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

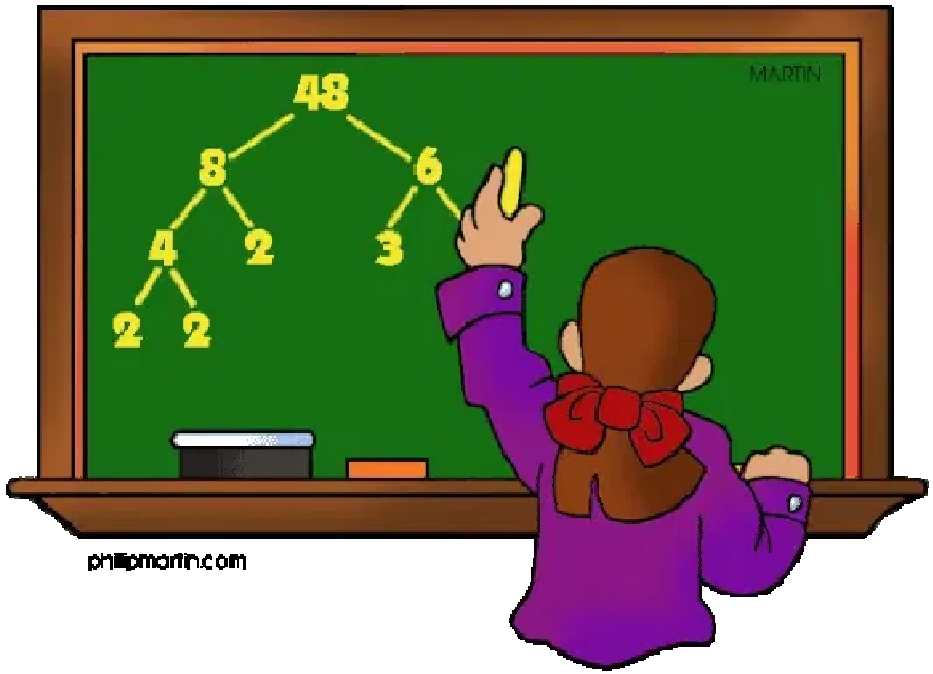
How to prevent Pest and Plant diseases

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

the PROBLEM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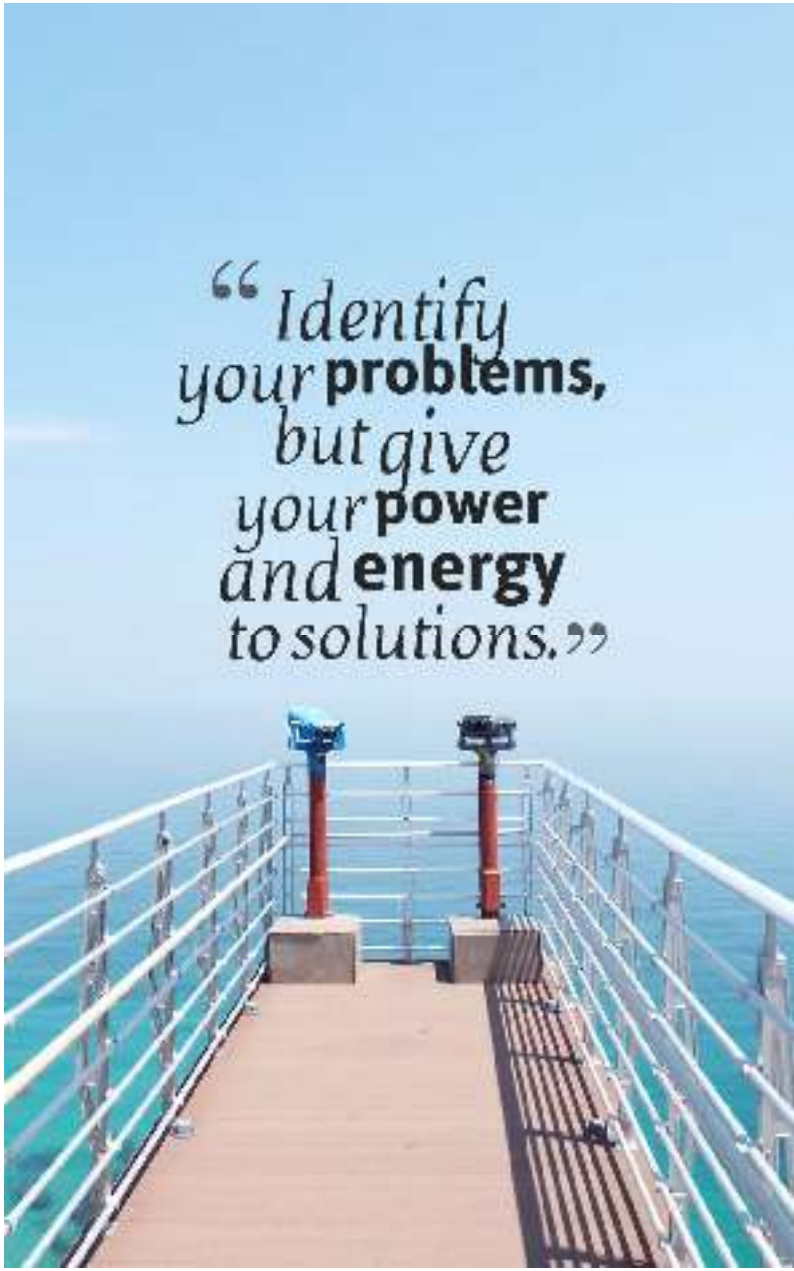
“Identify your problems, but give your power and energy to solutions.”

We need Food

We produce the material of food by farming (crop production)

In the farming (crop production), there is same plant in a wide area

the PROBLEM

We need a large crop production quantity for fully needed of human, So we (maybe) added a lot of the chemical fertilizer usually Nitrogen fertilizer

the PROBLEM

The monoculture and much of nitrogen fertilizer cause the insect herbivore are same and the quantity become larger. We called it pest

We need to manage the insect herbivore

What's the Problem?

1. Monoculture system and Low biodiversity
2. The used of a lot of chemical fertilizer without test before and Low organic fertilizer

1. Agroecosystem ecology as the basic of Integrated Pest Diseases Management
2. Integrated Pest Diseases Management itself

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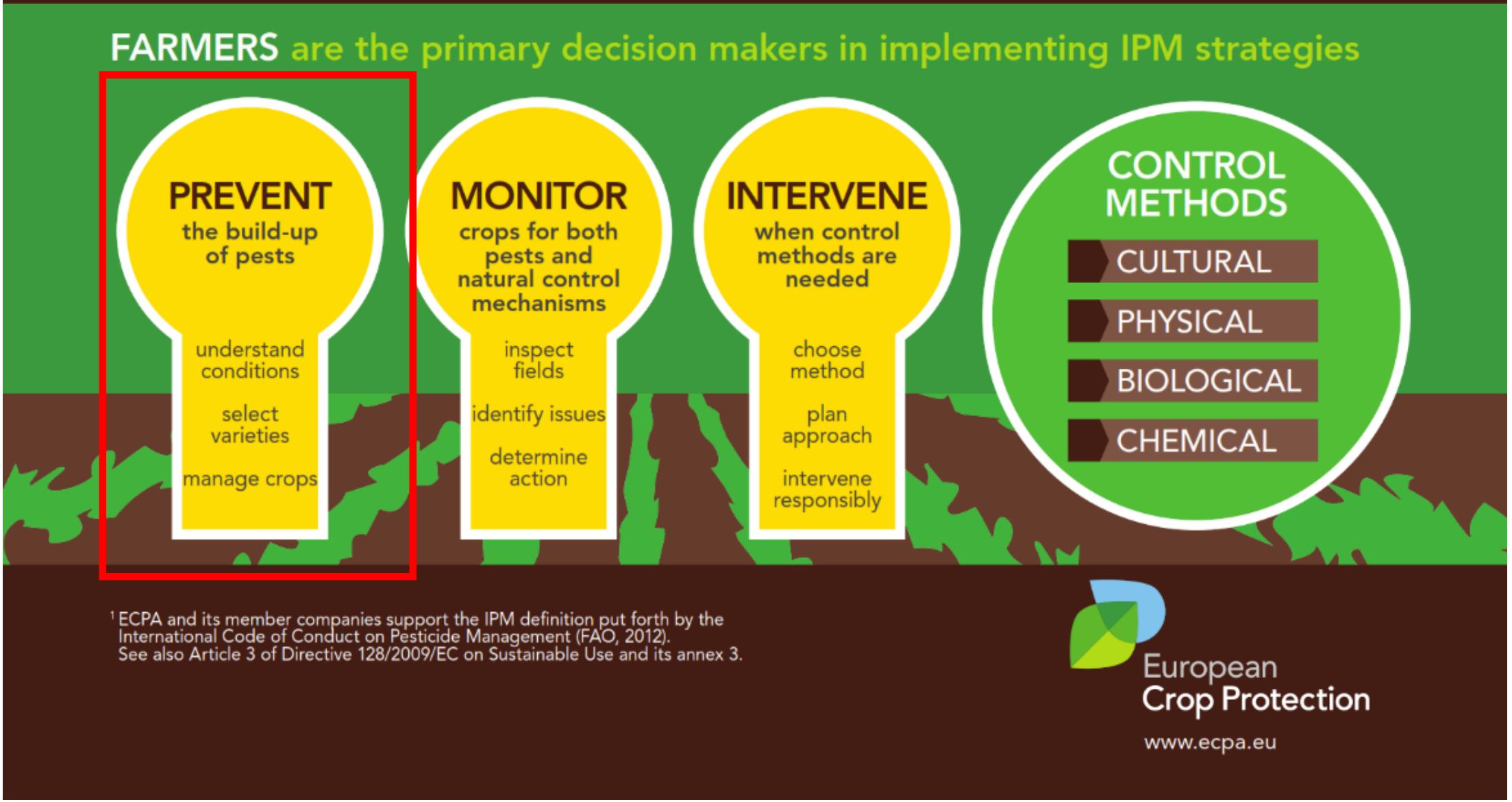
FAO definition:

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



[1] ECPA and its member companies support the IPM definition put forth by the International Code of Conduct on Pesticide Management (FAO, 2012). See also Article 3 of Directive 128/2009/EC on Sustainable Use and its annex 3.

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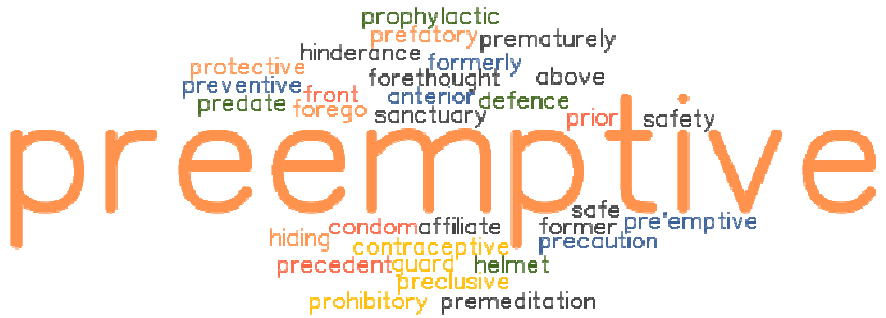
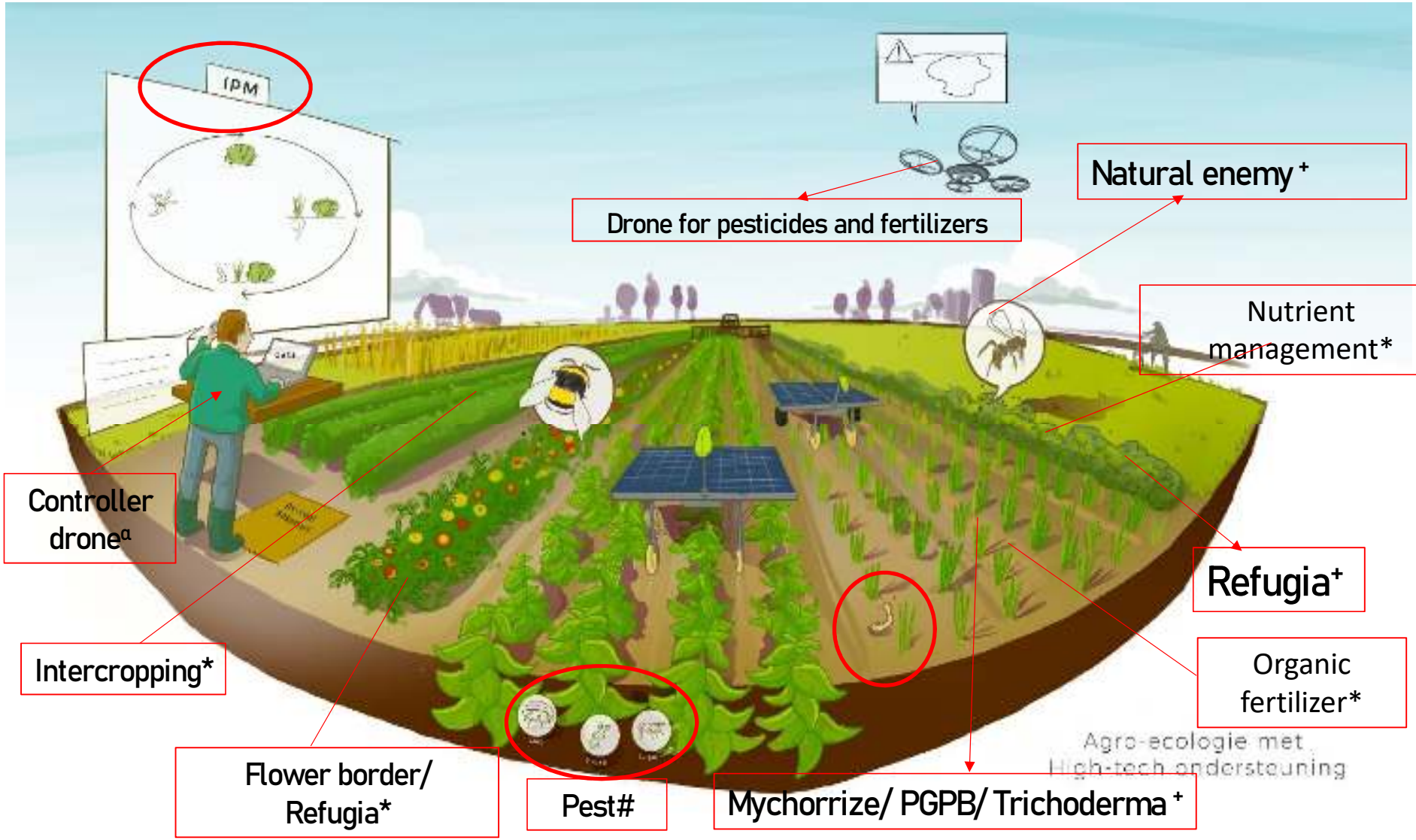
For long-term solutions to the pest and diseases problem could be achieved through the improvement and management of **agroecosystems** to prevent The damage caused pest and diseases



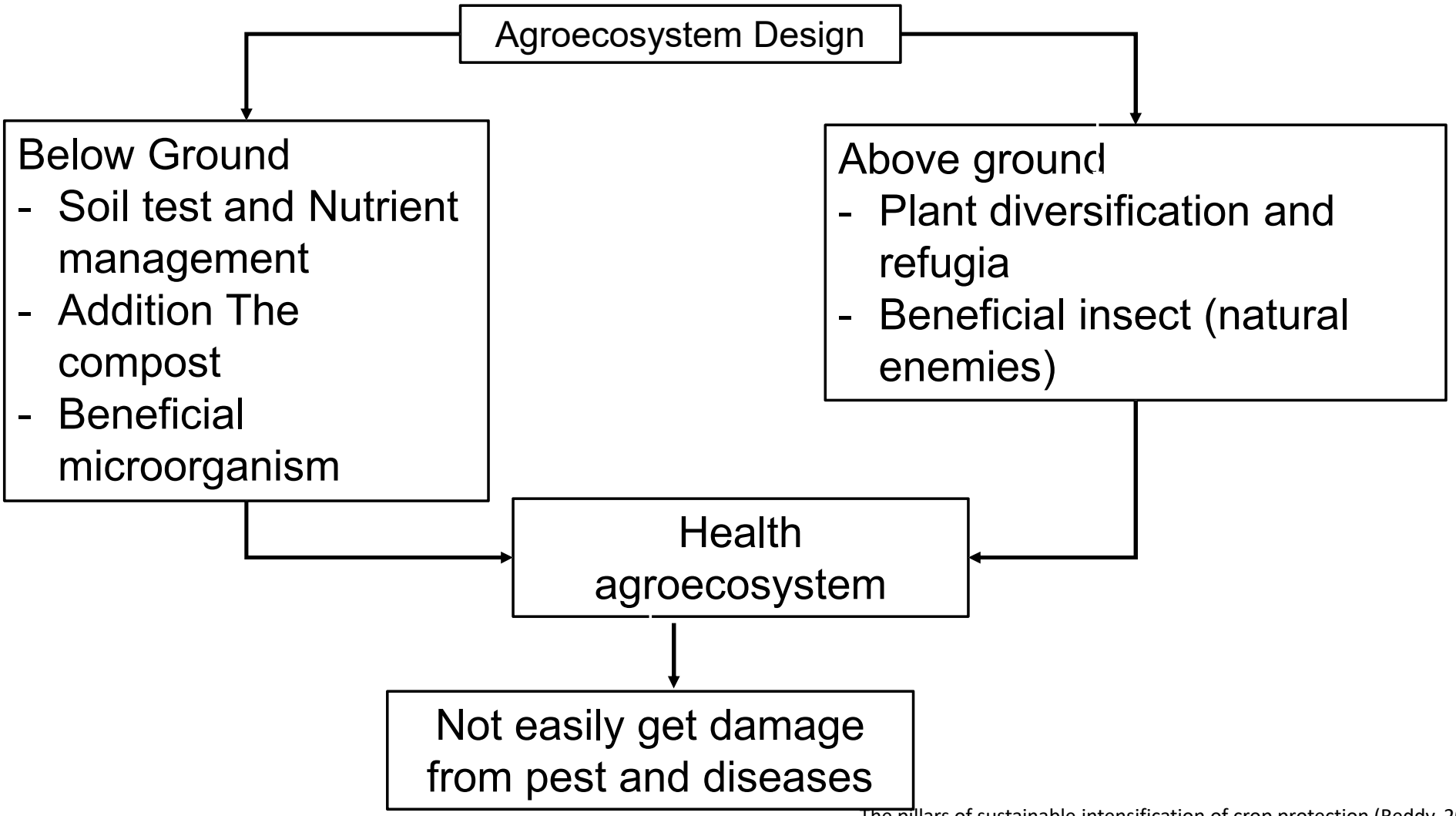
- The definition of Agroecosystem: communities of organisms interacting with their environment, which is modified to produce agricultural goods
- Agroecosystem design: planning of the spatial and temporal arrangement of an agroecosystem, as well of its agrobiodiversity and management, considering the interaction of its components, mutually and with their environment
- In a simple terms, agroecosystems is designing agricultural farm as closely as possible to the conditions of forest biodiversity



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
Stabilizing and protection of natural resources
Enhance diversity in riparian zones
Increasing agricultural production in a sustainable manner
Provision of adequate water amounts and quality
Promotion of regeneration of target plant species
Increase ecosystem resistance to disturbances

THE PILARS OF ECOLOGICAL PEST MANAGEMENT



The pillars of sustainable intensification of crop protection (Reddy, 2017)

ABOVE GROUND

1. PLANT DIVERSIFICATION
2. NATURAL ENEMIES

PLANT DIVERSITY

- INTERCROPPING
- ROTATION
- FLOWERING PLANT/ REFUGE

BENEFICIAL INSECT

- IDENTIFYNG BENEFICIAL INSECT
- CONSERVATION NATURAL ENEMIES

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

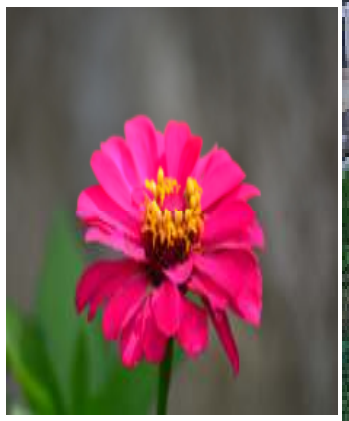
INTERCROPPING for small scale farming

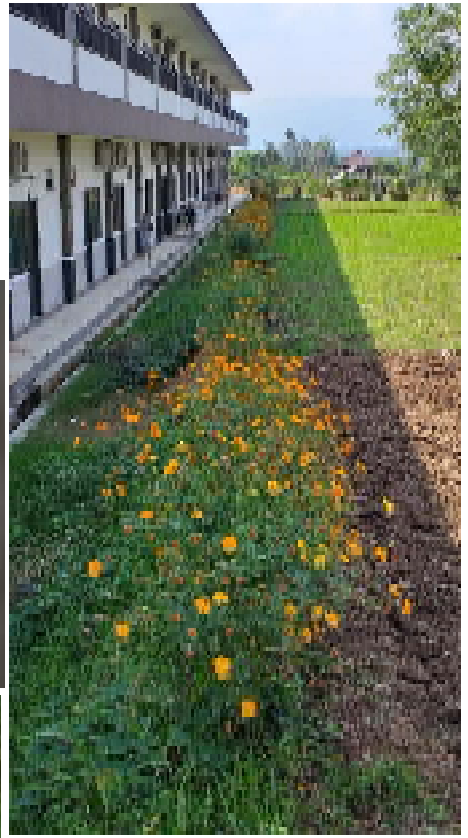
THE FLOWERING PLANT/ The REFUGIA

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



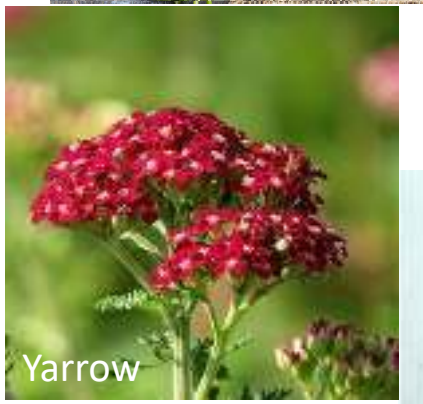


Flowering Plants That Attract Natural Enemies

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.

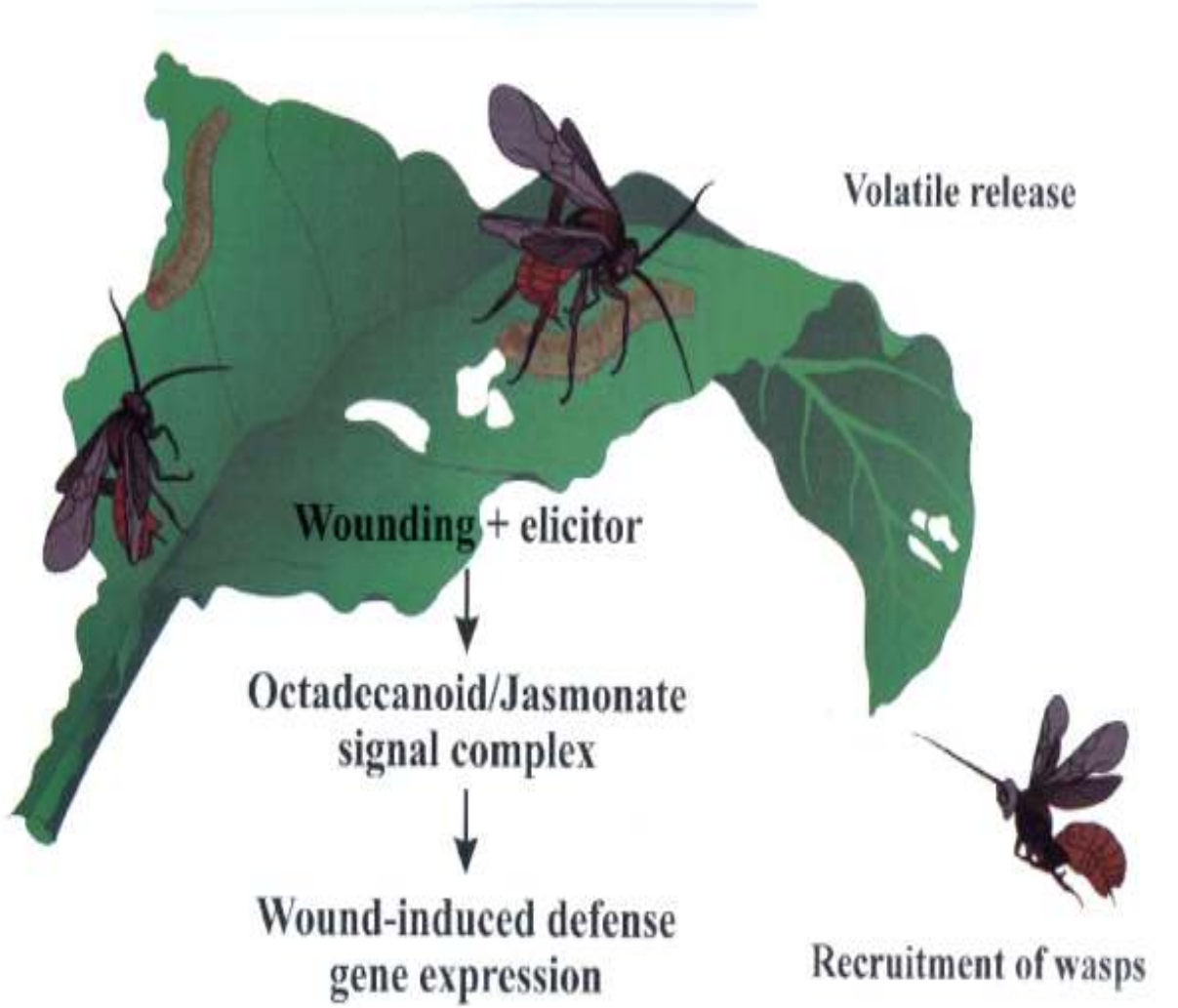


Figure 1. Volatile compounds are released by plants in response to insect feeding trigged by an interaction of elicitors from the oral secretions of insect herbivores with damaged plant tissue. These volatiles are used by some parasitoid wasps to locate their hosts.

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

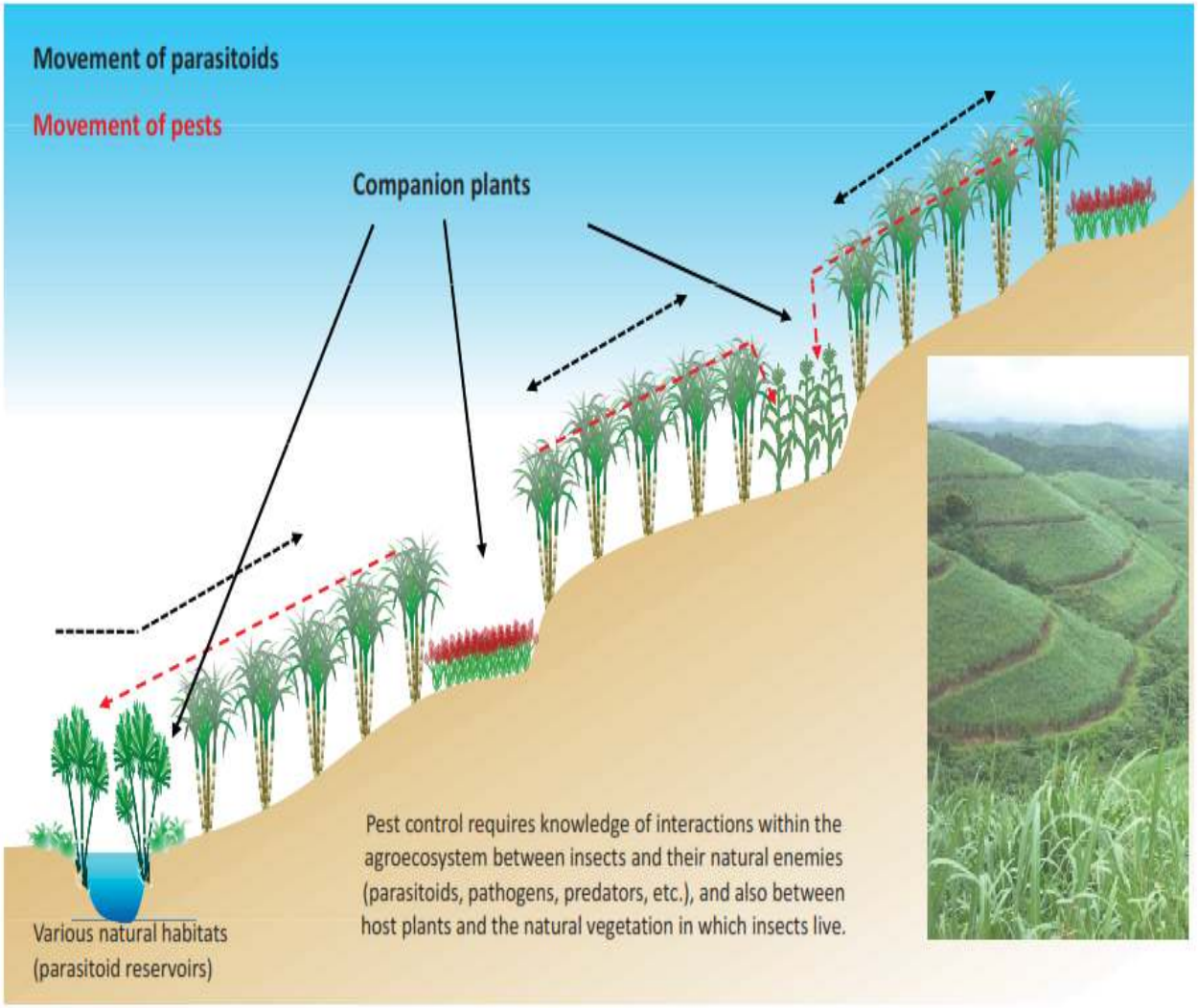


Fig. 8.8. Taking into account landscape components and companion plants for biological control of *Eldana saccharina*, a sugarcane pest in South Africa. (From Conlong and Rutherford, 2009.)

The example mechanism of the parasitoid to control the pest

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

The testing of NPK
by android application(IoT)

Determining the pH
Applying Calcium Carbonat for
Agriculture if the soil is acid

Applying only the amount of fertilizer needed

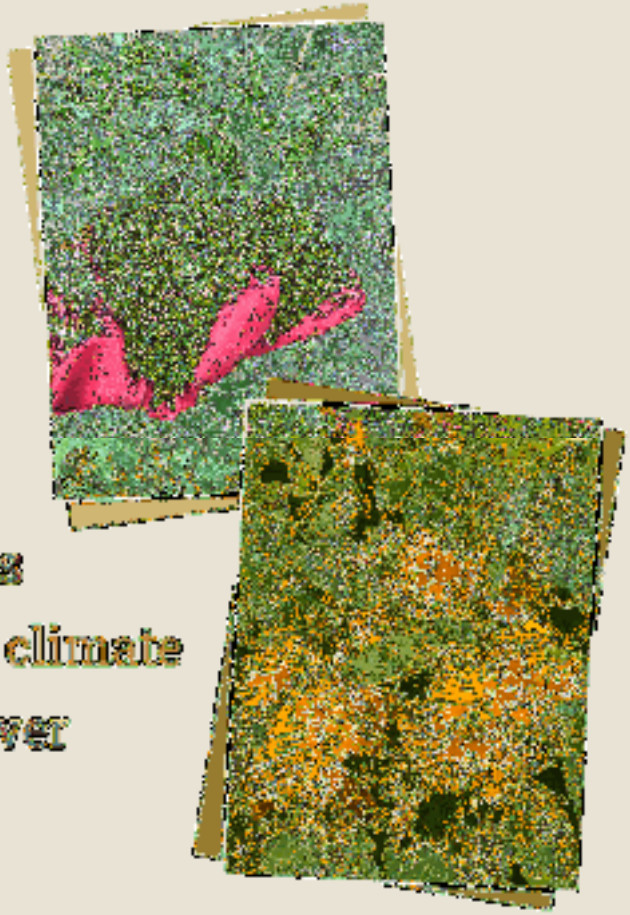
ADDITION OF ORGANIC MATTER/ COMPOST

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

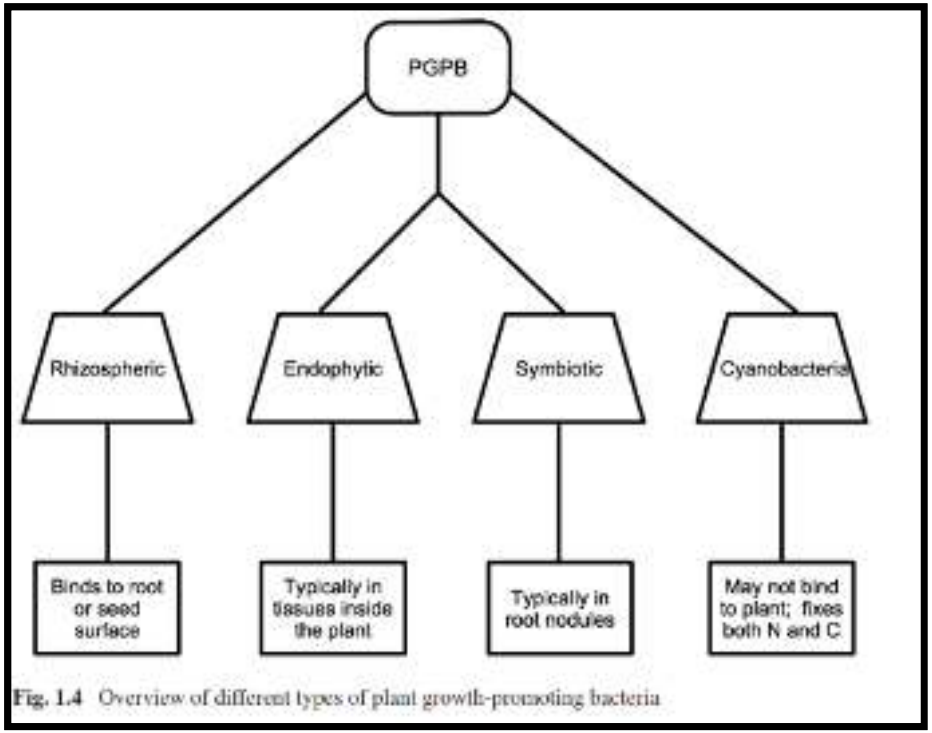


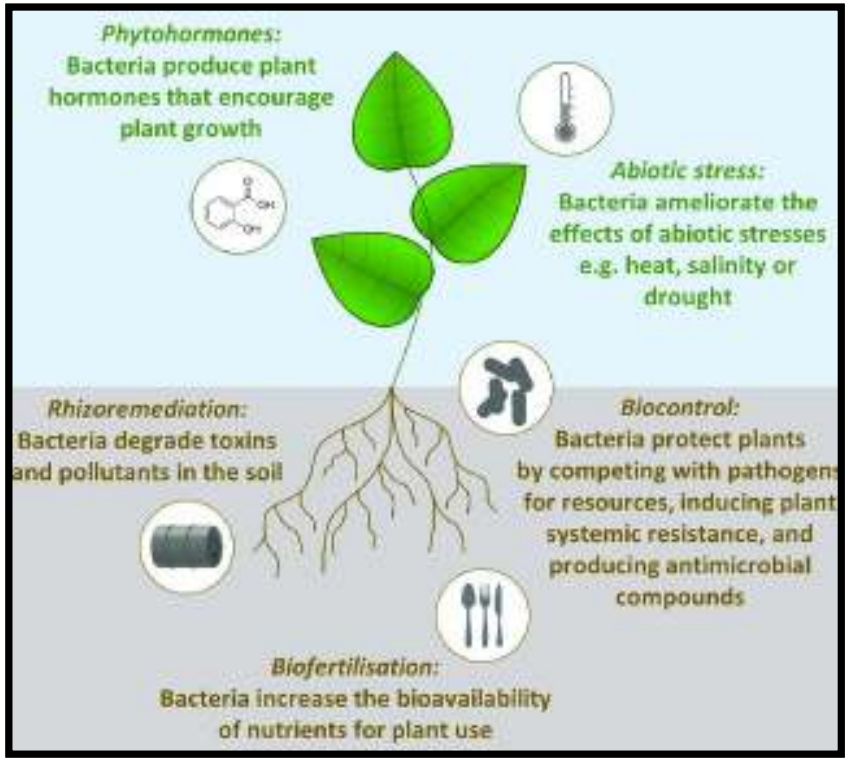
Fig. 1.4 Overview of different types of plant growth-promoting bacteria

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


empathy
What is Mycorrhizal Fungi?
Over 80% of plants live in a symbiotic relationship
with a remarkable organisim called mycorrhizal fungi.
00:00.00

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. Soil testing and nutrient management

- Not wasteful of nutrients and nutrients provided in accordance with the needs of the soil
- The right amount of nitrogen fertilizer is minimizes of the damage caused of the pest
- The right amount of fertilizer, the right purchase so that the production cost is reasonable (minimize compared with excessive fertilizer), the farmer become richer

2. Addition of the Compost, beneficial microorganism

- Use the local material, The farmer usually has the material, for example straw, household waste, more economic for the farmer

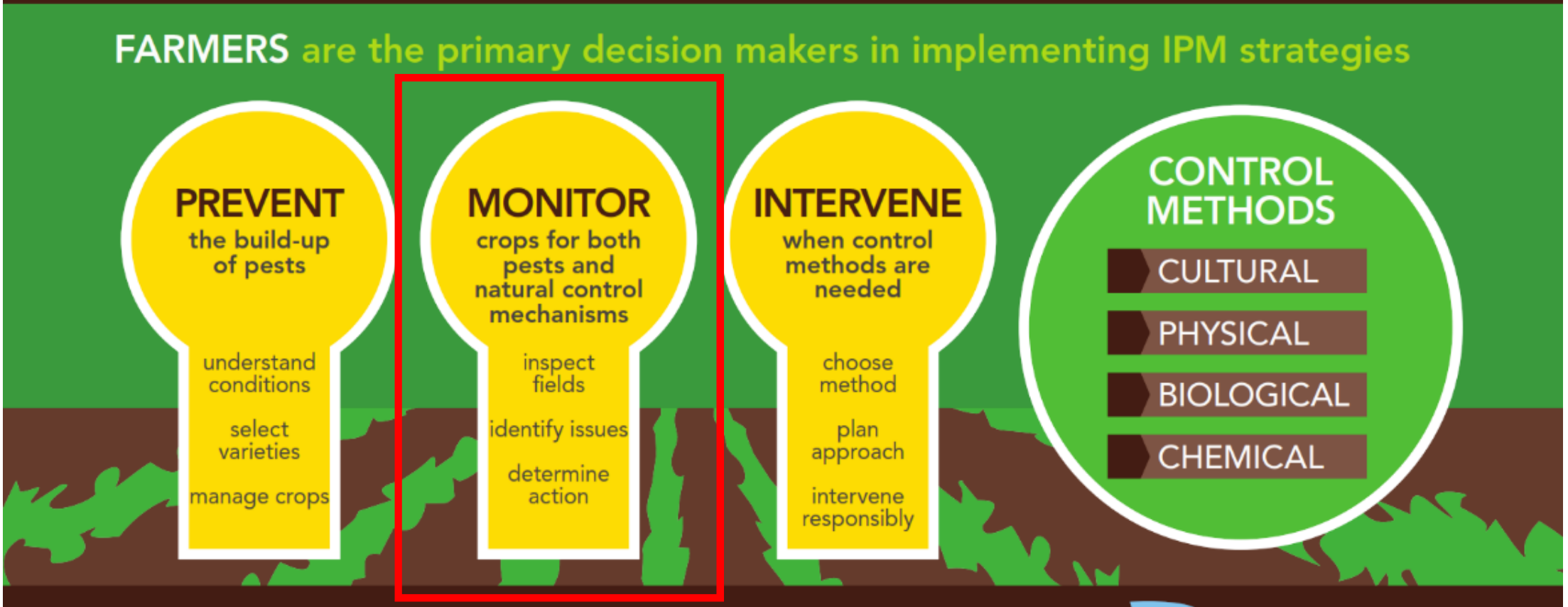
3. Rotation, crop diversity, intercropping, the refuge

- Increase the farmer income from the other varieties
- Over production of The refuge can be used as a dried flower for decoration

AGROECOSYSTEM VIDEOS

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
- To be able to carry out pest management appropriately, the identification of the pests must be correct

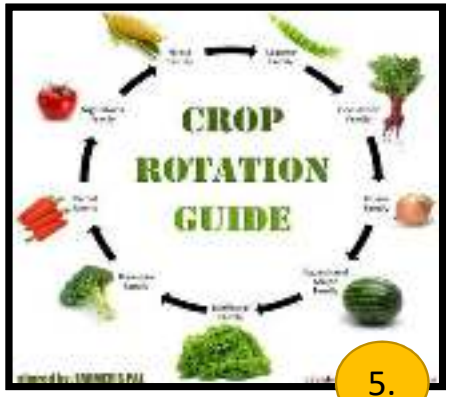



A1

Factors That Make Animal Become Pest

1.

2.



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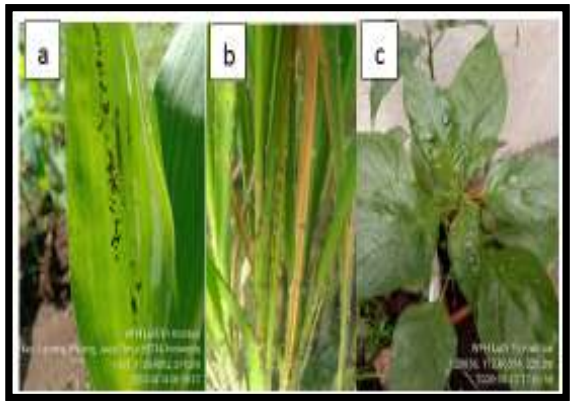
https://entomology.ca.uky.edu/



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.

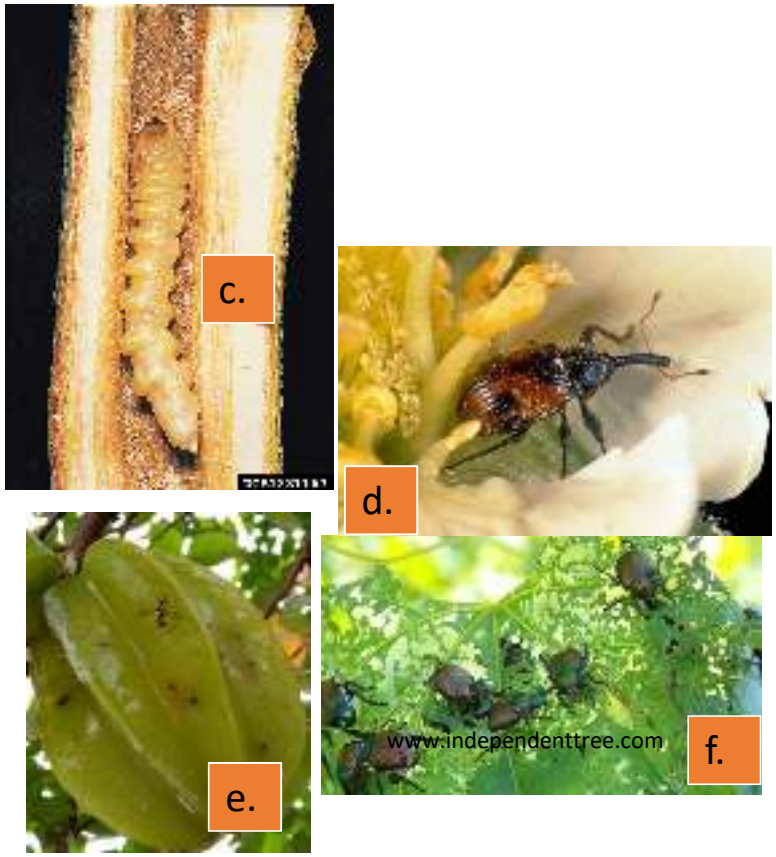
b. Tunnel in the stem and interrupt sap flow, often destroying the apical part of the plant; these are stem borers and shoot flies, such as Zeuzera in apple branches, Cephus in wheat, **Ostrinia in maize**, Atherigona in maize and sorghum.

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.**



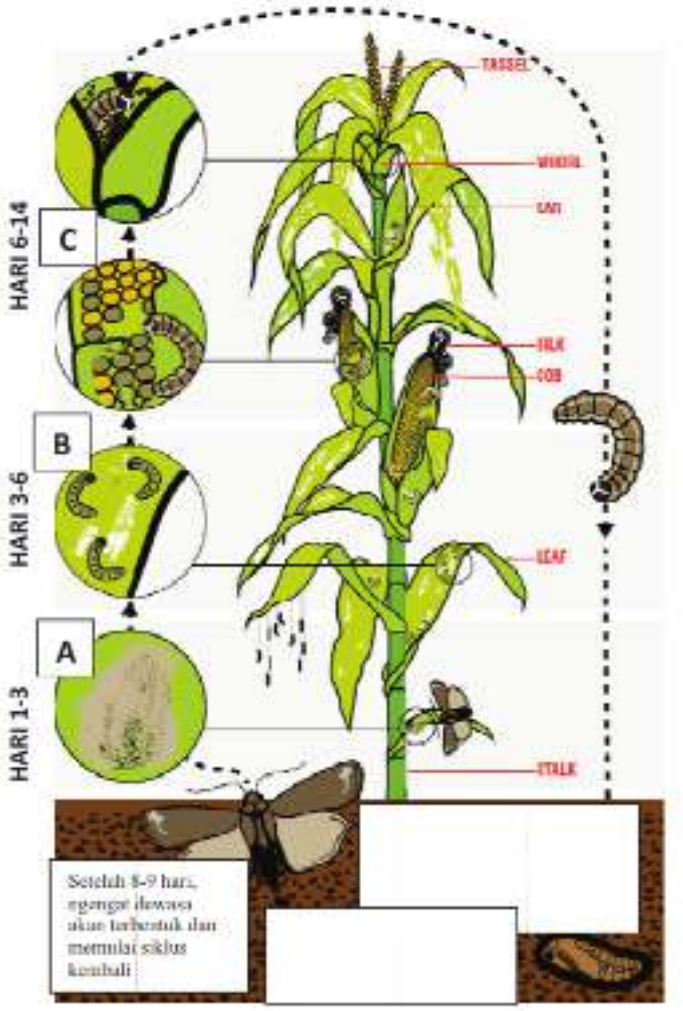
g. Injure or destroy seeds completely, or reduce germination due to loss of food reserves; examples are Hazelnut Weevil, **Maize Weevil,** Pea and Bean Bruchids, Pea Pod Borers, and Bean Pod Borers.

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.

In South Africa, the oviposition period is 10-23 days, with an average of 730 eggs per female (total 1600; maximum per night 480). Hairy surfaces are preferred for oviposition, which is closely linked with the period of bud burst and flower production in most host plants. Eggs hatch in 3 days at 22.5°C, and in 9 days at 17.0°C. The larval period lasts 18 days at 22.5°C and 51 days at 17.5°C, development thresholds being 14 and 36°C; rate of development is also affected by food. Fully grown larvae leave the plant to pupate in the soil at a depth of 3-15 cm. In Zimbabwe, pupation may occur in the tip of a maize cob. The pupa may undergo a facultative diapause, which considerably extends the pupal period. In southern Africa, the minimum pupal period in summer is 12 days, increasing as temperature falls to about 57 days. Emerging female moths must feed before their ovarioles are mature. Average life spans for males and females in South Africa are 9 and 14 days, respectively (8 and 11 days in Zimbabwe).

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

Pest of Mango

Fruit flies (*Bactrocera dorsalis, B. correcta & B. zonata*):

The female punctures outer wall of mature fruits with the help of its pointed ovipositor and insert eggs in small clusters inside mesocarp of mature fruits. On hatching, the maggots feed on fruit pulp and the infested fruits start rotting due to further secondary infection. Mango fruit flies distributed all over mango growing areas.

Fruit borer (*Deanolis albizonalis*):

Hatched larvae bore into fruits. Fully grown caterpillars have red bands on body alternating with white bands caterpillars bore into the fruit at the bottom (beak region) and feed inside reaching Kernels. Entrance hole is plugged with excreta. Affected fruits rot and fall prematurely.

Thrips (*Scirtothrips dorsalis*):

Nymphs and adults lacerate the tissues and suck the oozing cell sap. Leaf feeding species feed on mesophyll near leaf tips. Affected leaves show silvery sheen and bear small spots of faecal matter. Thrips are widely distributed in all mango growing areas

Mealy bug (*Drosicha mangiferae*):

The adult bugs are covered with whitish powder and colonize between bark of tree trunk, young shoots and panicles causing flower drop, affecting fruit set. They also excrete honey dew, a sticky substance, which facilitates development of sooty mould.

Shoot Borer (*Chlumetia transversa*):

Larvae bore into the young shoot by tunneling downwards resulting in dropping of leaves and wilting of shoots. Larvae also bore into the inflorescence stalk. Female moths lay egg on tender leaves.

Scale Insects (*Aspidiotus destructor, Ceroplastis* sp.):

The nymph and adult scales suck the sap of the leaves and other tender parts and reduce the vigour of the plants. They also secrete honeydew, which helps in the development of sooty mould on leaves and other tender parts of the tree. Scale insects are occurring in all mango growing areas

Video Hama

https://quizizz.com/join?gc=59660502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gracias
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