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# Vegetable Industry Forum

# Basics of Integrated pest and disease management for protected cropping

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Division/CARDI

**7th September 2018, Grand Ballroom, Hotel Cambodiana**

THE CENTRE FOR GLOBAL FOOD AND RESOURCES | THE UNIVERSITY of ADELAIDE
NSW Department of Primary Industries
Charles Sturt University
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# Aim

Provide a basic understanding of the Integrated insect pest and disease management for protected cropping

- what is making the crop injuries?
- what can you do about it?
- is it worth doing something about?
- to understand your management options and needs

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# Disease or Disorder?

What is the difference?

**Disease** – generally caused by another organism (often not visible to the eye)

**Disorder** – generally caused by a lack of or over supply of something

- Not enough NUTRIENTS available (nitrogen, phosphorus, potassium)
- Lack of available WATER or too much water
- Chemical damage

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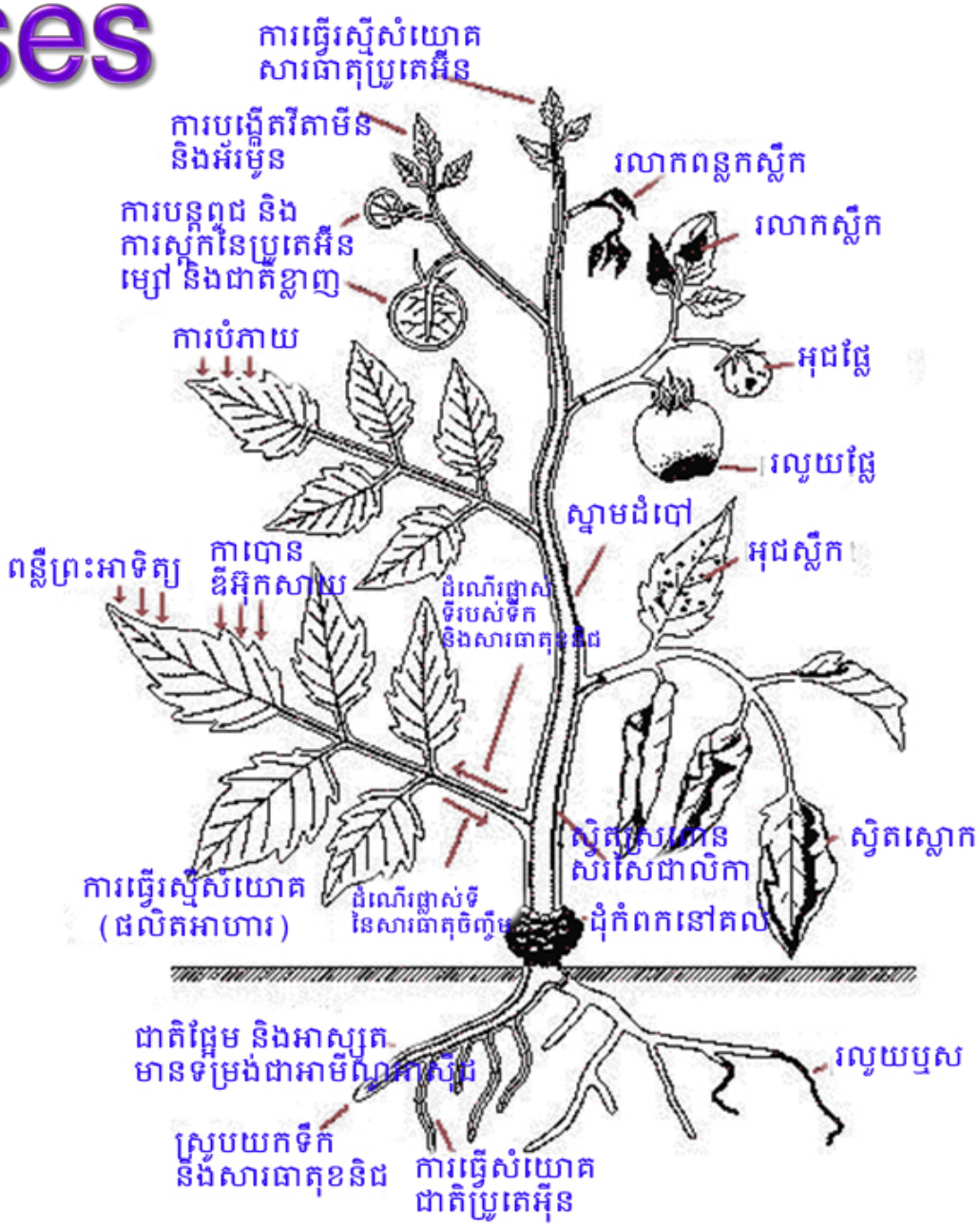
# Plant Diseases

Fungi

Bacteria

Viruses

Nematodes



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# Diagnosing a Disease

Why is it important to know the type of disease?

- Early detection may mean there is time to manage the problem
- Basic, cheap management will be possible
- Avoid applying unsuitable chemicals

**= SAVES YOU MONEY**

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# Diagnosing a Disease

- Identify the symptoms.
- Is it a problem caused by insects, diseases or management.
- Are all plants in the field affected? Are small areas in a field affected? Or an individual plants?
- Is there a pattern to the symptoms.
- The problems history.

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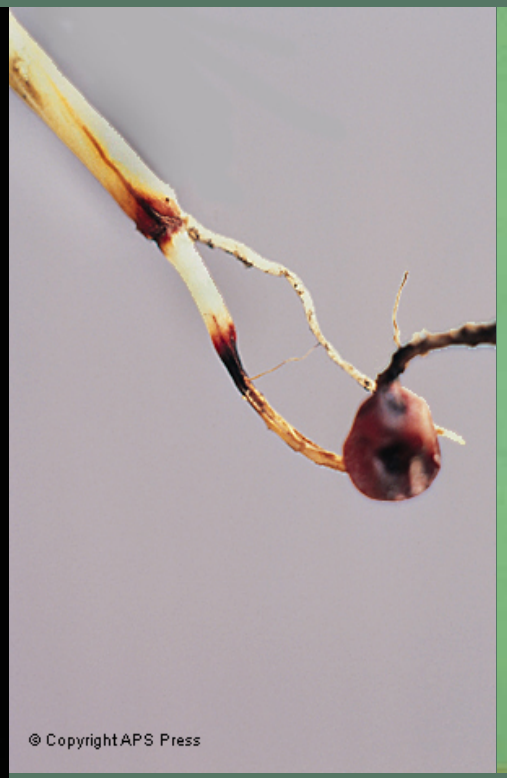




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ASEM 2012/081
Mid project review
13 – 14th June, Pakse

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# Fungi

- Responsible for about 85% of plant diseases
- Live in soil and on plant parts that are either alive or dead
- Most grow with tiny hair like structures called mycelium
- Many reproduce using spores – think of these as the fungal equivalent to plant seeds. Each spore can create a new fungal growth

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# Bacteria

- Cause about 10-20% of plant diseases
- Can not be seen with the eye
- Generally only enter the plant by natural or man made openings
- Like moist conditions
- Reproduce very quickly in the plant

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# Viruses

- Diagnosis difficult by symptoms alone
- Can not survive outside of plant or insect
- Spread via seed and planting material, MORE IMPORTANTLY many are spread by sucking insects – aphids, whitefly, plant hoppers
- Can not be seen without special microscopes

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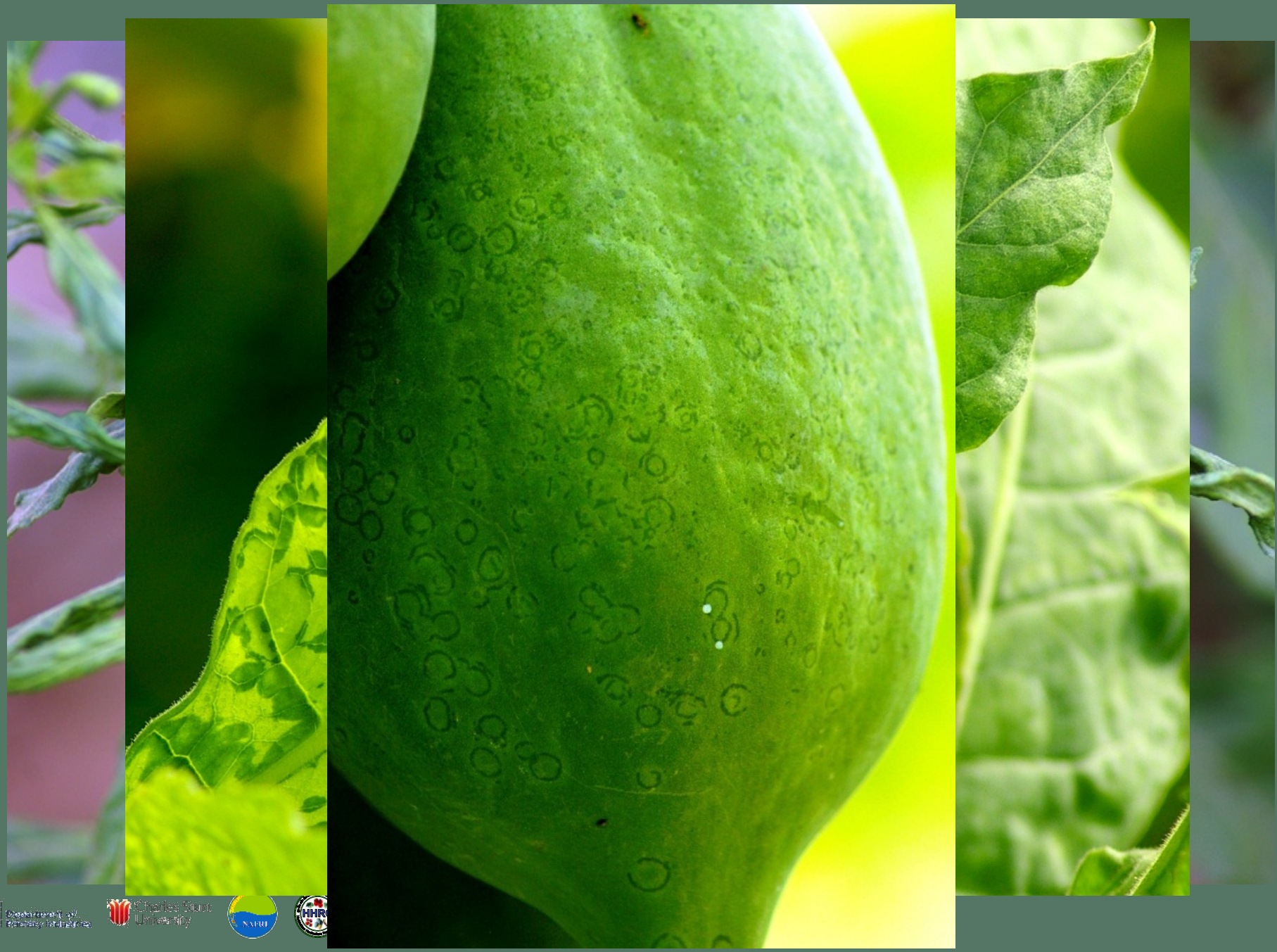

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# Nematodes

- Around 2500 plant parasitic species
- Live in the soil and water
- Generally no bigger than  1 mm in length
- Life cycle similar to insects
- Spread by wind, water, machinery, animals

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# Nematodes

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# Nematodes

http://fyi.uwex.edu/fieldcroppathology/2011/09/19/corn_nemato

http://agronomyday.cropsci.illinois.edu/2009/tours/d2real/

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# Monitoring For Disease

**early disease detection**

↓

**effective management**

↓

**improved profits**

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# General symptoms of insect pest damage to the crops

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# Types of insect pest damages

- **Chewing (ពួកទំពារ)**
  - beetles
  - grasshoppers
  - caterpillars

**Sucking (ចុចជញ្ជក់)**

- *Sucking Bugs*
- *Scales*

- **Rasping (បឺតជញ្ជក់)**
  - thrips
  - mites

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## Cucumber plants are susceptible to pests

- Cucumber Beetles
- Aphids
- Crickets
- Leafhoppers
- Thrips
- Grasshoppers

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# Understand the basic principles of insect pest and disease management

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# Farmers under pressure to

- produce more food from less land
- produce better quality food
- use less chemicals!

## កសិករតែងស្រមៃចង់សម្រេចឲ្យបាននូវការៈ

- ផលិតឲ្យបានច្រើនលើផ្ទៃដីតូច
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# Clarification……..

- *Not promoting the use of chemicals*
- *Not trying to stop the use of chemicals*

- **AIMING TO GIVE THE OPTIONS AND PROVIDE THE KNOWLEDGE FOR EFFECTIVE INSECT PEST AND DISEASE MANAGEMENT**

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# Strategies for IPM Management

- Reduce time the crop is exposed to insect pest and disease
  - planting time
  - time of maturity

  - Reduce initial insect pest and disease presence
    - quarantine
    - plant resistance
    - sanitation

    - Reduce rate of insect pest and disease spread
    - plant resistance
    - pesticides

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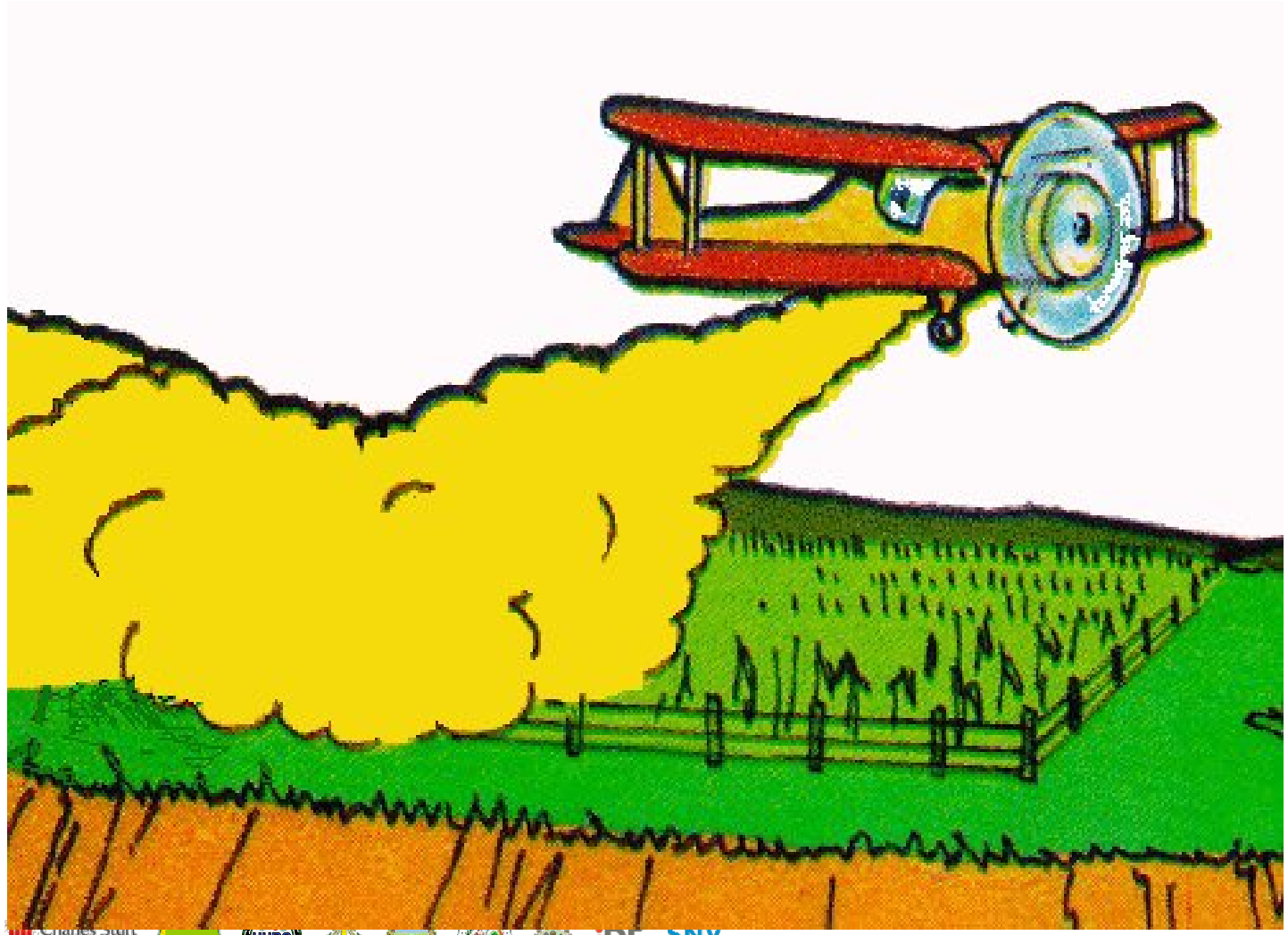
# Insect pest and disease Management are more than Spray and Pray



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# Insect pest and disease Management Options

1. Resistance- choice of crop variety
2. Cultural- crop rotation, resting fields, crop trash management, site preparation, irrigation
3. Physical- cutting ,pulling out plants
4. Exclusion- quarantine and sanitation
5. Biological- natural predators
6. Chemical- spraying, dipping

| | Resistance | Cultural | Physical | Exclusion | Biological | Chemical |
|---|---|---|---|---|---|---|
| Virus |  |  |  |  |  |  |
| Bacteria |  |  |  |  |  |  |
| Nematode |  |  |  |  |  |  |
| Fungi – soil |  |  |  |  |  |  |
| Fungi – air biotroph |  |  |  |  |  |  |
| Fungi – air necrotroph |  |  |  |  |  |  |

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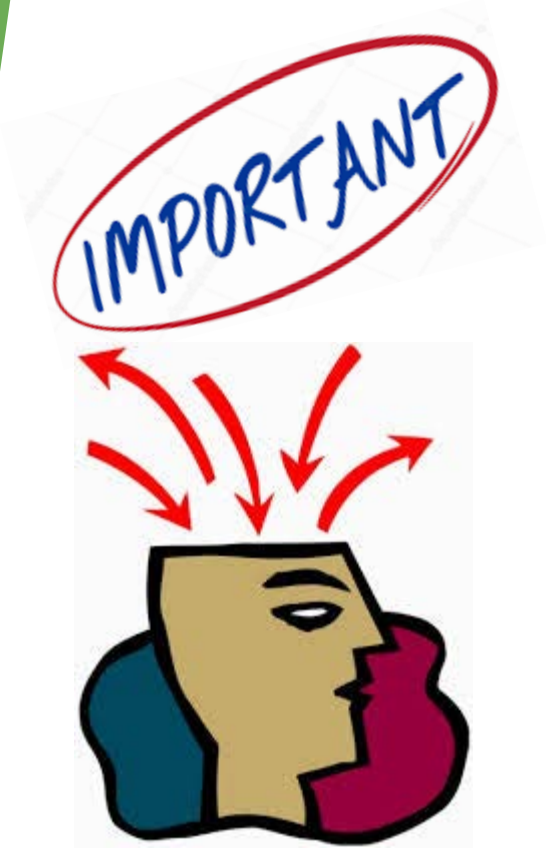
# Economic Advantage of Management




Economic Advantage

**Return if insect pest and disease is controlled** > [ **Return if insect pest and disease are not controlled** + **Cost of Control** ]

- By keeping records of previous crops you may be able to determine the economics for future crops

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# Plant Resistance

- Breeding programs to develop varieties resistant to insect  pest and disease
- Useful for limiting insect  pest and disease presence in following crop cycle
- Useful to limit insect  pest and disease spread

| | |
|---|---|
| **Virus** |  |
| **Bacteria** |  |
| **Nematode** |  |
| **Fungi – soil** |  |
| **Fungi – air biotroph** |  |
| **Fungi – air necrotroph** |  |

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# Cultural

- Operations in the field before, during and after the crop
- Used to reduce the initial insect pest and disease present
- Used to limit insect pest and disease spread

**Virus** 

**Bacteria** 

**Nematode** 

**Fungi – soil** 

**Fungi – air biotroph** 

**Fungi – air necrotroph** 

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# Cultural

- Reduce the initial insect  pest and disease present
  - Site preparation
    - cropping history
    - cultivation - deep burial of survival structures
    - better seed bed preparation reduces damping-off and other insects
    - weed removal
  - Planting material
    - choice of “clean” seed
    - sanitation in seedling production and transplant practices
  - Destruction of crop residues
    - crop trash removed or ploughed in
    - stubble ploughed in or burnt

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# Cultural

- Reduce the initial insect  pest and disease present
  - Manage weeds
    - removal during the growing season
  - Crop rotation
    - select varieties with increasing resistance
    - rotate unrelated crops (different family)

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# Cultural

- Limit insect  pest and disease spread
  - Sowing and harvesting practices
    - sowing time
    - spacing between row and plants
    - separate and destroy insect  pest and diseased fruit at harvest
  - Irrigation options
    - drip and flood is often better than overhead
  - Roguing
    - removal of infected plants
    - only in high economic value crops
    - conspicuous disease symptoms
    - limited dispersal mechanism of pathogen.

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# Cultural

Keep the crop happy and healthy

- nutrition
- soil pH
- irrigation

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# Physical Control

- Pruning
- Mulching
- Solarisation of soils

| | |
|---|---|
| Virus | ☹ |
| Bacteria | ☺ |
| Nematode | ☹ |
| Fungi – soil | ☺ |
| Fungi – air biotroph | ☹ |
| Fungi – air necrotroph | ☹ |

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# Exclusion

- Local, national and international operations to prevent the entry and establishment of insect pest and disease
- Important in reducing the initial insect pest and disease presence
- Important in limiting the spread of insect pest and disease

**Virus** 

**Bacteria** 

**Nematode** 

**Fungi – soil** 

**Fungi – air biotroph** 

**Fungi – air necrotroph** 

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# Exclusion

- Quarantine
  - Prevent the insect pest and disease from entering a field/district/Province
    - use planting material from reliable source
    - plant resistant varieties
    - report insect pest and disease outbreaks
    - controlled introduction of plants and planting material
  - Prevent a disease from escaping a crop
    - report insect pest and disease outbreaks
    - manage insect pest and disease outbreaks

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# Exclusion

- Sanitation
  - Prevent disease from entering or escaping a field
    - Avoid moving from insect pest and disease areas of the field to non- insect pest and disease areas. Clean any tools that have been used around or near infected plants.
    - Remove insect pest and diseased plant parts. Place them in a black plastic bag . Allow to dry in the sun for several days and then either dispose of AWAY from the field or burn.
    - Uproot and remove heavily insect pest and diseased plants from the field
    - Remove fruit/seed that has fallen to the ground
    - Remove crop debris straight after harvest

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# Biological Control

- The use of living organisms to suppress pest populations.
- Natural predators, parasites and pathogens
- Limiting the spread of insect pest and disease

**Virus** ☹

**Bacteria** ☺

**Nematode** 😐

**Fungi – soil** ☺

**Fungi – air biotroph** ☹

**Fungi – air necrotroph** ☺

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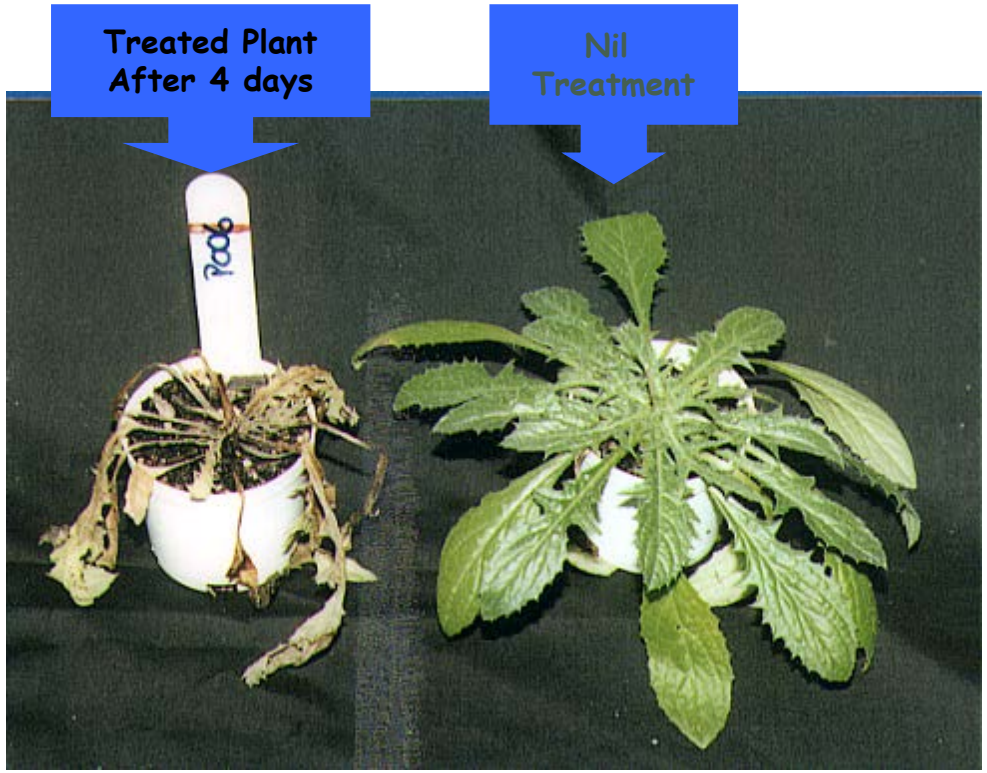
Not Treated

Treated

*Rhynchosporium* fungi controlling aquatic weed of rice




*Phomopsis* fungi controlling broadleaf thistle

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# Biological Control

- *Trichoderma*
  - Fungus often developed or used as a biocontrol agent
  - Common in soil
  - May control a range of fungi and bacteria

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# Chemical Control

- Herbicides, insecticides, fungicides
- Used to limit the spread of insect pest and disease
- Reality is fungi are the only disease causing organism effectively managed by chemical application

**Virus** ☹

**Bacteria** ☹

**Nematode** ☹

**Fungi – soil** ☹

**Fungi – air biotroph** ☺

**Fungi – air necrotroph** ☺

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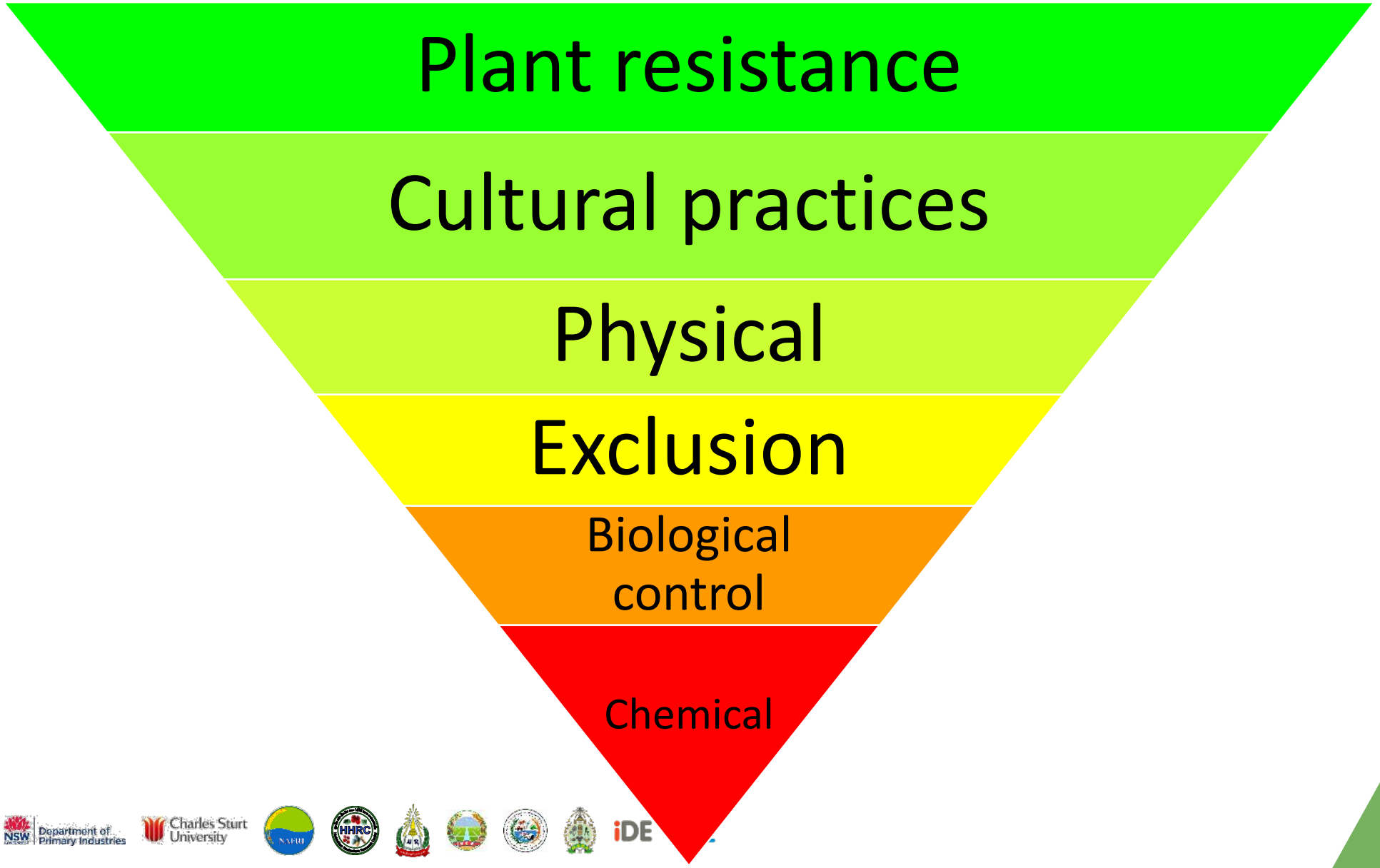
# Summary



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# Thank you very much

My word
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