

# Sow, Grow & Sustain- A Manual for Sustainable Gardening

HARITHAKRISHNA ECO-CLUB

## ***HARITHAMITRA Magazine***



**Sow**



**Grow**



**Sustain**



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It is my pleasure to introduce "Sow, Grow, Sustain: A Manual for Sustainable Gardening", a guide designed to inspire and empower our community towards sustainable living. Gardening is not merely about growing plants—it's about nurturing life, fostering respect for nature, and cultivating habits that contribute to a healthier planet.

Through this handbook, we aim to provide practical knowledge on sustainable gardening techniques that are simple yet impactful. It encourages readers to embrace practices that conserve resources, promote biodiversity, and reduce environmental impact.

At Dr V S Krishna Government Degree College (A), we believe in the importance of instilling environmental responsibility in our students and community. This manual is a step towards creating green spaces that reflect our commitment to sustainability and ecological balance.



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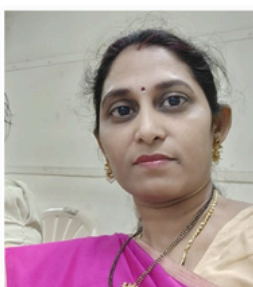
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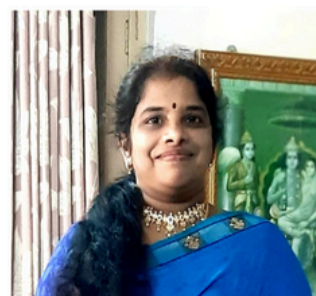
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# Organic fertilizers and pesticides

## Introduction

Organic fertilizers are derived from living things such as animals and plants. Most common are manures, bone meal, fish meal, vermi compost etc. They are generally released slowly as microorganism in the soil, have to break them down first so the plant can use them. Inorganic fertilizers are manmade formulae that can be formulated for various speeds of release. Most common are Urea, Single Super Phosphate, and Murate of Potash.

In general pesticide is a chemical or biological agent that deters, incapacitates, kills or otherwise discourages pests. Both chemical pesticides and bio pesticides are important for crop protection.

Organic fertilizers and pesticides reduce the dependence on artificial chemical products on different crops. They improve the soil, physical structure (soft and loose soil), chemical (increase nutrients), and biological (high population of beneficial microorganisms) composition. Improve yields and the quality of produce. Source of food for soil organisms.

## I. Preparation of organic fertilizers

### 1. Jeevamrutham

Jeevamrutham is a natural fertilizer.

#### Types of Jeevamrutham

1. The liquid state of Jeevamrutham
2. The semi-solid state of Jeevamrutham
3. Dry Jeevamrutham (Ghana Jeevamrutham)

#### 1. The liquid state of Jeevamrutham

Liquid Jeevamrutham is a microbial bio-fertilizer widely used in natural and regenerative farming to boost soil microbial activity and enhance plant health. Here's the detailed process for preparing this bio-stimulant.

#### Ingredients:

1. **Cow dung**– 10 kg
2. **Cow urine** – 10 litres
3. **Jaggery** (unrefined sugar) – 2 kg
4. **Pulse flour** (like black gram flour or chickpea flour) – 2 kg
5. **Soil** (preferably from the field where it will be applied) – a handful

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6. **Water** – 200 litres

### Preparation

#### Mixing the Ingredients:

- In a 200-litre drum, add 10 kg of fresh cow dung and 10 litres of cow urine.
- Stir the mixture to ensure uniform blending.

#### Adding Jaggery and Pulse Flour:

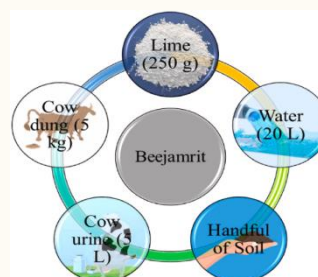
- Dissolve 2 kg of jaggery in water separately and pour it into the drum.
- Add 2 kg of pulse flour to the mixture. This supplies necessary nutrients to microorganisms during the fermentation process.

**Fig-1 Ingredients of Beejamrut**

### 2. Semi-solid state Jeevamrutham

The ingredients

- 5 liters cow urine,
- 100kg cow dung,
- 1 kg of pulses flour,
- 1 kg jaggery and
- A handful of fertile soil



#### Preparation of jeevamritam

Take a small amount of water and Mix all of them. Make the mixture as a small ball and keep these balls in direct sunlight to dry them. Keep the dried balls near the mouth of sprinkler or dripper. The microbes get activated again. When the waterfalls on the semi-solid Jeevamrutham

### 3. Dry Jeevamrutham (Ghana Jeevamrutham)

Ghana Jeevamrutham is an organic fertilizer that can enrich soil and plants, and provide nutrients for plant growth. It's a rich source of nitrogen and microorganisms that can improve soil fertility.

#### Materials required

- 200 ml water,
- 10 Kg cow dung,
- 20 Kg jaggery,
- 2 Kg pulses flour,
- 5-10 lit cow urine,



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- Handful of soil

**Fig-2 Ingredients of Jeevamrutam**



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### **Preparation of Ghana Jeevamrutham**

#### **Procedure**

Make a heap of treated cow dung and cover it with a jute bag for 48 hours to ferment. Spread the dung on the floor and dry it in the sun. Once dry, grind the dung into a powder using a thick wooden stick. Store the powder in jute bags in a room with good air flow.

#### **Jeevamrutham Irrigation and Dosage**

**Application Methods** Jeevamrutham can be applied through various irrigation systems, including drip, canal water, or sprinklers. When spraying, dilute the mixture before application.

**First Dosage:** One month after seed sowing, mix 5 liters of filtered Jeevamrutham with 100 liters of water. Stir well and spray this solution over one acre of vegetable crops. In summer, apply early in the morning or late in the evening; in winter, it can be applied at any time.

**Second Dosage:** Apply 21 days after the first spray. Mix 10 liters of filtered Jeevamrutham with 150 liters of water and spray over one acre.

**Third Dosage:** Apply 21 days after the second spray. Mix 20 liters of filtered Jeevamrutham with 200 liters of water and spray over one acre.

**Fourth Dosage** When fruits are beginning to develop, mix 6 liters of sour buttermilk with 200 liters of water and spray over one acre.

#### **Benefits of Jeevamrutham**

Jeevamrutham is an organic fertilizer that significantly enhances plant growth and immunity. It creates a conducive environment for microorganisms that help plants absorb essential nutrients like phosphorus, nitrogen, and potassium. Microbes in Jeevamrutham break down organic matter, such as earthworms, into molecular forms that plants can easily absorb through their roots. Additionally, these microbes contribute to soil fertility by decomposing organic waste, while the movement of earthworms helps to loosen the soil, making nutrient uptake easier for plants.



**Fig-3 Demonstration of preparation of Jeevamrutam**



**Fig-4 Demonstration of preparation of Jeevamrutam**





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### **2. Beejamrit (organic fertilizer)**

Beejamrit is an excellent organic solution for seed treatment, essential for ensuring high-quality and healthy crops. Seed treatment before planting or sowing is crucial, and Beejamrit offers a natural alternative to conventional fungicides.

#### **Preparation of Beejamrit (organic fertilizer)**

##### **Materials required**

- Water
- Cow Dung
- Lime
- Cow Urine
- Hand Full of Soil (preferably soil around Banyan tree roots)

##### **Procedure**

First of all, take 20 Liters of water in a vessel. After that, take 5 kg of native cow dung in a cloth and make a bundle. This cow dung bundle is hung in a pot of water for 12 hours in such a way that the bundle remains immersed in water. Mix 50 grams of lime in 250 ml water and keep it overnight. (We add limestone or lime to balance out the acidic nature of cow urine. It helps to maintain the pH level of the solution.) After 12 hours, take out the cow dung bag and squeeze it well so that all its juice comes in the water. After that, mix 5 Liters of cow urine and 1 Liter of cow's milk in this dung water solution and stir it well with a wooden stick, after that add overnight soaked lime to this Mix Cow Dung and Cow Urine solution and stir it with the help of a wooden stick. Now this slurry is ready for seed treatment. Use it within 24 hours.

##### **Mode of using Beejamrit**

After preparing Beejamrit, sprinkle the seeds to be sown on the ground or gunny bag or tie the seeds in a cotton cloth and dip them in Beejamrit for half an hour and then dry the seeds in the shade and sow them immediately.

**Fermentation:** Allow the mixture to ferment for 24 to 48 hours. This fermentation period helps in the development of beneficial microorganisms that enhance the efficacy of Beejamrit.

##### **Strain**

After fermentation, you can strain the mixture to remove any large particles, ensuring a smoother application.

##### **Application**

Before sowing seeds, soak them in the prepared Beejamrit slurry for a few hours or overnight. This treatment helps to protect seeds from soil-borne diseases and improves germination rates.

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### **Storage**

Store any unused Beejamrit in a cool, shaded area to prevent further fermentation and maintain its effectiveness.

By following these steps, you can prepare Beejamrit effectively and ensure better seedling health and growth.

### **Benefits of seed treatment with Beejamrit**

1. It cost very less as compared to the inorganic chemicals.
2. It also takes very less time for the preparation.
3. Seeds germinate quickly and in large numbers.
4. Plants avoid soil and seed borne diseases.
5. The development of roots and stems of soil plants is more.
6. The setting of roots of plants are very good and quick.
7. It also helps to improves the germination viability of the seeds.
8. This amazing organic solution speed up the spread of roots and protects it from pest or any fungal attack.

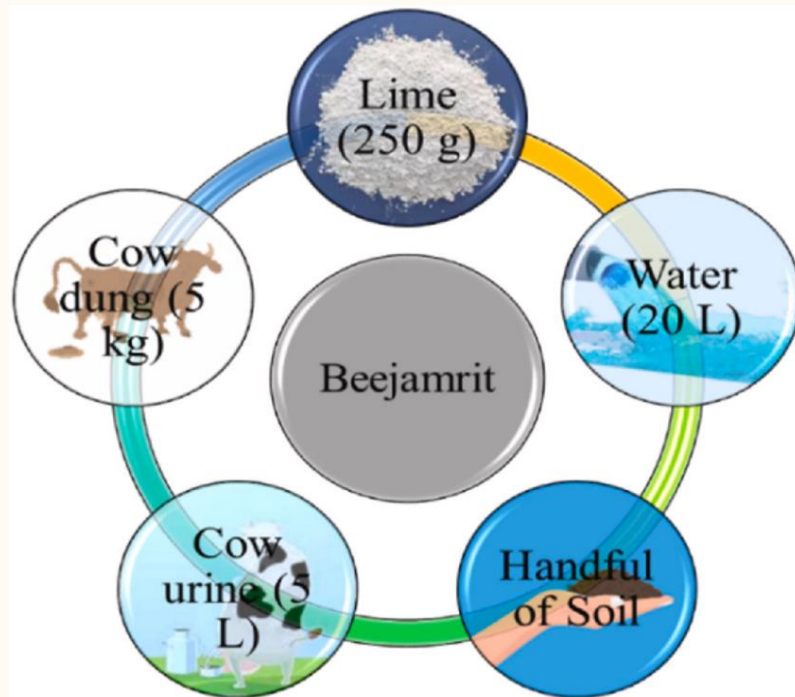
### **Precautions**

1. Sow the seed only after 1 hour of treating it with Beejamrit.
2. Lime should be dissolved in water first and mixed last.

Beejamrit is a very effective organic and natural medicine which helps in quick and large number of seed germination and plant roots and protects the sprouted seeds and shoots and plant roots from soil borne pathogens, thereby increasing the crop growth and production increases. Also, the cost of Beejamrit is negligible because it is made from domestic ingredients.



Fig-5 Beejamrut ingredients

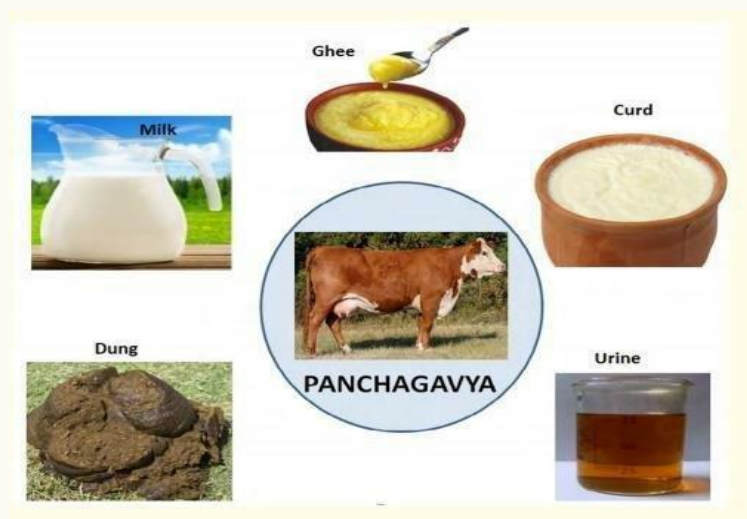




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### 3. Panchagavya

Fig-6 Ingredients of Pancha gavya



#### Requirements

Plastic Barrel,  
Measuring cylinder,  
Muslin cloth

#### Raw Materials

- Cow dung 5 kg,
- Cow's urine 3 L,
- Cow's milk 2 L,
- Curd 2 L
- Ghee 1 L.

#### Preparation Steps Preparation of Ingredients

Ensure that all ingredients are fresh and of high quality. Cow dung should be well-rotted, and all dairy products should be from cow milk.

#### Mixing Ingredients

In a large container or tub, combine 5 kg of fresh, well-rotted cow dung with 5 liters of fresh cow urine. Stir the mixture thoroughly.

#### Add Dairy Products

Add 2 liters of milk, 2 liters of curd, and 500 grams of ghee to the cow dung and cow urine mixture. Mix well to ensure even distribution.

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### **Fermentation**

Cover the container with a cloth or lid, allowing some air to circulate. Leave the mixture to ferment for 3 to 4 days in a shaded, cool area. Stir the mixture gently once a day to promote even fermentation.

### **Strain**

After the fermentation period, you may strain the mixture to remove any large particles, ensuring a smoother application.

### **Application**

Dilute the fermented Panchagavya with water before use. A common dilution ratio is 1 liter of Panchagavya to 10 liters of water. Use this diluted mixture for spraying on plants or as an irrigation solution.

### **Storage**

Store any unused Panchagavya in a sealed container in a cool, dark place. It can be kept for up to a month but is most effective when used fresh.

### **Benefits of Panchagavya**

- Improves Soil Health Enhances microbial activity and nutrient availability in the soil.
- Boosts Plant Growth Promotes better growth and increases resilience to pests and diseases.
- Increases Crop Yield Helps in improving overall crop yield and quality.
- Enhances Soil Fertility Provides essential nutrients and organic matter to the soil.



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### 4. Azolla Biofertilizer Cultivation of azolla -biofertilizer

Azolla is a small, floating aquatic fern that has gained prominence as a biofertilizer in sustainable agriculture due to its unique properties and benefits. Here's a comprehensive introduction to Azolla biofertilizer

#### Key Characteristics

**Rapid Growth:** Azolla can double its biomass in a few days under optimal conditions.

**Nitrogen Fixation:** Azolla forms a symbiotic relationship with the cyanobacterium *Anabaena azollae*, which fixes atmospheric nitrogen into a form that plants can use.

**Floating Nature:** As a floating plant, Azolla can cover the water surface, reducing water evaporation and suppressing weed growth.

#### Benefits of Azolla Biofertilizer

- **Nitrogen Enrichment:** Azolla can fix up to 50-80 kg of nitrogen per hectare annually, significantly enhancing soil fertility.
- **Improves Soil Health:** The decomposition of Azolla adds organic matter to the soil, improving its structure and increasing its water-holding capacity.
- **Reduces Chemical Fertilizer Use:** By providing a natural source of nitrogen, Azolla reduces the need for synthetic nitrogen fertilizers.
- **Weed Suppression:** When grown on the water surface, Azolla suppresses weed growth by shading the water.
- **Environmental Benefit:** Azolla contributes to reduced greenhouse gas emissions by limiting the release of methane from rice paddies and enhancing carbon sequestration.

#### Cultivation

- **Water Body Setup:** Azolla can be cultivated in shallow ponds, rice fields, or specially designed tanks.
- **Seedling Establishment:** Introduce a small quantity of Azolla to the water body. It will spread rapidly if conditions are favorable (e.g., warm temperatures, adequate sunlight).

#### Application

##### Direct Application

Azolla can be directly applied to the soil as a green manure by incorporating it into the soil before planting.

##### Water Surface Coverage

In rice paddies, allow Azolla to cover the water surface. It will naturally decompose and release nutrients into the soil.



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### Harvesting

Harvest Azolla regularly to prevent overgrowth and maintain optimal growth conditions. The harvested material can be used as a green manure or compost.

### Integration with Cropping Systems

Azolla can be integrated into various cropping systems, including rice, vegetables, and other crops, to enhance soil fertility and reduce input costs.

**Fig-7 Azolla Preparation**



**Fig-8 Azolla cultivation**





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**Fig-9 Harvest of Azolla for using as a biofertilizers**





### 5. Farm Yard Manure (FYM)

#### Introduction

Farm Yard Manure is a type of composted organic matter. It refers to the decomposed mixture of dung and urine of farm animals along with litter and left over material from roughages or fodder fed to the cattle. Farm Yard Manure (FYM) is a traditional and widely used organic fertilizer derived from the accumulation of animal dung, urine, bedding material, and other organic residues from farms. It plays a crucial role in sustainable agriculture by enhancing soil fertility and improving plant health.

#### Ingredients

1. Animal Dung Collected from various farm animals such as cattle, sheep, goats, and poultry.
2. Urine

Contains dissolved nutrients and contributes to the manure's nutrient content.

3. Bedding Material Includes straw, hay, or sawdust used in animal stalls, which adds carbon to the mixture.
4. Other Organic Residues Plant residues, crop leftovers, and other organic materials from the farm.

#### Key Characteristics

**Nutrient-Rich:** Provides essential nutrients including nitrogen (N), phosphorus (P), and potassium (K), as well as secondary nutrients and micronutrients.

**Organic Matter:** Improves soil structure, water retention, and microbial activity.

**Slow Release:** Nutrients are released gradually, providing a steady supply of nutrients to plants.

#### Benefits of Farm Yard Manure

- Soil Fertility Improvement
- Nutrient Supply: Enriches the soil with essential nutrients necessary for plant growth.
- Microbial Activity: Enhances microbial activity in the soil, which aids in nutrient breakdown and availability.
- Soil Structure Enhancement
- Organic Matter Addition: Increases soil organic matter, improving soil texture and structure.
- Water Retention: Enhances soil's water-holding capacity, reducing the need for frequent irrigation.
- Increased Soil Aeration

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- **Loosens Soil:** Helps in breaking up compacted soils, promoting better root growth and aeration.
- **Surface Coverage:** Helps prevent soil erosion by improving soil structure and stability.
- **Reduction in Chemical Fertilizer Use**
- **Natural Fertilizer:** Provides a natural source of nutrients, potentially reducing reliance on synthetic fertilizers.

### Preparation and Application of Farm Yard Manure

- **Collection:** Collect animal dung, urine, and bedding materials from livestock areas. Ensure the collection is done regularly to avoid odor issues and nutrient loss.

**Layering:** Create layers of dung, bedding material, and other organic residues in a composting area or pit.

- **Aeration:** Turn the compost periodically to aerate it and promote decomposition.
- **Moisture Control:** Maintain appropriate moisture levels to facilitate microbial activity and decomposition.
- **Maturation:** Allow the compost to mature over several months. The manure is ready for use when it turns dark brown and has a crumbly texture.

### Application

1. **Pre-Planting:** Incorporation FYM into the soil before planting to ensure nutrients are available for the growing crops.
2. **Side-Dressing:** Application of FYM around established plants to provide additional nutrients and organic matter.

### Storage

Store unused FYM in a cool, dry place or covered area to prevent nutrient loss and maintain quality.



### 6. Banana Fertilizers:

Banana peels are a great source of nutrients that can be used as fertilizer for plants in many ways, including:

- **Banana peel liquid:** Chop up banana peels and soak them in water for at least a day. The peels will release nutrients like potassium, magnesium, phosphorus, and calcium into the water, which can be used to water plants.
- **Banana peel powder:** Bake banana peels in the oven at a low temperature for about three hours to remove moisture. Then, grind the peels into a fine powder using a blender or pestle and mortar. This powder can be used as a slow-release fertilizer and mixed into cut flowers or added to the soil of tomato and pepper plants. Store the powder in an airtight container to prevent mold or fungus.
- **Banana peel mulch:** Place banana peels directly on the soil of potted plants or around the base of garden plants. As they decompose, they will release nutrients into the soil.
- **Banana peel compost:** Mix chopped banana peels with eggshells to create nutrient-rich compost.
- **Banana peel in compost pile:** Add banana peels to an existing compost pile.

Banana peels are rich in potassium and magnesium, which can help plants grow stronger stems and roots and improve nutrient distribution.

**Fig-10 Banana peel fertilizer**





### 7. Vermicompost

The process of natural, biological break down of compound organic matter into simpler form. Vermicompost (also known as worm compost or worm castings) is an advanced form of compost produced through the digestion of organic waste by earthworms (*Lumbricus terrestris*). It is widely recognized for its effectiveness as a high-quality organic fertilizer that enhances soil fertility and promotes plant growth.

#### What is Vermicompost?

The process involves feeding organic waste to earthworms, which then convert it into a dark, crumbly, and nutrient-dense material.

#### Benefits of Vermicompost

- Enhanced Soil Fertility.
- **Nutrient Supply:** Provides a balanced supply of macro and micronutrients, which improves plant growth and yield.
- **Organic Matter:** Adds valuable organic matter to the soil, boosting its fertility.
- Improved Soil Structure
- **Aeration:** Helps to loosen compacted soils, promoting better root growth and enhancing soil aeration.
- **Water Retention:** Improves the soil's ability to retain moisture, reducing the need for frequent irrigation.
- Addition of beneficial microorganisms
- **Microbial Activity:** Enriches the soil with beneficial microorganisms that help decompose organic matter and suppress soil-borne diseases.
- Reduced Soil Erosion
- Erosion Control: Enhances soil stability and structure, reducing the risk of erosion.
- Pest and Disease Resistance
- **Natural Immunity:** Contributes to healthier plants that are more resistant to pests and diseases.

#### Preparation and Application of Vermicompost Container

Use cement compartments, bins or troughs made of wood, plastic, or metal. Ensure proper ventilation and drainage.

#### Earthworms

Introduce red worms or other suitable species known for their composting abilities.



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### Organic Waste

Feed the worms a diet of kitchen scraps, vegetable peels, coffee grounds, shredded paper, and other organic materials. Avoid meat, dairy, and oily foods.

### Maintaining the System Moisture

Keep the composting material moist but not waterlogged.

### Aeration

Regularly turn the compost to provide oxygen and prevent odor.

### Harvesting Mature Compost

Vermicompost is ready when it becomes dark, crumbly, and has an earthy smell. This usually takes 2 to 3 months.

### Separation

Separate the compost from the worms. This can be done by moving the finished compost to one side of the bin and adding fresh waste to the other side, encouraging the worms to migrate.

### Application

1. **Soil Amendment:** Mix vermicompost into the soil before planting to improve soil health and fertility.
2. **Top Dressing:** Apply a thin layer around established plants to provide ongoing nutrition and support.

**Storage:** Store unused vermicompost in a dry, cool place. It can be kept for several months without losing its efficacy.

**Fig-11 Vermicompost Units**





### 8. Biogas Slurry

Utilization Of Waste Generated from The Biogas Plant ss Manure for Gardens

The waste produced by biogas plants, commonly known as biogas slurry or digestate, is a valuable resource for gardening and agriculture. It is rich in nutrients and can be effectively utilized as a natural fertilizer for enhancing soil fertility and promoting plant growth. Here's a comprehensive guide on how to utilize this waste as manure for gardens.

**Biogas Slurry:** Biogas Slurry is the residual material left after the anaerobic digestion process in biogas plants. It consists of Valuable fertilizer.

#### 2. Benefits of Using Biogas Slurry

**Nutrient-Rich:** Contains essential nutrients such as nitrogen (N), phosphorus (P), and potassium (K), along with secondary nutrients and micronutrients.

**Organic Matter:** Adds organic matter to the soil, improving soil structure and water-holding capacity.

**Cost-Effective:** Provides a low-cost alternative to synthetic fertilizers.

#### Application

**Soil Application:** Apply the diluted slurry directly to the soil around plants. It can be used during planting or as a supplementary feed for established plants.

**Foliar Spray:** For quick nutrient uptake, use the diluted slurry as a foliar spray. Apply it in the early morning or late afternoon to avoid leaf burn.



Fig-12 Bio- Gas Unit



### 9. Bone Meal

Bone meal is made from animal bones and is rich in phosphorus and calcium. It can be used for vegetables and fruit plants, leading to higher yields and better-sized produce.

### 10. OWDC (Original Waste Decomposer)

OWDC contains 80 types of bacteria essential for plants. Mix the liquid from the OWDC bottle into 100 liters of water along with 1 kg of jaggery. Stir daily for 5 to 7 days. After this period, dilute it with water in a 1:5 ratio for application to plants or a 1:10 ratio for spraying. It acts as a pesticide, fungicide and fertilizer, keeping the soil.



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### 11. Bio enzymes

Bio enzymes from organic waste

Ingredients of Bio enzymes

Fruit waste-6 kgs

Pineapple-2 kgs

Jaggery-6 kgs

Yeast-small quantity Soap nuts-2 kg

Bioenzymes preparation at the department of botany

#### Preparation

Take an air tight container. Measure all the ingredients. Add jaggery dissolved in water. Add the peels, yeast and close tight. Keep undisturbed in a shady spot. Open the lid and stir once a day. After a week open and stir once in 2-3 days.

**Fig-13 Bio enzymes**





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**Fig-14 Bioenzymes preparation**





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### 12. Seaweed Granules

Seaweed granules are a rich source of nutrients for plants, providing immediate energy and protecting them from various stresses. They enhance plant growth and help maintain suitable soil pH levels.

#### Sea weed

Typically, seaweed liquid fertilizer can be applied every 2-4 weeks during the growing season. Adjust frequency based on plant needs and growth stages.

#### Best Times

Apply during the growing season when plants are actively growing. Avoid applying during extreme temperatures or when plants are under stress.

### 13. Mulching

Mulching (Acchadana) Mulching with organic residues or live mulching reduces tillage and consequently labour requirements, suppresses weeds, promotes humus formation and enhances the water holding capacity of the soil. Mulching enhances the biological activity and replenishes the nutrient base of the soil. Adequate mulching keeps the top and sub soil moist and enhances the water holding capacity of the soil and also reduces water loss due to evaporation so that the crop will be better equipped to tide over drought conditions.

Mulching methods are several types they are

- **Organic Mulching.** As the name suggests, this type of mulch is made using natural elements like wheat straw, paddy straw, wood chips, dry grasses, pine needles, dry leaves, grass clipping, sawdust etc. ...
- **Straw Mulch:** It is the cover of dried straw biomass of the previous plants or crops
- Grass Clipping Mulch.
- Inorganic Mulching.
- Plastic Mulch.
- **Live Mulch:** Intercrops and mixed crops which give the symbiosis to the main crop.

Methods of composting

Home composting methods



## **14. Backyard composting**

**It is of three types.**

- Vermicomposting
- Bokashi composting
- Sub pod Composting

### **Backyard Composting Methods**

#### **1. Vermicomposting:**

- Uses worms, typically red wigglers, to break down organic waste into nutrient-rich compost called worm castings.
- Ideal for kitchen scraps, garden waste, and paper.
- Efficient and odourless if managed properly, producing high-quality compost in small spaces.

#### **2. Bokashi Composting:**

- An anaerobic fermentation process using Bokashi bran (microbes and molasses) to break down organic material.
- Suitable for all types of food waste, including meat and dairy.
- Produces pre-compost that can be buried in soil to fully decompose.
- 

#### **3. Fig-15 Bakashi composting**





### 4. Subpod Composting:

- A composting system installed underground, allowing worms and microbes to break down food scraps.
- Dual-purpose: serves as a compost bin and garden bed fertilizer.
- Low-maintenance, odourless, and space-efficient, with easy access for harvesting compost.

**Fig-17 Subpod Compost**



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## II. Preparation of Natural Biopesticides

### 1. Panchapatra Kashayam

#### Ingredients

**Pancha Patra Kashayam** is a traditional Ayurvedic herbal decoction used for detoxification and boosting immunity. "Pancha" means five, and "Patra" refers to leaves. This kashayam (herbal decoction) is made from five specific types of leaves, each with its own medicinal properties. Though the exact recipe can vary based on regional practices, the following is a general preparation method:

#### Ingredients:

1. **Tulsi (Holy Basil) Leaves** – 10-15 leaves
  - Known for its anti-inflammatory and antimicrobial properties.
2. **Neem Leaves** – 5-10 leaves
  - Strong detoxifier, good for skin and immune health.
3. **Bilva (Bael) Leaves** – 5-7 leaves
  - Helps in digestion and balancing Vata and Kapha doshas.
4. **Arjuna Leaves** – 5-7 leaves
  - Beneficial for heart health and balancing the body.
5. **Betel Leaves** – 5-7 leaves
  - Stimulates digestion and has antimicrobial properties.

#### Preparation:

1. **Wash the Leaves:** Clean all the leaves thoroughly under running water to remove dirt and impurities.
2. **Boil Water:** Take around 500 ml of water and bring it to a boil.
3. **Add Leaves:** Once the water is boiling, add the leaves. Allow it to boil on medium heat.
4. **Simmer:** Let the mixture simmer for about 15-20 minutes until the water reduces to half (around 250 ml).
5. **Strain:** Once done, strain the decoction to remove the leaves and pour the liquid into a cup.
6. **Consume:** Drink the kashayam warm. It's generally recommended to consume on an empty stomach in the morning.

#### Benefits:

- Detoxifies the body.



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- Boosts immunity.
- Promotes digestion and skin health.
- Balances doshas in Ayurveda (Vata, Pitta, Kapha).

For best results, consult an Ayurvedic practitioner before use, especially if you have any health conditions.

**Fig-18 Preperation of Pancha Patra Kashayam**





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### 2. Dasaparni kashayam (pesticide)

Dashaparni kashayam is used as a natural pesticide to control pests, diseases, and fungus on crops, vegetables, and fruit trees. is a plant spray made from crushed leaves, cow dung, cow urine, and water that's fermented for 40–45 days. The word "dashaparni" comes from the words "dasha" (ten) and "parni" (leaf), and the leaves used can include tobacco, marigold, custard apple, neem, and more. The mixture can also include other ingredients like turmeric, ginger, asafoetida, and green chili paste.

#### Ingredients

- Leaves of Neem -2kg
- Leaves of Tutikada -2 kg
- Leaves of maredu -2kg
- Leaves of Castor- 2 kg
- Leaves of *Pongamia*

Crush following plant parts in a 500-lit drum.

- Take Neem leaves—5 kg,
- *Vitex negundo* leaves-2 kg,
- *Aristolochia* leaves - 2 kg,
- Papaya (*Carica papaya*)-2kg,
- *Tinospora cordifolia* leaves- 2kg,
- *Annona squamosal* (Custard apple) leaves-2kg,
- *Pongamia pinnata* (Karanja) leaves-2 kg,
- *Ricinus communis* (Castor) leaves- 2 kg,
- *Nerium indicum*- 2 kg,
- *Calotropis prosera* leaves-2 kg,
- Green chili paste-2 kg,
- Garlic paste-250 g,
- Cow dung-3 kg,
- Cow urine-5 lit,
- Water-200 lit.

Crush all the ingredients and ferment for one month. Keep the drum in shade and covered with gunny bag. Shake regularly three times a day. Extract after crushing and filtering. The extract can be stored up to 6 months and is sufficient for one acre.



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### 3. Starch liquid

- Rice flour 1 kg,
- 250 grams inguva (asafoetida)
- 500-gram soap nut
- Water 5 L
- Soluble starch, 1 g
- Spray starch (the type used for ironing)
- Water (distilled or deionized) 100 mL

#### Instruments

- Balance Beaker,
- 250-mL Beaker,
- 250-mL Graduated cylinder,
- 100-mL Graduated cylinder,
- 100-mL
- Stirring rod Hot plate Stirring rod.

Starch liquid preparation

Use: 1. Controls the mealy bugs

### 4. Natural way of Controlling caterpillars

Controlling caterpillars naturally involves using methods that are environmentally friendly and minimize harm to beneficial insects and plants. Here are some effective natural methods to manage caterpillar infestations.

1. **Handpicking:** Regularly inspect your plants and manually remove caterpillars by hand. This method is effective for small infestations and allows for immediate action.
2. **Neem Oil:** Neem oil acts as a natural insecticide and disrupts the life cycle of caterpillars. Mix neem oil with water according to the manufacturer's instructions and spray it on affected plants.
3. **Diatomaceous Earth:** Diatomaceous earth is a natural powder made from fossilized diatoms. Sprinkle it on plants and around the garden. It damages the caterpillars' exoskeletons and dehydrates them.
4. **Beneficial Insects:** Introduce or encourage natural predators like parasitic wasps, lacewings, and predatory beetles that feed on caterpillars. These insects help keep caterpillar populations in check.
5. ***Bacillus thuringiensis* (Bt):** Bt is a naturally occurring bacterium that produces toxins lethal to caterpillars. It is available in various commercial formulations and should be applied according to the product instructions.
6. **Garlic and Chili Spray:** Blend garlic cloves and hot chili peppers with water, strain the mixture, and spray it on plants. The strong odor and spiciness repel caterpillars and other pests.
7. **Row Covers:** Use lightweight row covers or insect netting to physically block caterpillars from reaching your plants. Ensure the covers are securely fastened to prevent pests from getting underneath.
8. **Companion Planting:** Plant herbs and flowers that repel caterpillars or attract beneficial insects. For example, marigolds and nasturtiums can help deter certain caterpillar species.
9. **Trap Crops:** Plant sacrificial crops that attract caterpillars away from your main crops. Once the caterpillars are concentrated on the trap crops, they can be managed more easily.
10. **Handmade Sticky Traps:** Create homemade sticky traps using yellow or blue cards coated with a sticky substance. Caterpillars and other pests are attracted to the colors and become stuck.



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**11. Healthy Plant Practices:** Maintain overall plant health by providing proper nutrients, watering, and spacing. Healthy plants are more resistant to pests and can recover more quickly from infestations.

Using these natural methods can help effectively manage caterpillar populations while promoting a healthy and balanced garden ecosystem.

### 5. Neem Powder

Incorporating neem powder into the soil helps protect plants from various pests. Neem powder contains NPK (nitrogen, phosphorus, potassium) nutrients, which are beneficial for plant health. Aim to add a pinch of neem powder to every planting mix.

### 6. Neem Oil

Neem oil is an essential bio-pesticide for plant cultivation. Mix 5 ml of neem oil with 1 liter of water and spray it on all types of plants every 15 days to protect them from pests and diseases. Emulsified neem oil can be diluted directly in water, but a common method is to mix 5 ml of neem oil with 5 ml of dishwashing liquid in 1 liter of water before spraying.

### 7. *Metarhizium* (An insect bio control agent)

*Metarhizium* is a fungal species often referred to as the "king of bio-pesticides," *Metarhizium* is effective against around 300 types of pests, diseases, and insects that affect plants. To use it, mix 10 grams of *Metarhizium* with 1 kg of animal manure and 250 grams of neem powder. Add water, cover the mixture with a cloth, and let it sit for 7 days. After 10 days, apply this mixture to the plant pots. Alternatively, mix 10 grams of *Metarhizium* in 1 liter of water and apply it to plants or use it as a spray. It effectively controls soil-borne insects and grubs.

### 8. *Bavaria Bassiana*

This is a microbial fungicide that can be used on all types of flowers, vegetables, fruit plants, and indoor plants. Mix 5-7 grams of *Bavaria Bassiana* in 1 liter of water and spray it on the plants. It is effective against flying insects but should not be mixed into the soil.

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### 9. Neemastra

As it is an organic insecticide.

Preparation of Neemastra (Organic pesticide) Materials required

- Neem Leaves
- Neem Seeds
- Cow Dung
- Cow Urine
- Water
- Jaggery or Brown Sugar
- Optional Ingredients
- Garlic
- Onion
- Ginger

#### Neemastra Preparation

- 5 kg neem leaves crushed and mixed with water
- 5 litres urine and 2 kg cow dung added to it
- Ferment the prepared solution for 24 hours
- After 24 hour the mixture is filtered and diluted to 100 litres
- Use this bio-pesticide as foliar spray for 1 acre.

#### Limitations of Neemastra

Its residual effect is less powerful as compared to chemical pesticides. Some pests may linger even after application of the treatment. It may take longer to show desired result. It should be applied more frequently which makes its use more labour intensive and more time consuming. It is more specific only for sucking pests and mealybugs. After some time, pests may become resistant to Neemastra. So, it's best to use this biopesticide along with other cultural practices in IPM approach. Accurate pest identification and knowledge of pest life cycle is crucial while using organic insecticides. Shorter shelf life as compared to synthetic insecticides. One needs training to make it at home and use it effectively.



**Fig-19 Demonstration of preparation of Neemastra**



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### 10. Brahmastra (Organic pesticide)

Preparation of Brahmastra (Organic pesticide)

#### Materials required

- Cow dung
- Cow urine
- Neem leaf,
- *Pongamia pinnate* leaf /lantana camera,
- Custard apple leaves,
- Castor leaf,
- Bilwa (belpatra)

#### Preparation

20 lit of cow dung urine is be taken in a container and

2 kg neem leaf chutney,

2 kg pongamia pinnate leaf chutney/lantana camera,

2 kg datura leaf chutney,

2 kg custard apple chutney,

2 kg castor leaf chutney and

2 kg belpatra chutney

#### Procedure:

All the ingredients are to be added to it. Boiled well by stirring continuously, it should keep under low flame while boiling the contents for 1 hour and covered with lid. Allowed it cool for 48 hrs where all alkaloids will dissolve in it. Stirred it for morning and evening hours for 1 minute and filter the contents.

**Application:** Brahmastra is a concoction of tobacco leaves & other ingredients, fermented that helps in repelling large caterpillars & pests. 200 lit of water is to be added 6-8 lit of brahmastra mixed and sprayed. The content can be used up to 6 months. It controls sucking pests and leaf eating caterpillars.



**Fig-20 Preparation of Brahmastra by students**





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### 11. Agniastra (Organic Pesticide)

Preparation of Agniastra

#### Materials required

- Pot,
- Cow urine,
- Tobacco,
- Green chilli,
- Garlic,
- Neem leaves,
- Cloth

#### Procedure

Take a pot or a container and add 10 litres of cow urine. 1 Kg of tobacco leaves were crushed in urine. Crush and add 500 g of green chillies to cow urine. Next, add 500g of crushed garlic and add to cow urine. Finally, add 500g of leaf pulp and then boil the solution for 5 times. Left it for 24h for fermentation, filter the solution with cloth.

**Fig-21 Demonstration of preparation of Agniastra**





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### 12. Soil-Borne Diseases and Protection

To protect plants from soil-borne diseases, you should mix the following with the soil.

- *Trichoderma viride*
- *Pseudomonas*
- Neem Powder

Management of Pests and Disease-Causing Insects

Insects spread diseases primarily through three methods

1. **Penetration:** Insects invade plants without permission, creating holes or entering through them.
2. **Incubation:** They create a suitable environment for the growth of microbes
3. **Infection:** They spread infections and diseases, provoking outbreaks

### 13. Pest Management

#### a. Powdery Mildew/White Rust/Downy Mildew

Symptoms: White powdery substance on the upper side of leaves, which eventually turns yellow and dries out

**Treatment:** Apply neem extract every 10 days, twice in a row.

#### b. Downy Mildew

**Symptoms:** Powdery coating on the underside of leaves with yellowish spots that cause leaves to drop.

**Treatment:** Mix curd with asafoetida solution and spray once a week for two weeks.

#### c. Black Spots/Brown Spots/Fungus

Symptoms Round spots on the upper side of leaves, which may also affect fruits.

**Treatment:** Mix 3 grams of copper oxychloride with one liter of water and spray once every 10 days, twice.

#### d. Fire Blight

Symptoms: Causes the plant to dry out.

Treatment: Prompt removal and proper care are required.

#### e. Leaf Miner

**Symptoms:** Mining trails on leaves.

Treatment: Spray neem extract or neem oil once a week for two weeks. Remove and discard affected leaves

#### f. Fruit Rot/Anthracnose

**Symptoms:** Fruit flies and other pests affecting fruit.

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Treatment: Spray neem extract or neem oil once a week for two weeks. During fruit development, apply neem powder to the plant base and use fruit fly traps.

### **g. Virus (Mosaic) Diseases**

**Symptoms:** Yellowing streaks or patches on leaves.

Treatment: Spray neem extract or neem oil, or use a mix of neem and garlic extract once a week for two weeks.

### **Pests Affecting Crops Types**

#### **1. Chewing Pests**

Examples: Green bugs, red bugs, pink bugs, Pod borers, Pumpkin beetles. Treatment: Spray neem extract or neem oil once a week for two weeks.

#### **2. Sucking Pests**

**Examples:** Whiteflies, Greenflies.

Others Scale insects, Red mites, Whiteflies, Mealybugs, Leaf miners.

### **Control Methods**

For both chewing and sucking pests

- a. Mix curd with asafetida solution and spray once a week for two weeks.
- b. Neem extract Spray neem extract every 10 days, twice.
- c. Neem Powder/Neem Oil: Effective against nematodes and harmful microorganisms.
- d. Baking Soda Solution Mix one teaspoon of baking soda and two teaspoons of olive oil/vegetable oil in one liter of water. Spray to protect plants from fungal infections. It's best to spray once a week.

### **14. Pest-o-oil**

Pest-O-Oil is a mixture of various oils designed to be an effective pest control solution.

**Ingredients:**

The oils used in its preparation include

- Neem Oil
- Castor Oil
- Avocado Oil
- Fish Oil
- Karanja Oil
- Garlic Juice



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Pest-O-Oil dissolves quickly in water, so there is no need for additional emulsifiers. Because it is highly concentrated, only 0.5 ml to 1 ml of Pest-O-Oil should be mixed per liter of water before use.

Pest-O-Oil is effective against a wide range of pests, including

- Aphids
- Whiteflies
- Caterpillars
- Mealybugs
- White and Green Flies
- Red Spider Mites
- Pod Borers
- Flower Bud Borers
- Sucking Insects
- Fruit Flies
- Scale Insects

As Pest-O-Oil is completely organic, spraying it once a week on plants helps prevent pest infestations and keeps plants healthy.

In addition to spraying, Pest-O-Oil can be applied at the base of plants to prevent soil-borne pests, diseases, and insects.

### 15. Insecticidal Soap Materials

Castile soap or liquid soap: (free from degreasers and other additives) Water

**Optional:** Essential oils for added effectiveness (e.g., rosemary, peppermint)

#### Procedure

**Mixing:** In a spray bottle or a container, mix 2 tablespoons of Castile soap or liquid soap with 1 liter (about 1 quart) of water.

**Optional Additions:** If desired, add a few drops of essential oil.

**Application:** Shake well to combine and spray directly onto affected plants, targeting the underside of leaves where pests often reside.

**Frequency:** Apply every 5-7 days or after rain, ensuring full coverage of the pests.

### 16. Diatomaceous Earth

#### Materials

- Food-grade diatomaceous earth (ensure it is labeled as food-grade for safety)

#### Procedure

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- **Application:** Dust the diatomaceous earth directly onto the affected areas of plants and the surrounding soil.
- **Frequency:** Reapply after rain or watering, as moisture can reduce its effectiveness.
- **Note:** Wear a mask while applying to avoid inhaling the fine dust.

## 17. Soap and Water Solution

### Materials

- Liquid soap (mild, non-detergent, such as soap)
- Water

### Procedure

- **Mixing:** Combine 1-2 teaspoons of liquid soap with 1 liter (about 1 quart) of water.
- **Application:** Pour the mixture into a spray bottle and apply to affected plants, ensuring even coverage on both sides of the leaves.
- **Frequency:** Apply every 5-7 days or as needed, especially after rain.

## 18. Pyrethrin

**Fig-22 Source of Pyrethrin**



### Materials

- Pyrethrin concentrate (usually available from garden stores)
- Water
- Optional Emulsifier (like soap) to help mix

### Procedure

- **Mixing:** Dilute the pyrethrin concentrate according to the manufacturer's instructions, usually about 5-10 ml per liter (about 1 quart) of water.
- **Optional:** Add a few drops of mild soap to help the solution adhere to plant surfaces.
- **Application:** Spray the mixture onto affected plants, covering all surfaces thoroughly.
- **Frequency:** Apply every 7-10 days or as needed.



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### 19. Plant-Based Oils

#### Materials

- Plant-based oil (e.g., soybean oil, canola oil)
- Water
- Emulsifier (e.g., mild liquid soap)

#### Procedure

- **Mixing:** Mix 2-3 tablespoons of plant-based oil with 1 liter (about 1 quart) of water. Add 1 teaspoon of mild liquid soap to help emulsify the oil.
- **Application:** Shake well and spray directly onto affected plants, ensuring full coverage.
- **Frequency:** Apply every 7-10 days or as needed.

### 20. Horticultural Oils

#### Materials

- Horticultural oil (available at garden centers)
- Water

#### Procedure

- **Mixing:** Dilute the horticultural oil according to the manufacturer's instructions, typically 2-4 tablespoons per liter (about 1 quart) of water.
- **Application:** Spray the solution onto affected plants, making sure to cover both sides of the leaves and stems.
- **Frequency:** Apply every 7-14 days or as needed, especially before new growth begins.

### 21. Rotenone

#### Materials

- Rotenone concentrate
- Water

#### Procedure

- **Mixing:** Follow the manufacturer's instructions for dilution. Typically, it involves mixing 5-10 ml of rotenone concentrate per liter (about 1 quart) of water.
- **Application:** Spray the solution onto affected plants, ensuring thorough coverage.
- **Frequency:** Apply every 7-10 days or as needed. Note that rotenone should be used cautiously as it can be harmful to beneficial insects and aquatic life.

**Note:** Always wear protective clothing and follow safety guidelines when preparing and applying these pesticides.

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Effective remedies for pest management in Rainy season

This is the remedy for all kinds of pests that come to plants during monsoon:

### Ingredients:

Cow urine - 100ML

Asafoetida - 50g

Fermented buttermilk for a week - 2 liters (buttermilk should be cold boiled only)

### Method of Preparation:

1. Add ginger in water and after it dries and dissolves, mix all these ingredients in 20 liters of water.
2. Filter and spray to completely wet the plants.

### Essential Instructions:

This solution should be used within 1 day.

Use only on sunny days (morning or evening).

It is better to take care before the pest gets infected.

## 22. Tobacco

Tobacco can be used as an organic fertilizer, though it is not very common, and there are some benefits and drawbacks to consider.

### Usage:

1. **Tobacco dust or powder:** You can use tobacco dust or powder by mixing it into the soil. When mixed into the top layer of the soil in small amounts, it can provide nutrients.
2. **Tobacco compost:** Adding tobacco waste to your compost pile can also work. Ensure that it is well-composted before using it in your garden to avoid potential problems due to nicotine sensitivity in plants.
3. **Tobacco tea:** Soaking tobacco leaves or dust in water for a few days to create "tobacco tea" is another method. This can be diluted and used as a foliar spray or soil drench, though it is mostly used for pest control.

### Benefits of using tobacco as fertilizer:

- **Rich in nutrients:** Tobacco contains nutrients like nitrogen, phosphorus, and potassium, which are beneficial for plants.
- **Organic matter:** It adds organic material to the soil, improving soil structure and water retention.
- **Pest repellent:** Due to the nicotine, which is toxic to many pests, tobacco can act as a natural insect repellent.

### Drawbacks of using tobacco as fertilizer:



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- **Nicotine toxicity:** Nicotine is a potent chemical, and in large amounts, it can harm beneficial insects and even plants.
- **Soil pH impact:** Tobacco can make the soil more acidic, which may not be suitable for all plants.
- **Disease risk:** Tobacco can carry pathogens like Tobacco Mosaic Virus (TMV), which can infect other plants, especially those in the Solanaceae family like tomatoes and peppers.
- **Limited nutrient content:** Although it provides some nutrients, tobacco does not contain as many as other organic fertilizers like compost or manure.

### 23. Baking Soda:

#### 1. Fungal Disease Prevention:

- o **Powdery Mildew:** Baking soda can be used as a treatment for fungal diseases like powdery mildew, which affects plants such as cucumbers, squash, and roses.
- o **Recipe:** Mix 1 tablespoon of baking soda with 1 gallon of water and add a few drops of liquid soap (as a surfactant) to help it stick to the plant's leaves. Spray this mixture on affected plants to prevent or reduce the spread of fungal infections.

#### 2. Natural Pesticide:

- o Baking soda can be combined with other natural ingredients to make a mild pesticide. For example, mixing baking soda with oil or soap can help deter pests like aphids and spider mites.
- o **Recipe:** Mix 1 teaspoon of baking soda with 1/3 cup of olive oil or neem oil and 1/2 gallon of water. Spray this on plants to keep pests away.

#### 3. Soil pH Adjuster:

- o If you have very acidic soil, baking soda can be used to raise the pH slightly, making it more alkaline. This is useful for plants that prefer less acidic soil, though baking soda is only a short-term fix and should be used sparingly.
- o **Application:** Sprinkle small amounts of baking soda on the soil and mix it in lightly with water.

#### 4. Cleaning Garden Tools:

- o Baking soda can be used to clean gardening tools, pots, and containers. It has mild abrasive properties and acts as a natural disinfectant.
- o **Application:** Make a paste of baking soda and water to scrub off dirt, grime, and rust from your tools.

#### 5. Weed Control:



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o Baking soda can help kill small weeds that appear in cracks in walkways or garden paths. Its high sodium content can act as a natural herbicide.

o **Application:** Sprinkle baking soda directly onto the weeds. Be careful, as it can also harm nearby plants if used too generously.

### Benefits of Baking Soda for Plants:

- **Fungal Control:** Baking soda disrupts the ion balance in fungal cells, effectively killing or preventing them from spreading.
- **Non-Toxic:** Baking soda is relatively safe and non-toxic for humans, pets, and the environment when used properly.
- **Cost-Effective:** It's an inexpensive alternative to commercial fungicides and pesticides.

### Potential Risks and Drawbacks:

- **Salt Build-Up:** Baking soda contains sodium, which can accumulate in the soil if overused, leading to salt toxicity that harms plant roots and inhibits growth.
- **Limited Effectiveness:** While it can help control mild fungal infections, baking soda is not always effective for severe infestations or more resistant plant diseases.
- **pH Imbalance:** Using too much baking soda can raise the soil's pH too high, making it less suitable for plants that prefer slightly acidic conditions.

### Precautions:

- Always test on a small area of the plant before widespread use to ensure no adverse reactions.
- Avoid using it excessively, especially on delicate or sensitive plants.

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