitor the pests for their appearance and the incidence.
- To attract male and female insects to each other, insects naturally generate hormones called Pheromones.
- A special capsule of feromones are used to trap male or female which attracts each others and kill them to decrease population of next generation.
- Presently capsule of feromones for *Helicovepra armigera* i.e. Hexalure (tomato, okra, gram, redgram), *Spodoptra i.e. spodalure* (soybean), shoot and fruit borer (brinjal) i.e. leucilure, pink bollworm i.e. gossylure (cotton) are available in market (PCI).
- It is being utilized for mass trapping.
- Also attractants like methyl eujenol is used to attract and trap fruit flies of cucurbit and watermelon.

Light traps :

To attract adult insects of male and female and kill them in light trap to reduce the population of harmful insects.

Trap crops / Barrier crops / Refugia crops :

- These crops viz. Maize, Marigold, Cowpea and Mustard are grown at the border of main crop.
- Maize acts as a refugia arop or barrier crop in brinjal and okra.
- Marigold is a trap crop for *Helicoverpa armigera* in tomato.
- While mustard is a trap crop for *Plutella xylostella* in cabbage.
- Cowpea also harbor some beneficial insects like ladybird beetle which is predator for aphids.

Bird perches :

Some crops like Maize, Setaria, Jowar are used as bird perches on which bird can rest and able to pick worms.

Care should be taken that the height of bird parches should be more than the height of crops.

In some crops like grams, T shaped antenna is used as bird perche.

.....

Steps involved in certification

(1) Accreditation Agency – IFOAM – Tea, coffee, spices & coconut- director of cashew & coco board & APEDA

(2) Norms (1) No chemicals use for last 3 years
(2) specific production method
(3) Quality Standards

(3) Registration – 50% advance certification cost–

(4) signing of MOU (memorandom of under taking)

(5) crop & farm plan (6) Inspection (7) Approval of the inspection report by certification committee

(8) payment of the blance 50%.

(9) certification

(10) Issue of certification

Lecture No. 6

Quality Consideration,Certification,Labelling and Accreditation process,Marketing and Exports

- It is very important to follow good management practices to produce good quality produce.
- Also by taking in consideration the requirements of various National and private standards we have to maintain the quality of organic produce.

Quality Parameters :

* Maximum residue level (mg / kg).
* General appearance (color, shape).
* Flavor, texture, taste
* Damage caused by pests / dieseases
* Abnormal external moisture.
* Visible trace moulds.
* Size (mm / cm).
* Weight (kg / gms).
* Total soluble solids.
* Sugar / acid ratio.
* Skin defects.
* Keeping quality.
* Nutritional status.

Certification

Certification is a process that validates the claim of a producer. The process of certification has essentially three components

a) Accreditation body that defines and lays down the standards.
b) Certification body that inspects and certifies the project.
c) Project proponent that ensures that the said project is as per indicated standard.

- In the modern sense, 'Organic' is the labeling term that denotes products that have been produced in accordance with certain legally defined standards and norms and certified by a duly constituted certification authority.
- Certification is a annual process. The minimum requirement for certification of cropland is that no synthetic pesticides, herbicides or fertilizers have been applied to the land to be certified in the previous three years.
- A history of land that includes soil amendments applied, including manure and any pest / disease controls used in the previous three years is required in the form of a organic management plan.

Minimum requirement for Organic Certification :

* A certain degree of documentation for a clarity and consistency of farm.
* Soil fertility has to be maintained viz. crop rotation adapted cultivation techniques and nutrient cycles.
* Pest and disease attacks must be minimized by the means of healthy soil, natural enemies and adapted crop varieties.
* Only certified organic seeds should be used.
* All farm activities must be documented at every stage.
* Conventional units must be clearly separated from organic units (Conventional and organic products must not be mixed at any stage).
* Farms converting to organic farming have to undergo 3 years of transition period.
* Every farm, processor or exporter producing or handling organic produce needs to be inspected and certified once a year by an accrediated certification agency.

Labelling

- Labelling is an Important issue.
- The factors involved in consumers decision regarding the purchase of organic produce are mainly exogenous factors like certification, packaging and labeling.

Organic products may be labeled in the following ways -

* Where a minimum of 95 % of the ingredients are of certified organic origin, products may be labeled "Certified Organic" and should carry the logo of the certification programme.
* Where less than 95 % but not less than 70 % of the ingredients are of certified organic origin, products may be called **"Organic"** then it may be labeled as **"made with organic ingredients"**. Provided there is a clear statement of the proportion of the organic ingredients.
* Where less than 70 % of the ingredients are of certified organic origin, such products may not be called **"Organic"**.
* During the transition period, after the first 12 months the products can be labeled as **"In-conversion to organic"**.

Accreditation process

- In India, the **Agriculture and Processed Food Products Export Development Authority (APEDA), Ministry of Commerce, GOI,** is the key accreditation agency.
- The others being Coffee Board, Spices Board, Tea Board, Coconut Development Board and Directorate of Cocoa and Cashew nut Board.
- All certifying agencies are accredited by APEDA for carrying out the inspections and certifications according to the **National Standards for Organic Production (NSOP)** under the **National Programme for Organic Production (NPOP).**
- APEDA works in close co-ordination with the National Accreditation Body (NAB) and National Steering Committee for NPOP.
- The NPOP standards for production and accreditation system have been recognized by European Commission and Switzerland as equivalent to their country standards.
- Similarly UDSA has recognized NPOP assessment procedures of accreditation equivalent to that of US.
- With these recognition, Indian organic products duly certified by the accredited certification bodies of India are accepted by the Importing countries.

Marketing

- The organic product marketing is quite different than that of regular marketing of conventional agricultural produce.
- There is a less demand in domestic markets.
- Hence, there is a need to promote and develop the domestic market, so that dependance on international market for export can be minimized.
- Under these circumstances, it is expected that the consumers in metropolitan cities who are educated and have higher level of income and well known about the benefits of organic products, will be the largest buyers of organic products.
- No specific market structure is developed for organic produce.
- The efforts are required to be made for creation of awareness about organic produce, changing mindset of consumers to create congenial atmosphere for marketing of organic produce.
- One survey note indicates that more organic products in India are sold through the supermarket channels.
- Japanese market is the largest Asian market, as there is high demand for organic products and strong purchasing power.
- US organic market is world's largest market for organic products.

- The main factors in this markets are strong consumer awareness of health and environmental issues and positive growth.
- The consumers in this market are ready to pay price premiums of 10 to 25 %.

Exports

- India produces around 3,96,997 MT of certified organic products.
- Which includes varieties of all food products namely Basmati rice, pulses, honey, tea, spices, coffee, oilseeds, fruits, processed foods, cereals, herbal medicines and these value added products.
- The production is not limited to the edible sector but also produces organic cotton fibre, garments, cosmetics, functional food products etc.
- India exported 86 items last year (2007-08) with the total volume of 37533 MT.
- The export realization was around 100.4 million US $.
- Organic products are mainly exported to EU, US, Australia, Canada, Japan, Switzerland, African continent.
- Cotton leads among the products exported (16,503 MT).
- Major obstacles in low import of organic product from India are
    * High price expectations in relation to quality.
    * Low consistency of quality.
    * Contamination.
    * Slow shipment.
    * Time consuming and time complicated paper work.
    * Inconvenient modes of payment.
    * Too slow bank system and poor customer service from Indian traders after sales.

.....