Plant Biosecurity - Local and Global Perspectives
What are the Issues?
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Photo Credit: Stephanie Stocks, University of Florida
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- 2007: First time in history that urban populations are larger than rural.
- World population estimated at greater than 9 billion by 2050.
- Global poverty alleviation is dependent upon agriculture.

Photo Credit: Amanda Hodges, University of Florida
Urbanization-Lagos, Nigeria
What are the Issues?

- Increased wealth results in a higher demand for diverse diets, including various meats, fruits, and vegetables.
- Grain production uses less water.
Summary

- Agricultural Productivity
- Consumer Cost and Demand
- Urbanization
- Market Value of Agricultural Commodities
- Food Security and Safety
- Water Use
- Minimizing environmental impact
Pakistan farmers need wheat seed fast
Flooded country risks losing a year’s crop, further threatening nutrition of poor

1 September, 2010. Rome/Islamabad - FAO today called for more international funds to save the upcoming wheat planting season in Pakistan where floods covering land half the size of Italy have wiped out much of the country’s household wheat seed stocks.

Wheat, the staple food of the rural poor in Pakistan, is due to be planted in September through to November. More than half a million tonnes of wheat seed stocks have been destroyed by the floods.

In addition, in the flood affected areas, people are utilizing wheat seed stocks that have not been affected by the flooding to feed their families and the displaced people they are sheltering.

“Unless people get seeds over the next few weeks they will not be able to plant wheat for a year,” said Daniele Donati, Chief, FAO Emergency Operations, Asia, Near East, Europe and Special Emergencies. “Food aid alone will not be enough. If the next wheat crop is not salvaged, the food security of millions will be at risk.”

Wheat based flat bread, such as chapatti, is the main food of poor rural people in Pakistan.

Land for planting still exists

Wheat farmers in Pakistan were in the process of preparing their land for planting when the floods began. In some areas the fertile top layer of soil has been washed away, making planting impossible. In other areas, the land is still waterlogged or covered in silt and needs to be cleared. However, this is not the case everywhere.

“In many areas it will be possible to plant as soon as the water recedes. FAO and its cluster partners have the capacity to get seed to these areas provided we receive urgently needed funding. But the window of opportunity is closing as the planting season ends in mid November,” said Donati.

FAO has completed procurement for the provision of seeds to 200,000 farming families. If additional funding is committed soon, FAO will be able to provide seeds for twice that number. Early estimates show that 3.6 million hectares of standing maize, rice, sugar cane and cotton crops were destroyed in the floods that had displaced millions of people.
Food Security Example – Rice

Is America’s Food Supply Safe?

• Related to U.S. and international agricultural production issues.

• Economic and social impacts of a plant-production based bioterrorism attack would be devastating.

Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery, http://www.ars.usda.gov/is/graphics/photos/, Image No. k8991-1
What are the Issues?

Photo Credit: Stephanie Stocks, University of Florida
20th Century Agroterrorism

- Glanders
- Can be commonly seen today in Africa, Asia, the Middle East, Central and South America.
- Used by Germany, WWI and Japan, WWII

Photo Credit: Scott Bauer, USDA-ARS, USDA-ARS Image Gallery, http://www.ars.usda.gov/is/graphics/photos/, Image No. k8855-1
20th Century Agroterrorism

- Anthrax
- Somewhat common disease in tropical countries
- Occurs occasionally in the U.S.
- Used by Japan, WWII

20th Century Agroterrorism

- Rinderpest
- Occurred in Europe, Africa, and Asia
- Used by Japan, WWII
- Global eradication declared on June 28, 2011


20th Century Agroterrorism

- Colorado Potato Beetles
- Used by Germany, WWII

Photo Credit: David Cappaert, Michigan State University, http://www.bugwood.org/ Image No. 5178045
20th Century Agroterrorism

- African bush milk
- Used by the Mau Mau, 1952

20th Century Agroterrorism

- Mercury poisoning of Israeli oranges
- Used by the Arab Revolutionary Council, 1978

Photo Credit: USDA-ARS Image Gallery
http://www.ars.usda.gov/is/graphics/photos/, Image No. K3644-12
20th Century Agroterrorism

• Pesticide poisoning of grapes
• Used by Israeli individuals in Gosh Etzion, 1997
• ~17,000 metric tons of grapes destroyed

<table>
<thead>
<tr>
<th>Country</th>
<th>Period</th>
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<tbody>
<tr>
<td>Canada</td>
<td>1940s-1960s</td>
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<tr>
<td>France</td>
<td>1939-1972</td>
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<td>Former Soviet Union</td>
<td>1935-1992</td>
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<tr>
<td>United Kingdom</td>
<td>1937-1960s</td>
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<tr>
<td>United States</td>
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Select Agents and Toxin List

- Public Health Security and Bioterrorism Preparedness Response Act of 2002, HHS
  - CDC
- Agricultural Bioterrorism Protection Act of 2002, USDA
  - APHIS-VS
  - APHIS-PPQ
- Lists updated biannually
USDA-APHIS-PPQ
Select Agent and Toxin List

• Peronosclerospora philippinensis (Peronosclerospora sacchari)
• Sclerophthora rayssiae var. zeae
• Phoma glycinicola (formerly Pyrenochaeta glycines)
• Ralstonia solanacearum race 3, biovar 2
• Rathayibacter toxicus
• Synchytrium endobioticum
• Xanthomonas oryzae
Philippine Downy Mildew (PDM)

- Tropical Africa and Asia
- Maize, Sugarcane, Sorghum, Oats, Grasses
- Chlorotic striping followed by downy growth on or under leaf surface
- Followed by abnormally erect leaves that appear dried out followed by malformed tassels, interrupted ear formation and sterile seeds

Photo credits: C. De Leon - http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/Corn%20Downy%20Mildew%202009-18-06.pdf
Brown stripe downy mildew

• Found in tropical Asia

• Mainly affects corn, but can be found in crabgrass

• Narrow chlorotic stripes (mostly yellow, but sometimes red to purple)

• Lesions with well defined margins that come together to form large, necrotic lesions. May have small seed size.
Red Leaf Blotch (RLB)

- Central and Southern Africa
- Soybeans
- Lesions along the veins which spread to the lower leaf and then come together to form necrotic regions
- Can also form lesions on pods, stems, and petioles

Photo credits:
http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/Soybean%20RLB%20FINAL%20July%202009.pdf
Southern Wilt, Bacterial Wilt, and Brown rot

- Found around the world

- Mainly affects solanaceous plants

- Brown rot in potatoes - leaves wilt during the daytime, then recover during the night. They may develop a bronze cast and turn downwards.

- Plants become stunted and chlorotic with the stem having a streaked brown appearance.

Photo credit Centro Internacional de la Papa, Lima, Peru
Southern Wilt, Bacterial Wilt, and Brown rot

- Bacterial wilt in tomatoes – wilted leaves that do not drop, turning yellow and stunted, then brown and dry.

- May see vascular discoloration.

Southern Wilt, Bacterial Wilt, and Brown rot

• Southern wilt in geraniums - leaves wilt during the daytime, then recover during the night. Lower leaves wilt first, then become chlorotic.

• You may see – v-shaped chlorotic or necrotic areas on leaves, brown discoloration of the vascular system, rarely leaf spots.
National Plant Diagnostic Network

e-learning Module:

*Ralstonia solanacearum*

race 3, biovar 2

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**Bacterial Ooze**

Another diagnostic sign for potato brown rot in the field is bacterial ooze that can be observed from:

- Intact tubers at eyes or where the stolon attaches to tuber, that is often revealed by soil aggregation to tubers.
- Vascular ring of cut potato tubers, particularly when the cut tuber is squeezed.

**Symptoms On Potato and Tomato**

First visible symptoms of potato brown rot and tomato bacterial wilt are:

- Wilting of the youngest leaves.

These symptoms often are visible during the hottest part of the day.

They may appear on just one side of a leaflet or on a single branch and at any stage of plant growth.

At this stage, plants may appear to recover at night when temperatures are cooler.

High temperatures (85 to 95°F) favor symptom expression.
Gumming Disease

- Found in Australia, New Zealand, and South Africa
- Mainly affects rye and other grasses
- Nematode vectored with galls being produced (symptom). The bacteria will reproduce in the galls and in the seeds of the plant. Gumming is a sign of the disease.
- Produces corynetoxins which can kill livestock.

Photo credit: http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/RathayibacterPoisoningFeb2010.pdf
Potato Wart Disease

- Found around the world
- Mainly affects potatoes
- Above ground symptoms are rarely seen
- Attacks tubers, not roots, with warty, cauliflower-like protuberances originating at the eyes which spreads and eventually replaces the tuber tissue which will then rot and disintegrate.

Photo credits: Central Science Laboratory, Harpenden Archive, British Crown, [www.bugwood.org](http://www.bugwood.org), #0454023 and Michael Hampson, [http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/PotatoWart70109.pdf](http://www.ars.usda.gov/SP2UserFiles/Place/00000000/opmp/PotatoWart70109.pdf)
Bacterial Blight

- Found around the world, except Europe
- Mainly rice, wild rice varieties, and some sedges
- Pale-green to grey-green water soaked streaks near the leaf tip and along the margins with lesions turning yellow-white and having wavy edges as they get larger.
- On the inflorescences, you can see light brown to grey lesions that result in infertility and low quality of the grains

Photo credits:
T.W. Mew, International Rice Research Institute, www.bugwood.org, 0162038 and Donald Groth, Louisiana State University AgCenter, www.bugwood.org, #5390468
Bacterial Leaf Streak

- Found in tropical Asia
- Mainly rice and wild rice varieties
- Narrow, dark-greenish water soaked interveinal streaks of various lengths (which is initially restricted to the leaf blades).
- Lesions enlarge, turn yellowish-orange to brown, and have small amber colored droplets of bacterial ooze present on them. Lesion margins are more linear.

Photo credit:
Top - International Rice Research Institute, Los Banos Archive, International Rice Research Institute, Los Banos, www.bugwood.org, #1949007 and
Bottom - Donald Groth, Louisiana State University AgCenter, www.bugwood.org, #5390469
Former Select Agents and Toxins

- Citrus Greening, *Candidatus Liberibacter asiaticus*

- Detected in U.S. in August 2005

- De-Listed as a Select Agent October 2008

Ricin

- Castor beans are poisonous, however, ricin is derived from the waste material left over from processing castor beans to make castor oil.

- India produced almost 375,000 tons of castor oil in 2009.
Ricin Symptoms

• Inhalation: respiratory distress, fever, cough, nausea, and tightness in the chest. Low blood pressure, respiratory failure, and death may result.

• Ingestion: Vomiting, diarrhea that is bloody, severe dehydration, low blood pressure, hallucinations, seizures, blood in the urine, liver, spleen, and kidney failure, and even death.

• Skin and eye exposure: contact usually results redness and pain, but it is unlikely that ricin can be absorbed through normal skin.

• There is no antidote to ricin poisoning.
Plant Biosecurity

• Do only USDA-APHIS-PPQ select agents threaten U.S. Plant Biosecurity?
Questions?

• For more information, check out www.protectingusnow.org

• You can also contact:
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- National Plant Board (NPB) and State Departments of Agriculture
- National Plant Diagnostic Network (NPDN)
- Cooperative Agriculture Pest Survey Program (CAPS)
- Extension Disaster Education Network (EDEN)
- Regional IPM Centers
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