Conserving Agricultural Biodiversity: Participatory Plant Breeding and Bio-Dynamic Farming in Southeast Asia

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Current Situation in Conventional Agriculture

- Oligopoly by a few TNCs over agricultural inputs, including seeds
- “Green Revolution” package of technology remains as the dominant farming system, especially in intensive cultivation areas
- Dependence on chemical inputs
- Massive erosion of genetic erosion due to monocropping
- Environmental degradation and health impacts of massive use of pesticides
- Household food insecurity due to cash crop cultivation

World's Top 10 (+1) Seed Corporations

Company	2002 Seed Sales US millions
1. **Dupont** (Pioneer) US	$2,000
2. **Monsanto** (US)	$1,600
3. **Syngenta** (Switzerland)	$937
4. **Seminis** (US)	$453
5. **Advanta** (Netherlands)	$435
6. **Groupe Limagrain** (France)	$433
7. **KWS AG** (Germany)	$391
8. **Sakata** (Japan)	$376
9. **Delta & Pine Land** (US)	$258
10. **Bayer Crop Science** (Germany)	$250
11. **Dow** (US)	$200

World's Top 10 Agrochemical Firms

Company	2002 Agrichem Sales US m
1. **Syngenta** (Switzerland)	$5,260
2. **Bayer** (Germany)	$3,775
3. **Monsanto** (US)	$3,088
4. **BASF** (Germany)	$2,787
5. **Dow** (US)	$2,717
6. **DuPont** (US)	$1,793
7. **Sumitomo Chemical** (Japan)	$802
8. **Makhteshim-Agan** (Israel)	$776
9. **Arysta LifeScience** (Japan)	$662
10. **FMC** (US)	$615

Source: ETC Group, "Oligopoly Inc. Concentration of Corporate Power 2003"

Sustainable World Solutions: Examples from Southeast Asia

- Participatory Plant Breeding: PEDIGREA
  - Cambodia: Srer Khmer
  - Indonesia: FIELD Foundation
  - Philippines: PPRDI
- Bio-dynamic Organic Agriculture: Don Bosco Youth Foundation
  - Mindanao, Philippines

Conserving Agricultural Biodiversity: Participatory Plant Breeding

- Participatory Plant Breeding (PPB): a farmer-centered, community-based approach in plant breeding
- In Southeast Asia: primarily uses the Farmer Field School (FFS) approach in promoting PPB
  - Season-long
  - Experiential, Collective Observations
  - Farmer-led
  - Farm-based

- FFFS-PPB are conducted within the community, usually in the village hall, under a tree or any comfortable spot agreed on by the participants. In one community in Mindanao, farmers agreed to meet in the local cemetery (using the grave of the former village chief as table!) as there was no other available meeting place in the community
- At least 30% of all farmers who attend FFS-PPB are women

PPB in Southeast Asia: PEDIGREA

- Participatory Enhancement and Development of Genetic Resources in Asia (PEDIGREA)
- Collaboration between farmers, NGOs and public research institutions in the South and the North
  - Cambodia
  - Indonesia
  - Philippines

PEDIGREA

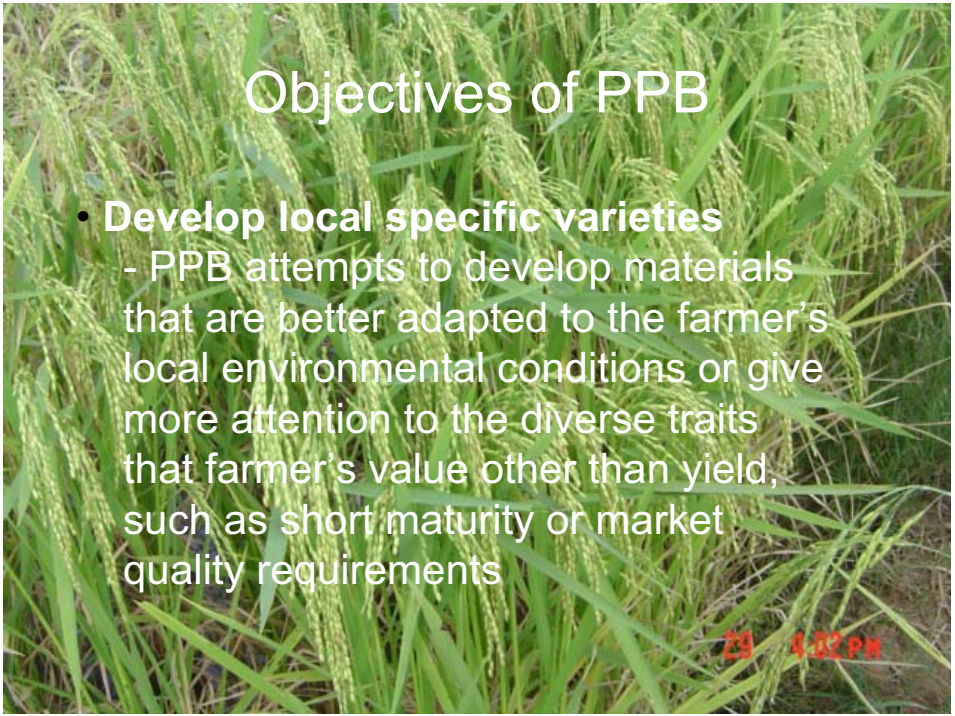
- Conceived in 2001 to develop institutionally sustainable approaches for PPB, mainly using the FFS model
- Brings together farmers, extensionists and scientists from various disciplines to develop, upscale and mainstream PPB activities in a FFS environment, and to strengthen the effectiveness of the approach
- Since 2002, pilot programmes conducted in selected farming communities in Indonesia, Cambodia and the Philippines, focusing on rice and indigenous vegetables
- These programmes are situated in intensive rice-based farming systems, exposed to considerable genetic erosion due to the Green Revolution

PEDIGREA

- Aims to develop farmer-led approaches; farmers decide upon goals and breeding objectives
- Empowers and strengthens the capability of farming communities to manage their genetic resources as part of local agrobiodiversity and contributes to food security
- Facilitates close collaboration with other stakeholders, including scientists and policy makers
- As of June 2005, a total of 22 FFS in rice and 17 FFS in local vegetables (pumpkin, wax gourd, eggplant, bitter gourd, string beans) were conducted in 23 communities. A total of 1,148 farmers have been trained, of which 25% are women. Farmers made a total of 175 crosses in rice, and 83 crosses in local vegetables, and currently manage more than 10 advanced lines and more than 300 segregating populations based on their own and formal sector crosses.

Objectives of PPB

- **Develop local specific varieties**
  - PPB attempts to develop materials that are better adapted to the farmer's local environmental conditions or give more attention to the diverse traits that farmer's value other than yield, such as short maturity or market quality requirements



Objectives of PPB

- **Improve Conservation and use of genetic diversity**
  - PPB promises to conserve valuable genes and genetic resources *in-situ*, which means conservation is embedded in the dynamic on-farm environment.
  - *In-situ* conservation has the capability of preserving more of the available genetic diversity at a lower cost than *ex-situ* conservation in gene banks. Being part of the farmer's evolutionary environment, it ensures adding value to local diversity over time.

Objectives of PPB

- **Improve Local Capacities**
  - as most of the know-how concerning crop improvement technologies have been confined to research institutions and organisations, PPB ensures that farmer's capacities to generate and manage genetic diversity are improved
  - This seeks to provide farmers to gain more control of crop development and seed supply and enables them to pursue a different future than that which is currently offered by institutional breeding, i.e. empowerment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Objectives of PPB

- **Inter-disciplinary**
  - since PPB is implemented in and around the farmer household, it covers much more than technology development and transfer of know-how to farmers
  - It entails a system of mutual learning by farmers, facilitators and researchers in a move to merge farmer's indigenous practices and knowledge with modern breeding technologies
  - Active participation of farmers, including women, is important to make an impact and to ensure that the technologies are integrated in the farmer's practices and owned by farmers

- Participants initially plant selected varieties in pots to collectively observe development and share observations on traits. Cross-breeding of parents is demonstrated using this potted population. Each participant maintains his/her own experiment in their own farm.

- Planting of selections collectively developed from the FFS-PPB is usually done in a small plot in the village donated by the community or a farmer who has some land to spare. FFS participants collectively observe the development of their selections here.


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- Individual farmers also bring their on-farm problems to the FFS-PPB, such as pest and disease infestations.
- The FFS-PPB becomes a forum for collective solution to farming problems.
- In the picture, a farmer is consulting his colleagues on the growth stunting of his pumpkin selections which he was experimenting on a small plot in his farm.

Objectives of PPB

- **Link with Research**
  - Participation of researchers in PPB is needed to make an impact on breeding technologies.
  - Much more than institutional breeding, PPB makes a close link with other disciplines as well, such as social and economic, which add value to PPB approaches within the context of the farmer household and to institutional science

Participants from the FFS-PPB in Takeo, Cambodia and two staff of Srer Khmer (a local NGO) sharing their observations on the selections that are about to be harvested and evaluated

Benefits from PPB

- PPB benefits communities and is advantageous for crops or geographic areas where conventional breeding efforts have been less successful or absent, especially in
  - *Marginal agricultural areas*, where environments are highly variable, such as in semi-arid rain-fed or mountainous areas. These conditions usually preclude the widespread adaptation of modern varieties.
  - *Rural areas* with little or no formal seed supply mechanism and/or primarily subsistence-based farming
  - *Locally important crops* that are important in local areas but have not been the focus of plant breeding efforts


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Reviving Farming Culture: Bio-Dynamic Agriculture in Mindanao

- The Greek word *"bios"* means life and *"dynamis"* means life energy. Biodynamic farming means "working with energies that create life"
- Farming system that integrates relationships between plants, animals and soil
- Farming practices that restore the soil to a balanced living condition through the application of different biodynamic preparations
- Treats the farm as a living organism, as part of living nature
- Integrates spiritual and traditional knowledge; hence the physical and non-physical aspects of farming

Reviving Farming Culture: Bio-Dynamic Agriculture in Mindanao

- Don Bosco Youth Foundation
  - Based North Cotabato, southern Mindanao
  - Pioneer in the promotion of bio-dynamic agriculture in the Philippines since 1994
  - Promotes and assists farmers in bio-dynamic farming across Northern, Central and Southern Mindanao
  - Several partner-municipalities have officially banned GMOs and promote the production on bio-dynamic agricultural products: rice, banana, mango

Reviving Farming Culture: Bio-Dynamic Agriculture in Mindanao

- Don Bosco Youth Foundation
  - Involved in marketing of and facilitating farmers' direct access to markets for bio-dynamic products
  - Community approach: women-led livelihood projects
    - Production of herbal medicines
    - Promotion of community-based alternative medicines
    - Production of natural soaps and herbal oils

Benefits from Bio-Dynamic Farming

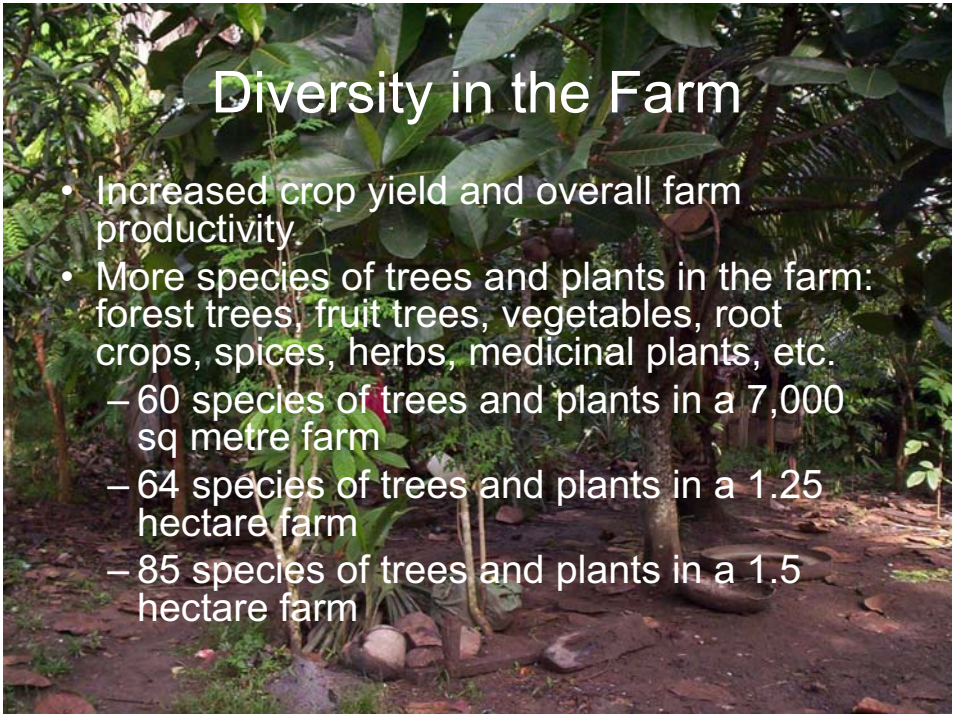
- Use of locally available farm inputs
  - Composting for soil fertility management
  - Use of local plants and herbs for pest and disease control
  - Use of locally-available and easy-to-prepare natural concoctions for pest and disease control

Benefits from Bio-Dynamic Farming

- Traditional knowledge-based farming practices
  - Use bio-dynamic calendar: matches with traditional farming calendar
  - Observation of farming do's and don'ts (taboos) that conform with local cultural practices
  - Encourages farmer-based innovations
- Healthier Farm Environment
  - No synthetic chemical inputs
  - Increased biodiversity in the farm

Benefits from Bio-Dynamic Farming

- Household Food Security
  - Species diversity on the farm provides stable and available food supply for the household
  - Diversity of food sources (plants and animals) ensures a broad nutrition base for the family



Diversity in the Farm

- Increased crop yield and overall farm productivity.
- More species of trees and plants in the farm: forest trees, fruit trees, vegetables, root crops, spices, herbs, medicinal plants, etc.
  - 60 species of trees and plants in a 7,000 sq metre farm
  - 64 species of trees and plants in a 1.25 hectare farm
  - 85 species of trees and plants in a 1.5 hectare farm

Diversity in the Farm

- Rice-coconut farming
- Rice-banana farming
- Rice-fruit tree raising
- Rice-fish farming
- Rice-duck farming
- Backyard poultry raising
- Backyard swine-raising
- Livestock

Diversity and climatic conditions

- Microclimate is enhanced through diverse and multi-storey cropping, which can be observed through presence of sanctuaries of beneficial insects very sensitive to this condition
- Efficient interception of solar radiation by the plants through multi-storey cropping - combination of sun- and shade-loving plants for efficient interception of sunlight
- Development of high resistance or tolerance of plants to extreme environmental conditions such as drought

Benefits from Bio-Dynamic Farming

- Stable income sources
  - Diverse food sources allows farmers to sell surplus to neighbors and local market
  - Perennial crops such as coconut provides a stable income source for farmers (i.e., selling of coconut wine and vinegar)
  - Fish-farming, poultry-raising and swine-raising provides good income sources