AVRDC-The World Vegetable Center:
Role of Horticulture in Poverty Alleviation

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The World Vegetable Center

Mission:
Alleviate poverty and malnutrition in the developing world through increased production, marketing and consumption of safe vegetables.
Poverty - A Global Challenge

About 1.1 billion people live on less than US$1 per day

Another 1.6 billion lives between 1-2US$ per day
Poverty-A Global Challenge

Population living on under $1 a day

- East Asia
- Sub-Saharan Africa
- South Asia
- Rest of the world
Poverty-A Global Challenge

Figure 2. Poverty map for less than one dollar a day

Percentage of people
- 40 - 73
- 20 - 40
- 5 - 20
- 2 - 5
- 1.5 - 2
- <2
Poverty-A Global Challenge
Poverty map for less than two dollars a day

Percentage of people:
- 75 - 92
- 50 - 75
- 28 - 50
- 15 - 28
- 2 - 12
- <2
Micronutrient deficiency - Another Global Challenge

- 2 billion affected by micronutrient deficiency
- 1.5 billion by iron deficiency
- 100-250 million preschool children severely affected by vitamin A deficiency
- 1.3-2.5 million deaths annually
Why Vegetables—Healthy Diets

AVRDC Recommendation = minimum required level is 100 g per day or 73 kg per annum
Why Vegetables?

Little hope from traditional agricultural production because of declining prices and reduced farm holding
Why Vegetables?

Per capita vegetable availability

Minimum required level

Kg/capita/annum

Bangladesh
Indonesia
Philippines
Pakistan
Malaysia
Sri Lanka
Thailand
India
Vietnam
Japan
Taiwan
Why Vegetables?

Source: FAOSTAT data, 2005.
Why Vegetables

An engine for economic growth

Vegetables:

- Create jobs
- Generate higher incomes
- Alleviate malnutrition
- Improve learning capacities
- Improve role of women
### Why Vegetables—Alleviate poverty

#### A. Providing farm employment

<table>
<thead>
<tr>
<th>Crop</th>
<th>Days/ha</th>
<th>Vegetable</th>
<th>Cereal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td></td>
<td>338</td>
<td>133</td>
</tr>
<tr>
<td>Cambodia</td>
<td></td>
<td>437</td>
<td>81</td>
</tr>
<tr>
<td>Laos</td>
<td></td>
<td>223</td>
<td>100</td>
</tr>
<tr>
<td>North Vietnam</td>
<td></td>
<td>468</td>
<td>216</td>
</tr>
<tr>
<td>South Vietnam</td>
<td></td>
<td>297</td>
<td>111</td>
</tr>
</tbody>
</table>

*Source: Ali and Abedullah, 2002*
# Input use on vegetables versus cereals

The table below shows the input use on vegetables versus cereals in South Vietnam, Laos, Cambodia, and Bangladesh.

<table>
<thead>
<tr>
<th>Input/Crop</th>
<th>South Vietnam</th>
<th>Laos</th>
<th>Cambodia</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pesticide (No. of spray)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>7.7</td>
<td>1.5</td>
<td>7.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Cereals</td>
<td>3.2</td>
<td>0.1</td>
<td>2.6</td>
<td>1.3</td>
</tr>
<tr>
<td><strong>Irrigation (No.)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>31</td>
<td>39</td>
<td>43</td>
<td>3</td>
</tr>
<tr>
<td>Cereals</td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td><strong>Fertilizer (kg/ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>534</td>
<td>91</td>
<td>148</td>
<td>276</td>
</tr>
<tr>
<td>Cereals</td>
<td>197</td>
<td>75</td>
<td>46</td>
<td>113</td>
</tr>
<tr>
<td><strong>Cash cost (US$/ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>658</td>
<td>117</td>
<td>406</td>
<td>428</td>
</tr>
<tr>
<td>Cereals</td>
<td>233</td>
<td>53</td>
<td>78</td>
<td>143</td>
</tr>
</tbody>
</table>
## ECONOMIC BENEFITS OF THE DIVERSIFICATION

### Resource use efficiency

<table>
<thead>
<tr>
<th>Crop/input</th>
<th>S. Vietnam</th>
<th>Laos</th>
<th>Cambodia</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land (US$/ha)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>1252</td>
<td>834</td>
<td>515</td>
<td>553</td>
</tr>
<tr>
<td>Cereals</td>
<td>158</td>
<td>152</td>
<td>73</td>
<td>30</td>
</tr>
<tr>
<td><strong>Labor (US$/labor day)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>8.4</td>
<td>13.9</td>
<td>4.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Cereals</td>
<td>4.8</td>
<td>8.8</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Water (% return on water cost)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>88</td>
<td>396</td>
<td>52</td>
<td>65</td>
</tr>
<tr>
<td>Cereals</td>
<td>37</td>
<td>144</td>
<td>26</td>
<td>40</td>
</tr>
<tr>
<td><strong>Benefit-cost ratio (%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetables</td>
<td>105</td>
<td>116</td>
<td>38</td>
<td>81</td>
</tr>
<tr>
<td>Cereals</td>
<td>35</td>
<td>81</td>
<td>33</td>
<td>13</td>
</tr>
</tbody>
</table>
ECONOMIC BENEFITS OF THE DIVERSIFICATION

Yield

Technical efficiency

Vegetable farmer

Non-vegetable farmers

$Y_1 > Y_2$ by 20%

Inputs

$Y_1$ $Y_2$
# A. Efficient Nutrient Source

<table>
<thead>
<tr>
<th></th>
<th>Philippines</th>
<th>Bangladesh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>1.72</td>
<td>1.04</td>
</tr>
<tr>
<td>Beef</td>
<td>0.41</td>
<td>1.28</td>
</tr>
<tr>
<td>Chicken</td>
<td>1.10</td>
<td>0.33</td>
</tr>
<tr>
<td>Fish</td>
<td>0.40</td>
<td>0.45</td>
</tr>
<tr>
<td>Carrots</td>
<td>1.78</td>
<td>2.27</td>
</tr>
<tr>
<td>Pakchoi</td>
<td>1.76</td>
<td>1.18</td>
</tr>
<tr>
<td>Pepper</td>
<td>1.42</td>
<td>2.07</td>
</tr>
<tr>
<td>Soybeans</td>
<td>2.67</td>
<td>4.32</td>
</tr>
<tr>
<td>English Spinach</td>
<td>2.09</td>
<td>6.49</td>
</tr>
<tr>
<td>Horse Radish</td>
<td>4.87</td>
<td>*</td>
</tr>
<tr>
<td>Jute Leaves</td>
<td>5.63</td>
<td>2.36</td>
</tr>
<tr>
<td>Amaranth</td>
<td>*</td>
<td>8.61</td>
</tr>
</tbody>
</table>

Efficiency = Nutritive value (US$/100g) / Average price (US$/100g)

* Implies that the commodity was not consumed in the survey area
RESEARCH UNITS
Genetic Resource Unit

- Collect Germplasm
- Exchange Germplasm
- Characterization of germplasm
- Standardized collections
- Indigenous knowledge
Breeding Program

Paul Gniffke (pepper)  Peter Hanson (tomato)
Breeding Priorities

*Tomato*

- Tomato leaf curl virus
- Bacterial wilt
- Antioxidants
- Heat tolerance
Breeding Priorities

**Pepper**

- Anthracnose
- Viruses
- Phytophthora blight
- Heat tolerance
Breeding Priorities

**Cucurbits**

- Diseases/Insects
- Landraces
- Export markets
- Nutraceuticals
Breeding Priorities

**Misc.**

- Onion storage
- Indigenous leafy vegetables
- Anti-oxidants
- Summer broccoli
Integrated Pest-Management

1. Biological control
2. In-host plant resistance
3. Cop Management strategies
4. Optimizing the chemical use
Economics and Nutrition

1. Dynamism in the horticulture sector

2. Ex-ante and ex-post Impact of vegetable and vegetable technologies (income, employment, nutrition, etc.)

3. Role of vegetables in the farming system (peri-urban, rice-based, upland).

4. Prioritization of horticulture research.

5. Methods to enhance bioavailability from vegetables
CROP MANAGEMENT

Develop sustainable vegetable technologies which can enhance small farmers’ income without damaging environment

(Organic Agriculture)
Training Activities
MULTILATERAL NETWORKING

SAVERNET

ERVERNET

REDCOHRE
Private Sector

Another link connecting AVRDC with farmers

• 72% of vegetable seed companies in Asia use improved lines from AVRDC

• APSA, Bayer, CropLife fund research
ACHIEVEMENTS OF AVRDC RESEARCH

Germplasm

Accession collected = 49339
No. of species = 343
Package distributed = 20,000/year
No. of countries = Over 80

Varieties released

No. of varieties released = 322
No. of countries = 55
ACHIEVEMENTS OF AVRDC RESEARCH

Multiple Disease Resistant, high yielding, and mildly pungent Chili Varieties
ACHIEVEMENTS OF AVRDC RESEARCH

Heat Tolerant Tomato
ACHIEVEMENTS OF AVRDC RESEARCH

Cherry Tomato
ACHIEVEMENTS OF AVRDC RESEARCH

Processing Tomato
ACHIEVEMENTS OF AVRDC RESEARCH

High-Beta Carotene Tomato

High β-carotene (3.52 mg/100 g)
Achievements of AVRDC Research

Heat Tolerant Cabbage
ACHIEVEMENTS OF AVRDC RESEARCH

High Yielding Vegetable Soybean
ACHIEVEMENTS OF AVRDC RESEARCH

High yielding, YMV Resistant, Short Duration, and synchronized Mungbean Varieties
ACHIEVEMENTS OF AVRDC RESEARCH

AVRDC’s grafting method

570,000 grafted tomato seedling during 2000 valued at 2.3 million NT$
ACHIEVEMENTS OF AVRDC RESEARCH

Grafted cherry tomato with eggplant rootstock in net house
ACHIEVEMENTS OF AVRDC RESEARCH

Non-circulating Hydroponics for Small farmers
ACHIEVEMENTS OF AVRDC RESEARCH

Diamondback moth

Parasite of DBM
ACHEIVEMENTS OF AVRDC RESEARCH

Training the national partners

- *Training at ARC/AVRDC*
- *On the job training*
ACHEIVEMENTS OF AVRDC RESEARCH

Number of trainees trained

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Headquarters</td>
<td>1028</td>
<td>1006</td>
</tr>
<tr>
<td>ARC, Thailand</td>
<td>272</td>
<td>157</td>
</tr>
<tr>
<td>RCA, Arusha</td>
<td>608</td>
<td>0</td>
</tr>
</tbody>
</table>
Tsunami Relief Project
Impact of AVRDC in Bangladesh

Trend in vegetable production

Production

Pre-innovation period = 13.7288 + 0.0183t₁
Innovation period = 13.7288 + 0.0183t₁ + 0.01293t₂

Area

Innovation period = 12.3247 + 0.0113t₁ + 0.0069t₂
Pre-innovation period = 12.3247 + 0.0113t₁
IMPACT OF VEGETABLE RESEARCH

Improvement in seasonal vegetable supply in Taiwan

<table>
<thead>
<tr>
<th>Month</th>
<th>Price index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>110</td>
</tr>
<tr>
<td>3</td>
<td>160</td>
</tr>
<tr>
<td>4</td>
<td>210</td>
</tr>
<tr>
<td>5</td>
<td>260</td>
</tr>
<tr>
<td>6</td>
<td>1985-88</td>
</tr>
<tr>
<td>7</td>
<td>1992-94</td>
</tr>
</tbody>
</table>

AVRDC
The World Vegetable Center
IMPACT OF AVRDC

• 25,000 vegetable gardening kits to Sri Lanka and Indonesia

APSA donated 5,500 kg of seeds

Distribution by NARES
# IMPACT OF AVRDC RESEARCH

## Economic surplus

<table>
<thead>
<tr>
<th>IARC</th>
<th>Economic surplus in billion US$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Producers</td>
</tr>
<tr>
<td>AVRDC</td>
<td>8.422</td>
</tr>
<tr>
<td>IRRI</td>
<td>3.020</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>0.799</td>
</tr>
</tbody>
</table>

Learning More
Thank you
Illustrated Issues
Indigenous Vegetables
Seed Production and Quality
Seed Sources
OP vs Hybrid
Pesticides Misuse
Diseases
Year-round and Protected Production
Transportation
Post Harvest & Marketing Chain
Cold Chain
Supermarkets
New Initiatives

- Organic vegetable production
- Cucurbit & onion breeding
- Private Sector Partners
- Global Horticultural Needs Assessment – Hort CRSP
- Global Horticulture Initiative
Learning More
Thank you
A Growing Center
New Scientists and Management

Jackie Hughes
DDG - Research

Chang Yin-fu
DDG – A&S

Leonidas Fereol
CIRAD Allium Embryologist

Hidekazu Sasaki
JIRCAS Functional Properties of IV

R. Srinivasan
Post-Doc Entomology

Manuel Palada
Head Crop Management

M. Takahashi
JIRCAS Legume Breeding

Virginie Levasseur
Mali Coordinator AVRDC-WARDA

R. Mavlyanova
Central Asia Coordinator

Peter Juroszek
Organic Veg Production

Ehsanullah Ehsan
Afghanistan Coordinator

IPM Outreach Coordinator