Past, Present and Future of Agricultural Biotechnology in Thailand: Part 2
Flooding or submergence tolerant rice: photo, non photosensitive varieties
Blast Resistant RD6 (Thanyasirin) Released to Farmer in 2008

Non resistant

resistant
Blast resistant RD 6 \(^\d\) growing in North and North-east Thailand
Breeders seed

Multiplication seed

Foundation seed

Commercial seed

Rice seed production

own use, sell

1 Million Ton of rice seed
20,000 Million Baht
Business Model to Produce Rice Seed for Community Use: Training the Trainer (skill farmer)

Rice Gene Discovery Unit
Multiplication seed 2.5 tons

Farmers produce commercial seed
Jan-April 2012
250 Rai (seed 10 kg./rai)

Commercial seed 125 tons
(ave. 500 kg/rai)
(price 20,000 baht/ton)

paddy 5,000 tons (ave. 500 kg./rai)
(price 15,000 baht/ton)

Sell to farmer for planting during
June-Oct 2012
10,000 Rai (12.5 kg./rai)

NSTDA and Small Holders
Plant Molecular Breeding: Genetic Engineering

WE VIEW IT AS A RATHER REMARKABLE FEAT OF GENETIC ENGINEERING.
Resistant to tomato yellow leaf curl virus

Papaya ring spot virus

susceptible
Examples of Current Work on Genetic Modification of Plants

R&D

- Development of papayas resistant to the papaya ringspot virus (PRSV)
- R&D on plant transformation in cassava, sugarcane, rice and orchid

Field Trial & Demonstration

- Only the virus PRSV resistant papayas went to field trial in 1997.
- In 2001, experiments involving GM plant were put on hold following a decision by the cabinet.
- Thailand’s Biosafety Guideline, initiated in 1992, cover areas of R&D, field testing, and commercialization.

TT & Commercialize

- Thailand is yet to trade genetically modified plants, except for research purposes.
- National Biosafety Act has been approved by the cabinet and is now under consideration by the Office of the Council of State of Thailand.
Thailand allows to import GM corn and soy bean for food, feed but not commercial cultivation

2012, Thailand produced 63,000 tons of soy bean
2012, imported 2.1 MT of soybean and 2.8 MT of soy bean meal from Brazil, US and Argentina
Thailand GMO Policy and Its Implication to Seed Industry: A Case Study on Field Corn

Corn production in Thailand (feed) 4.2 million tons
2 Million farmers
Corn seed used 21,000 tons (US $ 83 Million)

Export value of corn seed:
1,372 M baht in 2011
1,362 M Baht in 2012

Export markets
Vietnam (2011) 12,281 Ton/778 MB;
(2012) 8,919 Ton/801 MB

Indonesia (2011) 2,445 Ton/778 MB;
(2012) 1,389 Ton/187 MB

Philippines (2011) 405 Ton/49 MB;
(2012) 285 Ton/111 MB
Corn Production in the Philippines, 2000-2012

Source: DA - Bureau of Agricultural Statistics

Start of biotech corn propagation
GMO Status and Challenges to Thailand

2001

R & D

Green House

Field trial

Commercial

2011

R & D

Green House

Field trial

Commercial

Source: National Center for Genetic Engineering and Biotechnology

Vietnam expected to allow field grow in 2015
Thailand is a hub of global seed production

- Export seed companies = 80
- Multinational companies = 10 (R&D 9)
- Thai seed companies = 70 (R&D 21)
- R&D = 37.5%

Multinational companies in Thailand
- Monsanto
- Syngenta
- Sakata
- Pacific Seed (Holland)
- Pioneer
- Limagrain (Clause)
- East West Seed

Type of seed company
- R&D (breeding)
- Contract Seed Production
- Trading
Thailand Experiences on GM Crop Field Trials before 2001

1995: tomato FLAVR SAVR delay ripening (Upjohn)

1996: Bt cotton Stem borer (Novartis)

1997: BT cotton Stem borer (Monsanto)

1998: Bt corn Stem borer (Monsanto)

1999: Bt corn Stem borer MON 810 (Monsanto)

Papaya PRSV (DOA)
What is the future of Thai Agriculture
Can Thailand feed the world and sustain the planet?
Thailand is Net Energy Importer

Oil importer

Ag & Food exporter

Don't worry honey. We have a hybrid vehicle .......
Biofuels and Food: Trends and Prospects for Thailand
By 2100, global temp. increases 1.8-4°C (IPCC 2007)

IRRI field result
Every one degree increase in night temperature, rice productivity decreases 10% (Peng et al., 2004)
In 2010 drought exacerbated the pandemic situation, damaging approximately 1 million hectares of cassava plantation and causing a 20-25% reduction in yields.

2009 the spread of brown plant hoppers in rice field and causing a loss in 1.1 M ton paddy worth 11,000 M bahts.
The Number of Floods that Occurred by Country

- Cambodia: 5, 8
- Indonesia: 25, 59
- Lao P Dem Rep: 6, 5
- Malaysia: 4, 23
- Myanmar: 5, 7
- Philippines: 28, 43
- Thailand: 17, 32
- Viet Nam: 15, 37

Source: EM-DAT: The OFDA/CRED International Disaster Database
http://www.emdat.be - Université Catholique de Louvain - Brussels - Belgium
In 2010:
flood damaged more than 1.76 million hectares causing the government to approve approximately 550 million USD to help flood victims.

In 2011 (10 Oct):
flood damaged more than 1.4 million hectares.

November 2010 and June 2011
over 39 provinces in Thailand were experiencing drought, causing the government to allocate a budget of more than 13 million USD to relieve the problem.
Green House Gas Emission from Agricultural Sector (35%)
Mitigation

Adaptation: new crop variety

Global Climate Change
Seasonal Variability

Drought tolerant

Aerobic rice

Flooding tolerant

Pest tolerant
World Economic Integration

**NAFTA**
- Canada, USA, Mexico

**EU**
- 27 EU Member States
- GDP: 18,400 billion US (2008)

**BRIC**
- Brazil, Russia, India, China
- Population: 2,851 million (2010)
- GDP: 8,784 billion US (2008)

**APEC**
- 21 Economies in the Asia-Pacific such as USA, Japan, NZ, Korea, China, Russia, Thailand, Vietnam
- Population: 2,720.6 million (2009)
- GDP: 32,386.2 billion US (2009)

**ASEAN**
- AEC 2015
- Brunei, Cambodia, Indonesia, Laos PDR, Malaysia, Myanmar, Philippines, Thailand, Vietnam, Singapore
- Population: 592 million (2009)
- GDP: 1,500 billion US (2009)

**OECD**
- GDP: 18,400 billion US (2008)
ASEAN Integration 2015

ASEAN and dialogue partners

ASEAN

- 598 Mil. (9% World Population)
- 1,859 Bil. US$ *(3% World GDP)
  (Thailand 67Mil. Population)

ASEAN + 3

- 2,120 Mil. (30% World Population)
- 14,293 Bil. US$ (23% World GDP)

ASEAN + 6

- 3,388 Mil. (49% World Population)
- 17,251 Bil. US$ (27% World GDP)

Source: The World Bank, ASEAN Community in Figure 2011 via Thailand Management Association
ASEAN Economic Community and Its Implication to Thailand Agriculture

One Vision, One Identity and One Caring and Sharing Community
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Myanmar</td>
<td>48.37</td>
<td>70</td>
<td>835</td>
</tr>
<tr>
<td>Cambodia</td>
<td>36.68</td>
<td>56</td>
<td>934</td>
</tr>
<tr>
<td>Laos</td>
<td>30.80</td>
<td>75</td>
<td>1,446</td>
</tr>
<tr>
<td>Vietnam</td>
<td>22.02</td>
<td>48</td>
<td>1,528</td>
</tr>
<tr>
<td>Indonesia</td>
<td>14.72</td>
<td>39</td>
<td>3,910</td>
</tr>
<tr>
<td>Philippines</td>
<td>12.79</td>
<td>32</td>
<td>2,617</td>
</tr>
<tr>
<td>Thailand</td>
<td>12.36</td>
<td>40</td>
<td>5,678</td>
</tr>
<tr>
<td>Malaysia</td>
<td>11.87</td>
<td>11</td>
<td>10,304</td>
</tr>
<tr>
<td>Singapore</td>
<td>0.03</td>
<td>0.1</td>
<td>51,162</td>
</tr>
<tr>
<td>Country</td>
<td>Rice</td>
<td>Corn (feed)</td>
<td>cassava</td>
</tr>
<tr>
<td>------------</td>
<td>---------</td>
<td>-------------</td>
<td>---------</td>
</tr>
<tr>
<td>Indonesia</td>
<td>69.84</td>
<td>18.41</td>
<td>26.45</td>
</tr>
<tr>
<td>Vietnam</td>
<td>43.34</td>
<td>4.90</td>
<td>9.85</td>
</tr>
<tr>
<td>Thailand</td>
<td>36.18</td>
<td>4.86</td>
<td>27.55</td>
</tr>
<tr>
<td>Myanmar</td>
<td>29.26</td>
<td>1.49</td>
<td>0.57</td>
</tr>
<tr>
<td>Philippines</td>
<td>18.07</td>
<td>7.91</td>
<td>2.35</td>
</tr>
<tr>
<td>Cambodia</td>
<td>9.30</td>
<td>0.84</td>
<td>8.38</td>
</tr>
<tr>
<td>Laos</td>
<td>3.82</td>
<td>1.06</td>
<td>1.01</td>
</tr>
<tr>
<td>Malaysia</td>
<td>2.62</td>
<td>-</td>
<td>0.00</td>
</tr>
<tr>
<td>Brunei</td>
<td>2.92</td>
<td>-</td>
<td>0.00</td>
</tr>
</tbody>
</table>

unit: MT

ที่มา: จาเร็ค สิ่งหญีชา, 2013
## Export of shrimp 2009-2012

<table>
<thead>
<tr>
<th>Country</th>
<th>Value (US$ Million)</th>
<th>World ranking</th>
<th>World market share (%)</th>
<th>Asean market share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>3,120</td>
<td>1</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>Vietnam</td>
<td>2,200</td>
<td>2</td>
<td>16</td>
<td>1</td>
</tr>
<tr>
<td>Indonesia</td>
<td>1,500</td>
<td>4</td>
<td>11</td>
<td>2</td>
</tr>
</tbody>
</table>
## Export of Palm Oil 2012

<table>
<thead>
<tr>
<th></th>
<th>Quantity M. Ton</th>
<th>Value M. $US</th>
<th>World Ranking</th>
<th>World market share (%)</th>
<th>ASEAN market share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>18.8</td>
<td>17,602</td>
<td>1</td>
<td>47</td>
<td>15</td>
</tr>
<tr>
<td>Malaysia</td>
<td>15.6</td>
<td>15,456</td>
<td>2</td>
<td>41</td>
<td>11</td>
</tr>
<tr>
<td>Thailand</td>
<td>0.3</td>
<td>304</td>
<td>4</td>
<td>1</td>
<td>44</td>
</tr>
</tbody>
</table>

Source: Global Trade Atlas

## Export of Rubber and Rubber Products 2012

<table>
<thead>
<tr>
<th></th>
<th>Quantity M. Ton</th>
<th>Value M. $US</th>
<th>World Ranking</th>
<th>World market share (%)</th>
<th>ASEAN market share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>2.8</td>
<td>8,371</td>
<td>1</td>
<td>34</td>
<td>15</td>
</tr>
<tr>
<td>Indonesia</td>
<td>2.0</td>
<td>2,549</td>
<td>2</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>Malaysia</td>
<td>1.0</td>
<td>6,353</td>
<td>4</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Vietnam</td>
<td>1.1</td>
<td>2,850</td>
<td>3</td>
<td>7</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: Global rubber market/ Global Trade Atlas
Export Value from Agriculture and Food (2012)

80% of total export outside ASEAN

(Billion USD)

Source: Global Trade Atlas
Increase in investment from China; Korea and Japan in Africa and ASEAN on cassava industry
### ASEAN: Kitchen of the World

<table>
<thead>
<tr>
<th>Product</th>
<th>ASEAN world market share (%)</th>
<th>Thailand world market share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palm oil</td>
<td>89</td>
<td>1</td>
</tr>
<tr>
<td>Cassava products</td>
<td>84</td>
<td>57</td>
</tr>
<tr>
<td>Rice</td>
<td>55</td>
<td>29</td>
</tr>
<tr>
<td>Shrimp</td>
<td>42</td>
<td>20</td>
</tr>
<tr>
<td>Sugar</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>Rubber</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Poultry</td>
<td>7</td>
<td>7</td>
</tr>
</tbody>
</table>

ที่มา: Global Trade Atlas, 2013
<table>
<thead>
<tr>
<th>Country</th>
<th>Rice</th>
<th>Cassava</th>
<th>Shrimp</th>
<th>Natural Rubber</th>
<th>Poultry</th>
<th>Sugar</th>
<th>Vegetable</th>
<th>Processed Rubber</th>
<th>Palm Oil</th>
<th>Fruits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thailand</td>
<td>15.5</td>
<td>10.9</td>
<td>8.4</td>
<td>4.8</td>
<td>4.7</td>
<td>2.7</td>
<td>0.8</td>
<td>0.4</td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Vietnam</td>
<td>20.0</td>
<td>7.4</td>
<td>8.9</td>
<td>1.0</td>
<td>na</td>
<td>1.2</td>
<td>1.6</td>
<td>na</td>
<td>na</td>
<td>na</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.0</td>
<td>0.4</td>
<td>4.1</td>
<td>6.2</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.2</td>
<td>20.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Malaysia</td>
<td>0.0</td>
<td>0.1</td>
<td>1.6</td>
<td>3.3</td>
<td>1.0</td>
<td>0.4</td>
<td>0.2</td>
<td>0.7</td>
<td>23.7</td>
<td>0.1</td>
</tr>
<tr>
<td>India</td>
<td>12.9</td>
<td>0.3</td>
<td>5.1</td>
<td>0.6</td>
<td>0.3</td>
<td>3.7</td>
<td>1.0</td>
<td>1.1</td>
<td>0.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Philippines</td>
<td>0.1</td>
<td>0.0</td>
<td>0.9</td>
<td>1.3</td>
<td>0.5</td>
<td>1.3</td>
<td>0.2</td>
<td>1.0</td>
<td>0.0</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Calculated from World Trade Atlas and FAO statistic
Regional Sourcing
Regional Branding
Regional Innovation
Regional Talents
(สุวิชัย เมธินทรีย์, 2555)

ASEAN Seed Hub
Green City (environmental friendly)
ASEAN Center for Ag. Machinery
Smart Farmers
(Ministry of Agriculture and Co-operation)

What is Thailand’s position
ASEAN Preparedness for AEC 2015

ASEAN; one of the world agriculture and food producers.
Regional branding

Quality Assurance and safety
Regulation/Standard
ASEAN Harmonization

Sustainable Agriculture

ASEAN co-operation for ASEAN competitiveness: strengthening Thailand and ASEAN

Regional Center for HRD in agriculture/training
North-South, South-South
Regional Talent

Regional Center for R&D in Agriculture Adaptation

• High value product: from agriculture to agro-industries
• Improve logistics performance, connection within ASEAN
• GMO policy, registration etc.
Thailand Preparedness for AEC 2015

Produce more but less inputs
Increase productivity (yield/area)

Resource use (fertilizer, water) efficiency

Sustainable Agriculture

Climate Change/Variability

Agriculture Adaptation

Mitigation

High value products
<table>
<thead>
<tr>
<th></th>
<th>rice Ton/hectare</th>
<th>sugarcane Ton/hectare</th>
<th>cassava Ton/hectare</th>
<th>Oil palm Ton/hectare</th>
<th>Para rubber Ton/hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>4.4</td>
<td>70.2</td>
<td>12.5</td>
<td>14.38</td>
<td>1.13</td>
</tr>
<tr>
<td>Lead country</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>6.25</td>
<td>81.9</td>
<td>34.38</td>
<td>21.9-28.1</td>
<td>1.81</td>
</tr>
<tr>
<td>Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.81 India</td>
</tr>
<tr>
<td>India</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guatemala</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>76.25</td>
<td>23.75</td>
<td>14.38-18</td>
<td>1.62</td>
</tr>
<tr>
<td>ASEAN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vietnam</td>
<td>5.56</td>
<td>76.98</td>
<td>17.5</td>
<td>21.9</td>
<td>1.75</td>
</tr>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.75 Vietnam</td>
</tr>
<tr>
<td>Myanmar</td>
<td>4.06</td>
<td>60</td>
<td>18.75</td>
<td>16.23</td>
<td>1.28</td>
</tr>
<tr>
<td>Vietnam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.28 Malaysia</td>
</tr>
<tr>
<td>Cambodia</td>
<td>3</td>
<td>50</td>
<td>16.25-20</td>
<td></td>
<td>1.19</td>
</tr>
<tr>
<td>Laos</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.19 Cambodia</td>
</tr>
</tbody>
</table>

ที่มา: สำนักงานเศรษฐกิจการเกษตร
How to improve yield: 1. Genetic improvement
2. Improved crop management

Crop management

Genetic improvement

Yield (Tons/Hectare)

- sugarcane
- cassava
- Oil palm

<table>
<thead>
<tr>
<th>Crop</th>
<th>Yield (Tons/Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>sugarcane</td>
<td>281</td>
</tr>
<tr>
<td>cassava</td>
<td>81</td>
</tr>
<tr>
<td>Oil palm</td>
<td>94</td>
</tr>
</tbody>
</table>

- maximum genetic potential
- genetic potential of Thai elite line
- Thailand average yield

How to improve yield:

1. Genetic improvement
2. Improved crop management
## Export market of ASEAN member countries: Cassava products 2010-2012

<table>
<thead>
<tr>
<th></th>
<th>chip/pellet (HS 0714)</th>
<th>Native starch (HS 1108)</th>
<th>Modified starch (HS 3505)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thailand</strong></td>
<td>China (98%)</td>
<td>China (27%)</td>
<td>China (20%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indonesia (22%)</td>
<td>Indonesia (10%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan (7%)</td>
<td>Japan (32%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Taiwan (13%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Malaysia (11%)</td>
<td></td>
</tr>
<tr>
<td><strong>Vietnam</strong></td>
<td>China (90%)</td>
<td>China (64%)</td>
<td>China (15%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Japan (55%)</td>
</tr>
<tr>
<td><strong>Cambodia</strong></td>
<td>Thailand Vietnam China</td>
<td>China (70%)</td>
<td></td>
</tr>
<tr>
<td><strong>Indonesia</strong></td>
<td>China (60%)</td>
<td>Philippines (29%)</td>
<td>China (11%)</td>
</tr>
<tr>
<td></td>
<td>Japan (15%)</td>
<td>Malaysia (23%)</td>
<td>Japan (36%)</td>
</tr>
<tr>
<td></td>
<td>Korea (15%)</td>
<td>Taiwan (19%)</td>
<td>Netherland (28%)</td>
</tr>
<tr>
<td><strong>Laos</strong></td>
<td>China Vietnam Thailand</td>
<td>China (50%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan (33%)</td>
<td></td>
</tr>
<tr>
<td><strong>Myanmar</strong></td>
<td>China</td>
<td>China (20%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan (30%)</td>
<td></td>
</tr>
<tr>
<td><strong>Malaysia</strong></td>
<td>Singapore (90%)</td>
<td>Singapore (21%)</td>
<td>Singapore (28%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Japan (58%)</td>
<td>Japan (23%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thailand (7%)</td>
<td>Indonesia (23%)</td>
</tr>
<tr>
<td><strong>Philippines</strong></td>
<td>USA. (60%)</td>
<td>Myanmar (35%)/</td>
<td>USA. (10%)</td>
</tr>
<tr>
<td></td>
<td>Canada (20%)</td>
<td>Vietnam (15%)</td>
<td>Australia (42%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Malaysia (9%)</td>
</tr>
<tr>
<td><strong>Singapore</strong></td>
<td>Malaysia (75%)</td>
<td>Malaysia (40%)</td>
<td>Malaysia (26%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Indonesia (27%)</td>
<td>Indonesia (21%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thailand (17%)</td>
<td></td>
</tr>
</tbody>
</table>

Potential of Thailand Ethanol Industry
Biotech’s Plans to Sustain Agriculture

Biotechnology: new genes insertion and new traits; DNA marker assisted breeding

Agronomic practices: precision agriculture based on remote sensing and global positioning, new equipment for irrigation and new planting technology

Drought tolerance and nitrogen-use efficiency (water-optimized product, reductions in nitrogen fertilizer use)
**Nutrient Manager** provides farmers with field-specific guidelines.

**Computer via Web connection**

1. Access website: [www.irri.org/nmrice](http://www.irri.org/nmrice)
2. Answer 15 questions about field
3. Receive guideline via internet

**Mobile phone**

1. Call tool free number
2. Answer 12 questions about field
3. Receive guideline via text

**NM Rice**:
- For 94-105 sacks of rice on 1 hectare in dry season with good management practices:
  - Apply 3 bags 14-14-14 basal or within 10 days after transplanting (DAT), 1 bag urea at 21 to 25 DAT, 1 bag urea at 30 to 34 DAT.

**Available in**
- Philippines
- Indonesia, China
- Coming soon in Vietnam and other countries

*Source: Zeigler*
Village that Learns

ICT/ICM

Global Knowledge

Build on Existing

Network & Partnership

Reflection

Empowerment

Appropriated Technology

Phase 1
Distribute information

CEOs use the information in the planning process

Agricultural Information Network

Provide information for information brokers

Linkage and evaluation

Information push

Phase 2

Sustainability

Stake Holder

Information Diffusion

Community Learning Process

HOW WiMAX WORKS

Input information by community

Information pull

Reflects needs

Outputs

Network & Partnership

Reflection

Empowerment

Appropriated Technology

Phase 1
Distribute information

CEOs use the information in the planning process

Agricultural Information Network

Provide information for information brokers

Linkage and evaluation

Information push

Phase 2

Sustainability

Stake Holder

Information Diffusion

Community Learning Process

HOW WiMAX WORKS

Input information by community

Information pull

Reflects needs

Outputs
Why change?

It is not the strongest species that survives,
Nor the most intelligent,
But the one most responsive to change

Modern Agriculture and Thai Education
Thank you