Searching for Silver Bullets:
The Role of Technology in Food Security?

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Map: UNDP Human Development Index
Objectives of the Presentation:

- Why look for silver bullets?
- Examples Technology and Food Security from the Purdue portfolio
- Lessons learned
What is a “Silver Bullet”?

• In this context a “silver bullet” is a relatively simple, direct solution to a complex problem
• “Silver bullets” are often new technology
• Examples in Ag:
  – Hybrid maize
  – Short stemmed rice and wheat varieties

http://www.lonerangerfanclub.com/photogallery.html
Why Search for “Silver Bullets”?

• In agriculture we have a history of finding them.

• Frustration with the underlying social and political problems that inhibit development

• It is something we as researchers can do

• A new set of donors believe in the potential for technological solutions:
  – Bill & Melinda Gates Foundation
Side effects of Silver Bullets?

• In the long run silver bullets seldom are a simple and benign as they seem:
  – Hybrid seed and associated inputs must be purchased every season and tie farmers to agribusiness
  – Short stemmed wheat and rice, plus the agronomic practices that go with them, resulted in environmental degradation and increasing social inequality.

• Most silver bullets buy time to implement other solutions

Spraying pesticides in India. Due to poverty, irresponsible employers and ignorance about their health effects, pesticides are frequently used without protective clothing in the Third World. (Photo: Mark Edwards/Still Pictures)
Purdue University has a Long History in the Development of Agricultural Technology
Purdue University Role in Ag Technology for the US Corn Belt

- Purdue is a “Land Grant” University, created in 1867 to bring science to agriculture.
- Development of hybrid maize in the 1920s and 30s.
- Some of the earliest no-till planting research in 1940s.
- Precision agriculture applied GPS, GIS and remotes sensing in the 1990s.

Yield Map from Las Rosas Farm, Rio Quarto, Argentina.
Purdue International Agricultural Research started in Brazil in the 1950s

- Purdue faculty and their students helped develop the farming practices that made the Cerrados bloom.
- From the beginning the Brazilian vision was of large scale mechanized farms. That determined the kind of technology developed.

Photo Source: IPIA Archives
Farming Systems Research in Burkina Faso

- In the 1970s and 1980s, Purdue was involved in farming systems research, mainly in francophone West Africa.
- Soil & water conservation was a key part of that work.
- Photo shows junked tied ridgers in Donsin, Burkina Faso. Tied ridgers solved a technical problem, but not the economic problem.

Photo: J. Lowenberg-DeBoer
Breeding Sorghum for Striga Resistance

• The parasitic weed striga is a major problem for sorghum production in Africa

• Mainly with USAID funding, Dr. Gebisa Ejeta, colleagues and students have identified the biochemical mechanism for striga resistance and have developed resistant germplasm.

• Dr. Ejeta was awarded the World Food Prize in part for this research.
Women’s Entrepreneurship in West Africa

• Thousands of women earn their living selling street foods in West Africa.

• Dr. Joan Fulton is working with colleagues in Niger, Nigeria, Ghana and Senegal to develop ways for them to grow their businesses.

• For example, a coarsely ground cowpea flour may substantially reduce the labor required for kosaï (cowpea fritters).
In South Africa, precision agriculture must be adapted to wide row production systems – This photo shows Ntsikane Maine, a student from the University of the Free State on the farm of Sakkie Van Zyl.
Our Current “Flagship Effort” is the Purdue Improved Cowpea Storage (PICS) – Gates Foundation funding
Cowpeas are one crop that can be productive in harsh arid conditions.
Cowpeas are an important cash crop in West Africa.
Extensive Trade of Cowpeas in West & Central Africa – over 300,000 tons traded annually
Cowpeas are Used in a Variety of Dishes

Nutritious And Traditional Foods High in Protein Consumed in Rural and Urban Areas
Very Susceptible to Storage Damage

Cowpeas
Price of Cowpeas

October/November

April/May
Price of Cowpeas
PICS Technology Development

- In West and Central Africa cowpeas are important both for household consumption and as a cash crop.
- In the 1980s West African farmers identified storage as the most important cowpea constraint.
- Researchers from Purdue and the Institute for Agricultural Research for Development (IRAD) of Cameroon studied traditional on-farm storage methods.
- With laboratory and on-farm research they developed three non-chemical alternatives:
  - Storage in ash – not enough ash for large quantities
  - Solar heater – farmers complain that it is too much work
  - Triple bag hermetic storage – farmers adopt when they can find bags
Hermetic Storage

• The Bruchids use up existing oxygen
• Without Oxygen the Bruchids go dormant
• “Put the Bugs to Sleep”
Based on Results of Adoption Studies: PICS has two thrusts:

• Training Farmers in hermetic storage:
  – Storage demonstrations in all villages where cowpea is grown as a cash crop
  – Message reinforced by radio, cell phone video and other media
  – So far PICS has been in over 23,000 villages

• Supply chain development
  – Work with plastics manufacturers to make the right kind of bags – so far worked with five manufacturers in five countries
  – Develop the distribution system for PICS bags to the village level – this has been the bottleneck
Technology Transfer: 5 Years
10 Countries; 28,000 Villages

- Expect to directly benefit 3.4 million cowpea producing households
- Direct benefits for over 30 million people
Village demonstrations provide direct communication between PICS and farmers.
In some areas separate PICS demonstrations are organized for women’s groups.
Demostration bags are marked and placed in storage until public “open-the-bag” events in April and May the following year.
Radio offers another direct contact with listeners. This is a photo of the station in Dagarama Takaya, Niger.
Posters and pamphlets in local languages – Bambara Poster below:

1. Ka bor PICS san a feebe yamaruyalen fe.
2. Ka sakise Lamarata laja kojuman (tingenew be tomo ka bo a la).
3. Ka bor bana ninnu bo nagan na ka laje, boro fila minnu be konana na ni wo tu la, walima nu faralen te. Ni wo be boro la walima n’afa faralen don, fom te se ko lamara a kono.
5. Ka borow don nagan kono ko konanabono lafa doni doni sakise la. I b’a ko boro yigiyi jiga fiene bo a kono. I b’a yatemine ni sakise bii ne boro ni nago n’abu.

6. Ka bor fa haks la, dasiiroro ko soro a la. I b’a boro da bisi ko jigen fitun be ko bao a kono.
8. Cumancolaboro bana be dasiri konanaboro dasiiricogo la. Ka laban ka boraba ko cogo la; no ye nilonbono ye.

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Supply Chain Development:

- PICS has worked with five manufacturers in five countries
- In the first three years of the project, PICS has helped distributors order 390,000 sacks
- Another 858,000 sacks were ordered by businesses and government agencies
- The largest single order was 800,000 sacks by the Niger Food Security Agency
PICS Sacks Sold and Used in Demonstrations:

- About 146,000 PICS sacks have been used in village demonstrations.
- Businesses associated with the project have sold about 203,000 sacks
- Others have sold about 819,000 sacks
- Low, quality “fake” sacks are a growing problem – In the process of商标marking PICS logo
The Role of Ag Technology in Food Security: Lessons Learned

- **Solve their problems, not your problems** – get input from farmers, consumers, businesses to identify key constraints.

- **Have a vision for the future of agriculture** – In Brazil the vision was of large scale mechanized farms and in West Africa the PICS program started with a vision of commercial smallholder farms. The technology developed was quite different.

- **Consider the whole range of technology** – PICS bags are low tech, but solve a problem. There are cases in which biotechnology is the only tool available.

- **In the 20th Century most high impact ag technology has been embodied technology** – Everywhere knowledge and management skill are scarce.
“Information-intensive” vs. “Embodied knowledge”

<table>
<thead>
<tr>
<th>Information-intensive</th>
<th>Embodied knowledge</th>
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<tbody>
<tr>
<td>• Field level information needed to make decisions</td>
<td>• Information purchased in the form of an input</td>
</tr>
<tr>
<td>• Requires additional data and skill</td>
<td>• Requires minimal additional data/skill</td>
</tr>
<tr>
<td>• IPM</td>
<td>• Hybrid seed</td>
</tr>
<tr>
<td>• Organic farming</td>
<td>• Herbicides</td>
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<td></td>
<td>• Chemical fertilizer</td>
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The Role of Ag Technology in Food Security: Lessons Learned (Continued)

- **Bottlenecks occur throughout the value chain** – Ag technology is not just production technology. It also includes post-harvest operations, processing and marketing.

- **How will the technology be delivered to users?** – The commercialization step is often undervalued by the development community, but it is crucial.

- **What is the value proposition?** – Why will farmers, businesses and consumers be better off because of this innovation?

- **Include social, cultural and economics aspects in the planning** – The world is littered with technology that solves a technical problem, but does not fit the social, cultural and economic environment.
Conclusions & Future Directions

1. New “silver bullet” technology will not solve the world’s problems, but it may buy time for more permanent solutions.

2. Technology does not exist in a vacuum, but must be developed for the economic and social context – social science is important.

3. Local knowledge is essential. The basic science may be the same everywhere, but the application is local.

4. “The perfect is the enemy of the good.” – We need to think long term, but even a temporary solution is valuable.
Agricultural GDP (2000)

Questions?

Comments?

Thank You!

Map 10
Based on data from World Bank and FAO estimates.
Prepared by: FAO Statistics Division
Rome, 2003