Feed the Future Food Security Innovation Lab: Collaborative Research Program IPM

“IPM Key for Green Agriculture”

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Virginia Tech
IL – CRP IPM (CRSP) Participates in Hot, Flat and Crowed Parts of the Tropical World
Current IPM CRSP Programs

Regional Programs (Six):

**South East Asia:** Mike Hammig, Clemson University
- Philippines, Indonesia, Cambodia

**South Asia:** Ed Rajotte, Penn State University
- Bangladesh, India, Nepal

**Central Asia:** Karim Maredia, Michigan State University
- Tajikistan

**East Africa:** Mark Erbaugh, Ohio State University
- Kenya, Tanzania, Uganda

**West Africa:** Doug Pfeiffer, Virginia Tech
- Ghana, Senegal

**Latin America and the Caribbean:** Jeff Alwang, Virginia Tech
- Ecuador, Honduras, Guatemala

Office of International Research, Education, and Development, Virginia Tech
IPM CRSP Programs (Contd.)

Global Theme or Cross Cutting Programs (Five):

**Invasive Species, Parthenium:** Wondi Mersie, Virginia State Univ.
- Ethiopia, Uganda, Kenya, Tanzania

**Plant Diagnostic Laboratories:** Sally Miller, Ohio State University
- Six regions – 15 countries

**International Plant Virus Disease Network:** Sue Tolin, V. Tech
- Six regions – 15 countries

**Impact Assessment:** George Norton, Virginia Tech
- Six regions – 15 countries

**Gender Knowledge:** M.E. Christie, Virginia Tech
- Six regions – 15 countries

Office of International Research, Education, and Development, Virginia Tech
Integrated Pest Management

Development of IPM Components

- 1993 – 1998 Institutionalization (Components)
- 1998 – 2003 Institutionalization and Regionalization (Components)
- 2004 – 2009 Regionalization and Globalization (Components)

Development of IPM Packages

- 2009 – 2014 Regionalization (IPM Packages) and Globalization
Crops Addressed in the IPM CRSP

Vegetables
- Tomato
- Eggplant
- Pepper
- Potato
- Cucurbits
- Crucifers
- Beans
- Onions

Fruit and other crops
- Coffee
- Naranjilla
- Citrus
- Mango
- Passion Fruit
- Wheat
- Cacao
- Tree tomato

90%
10%
Crops Addressed in IPM CRSP

- **South Asia** – Eggplant, Okra, Tomato, Cucurbits, Crucifers, Beans, Coffee, Tea
- **Southeast Asia** – Eggplant, Onions, Tomato, Crucifers, Cucurbits, Cacao, Sweet Potato, Coffee
- **Central Asia** – Potato, Wheat
- **East Africa** – Tomato, Pepper, Onion, Passion fruit, Coffee
- **West Africa** – Tomato, Cabbage, Potato
- **LAC** – Naranjilla, Tomato, Pepper, Eggplant, Onion, Blackberry, Tree tomato
IPM Packages

IPM package for vegetables delivers food security and biodiversity

Use of bio-pesticides is one of the major components of IPM. The result is a significant increase in plant health and yield, a dramatic reduction in pesticide use, improvement in biodiversity, and an increase in farmer income.

IPM plays a major role in the management of Invasive Alien Plants and especially to manage Invasive Alien Arthropods and Microbes.

An IPM vegetable package is a set of technologies that can be applied to a given crop to obtain increased yield and reduce pesticide use. It includes the following elements:

- **Soil Preparation**
  Techniques to enhance the soil—such as soil solarization and the addition of growth enhancers such as neem cake, VAM, and fertilizers—provide vegetables with the nutrients they need and deter pests such as weeds and nematodes.

- **Seed Treatment**
  Seed treatments such as *Trichoderma spp.*, *Pseudomonas fluorescens* and *Bacillus subtilis* protect the seedlings from pests.

- **Seed Selection**
  Quality seeds should be chosen according to need and availability. Pest resistance, yield, marketability, and suitability to the environment are important considerations.

- **Seedling Selection and Grafting**
  All seedlings in the nursery should be closely examined for viral and other diseases, and infected seedlings should be eliminated from the planting material. Grafting for pest resistance should be done when needed.

- **Biological Control**
  Adoption of biological control is a major component of IPM. Local natural enemies such as parasitoids can significantly decrease the need for pesticides.

- **Traps and Biopesticides**
  Sticky traps, pheromone traps, and bait traps may be used for both monitoring and reducing pest populations. When these populations reach an economic threshold, biopesticides such as NPV can be used.

- **Supplemental Tactics**
  Supplemental tactics including physical management techniques, such as using stakes, nets, and planting trap crops or nectar plants can be used to reduce pest damage.

- **Strategic Action**
  Strategic action, such as irrigation and rogueing, should be taken to keep plants healthy, reduce re-infection, and discourage pests. While this step is very effective, it is often labor intensive.
IPM Package for Tomato

- Seed or seedling treatment with *Trichoderma*, *Pseudomonas fluorescens*, and *Bacillus subtilis*
- Solarization of seed beds and greenhouses
- Use of VAM, neem cake and other organics
- Selecting virus-resistant varieties
- Grafting on resistant rootstock for bacterial wilt, Fusarium and others
- Staking and mulching
- Yellow sticky traps for thrips, leafminers etc.
- Pheromone traps for *Helicoverpa* and *Spodoptera*
- Host-free period and rogueing for control of virus diseases
- Use of Biopesticides such as neem
- Use of microbial pesticides such as NPV, *Metarhizium*, and *Beauveria*
## Selected Impacts of the IPM CRSP

<table>
<thead>
<tr>
<th>Country and Authors</th>
<th>Crop</th>
<th>IPM Practice(s)</th>
<th>Net Benefits (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uganda, Moyo et al, 2007</td>
<td>Peanuts</td>
<td>Virus resistant variety</td>
<td>$33-36</td>
</tr>
<tr>
<td>Uganda, Debass, 2000</td>
<td>Beans and maize</td>
<td>Cultural</td>
<td>$36-202</td>
</tr>
<tr>
<td>Bangladesh, Debass, 2000</td>
<td>Eggplant, cabbage</td>
<td>Cultural practices</td>
<td>$26-29</td>
</tr>
<tr>
<td>Bangladesh, Rakshit et al, 2011</td>
<td>Cucurbits</td>
<td>Pheromone traps</td>
<td>$3-6</td>
</tr>
<tr>
<td>Ecuador, Baez, 2004</td>
<td>Plantain</td>
<td>Cultural</td>
<td>$59-63</td>
</tr>
<tr>
<td>Ecuador, Quishpe, 2001</td>
<td>Potatoes</td>
<td>Resistant variety</td>
<td>$50</td>
</tr>
<tr>
<td>Albania, Daku, 2002</td>
<td>Olives</td>
<td>Cultural</td>
<td>$39-52</td>
</tr>
<tr>
<td>Honduras, Sparger, et al, 2011</td>
<td>Eggplant, onion, tomato, and pepper</td>
<td>Cultural practices</td>
<td>$17</td>
</tr>
<tr>
<td>India, Selvaraj, 2012 (preliminary analysis)</td>
<td>Mulberry, papaya, cassava</td>
<td>Papaya mealybug parasitoid release</td>
<td>$500 to 1,300</td>
</tr>
</tbody>
</table>
Invasive Species

• Spiraling Whitefly – *Aleurodicus dispersus*
• Giant Whitefly – *Aleurodicus dugesii*
• Papaya mealybug – *Paracoccus marginatus*
• Solenopsis mealybug – *Phenacoccus solenopsis*
• Cassava mealybug – *Phenacoccus manihoti*
• Tomato leaf miner – *Tuta absoluta* (Gelechiidae)
• Banana leaf roller – *Erionota thrax* (Hesperiidae)
Papaya mealybug, *Paracoccus marginatus*

**Order:** Hemiptera, **Suborder:** Sternorrhyncha, **Family:** Pseudococcidae

- Native to Mexico
- First described in 1992
- Pacific: 2000-2005
- Asia: 2008
- West Africa: 2009
Solenopsis mealybug – *Phenacoccus solenopsis*

Native - U.S.A
New Mexico – 1897
Texas – 1990
Central and S. America – 1992
Hawaii – 1996
Chile – 2002
Pakistan – 2005
India – 2006
Nigeria – 2008
Indonesia – 2010

A parasitoid, *Aenasius bambawalei* (Hym.: Encyrtidae) – Fortuitous Introduction to India and Pakistan controlled this pest.
Cassava Mealybug – *Phenacoccus manihoti*

Native of South America
Introduced to Congo in early 1970s
Spread to Rest of Equatorial Africa
Thailand – 2009
Indonesia - 2010
*Tuta absoluta* in Africa South of Sahara

A native of South America. Introduced to Spain in 2006. Now it is in *Senegal, Sudan, and Ethiopia*. It will spread to the rest of West and East Africa in next one or two years.
Peanut Leafminer in Uganda
Thank You