Course- Organic Production Technology (ELP)
Course code- EL-AGP 811

Practical Manual

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Content

	management	
21	Preparation of fermented butter milk	
22	Quality aspect, grading, packaging and handling of organic produce	
23	Preparation of balance sheet	
24	Quality analysis of compost and vermicompost	

Experiment -1

Topic- Preparation of enrich compost (Coimbatore method)

Aim: To study the different methods of compost making

Objective: To prepare compost by Coimbatore method

Relevant information: This type of composting is done in pits of different sizes depending on the availability of waste material. It is very similar to NADEP method. It consists of layers of waste materials with mixture with organic manures, cow dung and water. Dry crop residue or plant parts are first laid in the pit.

Materials required:

1. Raw material: Any type of crop residue, weeds, dry plant part.

2. Starter materials: Cattle dung and water emulsion prepared by mixing 5-10 kg of cow dung with 2.5-5 litre of water.

3. Additives: Powdered bone meal 0.5-1 kg.

Procedure:

It is moistened with a suspension of cow dung and water and with fine bone meal sprinkled over it uniformly. Similar layers are laid one over another till the material rises 0.75 m. above the ground level. It is finally plastered with wet mud and left undisturbed for 8-10 weeks. Plaster is then removed, material moistened with water, given a turning and made into a rectangular heap under a shade.

It is left undisturbed till its use. This process is called as aerobic and anaerobic decomposition of compost. In this process elementary raw materials are not so well decomposed as in the other methods but organic matter and N contents are well preserved.

Pit size: A pit of 12’ length × 6’ width × 3’ depth is prepared for composting.

Steps followed

Step I

First layer: Spread the raw material to a depth of 9 inch and sprinkle water over it with a rose can or pipe until the entire material is moist.

Second layer: Uniformly broadcast about 1 kg of powdered bone meal over it to make a layer.

Third layer: Apply a layer of cow dung slurry with 5-10 litre of water.

Step II

Repeat this process until a heap of 0.75 meter above the ground level is formed.

Plaster the entire exposed surface area of the heap with mud. This will enable a semi aerobic fermentation process which would take place for above 4-6 weeks depending upon the nature of raw materials.

Apply sum amount of old compost as inoculums.

Step III

Observe time to time and apply water when it is necessary.

After 4-6 weeks remove the plaster, turn the material and apply water.

Step IV

Keep the heap open for a week to facilitate aerobic decomposition. Plaster it with a layer of moist clay for anaerobic fermentation. The compost will be ready within 4-5 months period starting from the day of preparation.

Important things:

Layering process is to be continued for about a fortnight.

Apply some old compost as inoculums.

Do not disturb the heap for about a month.

This method saves labour cost, as there is no need of regular turning and watering. That's why it is the cheapest process of composting.

Observation:

Time in days	**Colour**	**Texture**	**Smell**	**Moisture content (%)**	**Temperature (°C)**

Conclusion:

Precaution:

1. Handle the implements, other tools very carefully.

2. Wash your body part after completion of work.

Experiment -2

Topic- Preparation of enrich compost (Bangalore method)

Aim: To study the different methods of compost making

Objective: To prepare compost by Bangalore method

Relevant information: In this method of composting, dry waste material of 25 cm. thick is spread in a pit and a thick suspension of cow dung in water is sprinkled over for moistening. A thin layer of dry waste is laid over the moistened layer. The pit is filled alternately with dry layers of material and cow dung. It is left exposed without covering for 15 days.

Materials required:

1. Raw materials: Any organic material can be used for composting.

2. Starter/ Inoculation: FYM or mixture of dung, urine and litter or even knight soil.

3. Additives: Bone meal/ oil cake, wood ash.

Procedure:

Prepare a trench of 30 foot (length) × 6foot (width) × 3 foot (depth) or in pits of 20 foot × 6 foot × 3 foot size and follow the filling steps.

Step I

First layer:

Broadcast the basic raw materials into the pit to a depth of 25 cm.

Apply 20-30 gallons of water depending upon the dryness of material.

Second layer:

Place 5 cm layer of FYM/ preferably a mixture of dung, urine and litter from cattle shed over that. Cover the top with a layer of earth to a thickness of 15 cm.

Third layer:

Make a layer mix with earth or bone meal/ oil cake, wood ash etc. to improve the nutritional value of compost. Continue the filling of the layers till the heap rises over the ground level to a height of 0.5 meter. It may be given a dome- shape structure.

Step II

Keep it as such without any turning for about three months.

Open the heap. It will get a pleasant colour and smell. The compost contains about 1.5 % N, 1 % P_2O_5 with 1.5 % K_2O.

Observations:

Time in days	**Colour**	**Texture**	**Smell**	**Moisture content (%)**	**Temperature (°C)**

Conclusion:

Precaution:

1. Handle the implements, other tools very carefully.

2. Wash your body part after completion of work.

Experiment-3

Topic- Preparation of enrich compost (Indore compost)

Aim- To study the different methods of compost making

Objective- To prepare compost by Indore method

Relevant information- In Indore methods of composting, organic wastes are spread in the cattle shed to serve as bedding. Urine soaked material along with dung is removed every day and formed into a layer of about 15 cm thick at suitable sites. This method was developed by Howard who worked at The Indian Institute of Plant Industry, Indore.

Materials required:

1. Straw or any other organic farm waste is used as basic raw material.

2. Cow dung, urine, wood ash and soil is used as starter material.

Procedure:

Open a pit with a size of 10 foot or more (as convenient) in length, 6-8 foot width and 2-3 foot deep (not more than 3 foot).

Steps:

Step I: Placing the material

1. Chop the straw or other waste material and spread it with cattle dung and soil in a ratio of 4:2:1 up to 5 cm layer.

2. Sprinkle water over it.

3. Fill the pit with above materials up to 30 cm height above the ground level

4. Add one more layer of bedding material with wood ash and mud.

5. Provide extra aeration by making artificial holes or opening of 10 cm diameter in each foot length of the pit.

Step II: Turning

Turn the material 3 times for proper aeration and moisture content.

1. First turning- 10-15 days after filling the pit

2. Second turning- 15 days after first turning

3. Third turning- After 2 months of second turning.

Step III: Observation

Several changes take place during the completion of the whole method, observe the changes.

Observations:

Time in days	**Colour**	**Texture**	**Smell**	**Moisture content (%)**	**Temperature (**°C**)**

Conclusion-

Precaution:

1. Handle the implements, other tools very carefully.

2. Wash your body part after completion of work.

Experiment-4

Topic- Preparation of enrich compost (NADEP compost)

Aim- To study the different methods of compost preparation

Objective- To prepare compost by NADEP method

Relevant information- The NADEP method of compost making was first invented by a farmer named N. D. Pandharipande (also popularly known as NADEP kaka) of Maharashtra. The process includes the placing of selective layers of different types of compostable organic materials, followed by sealing with mud in a given structure prepared with brick and concrete/ mud. NADEP method is one aerobic method of composting.

Materials required-

i. Around 1500 kg of farm waste, like crop residues, weed, plant leaf, twigs, sugarcane bagasse, husk etc. It should be free from foreign materials like glass, plastic, stone etc.

ii. Cow dung (90-100 kg), the slurry from biogas plant can also be used.

iii. Dry ground soil.

iv. Water: as per the condition and types of material.

Procedure:

Pit size- A rectangular brick tank having a size of 10 ft (length) × 5 ft (breadth) × 3 ft (height) is required for making NADEP compost. Provide sufficient space in between the bricks for good aeration. The size may vary depending upon availability of raw material and demand.

Steps followed

Step I:

First layer: Fill the first layer to a height of 6 inches with farm waste with at least 100-120 kg material.

Second layer: Mix 4 kg of cow dung in 125-150 litres of water (cow dung slurry) and sprinkled on the farm waste and see whether the material is completely wet or not. The amount of water will be more in summer season.

Third layer: Take 60 kg of clean soil and dilute in water and sprinkled over the second layer.

Step II:

i. After completion of first three layers, fill the tank with same series of three layers in same sequence up to one and half foot above the edge of the tank in the shape of a cone.

ii. In a standard sized tank, 11-12 series of layers can be placed easily.

iii. Seal the tank with three inch layer of soil followed by plaster with liquid cow dung slurry. This will prevent cracks.

Step III:

Inspect the heap on regular basis. After a period of 15-20 days, you will notice that the volume of material will be reduced. It is due to degradation by microbial activities.

Open the tank and fill it again layer by layer in same sequence up to one and half foot above the edge of the tank. Once again, plaster it.

Step IV:

In order to maintain the moisture level (about 15-20%) and also to prevent cracking, apply cow dung slurry on the compost heap.

Cover the tank roof to prevent excess evaporation of water.

Observations:

The compost will be ready within 90-120 days. The compost will be deep brown in colour with a pleasant smell. It should be removed from tank and sieved.

Time in days	**Colour**	**Texture**	**Smell**	**Moisture content (%)**	**Temperature (°C)**

Conclusion:

Precaution:

i. The important technique in production of NADEP compost is that the entire tank should be filled in one operation.

ii. Filling should be completed within 24 hours and should never go beyond 48 hours, as this would affect the quality of compost.

iii. At any condition the compost should not be allowed to become dry. If cracks found, it should be promptly filled up with cow dung slurry.

Experiment -5

Topic- Preparation of vermicompost

Aim: To study the method of vermicompost making

Objective: To study the preparation and use of vermicompost

Relevant information: Vermicomposting is a method of preparing enrich compost with the use of earthworms. Earthworms accelerate the process of composting, aerate the organic matter and enhances the finished compost with nutrients and enzymes secreted from their digestive tracts. This enriched product is eventually called "worm cast" or **black gold**.

Castings

The expelled manure from worm has a bit of mucus surrounding each granule. This gets hardens on exposing to air. When these granular castings are mixed into soil, the nutrient from compost releases slowly to feed the plant. However, the hardened particles of mucus do not break down easily, thus they help in soil aeration and drainage. Casting is an organic soil conditioner as well as a super natural fertilizer which contents 7 times more P, 11 times more K and 1.5 times more Ca than other composts.

Methods of vermicomposting

Out of various methods, heap/bed and pit method is the most popular methods.

Heap/Bed method

In this method, composting is done in the cemented or over ground floor by making a bed of 6 ft. × 2 ft. × 2 ft. in size. This method is easy to maintain.

Pit method

Here vermicomposting is done in cemented pit with a size of 5 m. long × 1 m. wide × 1 m. high. This pit is covered with grass or any other local material. This method is not favourable due to poor aeration, water logging at bottom and high cost of production.

Materials required:

1. Earthworm species: *Eisenia foetida*, *Udrilus eugene*, *Perionyx excavates* etc.

2. Raw materials: Crop residues, weed biomass, vegetable waste, dry leaf, waste from agro-industries, bio degradable portion of rural and urban wastes.

3. Cow dung

4. Water

Phases of vermicomposting

Vermicomposting has 3 distinguished phases:

Phase I: Pre-digestion of organic waste on earthworm bed.

Phase II: Collection of earthworms and putting them on pre-digested waste compartment.

Phase III: Storing of vermicompost for proper moisture and growth of micro-organism.

Procedure

i. Prepare a pit or heap according to the requirement or availability of materials.

ii. Select the site near a water source in an unused shady area but should not any water stagnation.

iii. Create 1 inch thick layer of leaves.

iv. Put organic residue layer (finely chaffed material) up to 9 inch thick over the first layer.

v. Create a third layer up to 2 inch with cow dung slurry by mixing equal amount of dung and water.

vi. On 24^{th} day of processing, release 4000 worms in the pit (1 sq. m. - 2000 worms) without disturbing.

vii. Apply water regularly.

viii. The raw material will be turned into vermicompost in the form of worm excreta.

Observations:

Number of labour required-

Cost of raw materials-

Earthworm required/pit-

Size and colour of earthworms-

Days to decomposition-

Yield-

Conclusion:

Experiment -6

Topic- Multiplication of *Azolla*

Aim: To multiply *Azolla*

Objective: To learn the process of *Azolla* multiplication.

Relevant information: *Azolla* is a free-floating water fern that fixes atmospheric nitrogen in association with nitrogen fixing blue green algae *Anabena azollae*. The agronomic potential of Azolla is quite significant particularly for rice and it is widely used as bio-fertilizer for increasing rice yield. It can fix 40-60 kg N per ha per rice crop.

The common species of *Azolla* are *Azolla microphylla, Azolla pinnata, Azolla nilotica, Azolla maxicana and Azolla rubra.*

Materials required

1. Area- 40 sq. m. (1 cent) for tank construction.
2. Cattle dung 10 kg.
3. Jeevamrutha
4. *Vitex negundo* leaf extract
5. Fresh *Azolla* inoculum 8 kg.

Procedure

i. Select a swamp field and complete ploughing and levelling thoroughly.

ii. Divide the field into small sectors with bunds with a dimension of 20 × 2 m.

iii. Put 10 kg cow dung in 20 L water and mix thoroughly, sprinkle in the field.

iv. Put water in the sector up to a height of 10 cm. and maintain the water level.

v. Apply Jeevamrutha @ 500 ml.

vi. Apply fresh *Azolla* biomass @ 8kg to each plot.

vii. Apply Jeevamrutha on 4^{th} and 8^{th} day after *Azolla* inoculation @ 500 ml.

viii. Apply *Vitex negundo* leaf extract on 7^{th} day after *Azolla* inoculation.

ix. Maintain 10 cm. water level throughout the growing period (2-3 weeks).

x. As soon as Azolla mat begins to float on the water, harvest the *Azolla* by drain out the water and record the biomass.

Uses

Method of inoculation of *Azolla* in rice field

A. Azolla is mainly applied in two ways in rice field. It can be inoculated in rice field before transplanting and incorporated as green manure. This method requires huge quantity of fresh *Azolla*.

B. Azolla may be inoculated after transplanting of rice and grown as 'dual culture' with rice and incorporated subsequently.

Observations: Observe every day progress and do accordingly.

Conclusion:

Experiment -7

Topic- Multiplication of Blue Green Algae (BGA)

Aim: To study the multiplication technique of Blue Green Algae (BGA)

Objective: To learn the process of Blue Green Algae (BGA) multiplication.

Relevant information: Blue Green Algae (BGA) is a symbiotic association, used as bio-fertilizer which can able to fix atmospheric nitrogen. The most common and important species are *Anabena* and *Nostoc*. Others are *Calothrix , Plectoneme* and *Tolypotrix* etc. The amount of nitrogen fixed by these species varies from 15-45 kg per ha. It grows well under wide temperature range from 25 °- 45 ° C. Growth of Blue Green Algae (BGA) increases with bright sunshine hours. A neutral *pH* range is ideal for its growth.

Materials required

i. Fresh BGA inoculum

ii. Cattle dung

iii. Jeevamrutha

iv. Soil

v. Lime

vi. *Vitex negundo* leaf extract

vii. Polythene sheet

Procedure

Pit method

i. Prepare shallow cemented tank of 8.25 m long and 1.5 m wide and 0.25 m deep. Place a polythene sheet over the structure. Tank size varies depending on the space and material available.

ii. Place 20 kg soil and mix 80 g. Lime with it. Apply Jeevamrutha as a source of nutrient.

iii. Fill water around 6.5 cm depending on the local conditions and evaporation rate.

iv. After the settle down of soil, sprinkle hand full of cow dung and spread culture on the surface of standing water. Keep the whole system under direct sunlight.

v. Add water regularly depending on daily evaporation rate.

vi. When the mass increases (within 15 days of inoculation), allow water to dry up.

vii. Collect dry algae flakes and store it for field use.

Tray method

i. Iron tray of a dimension of 2 m × 2 m × 0.325 m size is standard.

ii. Place a polythene sheet over it.

iii. Apply 20 kg soil and Jeevamrutha.

iv. Spread 5-10 cm thick layer of Blue Green Algae (BGA) inoculum.

v. Maintain the water level.

vi. A thick mat of Blue Green Algae (BGA) will develop within 7-10 days of inoculation.

vii. Drain out the water and collect dry Blue Green Algae (BGA) flakes for field use.

Use

i. Apply algal flakes @ 10 kg per ha over standing water in rice field before 1 week of transplanting.

ii. Maintain water level in the field.

iii. Apply sodium molybdate if the soil is deficient in P.

Observations

Days to maturity:

Labour requirement:

Yield (kg dry flakes):

Precaution-

Do not store BGA materials with chemical fertilizers.

Conclusion-

Experiment -8

Topic- Field preparation and Layout

Objectives-

a. Prepare agriculture land for growing of crops

b. Making layout to conduct experiment as well to grow crops

Materials required for field preparation-

a. Primary tillage: Bullock plough / Tractor (using attachment like harrow, disc plough, leveller, planker etc.)

b. Secondary tillage: Rotavator, power tiller

c. Special attachment: Raisedbed maker, mulch sheet spreader, posthole digger, seed drill, seed-cum fertilizer drill, etc.

Methodology for field preparation-

Land is to be tilled initially using either bullock drawn plough or tractor drawn equipment like harrow or disc plough. Considering the land topography, level the field using a leveller. This levelling must be done before secondary tillage. After levelling, use secondary tillage equipments for final land preparation. Basal dose of fertilizer will be applied before last and final ploughing.

Inputs for layout-

a. No. of plots require to conduct an experiment or grow crops

b. Individual plot size depending on type of crop, water requirement, etc.

c. Total area require for the experiment / planting

d. Irrigation channel width

e. Bund width

f. Walking space

g. Special requirement, if any

Based on the above parameters layout is made

Materials required for layout-

a. Rope

b. Measuring tape

c. Pegs

d. Spade

e. Ridge maker (tractor attachment)

Methodology for field layout-

a. Three persons are required to set out right angle in any field following 3-4-5 measuring tape method .The first person holds together, between thumb & amp; finger, the zero mark & the 12 m mark of the measuring tape, the 2nd person holds between thumb & finger at 3m mark of the measuring tape and the 3rd person holds the 8m mark. Now stretch all sides of measuring tapes to form a triangle with lengths of 3 m, 4 m & amp; 5 m as shown in figure below. The angle near person one is a right angle. Instead of 3, 4 & 5m a multiple can be chosen as for example, 6, 8 & 10 m or 9, 12 & amp; 15m.

b. Fixing of peg – considering requirement of plot size, irrigation channel, etc., measuring tape is used to fix pegs on the soil surface.

c. Rope to be used to connect pegs.

d. Making of bunds -Width of bond depends upon soil type (For clay loam: 50 cm, for sandy: 60 cm)

e. Making of irrigation channel - Width of irrigation channel (decided on soil type): 1.25 m for clay lo 1 m for sandy soil.

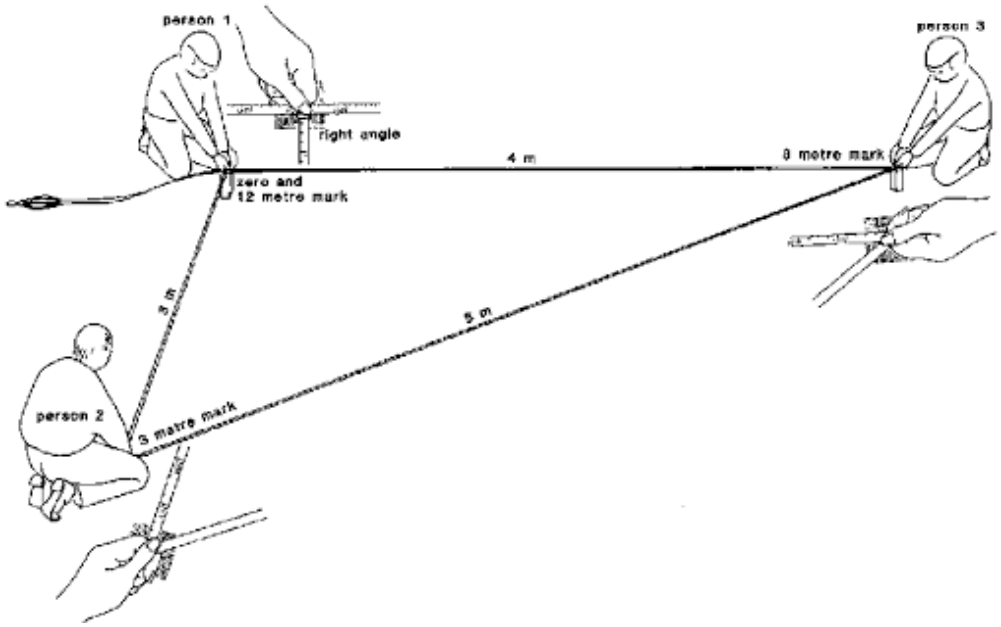
f. Levelling the plots using spade / tractor.

g. Application of basal dose as well as manure & amp; mixing in soil.

h. Opening line using hand hoe (line sow crop)

i. For broadcasted crop we may go for direct seeding on levelled plot & followed by light mixing of soil.

j. For transplanted crop puddling to be made before transplanting. The crop should be planted in North south direction so plants shading effect is less.



Conclusion-

Practical Significance: This experiment will help the students to learn good practical knowledge on field preparation, layout making for crop cultivation and conducting field experiments.

Experiment-9

Topic- Seed inoculation with bio-fertilizer

Aim- To inoculate crop seeds with bio-fertilizer

Relevant information- Rhizobial coating is to enriching the rhizosphere microenvironment with organic nutrients for early establishment.

Method-

1. Take the seeds in a plastic tray
2. Add proper quantity of adhesive (cool maida 10% gruel) to the seeds or jaggery
3. Shake gently so that the adhesive spreads evenly on all the seeds
4. Sprinkle the required biofertilizer (Rhizobium, Azospirillum, Azotobactor) evenly over the seeds and continue shaking.
5. The wet seed surface will attract the biofertilizer and result in even coating over the seeds
6. Roll the seed for uniformity
7. Shade dry the seed

Recommendations-

Seed rhizobial coating with 10% maida gruel @ 200-300ml/ kg of seeds and coating with biofertilizer @ 200-300 g per kg of seed improve the field emergence of green gram, black gram, cotton, tomato and brinjal.

Precautions-

- Seeds should not spill while shaking
- Adhesive should not be added excess. Since it will lead to formation of seed dumps.
- Inadequate application of adhesive will result in uneven seed coating
- Separate the seeds dumps formed, if any manually.
- Empty the seeds on a sheet of paper and allow it to dry for a day

Conclusion-

Experiment-10

Topic- Seed treatment and sowing

Aim- To treat the seeds for better germination and crop establishment

Procedure-

Seed Treatment Techniques for Vegetables

- Soak all kinds of vegetable seeds in biogas slurry for 30 minutes before sowing.
- Soak vegetable seeds in 2% *Panchagavya* (20 ml of *Panchagavya* in 980 ml of water) for 30 minutes before sowing for the production of healthy seedlings.

Bhendi

- Treat seeds with 15% or 25% raw cow's milk (150 ml of milk in 850 ml of water or 250 ml of milk in 750 ml of water) for 6 hours and then sow. This will increase the germination percentage and seedling vigour. It will also reduce the intensity of the vein clearing disease and increase the yield.
- Soak seeds in cow's urine at 5% or 10% concentration (50 ml of cow's urine in 950 ml of water or 100 ml of cow's urine in 900 ml of water) for 12 hours before sowing for good germination percentage.
- Soak seeds in 1 - 2% of *Panchagavya* (10 - 20 ml of *Panchagavya* in 990/980 ml of water) for 6 hours before sowing. This will improve the germination and seedling vigour.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds.
- Treat the seeds with biofertilizers - *Azospirillum* and *Phosphobacteria* (each @ 60 gms mixed with 60 ml of rice gruel for one kilogram of seeds) and shade dry for 30 minutes before sowing.
- For summer crop, soak the seeds in water for 12 hours before sowing.
- Soak the seeds in sweet flag *rhizome* extract or cow's urine solution (dilution 1:5 ratio – 1 part of extract or cow's urine in 5 parts of water) for 30 minutes before sowing. This will enhance the resistance against bacterial and fungal diseases.

Brinjal

- Soak the seeds in 12% raw cow's milk (120 ml of raw cow's milk in 880 ml of water)

for good germination percentage and seedling vigour. The germination speed is also increased.

- Seeds should be soaked in a solution of cow's urine (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases like fruit rot and die back.
- Seeds should be bundled using a thin cotton cloth and soaked in the biogas slurry for 12 hours prior to the sowing. This will kill all the disease causing microbes and also enhance the seed vigour.
- Treat the seeds with Trichoderma viride @ 4 gms/kg of seeds or with Pseudomonas @ 10 gms/kg of seeds and then sow after 24 hours. Bitter Gourd
- Soak the seeds in diluted cow's urine for 12 hours and in diluted cow's milk for 6 hours before sowing for good germination percentage. The dilution should be at the ratio of 1:1 (1 part of cow's urine or cow's milk with 1 part of water).
- Soak the seeds in raw cow's milk for 24 hours before sowing for good germination and yield.

Tomato

- Fumigate the seeds with *Acorus calamus* and *Embelia ribes* powder. Take seeds in a metal sieve. Take hot coal in a metal plate and sprinkle *Vasambu* or *Vaividanga* powder over the hot coal and hold the sieve with seeds against the fumes in a standing position for 2 – 3 minutes. This will enhance the germination rate and protect the seedlings from fungal pathogens. For treating 100 gms of seeds 5 gms of Sweet flag or *Vasambu* and 5 gms of *Vaividanga* is required.
- Soak the seeds tied in a khada cloth in diluted milk solution (75 ml milk and 425 ml water) for 6 hours and then sow. This will prevent the infection of seed borne diseases and enhance germination.
- Soak the seeds in a mixture of fermented buttermilk (3 days old) and water in 1:4 ratio for 6 hours and shade dry before sowing. The practice is applicable only for 6 to 12 months old seeds. Buttermilk can be replaced by Coconut or Palmyra toddy.
- kill the disease causing microbes and enhance the seed vigour.
- Treat the seeds with *Trichoderma viride* @ 4gms/kg of seeds and then sow after 24

hours.

Chillies

- Soak seeds in sweet flag extract or cow's urine at 1:5 ratio (1 part of extract or cow's urine with 5 parts of water) for 30 minutes before sowing. This will inhibit the seed borne diseases like fruit rot and die back. Soak seeds tied in a cotton cloth in biogas slurry for 12 hours before sowing. This will kill the disease causing microbes and enhance the seed vigour.
- Treat the seeds with *Trichoderma viride* @ 4gms/kg of seeds and then sow after 24 hours.

Bottle Gourd

- Soak seeds in water for 24 hours before sowing to break the dormancy and to quicken the germination.
- Soak seeds in warm water for 30 minutes before sowing. This helps in the softening of the hard seed coat.
- Soak seeds in cow's urine solution (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds and then sow after 24 hours.

Snake Gourd

Treat the seeds with cow dung @ 1 kg per kg of seeds for 30 minutes. This will increase the drought resistance and make the seeds germinate quickly.

Beans

- Soak the seeds in raw cow's milk for 24 hours before sowing for good germination and yield.
- Treat the seeds with powder form of Trichoderma viride @ 4 gms/kg or Pseudomonas @ 10 gms/kg of seeds. Seed treatment with Trichoderma or Pseudomonas protects the crops from disease causing microorganisms.

Root Vegetables

- Soak the seeds of beetroot and radish tied in a cotton cloth in water overnight or in

warm water for 30 minutes before sowing. This will help to quicken the germination and result in fast growth and healthy plants.

- Soak seeds in a solution of cow's urine (1 part cow's urine + 5 parts of water) for 30 minutes prior to the sowing. This will inhibit the seed borne diseases.
- Treat the seeds with *Trichoderma viride* @ 4 gms/kg of seeds and then sow after 24 hours.

Methods of sowing

a. Broadcasting

b. Line sowing / Line showing

c. Drilling

d. Transplanting

Materials required for line sowing

a. 2/3 types of seeds (100 g each)

b. Container – 10 l (one)

c. Hand hoe – 1

d. Pegs

e. Rope

Methodology- Fix the peg and rope open the line using hand hoe. Sow seed at desire density. Cover the seeds using soil**.** Sift the peg at a distance equivalent to line to line spacing. Continue the process of sowing.

Conclusion-

Experiment-11

Topic- Preparation of panchagavya

Aim: To prepare panchagavya

Objective: To learn the process of panchagavya preparation and its use.

Relevant information: Panchagavya is a mixture of different ingredients like cow dung, cow urine, milk, curd, ghee, jaggery, banana, tender coconut water and water. It has miraculous effects and has the potential in encouraging growth and providing immunity of plant system.

Materials required: Cow dung-7 kg, cow urine 10 litres, Ghee-1 kg, fresh cow milk- 3 litres, curd- 2 litres, jaggery-3 kg, well ripe banana- 12 nos, tender coconut water- 3 litres and water- 10 litres.

Procedure:

i. Take a wide mouthed earthen pot.

ii. Take the cow dung and ghee and mix thoroughly together in morning and evening. Keep the container as such for 3 days.

iii. After 3 days mix cow urine and water and keep it for few days.

iv. Stir the mixture twice a day both in morning and evening.

v. Add milk, curd, coconut water, jaggery and banana on 15^{th} day and keep it for another 15 days. Stirring should be done every day.

Application: Apply 30% Panchagavya for all the crops as foliar spray.

Conclusion-

Experiment-12

Topic- Preparation of liquid manure

Aim- To prepare liquid manure

Materials required- plastic barrel, fresh cow dung, cow urine, water, Jaggery

Procedure-

1. A simple barrel unit with a capacity of 200 litre is the chamber used for manufacturing liquid manures. Two outlets were fitted in the barrel at the height of 1½ feet and 2 feet from the bottom end and one more at the lower part of the barrel.

2. Fresh cow dung and urine was mixed in the unit at 1:1 ratio.

3. Add 10 parts of water and mix thoroughly and allow it for fermentation process. This will take 12 hours.

4. After 12 hours, add 1 kg of jaggery for every 100 litre fermented solution. Again, it is allowed for fermentation and sedimentation process. (It is location specific, the farm level other waste input like Palmyra fruit also can be used for the fermentation process)

5. The clear and enriched liquid organic manure is ready for field application in another 12 hours.

Conclusion-

Experiment-13

Topic- Preparation of Amritpani

Aim: To prepare amritpani

Objective: To learn the process of amritpani preparation and its use.

Relevant information: Amritpani is liquid manure and also used to improve the soil fertility. 'Amrut' means the drink considered as the 'heavenly drink', that rejuvenates the 'Gods' and has the supremacy to revive the dead.

Materials required: For making 200 litres of Amritpani (for 1 ha land) the following materials are required.

Ghee-250 gm, honey- 500 gm, Fresh cow dung- 10 kg, water- 200 litres and plastic container.

Procedure:

i. Thoroughly blend 10 kg cow dung with 500 gm honey into a creamy paste.

ii. Mix the creamy paste with 250 gm ghee.

iii. Dilute the mixture in 200 litre water.

iv. This mixture thus obtained is Amritpani.

Application:

- Seedling root dip before planting.
- Planting materials of sugarcane, turmeric, ginger etc. should be dipped into Amritpani before planting.
- Mixed with irrigation water for sugarcane.
- Soil application before planting for chilli, tobacco seedlings or fruit tree saplings.

Conclusion-

Experiment-14

Topic- Preparation of Beejamruth

Aim: To prepare beejamruth

Objective: To learn the process of beejamruth preparation and its use.

Preparation of Beejamruth

Relevant information: It is a fermented product used as plant growth stimulating elements. It is a rich foundation of beneficial micro-flora that support and excite the plant growth which ultimately improves the vegetative growth and quality of produce.

Materials required: Cow dung-5 kg, cow urine-5 lit., Lime- 50 gm, Soil 50 gm and water 20 lit.

Procedure:

i. Take 5 kg fresh cow dung in a cloth bag. Suspend the cow dung in a water filled container to extract the soluble ingredients of dung.

ii. Dissolve 50 gm lime in 1 litre of water in a separate jar.

iii. Keep the cow dung extract for 12-16 hrs and squeeze the bag.

iv. Add 5 litre cow urine and 50 gm fresh soil into the extract.

v. Add the lime in 20 litre of extract and incubate it for 8-12 hrs.

vi. Filter the content to obtain the perparation

Application: Apply it for seed treatment as soaking 100 kg seed in 20 litre beejamruth. Soak vegetative part like rhizome, stem, root and tuber for 2 minutes before planting.

Conclusion-

Experiment-15

Topic- Preparation of Jeevamruth

Aim: To prepare jeevamruth

Objective: To learn the process of jeevamruth preparation and its use.

Relevant information: It is an organic preparation used as nutrient source.

Materials required: Cow dung-20 kg, cow urine-10 lit., Gram flour- 1 kg, Jaggery- 1 kg, Dry soil-250 gm, water 200 litre, bucket and plastic container.

Procedure:

i. Mix cow dung in a separate bucket with ample water. No clods should be there.

ii. Mix jiggery and gram flour in water each in separate bucket.

iii. Pour cow dung, jiggery solution, gram flour liquid and cow urine in the plastic drum.

iv. Add soil and fill the drum completely with water.

v. Stir it thoroughly.

vi. Keep the solution for 3-6 days in shade depending on temperature

Application: Apply diluted (1:10) Jeevamruth as foliar spray at 15 days interval.

Conclusion

Experiment-16

Topic- Indigenous technological knowledge (ITK) for weed management

Aim: To prepare organic extract for weed management

Objective: To learn the process of preparation and use of *Parthenium* extract and *Calotropic* extract for weed management.

Preparation of *Parthenium* extract

Introduction: On soaking chopped plant part in water liberates several Chemicals present in the plant body. Once the mixture is boiled the Chemicals totally get diluted in water and regulate the wind infestations.

Materials required: *Parthenium* plant part- 1 kg, water - 10 litre, container

Procedure:

i. Collect freshly growing *Parthenium* with leaves

ii. Keep it under Sun for drying

iii. Chop it into small pieces.

iv. Soak the pieces in water in 1: 10 ratio (1 kg of *Parthenium* pieces in 10 litre of water) in a container for 24 hours at room temperature to prepare *Parthenium* water extract.

v. Collect the *Parthenium* extract by filtering it through a screen.

Use:

i. Boil the extract and reduce the volume by 20 times to prepare concentrated *Parthenium* water extract.

ii. Dilute the extract and spray it as pre emergence herbicide.

Conclusion

Experiment-17

Topic- Preparation of Ginger, garlic and green chilli extract

Aim: To know preparation of ginger, garlic and green chilli extract

Objective: To learn the process of preparation and use of ginger, garlic and green chilli extract.

Materials required: Ginger - 25 gram, garlic - 50 gram, green chilli -25 gram, kerosene oil- 10 ml, liquid soap - 12 ml and water - 3 litre.

Procedure:

i. Soak garlic in kerosene oil overnight.

ii. Grind and make a paste

iii. Add 50 ml water to chilli and make a paste

iv. Prepare the ginger paste

v. Mix all the ingredients and dilute into water and steer it well**.**

vi. Filter it to obtain the distillate and add liquid soap.

vii. Stir well before spray.

Use: Spray the diluted extract on infested plant. It is effective against aphids, armyworm, caterpillars, fruit borer, leaf miner etc.

Conclusion

Experiment-18

Topic- Preparation of Neemastra and Brahmastra

Aim- To prepare broad-spectrum botanical pesticides

Neemastra- Neemastra is a Natural Insecticide / Pesticide mixture to control the nymph of sucking insects and mealy bugs.

Ingredients- 100 Liter water, 5 Liter Cow Urine, 5 Kg Desi Cow Dung, 5 Kg Neem Leaves

Procedure-

- Crush 5 kg neem leaves in water
- Add 5 lit cow urine and 2 kg cow dung and ferment for 24 hours with intermittent stirring.
- Filter and squeeze the extract
- Dilute to 100 lit by adding water.
- Use as foliar spray over one acre, useful against sucking pests and mealy bugs.

Brahmastra-

Ingredients- 100 Liter water, 10 Liter Cow Urine, 2 Kg custard apple leaf, 2 Kg papaya leaf, 2 kg pomegranate leaf and 3 Kg Neem Leaf

Procedure-

- Crush 3 kg neem leaves in 10 lit cow urine.
- Crush 2 kg custard apple leaf, 2 kg papaya leaf, 2 kg pomegranate leaves, 2 kg guava leaves in water.
- Mix the two and boil 5 times at some interval till it become half
- Keep for 24 hrs, then filter squeeze the extract. This can be stored in bottles for 6 months.
- Useful against sucking pests, pod/fruit borers.
- Dilute 2-2.5 lit of this extract to 100 lit for 1 acre.

Conclusion-

Experiment-19

Topic- Use of pheromone, light trap and yellow sticky trap

Aim- To control insects by using traps

1. Pheromone trap-

Pheromones are the chemicals that insects secrete to inform other insects about danger, sex, or location. Pheromone traps are used as organic pest control in organic farming. In these traps, the pest insects such as moths, aphids, whiteflies, leafhoppers, etc are attracted and captured by using synthetically manufactured sex pheromones.

2- Light trap

Light traps can be used to monitor and trap the adults thereby reducing the population. Some common light traps that could be used are hurricane lamp, trap with electrical bulb etc. The adult moths have an inherent capacity to get attracted to the light. It should be set up in the field after 5.30 p.m. A large plate or vessel fitted with kerosene mixed water is kept near the light trap. The attracted moth falls in this water and die.

3- Yellow sticky trap

The sticky traps are used to attract flying pests such as whiteflies, thrips, aphids, leafhoppers, leaf miners, etc. The insects are attracted to the bright color of traps and stick to the adhesive surface of these traps. These are available in yellow and medium blue colors. The insects such as leaf miners, aphids, stink bugs, cucumber beetles, and leafhoppers are lured to yellow color. On the other hand, thrips are more attracted to the blue sticky traps.

Conclusion-

Experiment-20

Topic- Indigenous technological knowledge (ITK) for disease management

Aim: To know the Indigenous technological knowledge (ITK) for disease management

Introduction: Indigenous knowledge is the distinct knowledge that human being gained through inheritance from their ancestors. This knowledge bank provides a base for education, agriculture, Healthcare and host of other happenings. Ample of such information spread from generation to generation. Such ITK are still used in agricultural sectors for disease management.

Control of bacterial leaf blight of paddy by cow dung slurry

Ingredients: cow dung and 10 kg, water - 100 litre, fine cloth

Procedure:

i. Add a little bit of water in cow dung and steering well to make it a thick paste

ii. Step by step at all the cow dung in 100 litre of water by continuous staring.

iii. Filter the dilute true define cloth to obtain a fresh slurry

Use: Spray the dilute over the crop in an interval of 7-8 days depending upon degree of infestation.

Use of citronella extract

Materials required: Leaves and roots of citronella- 50 gram, Water- 2 litre

Procedure: Soak the grounded materials in water for few hours and filter it.

Use: Spray the materials over vegetables like tomato carrot and lettuce for controlling bacterial leaf blight.

Lemon glass, bitter gourd and chilli extract

Materials required: whole plant of lemongrass, chilli pods, bitter gourd leaves, liquid soap- 4 ml, mortar and pestle, strainer and bowl.

Procedure:

i. Smash lemongrass Chilli bitter gourd plant part into mortar and pestle to get the extract

ii. Take 5 - 7 tablespoon of lemongrass, chilli, bitter gourd extract and mix it thoroughly. Filter it in a bowl.

iii. Add the liquid soap for stickiness. Dilute the mixture in 4 litre of water.

Use: Spray in the infected plant in morning. It controls the blast disease of rice.

Turmeric extract for controlling powdery mildew

Materials required: turmeric rhizomes- 20 gram, cow urine- 200 ml water - 2-3 litre, liquid soap - 8-12 ml

Procedure:

Soak the shredded rhizomes in cow urine.

Strain it and dilute it into 2-3 litre of water

Add liquid soap, stir well and store

Use: Spraying should be done either in the early morning times or in the later part of afternoon over the interested plant.

Garlic extract

Materials required: garlic bulb - 2 number, water - 4 Cup, liquid soap, grinder, strainer and bottle.

Procedure:

i. Grind the garlic and mix with water.

ii. Leave the mixture for 24 hours.

iii. After 24 hours add soap and stir well and strain it then store it in bottle

Use: Dilute 1 part of emulsion with 9 part of water and stir it thoroughly before spring. Spray the mixture over infected plant preferably in the morning. It controls black spots, blight, fruit rot, mildew and rusts.

Baking soda

Materials required: baking soda, liquid detergent and water.

Procedure: Take 5 gram of baking soda and few ml of liquid detergent and dissolved in 1 litre water.

Use: Make fresh mixture and spray the mixture over infested plant preferably in the morning. It controls powdery mildew.

Conclusion

Experiment-21

Topic- Preparation of fermented butter milk

Aim- To prepare and use of fermented butter milk

Ingredients- 5 liters buttermilk, 1 liter tender coconut, 1-2 kg *Albizia Amara* leaves (or, 250-500 gm leaf powder), 500 gms waste fruit or 1 liter juice from waste fruit.

Preparation-

1. Mix the buttermilk and tender coconut.

2. Crush the leaves well.

3. If using waste fruit, add it to the crushed leaves and put this mixture in a nylon mesh and tie it.

4. Immerse the mesh in buttermilk – tender coconut solution. Let it ferment for seven days.

5. Filter the solution by using the nylon mesh before spraying.

If you use *Albizia Amara* leaf powder, use fruit juice instead of waste fruit. Mix all four ingredients and let it ferment for seven days. Note, again, that our goal is to simplify the process for farmers. That is why we suggest various combinations like waste fruit versus juice and *Albizia Amara* leaves versus leaf powder. Wherever *Albizia Amara* is not available, you may use soap nut seed powder instead. In that case, we call it soap nut-buttermilk solution.

Usage- Mix ten liters water with 500ml to 1liter solution and spray. This helps plant growth, repels insect, and adds resistance to fungal diseases.

Conclusion-

Experiment-22

Topic- Quality aspect, grading, packaging and handling of organic produce

Aim: To study the grading, packaging and handling of organic produce

Objective: To learn the process of post harvest management of organic produce, its quality, grading and packaging.

Introduction: principles of organic production may vary from region to region. However, there are certain legal minimum requirements to confirm the product as organic produce. The concept of organic does not end with production only. The organic production system includes:

i. Replenish and maintain soil fertility.

ii. Eliminate the use of toxic and persistent chemical pesticides and fertilizers.

iii. Encourage biological diversity.

Organic food: Organic foods are minimal process to maintain the integrity of the food without artificial ingredients and preservatives

Production: This is the foundation level; planting a seed, nurturing it to the fulfilment of its density as a fruit, root, or seeds and harvest it.

Harvesting: It is one of the most critical aspects in production of agricultural crop is harvesting. The possibility to spoil the crop and end up receiving a lower return is very acute. This requires knowledge how and when to harvest before it is grown. Many crops require specialized techniques to ensure that they reach market in the right condition.

Processing: Few agricultural harvests are eaten in the natural state but most are cooked. Processing is assumed for many reasons: the earliest was probably for preservation and storage, since many fruits were highly seasonal. Processing is now related with confirming about food safety, especially to limit the growth of micro-organisms that may cause food poisoning as well as deterioration and wastage of food.

Low-temperature, acidification and heat have all been practiced for many years. But progressively other approaches have also been established such as irradiation, vacuum packing and use of low temperature.

Limitations

The difficulties of organic food processing are:

i. The additives permitted for preservation and to improve taste and texture are greatly limited.

ii. The substances used for cleaning and processing machinery are also restricted. The research needs are, therefore, similar to those in production: how to achieve the desired aims with acceptable substances.

Experiment-23

Topic- Preparation of balance sheet

Aim: To study the cost of organic production system and preparation of balance sheet

Objective: To learn the process of data collection and calculation of cost of production.

Introduction: The organic production system always has some differences with traditional cultivation system. The inputs are also different from traditional crop cultivation as a result the ultimate cost varies. The price of organic product is also very high.

Procedure: Collect all the data related to all inputs required, cost of labour, collection of data and market study for organic produce.

Observation: Calculate the cost of cultivation, gross return, net return and calculation of B: C ratio with all collected data.

Sl. No.	**Particulars**	**Operations**	**Quantity**	**Rate (Rs.)**	**Amount (Rs.)**
1	Land preparation				
2	Layout				
3	Nursery bed preparation				
4	Seed				
5	Sowing/Planting				
6	Manure/ Compost Bio-fertilizer				
7	Application cost				
8	Weed management	(Cost of organics+ Preparation cost+ Application cost)			

9	Intercultural operation				
10	Plant protection	(Cost of organics+ Preparation cost+ Application cost)			
11	Irrigation charges				
12	Application cost				
13	Harvesting, drying				
14	Threshing, winnowing, bagging and storage				
Total					
Cost of cultivation (Rs.)					
Gross return (Rs.)					
Net return (Rs.)					
B:C ratio					

Yield-

Price-

Cost of cultivation (Rs ha $^{-1}$)

The prices of the inputs that were prevailing at the time of their application utilized for determining the cost of cultivation which was given in rupees per hectare.

Gross return (Rs ha $^{-1}$)

The model prices of rice prevailing in the market immediately after its harvest were used for the calculation of gross returns.

Net returns (Rs ha $^{-1}$)

The net return per hectare was worked out by deducting the cost of cultivation from the gross return and expressed in rupees per hectare.

Benefit cost ratio

In order to find out the economics of rice cultivation, the cost of cultivation and the gross return of all the treatments were worked out separately, from which the net return was obtained. Dividing this net return by cost of cultivation, we obtained the benefit cost ratio.

$$\text{Benefit cost ratio} = \frac{\text{Net return}}{\text{Cost of cultivation}}$$

Return per rupee invested

$$\text{Return per rupee invested} = \frac{\text{Gross return}}{\text{Cost of cultivation}}$$

Conclusion

Experiment-24

Topic- Quality analysis of compost and vermicompost

Aim: To understand the quality of compost and vermicompost

Objective: To learn the quality analysis of compost, vermicompost.

Relevant information: In recent few decades, dumping of huge quantity of organic wastes from different sources like domestic, agriculture and industrial wastes have caused serious environmental hazards and economic problems. Most of these wastes are either burnt or used for land filling. Burning of organic wastes contributes large amount of Carbon dioxide to the atmosphere that causes environmental pollution. This over all process tremendously leads to destroy the surface soil organic matter, decreases soil microbial population and affects the physical properties of the soil. Proper utilization of organic wastes can not only promote recycling of plant nutrients, it also improves soil health and environmental quality. Utilization of various organic residues such as Kitchen waste, weed wastes, Sewage and sludge, livestock wastes and agricultural wastes by making compost and vermicompost is very important in organic farming. It is very essential to analyze the quality of the compost and vermicompost before use.

Quality standards of vermicompost given by FCO

1	Moisture present by weight	15-25
2	Colour	Dark brown to black
3	Odor	Absence of foul odor
4	Particle size	Minimum 90% material should pass through 4.0 mm sieve
5	Bulk density (g/cm^3)	0.7-0.9
6	Total organic carbon, present by weight, minimum	18.0
7	Total nitrogen (as N), present by weight, minimum	1.0
8	Total phosphate (as P_2O_5), present by weight, minimum	0.8
9	Total potassium (K_2O), present by weight,	0.8

	minimum	
10	Heavy metal content, (as mg/kg), maximum Cadmium (as Cd) Chromium (as Cr) Nickel (as Ni) Lead (as Pb)	 5.0 50.00 50.00 100.00

Materials required:

pH meter, Electric Conductivity (EC) meter, Hot air oven, aluminium moisture box, digital weight balance, distilled water, 100 ml beaker, mesh sieve, Core sampler, compost and vermicompost sample.

Procedure:

Determination of *pH*: The *pH* of the compost sample is determined as per the procedure described by Chandrabose *et al*., (1988).

- Take 30 gm of air-dry sample and sieve it through 2mm mesh sieve.
- Transfer the fine sample to a clean 100 ml beaker and add 60 ml of distilled water.
- Stir the contents intermittently and the sample suspension just before taking the reading.
- Immerse the electrodes into the beaker and record the meter reading.

Determination of Electrical Conductivity (EC): The electrical conductivity of the test samples was determined as per the procedure outlined by Chandrabose *et al*., (1988). Electrical conductivity is the measurement of total amount of soluble salts present in the sample and is expressed as millisimens/cm (mS/cm).

- Take 5 gm of the experimental sample and add 50 ml of distilled water.
- Stir well and allow the suspension to settle for eight hrs.
- Immerse the electrode of the conductivity cell into the sample solution and record the EC (mS/cm).

Moisture content: Moisture meters give an immediate reading but these are said to lack accuracy. Oven drying provides an accurate method for measuring the moisture content of compost and vermicompost.

- Weight an empty aluminium moisture box and record the weight (W_1).
- Collect fresh compost/ vermicompost sample and record the weight of compost/ vermicompost+ aluminium moisture box (W_2).
- Put the box (with lid open) in a hot air oven at 105° C for 24 hours.
- Record the weight of dry soil sample+ aluminium moisture box (W_3).
- Calculate the moisture content of compost/vermicompost by using the following formula.

$$\text{Moisture content (\%)} = \frac{W_2 - W_3}{W_3 - W_1} \times 100$$

Bulk Density (g/cm^3):

- Record the weight of an empty aluminium moisture box.
- Determine the volume of core ($\pi r^2 h$)
- Drive the core of known volume vertically into the compost and draw sample.
- Collect the sample from the core in aluminium moisture box.
- Keep the moisture box (with lid open) in hot air oven at 105° C for 24 hours.
- Record the weight of dry sample.
- Calculate the bulk density of compost/vermicompost by using the following formula.

$$\text{Bulk density } (g/cm^3) = \frac{\text{Weight of oven dry sample (g)}}{\text{Volume of sample = volume of core } (\pi r^2 h)}$$

Observations:

Type of compost	***pH***	**EC (mS/cm)**	**Moisture content (%)**	**Bulk Density (g/cm^3)**	**Colour**

Conclusion: