

Vegetable Genebank Management and Seed Production Systems

26-29 May 2014

Ratanakiri Province, Cambodia

Training Report





The Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia) aims to support innovation by strengthening South–South dialogue and intraregional learning on sustainable agriculture technologies and trade facilitation. Funded by the European Union, SATNET facilitates knowledge transfer through the development of a portfolio of best practices on sustainable agriculture, trade facilitation and innovative knowledge sharing. Based on this documented knowledge, it delivers a range of capacity building programmes to network participants.

SATNET Asia is implemented by the Centre for Alleviation of Poverty through Sustainable Agriculture (CAPSA) in collaboration with the AVRDC – The World Vegetable Center, the Asian and Pacific Centre for Transfer of Technology (APCTT), the Food Security Centre of the University of Hohenheim and the Trade and Investment Division of UNESCAP.

This report has been produced with the assistance of the European Union. The contents of this report are those of the authors and can in no way be taken to reflect the views of the United Nations or the European Union. The report has been issued without formal editing.

Table of Contents

Introduction	4
Key learning and outcomes	5
1. Introduction.....	5
2. Status of vegetable production in Cambodia	5
3. Introduction to the conservation of plant genetic resources	6
4. In situ seed conservation	6
5. Seed saving and seed production technology	6
6. Field trip: community seed production areas in Ratanakiri	6
7. Community seed bank establishment and management	7
8. Way forward and course evaluation.....	7
Annexes	9
Annex 1: Training Program	9
Annex 2: List of participants	11
Annex 3: Community seed bank management plans – group outputs	12

Introduction

Small scale farmers have suffered losses in production of vegetables due to various constraints such as abiotic and biotic pressures and the availability of quality seeds (pure genetic stock, vigorous performance and disease free). Despite the growing commercial seed production sector the majority of farmers in the developing world still depend on farm saved seed. This is the main problem that farmers in Cambodia face, as reported by partners during the in country project consultation conducted by AVRDC in 2013. This finding was confirmed by the Annâdya¹ project that specifically articulated the need for capacity building on seed production and community seedbank management to greatly benefit the rural farmers in Cambodia.

A training session on “**Vegetable Genebank Management and Seed Production Systems**” was developed and conducted by AVRDC – The World Vegetable Center East and Southeast Asia regional office, in collaboration with Annâdya Project, at Ratanakiri Province, Northeast of Cambodia from 26 to 29 May 2014.

The training was facilitated through the Network for Knowledge Transfer on Sustainable Agricultural Technologies and Improved Market Linkages in South and Southeast Asia (SATNET Asia), a project funded by the European Union (EU). SATNET Asia catalyses knowledge transfer and sharing of best practices on sustainable agriculture, trade facilitation and innovative knowledge sharing through a range of capacity-building programmes to network participants. The goal is to enable participants to in turn transfer this knowledge to those who need it most – smallholder farmers, and small-scale entrepreneurs. AVRDC – The World Vegetable Center supports SATNET Asia through implementing capacity building activities in four targeted Southeast Asian countries: Cambodia, Indonesia, Lao PDR and Myanmar.

A total of 11 participants, 10 male and 1 female, attended the training and represented farmer’s group, non-government and government agencies that worked closely with Annâdya Project (Annex 1). The specific objectives of the training on “Vegetable Genebank Management and Seed Production Systems” were to:

1. Understand the vegetable seed industry in Cambodia,
2. Define appropriate and applicable seed production technologies,
3. Identify seed saving principles and practices,
4. Identify management practices in establishing and sustaining community seed banks,
5. Develop a plan on how to extend the knowledge and skills gained during the training.

¹The Annâdya project, funded by the European Union and implemented by Universite Libre de Bruxelles in partnership with the Cambodian Center for Study and Development in Agriculture (CEDAC), is based in Ratanakiri and aims to increase local food production through farming community development and use of innovation platforms to scale out technologies such as seed production systems.

Key learning and outcomes

1. Introduction

The training began with an introduction to participants and facilitators coming from AVRDC – The World Vegetable Center and Annâdya Project. Annick Schubert, Annâdya Project Manager, welcomed all participants and expressed her appreciation to AVRDC for responding to the request of facilitating the training on vegetable genebank management and seed production systems in Ratanakiri province, Cambodia. She briefly gave an introduction on the vegetable production sector in the province and how it is important for them to learn technologies which will help the farmers to produce quality seeds.

Somchit Pruangwitayakun presented the course objectives, program and processes. It was agreed in the discussion that to maximize the learning of the participants, English language will be used in the presentation and with alternate translation in Khmer language.

2. Status of vegetable production in Cambodia

Dr. Andreas Ebert, AVRDC's Global Theme Leader for Germplasm and Genebank Manager was the key resource expert of the training. He started by initiating a group discussion on vegetable production in Cambodia in the context of seed production and conservation. The group focused discussions in 3 main areas, (1) what are the problems they faced on seed and seed production; (2) what has been done to resolve the problems; and, (3) what future activities do they envision need to be undertaken. Below is what transpired in the discussion:

Key problems faced:

- ☞ Seed storage practices leading to reduced production in the next cropping season
- ☞ There are only 2 seed stations in Cambodia and they contain very few seeds
- ☞ Some commercially available seeds are not suitable to climatic condition of Cambodia, and mostly having low germination.
- ☞ Expensive imported seeds
- ☞ Pests and diseases infestations
- ☞ Health issues associated with chemical treatments on seed coats

Solutions:

- ☞ Seed production facilities
- ☞ Established seed producer groups
- ☞ Training on seed technologies
- ☞ Access to and sharing of seeds from other locations in the country
- ☞ Creation of traditional seed banks for vegetables

Plans:

- ☞ Farmers to produce their own seeds
- ☞ Equip the farmers with technical knowledge and skills in seed production, selection, storage, conservation
- ☞ Greater learning exchange among farmers
- ☞ Expand the seed producer groups
- ☞ Encourage more farmer innovators
- ☞ Propose to government bodies to set up seed research station in each province
- ☞ Conservation of local seeds
- ☞ Local seed certification schemes

The discussion allowed the participants to focus on important areas which they will take into consideration in the planning session at the end of the course.

3. Introduction to the conservation of plant genetic resources

Seed quality plays an imperative role in agricultural production and this to food and nutrition security. Seeds are the carriers of genetic diversity. To understand the terminologies and context of plant genetic conservation, Dr. Andreas presented and discussed the following:

- Global situation on nutrition: global hunger and micronutrient deficiency
- The role of AVRDC and others in combating global hunger
- The importance of food diversification, diet, to fulfill nutrition requirements
- Global interventions to address micronutrient malnutrition
- AVRDC's works in germplasm conservation and genebank management

The session enabled the participants to appreciate and connect the importance of seed conservation and availability to support the growing population.

4. In situ seed conservation

In-situ, a system of conserving biological diversity within natural habitats. Dr. Andreas Ebert led the participants' discussion on identifying suitable natural habitats for seed conservation and the appropriate conservation approaches and mechanisms. Participants learned through this session the importance of suitable practices to conserve seeds at the farm and community levels and further deepened their interest in establishing community based seed conservation system or community seedbanks.

5. Seed saving and seed production technology

Seed saving involves series of processes that include selecting suitable, healthy plants from which to save seeds, harvesting the fruits or pods at the right time, extracting, cleaning and drying the seed, packaging and storing them under proper conditions. Each of the processes was thoroughly discussed in this session and the case of AVRDC tomato seed practices and regeneration was presented as an example. The session also provided an opportunity of the participants to share their traditional practices in seed saving and preliminary assessments on seed viability and quality. The participants appreciated that understanding seed regeneration and the factors affecting seed quality, both during seed production phase and during seed processing and storage phase, is vital for community seedbanks to be a success.

The participants gained practical experience of seed saving technologies and in particular on methods for seed extraction, seed cleaning, seed drying and seed germination.

6. Field trip: community seed production areas in Ratanakiri

Participants visited Prak Village, Samki Commune OChum District, Ratanakiri province where Annâdya project had supported farmers through capacity building in agricultural development. They interacted with farmers led by Mr. Thorng Kham who showed them around the community and shared traditional practices in seed storage. The participants learned more on in-situ conservation when they harvested matured yard long beans, sorted and cleaned the seeds. They also went to the natural habitat of indigenous vegetables which constitute an important part of the Cambodian meals. On-site, they discussed practices and measures on how to preserve the genetic diversity of the indigenous vegetables, considered as a community treasure for them.

7. Community seed bank establishment and management

Community seed banks are established to combat seed insecurity. It does not only involve seeds but the collective effort of the community members to effectively manage the seed collection, to regenerate, produce, distribute and preserve seeds. Seed banks need to be effectively managed to perform these tasks. Dr. Andreas Ebert presented the main elements of establishing and managing seed banks. The participants were then divided into small groups and discussed among themselves the following aspects of seed banks:

- a. Management (structure, rules/policies involved)
- b. Basic infrastructure
- c. Crops to start with
- d. Best planting season for these crops and how to best manage them, special care, seed extraction, drying

Each group presented their discussion outputs which are shown in Annex 2:

8. Way forward and course evaluation

The participants discussed their key learning and insights from the training and what key points they would be taking forward.

- The knowledge and information shared was tremendous
- The simple methods in seed saving techniques are very applicable to local situation and can be implemented
- To lobby the government to improve support to the seed sector and community seed banks
- Assist in organizing seed producer groups
- Integrate into community planning the collection and conservation of local varieties of vegetables
- To link with international institution such as AVRDC for access to quality seeds and varieties
- Share the knowledge and skills gained to farmers.

9. Training course evaluation results

The training evaluation process was conducted through the following:

- ↳ Evaluation questionnaires or the KAP (knowledge, attitude, practice) survey was distributed to the participants at the end of the training course
- ↳ Sharing of learning and insights

Highlights of the KAP Survey:

KAP survey was completed by 9 participants out of the 11 registered participants of the training. Key findings of the survey are the following:

1. Content. The session on community seedbank establishment and management was rated highest with an average rate of 3.78 (4 – highest/excellent, 1- lowest/poor) followed by seed saving and seed production technology (3.44); introduction to plant genetic resources (3.22) and in-situ conservation: nature reserves, on-farm, home and school gardens, community seed banks (2.89). The participants rated the usefulness of the all sessions as “good”.
2. Process. The participants rated the overall process of the training (agenda and flow, facilitation, materials) as “good” with an average rate 3.28.

3. Comments from the participants in relation content and process:
 - More knowledge on community seed bank management as well as kind of seeds that can be adapted in Ratanakiri
 - Exchange of experience and ideas especially field visit and practical exercises
 - We now know how to germinate seed, measure seed moisture, clean and store seed and manage a seedbank
 - Good handouts
 - Knowledge and technologies are applicable
 - Need more details and time on the step by step process of CSBs
4. Aspects of the training which could be improved:
 - More practical exercises and field visits
 - Add more group discussion
 - Present a case study of a successful CSB
5. Key learning gained from the training:
 - Seed selection, cleaning and germination
 - Community seed bank development
 - Storage practices for seeds
 - Seed germination testing
6. Changes and improvement participants will undertake after the training
 - Practice applying the technologies on seed production
 - Discussion with colleagues on the establishment of community seed banks
 - Seed storage practices
 - Train the staff and farmers and promote in the village about good seed selection and germination before grow in the field
 - Save quality seeds for home garden projects
7. Participants rated high the applicability of learning gained from the training. 56 % said “most of it”, 34% “about half” and 12% said “a little”.
8. Sharing of learning. 100% of the participants said that they are going to share their learning to others, repeatedly mentioned are the colleagues, staff and farmers.

Annexes

Annex 1: Training Program

Monday, 26 May 2014

08.00-08.30	Arrival of participants
08.30-09.30	Opening program Welcome remark <i>Ms. Annick Schubert</i> <i>Project Manager, Annâdya Project</i> Course introduction <i>Ms. Somchit Pruangwitayakun</i> <i>Vegetable Research and Training Assistant</i> <i>AVRDC – The World Vegetable Center</i>
09.30-09.45	Coffee break
09.45-10.45	Status of vegetable production in Cambodia <i>Annâdya Project Team</i>
10.50-12.00	Introduction to the conservation of plant genetic resources <i>Dr. Andreas Ebert</i> <i>Genebank Manager</i> <i>AVRDC – The World Vegetable Center</i>
12.00-13.00	Lunch Break
13.00-14.30	In situ conservation: nature reserves, on-farm, home and school gardens, community seed banks <i>Dr. Andreas Ebert</i>
14.30-14.45	Coffee break
14.45-16.00	In situ conservation: nature reserves, on-farm, home and school gardens, community seed banks

Tuesday, 27 May 2014

08.00-10.00	Seed saving and seed production technology <i>Dr. Andreas Ebert</i> <i>Genebank Manager</i> <i>AVRDC – The World Vegetable Center</i>
10.00-10.15	Coffee Break
10.15-12.00	Seed saving and seed production technology
12.00-13.00	Lunch

13.00-16.00 Practical exercise on seed extraction, seed cleaning, seed drying and seed germination
Ms. SomchitPruangwitayakun
Vegetable Research and Training Assistant
AVRDC – The World Vegetable Center

Wednesday, 28May 2014

08.30 -15.00 Field trip: Community seed production areas in Ratanakiri

Thursday, 29 May 2014

08.00-10:00 Community seedbank establishment and management
Dr. Andreas Ebert
Genebank Manager
AVRDC – The World Vegetable Center

10:00-10:15 Coffee break

10:15-12.00 Policy issues in germplasm handling and exchange
Dr. Andreas Ebert

12.00-13.00 Lunch break

13.00-15.00 Planning workshop
Andreas Ebert / Ms.SomchitPruangwitayakun

15.00-16.00 Course evaluation
Ms. SomchitPruangwitayakun

Closing program
Annâdya Project Team

Annex 2: List of participants

S/N	Name	Position/ Organisation	E-mail address
1	Mr Tee Leena	Project coordinator Pokhao	leenapokhao@gmail.com
2	Mr Yun Samnol	Project coordinator Annadya	yunsamnol2012@gmail.com
3	Mr Cheav Sopheak	Thematic Supervisor Annadya	cheavsopheak@cedac.org.kh
4	Mr Khan Kimseang	Thematic Supervisor Annadya	khankimseang@gmail.com
5	Mr Chenda Ravuth	Thematic Supervisor Annadya	chendaravuth@gmail.com
6	Mrs Annick Schubert	Project management Annadya	annick.schubert@gmail.com
7	Mr Nov Sarath	Senior Trainer CEDAC_Phom Penh	novsarath@cedac.org.kh
8	Mr Bun Leng Hak	Planning officer PDA (Provincial Department of Agriculture)	lenghakbun2004@gmail.com
9	Mr Heang thira	Project manager CEDAC/GAA Ratanakiri	heangthira@gmail.com
10	Mr Prom Meta	Program manager GAA Ratanakiri	prommeta@gmail.com
11	Mr. Yim Seanghy	Project officer CEDAC	seanghy_yim@cedac.org.kh

Annex 3: Community seed bank management plans – group outputs

Group 1

1. **Management of community seed bank (CSB) (Prak, Katieng) :**
 - Structure: President, Treasurer, Secretary, Technical and QTAM expert, Marketing Expert, Technical assistant(s) and advisory authority (State/Elders)
 - Rules and regulations: set up by the managing structure
 - *Membership:*
 - Community member
 - Group membership size will be ideally 15 and max 25
 - Applying member has enough time to get involved and commits to attend meetings, trainings etc... on a regular basis
 - Agrees on rules and regulations
 - Deposit seeds produced by themselves (organic farming)
 - Commits to deposit a minimal amount of seeds per year
 - The CSB is divided in 100 shares. Each member is entitled to possess a maximum of 30 shares.
 - 1 share corresponds to a seeds amount (grid of seeds type)
 - Member receives a receipt from the treasurer stating what he deposited in the bank
 - Member can borrow seeds with a preferential interest rate of 10% to 20% per year
 - Members who want to resign will be entitled to a benefit only after two years accomplished of membership. Below this period of time, no benefit will be provided.
 - All resigning members will get back the seeds they deposited after the following crop season.
 - Develop business plan
 - *Borrowers (Community)*
 - Community members who are CSB members can apply seeds borrow if a CSB member becomes his referee.
 - Borrowers must agree with the CSB rule and regulations
 - Borrowers can borrow
 - *Customers (External to Community)*
 - Customers have to purchase order
 - MOU
2. **Basic infrastructure CSB**
 - Warehouse
 - Land
 - Equipment and material (Tractor, pumping water, install water system, electric machine etc.)
 - Seeds
3. **Crops of relevance for these communities to start**
 - Cucumber
 - Kinds of gourd
 - Pumpkin
 - Kind of cabbage
 - Kukrev
 - Kangkong
 - Pepper/chili

- Yard long bean
- Bean family
- Amaranth
- Eggplant
- Okra
- Spinach

4. Best planting season for these crops, crop management, special care, seeds extraction, drying

- Yard long bean
- Cucumber family
- Kangkong

Crop Management

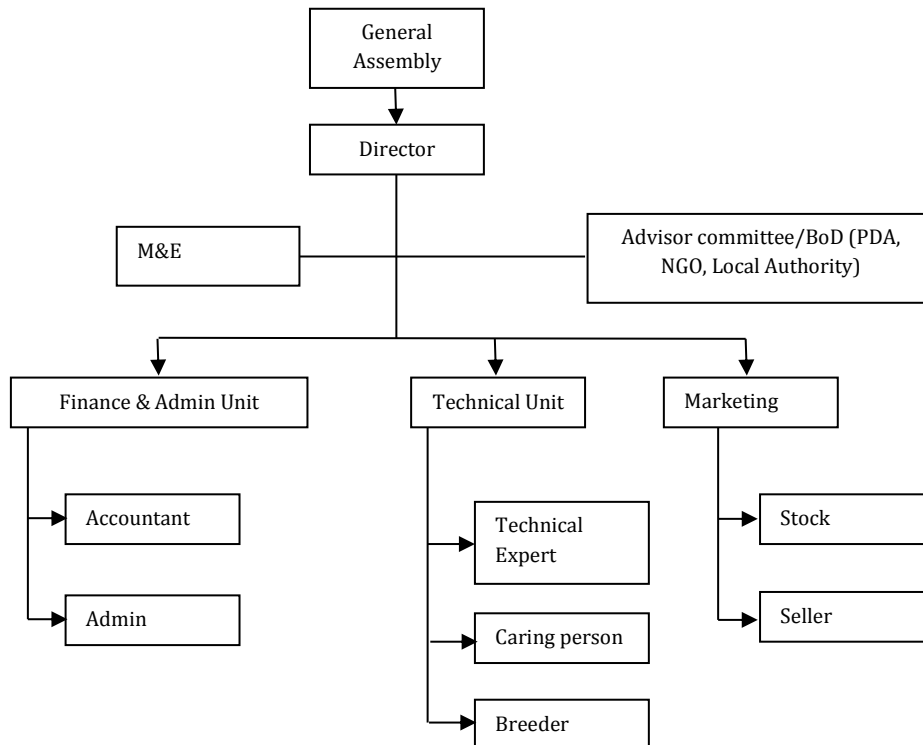
- Yard long bean
 - Production
 - Grows under warm temperature 25^oc
 - Full sunlight
 - A day-neutral plants that flower all year round
 - Isolation
 - Self-pollinating flower
 - Cross-pollination by insect'
 - Selection
 - Select healthy plant mark them for seed production
 - Rogue out disease plants
 - Harvesting
 - Allow pods to dry brown before harvesting
 - Cut pods with a sharp knife
 - Harvest 20 days after pollination
 - Processing
 - Pods are dried in the sun for 3 days
 - Discard blemished and shriveled
 - Place remaining seeds under shade for 1-2 weeks for further drying.
- Cucumber family
 - Production
 - Grows under warm season crop and very susceptible to frost
 - Good for high temperature and low humidity are ideal for the production of cucurbit seeds
 - Isolation
 - Most cucurbit plants produce separate male and female flowers on the same place
 - The flowers are insect-pollinated and easily cross within species
 - Hand pollination
 - Selection
 - Select early flowering, vigorous plants
 - Remove any deformed fruits
 - Harvesting
 - The fruit should be left fully ripen and turn color
 - After harvest, the fruit can be kept in a shad for a couple of weeks to allow the seed to further ripen.

- Processing
 - **(For wet seed)** Allow seeds and the jelly like surrounding liquid to sit in a container at room temperature for 1-2 days.
 - the jelly will dissolve and good seeds will sink to bottom while remaining debris and immature seeds can be rinsed away
 - Spread seeds on a paper towel or screen until dry
 - **(For dry seed)** Keep the seeds in the fruit until they naturally separate from the flesh
 - Identify when we shake the fruit the sound of seeds moving inside is heard
 - Cut off bottom of fruit and shake the seeds out
 - Winnow to clean the remaining chaff, and then place the seed on the screen for further drying before storage.
- Kangkong
 - Production
 - Can be grow both as a leafy vegetable crop or for seed production under tropical condition
 - Can be planted on any type of soil
 - Lowland plantings give higher seed yield than do upland plantings but take 5-6 months to complete the seed cycle.
 - Isolation
 - Self-pollinated crop but cross-pollination may occur
 - Isolate varieties 100 m apart.
 - Selection
 - Select plants that are vigorous, disease-free and uniform in plant characteristics.
 - Harvesting
 - Seed pods are mature
 - Up-root plants when dry weather is expected for several days.
 - Processing
 - Remove plant roots with a hoe and keep at the field
 - The plant mat will then curl into a loose bundle
 - After 3-4 days of drying the plant should be dry and ready for thresher.
 - Storage
 - Seed can store up to 2 year

Group 2:

Managing community seed banks

1. Structure



2. Role and Regulation of CSB

CSB Membership:

- The people in the community who volunteer to join as CSB members
- At least have 25 arcs of land for vegetable and fruit tree
- CSB members have to pay for membership fee 5\$
- CSB members have right to select CBS Director and decision making

CSB Committee and BoD:

- The committee elected by CSB members through General Assembly every 2 years
- BoD body should be selected by GA and they should coming from PDA, NGO and Local Authorities
- BoD play role to provide direction, consultation and funding support the CSB

3. Basic Infrastructure of CSB

- At least 2 ha of land
- Laboratory
- Seed warehouse
- Working office
- Equipment
 - Farmer equipment: Hoes, tanks, watering cans, tractor, etc.
 - Laboratory equi: refrigerator, balance scale, ph meters, moisture measuring, solar dryer, etc.

- Human Resource
- Transportation
- Irrigation system

4. Crop Relevant

- Soybean
- Tomato
- Pumpkin
- Cucumber
- Bitter gourd
- sponge gourd
- Amaranth
- Egg plant
- Maize
- Taro
- Moringa
- Epil epil
- pepper/ chilli
- Longbean
- Mungbean
- Morning glory
- Spinach / cabbage
- Salad

5. 3 main crops for the CSB

a. Soybean

Activity	5	6	7	8	9	10	11	12
Land preparation	⇒							
Planting		⇒						
Weeding			⇒					
Harvesting				⇒				
Drying					⇒			
Storage					⇒			

Soy bean seed production

- Best planting start from June
- Pods harvest in late Sept to early October when the pods turned yellow/well develop, but avoid to much dry.
- After harvest, we dry the pods for 1-2 weeks under shelter (not directly sunshine).
- Extract the seed from the pods by hand carefully and then select good seeds then storage in the nylon bag.

Soybean seed extraction



b. Cucumber

Activity	9	10	11	12	1	2	3	4
Land preparation		→						
Planting			→					
Weeding				→				
Harvesting					→			
Drying						→		
Storage							→	→

Cucumber seed production

- Best planting start from late Oct to early Nov
- Fruit harvest in late Dec to early January when the fruit well develop (fully ripe) turned colored to yellow.
- After harvest, we keep the fruit for 1-2 weeks under shelter and then extract the seed and soak seed in the water 2-3 days and then clean the seed and dry under shelter until it dry enough.
- Select good seeds then storage in the nylon bag.

Cucumber seed extraction



c. Spinach

Activity	9	10	11	12	1	2	3	4
Land preparation		→						
Planting			→					
Weeding				→				
Harvesting					→			
Drying						→		
Storage							→	→

Spinach seed production

- Best planting start from early Nov
- Seed harvest in late January when the florescent are dry enough (attention: If the florescent are very dry, the seed will be fall down)
- After harvest, we keep the seed for 1-2 weeks under shelter.
- Select good seeds then storage in the nylon bag.

Spinach seed selection

