Innovation for Food Security: USAID’s Feed the Future Research, Policy, and Capacity Development Programs

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Outline

✓ Feed the Future background
✓ Agricultural research, policy, and capacity development investments under Feed the Future
✓ Opportunities for faculty, students, and administrators
The Global Challenge

- About **842 million** people suffer from chronic hunger

- The world’s population will increase to more than **9 billion by 2050**

- Food production will have to **increase by at least 60%** to feed the world
Global Food Prices

Source: FAO
Feed the Future

✓ Announced in 2009 at G-8 Summit in L’Aquila, Italy, with $3.5 B investment
✓ Objectives: reducing poverty and undernutrition
✓ Metrics: poverty, stunting
✓ Country-owned, country-led

Photo: Borlaug Foundation
Why Agriculture?

“GDP growth originating in agriculture is at least twice as effective in reducing poverty as GDP growth originating outside agriculture.”
U.S. Government Partners
External Partnerships

✓ Governments
✓ Multilateral organizations
✓ Faith-based community
✓ Civil society
✓ Private sector
Focus Countries
New Alliance for Food Security & Nutrition

✓ African countries commit to policy changes to increase private investment
✓ More than 140 companies (African and international) have committed over $3.75 billion
✓ Ten countries involved: Ethiopia, Ghana, Tanzania, Benin, Burkina Faso, Côte d'Ivoire, Malawi, Mozambique, Senegal, and Nigeria
1. Help farmers produce more
2. Help farmers get more food to market
3. Support Research & Development to improve smallholder agriculture in a changing climate
4. Strengthen Regional Trade
5. Create a better Policy Environment
6. Improve Access to Nutritious Food and Nutrition Services
SPRING/Bangladesh
Nerica Rice in Senegal
Fertilizer Deep Placement in Bangladesh
Demand Growth of *Guti* Urea under AAPI – cumulative –

Demand Growth of *Guti* Urea under AAPI – cumulative –

UDP Area ('000' ha)

Guti Urea Users ('000')

- UDP Area
- Guti Urea Users

2010  2011  2012
Supply Growth of *Guti* Urea under AAPI

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Machines</th>
<th>Guti Urea Machine</th>
<th>Guti Urea Use</th>
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<tbody>
<tr>
<td>2010</td>
<td>0</td>
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<tr>
<td>2011</td>
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<tr>
<td>2012</td>
<td>900</td>
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Feed the Future Food Security Innovation Center
Defining FTF Research Priorities

Using poverty & nutrition lens: Identify key production systems where hunger and poverty are significant…

Prevalence

Sub-national poverty ca. 2005 ($<1.25/day)

Source: Stan Wood et al. (IFPRI) 2009.
Child Stunting

Source: USAID and IFPRI, Harvest Choice maps
Overarching Goal: Sustainable Intensification

Three research themes:

- Advancing the productivity frontier
- Transforming key production systems
- Improving nutrition and food safety

Anchored by key geographies:

- Indo-gangetic plains in South Asia
- Sudano-sahelien systems in West Africa
- Maize and livestock mixed systems in East and Southern Africa
- Ethiopian highlands
Food Security Innovation Center

3 Major Research Programs – “Big Ideas”

Program for Climate Resilient Cereals

Program for Advanced Research on Plant & Animal Diseases

Program for Productive Livestock

Program for Sustainable Intensification

Program for Policy Research and Support

Program for Safe and Nutritious Foods

Program for Human and Institutional Capacity Development

Integrated Cross-Cutting Programs
Challenge: Increase cereal yields and adaption to climate change for improved feed and fodder production

- Cereals account for approximately two-thirds of all human energy intake
- An estimated 1.2 billion poor people depend on wheat

Solutions:
- Invest in development and dissemination of improved cereals
- Take advantage of emerging biotech and genomic tools
- Partner with private R&D companies and US universities
- Leverage BMGF investments
- Improve fodder quality for dual purpose use

Example Projects:
- Rice, wheat, maize, dryland cereal CRPs
- WSU Improved Wheat for Heat Tolerance and Climate Resilience
- UC Davis Abiotic Stress Tolerant Millet
Submergence Tolerance in Rice

• Allows rice to tolerate submergence for up to 14 days (dormancy, energy conservation during flood), recover after flooding subsides. Five days destroys most rice crops.

• Rapidly introgressed into popular varieties (IR64, Swarna) through marker assisted selection – already delivered to hundreds of thousands of farmers in South Asia.

• Developed by International Rice Research Institute.
• Allows maize to tolerate and improve yield under moderate drought stress (as defined by USGS/NOAA)

• Taking best drought tolerant traits from existing germplasm to breed into preferred (African) germplasm for hybrids / OPV’s (2M farmers adopting)

• Adding additional traits through genetic engineering to increase beyond natural germplasm (commercial “DroughtGuard” & “AQUAMax” traits released in US last year)

GE drought tolerant corn in US
Heat Tolerance in Wheat

- Mitigate risks of high temperature during winter growing season - Different forms of heat stress affects 36M ha in developing countries (continuous and “acute”)

- Temp over 80 significantly impact yield (a few percent per degree) – tremendous impact in places like India / Ethiopia

- Many parallel efforts worldwide (Mexico, Australia, US, France) aimed at modern breeding / biotechnology for increasing heat tolerance.

- Identify native genes, sources of heat tolerance, looking at GE approaches for promising genes
**Challenge:** Increase productivity and availability of legumes

- Abiotic stresses decrease legume yields by up to 40%
- Pests and diseases can decrease yields by up to 35%
- The grain legume value chain directly benefits women, especially in Africa

**Solutions:**
- Elevate legumes as major investment area under the research strategy
- Tackle yield, climate resilience and biotic stresses for staple legumes
- Utilize private sector knowledge and skill in transgenic and emerging genomic tools

**Example Projects:**
- Grain Legumes Innovation Lab
- Peanut & Mycotoxins Innovation Lab
- AATF Bt Cowpea
- CGIAR Grain Legumes CRP
New black bean varieties grown by >50,000 households

Program: Feed the Future Innovation Lab for Collaborative Research on **Grain Legumes**

University lead: **Michigan State University**
- Core research for 10+ years on variety development
  - Focus on Central American highlands
  - Beans contribute to nutrition and income gains
- Scale-up effort
  - Honduras, Guatemala, Nicaragua, Haiti
  - Community seed systems get varieties to farmers
- >50,000 households received seed
**Challenge:** Protect animals and tropical staples from major pests and diseases

- Plant diseases on major food crops cause up to 40% of pre-harvest losses
- Over 90% of the world’s wheat acreage is susceptible to wheat stem rusts
- Over 1.6 billion families depend on livestock for their income and nutrition

**Solutions:**

- Leverage US science and leadership in advanced genomic/biotech tools
- Utilize transgenic tools for critical plant diseases
- Build public sector capacity to use biotech tools

**Example Projects:**

- Virus Resistant Cassava for Africa
- East Coast Fever vaccine development (USDA)
- Venganza—Wheat Stem Rust & Mycotoxins
- Late blight resistant potato
- New disease resistant livestock program
Fruit and shoot borer damage

An FSB larva that has bored into the shoot of an eggplant, thus causing the plant to whither.

An FSB larva that has bored into an eggplant fruit, causing considerable damage and rendering it unfit for market.

Source: ABSPII
Insect Resistant Eggplant
Feed the Future Innovation Lab for Genomics to Improve Poultry

• Newcastle Disease is the number one constraint to raising poultry in Africa with some strains can cause mortality as high as 80% in village flocks
• A vaccine is available but not widely used due to problems of inadequate extension services, a need for a cold chain, and unreliable production and distribution
• This Innovation Lab aims to identify regions in the chicken genome that confer enhanced resistance to Newcastle disease and heat tolerance
• Vaccination combined with enhanced genetics could have a synergistic effect and improve Newcastle disease resistance in chickens
Feed the Future Innovation Lab for Rift Valley Fever Control in Agriculture

- Rift Valley Fever is an episodic, mosquito-borne, viral disease that infects sheep, goats, cattle, and humans in Sub-Saharan Africa
- The Rift Valley Fever vaccines that are available for livestock cause adverse reactions
- Innovation Lab aims to develop a safe and economical Rift Valley Fever vaccine that would provide life-long immunity from a single vaccination, be delivered through a needle-free device, and would be compatible with a diagnostic test to distinguish vaccinated from naturally infected animals
**Challenge:** Sustainably increase production and consumption of highly nutritious foods and diversify diets

- Fruits, vegetables and animal source foods provide critical micronutrients for child development
- One third of children under five in low-income countries are stunted
- Half of all children and pregnant women are anemic

**Solutions:**
- Nutrition research on behavior, food utilization and household dynamics
- Research on production/consumption biofortified and nutrient-rich crops
- Develop options to strengthen post harvest handling and food safety
- Invest in horticulture, animal sourced food value chains

**Example Projects:**
- Meat, Milk & Fish and Nutrition CRPs
- Horticulture, Livestock, AquaFish & Nutrition Innovation Labs
- World Vegetable Center
### Post-Harvest Losses

- Grain handling and storage
- Cold-chain management: meat, fish
- Breaking down SPS barriers
- Controlling post-harvest pests/disease
- Food preservation, esp. by women
Coolrooms and Cool Transport for Small-Scale Farmers

Horticulture CRSP tested the ‘Cool-bot’, which creates a small-scale cooler out of a well-insulated room, in India, Uganda, and Honduras.
Robert Paull (U of Hawaii–Manoa) and colleagues screened natural coatings and extracts and developed a wax coating that controls postharvest diseases in papaya.

NEW WAX FORMULATION
WAX + ESSENTIAL OIL
PAPAYA HELD FOR 14 DAYS AT 13 °C

CONTROLS
NO TREATMENT
Identifying causes of malnutrition in Nepal

What factors **linked to agriculture** contributes to poor child growth?

What is the role for local diet in **treating** worst cases of malnutrition?
Interviewing women in Nepal

- Health seeking behaviors
- Sanitation/hygiene practice
- Knowledge of food safety
- Dietary choices
Orange-Fleshed Sweet Potato in Ghana

Photo by Robert Zabawa
Aflagoggles
Next generation aflatoxin detection
Feed the Future Innovation Lab for Collaborative Research On Peanut Productivity & Mycotoxin Control
Led by University of Georgia

Lead PI: Dr. Haibo Yao, Mississippi State
Incorporating UV Fluorescence with Optics

Project goal: to develop portable, fluorescence spectral-based technology for rapid and non-invasive aflatoxin detection in maize.

International development application: Non-destructive aflatoxin detection
Users: breeders selecting for aflatoxin resistance, traders, households, consumers at market...

Detection Results: Normalized Fluorescence Difference Index: \( \text{NDFI} = \frac{(537\text{nm} - 437\text{nm})}{(537\text{nm} + 437\text{nm})} \)
Program for Sustainable Intensification

**Challenge:** Fundamentally Transform Key Production Systems

- In Africa, 65% of agricultural land suffers from physical and chemical degradation
- African cereal and milk yields are less than half the global average

**Solutions:**
- Integrate research outputs, policy and nutrition in production systems
- Focus multiple interventions within targeted geographic areas
- Diversify major production systems with improved crops and animals
- Evaluate and disseminate improved soil and water management practices

**Example Projects:**
- Integrated Pest Management Innovation Lab
- Africa RISING
- Cereal Systems Initiative for South Asia
- Sustainable Agriculture and NRM Innovation Lab
Pigeonpea

• Nodulates with indigenous Rhizobium, Fix N
• Yield: 2.5 t/ha
• Multiple uses:
  - Provisioning
    - Food
    - Fodder
    - Fuel wood
    - Yield stability
  - Regulating
    - Soil cover
    - Moisture retention
    - Soil fertility
Intercropping and rotations

Cereal - Legume intercrop

Legume-legume
Inclusion of PP in cropping systems increase grain yield of maize

<table>
<thead>
<tr>
<th>Cropping system</th>
<th>yield increments (%)</th>
<th>Source</th>
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<tbody>
<tr>
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<tr>
<td>GNPP/MZ</td>
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<td>1</td>
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<td>4</td>
</tr>
<tr>
<td>PP/MZ</td>
<td>+207-309</td>
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</table>

1= Mhango et al., 2010. 2= Daniel and Ong (1990); 3=Abunyewa and Karbo (2004); 4=Egbe et a., 2007

Fig 1: Maize yield under continuous maize and PP/maize rotations, northern Malawi
Challenge: Create supportive agricultural policy environments

• Help countries embrace predictable, inclusive, evidence-based and transparent policy formulation and implementation

Solutions:
• Work with host-country governments and multilateral institutions to improve enabling policy environments
• Address land and natural resource governance and resilience policy, nutrition policy constraints.
• Improve function of and access to markets

Example Projects:
• Feed the Future Policy Plan
• Assets and Market Access Innovation Lab
• Program for Biosafety Systems
• New Alliance partnerships
Evidence-based Policy in Tanzania

We were wrong on food exports: PM

Ban on export of food to be lifted

PM Pinda
Index Based Livestock Insurance (IBLI), Marsabit District, Northern Kenya

- Uses satellite spectrometer data to correlate vegetation groundcover with predicted livestock mortality
- Insurance payouts are based on that prediction, rather than on verification of individual losses
- Avoid costly coping strategies that often lead to poverty traps and the intergenerational transfer of poverty
- Enable farmers to increase investment in potentially higher-return activities
IBLI Kenya: Impacts

The first payment of indemnities took place in October 2011. A survey conducted at that time asked households to predict how the insurance payments would change their coping strategies. Compared to uninsured households, insured households were:

- 22-36 percentage points less likely to draw down assets
- 27-36 percentage points less likely to reduce meals
- 42-50 percentage points less dependent on food aid
- 0-26 percentage points less reliant on other forms of assistance
**Challenge:** Professional and organizational capacities are inadequate to address agricultural challenges and opportunities

- Public agricultural institutions are weak
- Private sector needs skilled employees
- Experienced faculty and managers are retiring
- Women hold few management positions

**Solutions:**

- Strengthen human and institutional capital base
- Support best practice development
- Support women in agricultural research
- Develop human skills through fellowships and long-term degree training

**Example Projects:**

- InnovATE – Agricultural Training & Education
- African Women in Agricultural Research and Development (AWARD)
- Borlaug Higher Education for Agricultural Research and Development
Multiple Levels of Capacity Development
Program for Human and Institutional Capacity Development

Ag Innovation System (AIS)

- Exporters
  - Agro-Processors
- Producer Organizations
- Input Providers
- Credit Agencies
- Property Agencies

Agricultural Knowledge and Information Systems

- Agricultural Research System
- Agricultural Extension & Advisory Services
- Agricultural Education System

Regulatory Framework and Sectorial Policies
African Women in Agricultural Research and Development (AWARD)
Borlaug Higher Education for Agricultural Research and Development

- Uganda
- Ghana
- Bangladesh
- Cambodia
- Mali
- Malawi
- Mozambique
- Liberia NEW
- Kenya NEW
- South Sudan NEW

http://bheard.isp.msu.edu/
Innovation for Agricultural Training and Education

Modernizing Agricultural Education
The lack of an adequately trained workforce is one of the biggest constraints to achieving food security.

InnovATE—Collaborating to improve the productivity of the agricultural workforce at all levels, through training and education.
Armenia: Sustainability Plan for ATC

- Business plan
- Increase revenues
- Decrease costs
- Establish an endowment
- Fundraising for scholarships
- Policy for indirect costs
- Fund management capacity
- Increase tuition
- Increase government investment
- Increase linkages
- Establish a research office
- Joint research ventures
- Innovation incubators
- Engage with Agrarian Univ
- Expand alumni network
- Enhance career counseling
- Long-term partnerships
- Accreditation options
- Advisory board
- New curriculum
- Value chain focus
Votech Agricultural Education in the RAAS, Nicaragua
Modernizing Extension and Advisory Services

Global Learning Exchange on Best Fit Approaches in Extension and Advisory Services

Washington, D.C. - June 6-8, 2012

This exchange on current issues in extension is designed as a marketplace of ideas, a platform for lively discussion and sharing of good practice. Participants are invited to share their own knowledge resources pertaining to the themes presented. Beginning with topics of broad interest on day one, the sessions on subsequent days have more limited space and are intended for workshop style facilitated discussions. The purpose of the workshop is twofold—to review and confirm current understanding of good practice in public and private extension service delivery and to identify priority areas for development.
What is PBS?

The Program for Biosafety System (PBS) supports partner countries in Africa and Asia in the responsible development and use of biotechnology. Managed by the International Food Policy Research Institute (IFPRI), PBS works with countries interested in using biotechnology to enhance agricultural innovation.

Today, smallholder farmers in more than 15 countries successfully grow crop varieties developed through biotechnology.

PBS works with stakeholders to develop and implement science-based, functional biosafety systems that ultimately: Expand producer choice, inspire consumer confidence, facilitate trade, and promote...
Confined field trial guidelines in India
For Students and Faculty: Needed Skills and Experience

• Soft skills beyond core research training
  – Budgeting, communications, management, teamwork, leadership, working across disciplines

• Build experience – GO ABROAD!
Opportunities for Funding & Engagement

• Contracts: [https://www.fbo.gov/](https://www.fbo.gov/)
• Grants: [www.grants.gov](http://www.grants.gov)
• E-Training modules on partnering with USAID on [www.usaid.gov](http://www.usaid.gov)
Opportunities: Current Solicitations

• **Feed the Future Biotechnology Partnership**
  – Q&A Webinar: June 9, 2014
  – Closing Date: August 1, 2014

• **Feed the Future Innovation Lab for Integrated Pest Management:**
  – Closing Date: June 25, 2014
Advisory and Unfunded Engagement

✓ Webcasts, Streaming, and Online Discussions
  • Discuss the high-level and programmatic strategies in a public venue accessible to potential partners everywhere

✓ International Development Community and Resources
  • Training and Resources for Professional/Curriculum Use
  • Communities of Practice (e.g., AgriLinks)
  • Crowdsourcing and Data

✓ Public Meetings
  • Board for International Food and Agriculture Development
  • Advisory Committee on Voluntary and Foreign Aid
Opportunities: Research

• NSF’s PEER program (PEER Science and PEER Health)
  – www.nationalacademies.org/peer

• Research and Innovation Fellowships (NSF GRFP eligible)
  – http://www.usaid.gov/RIFellowships

• LINKAGES program with CGIAR (faculty)
    iar_universities_link_program.pdf

• US Global Food Security Fellows Program (for American
  graduate students) and Summer Institute
  – http://www.purdue.edu/discoverypark/food/borlaugfellows/
US Borlaug Global Food Security Fellows Program

http://www.purdue.edu/discoverypark/food/borlaugfellows/
Opportunities: Capacity Development

• Farmer-to-Farmer volunteers

• Borlaug Higher Education for Agricultural Research and Development (students and mentors)

• Borlaug Leadership Enhancement in Agriculture Program (students and mentors)
Borlaug Leadership Enhancement in Agriculture Program (LEAP)
2006 Borlaug LEAP Fellow Peter Aikpokpodion set out on a career path in academia but instead ended up in government helping to lead Nigeria’s cocoa transformation agenda.

2010 Borlaug LEAP Fellow Senorpe Asem-Hiabilie used her fellowship to collect field data in Ghana for her study investigating human exposure to environmental estrogens.

2014 Borlaug LEAP Fellow Allan Bomuhangi will be arriving at Penn State in the Fall. He is studying the gender dimensions to climate change.
The Norman Borlaug Award for Field Research and Application, Endowed by the Rockefeller Foundation

2013 recipient, Dr. Charity Mutegi

- Employee KARI
- Gender & Diversity (AWARD pilot)
- 2008 Borlaug LEAP Fellow
  - Fellowship at Penn State/ICRISAT
- USAID Linkage grant, ICRISAT/U Georgia
- Peanut CRSP & IITA
- IITA & USAID Aflasafe Project
- Borlaug LEAP support for WFP, 2011
- Borlaug Award for Field Research
Opportunities: Policy & Development

• AAAS Science & Technology Policy Fellowships (State/USAID, others)

• Payne Fellowships (Foreign Service for minorities)

• USAID Internships and Virtual Foreign Service:
  – [http://www.state.gov/vsfs/](http://www.state.gov/vsfs/)

• Jefferson Science Fellows (Dept of State/USAID)
“We will drive the growth of the future that lifts all of us up.”
– President Barack Obama, 2009

Thank You!

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www.feedthefuture.gov