



Sustainable Plant Protection



Learning Objectives


- To present the concept and condition of sustainable plant protection
- To show interaction between environment, crop, pest and humans
- To present the concept of Integrated Pest Management (IPM)



Content

- Why sustainable plant protection
- Interactions between environment, crops, pests and humans
- The concept of Integrated Pest Management
- Conditions for sustainable plant protection

Why sustainable plant protection?

| Yield losses in global rice production |  © B. Y. Ashiadey |
|--|---|
| Attainable production | 933.1 M t |
| Potential yield loss without plant protection ¹⁾ | 60-80% |
| Actual yield loss with present plant protection ¹⁾ | 20-50% |
| Absolute yield loss lowland rice, Asia (median) ²⁾ | 1.2-2.2 t/ha |

1) Oerke 2006 2) Savary et al 2000b

Why sustainable plant protection?

Implications of intensive use of synthetic plant protection products (pesticides)

- On persons handling and applying pesticides
- Environment including biodiversity and water bodies
- Consumer protection and food safety
- Pesticide externalities

Need for sustainable agricultural production and plant protection

- Emphasis on improving agricultural productivity while minimizing harmful effects on the climate, soil, water, air, biodiversity and human health
- Aims to minimize use of inputs from non-renewable resources and to preserve natural resources for coming generations

Some figures about the economic importance of pesticides

The market for pesticides can be broken down into two segments: synthetic pesticides and bio pesticides

Synthetic pesticides should total \$44 billion in 2012 and \$61.5 billion in 2017

Bio pesticides are expected to total \$2.1 billion in 2012, and surpass \$3.7 billion in 2017

Source: BCC Research:Global Markets for Biopesticides(CHM029D), 2012

Interactions between environment, crops, pests and humans



Source: commons.wikimedia.org



What is a pest (from the perspective of the farmer)?



Source: Shutterstock.



Source: Shutterstock.

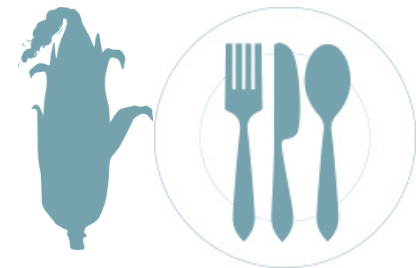
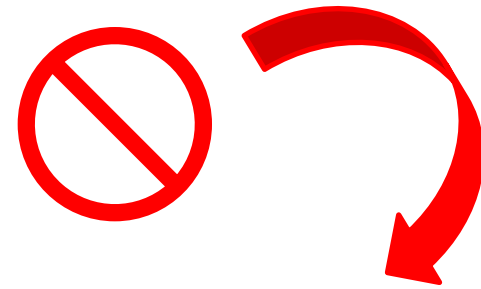


Source: Shutterstock.

How this perspective could affect the environment and human health?

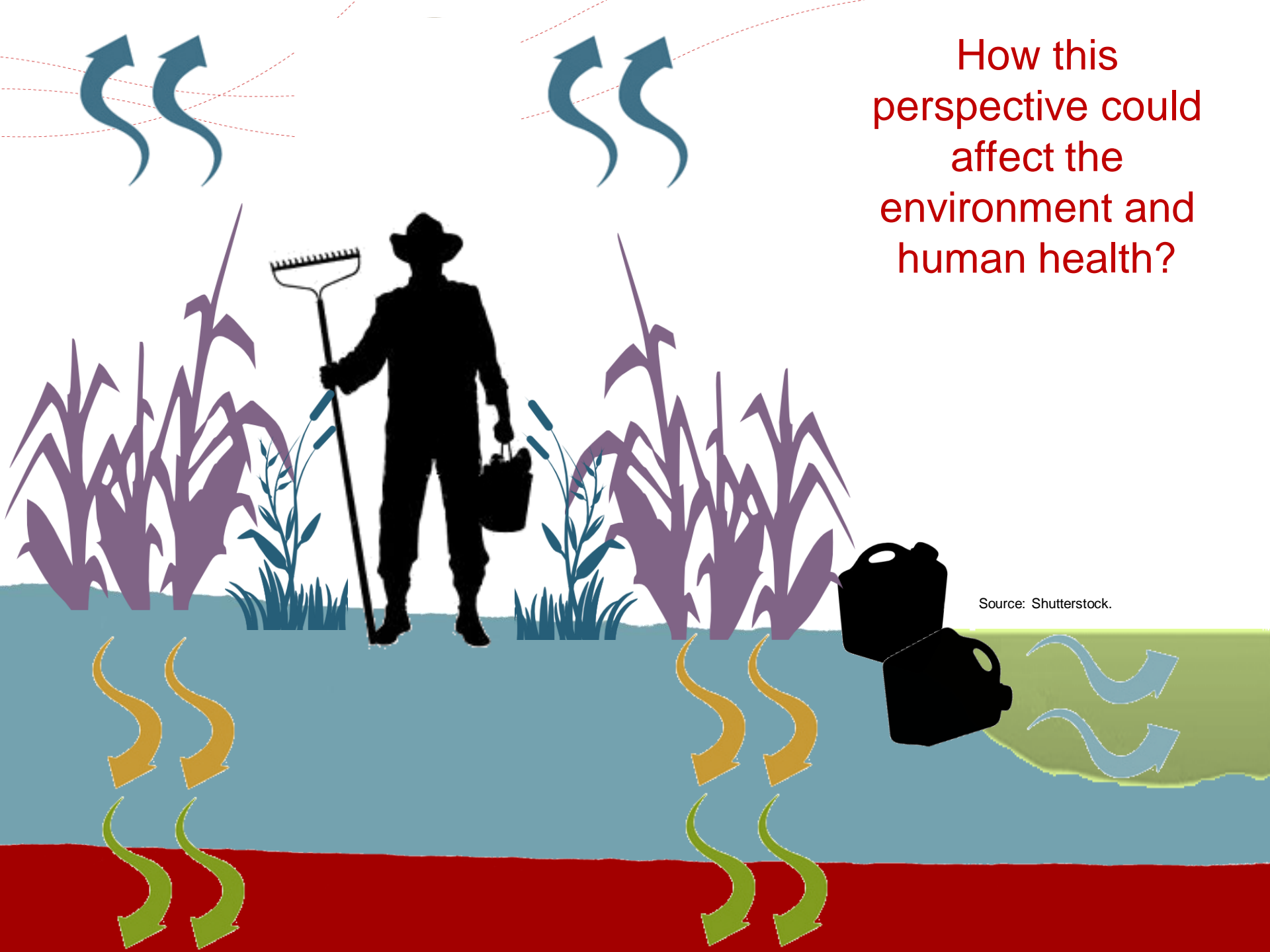


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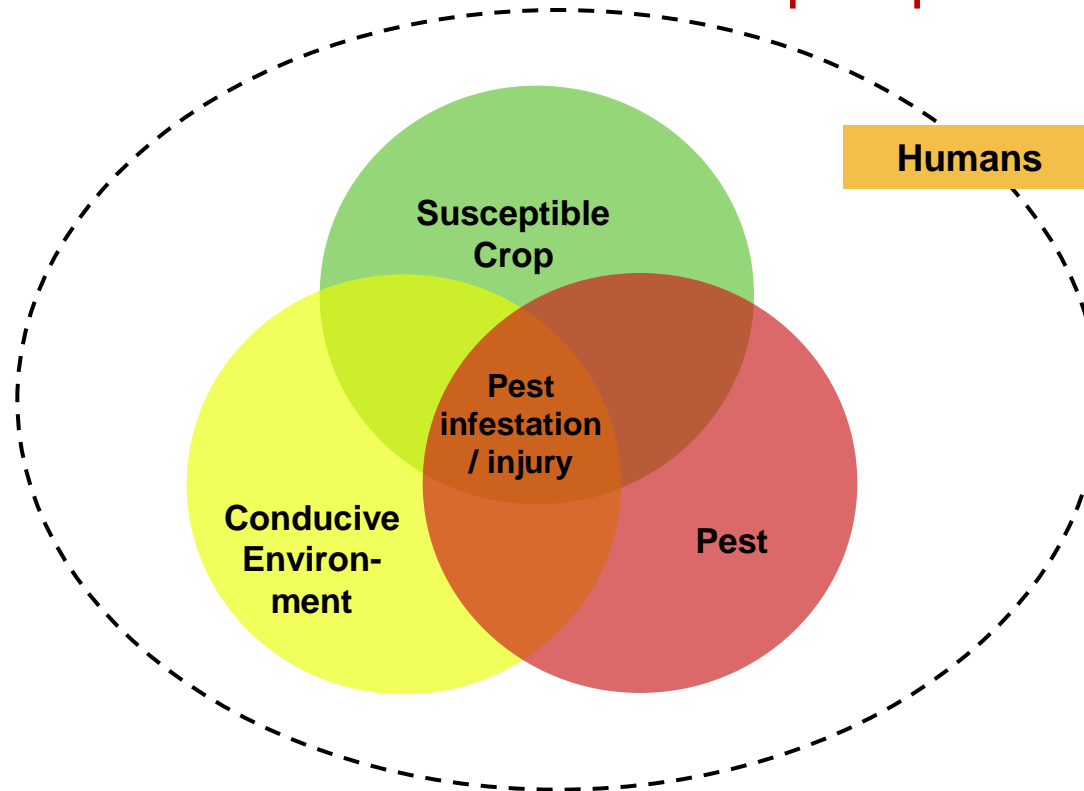
Source: Shutterstock.

How this perspective could affect the environment and human health?





Interaction between environment - crops - pests - humans



For a substantial pest infestation and injury to occur, all three elements of the so-called pest triangle must be present.



Wrap up: Causes for crop injury and crop losses

Biotic factors:

- **Weeds** (grassy, leafy, parasitic weeds)
- **Animal pests** (insects, mites, nematodes, slugs/snails, rodents, birds, mammals)
- **Diseases** (fungi, viruses, bacteria, microorganisms)

Abiotic factors:

- **Water** (drought, waterlogging)
- **Temperature**
- **Nutrients/soil** (deficiency, toxicity)
- **Light** (sun scorching,...)
- **Wind**

(see modules Water and Water Use, Climate, Nutrients)

The concept of Integrated Pest Management (IPM)





IPM: Definition

“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 and animal health** and/or 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 - WHO definition, 2014)



IPM: Concepts

1. Prevention and/or preliminary suppression of harmful organisms through cultural practices and good agricultural practices (GAP)

- But first...build your knowledge base!





IPM: Concepts

1. Prevention and/or preliminary suppression of harmful organisms through cultural practices and good agricultural practices (GAP)

Crop rotation



Intercropping



Proper field sanitation and hygiene measures





IPM: Concepts

2. Use of **resistant** / **tolerant** varieties.

- Choice of variety and quality of seeds.
- Locally adapted varieties: stronger crops – more tolerant to pests.
- Healthy/ good quality seeds: healthy seeds are especially important for seed borne diseases, good quality seeds essential to grow strong crop.





IPM: Concepts

3. Protection and enhancement of beneficial organisms

- Each pest organism is part of a complex ecosystem and has a number of natural enemies (beneficial organisms).
- Beneficial organisms provide natural biological control (and pollination).
- Agricultural production should aim at enhancement and protection of beneficial organisms (biodiversity).

a) Conservation of natural habitats/retreat areas

b) Use non hazardous and gentle plant protection measures



e.g. treat only heavily infested parts of field.



Case Study from Malaysia

Biological control of field rats

Source: Ghazali Zakaria





IPM: Concepts

4. Decision making based on **knowledge, understanding, monitoring** and **economic thresholds**.

¿What is worth more, the yield that I might lose if I don't do anything - or the cost of a plant protection measure for example spraying?



Source: <http://thebatteryrecycler.com>



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Recognition of pests and natural enemies and understanding their interaction.



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Effect of pests on crop yield.



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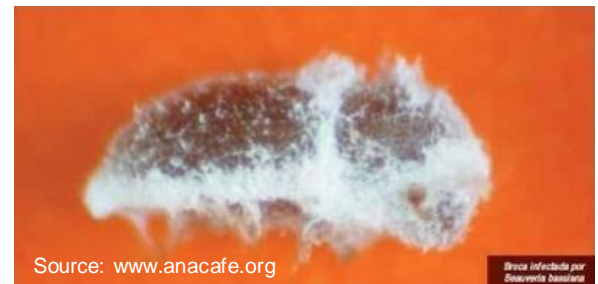
Effect of pesticides on natural enemies and consideration of available alternatives, how to apply, costs.



IPM: Concepts

5. Plant protection mechanisms (sustainable pesticide use as last resource)

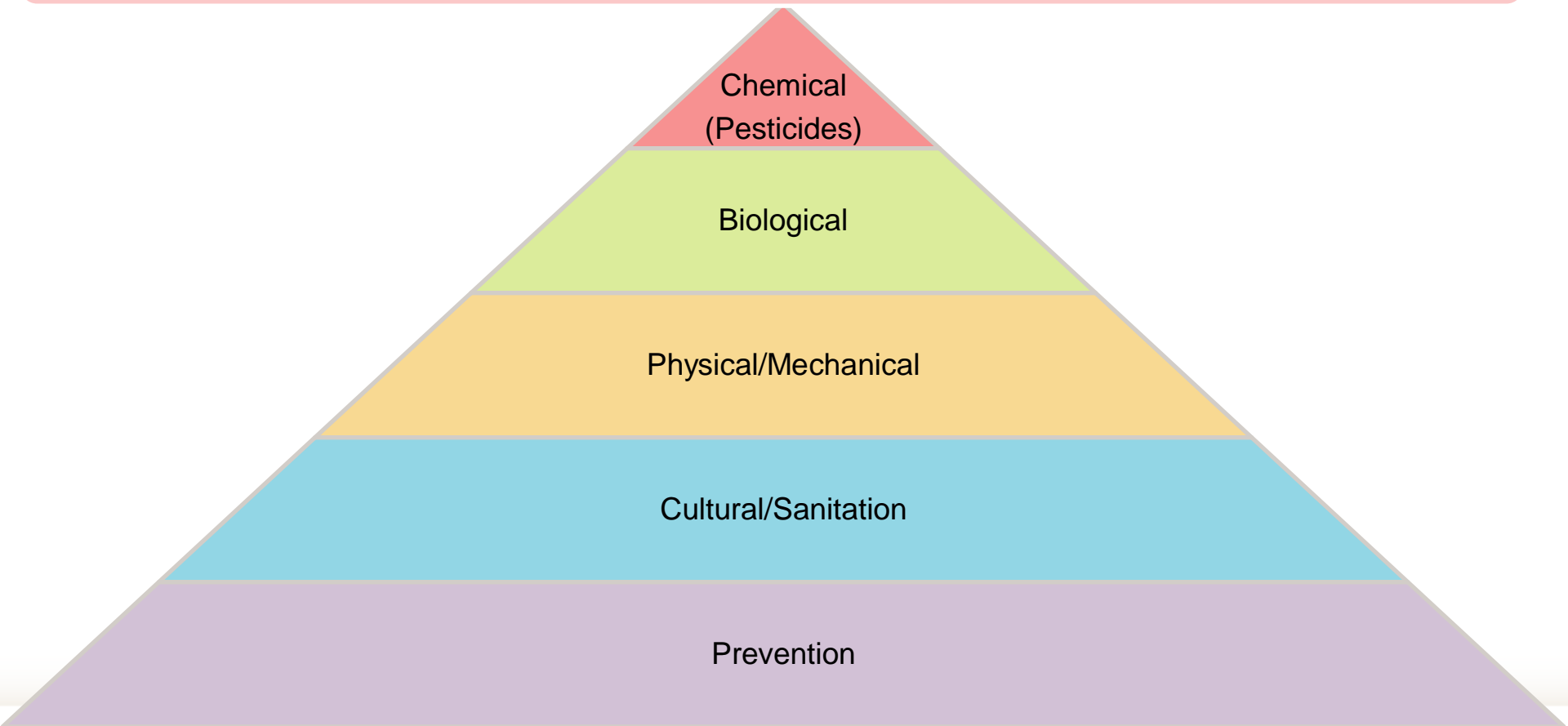
- Botanical pesticides (plant derived products).
- Behavioural control of insects (trapping with sex pheromones or plant derived attractants).
- Physical/mechanical techniques (mechanical weeding, insect nets, rat barriers and traps, hot water seed treatment).
- Biological control (predators, parasitoids, herbivores, pathogens, microbial pesticides).
- Chemical control → only as last resource!!!





IPM: Concepts

5. Plant protection mechanisms (sustainable pesticide use as last resource)





IPM: Concepts

5. Plant protection measures (sustainable pesticide use as last resource)

Efficient and safe use of pesticides:

- Consider GAP's
- Reduce pesticide dosage, frequency and limit treatment to infested areas
- Choose the best timing (crop stage - pest stage - weather conditions)
- Pesticide application equipment should work efficiently and properly



Conditions for sustainable plant protection



© Gisela Felkl



What is needed for applying sustainable plant protection?

- Building up and transferring knowledge! Communication is a key!
- Plant protection is complex
- Adapting/changing pesticide use philosophy
- Integrating the different available systems and methods (IPM)
- Adapting the applications into your particular context.
- Supporting research and innovation & developing alternative technologies



D. Jarvis. (www.flickr.com)



OISAT: Online Information Service for Non-chemical Pest management in the Tropics

http://www.oisat.org/fulltext_docs.php?category=field_guides&pos=0&what=pub_year&order=0

Visit also the website: <http://www.asean-agrifood.org/resources/>

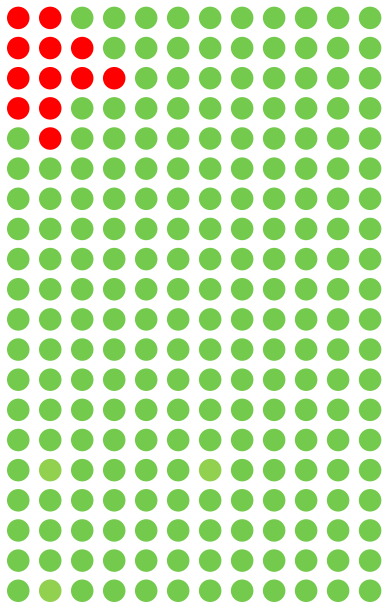
for downloading the ASEAN guideline for biological control agents (BCA)



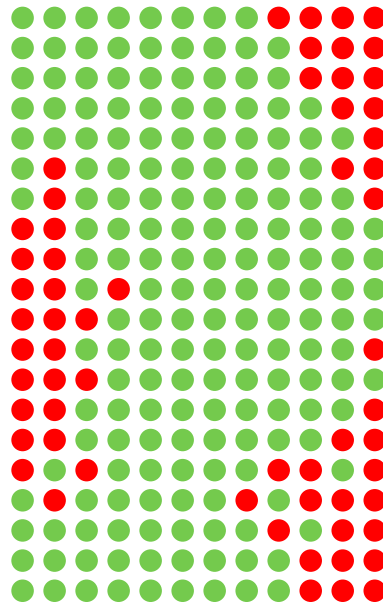
Incidence and Severity of disease infection

● = healthy plant ● = diseased plant

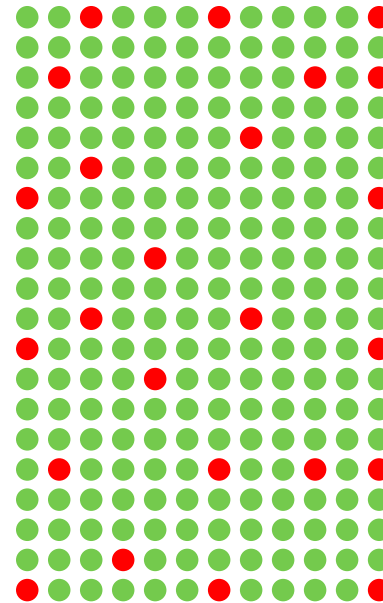
How severe is the infection?



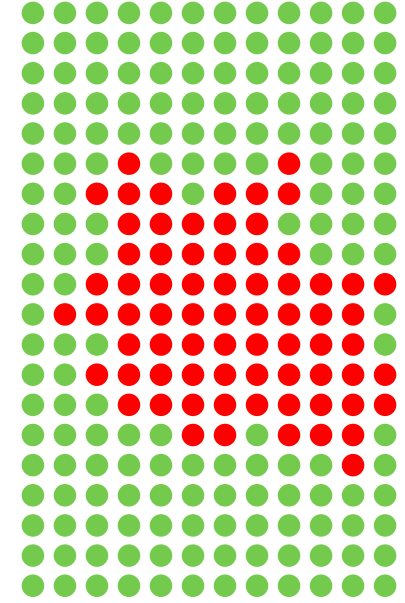
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30 %



Thank you!

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