Enhancing the impact of horticulture on poverty reduction and nutrition outcomes

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We build international partnerships for fruit and vegetable research to improve livelihoods in developing countries.
Why Horticulture?

- High value crops – income generation and diversification
- Intensive farming on small plots possible
- Nutritional benefits of diet diversification
- Potential source of micronutrients (Vitamin C, Vitamin A, Vitamin E, K⁺, etc.)
- Women are heavily engaged in horticulture crop production and marketing
Current Horticulture Development Projects
Horticulture Innovation Lab is Developing/Promoting Several Technologies

- Will focus on postharvest technologies for this presentation
Postharvest handling is a key technology for horticulture

- Reduce losses
- Maintain quality
  - Nutrition
  - Safety
  - Taste
  - Appearance
India is the world's 3rd largest producer of fruits & vegetables, yet per capita consumption and exports are very small.

Losses (in value) average 50% during marketing.

Value equal to the Indian automobile industry!

High losses mean small margins, yet high prices.

High prices lead to low consumption and undernutrition.

India horticulture needs better postharvest!
Factors contributing to postharvest losses

- Temperature
- Water loss
- Damage
- Diseases
- Ethylene
- Continued growth
- Plant Nutrition
Cool temperatures are key

After 7 days in storage
Low-tech systems use evaporative cooling

- Room with wetted charcoal walls
- The ‘zero energy’ cooler
- Only work in the dry tropics
The CoolBot

- Uses a domestic air conditioner
  - Window or ‘Split unit’
- A special controller allows it to achieve low temperatures
Potato harvest in Bangladesh
Problems with ambient storage
In collaboration with CIP, we are comparing CoolBot cold rooms with simple ‘ambient’ storage and ‘improved ambient’ storage systems designed by BRAC.
Solar power for cooling

- Expensive
- Becoming affordable
Drying

- Drying horticultural crops
  - Adds value
  - Use for excess product
  - Provides off-season nutrition

- Solar drying
  - Cabinet dryers are common
Chimney Dryer

- Inexpensive
- Efficient
- High air speed

Chimney made of 4 poles pounded into ground and covered with poly film. Flow rate in stack = 270 m³/h. Stack height = 2m high (above trays) with a 1m x 0.25m cross section.

1 m high ‘table’ constructed of wood, pipe, or metal angle, then covered with black plastic or cloth. Clear plastic film is placed over the trays and the sides of the table.
Dry chain is critical to maintain quality of dried products

Drying beads

- Made of special type of zeolite
- Can be reused indefinitely
- Can be used for both storing and drying
- Can store in airtight container
  - Prevent mold (including Aspergillus) and insect growth
  - Exclude vermin

Drying systems for large quantities under development
Scaling up technologies, research and solutions

- Scaling strategy
  1. Regional Centers
  2. Private sector partnerships and entrepreneurs
  3. Extension and developing market linkages
Regional Centers of Innovation

- Central America
  - Zamorano University, Honduras

- Southeast Asia Center
  - Kasetsart University, Thailand

- East Africa Center
  - Participatory Training Center
    - KARI–Thika, Kenya

We were innovation before innovation was cool!
Our projects work with small and medium sized companies to:

- Source and test materials (AgroNets)
- Design new and innovative products (Drying Beads)
- Market produce (SUN International Hotels)
- Improve cold storage options (Store–It–Cold)
- Improve nutrition by incorporating sweet potato puree into new food products (Bakers in Ghana)
Key to Adoption of All Improved Horticulture Practices is Access to a Viable Market

- Likely return on investments made is key
- Reliable market for crop
- Ability to store crop short time provides essential bargaining power (cool storage)
- Transportation to market
- Farmer associations can be instrumental
Our projects are researching how farmers get and use information, allowing us to identify HOW best to scale our projects. We are:

- Using the Participatory Market Chain Approach to bring value chain actors together to improve market linkages
- Training savings groups to use their resources collectively to improve production and postharvest practices.
Linking farmers to markets

- Linking new woman farmers to buyers at local hotels and supermarkets
- Strengthening production practices and the postharvest value chain
Improving on–farm crop diversity through horticulture increases the likelihood that a family will diversify their diet.

Low dietary diversity is linked to higher rates of malnutrition among infants and young children–

Nutrient–dense foods such as fruits and vegetables are necessary for optimal mental and physical growth throughout development.

(Arimond & Ruel, 2004; Arimond et al., 2010; Ruel, 2003)
Diet diversity

- Dietary diversity (DD) has been shown to be associated with nutrient adequacy and nutritional status (independent of socioeconomic status).
- The more diverse the diet the higher the chances of having adequate nutrition.

MPA = mean probability of adequacy

Arimond et al. 2010
Miller et al. 2013

**Fig. 2.** An illustration of the nutritional impact of adding variety to diets. Eight rice-based diets were formulated to provide 2250 kcal/day. When foods were added, the quantity of rice was reduced by an amount required to keep the total calorie value constant. Foods were added in amounts equal to 1 typical serving, except for milk, where 2 servings were added. The nutrient levels are expressed as a percentage of the Recommended Dietary Allowances for a physically active woman of childbearing age.
Increasing the production of nutrient dense foods, especially fruits and vegetables, is one of the most effective strategies to improve year-round micronutrient intakes and create healthy diet patterns (Herforth, FAO 2012).

Other strategies include increasing women's share of income, as well as increasing production of underutilized fruits and vegetables such as African Indigenous vegetables.
What is the Evidence?

- Will increased production of horticultural crops lead to increased consumption?
  - Who will increase their consumption?
  - If farmer does not, what are the barriers?
    - Lack of information about nutritional value?
    - Desire to sell the product to obtain income?

- How good is our evidence of fruit and vegetable consumption?
  - How much are households really consuming?
  - Based on household surveys or production/market information?
Nutrition outcomes will be a focus in future Horticulture Innovation Lab Programs

- Household consumption level
- Nutrition education combined with assistance in production practices, evidence of nutrition outcomes
  - Household gardens
  - Commercial production
Thank you!!

For more information:

http://horticulture.ucdavis.edu