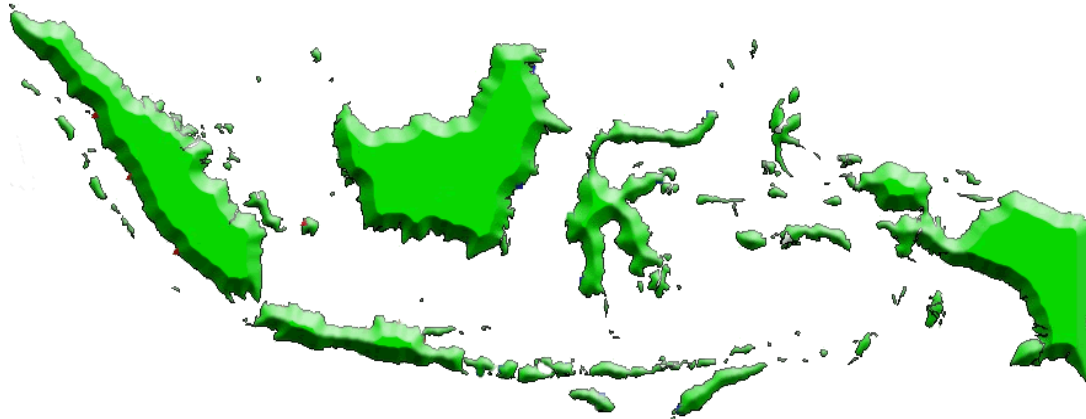


# IPM Tactics for Vegetable Crops in Indonesia

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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*





# IPM Tactics: Cultural Control

## ❑ 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



# IPM Tactics: Cultural Control

## ❑ 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





# IPM Tactics: Cultural Control

## ❑ Screened-seed bed

- To protect chilli pepper and tomato seedlings from early infestation by insect vectors



# IPM Tactics: Cultural Control

## ❑ 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 Extention Probolinggo, East Java)



# IPM Tactics: Cultural Control

## ☐ Yellow sticky trap

- Mass-trapping leafminer flies in onion



# IPM Tactics: Cultural Control

## □ Light traps

- Mass-trapping *S. exigua* moths are practiced by shallot farmers in Brebes (Central Java)
- “Village business opportunity” : Rental Generator





# IPM Tactics: Cultural Control

## ❑ Other cultural control tactics

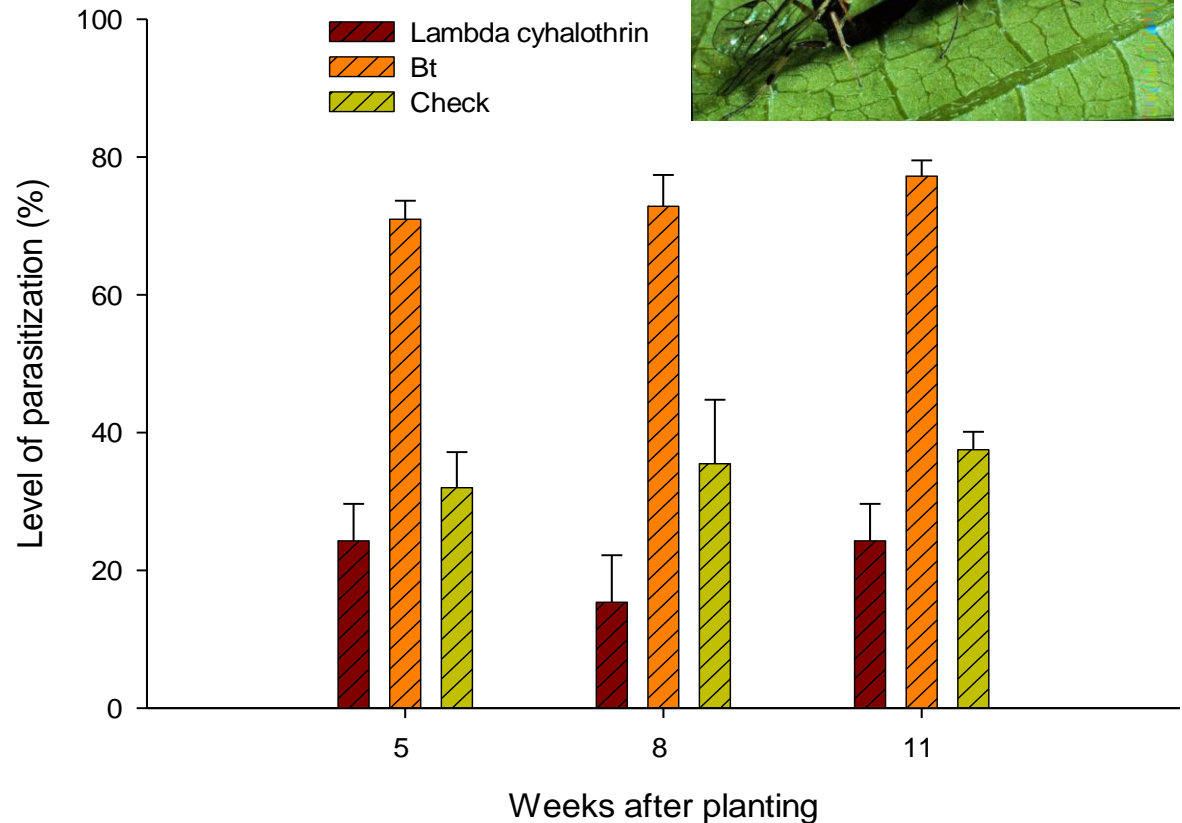
- Crop rotation, crop sanitation
- Use of fermented compost (bokashi)
  - Improving soil quality
  - Improving soil health
  - Better plant growth
- Bamboo staking
  - New practice in potato



# IPM Tactics: Biological Control

## □ 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*

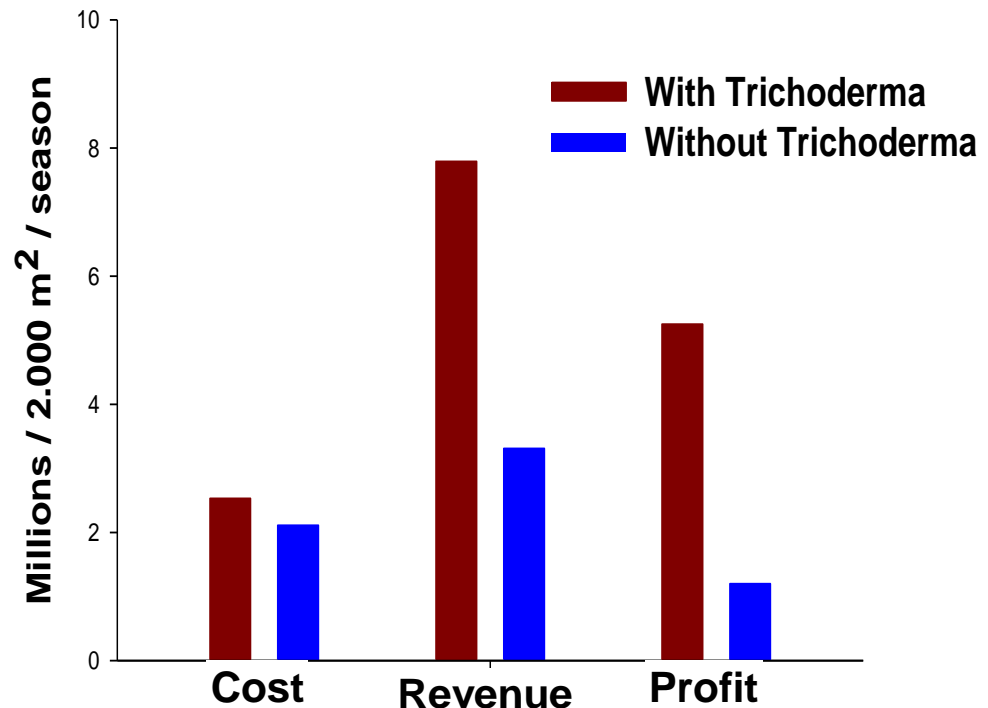


# IPM Tactics: Biological Control

## □ Use of *Trichoderma harzianum*



Effects of Trichoderma Application on Cost, Revenue and Profit



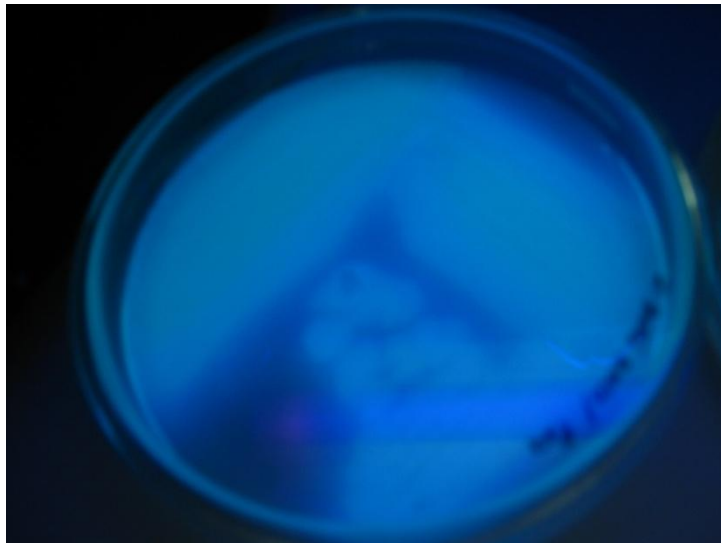
- Applied by farmers especially to control club root in crucifers
- Also used on other vegetable for controlling soil pathogens



# IPM Tactics: Biological Control

## □ Use of plant growth promoting rhizobacteria

- *Pseudomonas flourescens*
- *Bacillus subtilis*



# IPM Tactics: Biological Control

## □ 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

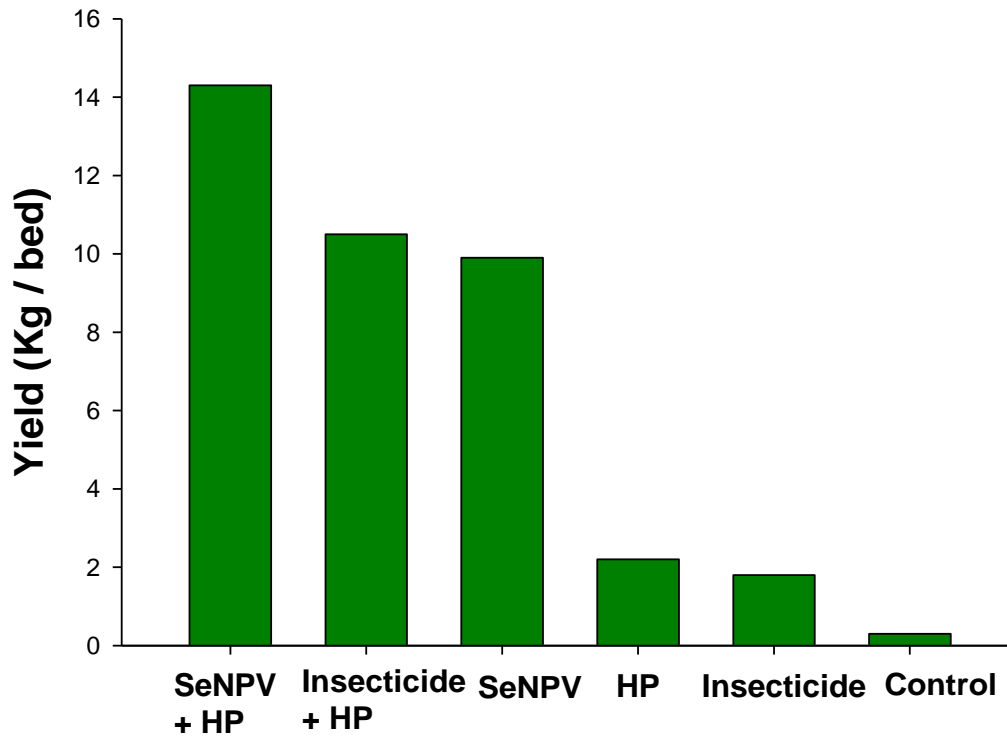




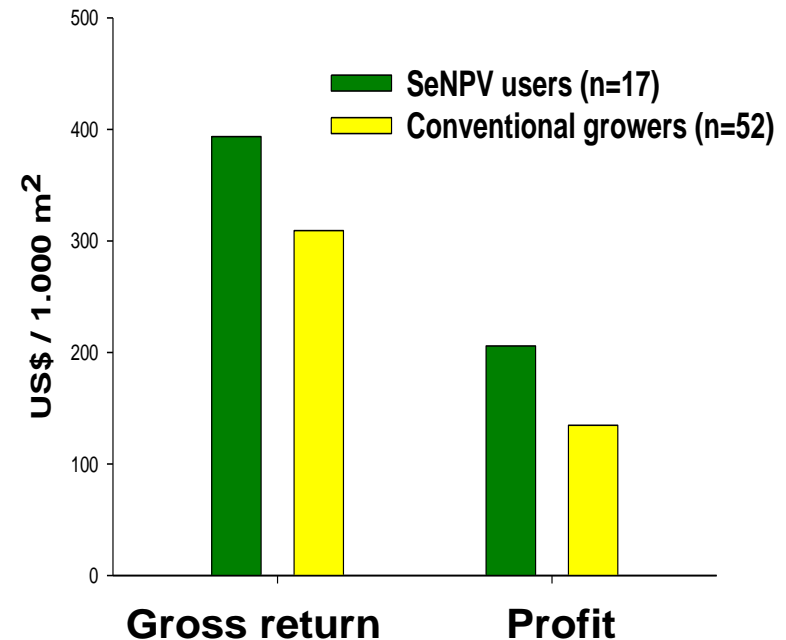
# IPM Tactics: Biological Control

## ☐ Use of Nuclear polyhedrosis virus

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



Economic impacts of using SeNPV



# IPM Tactics: Biological Control

## ❑ Use of Nuclear polyhedrosis virus

- Small-scale commercial production of SeNPV by a local NGO



**NATURAL VIREXI**  
AGENS HAYATI PENGENDALI ULAT GRAYAK

**CIRI ULAT GRAYAK :**

1. Ulat muda berwarna hijau
2. Ulat dewasa (*S. exigua*) hijau tua dan *S. litura* coklat kehijauan
3. Terdapat garis hitam melingkar pada ruas perut pertama (*S. exigua* samar dan *S. litura* jelas)
4. Terdapat garis kuning/putih memanjang sepanjang tubuh
5. Terdapat bulatan/bulan sabit hitam pada bagian belakang kanan perut sepanjang tubuh

**MENGAPA VIREXI**

1. Efektifitas sangat tinggi terhadap ulat grayak (*Spodoptera exigua*)
2. Tidak mengganggu musuh alami lain
3. Mudah menyebar
4. Aman bagi manusia, hewan dan lingkungan
5. Mendukung pertanian berkelanjutan

**SASARAN**

Spesifik/khusus: Ulat grayak (ulat tentara) *Spodoptera exigua* pada tanaman Bawang Merah, Bawang Daun, dan Bawang Putih.

**MEKANISME INFEKSI**

**PETUNJUK PENGGUNAAN**

1. Bersihkan tangki semprot dari pestisida kimia.
2. Larutkan 1 sachet (bungkus) VIREXI dalam 15 liter air, aduk sampai merata dan masukkan dalam tangki semprot.
3. Semprotkan pada seluruh bagian tanaman.
4. Penyemprotan sebaiknya sore hari.
5. Untuk pemeliharaan tanaman semprotkan setiap seminggu sekali.

**PERINGATAN**

1. Jangan dicampur dengan pestisida.
2. Simpan ditempat yang sejuk (suhu 20° - 30° C) dan terlindung dari sinar matahari langsung.

**Ramah Lingkungan**  
ISI : 5 Sachet @ 20 gram  
Konsentrasi : 1,5 x 10<sup>10</sup> PIBU/gram

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# IPM Tactics: Botanical Control

## ☐ Botanical pesticides

- Preparing plant extracts for pesticides



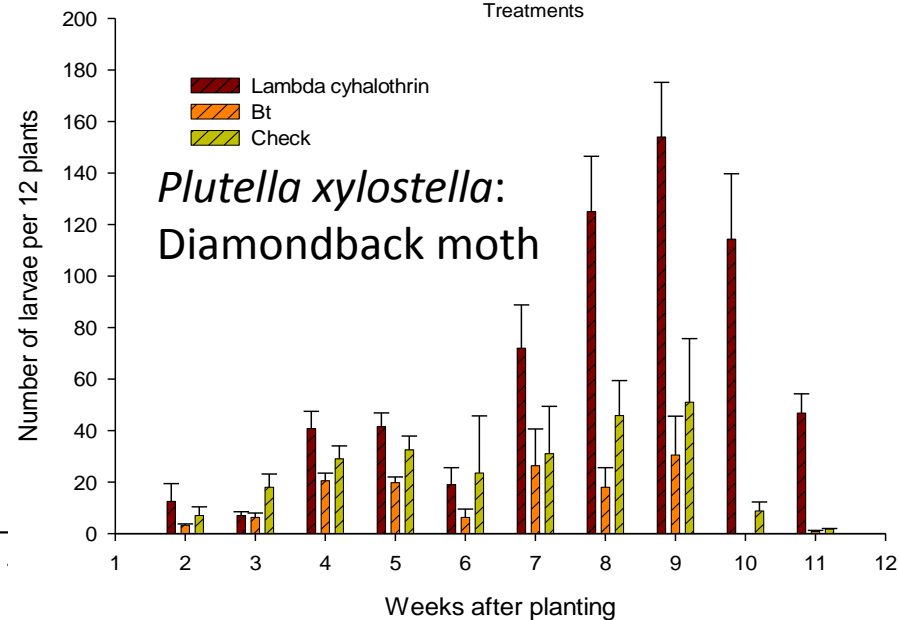
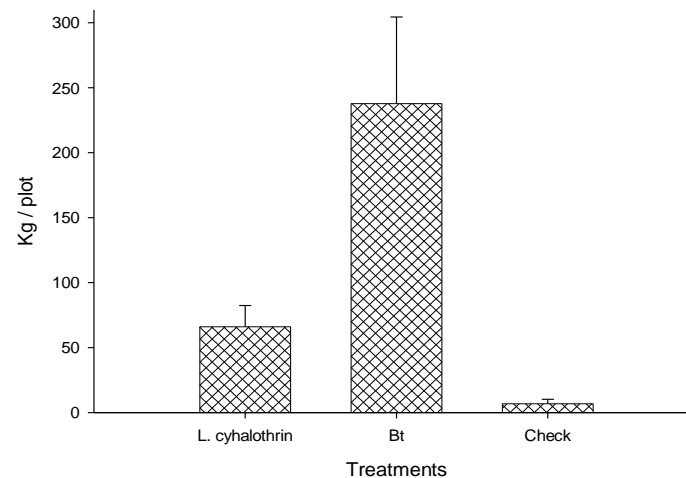
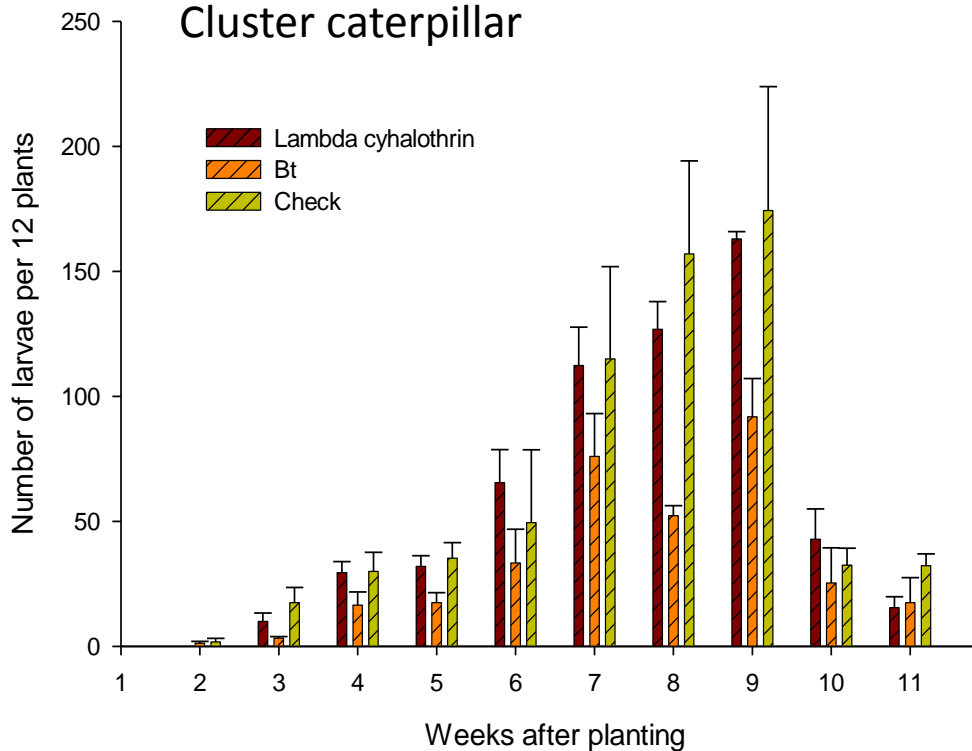
- Preparing pesticide from neem kernel



# IPM Tactics: Microbial Control

## ☐ Bt applied to cabbage

*Crocidolomia pavonana*:  
Cluster caterpillar





# IPM Demonstration Plots

## Broccoli

### Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis*, *Pseudomonas fluorescense*
- 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



# IPM Demonstration Plots

## Tomatoes

### Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis*, *Pseudomonas fluorescense*
- 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





# IPM Demonstration Plots

## Chilli pepper

### Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis*, *Pseudomonas fluorescence*
- 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



# IPM Demonstration Plots

## Green Onion

### Additional IPM Tactics

- *Trichoderma harzianum* with bokashi
- *Bacillus subtilis*, *Pseudomonas fluorescence*
- 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