



# Sustainable Agriculture Part 1



**IDRC · CRDI**

International Development Research Centre  
Centre de recherches pour le développement international



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# Overview



Part.1- 6:00-8:00	Part.2- 6:00-8:00	Part.3- 6:00-8:00	Part.4- 6:00-8:00
<ul style="list-style-type: none"> <li>Define Sustainable Agriculture (SA)</li> <li>Benefits</li> </ul>	<ul style="list-style-type: none"> <li>Discuss the role of Soil fertility in Sustainable Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>Discuss Pre-Harvest factors affecting Fruit + Vege. Quality</li> </ul>	<ul style="list-style-type: none"> <li>Discuss the type, cause &amp; remedies associated with Post harvest loss from harvest to Consumption. ( Handling, PH treatments)</li> </ul>
<ul style="list-style-type: none"> <li>Components of Sustainable Agriculture</li> <li>Sustainable Agriculture Practices.</li> </ul>	<ul style="list-style-type: none"> <li>Soil Conservation Methods:                             <ul style="list-style-type: none"> <li>Cover crops</li> <li>No till farming</li> <li>Organic mulches</li> <li>Inorganic mulches</li> <li>Different colour plastic mulches and their benefits.</li> <li>Establishment of fibrous root tree crops in sloping lands</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Identifying Climacteric and Non Climacteric fruits.</li> </ul>	<ul style="list-style-type: none"> <li>Discuss the type, cause &amp; remedies associated with Post harvest loss from harvest to Consumption.</li> <li>(Grading, Storage, Ethylene production)</li> </ul>
<ul style="list-style-type: none"> <li>Selecting Healthy seedlings</li> </ul>	<ul style="list-style-type: none"> <li>Water Harvesting and Benefits</li> </ul>	<ul style="list-style-type: none"> <li>Post Harvest Define</li> </ul>	<ul style="list-style-type: none"> <li>Packaging Benefits- Increasing shelf-life</li> </ul>
<ul style="list-style-type: none"> <li>Discuss Strategies of SA: Crop Scheduling, Mr. Stacky, Inter cropping, Crop Rotation, IPM, Companion Planting, Integrating Livestock and Crops and High tunnel production.</li> <li>Choose 2 Individuals for the MILLY (Most Important Lesson Learnt Yesterday) 5 min. each</li> </ul>	<ul style="list-style-type: none"> <li>Simple Irrigation System.</li> <li>Components of a Simple Irrigation System</li> <li>Irrigation Scheduling</li> <li><b>GUEST PRESENTER from Caribbean Chemicals TT</b></li> <li>Selection of 2 Individuals for the MILLY (Most Important Lesson Learnt</li> </ul>	<ul style="list-style-type: none"> <li>Discuss the type, cause &amp; remedies associated with Post harvest loss from harvest to Consumption. (Harvesting techniques, removal of field heat)</li> <li>Selection of 2 Individuals for the MILLY (Most Important Lesson Learnt Yesterday)</li> </ul>	<ul style="list-style-type: none"> <li>Selective packaging</li> <li>Types of packaging</li> </ul>

# What is Sustainable Agriculture

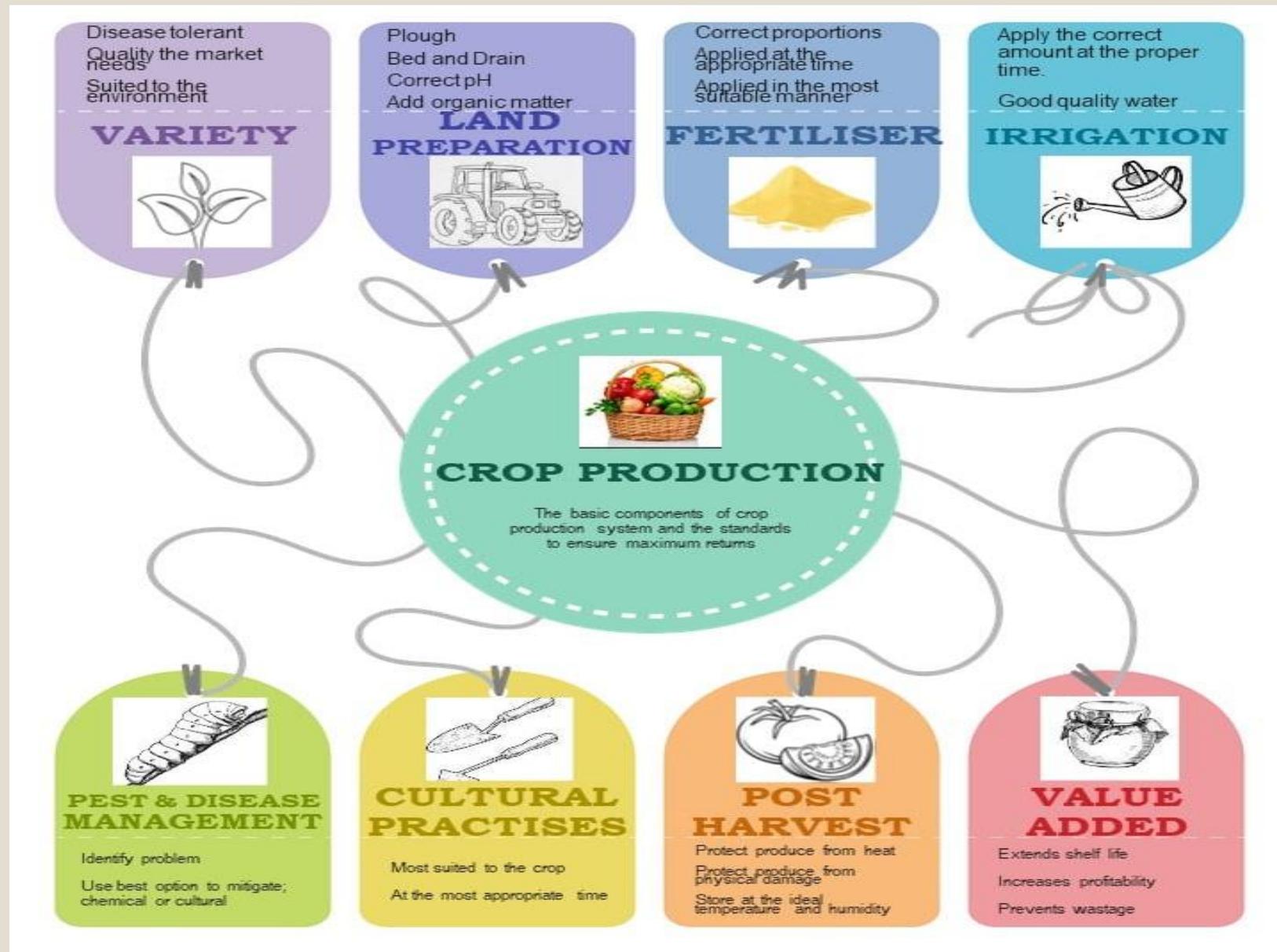
Sustainable Agriculture is a type of Agriculture that focuses on producing crops and livestock, while having minimal effect on the environment.

Sustainable agriculture also focuses on maintaining economic stability of farms and helping farmers improve their techniques and quality of life.

The ideal sustainable agriculture:

- Conserve water
- Reduce chemical usage
- Reduce fertilizer usage
- Promote biodiversity in crops and livestock,
- Prevent soil erosion.





# The major component of sustainable agriculture?



The main components of both sustainable farming and conventional farming are the same:



Soil management- Fertility, Soil and moisture conservation ...



Crop management- Crop rotation, intercropping ...



Water management-Drip Irrigation....Water harvesting



Disease/pest management- IPM



Waste management- Composting

# Sustainable Agriculture Practices



Common sustainable agricultural practices are:



Crop rotation planting legumes after nitrogen dependent crops such as corn, to replenish nitrogen to the soil.



Drip irrigation running of tubing to direct water to the roots of individual plants to prevent water loss and waste... GPH



Integrated Pest Management (IPM) using native predators (e..g. ladybugs), intercropping, seasonal plantings, mechanical means to remove/prevent pests.



Planting cover crops to prevent soil erosion and conserve moisture



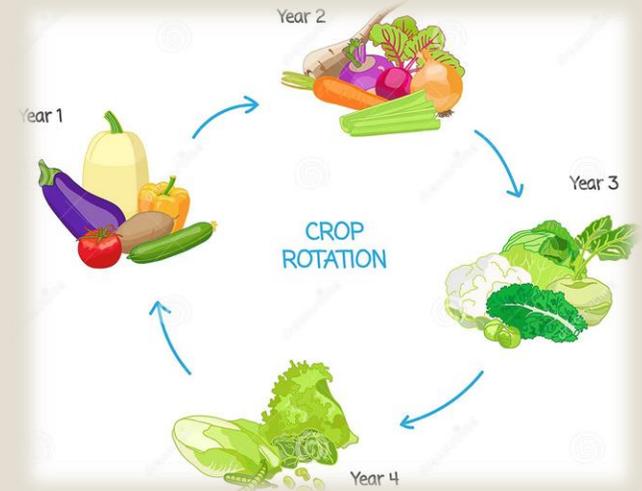
Growing of diverse produce ensuring that biodiversity in the food system is not lost.



Small scale agriculture growing food on smaller local farms instead of large farms.



Integrating livestock and crops



# Self –Sustainable Farming/Peri-Urban Farming

Self sufficiency farming is producing most or all your food on your own land/backyard. A self-sufficient farmer does little or no trading.

Peri-urban agriculture gives women and other non-heads of household a low-barrier occupation through which to support their families, adding to household productivity and giving women an outlet to assert themselves. Producing food in areas nearby to cities shortens supply chains, which aids quality and cost.



## The “Pillars” of Food Security





# Self Sustainable Agriculture

Do You Want to Grow Your Own Food But Limited by?

- 1) No available soil- Concrete jungle
- 2) Small yard space
- 3) Land tenure

Grow Box



PVC Gardening



Recycled Tyre



# Self Sustainable Agriculture

Pallet planter



Recycled feed/ flour sack



Recycled bottles



# Self Sustainable Agriculture

Strawberry Planter



Grow bags



Bamboo Planter



Recycled guttering



# Strawberry planter in Progress





## Self Sustainable Agriculture

# Self Sustainable Agriculture



# Activity Area



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What are 3 benefits of sustainable agriculture?



# Activity Area



- Benefits of Sustainable Agriculture
- Contributes to Environmental Conservation.
- Reduces Energy consumption
- Public Health Safety and awareness
- Minimize /Prevent Pollution.
- Reduces Air Pollution
- Prevents Soil Erosion
- Reduction in Cost of production
- Increases Biodiversity.



# Selecting healthy seeds and Seedlings

## SELECTION OF SEEDS FOR SOWING

Seeds for sowing must:

- Be suitable to local environmental conditions
- Have a uniform size
- Have a good germination percentage (>85%)
- Be treated against pests
- Be selected from high yielding varieties

## Signs of ROOT ROT

- Slow growth
- Mushy stems
- Wilting, yellow, distorted leaves
- Roots are brown and soft instead of firm and white
- Soil smells rotten

## GOOD TOMATO SEEDLINGS

- ❖ Have proper shoot to root ratio – 2:1
- ❖ Be of Uniform appearance
- ❖ Free from pests and diseases – no brown/black spots, holes, or insects present
- ❖ Healthy white roots
- ❖ No balling of roots – root bound (too old)
- ❖ Vigorous, healthy growth – not tall and spindly
- ❖ Ideal for transplanting at stage of 4 – 6 healthy, green leaves
- ❖ Be absent from premature flowers and fruits – stressed seedling will not produce at its full Genetic Potential
- ❖ No signs of nutrient deficiency – yellow, brown or purple discolouration.

Label  
your crops

TOMATO  
20-4-15



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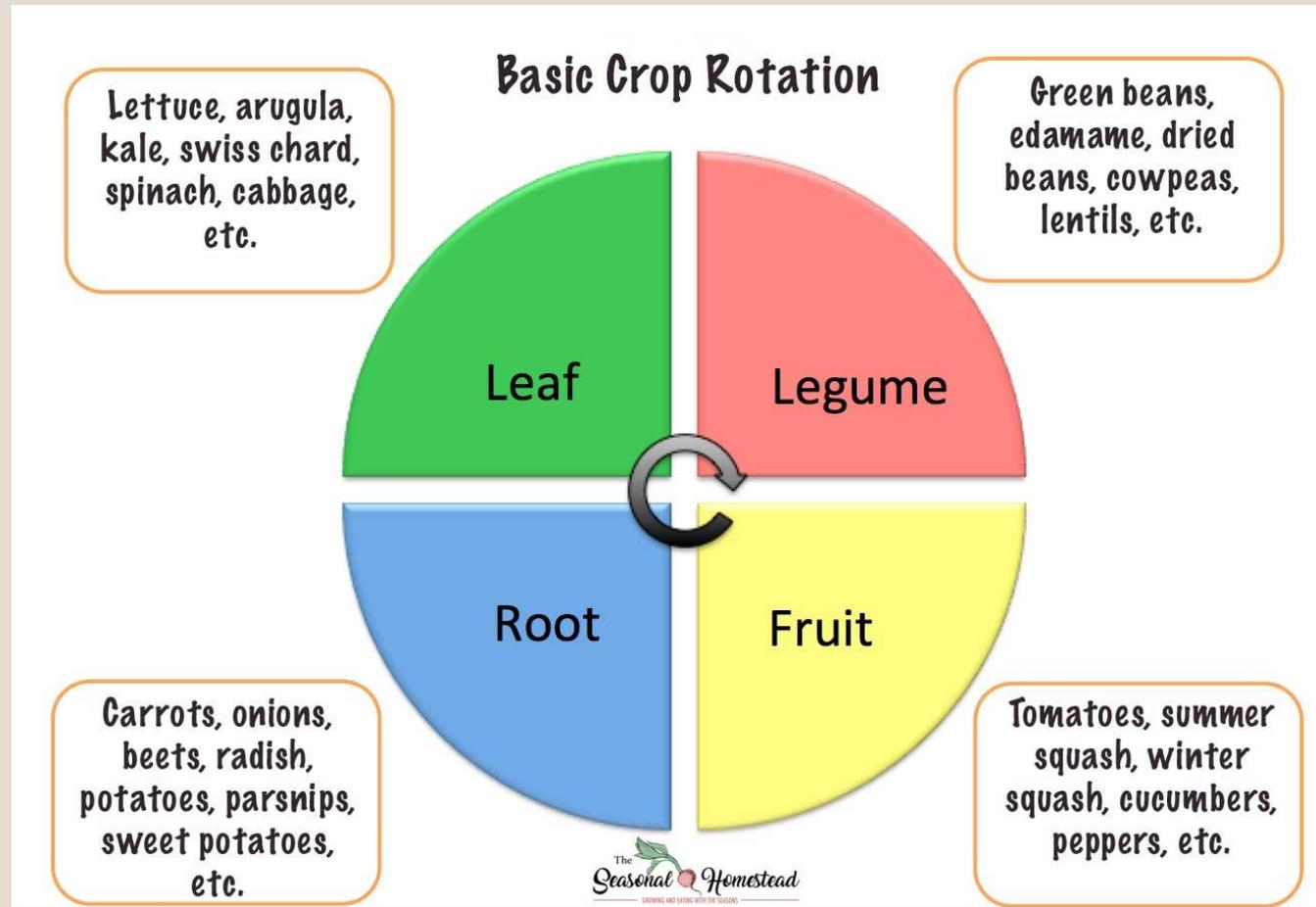
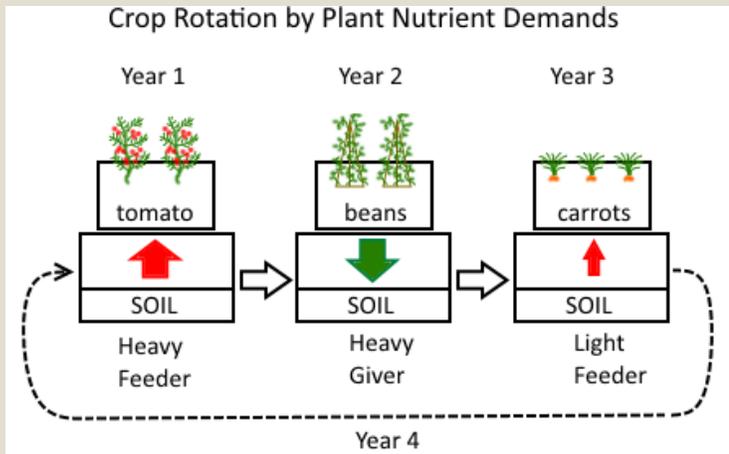
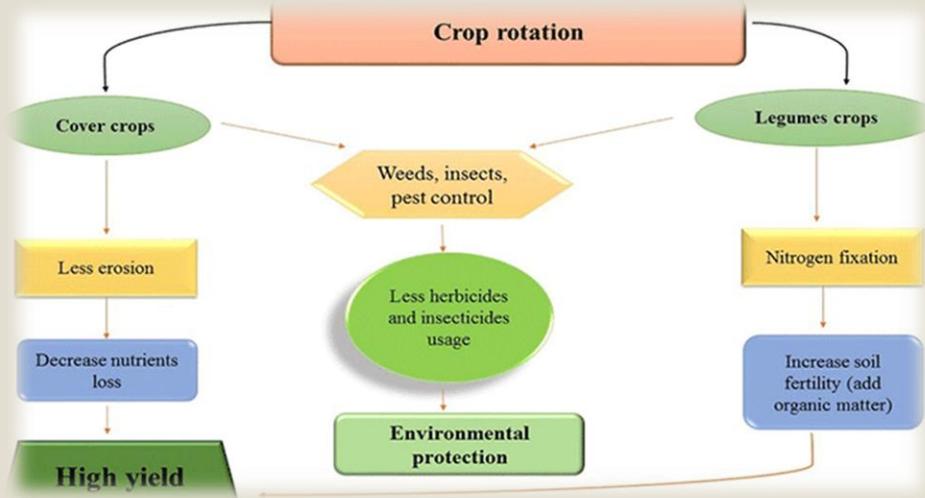


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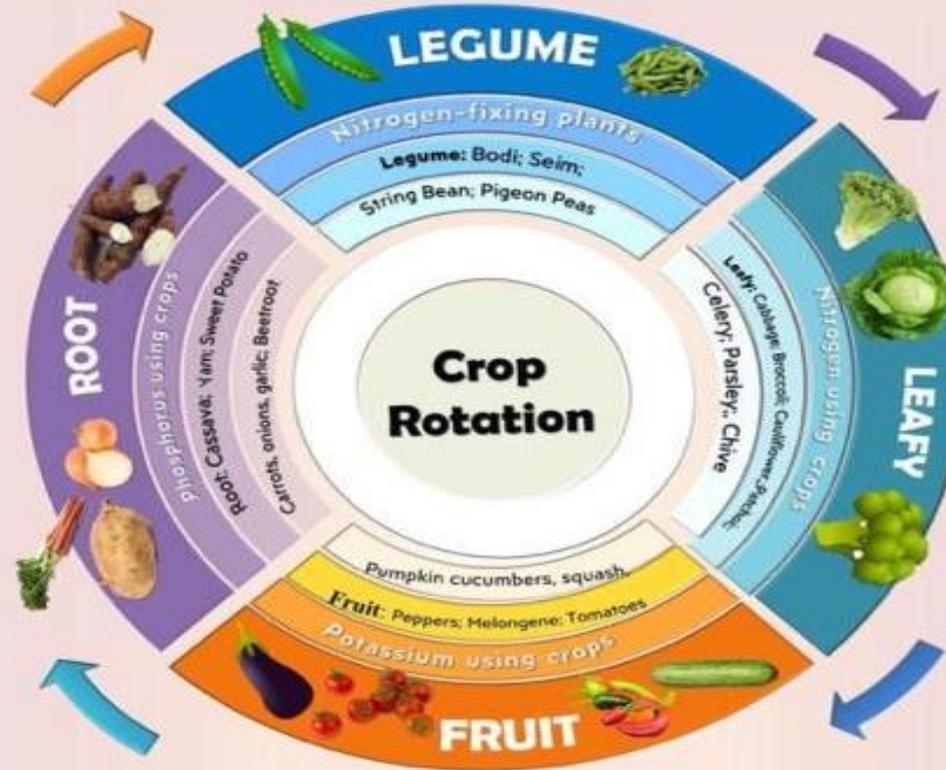


# Crop Rotation

Crop rotation is the cornerstone pest control in the tropics. When a single crop is planted repeatedly in the same soil, insects and diseases that attack that crop are allowed to build up to unmanageable levels, greatly reducing the farmer's harvest.



This is a system of crop production, which involves the repetitive cultivation of an orderly succession of different families of crops on the same parcel of land/ container within a given period of time.



### Benefits of Crop Rotation

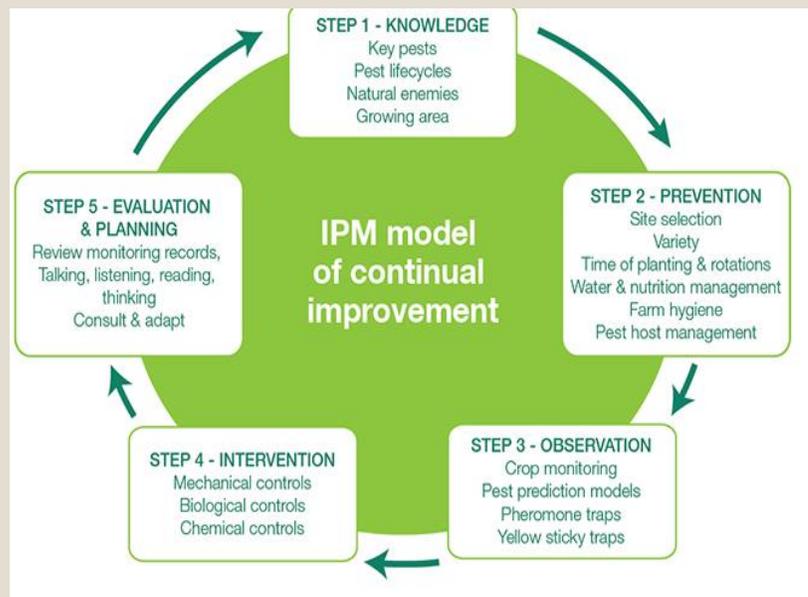


# Integrated Pest Management

Integrated Pest Management (IPM) combines the use of biological, cultural and chemical practices to control insect pests in agricultural production.

IPM should not be confused with organic practices. It does not discourage spraying chemicals; it promotes spraying with selective pesticides only when the crop needs it, which generally means that less pesticide is used. **Biosecurity Measures must also be put in place.**

Purchase healthy seedlings free from pest & disease



Look for vigour & uniform growth of seedlings



Look for discolouration at stem just (1/2 inch) above soil level for a disease



Look for insect pests (aphids, whiteflies, thrips) on seedlings mainly on lower surface leaves



Look for disease symptoms viz., leaf spot/blight/hole /yellowing on seedlings



## Early Monitoring

Be vigilant for diseases viz., root rot, collar rot, wilt, leaf spots, stem blight and fruit rot & Insects viz., whiteflies, scale insects, thrips, leaf miner, aphids, mealy bugs, leaf feeder at early stages to prevent spread & control.



# Cultural Control

Cultural controls are nonchemical practices that reduce pest establishment, reproduction, dispersal, and survival. For example, crop rotation - replacing a susceptible crop with a less susceptible crop; and changing irrigation practices - less watering can reduce root disease and weeds.

- Barrier Methods e.g., Sticky traps, copper strips, pheromone traps, Companion planting, proper plant density and Soil solarization.

## Field Hygiene is Important



Sticky traps



Yellow cup or pool noodle with vegetable oil



## Yellow Sticky trap for monitoring and control.

- Use yellow bristol board or sturdy plastic to prepare a yellow sticky trap ( approximately 15 cm x 15 cm or 6 in x 6 in).
- Spread with vegetable oil (preferably oil with more stickiness and viscous) or petroleum jelly.
- Hang near plants, preferably one trap per 20-25 square ft. for an effective control. Or, use stakes to plant them in beds
- Replace new traps once in a week based on insects trapped.
- Use buckets or plastic cups for same purpose as shown



# Cultural Practices cont.

Copper wire to repel slugs and snails.  
Copper carries a charge that interferes with a slug's slime, which they don't like and thus avoid.



Old Disc to scare off birds from fruits and seeds



Plastic bags in corn and peas field to scare birds



# Biological Control

Biological control is where predatory or parasitic insects and mites known as 'beneficials' or 'good bugs' help to control chewing and sucking insects that affect the quality and productivity of crops by killing them or disrupting their breeding cycle.





**5 MIN  
BREAK**

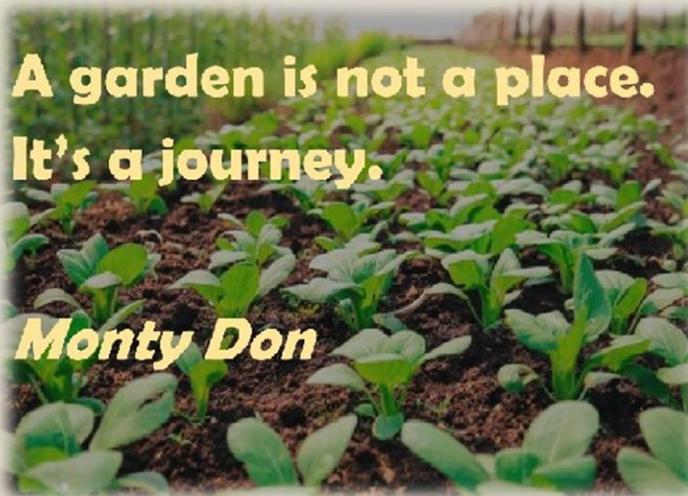
**“To plant a garden  
is to believe  
in tomorrow.”**

Audrey Hepburn



**A garden is not a place.  
It's a journey.**

**Monty Don**



**As I work on the garden,  
the garden works on me.**

- Gayla Trail



“

**Agriculture**

**is the most healthful,  
most useful and most  
noble employment  
of man.**

- George Washington

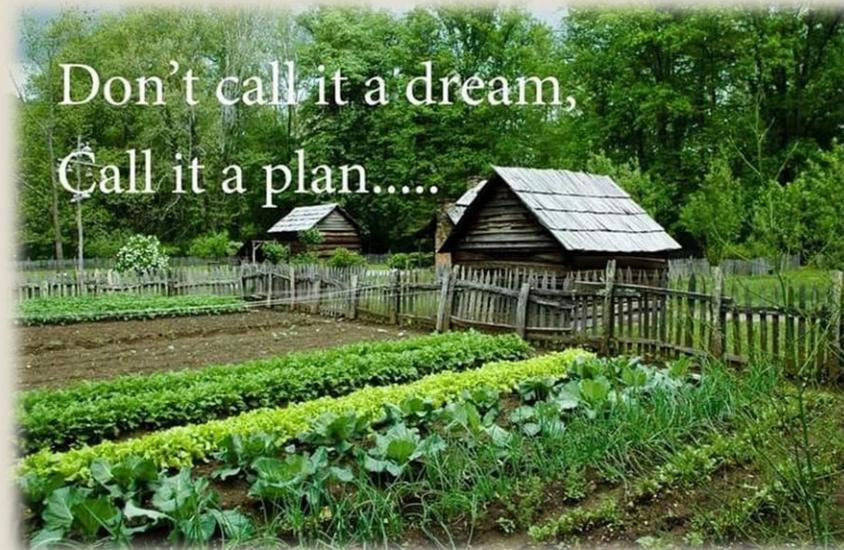


I AM AGRICULTURE – ARE YOU?

**If you have a garden and  
a library, you have every-  
thing you need.**

- Cicero

**Don't call it a dream,  
Call it a plan.....**



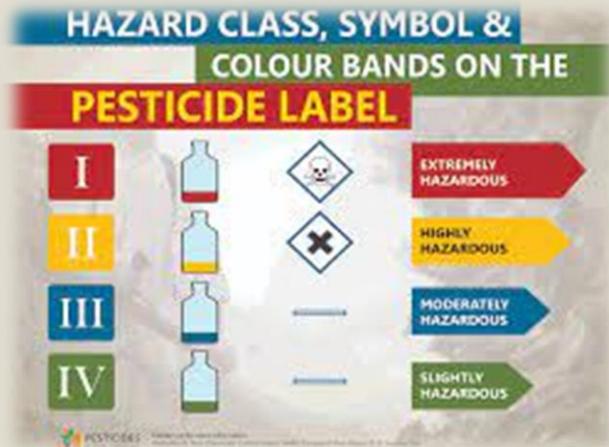
# Chemical Control



Chemical control involves the use of pesticides in the management of pests. It is used in IPM when biological and cultural control has not been enough to protect the productivity of the crop. Where chemical control is required, selective insecticides are chosen which target the pest, leaving the beneficial population unharmed.



The use of chemical is done when both Cultural and Biological control does not work. Using Pesticides less likely to cause hazards FIRST. ( Know the pesticide label Toxicity Color Code)



## Commercially Available Bio-pesticides

Source neem & essential oil- based biopesticides from agro-shops / pharmaceuticals for the control of pests and diseases. Follow instruction on label carefully



# Home- made remedies

## Garlic preparation for pests & disease control in home gardening



- Take 100 g (Approximately two bulbs) of peeled garlic
- ↓
- Add 200 ml of water & blend at high speed for 3-5 min
- ↓
- Add 700 ml of hot water to the mix and keep it overnight (12 hr)
- ↓
- Strain it to obtain the spray solution
- ↓
- Add a table spoon of ANY liquid soap & vegetable oil each, mix well and spray
- ↓
- Repeat spray at weekly interval depending on pest population

- i. Water blasting (spray) at morning times to wash off the whiteflies, aphids, thrips.
- ii. Do not spray water in the evening hours as this will attract diseases.
- iii. Spray soap solution (1 tablespoon per litre water) to control insects. Mix with 1 table spoon of vegetable oil to help the soapy water stick.



## NEEM Extract



- Take 100 gram of neem leaves / 100 gram dried neem seeds
- ↓
- Add approx. 100-150 ml of water & blend at high speed for 3-5 min
- ↓
- Add 200 ml of hot water to the mix and keep it 2 hrs
- ↓
- Strain it & dilute 10 times to obtain the spray solution
- ↓
- Add table spoon of any vegetable oil (sticking), mix well and spray
- ↓
- Repeat spray at weekly interval depending on pest population

## MAKING ORGANIC PESTICIDES USING LOCAL MATERIALS

### NEEM

(Azadirachta indica A. Juss)

#### Part II



**NEEM CAKE**  
 The remaining solid from the neem oil extraction is called **Neem Cake**. It is used as a soil enhancer/pest repellent. **Neem cake** is a good source of organic fertilizer as it contains NPK and micronutrients and can be applied directly to soil. Adding 1 – 2 kg of **Neem cake** to 10 square meters of soil reduces nematode infestation.

**NEEM SPRAY**  
 Mix 50 grams of crushed neem seeds in 1 Litre of water and leave for 12 – 24 hours. Apply every 10 -15 days if required.

**NEEM LEAF INSECTICIDE**  
 You can make neem leaf insecticide by crushing and steeping neem leaves. Use cold water and steep the leaves overnight or longer, rather than boiling. Boiling, in fact, any heat, destroys the active ingredients. Filter, do not dilute, and spray the liquid on plants during the cooler part of the day.



## MAKING ORGANIC PESTICIDES USING LOCAL MATERIALS

### RED PEPPERS

(*Capsicum sp.*)

#### Part I



**Capsaicin** is the compound in hot peppers that give it the "hot" taste. It can also be used as a biochemical pesticide. In powdered, liquid or with other ingredients Red Peppers offer protection against many insects, also bacterial and fungal diseases.

Among those pests that may be repelled by red peppers are **aphids, lace bugs, beetles, leafhoppers, and spider mites**. Red pepper spray works best as protection against flying insects that feed on leaves, flowers, and fruit.

#### How does Red pepper pesticides work?

Capsaicin repels insects by causing membrane damage and metabolic disruption. It also affects the nervous system of invertebrates. Most insects are repelled by pepper spray and will avoid treated plants.

#### LIQUID SPRAYS CAN BE PREPARED BY USING:

**FIVE (5) GRAMS (1 TEASPOON) OF CRUSHED, CHOPPED, OR DRIED PEPPERS TO SIX (6) LITRES (1.6 GALLON) OF WATER.**

**BOIL OR SOAK OVERNIGHT; FILTER AND DILUTE BEFORE USING.**

Add 30 mls (2 tablespoons) of mild dishwashing liquid per 3.7 litres (1 gallon) to help the mixture adhere to the plants. Wear gloves/goggles when preparing and using the spray. Cover plants thoroughly with the spray. Repeat if needed. Spray plants at the cooler times of the day.

## MAKING ORGANIC PESTICIDES USING LOCAL MATERIALS

### MARIGOLD

(*Tagetes sp.*)

#### Part I



Marigolds (Gainda) can deter a wide variety of Insect Pests, such as: Aphids, Caterpillars, Moths, Ants and Flies.

#### MARIGOLD SPRAY:

- **Place large quantities of fresh, crushed flowers, leaves & stems in a bucket of water.**
- **Allow to decompose over 5 – 10 days.**
- **Filter and dilute with water in a 1:2 Ratio.**
- **For every 1 litre of solution, add 1 tablespoon mild dishwashing liquid.**

This mixture can be stored for up to two (2) weeks in the refrigerator.

This liquid also acts as a Crop Strengthener to help Tomatoes, Peas and Beans resist Fungal Diseases.

When applying, pay special attention to the underside of the leaves. You will need to reapply every few days or after it rains.

# Baking Soda Spray for Powdery Mildew:

- 1 tablespoon baking soda
- 1 tablespoon vegetable oil
- 1 teaspoon dish soap
- 1 gallon of water



## MAKING NATURAL PESTICIDES USING LOCAL MATERIALS

### Wood Ash



Wood Ash can be used as a dry powder or in solution to control both soft-bodied and sucking insects.

Apply as a mulch to deter insects, slugs, snails, and nematodes.

Use as a **DRY DIP** for planting materials and cuttings to prevent bacterial, fungal, and viral diseases.

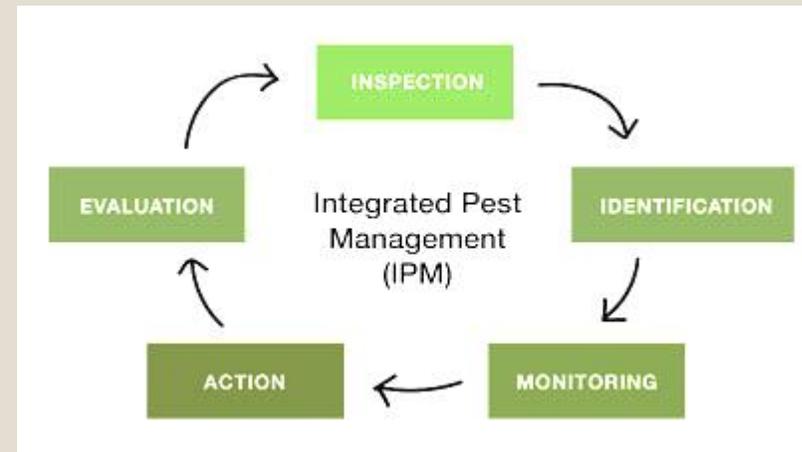
Spray a mixture of wood ash and soap solution to protect plants from flea beetles, mites, and stink bugs.

Mix the following ingredients together and allow to soak for several hours.

- ❖ **½ cup (64g) Wood ash**
- ❖ **½ cup (64g) Agricultural lime**
- ❖ **1 Gallon (4 Litres) Water**

Filter and spray crops.

**Very effective against sucking pests and cucumber beetles.**



# Companion Planting

## BENEFITS OF COMPANION PLANTING

- Deterring pests: Certain plants act as insect repellents or deter critters.
- Attracting beneficials: Some plants also attract beneficial insects.
- Shade regulation: Large plants provide shade for smaller plants in need of sun protection.
- Natural supports: Tall plants, like corn, can support lower-growing, sprawling crops such as cucumbers and string beans.
- Improved plant health: When one plant absorbs certain substances from the soil, it may change the soil biochemistry in favor of nearby plants.
- Improving soil fertility: Some crops, like beans, peas, and other legumes, help to make nitrogen more available in the soil.
- Weed suppression: Planting sprawling crops like potatoes with tall, upright plants minimizes open areas, where weeds typically take hold.
- Maximize Land use. Sweet potato>>Corn>>Pigeon peas>> Cassava.



## Small space –Large Production

Mr. Stacky is an innovative vertical gardening design that save space, water and nutrients. Mr.Stacky allows home and commercial gardeners to grow more plants in less space.



# Small space –Large Production



# Integrating Livestock and Crop

The advantages of integration are obvious. As far as fish production is concerned, it serves the major purpose of providing cheap feedstuffs and organic manure for the fishponds, thereby reducing the cost and need for providing compounded fish feeds and chemical fertilizers.

Chickens being placed over a fish tank- droppings from chicken and feed makes algae for fish to feed on.



Water from the fish tank is used to water vegetables in the back yard.



# Integrating Livestock and Crop

The principal advantage of integration is the demonstration of total farm productivity and sustainable agriculture in the context of efficient natural resource management, together with attendant benefits:

- Reduced risk of raising a single product.
- Increased water infiltration and resistance to soil erosion.
- Reduced fertilizer costs use from nutrient cycling.
- Reduced weeding
- Improved soil fertility due to the return of dung and urine
- Value addition to the tree crop.



# High tunnel Production

A High Tunnel is a polyethylene-covered metal structure, sometimes called a “Hoop House,” that covers high-value crops to extend the growing season in an environmentally-safe manner. High tunnels act as rain shelters for production of high-value crops during the rainy season .



# Bio-security Measures

The implementation of biosecurity measures all along the production chain minimizes the risk of introduction of new pathogens into the farms, as well as their spread within farms.

Biosecurity Measures :

- Provide a footbath at entrance on the farm or into greenhouses
- Limit non-essential traffic on the farm.
- Keep a record of all farm visitors.
- Have only one entrance/exit.
- Keep other animals and strangers off the property.



# Activity Area



Outline the 5 sustainable agricultural practices?  
Discuss the 5 components of I.P.M.



# Activity Area

sustainable agricultural practices

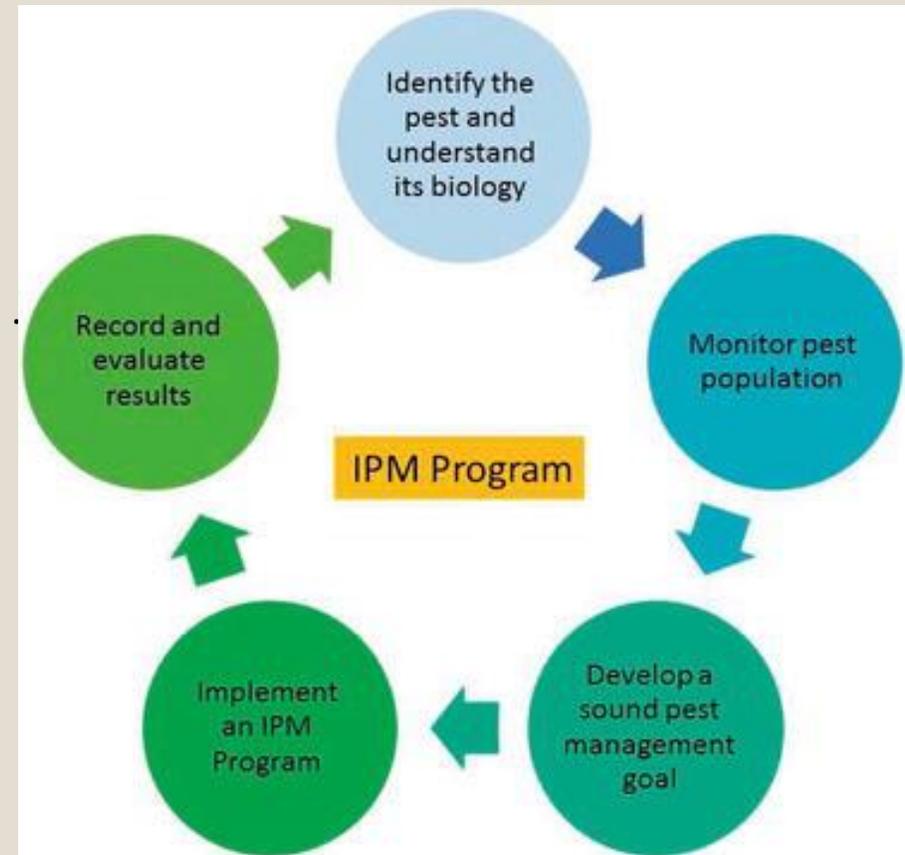


- Rotating crops and embracing diversity
- Establishing cover crops
- Reducing or eliminating tillage
- Applying integrated pest management (IPM)
- Integrating livestock and crops
- Adopting agroforestry practices



Activity Area

## 5 components of I.P.M.



# Crop Production Schedule

Steps in preparing a Crop Production Schedule:

Start with your Crop Formula. For example, Tomato- 5 + 12 + (4 – 10)

That is, 4-5 weeks for nurseries, 12 weeks between transplanting and first harvest and 4 to 10 weeks of harvest.

Watermelon – (0-5) + (9-11) + (1-3)

Lettuce – (3-4) + (4-7) + (1-2)

Melongene, Hot / Sweet Pepper, Pimento – 5 + 12 + ( 12-20)





Discuss how Small Producers/ Family Farms contribute to Sustainable Development?



# Activity Area

Discuss how Small Producers/ Family Farms contribute to Sustainable Development?



- Produce food for Families, communities and local and regional export markets.
- Constant source of employment for families, villagers.
- Provide a safety net to generations of families including members of their communities.
- Protect the natural environment and Biodiversity .
- Use Organic products and practices and native species in their methods of farming.
- Practice Agriculture Diversification and mixed method farming and responds to environmental and market changes.
- Source of indigenous knowledge and practices that are passed on over generations.
- Preserve traditions and local culture.
- Own their labour, farming business, and are free to make their own decisions.
- Stabilize rural communities and stimulate economic activities in villages .

# Crop Family and Examples



## Plant Families of Vegetable Crops

Family Name	Common Name	Vegetable Crops
Solanaceae	Nightshade Family	Tomatoes, potatoes, tomatillos, peppers, and eggplant
Brassicaceae	Brassica or Mustard Family	Cabbage, cauliflower, broccoli, kohlrabi, kale, brussel sprouts, turnips, radish, rapeseed, mustard, collards, watercress, pak choi, bok choi, rutabaga
Cucurbitaceae	Cucumber or Squash Family	Cucumbers, melons, watermelon, summer squash, pumpkin, winter squash, and gourds
Fabaceae	Legume Family	Beans, peas, lentils, peanuts, soybean, cowpea
Poaceae	Grass Family	Corn, wheat, barley, oats, sorghum, rice, millet, rye
Liliaceae	Alliums	Asparagus, onions, leeks, chives, garlic, shallots
Apiaceae	Carrot Family	Carrots, parsnips, celery, dill, chervil, cilantro, parsley, fennel
Asteraceae	Aster Family	Lettuce, endive, radicchio, chicory, artichoke, Jerusalem artichoke
Chenopodiaceae	Spinach Family	Spinach, beets, Swiss chard

# FEEDBACK



# Most Important Lesson Learnt Yesterday



