ECOLOGICALLY BASED INTEGRATED PEST MANAGEMENT

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LEARNING OBJECTIVE

At the end of this session, The Partisipant should

have a better understanding of

How to prevent Pest and Plant diseases

By Agroecosystem ecology as the basic of

Integrated Pest Management


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

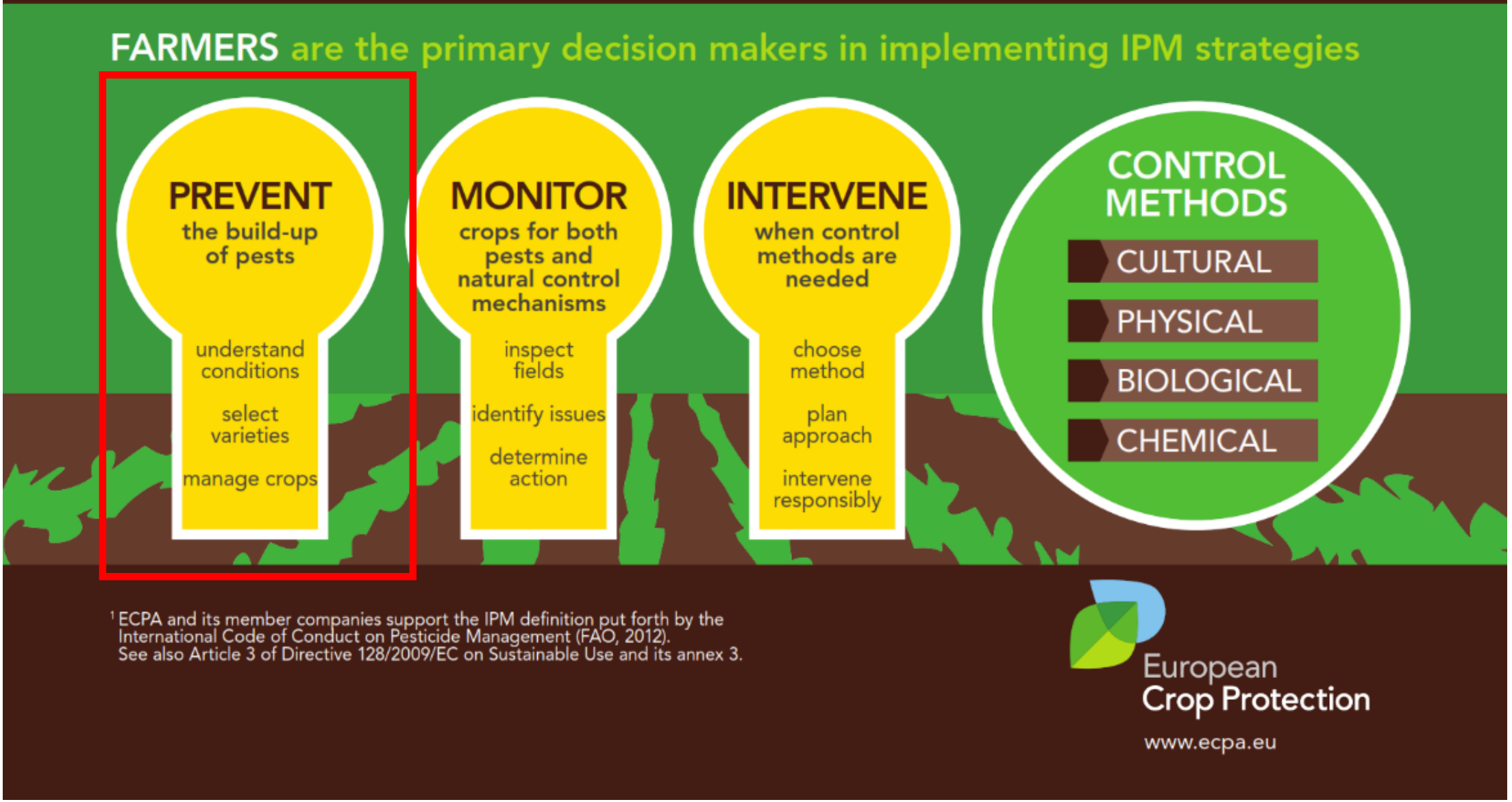
FAO definition:

Integrated Pest Management (IPM)

means the careful consideration of all available pest management techniques and subsequent integration of appropriate measures that discourage the development of pest populations and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agro-ecosystems and encourages natural pest control mechanisms (FAO, 2020).

KEY COMPONENTS OF IPM

FARMERS are the primary decision makers in implementing IPM strategies



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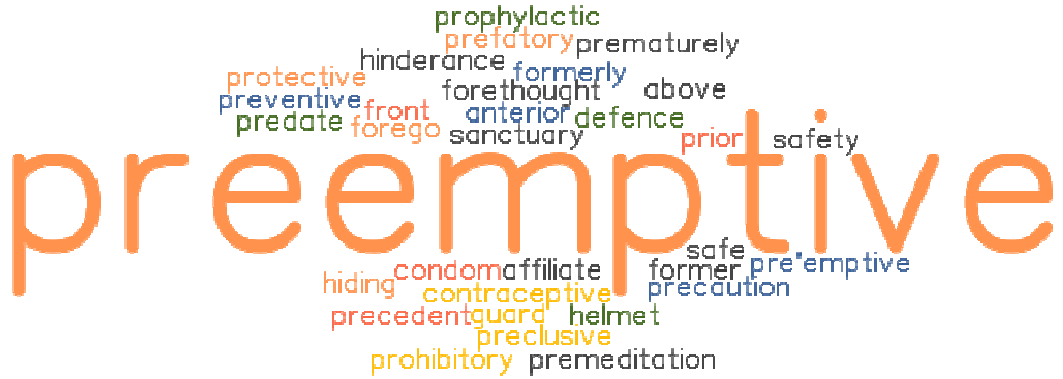
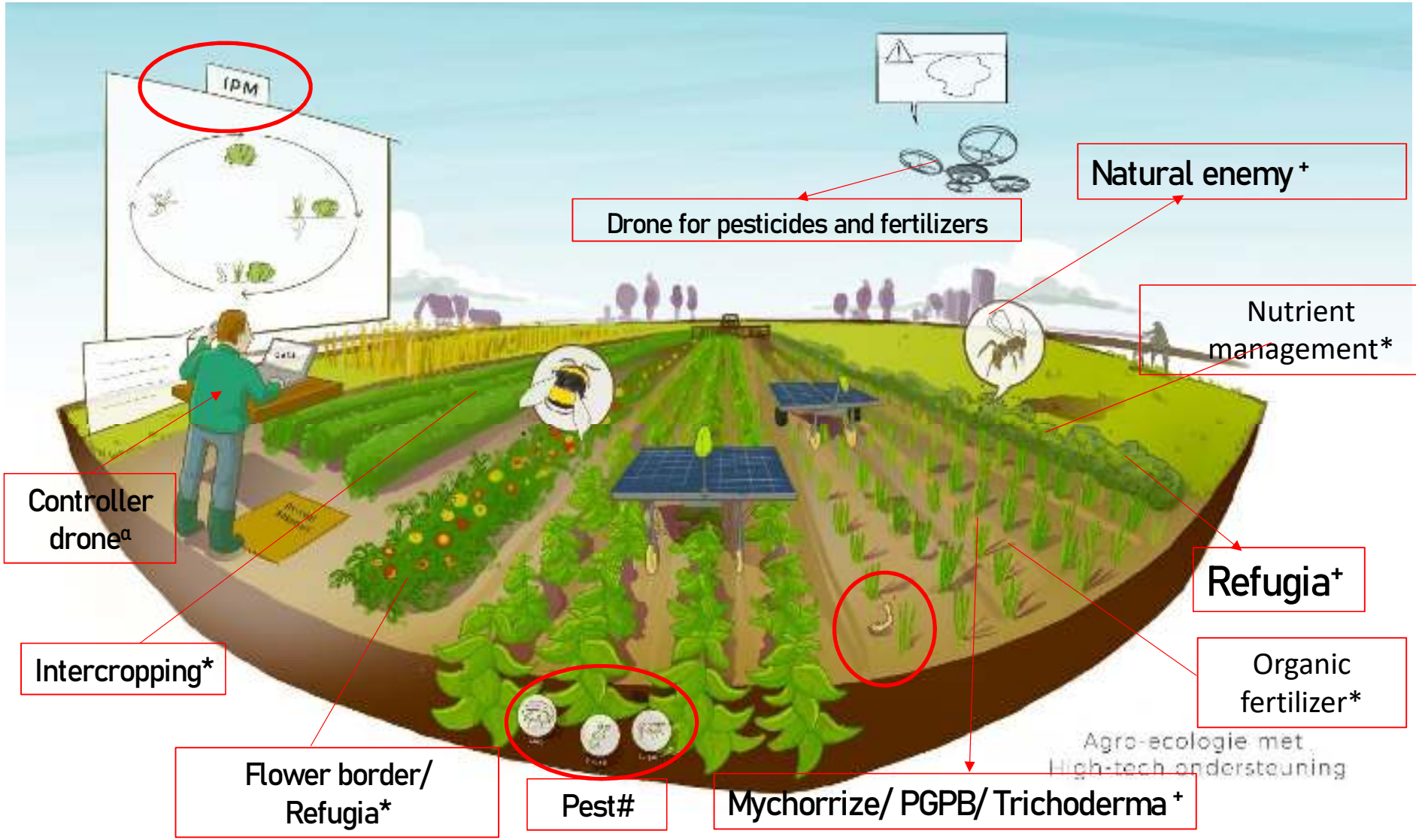


Long-term solutions to the pest and disease problem could be obtained through improving and managing agroecosystems to **prevent** the damage from pests and plant diseases.

Agroecosystem is defined as a community of organisms interacting with their environment to produce agricultural products.

Agroecosystem design is the planning of an agroecosystem's geographical and temporal layout, as well as its agrobiodiversity and management, while taking into account the interactions between its components and their surroundings.

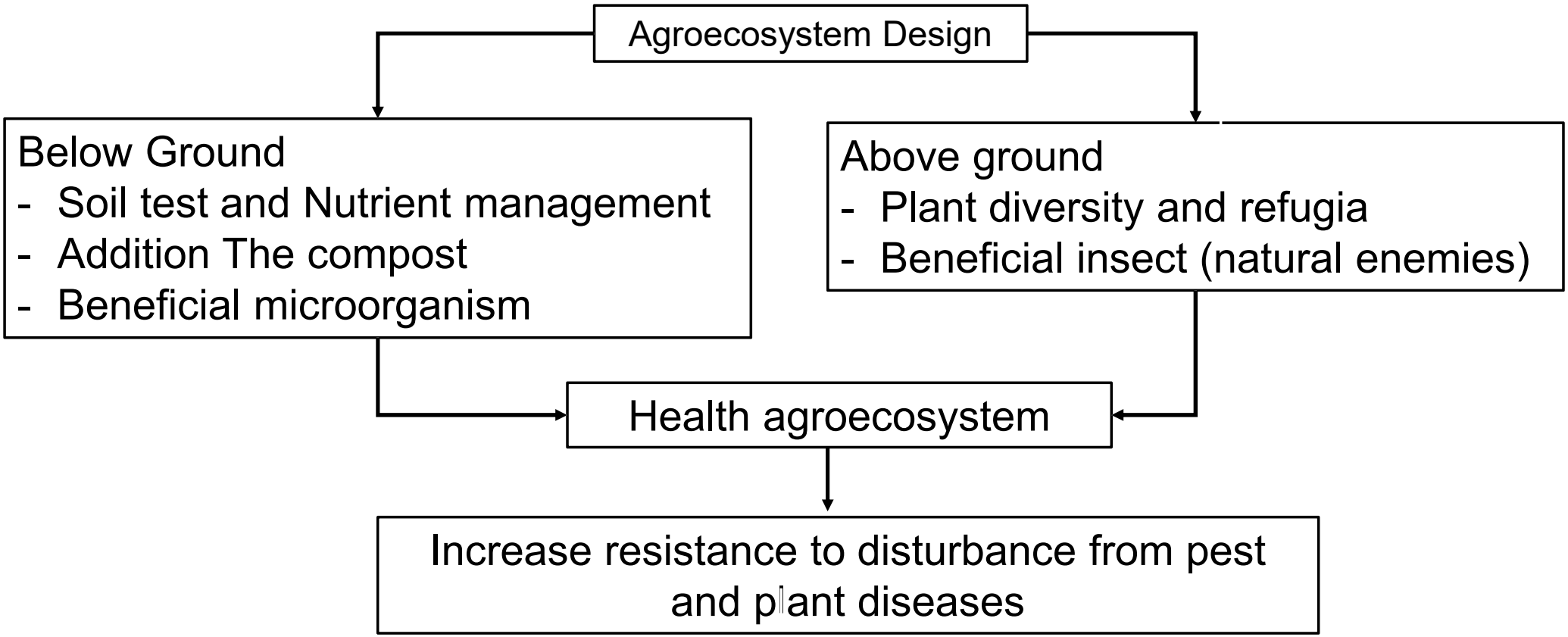
In simple terms, agroecosystems are agricultural farms that are designed to mimic the circumstances of forest biodiversity as nearly as possible.



Sumber: https://www.wur.nl/nl/Onderzoek-Resultaten/Onderzoeksinstituten/plant-research/Open-teelten/Landbouw-van-de-toekomst.htm


Goals of landscape management
Provision of food and shelter for wildlife
Creation of habitat mosaics
Enhance diversity
Provision of adequate water amounts and quality
Increase ecosystem resistance to disturbances
Promotion of regeneration of target plant species
Increasing agricultural production in a sustainable manner
Stabilizing and protection of natural resources

THE PILARS OF ECOLOGICAL PEST MANAGEMENT



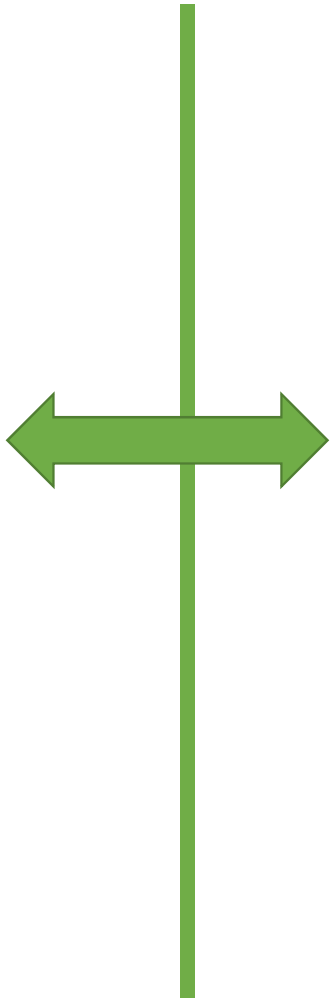
Manage insect in your farm: a guide to ecological strategies (Altieri, 2005).
The pillars of sustainable intensification of crop protection (Reddy, 2017)

ABOVE GROUND

1. PLANT DIVERSITY
2. NATURAL ENEMIES

PLANT DIVERSITY

- INTERCROPPING
- FLOWERING PLANT/ REFUGE
- ROTATION



BENEFICIAL INSECT

- CONSERVATION NATURAL ENEMIES

Figure . The Example of Crop Diversity
Source: ICAT Ketindan collection

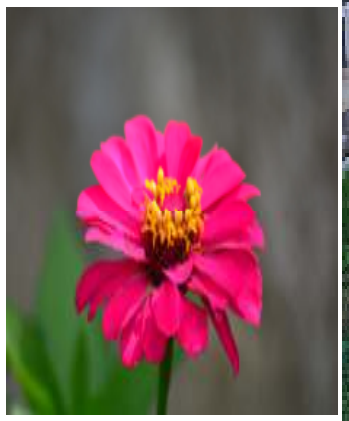
INTERCROPPING for small scale farming

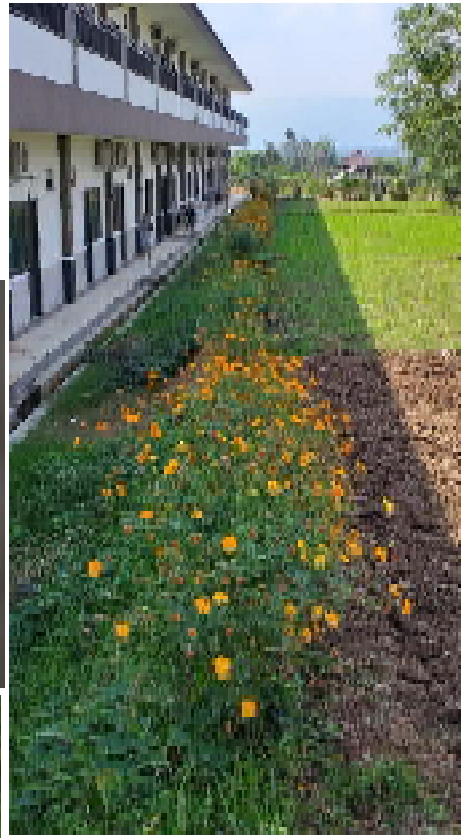
THE FLOWERING PLANT/ The REFUGIA

The Examples of Ecologically Based Integrated Pest Management For Small Scale Farming

REFUGIA

Refugia is an area overgrown with several types of plants that can provide shelter, feed sources for natural enemies such as predators and parasitoids, it can be planted polyculture or intercropping with other plants



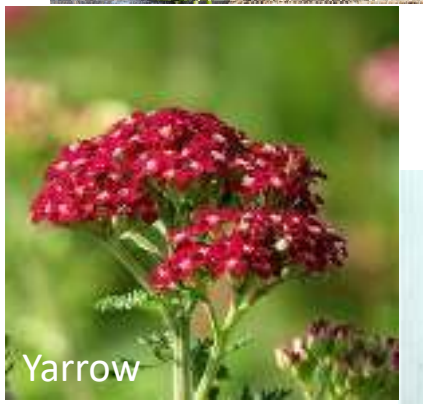


Flowering Plants That Attract Natural Enemies

COMMON NAME	GENUS AND SPECIES	PHO LOC
***Umbelliferae* (Carrot family)**		
Caraway	*Carum carvi*	
Coriander (cilantro)	*Coriandrum sativum*	
Dill	*Anethum graveolens*	
Fennel	*Foeniculum vulgare*	
Flowering ammi or Bishop's flower	*Ammi majus*	
Queen Anne's lace (wild carrot)	*Daucus carota*	
Toothpick ammi	*Ammi visnaga*	
Wild parsnip	*Pastinaca sativa*	
***Compositae* (Aster family)**		
Blanketflower	*Gaillardia* spp.	
Coneflower	*Echinacea* spp.	p. 5
Coreopsis	*Coreopsis* spp.	
Cosmos	*Cosmos* spp.	
Goldenrod	*Solidago* spp.	
Sunflower	*Helianthus* spp.	p. 4
Tansy	*Tanacetum vulgare*	
Yarrow	*Achillea* spp.	


Dill


Blanket flower


Yarrow


Coriander


Goldenrod


Tansy

Legumes	
Alfalfa	*Medicago sativa*
Big flower vetch	*Vicia grandiflora*
Fava bean	*Vicia fava*
Hairy vetch	*Vicia villosa*
Sweet clover	*Melilotus officinalis*
***Brassicaceae* (Mustard family)**	
Basket-of-gold alyssum	*Aurinium saxatilis*
Hoary alyssum	*Berteroa incana*
Mustards	*Brassica* spp.
Sweet alyssum	*Lobularia maritima*
Yellow rocket	*Barbarea vulgaris*
Wild mustard	*Brassica kaber*
Other species	
Buckwheat	*Fagopyrum esculentum*
Cinquefoil	*Potentilla* spp.

- The Mechanism of the Refugia to to attract the parasitoid (Biological control agent) and control the population of pest;
- The parasitoid come to the refugia caused finding the nectar
- The parasitoid get the volatile compounds from the plants in response to insect.

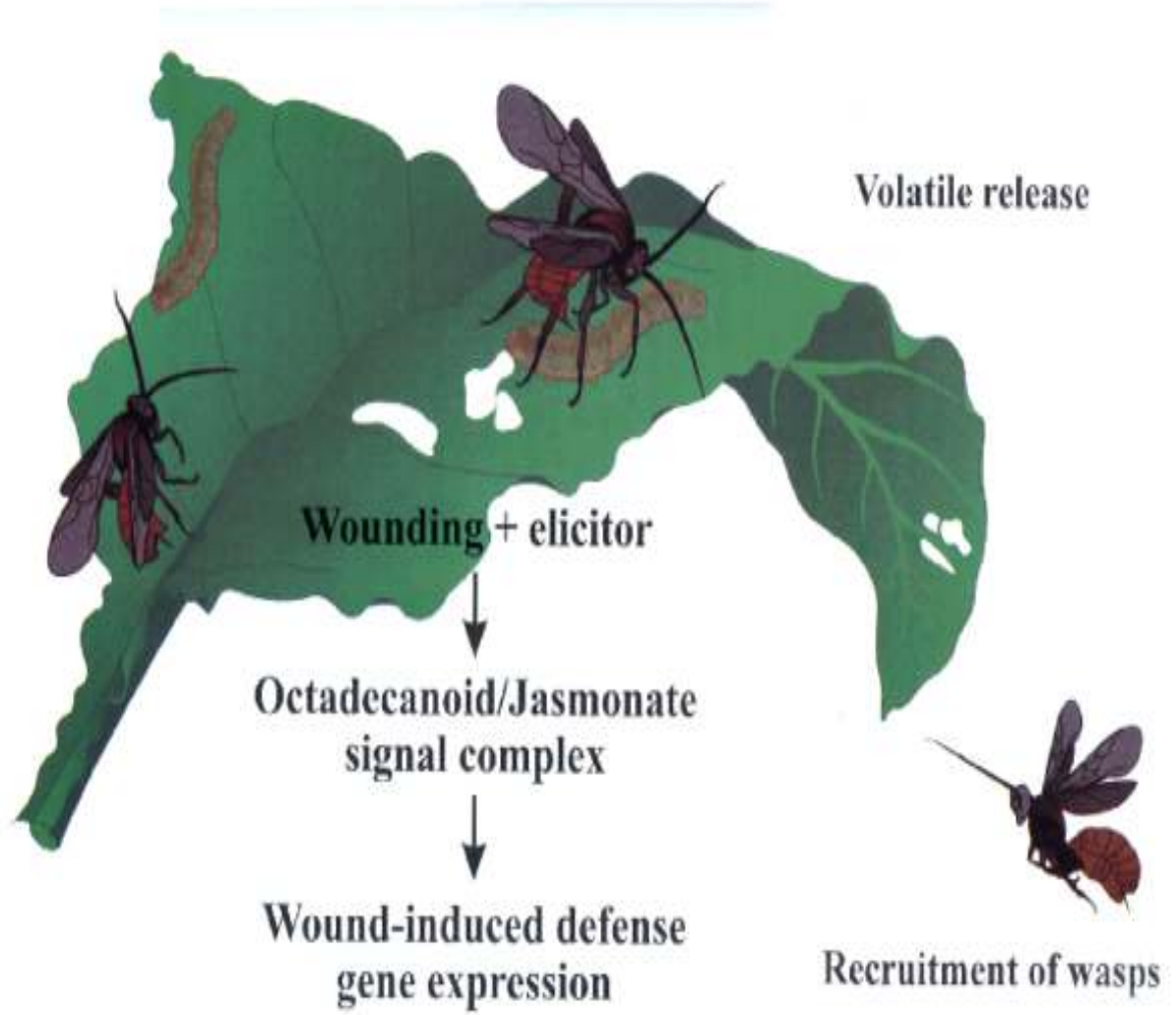


Figure 1. Volatile compounds are released by plants in response to insect feeding trigged by an interaction of elicitors from the oral secretions of insect herbivores with damaged plant tissue. These volatiles are used by some parasitoid wasps to locate their hosts.

The mechanism of the refugia or intercropping to block movement of pest

- The refugia or other plant varieties on the field
- The difference of the movement of pest and parasitoid,
- that a toxic meet, What a tragedy

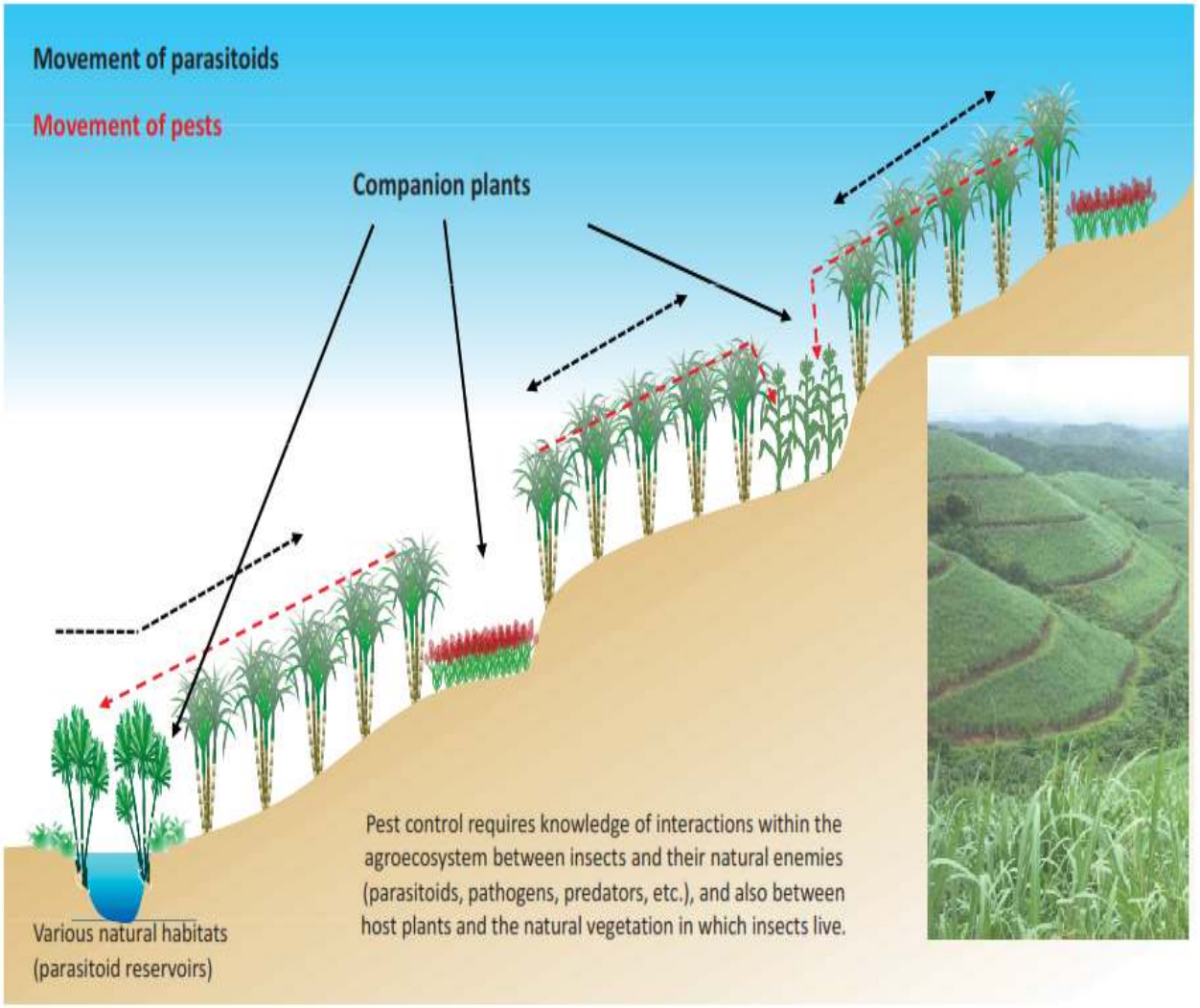


Fig. 8.8. Taking into account landscape components and companion plants for biological control of *Eldana saccharina*, a sugarcane pest in South Africa. (From Conlong and Rutherford, 2009.)

BELOW GROUND

1. Soil test and Nutrient management
2. Addition of The compost
3. Beneficial microorganism

SOIL TESTING AND NUTRIENT MANAGEMENT

The Advantages fos soil testing:

1. To optimize crop production
2. To protect the environment from contamination by run off and leaching excess fertilizers
3. To aid in the diagnosis pf plant culture problem (Abiotic factor)
4. To improve the nutritional balance of the growing media
5. To save money and conserve energy by applying only the amount of fertilizer needed

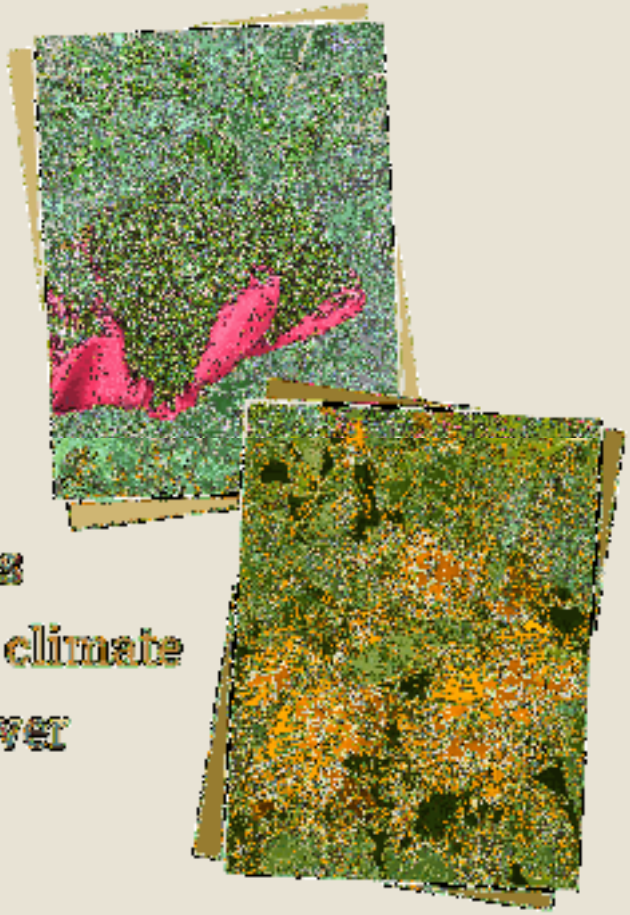
ADDITION OF ORGANIC MATTER/ COMPOST

Dont burning the straw

If its burned, The nutrient like magnesium, silica, etc is lost

10 REASONS TO COMPOST

1) Improves plant growth
2) Reduces soil erosion
3) Allows soil to retain more water
4) Enhances soil fertility
5) Reduces waste landfilled & burned
6) Benefits soil structure
7) Allows soil to retain more nutrients
8) Stores carbon in soil to protect the climate
9) Builds community resilience & power
10) Is something everyone can do!



ILSR INSTITUTE FOR Local Self-Reliance

Water

How To Composting

1. Preparation of the material (straw, 2 l molasses, 2 l decomposer, 200 l water
2. Mill the straw and stacked in layer
3. Mix the water, decomposer and molasses, wait for 30 minutes to active the decomposers
4. Spray the mix water to the milled straw
5. Use the bamboo pipe to aeration
6. Cover the straw with plastic
7. Incubate it in 14 -30 days until ripe

The Ripe compost characteristic

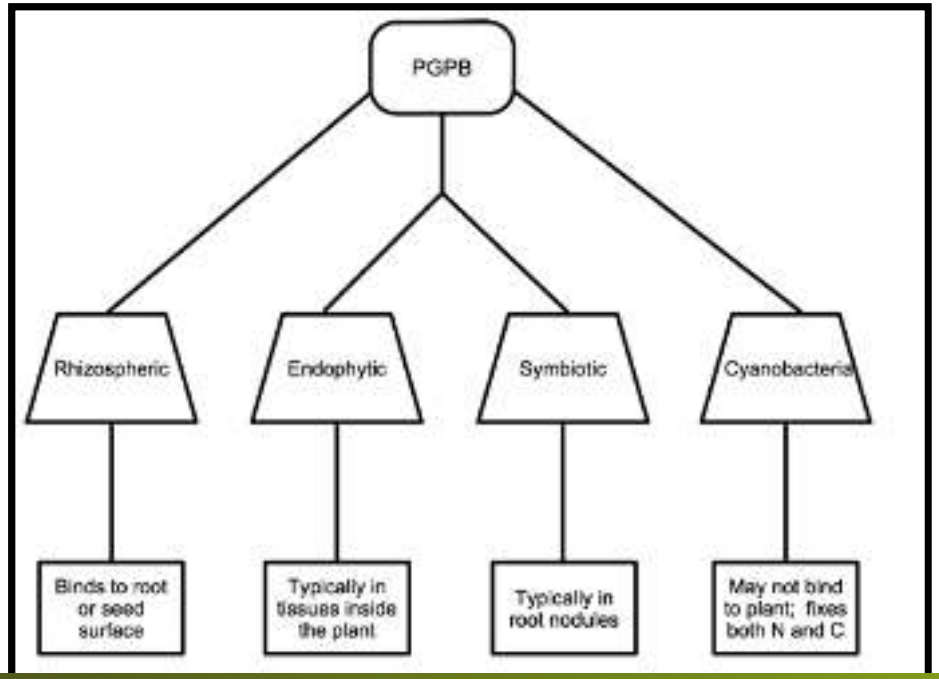
followed by balitanah (IAARD):

1. Constant temperature 40-50^{0}c
2. Crumbs and dark brown color
3. C-organic > 12%
4. C/N ratio 15-25%
5. Moisture content 40-50%

BENEFICIAL MICRO-ORGANISM

BACTERIA

Plant Growth Promoting Bacteria

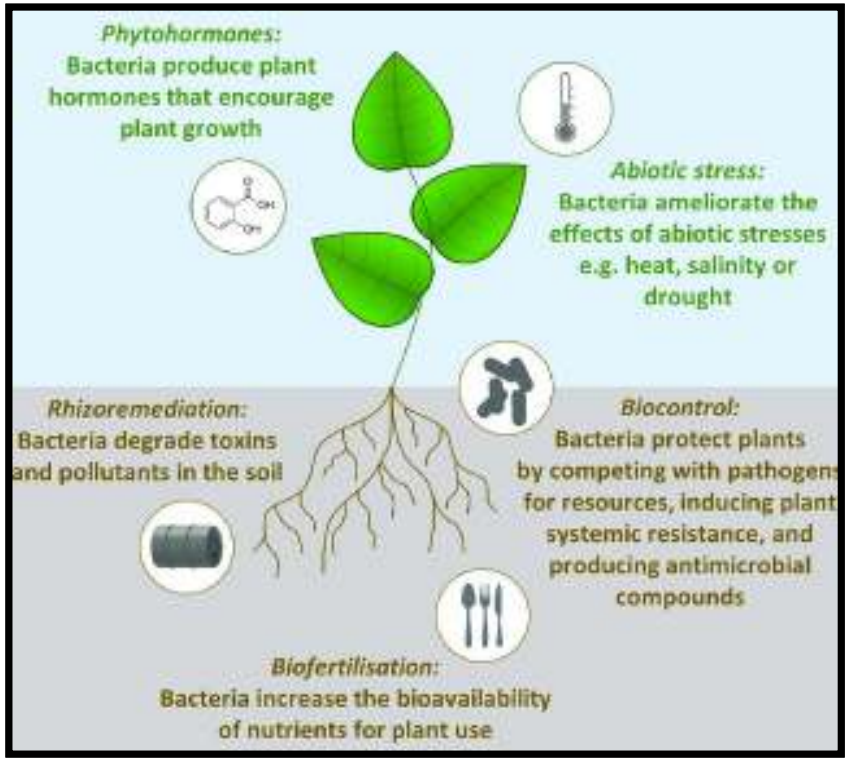


FUNGI

Mycorrhize, Trichoderma sp., Gliocladium sp.

The Beneficial of Plant Growth Promoting Bacteria:

1. Biostimulant, enhanced plant growth cause the ability to produce growth regulator hormone indol acetic acid (IAA)
2. Bioprotectant, increased plant resistance, cause the ability to produce antibitics
3. Biofertilizer, solubilizing phosphate



Mass production of PGPB

Liquid Media Uses bamboo root

The Material and Equipment

1.

Bamboo roots taken from the soil in 10-15 depth. Clean bamboo roots and soaked with boiled water, incubate it for 3 days

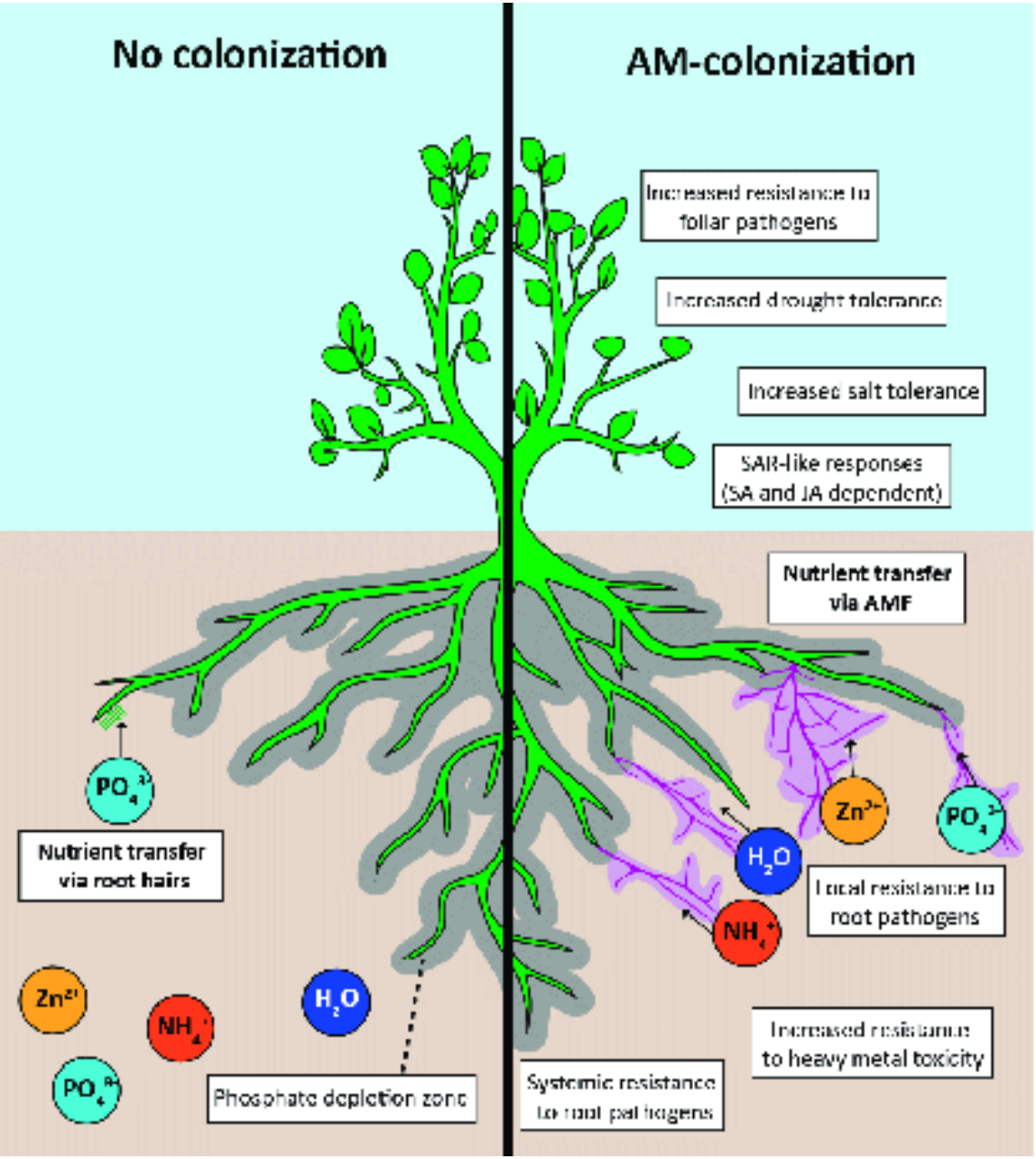
2.

Make a medium with a mixture of 15 liters of water, 200 gr of sugar, 100 gr fish paste, 500 gr of bran, 1 tbsp calcium soaked in water

3.

After media on the room temperature, mixing filtered media and filtered bamboo root water

The Application of Beneficial Micro - Organism



Why? Mycorrhize

1. Bioprotectant
2. Biostimulant
3. Biofertilizer
4. Increased drought tolerance,
   By expand the roots and looking for water sources

Jacott, Catherine & Murray, Jeremy & Ridout, Christopher. (2017). Trade-Offs in Arbuscular Mycorrhizal Symbiosis: Disease Resistance, Growth Responses and Perspectives for Crop Breeding. Agronomy. 7. 75. 10.3390/agronomy7040075.

Propagation of Mycorrhize

1 kg Mycorrhize starter → Add to 100 kg of the compost → Cover with plastic or Put in the sack → Incubate in 7 days, → the compost plus mycorrhize is ready to apply

Source: Nusantara, et al., 2012

Ecologically based IPM is economic feasible and sustainable

1. Nutrient management and soil testing

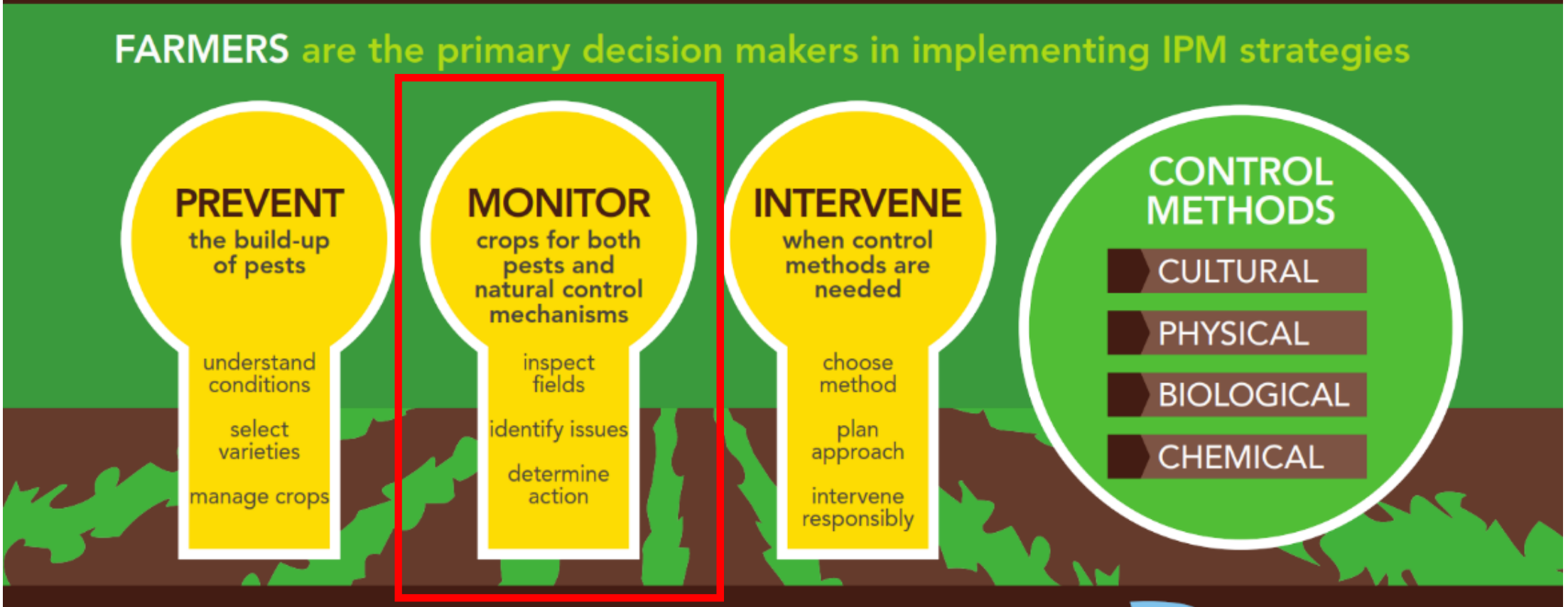
Nutrients are not wasted, and nutrients are delivered in accordance with the soil's needs.The usage of the proper amount of nitrogen fertilizer reduces the pest's damage.The farmer becomes wealthier by using the appropriate amount of fertilizer and making the appropriate purchase so that the production cost is realistic (as opposed to excessive fertilizer).

2. Addition of Compost and beneficial microorganisms. Use local materials, which the farmer normally has on hand, such as straw or domestic garbage, which is more cost effective for the farmer.

3. Crop diversification, intercropping, and the refuge Increase the farmer's income by introducing new kind if There is an abundance of The refuge can be used to decorate like a dried flower.

KEY COMPONENTS OF IPM

FARMERS are the primary decision makers in implementing IPM strategies



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PEST IDENTIFICATION

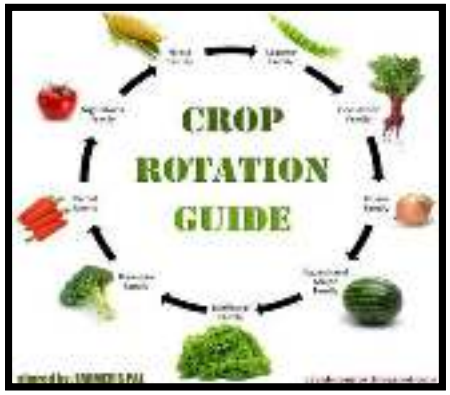
- Pest are animals whose life activities (feeding, sheltering and reproducing) interfere crop production




A1

Animals as Pests: What Causes Them?

1.



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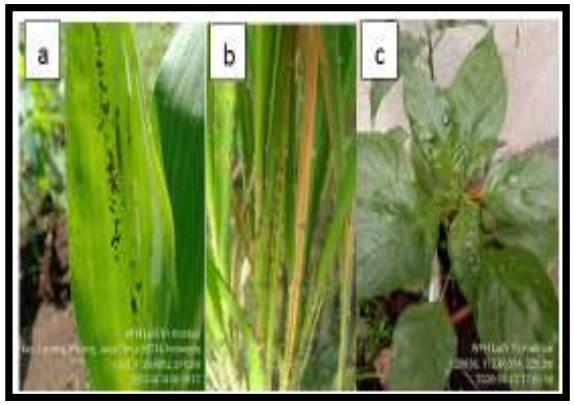
Slide 40

A1 ANDRIANI, 22-Apr-21

https://entomology.ca.uky.edu/



Insect Pest Characteristic

To classify insects become pest is determine by the Mouthparts:

1. Piercing sucking : a beak through which liquid food is ingested, example: hemipteran, homoptera, thrips
2. Biting/ Chewing: mandible act as jaws, example: grashoppers, beetles, termites, larval moths

Biting insects may damage plants as follows:

a. Reduce the amount of leaf assimilative tissue and hinder plant growth; examples are leaf-eaters, such as adults and nymphs of locusts and Epilachna and **larvae of Plutella**, Pieris, Plusia (Lepidoptera) and sawfly larvae.

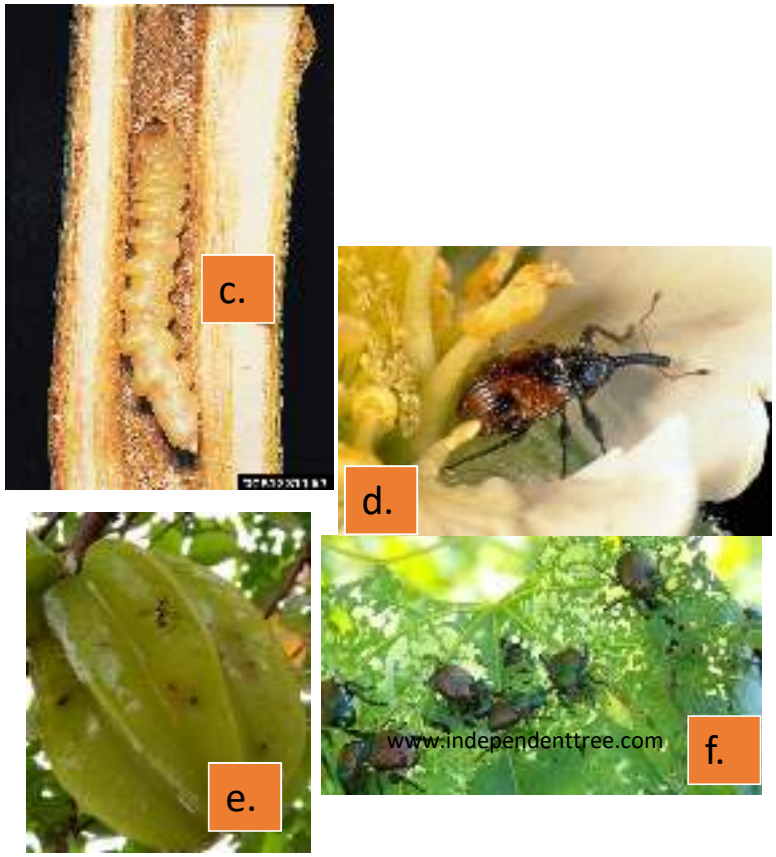
b. Tunnel in the stem and interrupt sap flow, often destroying the apical part of the plant; these are stem borers and shoot flies, such as Zeuzera in apple branches, Cephus in wheat, **Ostrinia in maize**, Atherigona in maize and sorghum.

c. Ring-bark stems, for example some Cerambycidae.

d. Destroy buds or growing points and cause subsequent distortion or proliferation, as **with Fruit Bud Weevils** (Anthonomus spp.) on shoots of apple, pear, etc.

e. Cause premature fruit-fall, as with Cherry **Fruit Fly**, Codling Moth, Apple Sawfly.

f. Attack flowers and reduce seed production, as with the blossom beetles (Meligethes spp.) and **Japanese Beetle.**



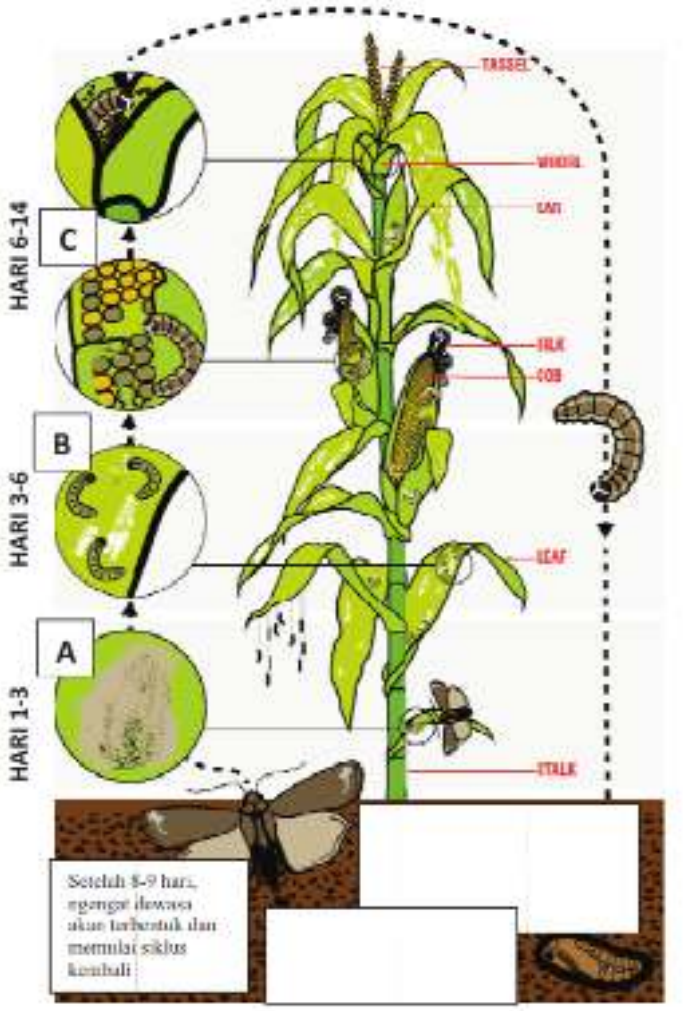
g. Injure or destroy seeds completely, or reduce germination due to loss of food reserves; examples are Hazelnut Weevil, **Maize Weevil,** Pea and Bean Bruchids, Pea Pod Borers, and Bean Pod Borers.

h. Attack roots and cause loss of water and nutrient absorbing tissue, as with **wireworms** and various chafer larvae (Scarabaeidae) and other beetle larvae in the soil.

i. Remove stored food from tubers and corms, and affect next season's growth; examples are cutworms and wireworms in potato, and Potato Tuber Moth larvae.

Pest of Maize

Spodoptera frugiperda (Fall armyworm)



Egg mass

Larva

Pupa

Female moth

Male moth

Pest of Maize

Helicoverpa armigera (corn earworm)

Symptom:

Eggs are laid on the silks, larvae invade the cobs and developing grain is consumed. Secondary bacterial infections are common.

https://www.cabi.org/isc/datasheet/26757#todescription

Pest of Coffee

Hama

Penggerek buah kopi (PBKo)

Penggerek cabang kopi (*Xylosandrus* spp.)

Kutu hijau

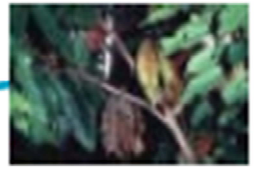
Kutu putih

Penggerek batang/cabang (*Zeuzera coffeae*)

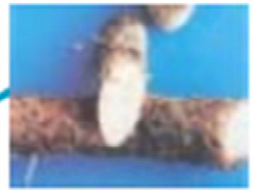
Penyakit

Karat daun kopi

Bercak daun kopi



Jamur upas



Penyakit akar

Nematoda

Green coffee scale

Green coffee scale *(Coccus viridis)* is a common and serious problem. Scales suck the plant sap resulting in reduced growth and crop yield. Sooty mould (a black, loose, sooty-like cover) often develops on leaves. It grows on the sweet exudate from the scales (honeydew) that also attracts ants.

Symptoms

Green oval shaped scales about 2 to 3 mm long. Often found concentrated on leaf veins and tips of new shoots. Infestations then produce spots of honeydew, which become covered with a black sooty mould. Defoliation of badly affected trees can occur.

Natural enemies

Grenn coffee scale

Coffee berry borer

Coffee berry borer *(Hypothenemus hampei)* is a relativity new, but very serious problem in Lao. It is causing significant damage, with perhaps as high as 50% yield loss. The adult is a small black beetle (about 2.5 mm long) and covered in thick hairs. The female beetle bores into berries through the navel region. Cherries are attacked in various stages but tunnelling and laying of about 15 eggs occurs only in hard beans. The eggs hatch in about 10 days and the larvae feed on the beans making small tunnels. Beetles in the cherries either on the plant or on the ground, can survive for more than five months.

Symptoms

Fruit drop of young, green cherries. A small hole is evident on the cherry. Cherries that do not drop often have defective, damaged beans.

Pest of Potatoes

The Damage

The adults and larvae cause severe damage to potato crops by chewing the leaves, stems and flowers. They feed on the lower epidermis and mesophyll of potato leaves, leaving only the upper epidermis intact. As a result, the damaged leaves and stems have many transparent concave lines running parallel to each other, leaving the vein and epidermis seriously damaged.

FIGURE Adult *Henosepilachna vigintioctomaculata* on damaged plant.

Menochilus sp. or *coccinelid* sp. natural enemies has a brilliant and lustrous color, but *epilachna* sp.pest has a dull color.

Pest of Potatoes

FIGURE Fully-fed wireworms.

FIGURE Tubers showing wireworm damage.

The damage

Wireworms bore into the tubers, making

Cylindrical holes. Secondary infection from

Various diseases can follow, further

reducing the quality of the crop.

Giordanengo, P., Vincent, C., and Alyokhin, A. 2013. Insect Pests of Potato Global Perspectives on Biology and Management. Elsevier Inc.

Pest of Potatoes

Trips

The damage

adults and larvae scrape the epidermal tissues of leaves. The surface of leaves becomes whitened and somewhat flecked in appearance. The tips of leaves wither, curl up, and die. The undersides of leaves become spotted with small, brownishblackish specks

FIGURE Spots due to thrips feeding.

FIGURE Nymphs of thrips.


thank you
danke
謝謝
ngiyabonga
teşekkür ederim
спасибо
gracias
dziękuję
bedankt
obrigado
go raibh maith agat
merci
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