IPM Tactics for Vegetable Crops in Indonesia

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Outline of Presentation

- Major Pests and Diseases
- IPM Tactics: Cultural Control
- IPM Tactics: Biological Control
- IPM Tactics: Chemical Control
- IPM Demonstration Plots
Crucifers: Major Pests and Diseases

- Clubroot
  - Mostly in acid soil
  - Damage increases when seedling infected at early stage

- Cabbage webworm and diamondback moth
  - Mainly during dry season
Onion: Major Pests and Diseases

- Beet Armyworm *Spodoptera exigua*

- Leafminers *Liriomyza* (exotic)
  - *L. huidobrensis* (1994)
  - *L. chinensis* in (2000)
Chilli Pepper: Major Pests and Diseases

- Viruses
- Anthracnose
Tomatoes: Major Pests and Diseases

- Viruses

- *Phytophthora infestans*

- *Helicoverpa armigera*
Soil liming for clubroot

- To increase soil pH
- 2 – 4 ton / ha about a month before transplanting
- Provide unfavorable environment for *Plasmodiophora brassicae* causing clubroot in crucifers
Use of “fresh soil” and elevated seed bed

- Fresh soil obtained from uncultivated land is free from disease inoculum
- Elevated seed bed avoids contact with soil pathogens
- Important for reducing clubroot in crucifers
IPM Tactics: Cultural Control

- Plastic mulching
  - Conserving soil moisture
  - Controlling weeds
  - Repelling some insect pests
  - Better plant growth
IPM Tactics: Cultural Control

- **Hand-picking**
  - Collecting egg masses and larvae of *Spodoptera exigua* in shallot
  - Common practices in Brebes (Central Java)
  - Conducted in the morning (07-11 am) by women labors while weeding

- Hand-picking egg masses and larval cluster of cabbage webworm
To protect chilli pepper and tomato seedlings from early infestation by insect vectors

- **Screened-seed bed**
Screen enclosure

- Practiced by shallot farmers in Probolinggo (East Java) to protect from *Spodoptera exigua* infestation
- Cost: Rp 21,977,500 / ha
- Can be reused for 6 growing seasons
- Cost: Rp 21,977,500 / ha or Rp 4,162,917 / ha/season
- Cost of insecticides: Rp 7,561,500/ha/season
- Environmental and health costs of pesticides

(Source: Arif Kurniadi. Agriculture Service Extension Probolinggo, East Java)
IPM Tactics: Cultural Control

- Yellow sticky trap
  - Mass-trapping leafminer flies in onion
Mass-trapping *S. exigua* moths are practiced by shallot farmers in Brebes (Central Java)

“Village business opportunity”: Rental Generator
Other cultural control tactics

- Crop rotation, crop sanitation
- Use of fermented compost (bokashi)
  - Improving soil quality
  - Improving soil health
  - Better plant growth
- Bamboo staking
  - New practice in potato
Use of Parasitoids

- Introduction of *Diadegma semiclausum* to control DBM in early 1950s
- Established and very successful (up to 96% parasitization)
- Use selective microbial insecticides to conserve parasitoids
IPM Tactics: Biological Control

- **Use of *Trichoderma harzianum***
  - Farmer training on *Trichoderma* propagation
  - Farmer level production of *Trichoderma*
**IPM Tactics: Biological Control**

- **Use of *Trichoderma harzianum***
  - Applied by farmers especially to control club root in crucifers
  - Also used on other vegetable for controlling soil pathogens

Effects of *Trichoderma* Application on Cost, Revenue and Profit

- **Cost**
  - With *Trichoderma*: 2
  - Without *Trichoderma*: 4

- **Revenue**
  - With *Trichoderma*: 8
  - Without *Trichoderma*: 6

- **Profit**
  - With *Trichoderma*: 6
  - Without *Trichoderma*: 2

Millions / 2,000 m² / season
IPM Tactics: Biological Control

- Use of plant growth promoting rhizobacteria
  - *Pseudomonas flourescens*
  - *Bacillus subtilis*
Use of Nuclearpolyhedrovirus

- SeNPV was discovered from Cimacan (West Java) during previous Clemson/USAID Palawija IPM Project

- Mass-produced by farmer using S. exigua larvae from hand-picking
- **Use of Nuclear polyhedrosis virus**

  Yields of shallots treated with combinations of SeNPV, insecticides, and hand-picking

  ![Graph showing yields of shallots](image)

  Economic impacts of using SeNPV

  ![Graph showing economic impacts](image)

  **IPM Tactics: Biological Control**

  - Use of SeNPV
  - Use of insecticides
  - Hand-picking
Use of Nuclear polyhedrosis virus

- Small-scale commercial production of SeNPV by a local NGO
IPM Tactics: Botanical Control

- Botanical pesticides
  - Preparing plant extracts for pesticides
  - Preparing pesticide from neem kernel
**IPM Tactics: Microbial Control**

- **Bt applied to cabbage**

*Crocidoloma pavonana*: Cluster caterpillar

- Lambda cyhalothrin
- Bt
- Check

*Plutella xylostella*: Diamondback moth

- Lambda cyhalothrin
- Bt
- Check
Additional IPM Tactics
- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis, Pseudomonas flourescence*
- Lower rates of synthetic fertilizers
- Hand-picking and botanical extracts for the control of caterpillar pests.

Results: IPM vs Farmer Practices
- Yield: 491 kg vs 510 kg
- Cost: Rp 824,000 vs Rp 1,544,000
- Net income: Rp 1,140,000 vs Rp 496,000
Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis*, *Pseudomonas flourescence*
- Lower rates of synthetic fertilizers
- Plastic mulch
- Screened-seed bed

Results: IPM vs Farmer Practices

- Yield: 12,295 kg/ha vs. 10,305 kg/ha
- Cost: Rp 2,484,000 vs Rp 2,082,500
- Net income: Rp 15,958,500 vs Rp 12,665,000
**Chilli pepper**

**Additional IPM Tactics**
- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis, Pseudomonas flourescence*
- Lower rates of synthetic fertilizers
- Plastic mulch
- Screened-seed bed

**Results: IPM vs Farmer Practices**
- Yield: 1,525 kg/ha vs. 1,025 kg/ha
- Cost: Rp 2,693,600 vs Rp 2,749,200
- Net income: Rp 12,250,000 vs Rp 7,500,600
Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis, Pseudomonas flourescence*
- Lower rates of synthetic fertilizers
- Hand-picking egg masses & caterpillars

Results: IPM vs Farmer Practices

- Yield: 505 kg/ha  vs. 480 kg/ha
- Cost: Rp. 1,604,000 vs 1,599,500
- Net income: Rp 416,000 vs. 320,000
Thank You