MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE

SEMESTER END THEORY EXAMINATION

B.Sc. (Hon.) Agriculture

Semester	:-	IV (New)	**Academic Year**	:-	2022-23
Course No.	:-	AGRO –248	**Title**	:-	Principles of organic farming

Answer Sheet

SECTION "A"

Q. 1 What do you mean by certification? Write minimum requirement for organic certification and enlist accredited certification agencies involved in it.

Ans. Certification means having the farm and the farmer's methods inspected by an organic certifying group to ensure that they comply with guidelines of organic farming. Each certifying group has a code of standards which is available to interested people. Certification is a procedure by which a third party gives written assurance that a product, process or services in conformity with certain standards. The certification process focuses on the method and material used in production. There are three main requirements.

1. The methods and material used in production must meet organic standards
2. There must be clear and on-going documentation of these methods and materials
3. There must be a paper trail tracing a product back to its production site, in order to verify the methods and materials used in its production.

Therefore, in essence, organic certification is a simple concept, A third party evaluates producers, processors and handlers to determine whether they conform to an established set of organic standards. Those who conform are certified by the agent and allowed to use a logo, Product statement or certificate to document their product as certified organic.

Accredited certifying / inspection agencies :-

Accredited certifying /inspection agencies are as follows :-

1. Association for promotion of organic farming
   No.3, 9th Cross, 5th main Road, Jay Mahal Extension, Bangalore -46
2. Bioinspecta,Ackerstrasse, Postfach CH-5070 Frick, Switzerland
3. Ecocert International (Germany), Ecocert SA Branch office, 54A, Kan Nakshetrawadi, Aurangabad -431002
4. Indian Organic Certification Agency (INDOCERT),Thottumugham P.O. A Cochin, Kerala
5. IMP Control Private Limited,26, 17th Main, Hal 2nd "A" Stage, Bangalore – 56
6. LACONGMBH,Weingarten Str. 1.5, 77654, Offenburg, Germany

Branch office in India

- Mithradham, Chunangaveli Alwaye-683105, Kerala
- International Resources for Fairer Trade, Sona Udyog (Industrial Estate) Ur Panchyat Road, Andheri (E), Mumbai- 400 0069
- Naturland-Association for Organic Agriculture, Christina Reifenra Management, Kleinhademer Weg I, 82166 Graelfing, Germany.
- Dr. Prabha Mahale (GF), M-13/27, DLF City II, 122002 Gurgaon, Haryana
- Indian Society for Certification of Organic Products (ISCOP), "RASI 1 162/163, Tamil Nadu-641001
- Skal International and Certification Agency 3rd Floor, Monarch Chambers, 1 Road, Bangalore-560001

- SGS India Pvt. Ltd., 250 Udyog Vihar, Phase-IV, Gurgaon-122015

Procedure for certification and inspection :-

Organic farming is a "Process certification" and not "Product Certification" The cetification agency has to be impartial. Its accreditation by an authorized accreditation agency is mandatory. Only after issuance of accreditation certificate it can act as certification agency.

- The certification agency may appoint one or more inspection agents by entering into a written contract, specifying the terms and conditions of their agreement.
- They prescribe specific document to be maintained at the level of farmers/farmers' group.
- They also prescribe minimum conversion period.
- They are also authorized to issue necessary certificate of organic production to farmers.
- They either themselves may inspect the record of organic farmers' group or may appoint inspector. The certification agency, if needed, may get the sample of soil, water, organic inputs pesticides etc. and get them tested.
- Inspector report their findings in writing. This information will be treated strictly confidential.

Based on inspector report, the certification agency will issue certificate and allow to use a logo.

Q. 2 Describe in short weed management in organic mode of production

Ans. Considering the requirement of organic farming system and population dynamics of the weed species following methods are adopted for effective weed management.

1. **Preventive method**
2. **Mechanical method**
3. **Cropping and competition method**
4. **Biological method**

1. **Preventive method :-**The preventive measures consist of the following:
    1. Use of clean seed (i. e. Free from weed sccds)
    2. Use well decomposed cow dung or compost.
    3. Cut weeds before seeding.
    4. Remove the weed growth.
    5. Farm implements and machinery's should be properly cleaned before using.
    6. Does not use soil/sand of weed-infested area.
    7. Nursery stock should be free from weeds.

2. Mechanical method:- it include i) Ploughing, ii) Harrowing, iii) Hand pulling, iv) Hand weeding, v) Hoeing, vi) Burning vii) Mulching by non – living materials. However, the selection of a suitable method depends upon location, extent and habitat of weed.

Hand pulling or hoeing is found to be more effective only when the weed infested area is very small. Nut grass may be controlled by repeated weeding and hoeing. Annual and biennial weeds could be eradicated by cutting, hoeing or tillage operations before flowering of the weeds. Xerophytic weed like *Alhagea spp. Pluchea spp* and perennial weeds like *Cyperus spp.* and *Cynodan spp.* could be nicely controlled by flooding and exposing through deep ploughing and then flooding for 4 – 6 weeks period Weeds in orchards and sugarcane fields could be controlled by burning them. A thick mulch of hay saw dust, straw, paper and plastic films can control majority of weeds.

i Thermal Weed Control

a) Flamers

Flamers are useful for weed control. Thermal weed control involves the use of flaming equipment to create direct contact between the flame and the plant. This technique works by rupturing plant cells when the sap rapidly expands in the cells. Sometimes thermal control involves the outright burning down of the weeds. Flaming can be used cither before crop emergence to give the crop a competitive advantage or after the crop has emerged. However, flaming at this point in the crop production cycle may damage the crop. Although the initial equipment cost may be high, flaming for weed control may prove cheaper than hand weeding.

Propane – fuelled models of flamers are the most commonly used. Flaming dose not burn weeds to ashes; rather the flame rapidly raises the temperature of the weeds to more than 130 F. The sudden increase in temperature causes the plants cell sap to expand, rupturing the cells, walls. For greatest flaming efficiency, weeds must have fewer than two true leaves. Grasses are difficult to impossible to kill by flaming because the growing point is protected underground. After flaming, weeds that have been killed rapidly change from a glossy appearance to a duller appearance. Flame weeders can be used when the soil is too moist for mechanical weeding and there is not soil disturbance to stimulate further weed emergence. Flaming can be used prior to crop emergence in slow-germinating vegetables such as peppers, carrots, onion, and parsley, Onions have some tolerance to flaming and flame weeding has been successful in both pre and post - crop emergence conditions and after transplanting.

Transplanted cabbage has some tolerance to heat, allowing band flaming to be used along the crop row. Damage can occur when the treatment is applied too early, but the crop usually recovers. In a young pear orchard, where treatments were started on a clean soil after cultivation, flaming kept weed growth in check. In an established apple orchard, there was insufficient control of perennial weeds. Best is obtained under windless conditions, as winds can prevent the heat from reaching the target weeds. The efficiency of flaming is greatly reduced if moisture form dew or rain is present on the plants. Early morning and early evening are the best times to observe the flame patterns and adjust the equipment.

b) Soil solarisation

During summer, organic farmers sterilize their soil through solarisation. In this process, a clear plastic film is placed over an area after it has been tilled and tightly sealed at the edges. Solarisation works when the heat crated under the plastic film becomes intense enough to kill weed seeds.

c) Infrared weeders

Infrared weeders are a further development of flame weeding in which the burners heat ceramic or metal surfaces to generate the infrared radiation directed at the target weeds. Some weeders use a combination of infrared and direct flaming to kill the weeds. In general, flame weeders are considered to be more effective because they provide higher temperatures, but burner height and plant stage are important too. Infrared weeders cover a more closely defined area then those of the standards flame weeder, but may need time to heat up.

d) Freezing

Freezing would be advantageous only where there is an obvious fire risk from flaming. Liquid nitrogen and solid carbon dioxide (dry ice) can be used for freezing weeds.

Various test systems using electrocution, microwaves and irradiation have also been evaluated for weed control purposes, but high energy inputs, slow work rates and the safety implications for operators have hampered developments. Lasers have been completely. Weed control using ultraviolet light has been patented but remains at an experimental stage.

3. Cropping and competition method:-This includes

i) Proper crop rotation

ii) Use of crops which smother weeds through their growth competition.

Good crop rotation is an efficient means of reducing weed population. Introduction of a Rabi crop or thick growing crop or fallow, helps in controlling the weeds effectively. Inter tilled crops like cotton and crops like potato or groundnut, which necessarily require digging of soil, helps in reducing the infestation of weeds.

Growing of crops like sun hemp which have a very vigorous and leafy growth helps in smothering weeds. They shade out the weeds and compete with them for light, water and nutrients thereby reducing the weed population.

4. Biological weed control:-

In this method, a natural enemy of weed plants is used which attack them and reduce their number below an economical level. This method has advantage over chemical method, as it is permanent, cheap and effective but this is a slow process and suits to only specific weeds species.

Bio agents like insects, Pathogen etc., and other animals are used to control weeds. Insects and pathogen infest weeds and they either reduce growth or kill weeds.

For example

1. **Insects:-**
   - i. *Lantana camera was controlled by two beetles viz., Octotoma scabripennis and Uroplata giraldi*
   - ii. Prickly pear weed (*Opintia spp*) was controlled by Cochineal insects *(Dactylopius tomentosus)*
   - iii. *Alligator weed* controlled by flea beetle
2. **Fish :-** Common carp and Chinese carp control aquatic weeds.
3. **Mannals :-** Manetee or sea cow is very effective in controlling water hyacinth.
4. **Snails :-** *Marisa spp* and other fresh water snails feed on submerged weeds like cattail and algae
5. **Fungi :-** Water hyacinth can be controlled by *Rhizoctinia blight*
6. **Mites: -** A spider mite is found effective in controlling prickly pear.
7. **Plants: -** Cowpea sown in between sorghum rows effectively reduces the growth of weeds.

Commercial mycoherbicides

Trade name	Pathogen	Target weed
Devine	*Phytophthora plamivora*	*Morreria odorata* (Strangler vine) *in citrus*
Collego	*Colletotrichum gleosporoides f.sp. aeschynomene*	*Aeschynomene virginica* (northen joint vetch) in rice and soybean
Biopolaris	*Biopolaris sorghicola*	*Sorghum halepense* (Johnson grass)
Biolophos	Streptomyces hygroscopius	General vegetation (non – specific)
LUBAO 11	*Colletotrichum gleosporoides f. Sp. Cuscuttae*	*Cuscutta sp.* (Dodder)
01	*Alternaria cassiae*	*Cassia abtusifolia*
ABG 5003	*Cercospora rodmanii*	*Eichhornea crassipes* (water hyacinth)

Q. 3 Write in detail about pest and disease management in organic farming

Ans: Planning for effective insect and disease management must involve the entire farm operation and use all information available. Any strategy in organic farming should include methods for:

- **Insect and disease avoidance**
- **Managing the growth environment**
- **Direct treatments**

i. Avoidance Techniques:

To manage pests and diseases effectively, producers need to understand the biology and growth habits of both pest and crop. The type and concentration of pests are often responses to previous crop history, pest life cycles, soil conditions and local weather patterns.

Crop Rotations

Crop rotation is central to all sustainable farming systems. It is an extremely effective way to minimize most pest problems while maintaining and enhancing soil structure and fertility.

Diversity is the key to a successful crop rotation program. It involves:

- Rotating early-seeded, late-seeded and fall-seeded crops
- Rotating between various crop types, such as annual, winter annual, perennial, grass and broadleaf crops; each of these plant groups has specific rooting habits, competitive abilities, nutrient and moisture requirements. (True diversity does not include different species within the same family - for example, wheat, oats and barley are all species of annual cereals.)
- Incorporating green manure crops, into the soil to suppress pests, disrupt their life cycles and to provide the additional benefits of fixing nitrogen and improving soil properties
- managing the frequency with which a crop is grown within a rotation
- maintaining the rotation's diversified habitat, which provides parasites and predators of pests with alternative sources of food, shelter and breeding sites
- planting similar crop species as far apart as possible. Insects such as wheat midge and Colorado potato beetle, for example, are drawn to particular host crops and may overwinter in or near the previous host crops. With large distances to move to get to the successive crop, the insects' arrival may be delayed. The number that find the crop may be reduced as well.

Diverse rotations are particularly effective in regulating flea beetles, cabbage butterfly, wheat midge, wheat stem maggot and wheat stem sawfly.

Rotations are also effective in controlling soil- and stubble-borne diseases. The success of rotations in preventing disease depends on many factors, including the ability of a pathogen to survive without its host and the pathogen's host range. Those with a wide range of hosts will be controlled less successfully. For example, sclerotinia stem-rot is a common disease in conventionally grown canola on the Prairies, but it can also infect at least a half dozen other field crops. Rotations will not have much effect on pathogens that live indefinitely in the soil, but will shorten the life span of pathogens that can survive only brief periods apart from their hosts. Other situations that limit the benefit of crop rotations include: the transmission of pathogens via seed, the presence of susceptible weeds and volunteer crops that harbour pathogens, and the invasion of pathogens by wind and other means.

Liquid extracts for disease management

Disease	Type of compost
Late blight of potato ,tomato	Horse compost extract
Graymold on beans strawberries	Cattle compost extract
Downy and powdery mildew of grapes	Animal manure-straw compost extract
Powdery mildew on cucumbers	Animal manure-straw compost extract
Graymold on tomato, pepper	Cattle and chicken manure compost ext
Apple scab	Spent mushroom compost extract

Biological agents to control pests of different crops:

Sr. No.	Biological Agents	Pest	Cr
1.	*Trichogramma brassiliensis* - 1.0 cc/ac. once in 10 days (Egg parasitoid)	*Lepidopteron, Heliothis Spp*	Cotton, Toma
2.	*Trichogramma chilonis* - 2 cc/ac once in 15 days	Borers	Sugarcane, pa pulses, Veget
3.	Nuclear Polyhedrosis Virus (NPV) 100-200 LE/ac	*Spodoptera Spp & Heliothis Spp*	Vegetables
4.	*Chrysoperla Sp* 5000 - 10000 eggs /ha, 3 - 4 times in 15 days, (Green lace wing)	Prudenia, Caterpillars, White flies,thrips, aphids	Vegetables
5.	Beauveria bassiana - 1.0% Affects the young stage,	*Helicoperva, spodoptera,* borers, hairy caterpillars, mites, scales etc.	Vegetables, c fruits
6.	Metarhizium anisopliae - 0.5 - 1.0 % affects all stages	White grubs, Beetle grubs, caterpillars, Semi loopers, mealy bugs, BPH	Sugarcane, gr rice, potato, c cereals
7.	*Verticillium lecanii* - 0.5 - 1.0 %, affects all stages	All sucking soft bodies insects	Sugarcane, gr rice, potato,c
8.	Phascilomycetes	Nematodes	All crops
9.	*Bacillus thuringiensis* var kustaki 0.3 - 0.4 %	Helicoperva, spodoptera, borers, hairy caterpillars, mites, scales etc.	Vegetables,ce fruits
10.	NPV - Nuclear Polyhydrosis Virus of *Spodotera litura* 250 - 500 ml/ ha 2 - 3 time at 10 days interval	*Spodotera litura*	Cotton, groun cabbage, chil
11.	NPV - Nuclear Polyhydrosis Virus of *Helicoverpa armigera* 250 -500 ml/ ha, 2 - 3 time at 10 days interval	*Helicoverpa armigera*	Cotton, groundnut, pu cabbage, chil

Biopesticides and IPM products for various crops:

Crop	Pest/Diseases	Biopesticides
Cotton	Bollworms	Traps, lures, BT, NPV, Tricho
	Whitefly, jassids, thrips	Neem 1500 ppm
	Mites	*Chrysoperla, verticillium, Baeu*
	Wilts and leaf spots	*Trichoderma, Pseudomonas*
Rice	Yellow stem borer, leaf folder	Traps, lures, BT, *Trichogramm*
	Hoppers, Sheath blight and leaf spots	Neem 1500 ppm, *Baeuveria*
Pulses	Bollworms or cutworms	Traps, lures, BT, NPV, *Tricho*
	Wilts	*Trichoderma, Pseudomonas*
Tomato, Capsicum	*Heliothis*	Traps, lures, BT, NPV, *Tricho*
	Mites	*Trichoderma, Pseudomonas*
Brinjal, okra	Fruit borer	Traps, lures, BT, NPV, *Tricho*
	Mites	Neem 1500 ppm, *verticillium*

Q. 4 Write in detail about the criteria for choosing of varieties in organic farming

Ans. The careful selection of crops and plants varieties complements sound ecological soil management practices. Choice of crops should be appropriate the soil and regional climate to ensure optimum crop success. The varieties of all the most of the crops so far recommended for commercial cultivation have been developed and evaluated under high input inorganic farming conditions. Such varieties may not perform better under low input organic farming conditions.

Keeping in view the potential of organic farming in India, there is an urgent need to identify the potential genotypes/varieties responsive to low input conditions of organic farming. Success in organic farming requires qualities such as good competition ability against weeds and ability to uptake nutrients from sparingly soluble sources. These are not selected for in conventional breeding. Foreign countries offer financing for the efforts to develop and test superior varieties for organic farming.

Choosing the right variety can be a complex process and you need to accept that it will probably take a few years, and lot of trial error, before you find the varieties that really suit you and your system. There are many issues you need to take into account including:

1)The market:-

This is often the last thing that breeders look at, but it is right at the top of a grower's priority list. Multiple retailers often specify the varieties they want based on a range of factors they consider important. You will also be required to deliver large volumes of product over a very short period of time so F1 hybrids, that tend to develop more uniformly, are more suitable. Supplying a market stall, a box scheme or a restaurant is a different ball game altogether. The characteristics you are looking for are probably very different. Typically you will be supplying small amounts of produce over long periods, which means that uniformity of development is much less of an issue.

2) Yields:-While many conventional breeding programmes focus on maximising yields, the organic grower often thinks more in terms of optimal yields. This takes account of the fact in organic systems nutrients are not very abundant and other characteristics, such as disease resistance are just as, if not more, important.

3) Vigor:-Good early vigour is very important in organic systems, particularly in relation to pest, disease and weed problems. In a situation where you cannot rely on chemical solutions, you need the crop to get away quickly to out-compete weeds and resist attack from pests and disease resistance to pests and diseases. Certain varieties have high levels of resistance to specific pests and diseases.

4) Seasonality:-If you are producing crops throughout the year, such as cauliflowers, cabbage or lettuces, you will need a suite of varieties that mature in the different seasons, in the same way you can chose to cultivate winter or spring cereal varieties.

5) Tolerance to abiotic stress:

Breeding for tolerance to the abiotic stresses is another important issue.Apart from nutrient stress resistance, drought, salinity, aluminium toxicity and heat stress are other important abiotic stress factors that cause yield reductions. With climate change, the importance of drought and the area of irrigated land with saline soils are expected to increase significantly.

6) Resistance to Pest:

i. Resistance to major seed-borne diseases

Resistance to seed-borne diseases in organic seed production is an important issue as few seed treatments are permitted for use under organic farming standards.

ii. Resistance to other fungal and bacterial diseases

Tolerance to diseases that may cause injuries and are likely to affect plant health and quality is crucial for minimizing the gap between yield potential and actual yield. This applies to conventional high-input as well as to low-input or organic farming.

iii. Insect resistance

Some insect pests are specific to certain crops, such as wheat stem sawfly, while others, such as grasshoppers, will attack numerous crops.

Because insecticides are not permitted under organic farming standards, organic growers apply alternative measures. Examples of cultural management tools are e.g., the establishment of beetle banks to maintain high predator or parasite populations; companion plants to repel or distract pests; mass trapping systems, pheromone-based mating disruption.

7) Rotation

These choices must also fit in with the crop rotation plan that has been developed. Residual effect of preceding crop on nutrient availability of succeeding crop. Legume rotation.

Q. 5 What is organic farming? Describe in brief the important principles of organic farming.

Ans. Defination: Organic farming is a production system that integrates site specific cultural, biological and mechanical practices designed to foster the cycling of resources, ecological balance and biodiversity **or** It is a production system which avoids or largely excludes the use of synthetically compounded fertilizers, pesticides, growth regulators and livestock feed additives

The concept of organic farming is based on following principles:

- Nature is the best role model for farming, since it does not use any inputs nor demand unreasonable quantities of water,
- The entire system is based on intimate understanding of nature's ways. The system does not believe in mining of the soil of its nutrients and do not degrade it in any way for today's needs,
- The soil in this system is a living entity, The soil's living population of microbes and other organisms are significant contributors to its fertility on a sustained basis and must be protected and nurtured at all cost.
- The total environment of the soil, from soil structure to soil cover is more important.

The basic principles of organic farming are - Conservation of soil, Maintenance of soil fertility, Natural nutrient mobilisation, Pest management through biological pest control, Increase in biodiversity genetic base, No use of synthetic and agrochemicals, Prohibition of Genetic Engineering and related products ,Usage of farm manures and crop residues, Biologically active soil life

The four important principles were summarised as under

1. **Principle of health**

Organic Agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. This principle points out that the health of individuals and communities cannot be separated from the health of ecosystems - healthy soils produce healthy crops that foster the health of animals and people. Health is the wholeness and integrity of living systems. It is not simply the absence of illness, but the maintenance of physical, mental, social and ecological well-being. Immunity, resilience and regeneration are key characteristics of health.

The role of organic agriculture, whether in farming, processing, distribution, or consumption, is to sustain and enhance the health of ecosystems and organisms from the smallest in the soil to human beings. In particular, organic agriculture is intended to produce high quality, nutritious food that contributes to preventive health care and well-being. In view of this it should avoid the use of fertilizers, pesticides, animal drugs and food additives that may have adverse health effects.

2. **Principle of ecology**

Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. This principle roots organic agriculture within living ecological systems. It states that production is to be based on ecological processes, and recycling. Nourishment and well-being are achieved through the ecology of the specific production environment. For example, in the case of crops this is the living soil; for animals it is the farm ecosystem; for fish and marine organisms, the aquatic environment.

Organic farming, pastoral and wild harvest systems should fit the cycles and ecological balances in nature. These cycles are universal but their operation is site-specific. Organic management must be adapted to local conditions, ecology, culture and scale. Inputs should be reduced by reuse, recycling and efficient management of materials and energy in order to maintain and improve environmental quality and conserve resources.

Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.

3. **Principle of fairness**

Organic Agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities. Fairness is characterized by equity, respect, justice and stewardship of the shared world, both among people and in their relations to other living beings.

This principle emphasizes that those involved in organic agriculture should conduct human relationships in a manner that ensures fairness at all levels and to all parties - farmers, workers, processors, distributors, traders and consumers. Organic agriculture should provide everyone involved with a good quality of life, and contribute to food sovereignty and reduction of poverty. It aims to produce a sufficient supply of good quality food and other products. This principle insists that animals should be provided with the conditions and opportunities of life that accord with their physiology, natural behaviour and well-being. Natural and environmental resources that are used for production and consumption should be managed in a way that is socially and ecologically just and should be held in trust for future generations. Fairness requires systems of production, distribution and trade that are open and equitable and account for real environmental and social costs.

4. **Principle of care**

Organic Agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment. Organic agriculture is a living and dynamic system that responds to internal and external demands and conditions. Practitioners of organic agriculture can enhance efficiency and increase productivity, but this should not be at the risk of jeopardizing health and well-being. Consequently, new technologies need to be assessed and existing methods reviewed. Given the incomplete understanding of ecosystems and agriculture, care must be taken.

This principle states that precaution and responsibility are the key concerns in management, development and technology choices in organic agriculture. Science is necessary to ensure that organic agriculture is healthy, safe and ecologically sound. However, scientific knowledge alone is not sufficient. Practical experience, accumulated wisdom and traditional and indigenous knowledge offer valid solutions, tested by time. Organic agriculture should prevent significant risks by adopting appropriate technologies and rejecting unpredictable ones, such as genetic engineering. Decisions should reflect the values and needs of all who might be affected, through transparent and participatory processes.

Q. 6 Describe in details operational structure of the NPOP

Ans. The operational structure of the NPOP is given in Fig. 1 below: National Steering Committee (NSC)) (Members appointed by the DoC) National Standards for Organic Production (NSOP), Technical Committees (TC) (for review of NSOP, accreditation criteria, procedures for inspection and certification agencies), Certification Bodies Exporters National Accreditation Board (NAB), Evaluation Committee (EC) Producers Processors Department of Commerce

Apeda Organizational Set Up: Details of the organizational set-up of the NPOP are given below

(a) Department of Commerce (DOC):

The National Programme for Organic Production shall be operated under the overall guidance and directions of the Department of Commerce, Government of India. The Department of Commerce shall act as the Apex body of the NPOP.

(b) National Steering Committee (NSC) :

The Department of Commerce shall constitute an apex policy formulation committee called the National Steering Committee (hereinafter referred to as 'NSC') to be headed by Commerce Secretary. The Commerce Secretary may nominate any other officer to chair the NSC meeting. The NSC shall be responsible for the implementation and administration of the NPOP. The NSC shall be serviced by APEDA. The members of the NSC shall be drawn from the Department of Commerce, Ministry of Agriculture, Ministry of Textiles, Department of Animal Husbandry, Dairying & Fisheries, Ministry of Food Processing Industries, Ministry of Science & Technology, Ministry of Rural Development, Ministry of Environment & Forest, APEDA, Marine Products Export Development Authority (MPEDA), Commodity Boards (such as the Tea Board, Spices Board, Coffee Board, Food Safety and Standards Authority (FSSAI) and other government and private organizations having experience in organic farming and production. The members of Ministries shall be the Ex-officio members of the NSC. The NSC shall have the power to co-opt members other than those mentioned in this clause 2.3 (b) or as notified by Government of India from time to time.

The responsibilities of the NSC shall inter alia, include the following:

1. Approving procedures for implementation of the NPOP, which would include the NSOP, Accreditation policy and procedures as well as the regulations for use of the Certification Trade Mark "India Organic Logo".
2. Delegating responsibility of implementing the NPOP.
3. Constituting the National Accreditation Body (NAB).
4. Constituting Technical Committee(s) and such other committees as deemed appropriate for the implementation of the NPOP.
5. Take decisions on the proposals placed by various committees set up by NSC. The NSC shall meet at least once a year to review the functioning of the NPOP and take decisions on various policy matters concerning the implementation and functioning of the NPOP. The quorum for such a meeting shall be 30 % of the total strength. The

NSC shall also appoint such sub-committees, as it deems fit, for the smooth and efficient functioning and implementation of the NPOP. The NSC shall review and amend the NPOP from time-to-time.

(c) National Accreditation Body (NAB)

The NAB shall be serviced by APEDA. The NAB shall consist of members representing Department of Commerce, Ministry of Agriculture, FSSAI, MPEDA and various Commodity Boards (such as the Tea Board, Spices Board, Coffee Board). The Additional Secretary (Plantations) shall be the Chairman of the NAB. The NAB shall have the power to co-opt members other than those mentioned in this clause 2.3 (c) as notified by the Government of India from time to time. The NAB shall meet as and when required for review of the Certification Bodies.

The responsibilities of the NAB shall include:

1. Drawing up procedures for the evaluation and accreditation of the certification programmes of the Certification Bodies
2. Formulating procedures for evaluation of the Certification Bodies
3. Accreditation of the Certification Bodies
4. Constituting an Evaluation Committee
5. Any other responsibilities assigned by NSC from time to time The quorum for NAB meeting shall be 30 % of the total strength.

(d) Agricultural and Processed Food Products Export Development Authority (APEDA).

APEDA shall function as the Secretariat for the implementation of the NPOP. The responsibilities of APEDA, as a Secretariat, shall include, inter alia, the following:

1. Take steps for the implementation of the decisions of the NSC, NAB and the Committees constituted under the NPOP.
2. Organize and convene all the meetings under NPOP
3. Convene the various committees constituted under the NPOP.
4. Evaluation of the Certification Bodies
5. Investigation of complaints received from the importing countries
6. Initiate any other multilateral issues pertaining to equivalence etc. that would promote the export of organic products.
7. Receive and screen applications from the applicant bodies and coordinate and arrange their evaluations
8. Shall issue necessary implementation guidelines to the accredited Certification Bodies for inspection and certification from time to time
9. Any other functions assigned by the NSC/NAB from time to time APEDA shall meet the requirements of ISO 17011 for accreditation of Certification Bodies under the NPOP.

(e) Technical Committee

The NSC shall constitute various Technical Committee(s) comprising of experts drawn from relevant field/organizations to formulate various technical standards, suggests amendments/changes in the existing standards, review the standards from time to time and to advise the NSC on relevant issues pertaining to organic sector.

(f) Evaluation Committee (EC)

The NAB shall constitute an Evaluation Committee to evaluate the implementation of certification programme of the Certification Bodies. The NAB shall draw a panel of experts qualified in the field of agricultural sciences or any related field of food industry. These experts shall be drawn from organizations that are not involved in the certification activities and shall sign a contract of confidentiality with APEDA. The experts shall have required training in audit procedures. The Certification Body shall not be evaluated by the same committee for more than two consecutive years.

An Evaluation Committee shall be drawn from this panel of experts and shall comprise of minimum of three experts. Two experts shall constitute the quorum.Such Evaluation Committee will evaluate the Certification Body at least once in a year and shall submit the following documents to APEDA after completion of the evaluation: (i)Conformity/non-compliance report (ii) Observations (iii) Recommendations (iv) Supporting documents APEDA shall review the report(s) of the Evaluation Committee and submit its assessment report and present it, along with its recommendations, to the NAB for accreditation decision. 18 Any deviation from the report of the Evaluation Committee shall be recorded in writing by APEDA.

- Eligible Inspection and Certification Agencies implementing certification programmes will be evaluated by an evaluation committee.
- The evaluation committee will be accreditated by the National Accreditation Body.
- The members of the Evaluation Committee will comprise of members drawn from APEDA , Coffee Board, Spices Board, Tea Board, Ministry of Agriculture and Export Inspection Council of India (EIC/Export Inspection Agencies (EIAS)

(h) Certification Bodies

Agencies accredited by the National Accreditation Body under NPOP for certifying organic products. The accredited Certification Bodies shall certify organic products as per the scope of accreditation approved by the NAB.

Q. 7 Write in short about marketing and export potential of organic produce

Ans. **Marketing** :- Marketing is the creative management function, which promotes trade and employment by assessing customer needs. Marketing is a planned selling effort concerned with exchange and therefore closely related to desires. The success of marketing depends upon the availability of produce in the right place, right time right price, right quality and right quantity.

Global status of Organic Food market :-

At global level, the market for organic food is expanding vigorously. Organic farming system are experiencing rapid growth worldwide through creative energy of thousands of grassroot organizations, farmers, traders and consumers. About 10,000 of "Campensinos" in Mexico have sound incomes today and good perspectives for the future because they grow organic products such as coffee and sell them in fair trade and organic market. In Egypt, best selling herbal tea is certified as organic and sold in over 10,000 shops and pharmacies. In Germany, biodynamic SEKEM initiative, employing about 1,000 people delivers its products to 7,000 pharmacies and 2,000 shops. Rapidly growing consumer demands are also increasing in Argentina, Japan, Poland and Australia.

Domestic market :- Although India has initiated export market for organic foods successfully, the situation in relation to domestic organic market is quite miserable. The demand for organic product in India has not been developed so far. Major market for organic product are in the metropolitan cities like Mumbai, Delhi, Kolkata, Chennai, Bangalore and ,Hyderabad and other few cities. Appropriate training programmes for farmers and NGOs, easy access to financial support and group discussion, strengthening the market intelligence, maintenance of the quality, flexibility of mode of payment through bank and fixing reasonable prices could be the possible strategies to develop the domestic market and promote export of organic products.

Limitations in Marketing :-

i. Inadequate knowledge about package of practices of organic crops.
ii. Farmers do not know where to sale and consumers do not know where to get.
iii. Market is limited and supply is inconsistent.
iv. Expected premium is not received, therefore sale is not ensured.
v. Farmers cannot identify as to what crop will be grown organically, what price will be charged.
vi. Lack of consumer awareness on the benefit of organic produce.
vii. The quality supply is not ensured.
viii. Logistic of slow shipment, restriction for importing Indian organic products.
ix. Time consuming and complicated paper work while dealing with export authorities.
x. Less effort to develop domestic market

Export potential

There is a huge difference between the conventional farming and organic farming in sales. Products produced from conventional methods are now considered to be of lower quality when compared to the ones produced from organic farming. India has been adopting various methods to increase its export value. In that context, agricultural sector takes the major part. Export of rice, cereals, cotton etc were previously exported, but profits gained were less. Now, due to organic farming the cost of production being less, allows you to have more profit which indirectly affects the government's export value in a positive way.

After analysis, it is seen that the production of rice and spices can bring regular income to new growers. Non-perishable nature of these products allows you to settle your business taking a longer time. Apart from this reason, spices are of high demand in and outside India. Foreign countries import spices from India in huge quantities. Thus, production of these will provide you domestic and international opportunities.

The next in line is the production of cereals. Grading has become a trend in conventional farming. The producers of cereals grade them according to their quality and this has clearly shown the consumers about the quality of production. By considering this, people now shift their interests to standardized quality of organic cereals. In the end organic farming paves way for environmental health and public health. employment opportunities will also increase as the industry expands. There are various schemes for people who do not have a strong financial background. Under the scheme of National Project on Organic Farming, the government of India offers 60 lakhs for bio fertilizers and manures.

It is acceptable fact that India comparative has a high advantage in organic food production to compete in the international market as 65% of arable land is mainly rain-fed, negligible amount of fertilizers is being used. Farmers in these areas often use organic manure as a source of nutrients that are readily available either in their own farm or in their locality. The northeastern region of India provides considerable scope and opportunity for organic farming due to least utilization of chemical inputs. It is estimated that 18 million hectares of such land is available in the Northeast, which can be exploited for organic production. With the sizable acreage under naturally organic/default organic cultivation, India has tremendous potential to grow crops organically and emerge as a major supplier of organic products in the World's organic market.

Global demand for organic food has created new export opportunities for developing countries. With the increasing preference of consumers in developed countries for certified organic foods, the demand has been rising by about 12 % to 17

% every year, but the availability of certified foods worldwide is only in the range of 3% to 8%. This indicates the excellent potential for exporting organic foods, which can perhaps be tapped best through group initiatives in organic farming.

Q. 8 Define green manuring and write its types, advantages and disadvantages

Ans. Green manuring :-

Green manuring cab be defined as practice of ploughing or turning into the soil undecomposed green plant tissues for the purpose of improving physical structure as well as fertility of soil.

Leguminous green manures :-

Sesbania (*Sesbania speciosa*), Dhaincha (*Sesbania aculeata*), Moong or green-gram (*Vigna unguiculata*), Cowpea (*Vigna radiata*), Sunhemp (*Crotalaria juncea*), Cluster bean (*Cyamopsis tetragonoloba*), Urid or black-gram (*Vigna mungo*), Berseem (*Trifolium alexandrium*)

Non-leguminous green manuring crops :-

Jowar (*Sorghum bicolor*), Maize (*Zea mays*), Sunflower (*Helianthus annus*)

Types of green manuring:

i)Green manuring (In situ): In this system green manure crop are grown and buried in the same field. Various methods of green manuring in situ are followed.

a) Summer sown catch crop: The quick growing green manure crops are grown in May to June and buried in the field at the time of field preparation of *Kharif* crops.

b) Inter row sown crops: The quick growing green manure crops are sown between the lines along with the main crop. These inter sown green manure crop are buried in the field after 6 to 8 week. This method is followed in Punjab and U.P.

c) Crop taken on bare follow: In whet tract or in vegetable, green manure crops are sown and buried during the *Kharif* season instead of keeping fallow or *Kharif* crop. In this method the cultivator loose one *Kharif* season.

d) Green manure as a main crop: This practice is adopted only on very poor sandy soils or in the program of reclaiming saline and alkaline soil. Under these conditions, dhaincha is raised as a main green manure crop.

ii) Green leaf manuring (Ex situ): refers to burring of the green leaves and tender twings collected from shrubs and trees from bund area and forest and add into the soil at the time of field preparation

"Characters of a good green manuring crops" :-

1. It should yield a large quantity of green material with a short period
2. It should be quick growing, especially in the beginning so as to suppress the weeds.
3. It should preferably be a legume.
4. It should succulent & has more leafy growth.
5. It is easy to incorporate.
6. It is quickly decomposable

Nutrient content of important green manure and green leaf manure crops:-

Sr.No	**Crops**	**Nutrient content (%) on dry weight bas**		
A) Green manure:-		**N**	**P**	**]**
1.	*Sebania aculata* – Dhaincha	3.3	0.7	1
2	*Crotalaria Juncea*-Sannhemp	2.6	0.6	2
3	*Sesbania speciosa*	2.7	0.5	2
4	*Tephrosia purpurea*	2.4	0.3	0
5	*Phasolus trilobus*	2.1	0.5	
B) Green leaf manure:-				
1	*Pongamia pinnata / glabra* (Karanj)	3.2	0.3	1

2	*Glyricidia maculeata*	2.9	0.5	2.8
3	*Azadirachta indica* (Neem)	2.8	0.3	0.4
4	*Calatropis gigantea*	2.1	0.7	3.6

Advantages of green manuring:

1. It adds the organic matter to the soil & stimulate the activity of Microorganisms.
2. It improves the Structure of the soil, thereby improving the water holding capacity of soil decreasing runoff erosion.
3. It fixes the nitrogen from atmosphere.
4. It suppresses the growth of weeds
5. It takes nutrients from lower layers of the soil and adds to the upper layer in which it is incorporated.

Disadvantage of green manuring:-

1. Incidence of pest & diseases may increase
2. Loss of one crop
3. Depletion of moisture which affects the growth of the succeeding crop

Types of green manuring :-

There are two types of green manuring :

Green manuring in-situ:-

The most common green manure crops grown under this system are sunhemp (*Crotalaria juncea*), dhanicha (*Sesbania aculeata*), *Sesbania rostrata* and gaur (*Cyamopsis tetragonoloba*). In this system, green manure crops are grown and buried in the same field, which is to be green manured, either as a pure crop or as an intercrop with the main crop.

Green-leaf manuring :-

Green-leaf manuring refers to turning into the soil green leaves and tender green twigs collected from shrubs and trees grown on bunds, wastelands and nearby forest areas. The common shrubs and trees uses are: Glyricidia (*Glyricidia maculata*), Sesbania (*Sesbania speciosa*) and Karanj (*Pongamia pinnata*).

The common method of growing green manure crops are:

- As summer-sown catch crops.
- Inter-row sown crops.
- Crops taken on bare fallow.
- Green manure as main crops.

Q. 9 Explain in detail about vermicomposting technology

Ans. *vermicomposting* is the process of turning organic debris into worm castings. The worm castings are very important to the fertility of the soil. The castings contain high amounts of nitrogen, potassium, phosphorus, calcium, and magnesium. Castings contain: 5 times the available nitrogen, 7 times the available potash, and 1 ½ times more calcium than found in good topsoil. Several researchers have demonstrated that earthworm castings have excellent aeration, porosity, structure, drainage, and moisture-holding capacity. The content of the earthworm castings, along with the natural tillage by the worms burrowing action, enhances the permeability of water in the soil. Worm castings can hold close to nine times their weight in water. "Vermiconversion," or using earthworms to convert waste into soil additives, has been done on a relatively small scale for some time. A recommended rate of vermicompost application is 15-20 per cent.

Vermicomposting is done on small and large scales. In the 1996 Summer Olympics in Sydney, Australia, the Australians used worms to take care of their tons and tons of waste. They then found that waste produced by the worms was could be very beneficial to their plants and soil. People in the U.S. have commercial vermicomposting facilities, where they raise worms and sell the castings that the worms produce. Then there are just people who own farms or even small gardens, and they may put earthworms into their compost heap, and then use that for fertilizer.

Vermicompost and its utilization

Vermicompost is nothing but the excreta of earthworms, which is rich in humus and nutrients. We can rear earthworms artificially in a brick tank or near the stem / trunk of trees (especially horticultural trees). By feeding these earthworms with biomass and watching properly the food (bio-mass) of earthworms, we can produce the required quantities of vermicompost.

Vermicompost is a mixture of worm castings, organic material, humus, living earthworms, cocoons and other organisms.Depending upon nature of substrate, vermicompost contains 2.5 – 3.0% N, 1.0 – 1.5% phosphorous and 1.5 – 2.0% potash.

In India, only two species are being commonly used for vermiculture namely *Eisenia foetida*, and *Eudrilus eugeniae*.

The materials required for vermicomposting are :

Any types of biodegradable wastes-

- Cattle dung,
- Agricultural wastes, e.g. vegetables wastes, sugarcane trash, weed biomass etc.
- Plant products, e.g. sawdust and pulp, various types of leaf litter.
- City refuse and biodegradable portion of urban and rural wastes
- Hotel refuse
- Biogas slurry
- Waste from agro-industries

Vermicompost can be prepared by pit, heap method or in concrete tank. However, all the methods shed is necessary for protecting the worms from rain and direct sunlight.

Preparation of vermicompost by heap method :-

1. Prepare the heap of organic matter having size 2.5 – 3 m length, and 90 cm width.
2. First sprinkler the water on ground
3. Place 3-5 cm thick layer of slowly decomposing organic substances such as coconut coir, grass, rice husk, baggas etc. and sprinkle sufficient water on it.
4. Over this layer, place 3-5 cm thick layer of partially decomposed FYM or Compost or Garden soil and moist it. This layer will serve as a temporary shelter for earthworm
5. Then release the earthworm on it @ 7000 earthworm per 100 kg of organic matter.
6. Then place a layer of partially decomposed crop residue, cow dung, weeds, leaves of glyricidia, poultry manure, fish meal etc. For enhancing decomposition and vermicomposting process the organic material should be cut into smaller pieces. The total height of the heap should not be more 60cm. Sprinkle sufficient water on it.
7. Cover the heap with gunny bag and sprinkle water daily to maintain 40-50 % moisture content. The temperature of the heap should be 25 – 30^{0}C.
8. After 2 - 2.5 months the heap will be ready for harvest with good quality vermicompost. The removed vermicompost should be heaped in an open

place. Then the worms will find way to the bottom of the heap. The vermicompost from the top can be removed, dried in shed and sieved to separate earthworm, which will be again used for preparation of vermicompost.

Preparation of vermicompost in concrete tank

1. The vermicompost can be prepared in concrete tank. The size of the tank should be 10 ft. length or more depending upon the availability of land and raw materials, breadth 3- 5ft and height 3 ft. Suitable plastic tube / basin structure may also be needed. The floor of the tank should be connected with stones and pieces of bricks.
2. The available bio-wastes are to be collected and are to be heaped under sun about 7-10 days and be chopped if necessary.
3. Sprinkling of cow dung slurry to the heap may be done.
4. A thin layer of half decomposed cow dung (1-2 inches) is to be placed at the bottom.
5. Place the chopped bio waste and partially decomposed cow dung layer wise (10-20 cm) in the tank / pot up to the depth of 2 ½ ft. The bio waste and cow dung ratio should be 60: 40 on dry wt. Basis.
6. Release about 2-3 kg earthworms per ton of biomass or 100 nos. earthworms per one sq. ft. area.
7. Place wire net / bamboo net over the tank to protect earthworm from birds.
8. Sprinkling of water should be done to maintain 70-80 % moisture content.
9. Provision of a shed over the compost is essential to prevent entry of rainwater and direct sunshine.
10. Sprinkling of water should be stopped when 90 % bio-wastes are decomposed. Maturity could be judged visually by observing the formation of granular structure of the compost at the surface of the tank.
11. Harvest the vermicompost by scrapping layer wise from the top of the tank and heap under shed. This will help in separation of earthworms from the compost. Sieving may also be done to separate the earthworms and cocoons.

Advantages of vermicompost:

1. Vermicompost is rich in all essential plant nutrients.
2. Vermicompost is free flowing, easy to apply, handle and store and does not have bad odour
3. It improves soil structure, texture, aeration, and water holding capacity and prevents soil erosion
4. Vermicompost is rich in beneficial micro flora such as a N- fixers, P-solubilizers, cellulose decomposing micro-flora etc in addition to improve soil environment.
5. Vermicompost contains earthworm cocoons and increases the population and activity of earthworm in the soil
6. It prevents nutrient losses and increases the use efficiency of chemical fertilizers
7. Vermicompost is free from pathogens, toxic elements, weed seeds etc.
8. Vermicompost minimizes the incidence of pest and diseases.
9. It enhances the decomposition of organic matter in soil.
10. It contains valuable vitamins, enzymes and hormones like auxins, gibberellins etc.
11. Provides excellent effect on overall plant growth, encourages the growth of new shoots / leaves and improves the quality and shelf life of the produce.
12. It neutralizes the soil protection.

Phases of vermicomposting

Phase 1: Processing involving collection of wastes, shredding, mechanical separation of the metal, glass and ceramics and storage of organic wastes.

Phase 2: Pre digestion of organic waste for twenty days by heaping the material along with cattle dung slurry. This process partially digests the material and fit for earthworm consumption. Cattle dung and biogas slurry may be used after drying. Wet dung should not be used for vermicompost production.

Phase 3: Preparation of earthworm bed. A concrete base is required to put the waste for vermicompost preparation. Loose soil will allow the worms to go into soil and also while watering, all the dissolvable nutrients go into the soil along with water.

Phase 4: Collection of earthworm after vermicompost collection. Sieving the composted material to separate fully composted material. The partially composted material will be again put into vermicompost bed.

Phase 5: Storing the vermicompost in proper place to maintain moisture and allow the beneficial microorganisms to grow.

What Worms Need

The Five Essentials

Compost worms need five basic things:

1. An hospitable living environment, usually called "bedding"
2. A food source
3. Adequate moisture (greater than 50% water content by weight)
4. Adequate aeration
5. Protection from temperature extremes

These five essentials are discussed in more detail below.

Bedding

Bedding is any material that provides the worms with a relatively stable habitat. This habitat must have the following characteristics:

High absorbency

Worms breathe through their skins and therefore must have a moist environment in which to live. If a worm's skin dries out, it dies. The bedding must be able to absorb and retain water fairly well if the worms are to thrive.

Good bulking potential

If the material is too dense to begin with, or packs too tightly, then the flow of air is reduced or eliminated. Worms require oxygen to live, just as we do. Different materials affect the overall porosity of the bedding through a variety of factors, including the range of particle size and shape, the texture, and the strength and rigidity of its structure. The overall effect is referred to in this document as the material's bulking potential.

Low protein and/or nitrogen content (high Carbon: Nitrogen ratio)

Although the worms do consume their bedding as it breaks down, it is very important that this be a slow process. High protein/nitrogen levels can result in rapid degradation and its associated heating, creating inhospitable, often fatal, conditions. Heating can occur safely in the food layers of the vermiculture or vermicomposting system, but not in the bedding.

Requirements

Housing: Sheltered culturing of worms is recommended to protect the worms from excessive sunlight and rain. All the entrepreneurs have set up their units in vacant cowsheds, poultry sheds, basements and back yards.

Containers: Cement tanks were constructed. These were separated in half by a dividing wall. Another set of tanks were also constructed for preliminary decomposition.

Bedding and feeding materials: During the beginning of the enterprises, most women used cowdung in order to breed sufficient numbers of earthworms. Once they have large populations, they can start using all kinds of organic waste. Half of the entrepreneurs have now reached populations of 12,000 to 15,000 adult earthworms.

Vermicompost Production Methodology

i) Selection of suitable earthworm

For vermicompost production, the surface dwelling earthworm alone should be used. The earthworm, which lives below the soil, is not suitable for vermicompost production. The African earthworm (*Eudrillus engenial),* Red worms (*Eisenia foetida)* and composting worm (*Peronyx excavatus)* are promising worms used for vermicompost production. All the three worms can be mixed together for vermicompost production. The African worm (*Eudrillus eugenial)* is preferred over other two types, because it produces higher production of vermicompost in short period of time and more young ones in the composting period.

ii) Selection of site for vermicompost production

Vermicompost can be produced in any place with shade, high humidity and cool. Abandoned cattle shed or poultry shed or unused buildings can be used. If it is to be produced in open area, shady place is selected. A thatched roof may be provided to protect the process from direct sunlight and rain. The waste heaped for vermicompost production should be covered with moist gunny bags.

iii) Containers for vermicompost production

A cement tub may be constructed to a height of 2½ feet and a breadth of 3 feet. The length may be fixed to any level depending upon the size of the room. The bottom of the tub is made to slope like structure to drain the excess water from vermicompost unit. A small sump is necessary to collect the drain water.

In another option over the hand floor, hollow blocks / bricks may be arranged in compartment to a height of one feet, breadth of 3 feet and length to a desired level to have quick harvest. In this method, moisture assessment will be very easy. No excess water will be drained. Vermicompost can also be prepared in wooden boxes, plastic buckets or in any containers with a drain hole at the bottom.

iv) Vermiculture bed

Vermiculture bed or worm bed (3 cm) can be prepared by placing after saw dust or husk or coir waste or sugarcane trash in the bottom of tub / container. A layer of fine sand (3 cm) should be spread over the culture bed followed by a layer of garden soil (3 cm). All layers must be moistened with water.

If available, shredded paper or cardboard makes an excellent bedding, particularly when combined with typical on-farm organic resources such as straw and hay. Organic producers, however, must be careful to ensure that such materials are not restricted under their organic certification standards. Paper or cardboard fibre collected in municipal waste programs cannot be approved for certification purposes. There may be cases, however, where fibre resources from specific generators could be sourced and approved. This must be considered on a case-by-case basis. Another material in this category is paper-mill sludge, which has the high absorbency and small particle size that so well complements the high C:N ratios and good bulking properties of straw, bark, shipped brush or wood shavings. Again, the sludge must be approved if the user has organic certification.

In general, it should be noted by the reader that the selection of bedding materials is a key to successful vermiculture or vermicomposting. Worms can be enormously productive (and reproductive) if conditions are good; however, their efficiency drops off rapidly when their basic needs are not met (see discussion on moisture below).

Good bedding mixtures are an essential element in meeting those needs. They provide protection from extremes in temperature, the necessary levels and consistency of moisture, and an adequate supply of oxygen. Fortunately, given their critical importance to the process, good bedding mixtures are generally not hard to come by on farms. The most difficult criterion to meet adequately is usually absorption, as most straws and even hay are not good at holding moisture. This can be easily addressed by mixing some aged or composted cattle or sheep manure with the straw. The result is somewhat similar in its bedding characteristics to aged horse manure.

Mixing beddings need not be an onerous process; it can be done by hand with a pitchfork (small operations), with a tractor bucket (larger operations), or, if one is available, with an agricultural feed mixer. Please note that the latter would only be appropriate for large commercial vermicomposting operations where high efficiency levels and consistent product quality is required.

v) Worm Food

Compost worms are big eaters. Under ideal conditions, they are able to consume in excess of their body weight each day, although the general rule-of-thumb is ½ of their body weight per day. They will eat almost anything organic (that is, of plant or animal origin), but they definitely prefer some foods to others. Manures are the most commonly used worm feedstock, with dairy and beef manures generally considered the best natural food for Eisenia, with the possible exception of rabbit manure. The former, being more often available in large quantities, is the feed most often used.

vi) Selection for vermicompost production

Cattle dung (except pig, poultry and goat), farm wastes, crop residues, vegetable market waste, flower market waste, agro industrial waste, fruit market waste and all other bio degradable waste are suitable for vermicompost production. The cattle dung should be dried in open sunlight before used for vermicompost production. All other waste should be predigested with cow dung for twenty days before put into vermibed for composting.

vii) Putting the waste in the container

The pre-digested waste material should be mud with 30% cattle dung either by weight or volume. The mixed waste is placed into the tub / container upto brim. The moisture level should be maintained at 60%. Over this material, the selected earthworm is placed uniformly. For one-meter length, one-meter breadth and 0.5-meter height, 1 kg of worm (1000 Nos.) is required. There is no necessity that earthworm should be put inside the waste. Earthworm will move inside on its own.

viii) Watering the vermibed

Daily watering is not required for vermibed. But 60% moisture should be maintained throughout the period. If necessity arises, water should be sprinkled over the bed rather than pouring the water. Watering should be stopped before the harvest of vermicompost.

ix) Harvesting vermicompost

In the tub method of composting, the castings formed on the top layer are collected periodically. The collection may be carried out once in a week. With hand the casting will be scooped out and put in a shady place as heap like structure. The harvesting of casting should be limited up to earthworm presence on top layer. This periodical harvesting is necessary for free flow and retain the compost quality. Other wise the finished compost get compacted when watering is done. In small bed type of vermicomposting method, periodical harvesting is not required. Since the height of the waste material heaped is around 1 foot, the produced vermicompost will be harvested after the process is over.

x) Harvesting earthworm

After the vermicompost production, the earthworm present in the tub / small bed may be harvested by trapping method. In the vermibed, before harvesting the compost, small, fresh cow dung ball is made and inserted inside the bed in five or six places. After 24 hours, the cow dung ball is removed. All the worms will be adhered into the ball. Putting the cow dung ball in a bucket of water will separate this adhered worm. The collected worms will be used for next batch of composting.

Worm harvesting is usually carried out in order to sell the worms, rather than to start new worm beds. Expanding the operation (new beds) can be accomplished by splitting the beds that is, removing a portion of the bed to start a new one and replacing the material with new bedding and feed. When worms are sold, however, they are usually separated, weighed, and then transported in a relatively sterile medium, such as peat moss. To accomplish this, the worms must first be separated from the bedding and vermicompost. There are three basic categories of methods used by growers to harvest worms: manual, migration, and mechanical. Each of these is described in more detail in the sections that follow.

a) Manual Methods

Manual methods are the ones used by hobbyists and smaller-scale growers, particularly those who sell worms to the home-vermicomposting or bait market. In essence, manual harvesting involves hand-sorting, or picking the worms directly from the compost by hand. This process can be facilitated by taking advantage of the fact that worms avoid light. If material containing worms is dumped in a pile on a flat surface with a light above, the worms will quickly dive below the surface. The harvester can then remove a layer of compost, stopping when worms become visible again. This process is repeated several times until there is nothing left on the table except a huddled mass of worms under a thin covering of compost. These worms can then be quickly scooped into a container, weighed, and prepared for delivery.

There are several minor variations and/or enhancements on this method, such as using a container instead of a flat surface, or making several piles at once, so that the person harvesting can move from one to another, returning to the first one in time to remove the next layer of compost. They are all labour-intensive, however, and only make sense if the operation is small and the value of the worms is high.

b) Self-Harvesting (Migration) Methods

These methods, like some of the methods used in vermicomposting, are based on the worms tendency to migrate to new regions, either to find new food or to avoid undesirable conditions, such as dryness or light. Unlike the manual methods described above, however, they often make use of simple mechanisms, such as screens or onion bags.

The screen method is very common and easy to use. A box is constructed with a screen bottom. The mesh is usually ¼", although 1/8" can be used as well. There are two different approaches. The downward-migration system is similar to the manual system, in that the worms are forced downward by strong light. The difference with the screen system is that the worms go down through the screen into a prepared, pre-weighed container of moist peat moss. Once the worms have all gone through, the compost in the box is removed and a new batch of worm-rich compost is put in. The process is repeated until the box with the peat moss has reached the desired weight. Like the manual method, this system can be set up in a number of locations at once, so that the worm harvester can move from one box to the next, with no time wasted waiting for the worms to migrate.

The upward-migration system is similar, except that the box with the mesh bottom is placed directly on the worm bed. It has been filled with a few centimeters of damp peat moss and then sprinkled with a food attractive to worms, such as chicken mash, coffee grounds, or fresh cattle manure. The box is removed and weighed after visual inspection indicates that sufficient worms have moved up into the material. This system is used extensively in Cuba, with the difference that large onion bags are used instead of boxes. The advantage of this system is that the worm beds are not disturbed. The main disadvantage is that the harvested worms are in material that contains a fair amount of unprocessed food, making the material messier and opening up the possibility of heating inside the package if the worms are shipped. The latter problem can be avoided by removing any obvious food and allowing a bit of time for the worms to consume what is left before packaging.

Q. 10 Write short notes (Any Two)

1) Biofertilizer :

The term bio-fertilizer refers to the preparation containing primarily active strains of microorganism. They are ready to use live formulates of such microorganism, which on application to seed, root or soil fix atmospheric nitrogen or solubilize/mobilize plant nutrients or otherwise stimulate plant growth substances.

Biofertilizers such as Rhizobium, Azotobacter, Azospirilium and blue green algae (BGA) have been in use a long time. Rhizobium inoculant is used for leguminous crops. Azotobacter can be used with crops like wheat, maize, mustard, cotton, potato and other vegetable crops.

Classification of biofertilizers :_

Depending upon the activity of mobilizing different nutrient biofertilizers are broadly classified as :-

1. Nitrogen Fixer.
2. Phosphates solubilize and mobilize.
3. Compost accelerators and enrichers.

1. Nitrogen fixer: - Depending upon the mechanisms of nitrogen fixation this group is broadly grouped as :-.

i. **Symbiotic Nitrogen fixer**: - There microbes fix atmospheric nitrogen with symbiotic association.

a) *Rhizobium* are host specific and they fix nitrogen with symbiotic association with host plant. It is recommended for leguminous pulses and oilseeds.

b) Azolla (Azolla and Anabaena azollae)

ii. Associative symbiotic Nitrogen fixer:-

a) *Azospirilluum*

iii. Non-Symbiotic Nitrogen fixer :-

a) Azotobacter   b) Blue green algae

2. Phosphate solubilizer and mobilize :-

These are responsible for conversion of fixed form of phosphorus to available form. The Phosphate solubilizing biofertilizer includes *Bacillus, Pseudomonus* or fungi such as *Aspergillus, Penicillium*

The Phosphate mobilizing biofertilizer includes VA-mycorrhizal fungi such as *Blomus, Gigaspora* etc.

3. Compost accelerators and enrichers :- Decomposition or composting is essentially a microbiological process accomplished by the combined activity of bacteria, fungi, actinomycetes and protozoa. Compost accelerators are needed to decompose the lignin and cellulose of the waste materials. Species of *Trichoderma,* *Penicillium, Aspergillus, Trichurus* and *Paecilliomyces* are the compost accelerators.

Methods of Biofertilizer application :-

1. Seed treatment: - The bioferlizer are mixed with water and slurry is prepared. Required amount of seed is mixed properly with the slurry in such a way that there will be a thin and complete coating of biofertilizer on the seed. The treated seed should be dried under the shade and then sown in the field preferably in afternoon.

2. Root treatment:- The crops which are grown from seedling, the root of these seedlings should be dipped in the biofertilizer solution for half an hour and then the seedling will be transplanted in the main field. Seedling root dip is highly effective for vegetable seedling, sugarcane stem cutting, potato tuber cutting as well as for rice seedling also.

3. Soil treatment: - Biofertilizer @ 10 kg/ha is required for effective and efficient nutrient management. The biofertilizer is distributed in the field uniformly. On the other hand required quantity of biofertilizer should be incubated with FYM for 24 hours and applied in the field for even and effective distribution.

Advantages of biofertilizer application:-

1. It is low cost input for crop production
2. It is an pollution free input.
3. It is an energy conserving input in agriculture.
4. It is helpful for quicker decomposition.
5. It maintains soil health without creating any environmental pollution.
6. This input reduces the underground water pollution
7. It secretes some hormone and growth regulator which indirectly helpful for higher crop production.
8. Plant nutrient release from biofertilizer available to the plant slowly.
9. It secretes some antibiotic which reduces crop diseases.

2) Compost enrichment :

Compost prepared by traditional method is usually low in nutrients and there is need to improve its quality. Enrichment of compost using low cost N fixing and phosphate solubilising microbes is one of the possible way of improving nutrient status of the product. It could be achieved by introducing microbial inoculants, which are more efficient than the native strains associated with substrate materials. Both the nitrogen fixing and phosphate solubilising microbes are more exacting in their physiological and ecological requirements and it is difficult to meet these requirements under natural conditions. The only alternative is to enhance their inoculums potential in the composting mass. Studies conducted at IARI, New Delhi, showed that inoculation with Azotobacter/Azospirillum and phosphate solubilizing culture in the presence of 1 % rock phosphate is a beneficial input to obtain good quality compost rich in nitrogen (1.8 %). The humus content was also higher in material treated with microbial inoculants.

Farm compost is poor in P content (0.4-0.8 %). Addition of P makes the compost more balanced, and supplies nutrient to micro-organisms for their multiplication and faster decomposition. The addition of P also reduces N losses.

Compost can be enriched by:

- Application of, bone meal or phosphate rock: 1 kg of superphosphate or bonemeal is applied over each layer of animal dung.
- Low-grade phosphate rock can also be used for this purpose.
- Use of animal bones: these can be broken into small pieces, boiled with wood ash leachate or lime water and drained, and the residue applied to the pits.

This procedure of boiling bones facilitates their disintegration.

- Even the addition of raw bones, broken into small pieces and added to the pit, improves the nutrient value of compost significantly.
- Wood ash waste can also be added to increase the K content of compost.
- Addition of N-fixing and P-solubilizing cultures (IARI, 1989):
- The quality of compost can be further improved by the secondary inoculation of *Azotobacter*, *Azospirillum lipoferum*, and *Azospirillum brasilence* (N-fixers); and *Bacillus megaterium* or *Pseudomonas* sp. (P solubilizers).
- These organisms, in the form of culture broth or water suspension of biofertilizer products, can be sprinkled when the decomposing material is turned after one month. By this time, the temperature of the compost has also stabilized at about 35 °C. As a result of this inoculation, **the N content of straw compost can be increased by up to 2 %.**

In addition to improving N content and the availability of other plant nutrients, these additions help to reduce the composting time considerably.

3) Packing and labeling of organic produce:

Packing is done for more efficient handling and marketing. Packing cannot improve quality. Hence only the best possible produce should be packed. Inclusion of decayed, damaged produce in bulk or consumer packages may become source of infection and reduce the sale at the market. Packing is not a substitute for refrigeration, packing combined with the refrigeration is the best method.

A good package should aim at protection of products from physical, psychological and pathological deterioration through storage, transport and marketing.

Benefits of packing:-

1. Serve as an efficient handling unit
2. Good storage unit
3. Protects from mechanical damage and moisture loss
4. Protects quality and reduces wastage
5. Provide service and sale motivation.

Materials for packaging:-

For packing recyclable, and reusable system shall be used wherever possible. Use of biodegradable material is desirable. Material used for packing shall not contaminate food. , unnecessary packing should be avoided.

Gunny bags, wooden boxes, bamboo baskets are the conventional packs. Corrugated Fiber boards (CFB) cartons are used for packing fruits.

Labelling :-

- The label should be attractive, clear, accurate information on the organic status of product should be given.
- The label for organic and conventional product should be distinguishable by different col our labels.
- The detail like name of product, quality of product. Name and address of producers, name of certification agency. Certification lot no etc are given on label e.g. information required on label.

Crop :- O.G (organic ginger)
Country :- I (India)
Field No :- 05
Date of harvest :- 32 (3^{rd} February)
Year :- 2008

Lot number :- 0G, I, 05, 32, 2008

Lot no is helpful in keeping back the product, particularly the field no in which it is grown in case of contamination; lot no should include the crop, country, field number, harvest date and year.

SECTION "B"

Q.11 State true or False

1. The Department of Commerce shall act as the Apex body of the NPOP: **True**
2. The benefits of organic practices are seen immediately: **False**
3. Biochar is an organic carbon rich material produced via pyrolysis of agricultural bio-waste such as wood chip or crop straw :**True**
4. The use of genetically engineered seeds, transgenic plants or plant material is not prohibited. :**False**

Q.12	**Match the pairs**		
	'A'	**Ans**	**'B'**
	1. NPOP	(e)	a. Hyderabad
	2.Non symbiotic nitrogen fixer	(d)	b. 2 nd October
	3 CRIDA	(a)	c. Solapur
	4. MOFF	(b)	d. *Azotobacter*
			e. Gaziabad

Signature of Course Instructor,	Signature of University Head of the Department
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