ECOLOGICALLY BASED INTEGRATED PEST MANAGEMENT

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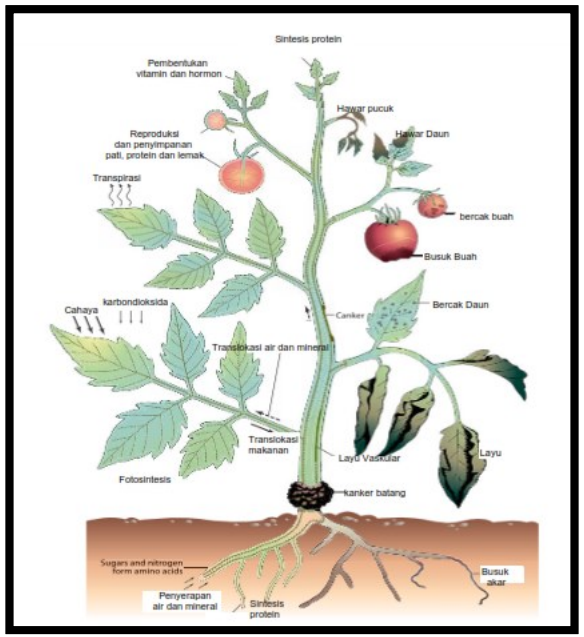
LEARNING OBJECTIVE

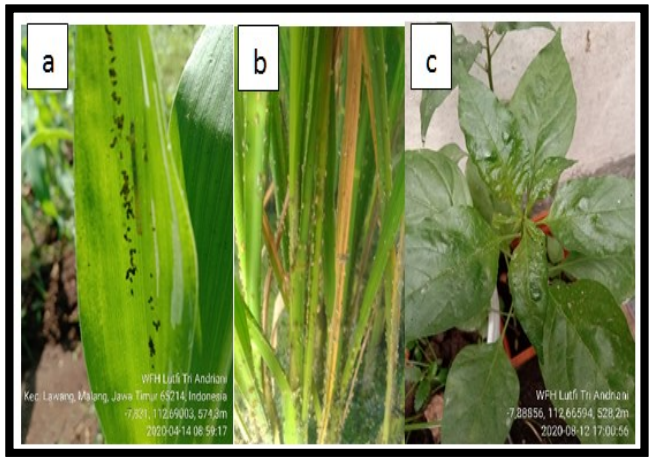
At the end of this session, The Partisipant should have a better understanding of

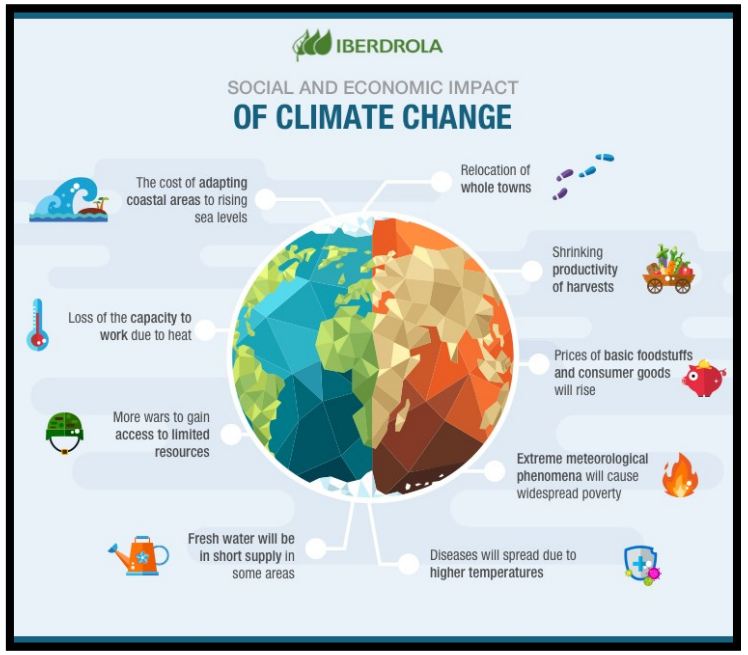
1. Pest and Plant diseases
2. Agroecosystem ecology as the basic of Integrated Pest Management

BACKGROUND

https://news.wsu.edu/2019/05/08/communicating-food-benefits-gets-kids-eat-healthier/







FAO definition:

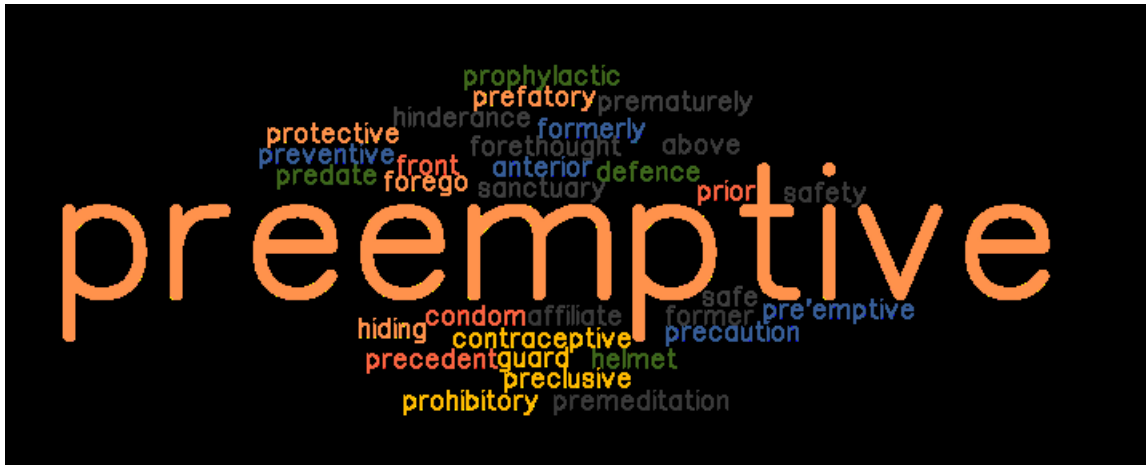
Integrated Pest Management (IPM)

means the careful consideration of all available pest control techniques and subsequent integration of appropriate measures that discourage the development of pest populations and keep pesticides 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).

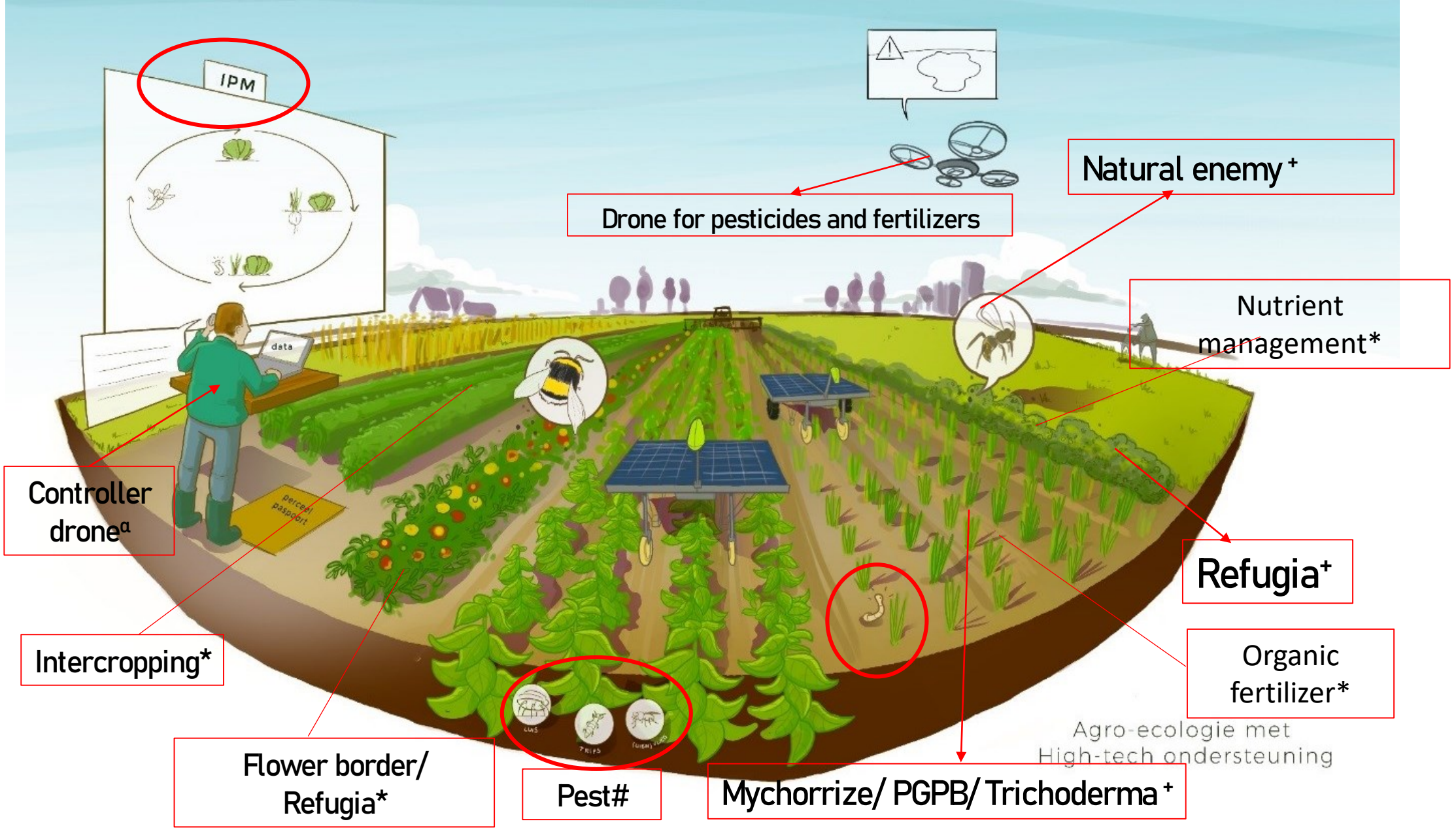
The Principal of Integrated pest Management in Indonesia

1. Cultivation of healthy plants
2. Pest monitoring
3. Natural enemy conservation
4. Farmers as expert in IPM

For long-term solutions to the problem of pest and plant disease can only be achieved through the improvement and management of **agroecosystems** in a way that maximizes preemptive action (especially to prevent attack before the pest enable)



- 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


IPM
data
perceel paspoort
Drone for pesticides and fertilizers
Natural enemy +
Nutrient management*
Controller drone[α]
Refugia+
Intercropping*
Organic fertilizer*
Flower border/ Refugia*
Pest#
Mychorrize/ PGPB/ Trichoderma +
Agro-ecologie met
High-tech ondersteuning

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1. Cultivation of healthy plants

INTERCROPPING

- Intercropping is an all encompassing term for the practice of growing two or more crops in close proximity. Mix cropping or polycultures.
- plant cultivation according to standard operational procedures, for example space between the plant, pruning of plantation crops, etc.

CROP	INTERCROP	PEST(S) REDUCED	MECHANISMS
Cauliflower	Corn spurry	Cabbage looper, flea beetle, aphid	Predators
	Lambsquarters	Imported cabbage butterfly	Predators
	White or red clover	Cabbage aphid, imported cabbage butterfly	Physical interference, predators
Corn	Wild parsnip, wild mustard, chickweed, shepherd's purse, and lady's thumb smartweed	Black cutworm	Parasitic wasps
	Pigweed	Fall armyworm	Uncertain
	Giant ragweed	European corn borer	Parasitic wasps
	Sweet potato	Leaf beetle	Attract pest to alternative plant
	Beans	Leafhoppers, leaf beetle, fall armyworm	Physical interference, Predators
	Beans, weeds	Fall armyworm	Predators
	Pigweed, Mexican tea, goldenrod, beggertick	Fall armyworm	Predators
	Soybean	Corn earworm	Predators
	Peanut	Corn borer	Visual masking
	Clover	Corn borer	Physical interference
Cow pea	Sorghum	Leaf beetle	Chemical repellent
Cucumber	Corn, broccoli	Striped cucumber beetle	Physical interference
Crucifers	Wild mustard	Cabbageworm	Parasitic wasps
Fruit trees	Rye, wheat, sorghum used as mulch	European red mite	Predators
	Alder, bramble	Red spider mite	Predators

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

The criteria of refugia plants:

1. Choose plants that have flowers and striking colors,
2. Rapid and sustainable plant regeneration Seeds or Seeds are easy to obtain Easy to plant

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.

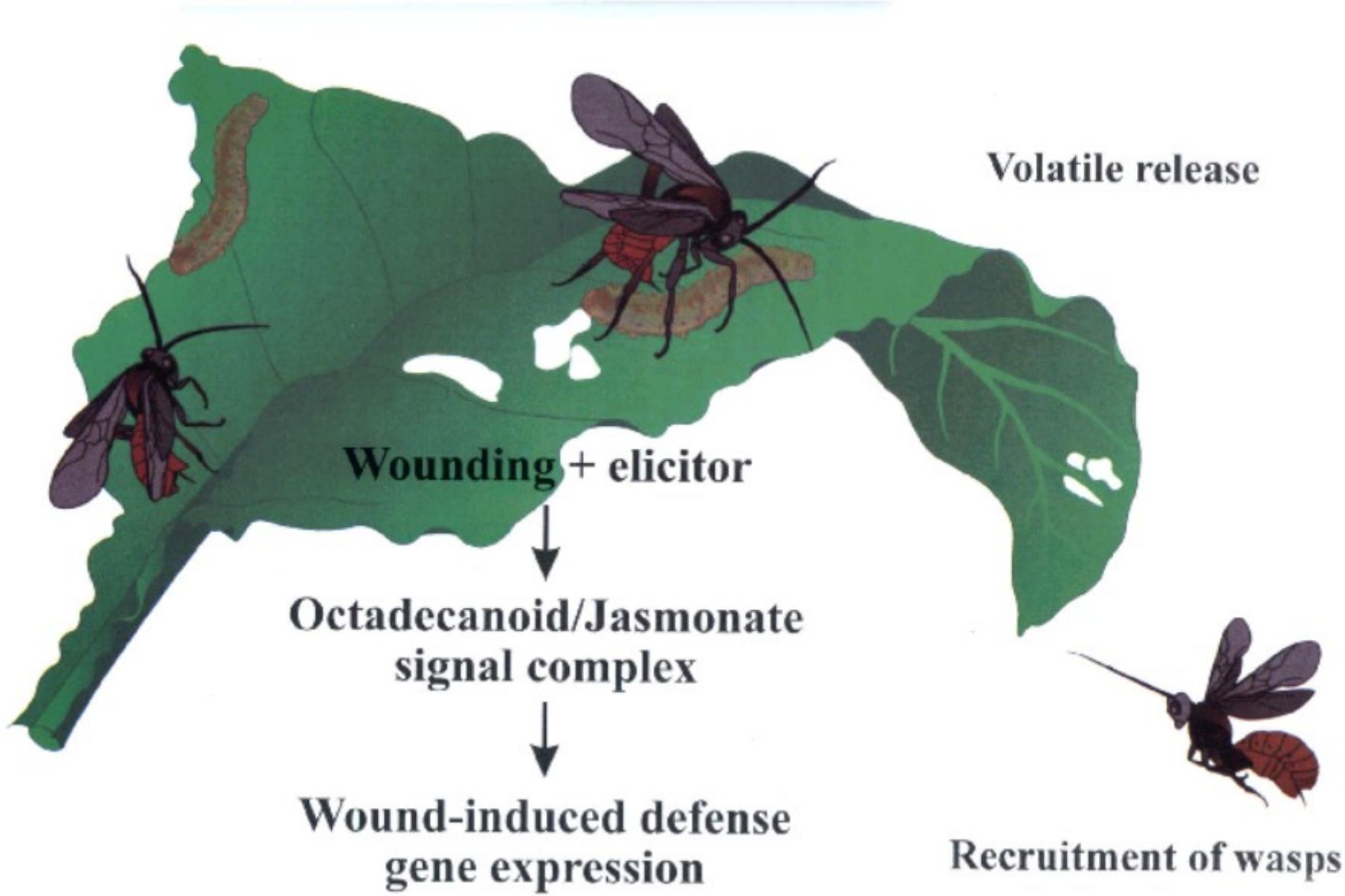


Figure 1. Volatile compounds are released by plants in response to insect feeding trigged by an interaction of elicitors from the oral secretions of insect herbivores with damaged plant tissue. These volatiles are used by some parasitoid wasps to locate their hosts.

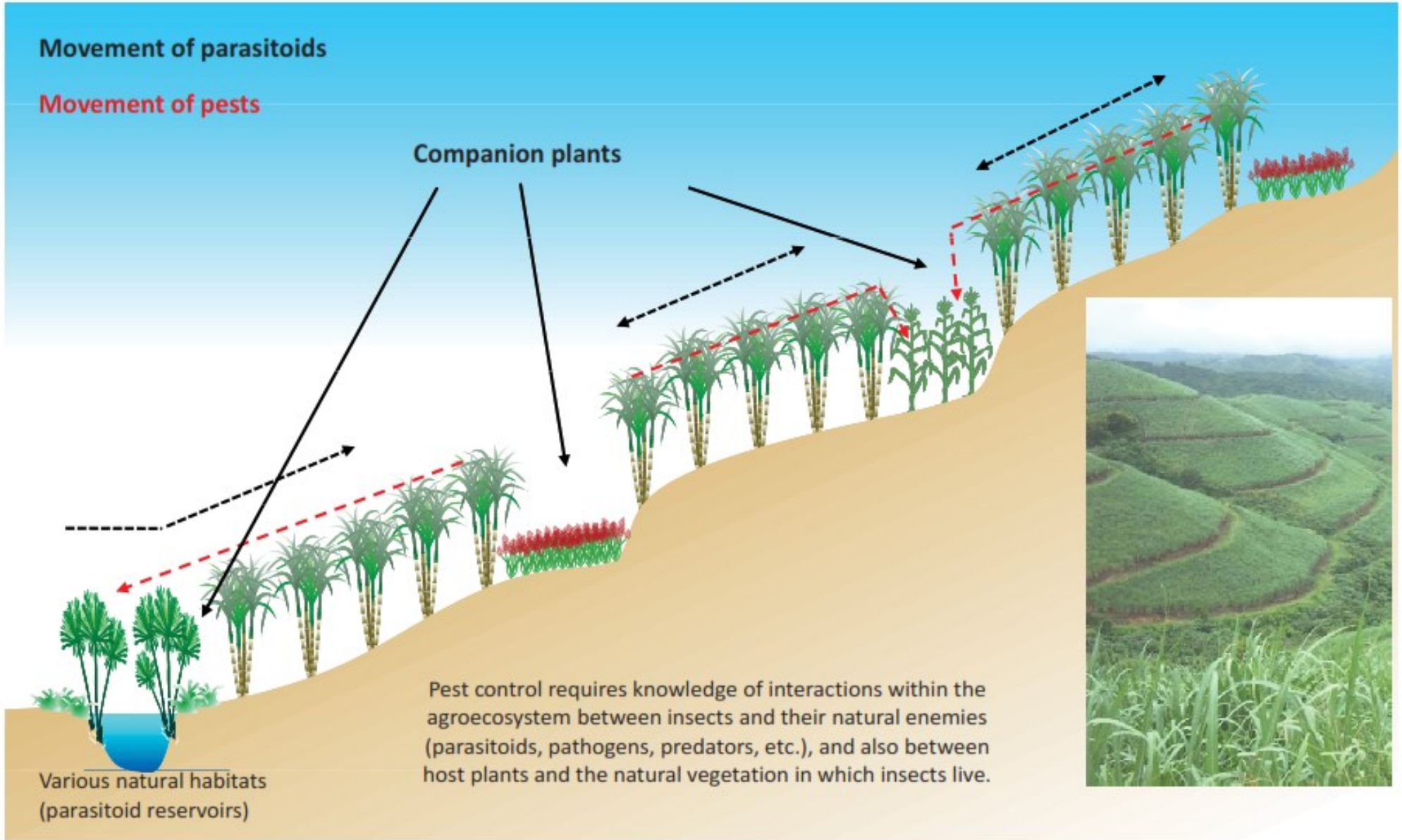


Fig. 8.8. Taking into account landscape components and companion plants for biological control of *Eldana saccharina*, a sugarcane pest in South Africa. (From Conlong and Rutherford, 2009.)

HEALTHY SOIL

1. Organic matter
2. Nutrient management
3. Cover crop
4. Beneficial organism in the soil

Dont burn straw

ORGANIC

MATTER/ FERTILIZER

MUST DO

FIFTY YEARS OF EARTH DAY

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

Learn how: ilsr.org/composting

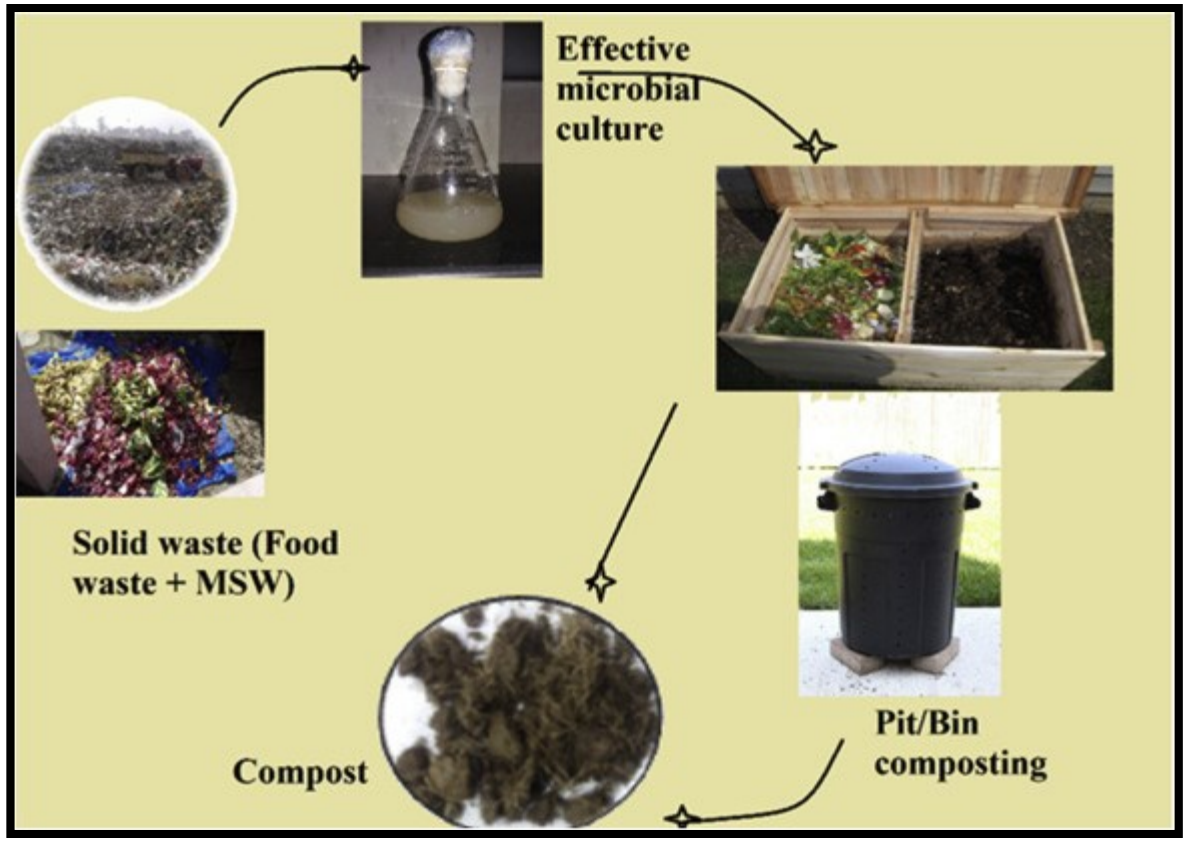


Figure 1: A complete process flow for the production of biofertilizer/compost (phase 1)

2. NUTRIENT MANAGEMENT

Although more research is needed to clarify the relationships between crop nutrition and pests, most studies assessing the response of aphids and mites to nitrogen fertilizer have documented dramatic expansion in pest numbers with increases in fertilizer rates.

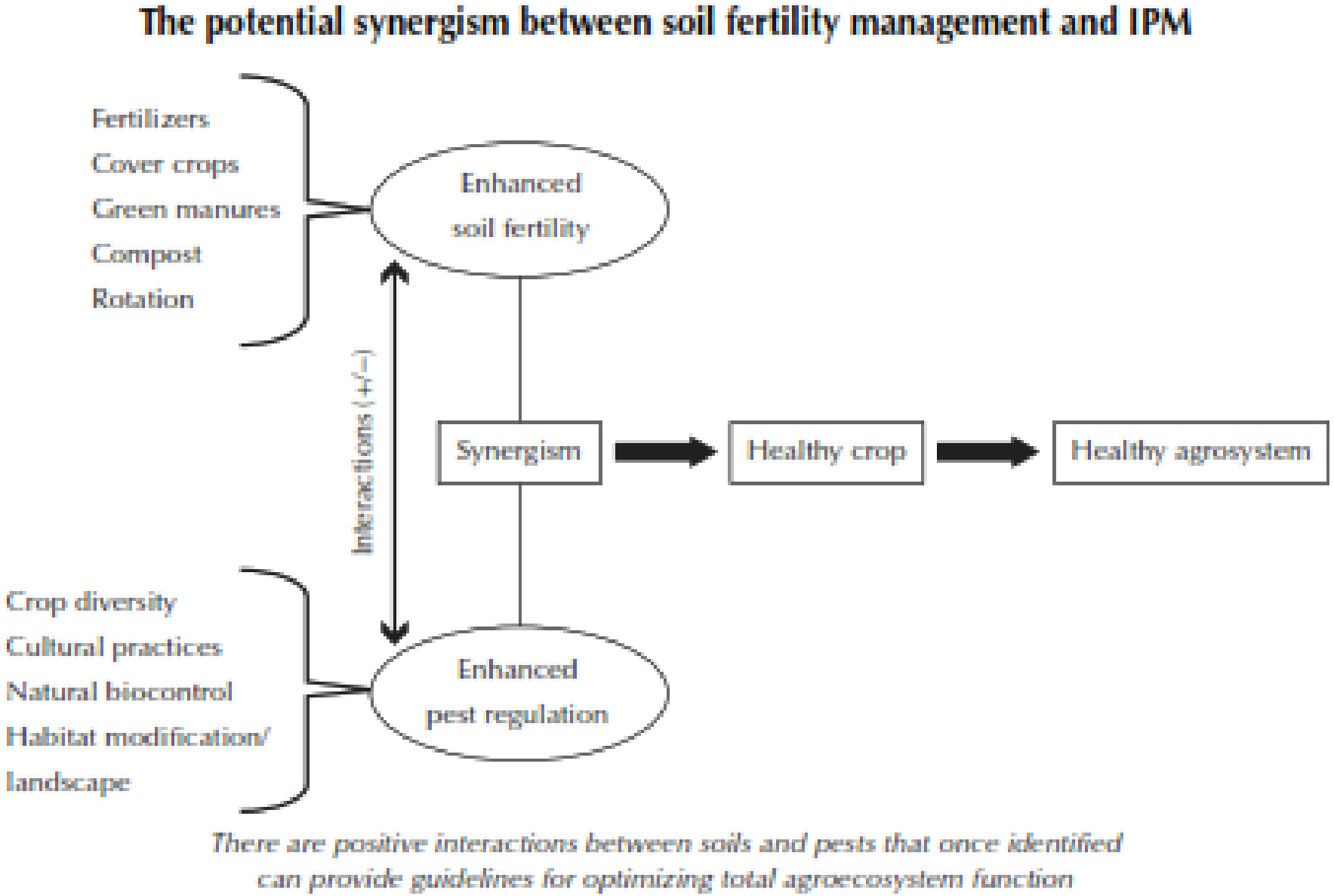


Fig. 8.9. Optimizing soil–pest interactions: a key pathway to achieving sugarcane agroecosystem health. (From Altieri and Nicholls, 2003.)

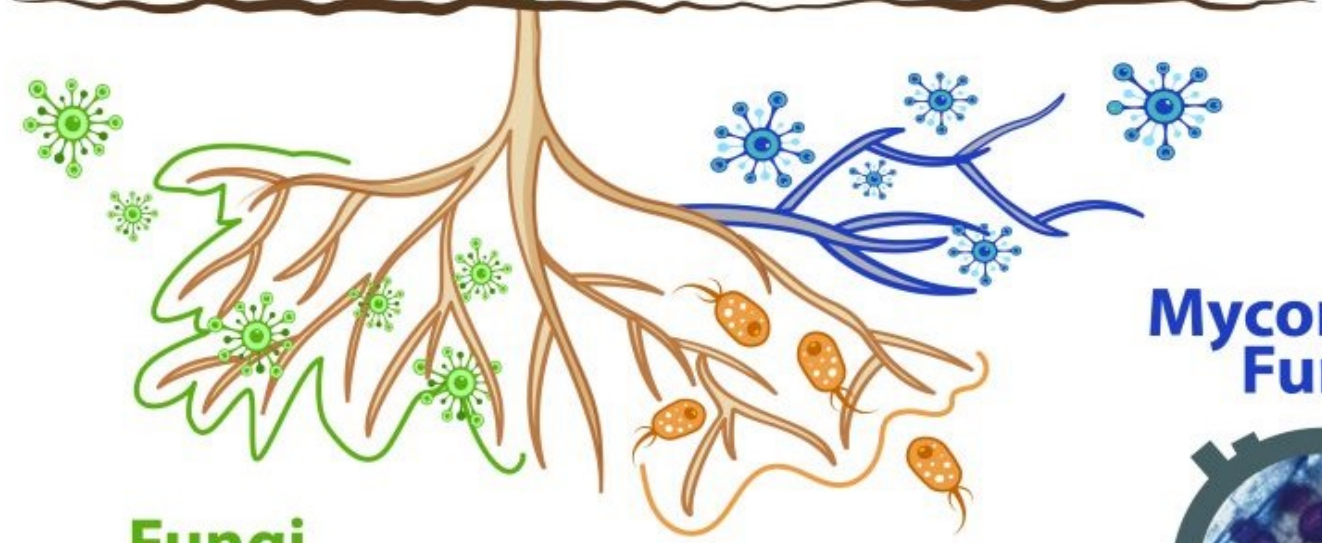
3. COVER CROP

Types of biostimulants

4. FOCUS ON: BENEFICIAL MICRO-ORGANISMS

Soil's health is essential for good root and plant growth. Micro-organisms are principal actors of soil's life and so they play a prominent role in plant development.
Many micro-organisms such as bacteria, fungi (especially mycorrhizal fungi) are acting on the plant also as biostimulants.

Facts and figures:
soil is alive!!
in 1 g of soil we can find until 1 billion of bacteria and 1 million of fungi and protozoa.



Fungi

° Degradation of organic matter

° Solubilisation of nutritional elements

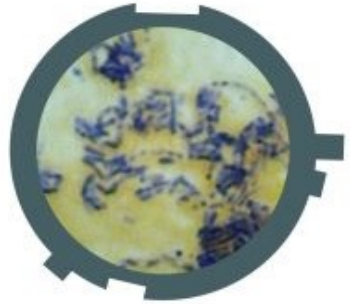
° Root Biostimulation

° Formation of aggregates

° Root colonization

° Competition with other organisms

Bacteria



° They participate in the Nitrogen cycle (Fixing, nitrification,...)

° Root Biostimulation

° Solubilisation of soil nutrients

° Promotion of soil aggregation

° Promotion of plant growth (PGPR)

Mycorrhizal Fungi

Mycorrhizae is the name of the plant-fungus symbiosis. Without the root, the fungus dies.

° Increase of root absorption area (from 100 to 1000 times)

° Carrier of nutritional elements and water

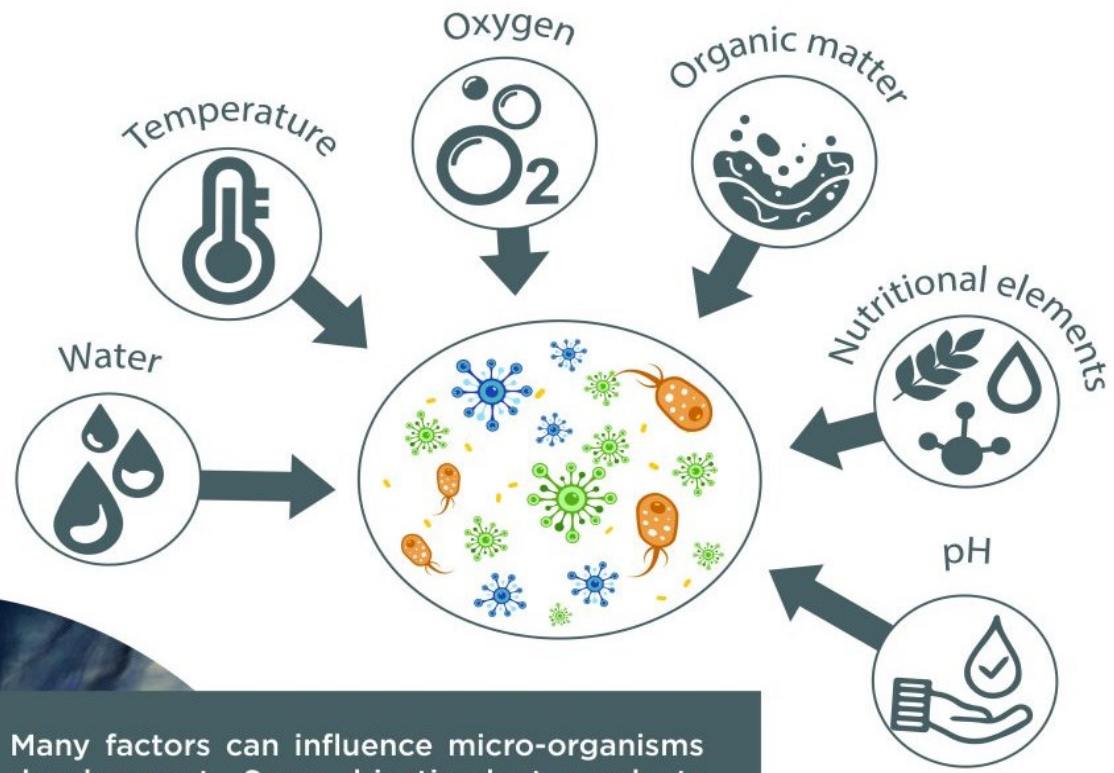
° Increase water retention capacity

° Improvement of tolerance to abiotic stress

° Biostimulation of roots

° Formation of aggregates (better soil structure)

How to increase micro-organisms development?



Many factors can influence micro-organisms development. Some biostimulant products are able to stimulate the growth of beneficial microbials in the rhizosphere and surrounding soil, improving soil biological fertility.

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WE ARE BIOSTIMULANT!™

Plant Growth Promoting Bacteria

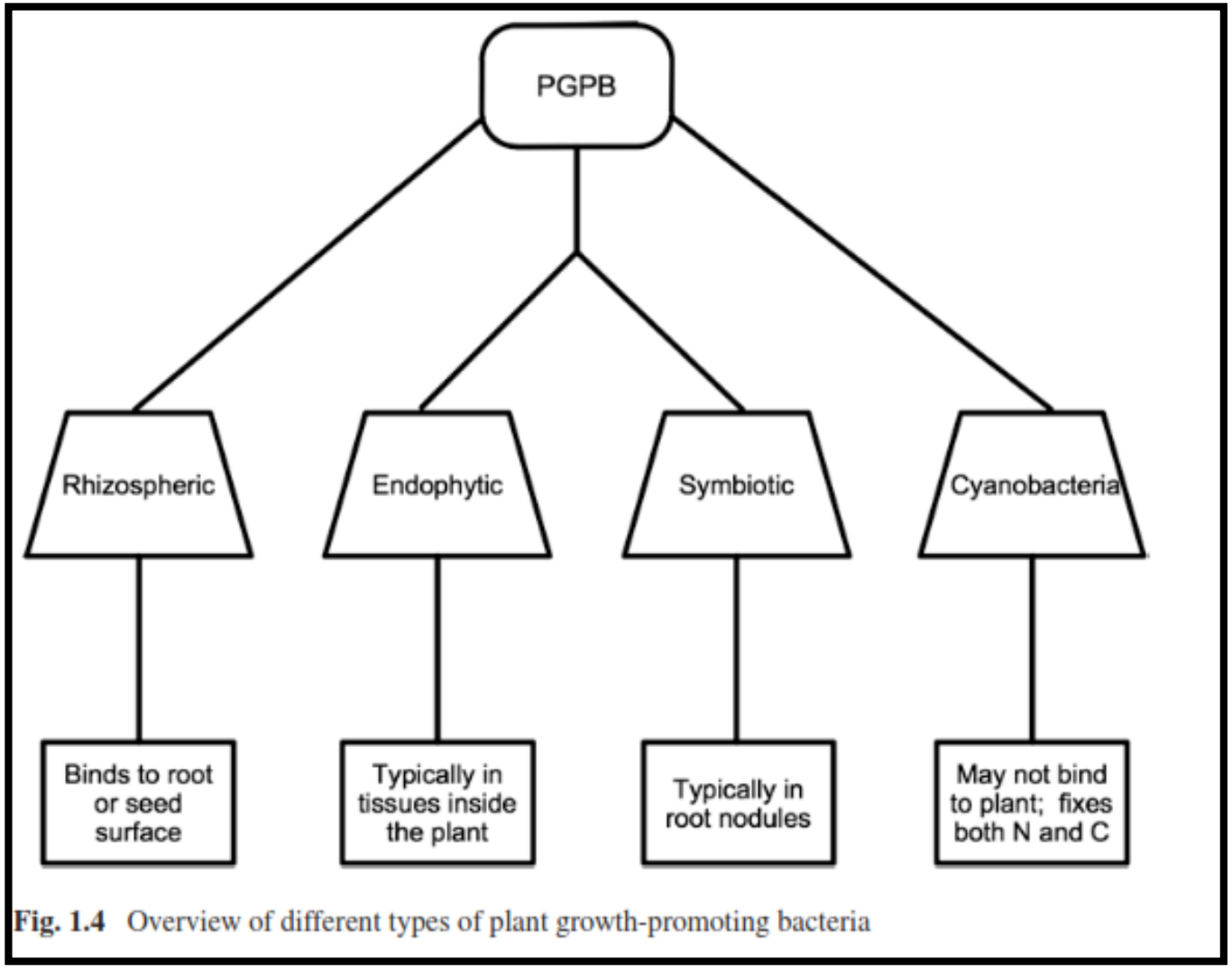
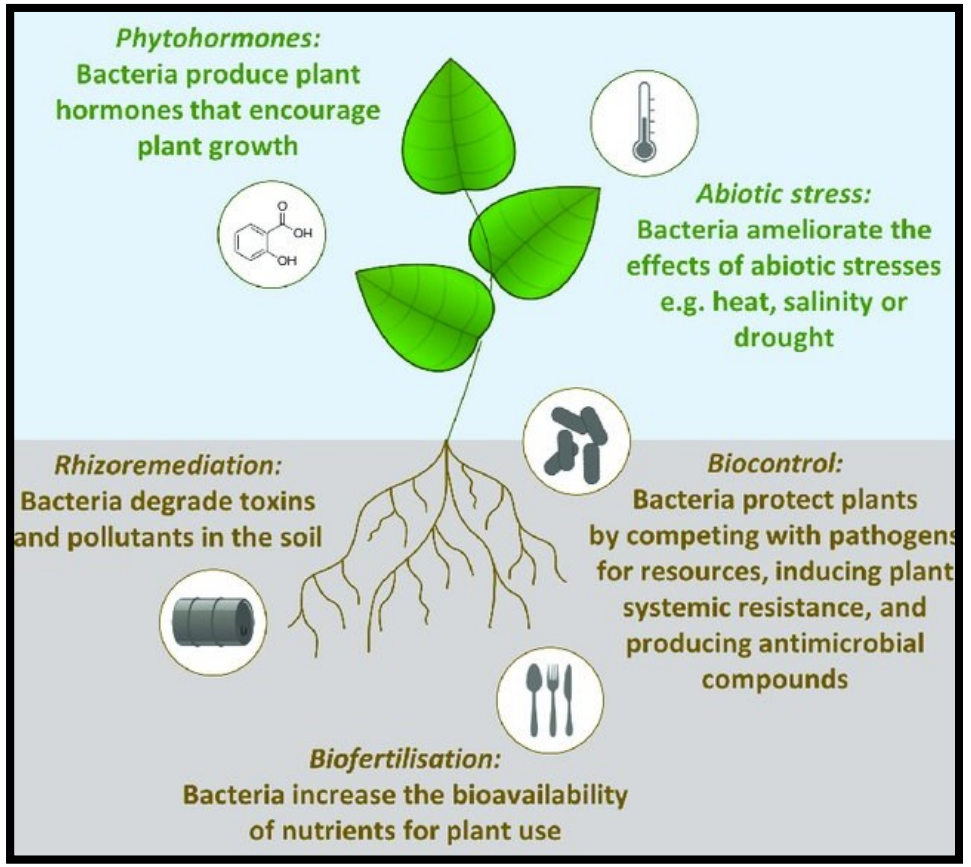


Fig. 1.4 Overview of different types of plant growth-promoting bacteria

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



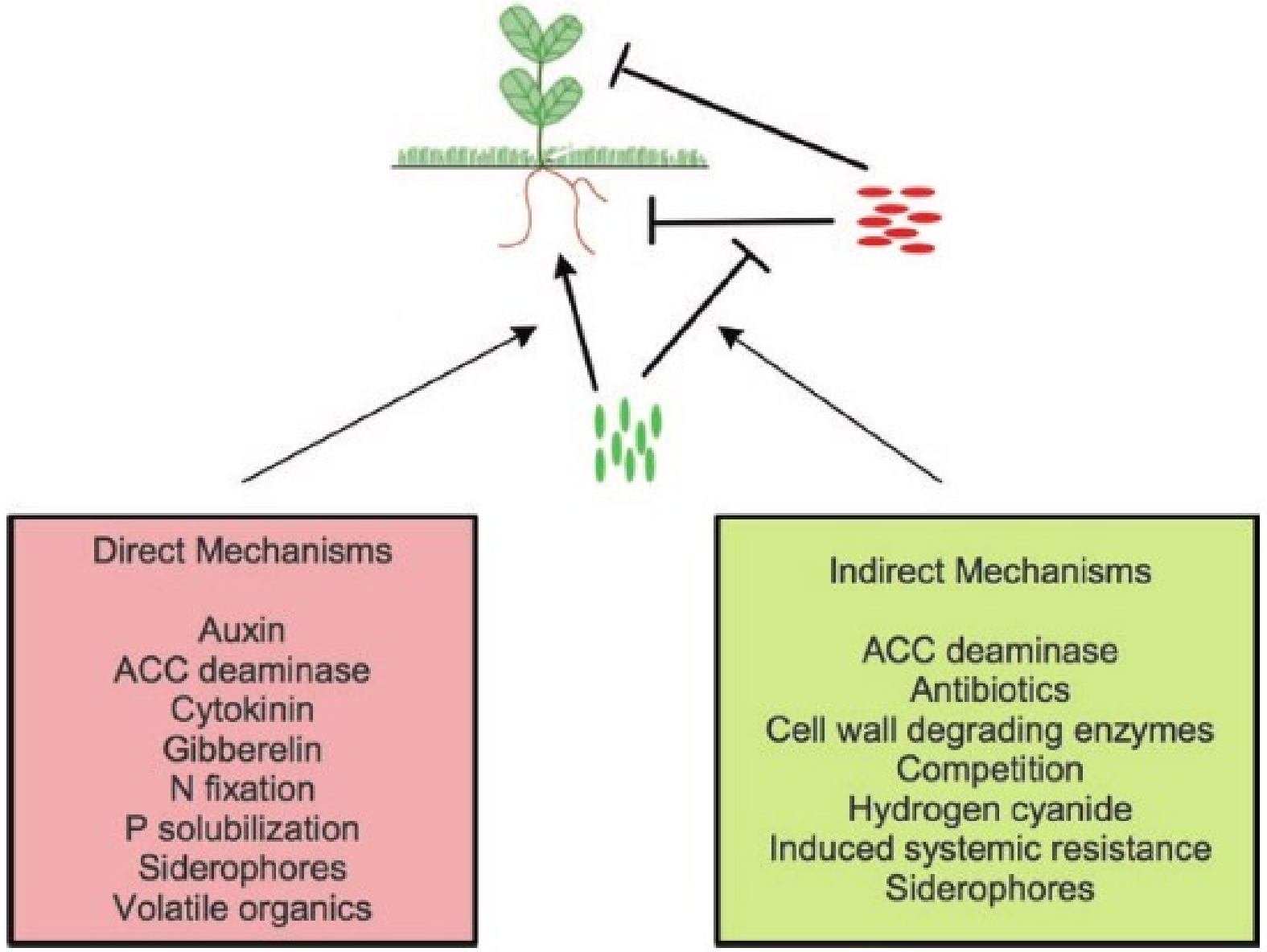


Fig. 1.11 Schematic representation of the main direct and indirect mechanisms used by PGPB to facilitate plant growth and development

Mass production of PGPB

Liquid Media Uses bamboo root

The Material and Equipment

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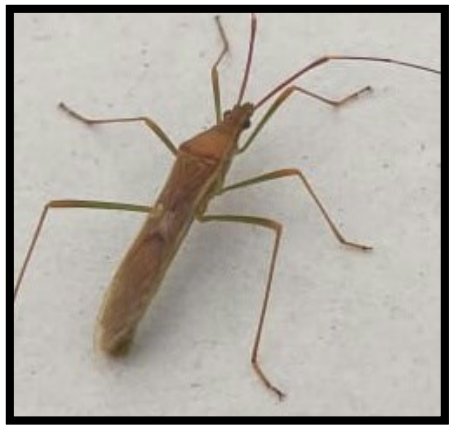
2. Pest Monitoring

If we are going to pest monitoring, of course, we have to know the differences between pests and plant diseases

PEST

- 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

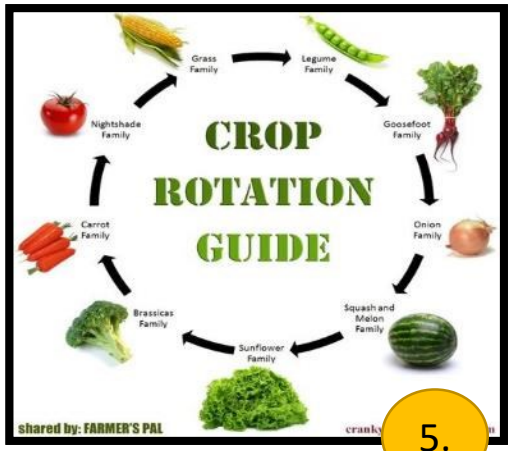


Factors That Make Animal Become Pest

1.

2.



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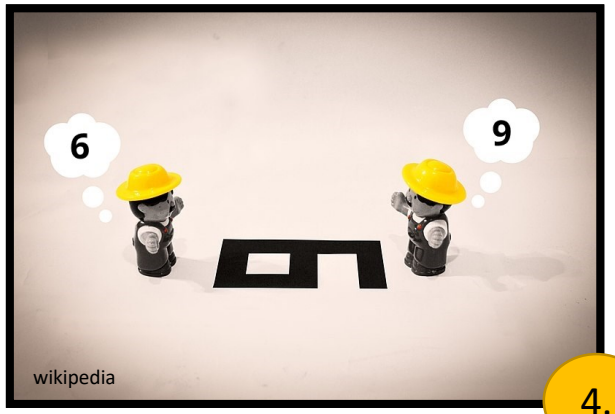
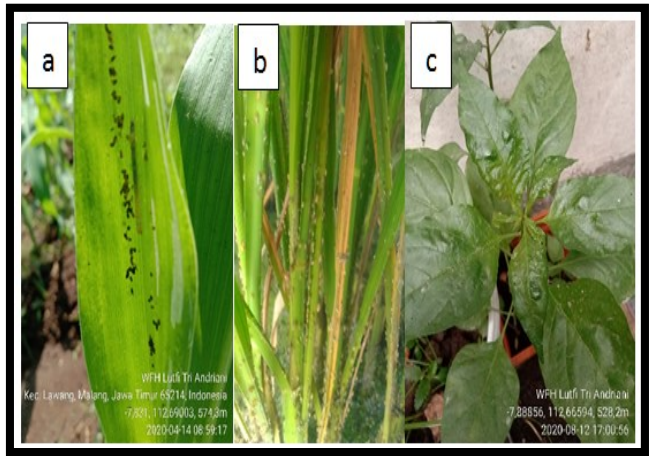


4.

3.

Insect Pest Characteristic

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



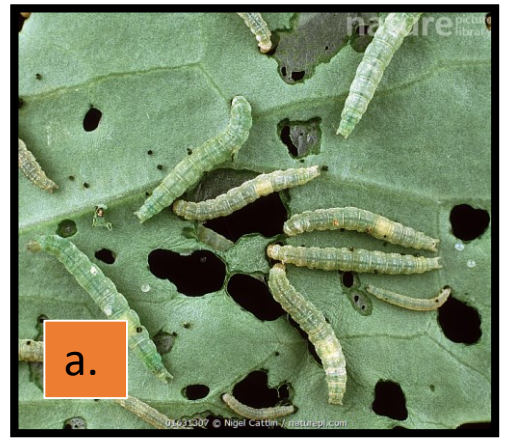
To classify insects become pest is determine by the Mouthparts:

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.

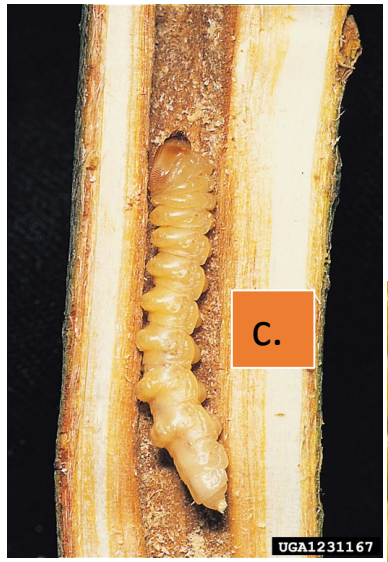


c. Ring-bark stems, for example some Cerambycidae.

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.

PLANT DISEASES

- A plant disease is an abnormality in the structure and/or function of the host plant cells and/or tissue as a result of a continuous irritation caused by a pathogenic agent or an environmental factor
- Plant diseases can be broadly classified according to the nature of their primary causal agent, either infectious or noninfectious.

- Infectious plant diseases are caused by a pathogenic organism such as a fungus, bacterium, mycoplasma, virus, nematode
- Noninfectious plant diseases are caused by unfavourable growing conditions, including extremes of temperature, disadvantageous relationships between moisture and oxygen, toxic substances in the soil or atmosphere, and an excess or deficiency of an essential mineral.

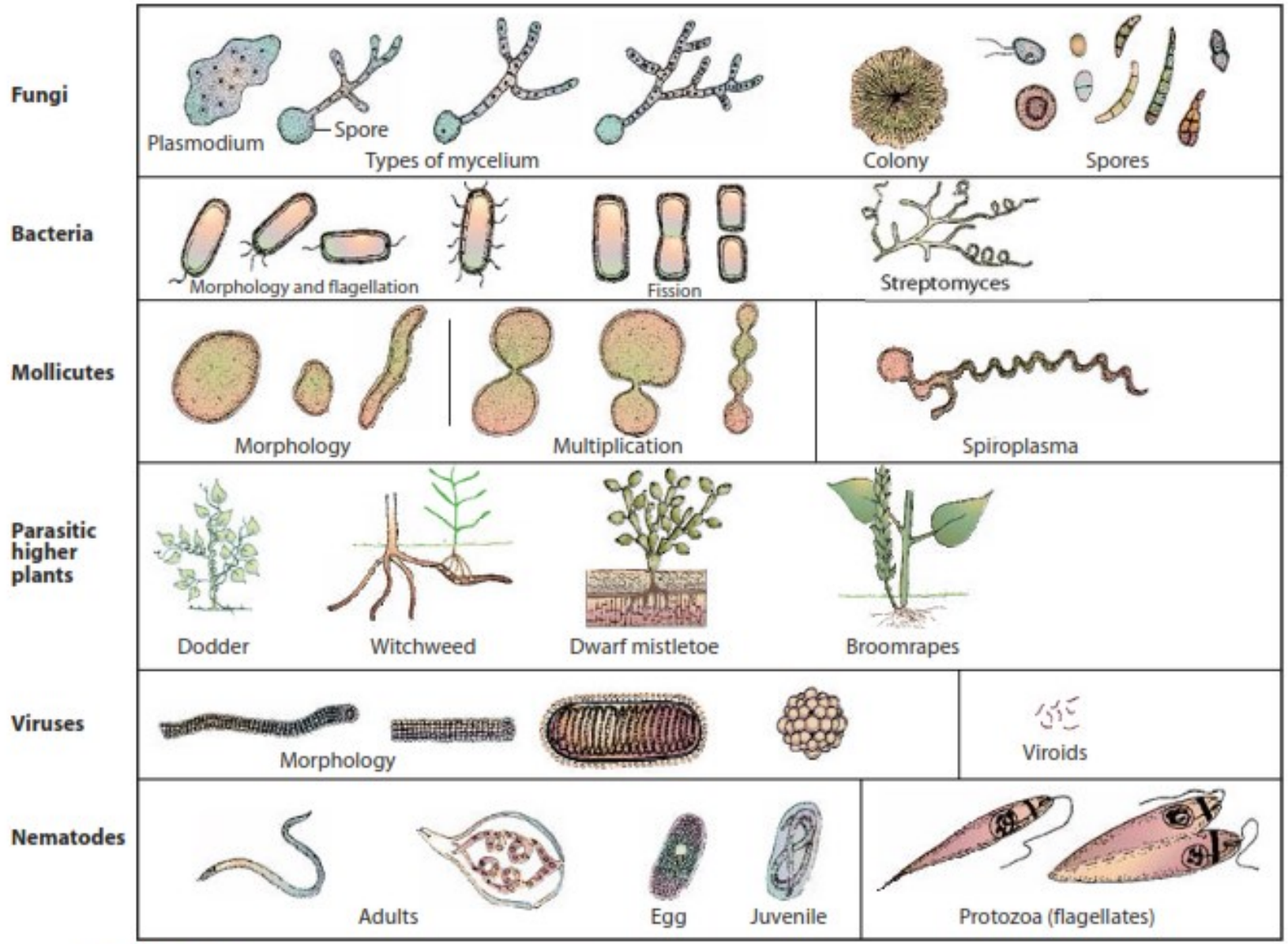


FIGURE 1-3 Morphology and ways of multiplication of some of the groups of plant pathogens.

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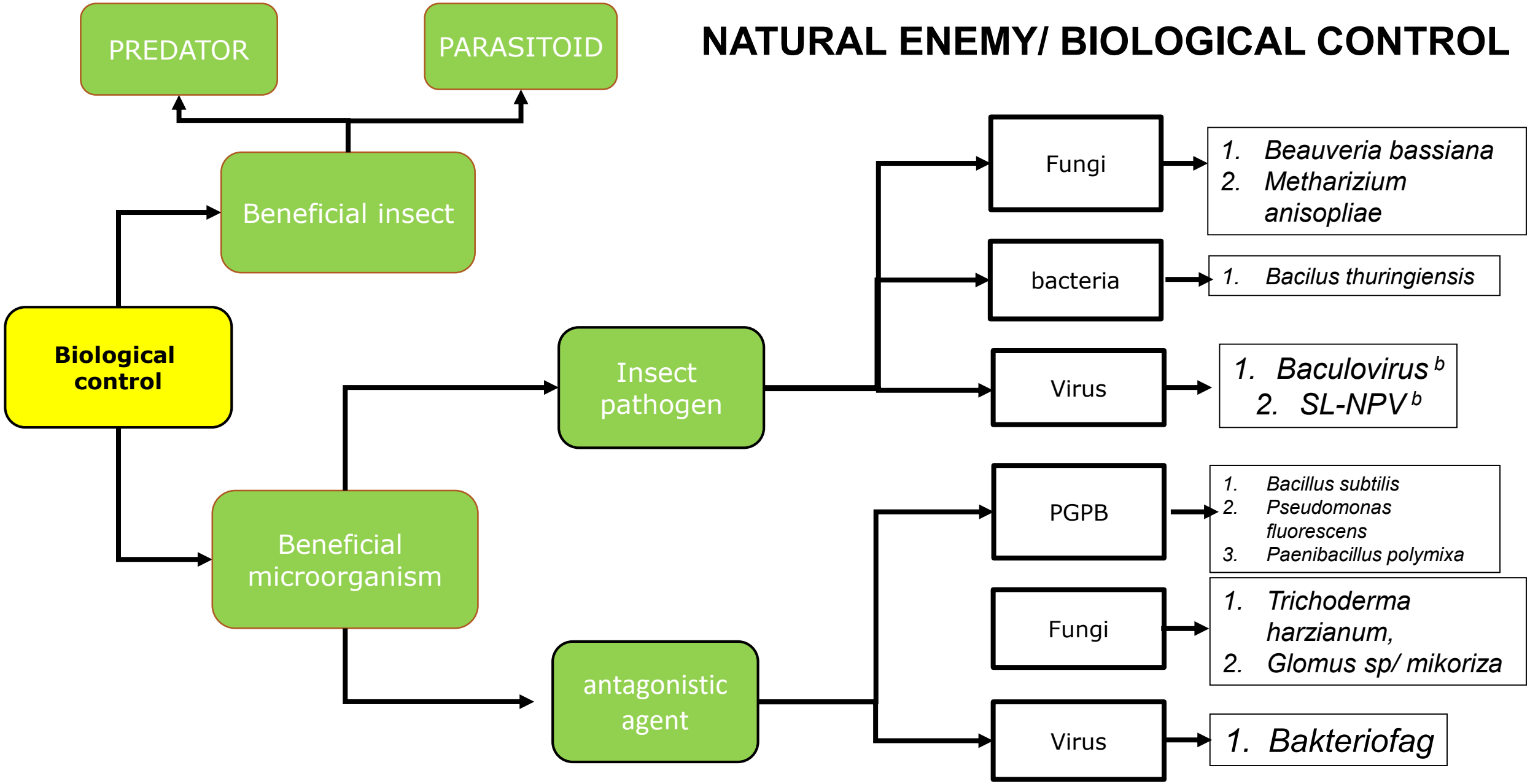
3. Natural enemy conservation

NATURAL ENEMY/ BIOLOGICAL CONTROL



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4. Farmers as expert in IPM

Group farmer meet to manage the action plan about preemptive solution on the farm

The More Variety, The Better Society


thank you
danke
謝謝
ngiyabonga
teşekkür ederim
gracias
спасибо
Баярлалаа
рахмат
dank je
bedankt
dziękuję
obrigado
sukriya
kop khun krap
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terima kasih
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