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# Eco-friendly solutions for Pest and Disease Management in Sweet Potato

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Pests & Diseases

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Use of chemical Pesticides

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**HHPs**

## Impact of pesticides

**Human Health**

**Food Safety**

Pests & Diseases

Use of chemical Pesticides

**HHPs**

## Impact of pesticides

**Environmental toxicity**

Water & Ground water contamination

Soil Health affected

Pollution

Pests & Diseases

Use of chemical Pesticides

**HHPs**

**Impact of pesticides**

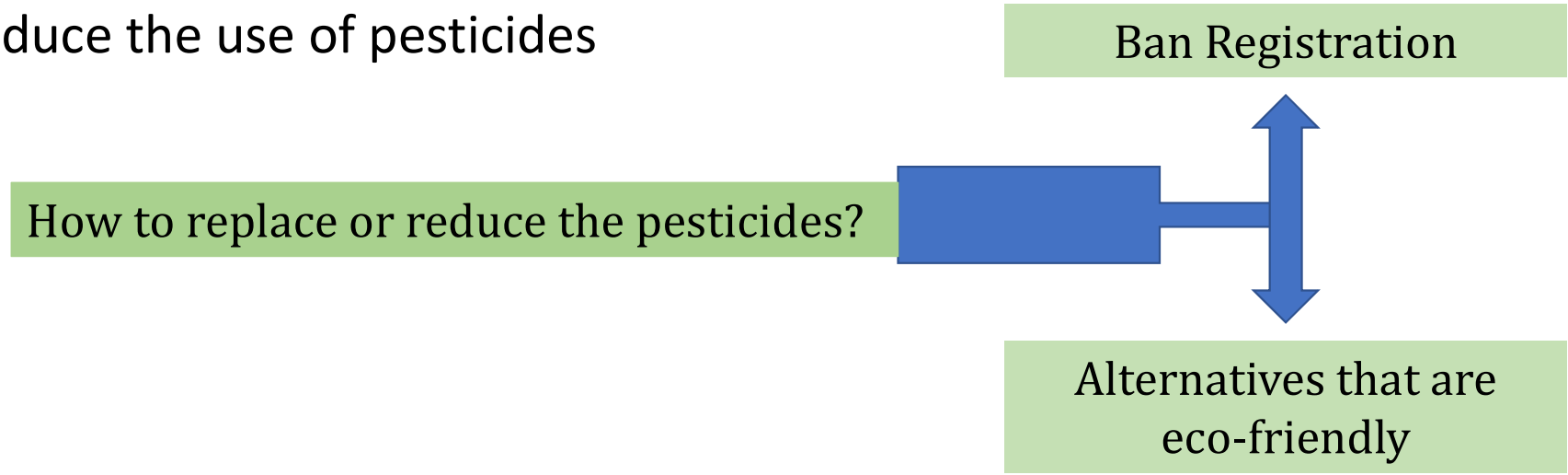
Trade impacts

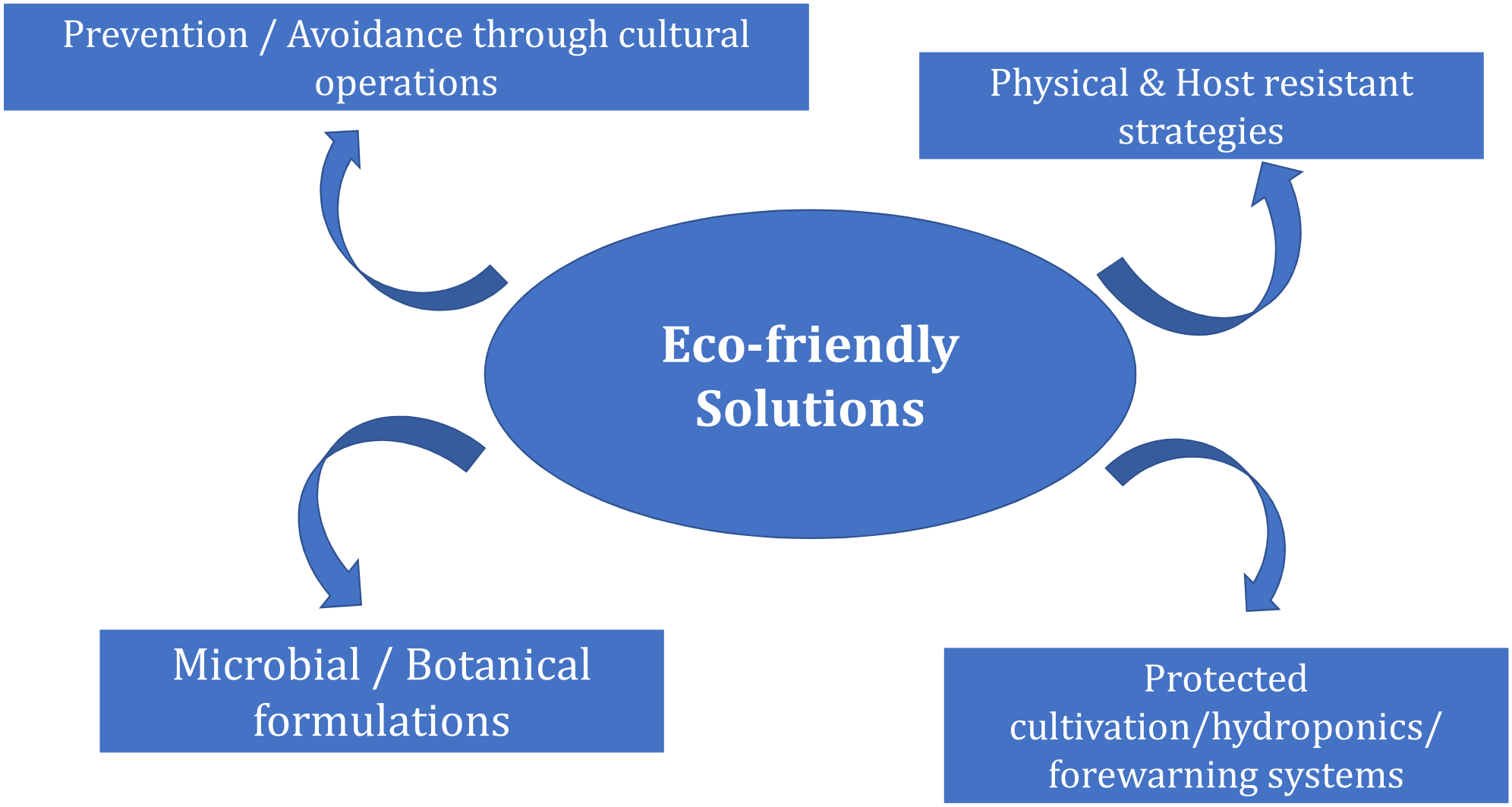
**Others**

Development of resistance

# Solutions:

- Replace the hazardous pesticides
- Reduce the use of pesticides




Prevention / Avoidance through cultural operations
Physical & Host resistant strategies
Eco-friendly Solutions
Microbial / Botanical formulations
Protected cultivation/hydroponics/ forewarning systems

# 1. Pre-planting techniques for pest/disease control

- Know the history of pest/disease incidence of the field
- Avoid SP infested field for planting of the crop again
- Practice soil solarization where field has the history of soil borne disease incidence.
- Wet the soil, cover with plastic tarp & allow for 6 weeks period
- A raised bed system is suitable for soil solarization.
- Soil solarization should be done before planting and during dry, long sunshine hours.

  - Effective against soil borne fungi/bacteria/ insects

# 1. Pre-planting techniques for pest/disease control

- Remove any plant debris or destroy if any infested plant materials left in the field before land preparation to avoid inoculum/propagules
  - Eg. 0.7 ton of plant debris can harbor 1 mill SPW
- Remove weed or volunteer plants from the field before planting as this could be a shelter/alternate host for SPW/soil/foliar pathogens
- Practice land preparation with deep ploughing to expose the soil borne fungi/bacteria/insects to sunlight
- Plant green manure crops before SP planting to improve soil aggregate, fix N and organic matter

Deep ploughing

Green manure – Sun hemp

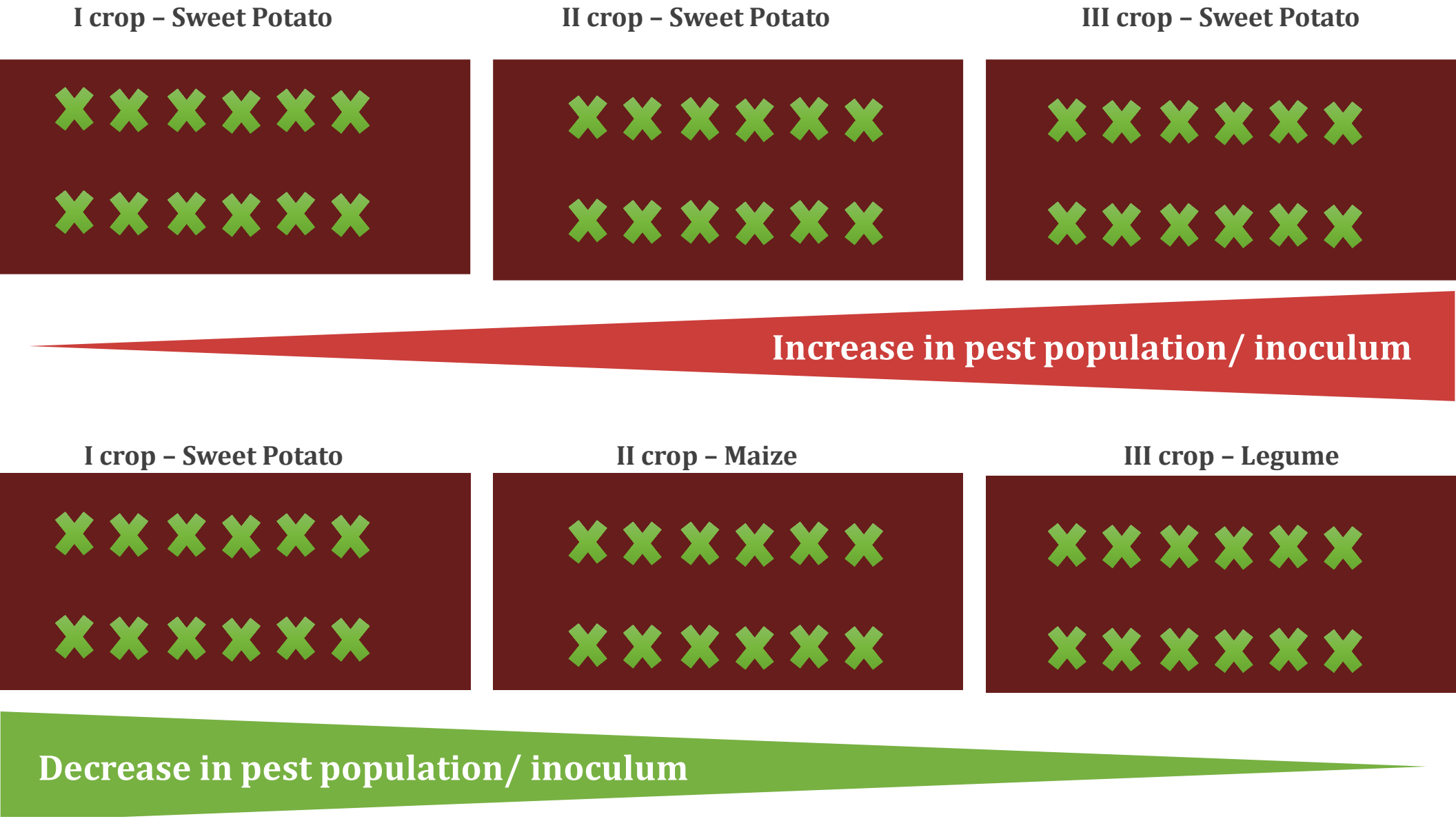
Removal of plant debris after harvest

# 2. Intercropping/Crop rotation with non host crops

- Avoid mono-culturing of sweet potato
- Mixed cropping with maize, colacasia (Taro), ginger, yam, bodi (cowpea) and sunflower
- 10 fold reduction in SPW damage was noted in India
- Follow crop rotation with non-host crops
- Avoid continuous rotation with host crops that has same infestation and pathogens

  Eg. Potato/Onion/Lettuce/Tomato/Sweet Pepper


Farm level


I crop – Sweet Potato
II crop – Sweet Potato
III crop – Sweet Potato
Increase in pest population/ inoculum
I crop – Sweet Potato
II crop – Maize
III crop – Legume
Decrease in pest population/ inoculum

# 3. Source and plant healthy, pest & disease free slips

Ensure that slips are healthy and free from diseases, insect pests, virus vectors
Young vines are better than old ones

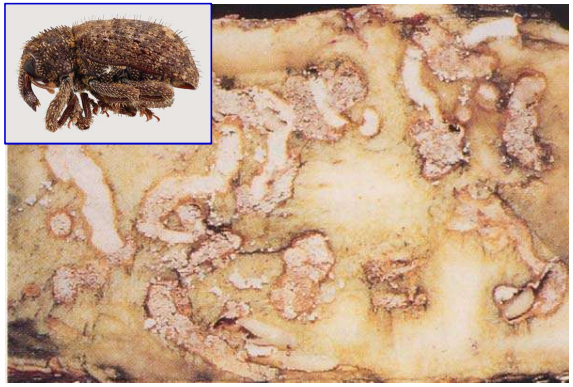
- Ensure the source field is free from pests/disease
- Younger vines are less infested than the older ones

Ensure slips are free from pests/diseases
Eg. Weevil free vines is the first step of managing SPW

Look for insect pests (aphids, whiteflies) on seedlings mainly on lower surface leaves - Virus

# 4. Regular monitoring and understanding of damages caused by insects and diseases

Weevil Damage – Photo Credit J. Smith



WI Weevil Damage – Jane O Sullivan

Key understanding on:
- Where does it come from?
- When and How it affects the crop?
- How serious is the pest/ disease?

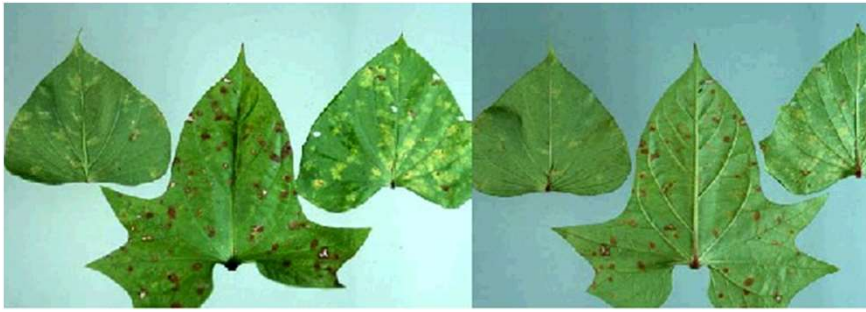
Knowledge on the life cycle and damage caused by major pests

**Borers & Leaf feeders**
Sweet Potato Weevil – *Cylas formicarius*
West Indian sweet potato weevil - *Euscepes postfasciatus*
*Root Grub - Phyllophaga*
*Stem Borer - Megastes grandalis*

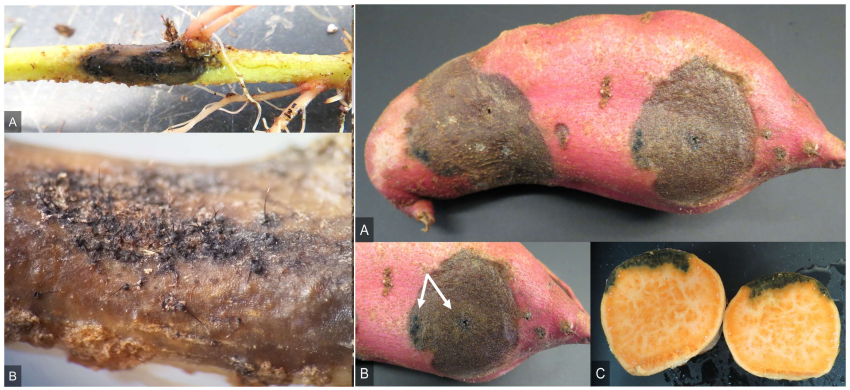
**Sucking insect pests (also vectors for virus)**
-White flies
- Aphids

# 4. Regular monitoring for diseases throughout the cropping period


Leaf spots – Phyllosticta, Alternaria, Colletotrichum



White rust – *Albugo Ipomea* (Dr Clarke – LSU)




Black rot (*Ceratocystis fimbriata*) - Plant Health Progress, APS 2019

Rhizopus rot – Postharvest

**Diseases caused by fungal pathogens including wilt**

# 4. Regular monitoring for diseases throughout the cropping period

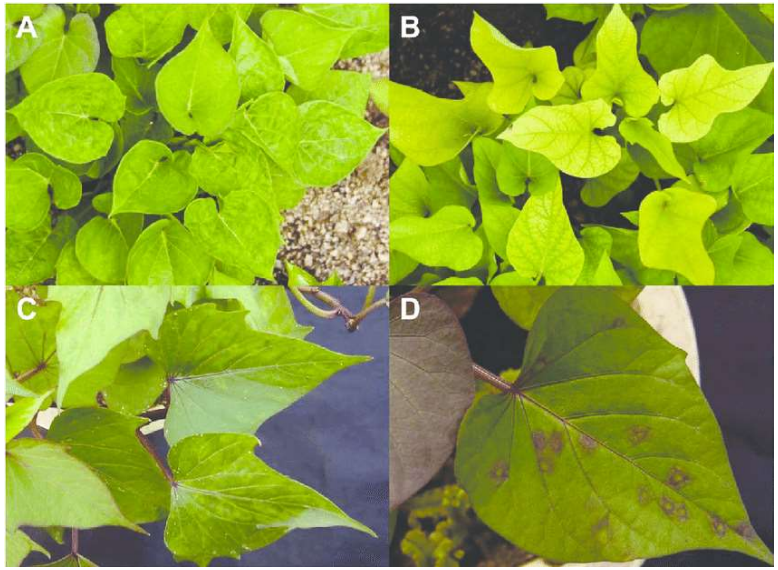
**Bacterial diseases**

- Bacterial soft rot – *Erwinia (Dcikeya) chryasanthemi*
- Bacterial wilt – *Ralstonia solanacearum*
- Soil borne pathogens

Soft rot Samsonn et al., 2005

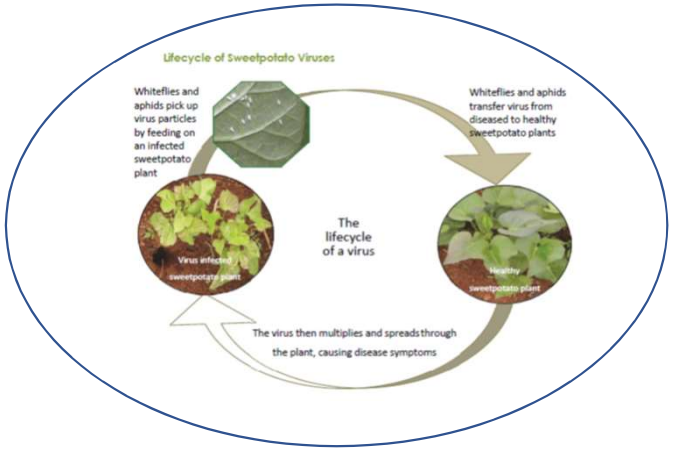
**Viruses diseases**

- Sweet potato feathery mottle virus (aphid)
- Sweet potato chlorotic stunt virus (white fly)
- Sweet potato virus complex

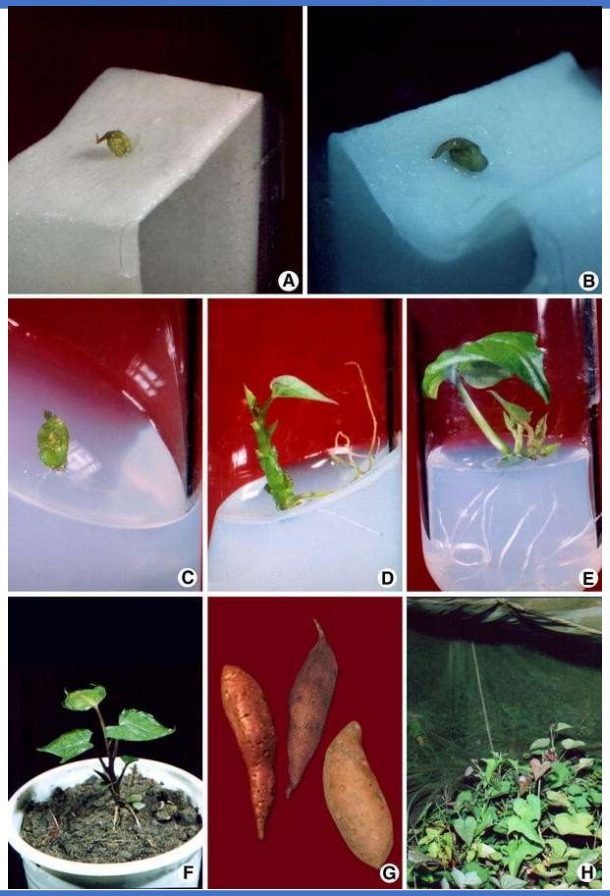




Virus - (A) mottle and puckering; (B) Chlorosis and vein banding; (C) chlorotic ring spot; (D) chlorotic local lesion and purpling in a cultivated field - Hae-Ryun Kwak et al., 2015

# 5. Production of quality & virus free planting materials in sweet potato through certification




- Meristematic culture is a technique of producing disease free plants from the meristem/apical cells/actively growing cells using tissue culture
- Viral diseases elimination through meristem culture in sweet potato is considered as low cost option towards commercialization of producing and supplying to farmers.
- Development of certification system for virus free production is one of the key solutions for virus management in sweet potato




**a** apical meristem
**b** Primary shoots initiation

**c** Shoot with primary
**d** Plantlet development
**e** Multiplication of plantlets

**f** Acclimatization
**g** Storage root
**h** Meristem-derived plantlets

Alam et al, 2013

Agriculture Ministry & Pvt Entrepreneurs

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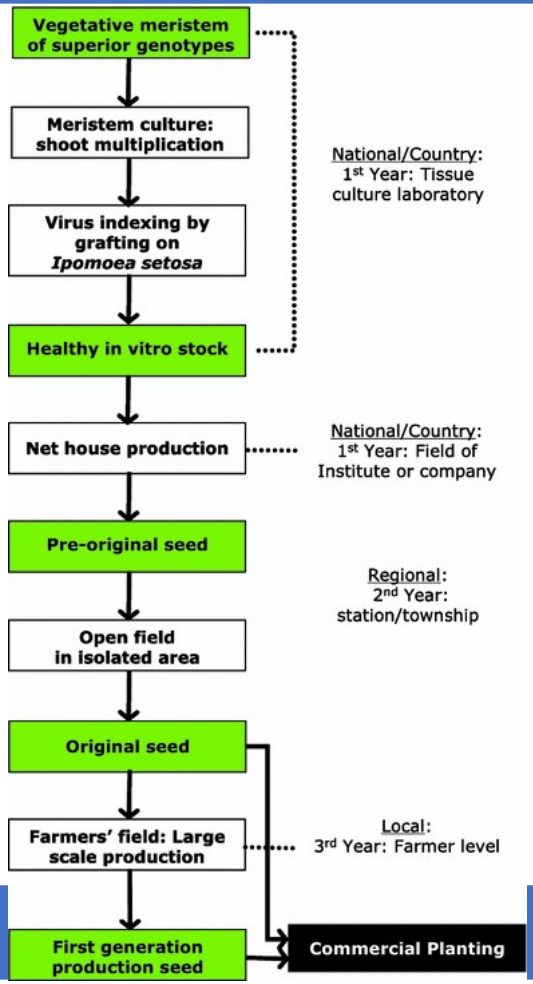
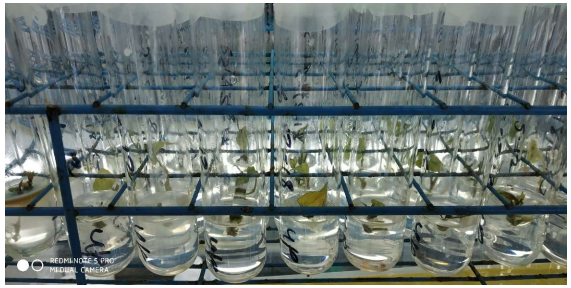
- Development of certification system for virus free production is one of the key solutions for virus management in sweet potato

Alam et al, 2013



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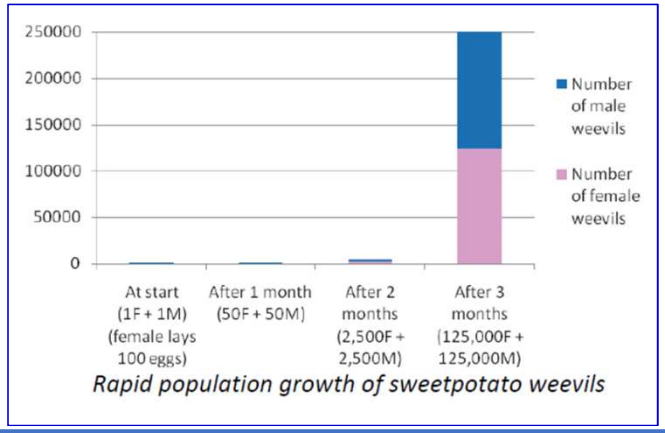
# 6. Field sanitation / Avoid injury to roots /Avoid pre-disposition for pest & disease development

- Maintain field free from weeds
- Mulching to conserve moisture and avoid weeds
- Avoid injury to root – bacterial pathogens
- Irrigation to avoid cracking of soil that favour laying by SPW
- Avoid sprinkler irrigation in the evening hours
- Avoid high density and overcrowding of plants
- Proper disposal of plant debris/farm wastes




*Rapid population growth of sweetpotato weevils*

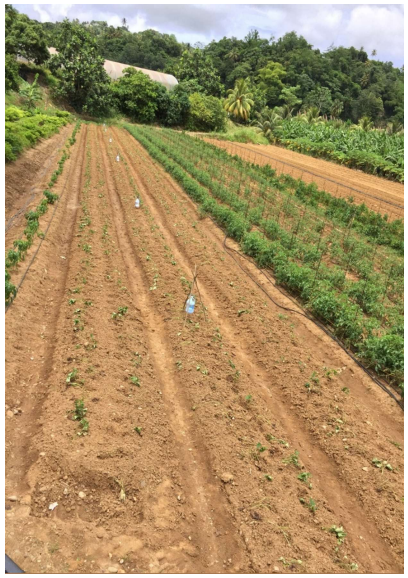
Farm level

# 7. Pheromones for insect monitoring and trapping

Monitoring of insect (SPW)

Mass trapping of insect

Use of Pheromone was effective in reducing SPW in St Lucia –(J Smith)

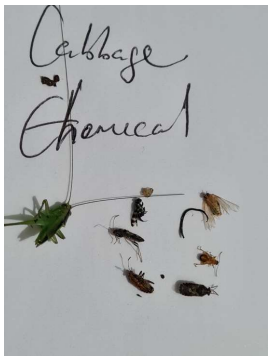


- Effective in reducing damage of SPW from 80% to 20%
- Sex and aggregating pheromones used – 15-20 /acre
- Sterile Insect Technique – recent studies which identified a chemical from male adult of SPW has mating unreceptivity by female insect

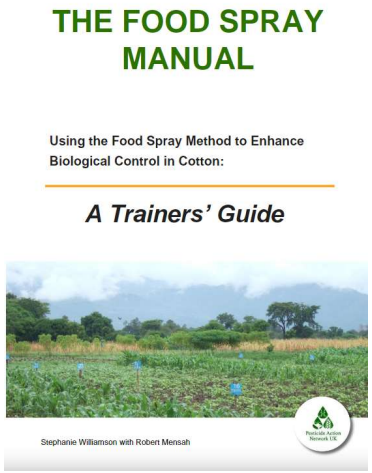
Farm level

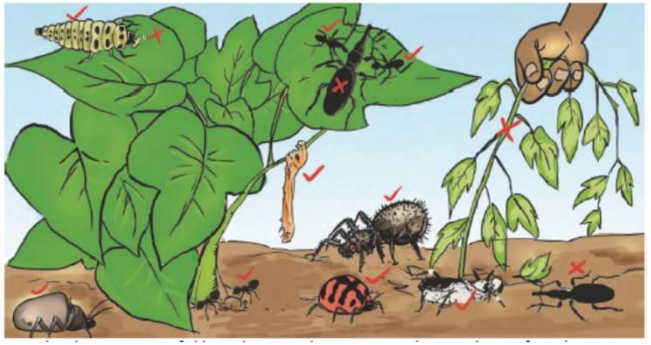
# 8. Food Spray Technique to attract natural enemies of pests

- Use of pheromones with attracting natural enemies.
- This is mainly to attract natural enemy population
- Enhanced growth was noticed in tested crops







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# 9. Microbial & Botanical formulations for pest & disease management

**Insect management**

- *Bacillus thuringiensis*
- Entomopathogenic fungi
  - *Beauveria*
  - *Metarrhizium*

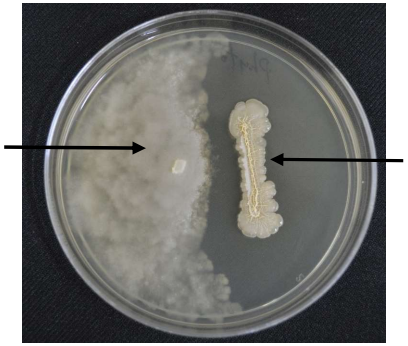
**Disease management**

- *Bacillus subtilis*
- *Bacillus amyloliquefacines*
- *Trichoderma*
- VAM

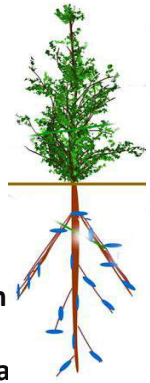
**Neem / Azadirachtin formulations**

Biological control of plant pests/diseases and development of formulations

**Plant disease causing fungi**



**Plant Growth Promoting Rhizobacteria**



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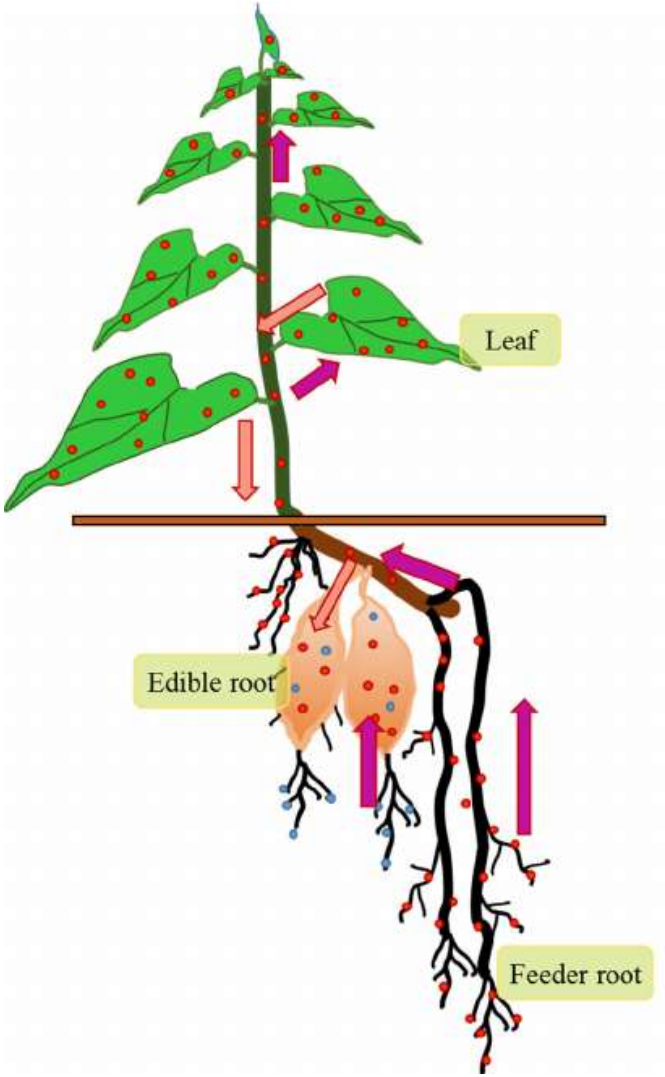
Developed the bio-product after series of experiments



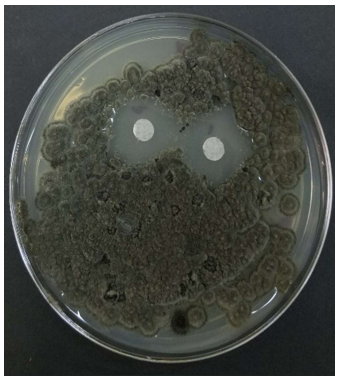
# How does the biocontrol act against pathogens?

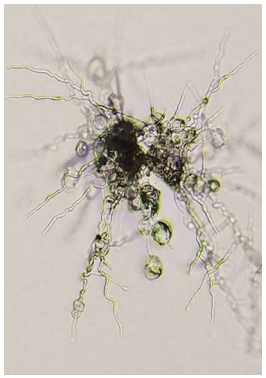
**Growth promotion**
Growth promoting genes
- Phytohormones
- Mitigation of stress

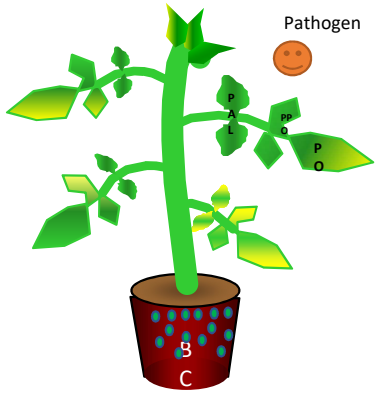
**Antagonism**
- Antibiosis
- Lipopetides

**Lytic enzymes**
- Chitinase
- β1,3-glucanse

**Induction of defense enzymes**
& responses in plants against diseases







# Summary

| Prevention / Avoid disease through farm operations | Mass trapping | Host resistance | Biologicals |
|---|---|---|---|
| Pre-planting field preparation<br>Disease free seeds & seedlings<br>Field sanitation<br>Early identification of diseases<br>Avoid pre-disposition conditions | Use of pheromones & FS Techniques | Identify resistant varieties | Microbial based pesticides<br>Botanical based pesticides |

More & combined use of environment friendly practices will assist in accomplishing sustainable management of PLANT HEALTH in SWEET POTATO


Thank you...