

**Proceedings
of
International Bio-slurry Study Tour
Sauraha, Chitwan, Nepal
11-15 September, 2007**

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Executive Summary

Netherlands Development Organisation (SNV) in association with Biogas Sector Partnership-Nepal (BSP-Nepal) organised a four-day International Bio-slurry Study Tour in Chitwan, Nepal on 11-14 September, 2007. Sixteen participants from 7 countries of Asia and Africa were participated in the study tour. This study tour proceeding includes (i) the summary of country presentations on the status of bio-slurry management and utilization (ii) Field visit experience and, (iii) Group discussions..

The overall objective of the study tour is:

Enhance the exchange of experiences and knowledge among bio-slurry extension officers in SNV supported programs.

Specific objectives are:

- Identification of most successful extension methods/vehicles in the different programs;
- Exchange on bio-slurry storage, treatment, transport and application methods during the monsoon season and/or in areas with high water tables;
- Optimisation of bio-slurry extension activity plans.

There were two Technical Sessions. In session I, country papers were presented and discussed. Participants visited Elephant Breeding Centre. They also visited five biogas plants and shared experiences with biogas owners at Nawalparasi. Improved cattle shade, urine collection and toilet attachment was found there. Number of pits is less in most cases and pit management and slurry management was not at satisfactory standard level. Participants visited and discussed with officials of a biogas company and an appliances workshop.

In session II, there was a group exercise and for which the participants were divided into four groups to work with two themes (i) Extension methods, vehicles, success and failures - Group 1 & 3 (ii) Slurry storage and use under wet condition – Group 2 & 4. In addition to specific theme there was special consideration for each group ‘Recommendation on making linkages for slurry extension with different programs and organizations’. Each group presented their output, discussed and recommendation prepared

Considering the outcome of country presentation, field visit and group exercise the actionable issues raised related to research, extension and organizational set up of bio-slurry component are summarised as follows.

Research

- Laboratory and on-farm farmers’ participatory research on bio-slurry management should be an integral part of biogas program of each country.
- Research should address the decomposition, mineralization and release pattern of plant nutrients of bio-slurry from different substrates.
- Determination of heavy metal concentration in bio-slurry and their effect on soil, water and crop production
- Slurry handling, device of low cost slurry transport means, duration and methods of composting and improvement of storage system.

Extension

- IPNS approach for research, extension and use of bio-slurry as fertilizer material.

- Whole Family Approach for users training
- Farmers Field School Approach in areas where plants are in cluster

Organizational issues

- Set up of bio-slurry management unit at each country program
- Linking GO and NGO partnership
- Evaluate the present interest and capacity of companies in doing slurry activities considering bio-slurry is an agricultural activity.
- There is a need to form a bio-slurry forum

Frequency of study tour

- Similar study tour program should be arranged twice in a year to see the wet and dry season management of bio-slurry and its effect on seasonal crops

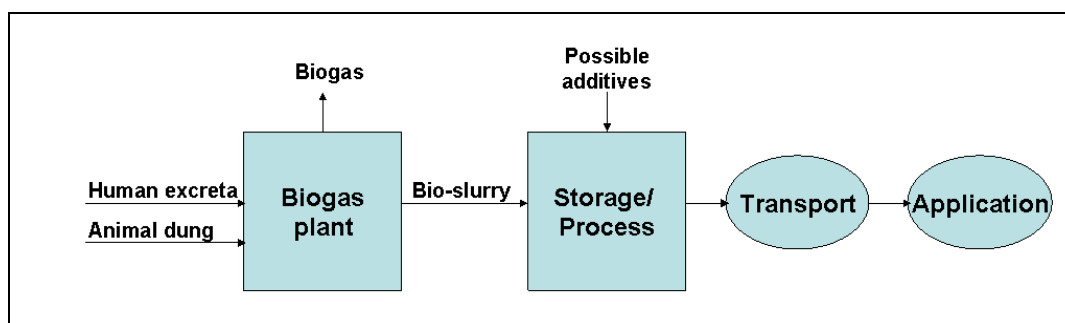
1. GENERAL

Netherlands Development Organisation (SNV) in association with Biogas Sector Partnership-Nepal (BSP-Nepal) organised a four-day International Bio-slurry Study Tour in Chitwan, Nepal on 11-14 September, 2007. Sixteen participants from 7 countries of Asia and Africa were participated in the study tour. This study tour proceeding is intended to bring the ideas and views of those attending the tour to a wider audience of bio-slurry practitioners. It is expected that this proceeding will contribute to the broader ongoing discussions about programs and activities that will facilitate the inclusion of effective management and use of bio-slurry in initiatives on promotion and development of biogas technology in different parts of the globe.

This study tour proceeding includes (i) the summary of country presentations on the status of bio-slurry management and utilization (ii) Field visit experience and, (iii) Group discussions. As much as possible, the issues raised by the participants during different sessions have been presented in their own words.

2. BACKGROUND

Domestic biogas plants convert animal dung and human excreta at household level into small but precious amounts of combustible gas, known as 'biogas'. This gas can be effectively used in simple gas stoves for cooking and in lamps for lighting. The residue of the process is known as 'bio slurry'¹.



The biogas/biodigester programs supported by SNV in Asia and Africa all have a bio-slurry extension component. The aim of this component is to maximise the revenues for a farmer on his investment by making optimal use of bio-slurry as organic fertiliser to enhance agricultural productivity or as food for fishpond and feed for animal.

As the return of the investment will increase, the market for biodigesters especially among the resource poor farmers will increase as well.

Considering the importance of the best possible use of bio-slurry by SNV an international workshop on this topic was organised in September 2006 in Bangkok, Thailand. In this workshop experts from research institutes in Bangladesh, India and China together with biodigester practitioners from Africa, Asia and Europe shared their experiences.

¹ The term bio-slurry is used here for the residue that comes out of the biogas plant. Other terms sometimes used are just 'slurry', 'effluent', 'bio-manure', 'sludge', 'organic fertiliser' and 'organic manure'.

During the workshop topics such as slurry characteristics, processing and application as well as extension methods were discussed. The set-up of bio-slurry extension component within biogas programs was the topic of a group exercise. The workshop was considered an inspiration, especially for programs still in a starting phase.

To follow-up on this workshop, a study tour for bio-slurry experts working in SNV supported programs was proposed. The study tour comprises of a workshop and field visit.

3. OBJECTIVES OF THE STUDY TOUR

The overall objective of the study tour is:

Enhance the exchange of experiences and knowledge among bio-slurry extension officers in SNV supported programs.

Specific objectives are:

- Identification of most successful extension methods/vehicles in the different programs;
- Exchange on bio-slurry storage, treatment, transport and application methods during the monsoon season and/or in areas with high water tables;
- Optimisation of bio-slurry extension activity plans.

4. SCHEDULE

The study tour was conducted for four days. The study tour program consisted of three main sessions – country presentations & discussions, field visits and group exercise. The detailed schedule has been given in Annex-1.

5. PARTICIPANTS

Sixteen participants from Bangladesh, Cambodia, Ethiopia, Lao PDR, Nepal, Vietnam, Rwanda took part in the workshop. The details of the participants have been given in Annex-2.

6. PROCESS AND OUTCOME

6.1 Opening Remarks

Following the formal registration of participants, a brief opening ceremony was organised in which Mr. Ram Prasad Dhital, RESS Program Coordinator, AEPC, Nepal welcome the participants in the workshop and in Chitwan, Nepal. Mr. Saroj Raj, Executive Director, BSP-Nepal in his opening remarks, mentioned the importance of biodigester technology in rural development. He strongly pointed out the necessity of sharing experiences from each other participants from Asian and African countries. He reminded the outcome and action plan made in the Bangkok workshop and expected that the present workshop would assess the status of progress i.e. where we are and how far we have to go. He hoped that the better management of bio-slurry would positively contribute in maintaining the soil health and in increasing the agriculture production and thereby in improving quality of life of people.

The opening remark of Mr. Saroj Raj was followed by the brief personal introduction of the participants. At the end of the opening ceremony, Mr. Uttam P Jha, Advisor of SNV-Nepal gave a vote of thanks and wished the success of the workshop.

6.2 Introduction of the Workshop

The workshop commenced with a brief introduction from Ms. Bindu Manandhar, Senior Officer of BSP-Nepal and coordinator of the workshop on the objectives, contents, expected outcome of the workshop, some practical issues related to logistic arrangements and few changes in the schedule of the workshop.

6.3 Technical Session I

6.3.1 Presentation of Country Papers

Session chairman Mr. Saroj Raj's brief on organizational aspects of the session was followed by country reports on research and extension of bio-slurry in Vietnam, Cambodia, LAO PDR, Bangladesh, Ethiopia and Nepal.

Country Paper from Vietnam

a. General

Presenting her paper entitled, '**Bio-slurry Utilisation in Vietnam**', Ms. Le Thi Xuan Thu highlighted on various research activities conducted in Vietnam in the past and corresponding outcomes. She also described the current status of use of bio-slurry in Vietnam including challenge and opportunities and a case study on use of bio-slurry in tea production.

Biogas project in Vietnam is implemented in two phases. In phase I, 18,000 plants were established in 12 provinces; further 23,000 plants were established during 2006 and 2007 in 25 provinces in phase II. The average size of digester has been increased from 9.78 m³ in phase I to 11.03 m³ in 2007. The use of bio-slurry by the households increased from 41% in phase I to 62% in 2007.

b. Presentation Highlights

Research

Research on bio-slurry is done by research institutes and universities of Vietnam. Research focuses on determination of concentration of primary plant nutrients (N, P and K) and heavy metals (Cd, Pb, As, Hg) in solid and liquid bio-slurry and loss of N after different days of storage.

- Both the total content and available content of N, P, and K in bio-slurry are relatively higher than those of FYM/manure.
- The amount of loss of N increases with increase of storage time.
- The content of heavy metal (Cd, Pb, As, Hg) in bio-slurry is within allowable standards of Vietnam.
- Bio-slurry contains cellulose decomposing bacteria, yeast and molds.
- Bio-slurry can be used as pig feed @ 1-2 litre per kg of basal diet and that increase the meat production without any negative effect on health and quality of pig meat.

Demonstration

Forty four demonstrations were conducted with bio-slurry on vegetables, rice, fruit and industrial crops.

- Use of bio-slurry increased the yield of vegetables, rice, fruit and industrial crops by 2-14%, 7%, 20-30% and 5-14%, respectively and reduced the incidences of insect pests considerably.
- Effect of bio-slurry use in terms of economic aspect, quality of product and food safety can be realized with the increase of income by 10-60%, 25%, 98-130% and 87% in vegetables, rice, fruit and industrial crops, respectively compared to no fertilizer use.

Current status of use of bio-slurry

- About 88% of the bio-slurry users use slurry as fertilizers for growing vegetables and 7% for fish ponds.
- Use bio-slurry instead of chemical fertilizer in tea farming improves quality of tea product, and helps to increase yield by 11%, saves net amount of 148 euro/ha/harvest (about 5-6 harvest/year)
- Use of bio-slurry as pig-feed helps in saving food cost to an amount approximately 9-11euro/pig/feeding cycle of two months. However, feeding of bioslurry for piglet is not recommended.
- Use of bio-slurry as feed for fish culture in ponds increases the yield of fish by 13% and income by 13%.
- Difficulty in transportation, low level of awareness of users, lack of labour for handling and application, and traditional habits of people not to use pig manure in farms are some of the barriers in popularising use of bio-slurry in Vietnam.
- There are opportunities of commercialization of bio-slurry use and slurry could be a part of organic agriculture.
- Three posters on use of bio-slurry have been developed.

Future action plan

- Present research and demonstration activities will be continued.
- More promotional and education document will be developed.
- Stakeholder meetings will be organized

c. Discussion Highlights (Question/comments and Answer)

Dr. Fokhrul Islam from Bangladesh

Comments

The figures of N loss should be the percent of the total N content of bio-slurry.

Anaerobic bacteria and ammonification bacteria are not pathogen.

The concentration of Pb in slurry was found higher than Vietnam standard for water.

Question

What are the standards of heavy metals in bio-slurry use as organic manure or fertilizer?

Presenter: Accepted the comments

Country Paper from Cambodia

a. General

Mr. Kong Kea, NBP Bio-slurry and Extension Officer presented the **Country Report on the Use of Bio-slurry in Cambodia**. He gave an overview of the national bio-digester program and bio-slurry unit in NBP, Cambodia. The program implementation started in March 2006 and covers five provinces. The target of the first phase (2006-2009) of the program is to build 17,500 biogas plants and 760 plants have been established. Bio-slurry promotion is a core activity of the program started in August 2006.

b. Presentation Highlights

Research

Farmer Participatory Action Research on bio-slurry was undertaken jointly by NBP and CEDAC (NGO). Research issues and experiment protocols were identified through a discussion meeting among extension workers of provincial biogas program office (PBPO) of NBP and CFA of provincial CEDAC office and farmers. Extension workers and CFA provided training to the co-operator farmers. The extension workers and CFA do follow up of each field experiment at least 10 times per season. Research data was collected and compiled by the farmers, extension workers and CFA. The NBP Bio-slurry and Extension officer monitored and supervised the activities of extension workers and CFA regularly.

- No specific research results were presented.

Training and study tour

- A refresher training course on bio-slurry management and utilization for all extension workers and NGO staff was organized.
- Topics on bio-slurry management and utilization were included in the training curriculum for supervisor and mason training.
- A topic on bio-slurry management and utilization was included in the training program for biogas users.
- Study tour was organized for biogas users to visit experimental sites where co-operator farmer of research explained the methods used and his/her opinion about the trial performance.
- Training materials (Guide, booklet, leaflet and poster) were developed for use of extension workers and farmers.

Current status of use of bio-slurry

- About 78% of the biogas plant owners use bio-slurry as fertilizers and pesticide for growing crops, for fish culture and in vermi-culture.
- Bio-slurry is used in both of solid and liquid forms as basal and topdressing in different crops.
- Bio-slurry is used in rice and vegetables @ 10-15 t ha⁻¹ and 15-20 t ha⁻¹ respectively.

- Application of slurry increases yield of different crops as compared to that of farm yard manure
- Application of bio-pesticide is found effective to control of BPH.
- Growth of fingerling attains at sellable size one week earlier when bio-slurry is used as feed compared to normal feeding.

Experience learned

- Application of liquid slurry as top dressing makes the soil surface compact.
- Vegetable seedlings were rotten or damaged when liquid slurry was applied at high rate.
- Slurry application is not advisable immediately after transplanting of rice.

Challenges of bio-slurry management

- More time and labour is needed for bio-slurry management and utilization.
- Additional investment is needed for building compost hut which is often poor farmers can not afford.

Future action plan

- Present Farmers Participatory Action research activities will be continued.
- Research program will be undertaken to assess the effectiveness of bio-slurry extension methods being practiced.
- A provincial workshop on use of bio-slurry will be organized for NGOs and other development partners.
- Organizing local study tour for digester owners will be continued.
- More promotional and education document will be developed.
- More case studies will be done.

c. Discussion Highlights (Question/comments and Answer)

Dr. Getachew Eshete from Ethiopia

Comment-Setup of bio-slurry unit within the biogas program is highly appreciable and found an effective step forward.

Question-What are the major challenges faces by the farmers regarding transportation of liquid bio-slurry?

Answer: Farms are way from households.

Dr. Fokhrul Islam from Bangladesh

Comment-Bio-slurry unit as set up in Cambodia should be replicated in other countries

Question-What is the link between GO and NGO in relation to bio-slurry extension? Is CEDAC an agricultural organization? What is its role in bio-slurry extension?

Answer- There is a strong linkage between GO and NGO. CEDAC works for agriculture.

Mr. Wahidur Rahman from Bangladesh

Question-who are the target group for preconstruction training?

Answer-Interested farmers

Country Paper from LAO PDR

a. General

Presenting 'A Country Report on Biogas Pilot Program (BPP) in Lao PDR', Mr. Phouee Vilay, Training and Promotion Officer highlighted on the present status, future plans and few issues and questions related to bio-slurry management. Though BPP officially started in November 2006 but actual implementation started in March 2007 in four districts using 'LaoNet' model modified from Nepal.

b. Presentation Highlights

Current status

- Nine masons and nine supervisors were trained but at present only 7 are actively working for BPP
- Eleven demonstration and 25 customer systems have been installed
- Quality control procedures is developed with spreadsheets for analysis of results
- District staffs are trained to perform QC and help with promotional Village Workshops
- Bio-slurry activities have been started with 36 biogas plants

Future action plan

- BPP will conduct trials and demonstration both at the National and Village level on use of bio-slurry as fish feed and in improving livestock feed such as improved grasses and leguminous forage
- Establish formal MOU/agreement with suitable Bio-slurry extension organizations (Agricultural College, farmer's organization etc.)
- Arrange relevant training sessions at slurry demo sites for lead farmers, district DLF officers, and extension workers from other organizations
- Research and Development activities on appropriate value-adding applications for bio-slurry in Laos (e.g : drying and packaging)

Few Issues and Questions

- How should we design the bio-slurry trials at farms?
- Is there a sample plan or TOR for this type of trials?
- How can we convince our farmers that bio-slurry is completely safe to use for food crops?
- Is it feasible to package and sell bio-slurry commercially?
- What are the best techniques for using bio-slurry as fish feed?
- How to maximize the benefits of use of bio-slurry for fodder crops?
 - how much of bio-slurry should be used per unit area of crops or tree plantation?
 - should we use liquid bio-slurry directly for vegetable, grain crop and tree plantation?

c. Discussion Highlights (Question/comments and Answer)

The issues and questions raised by the presenter were discussed and suggestions were given by participants

Country Paper from Bangladesh

a. General

Dr. M. Fokhrul Islam presented the paper entitled, '**Bio-slurry Extension in Bangladesh: Approach and Practice**'. Dr. Islam in his introduction highlighted two major challenges faced by farm households: (i) supply of inadequate fuel/biomass for cooking, and (ii) demand of more food to feed increasing population. Bio-gas and bio-slurry can contribute to minimize these problems. His presentation included status (changes over time) of soil organic matter and changes of some primary, secondary and micronutrient, availability and use & abuse of biomass (organic materials) and its consequence in declining soil fertility, crop production and total factor productivity. No further improvement was made until June 2007 from the status as stated in the proceedings of the Bangkok workshop and action plan taken in that workshop regarding the status of bio-slurry management and utilization in Bangladesh. He presented plan and suggested approaches for future adaptive research and extension & training on management and utilization of bio-slurry, promotion of use of bio-slurry, monitoring of the activities, limitations and few options for slurry extension.

b. Presentation highlights

Changes of soil fertility and contribution of organic manure

- Large amount of biomass (40% of cowdung, 28-62% of crop residues) is used for cooking & other purposes resulted a large amount of organic matter and plant nutrients gets lost through burning which causes a decline in soil fertility.
- Soil organic matter is decreased by 20-36% over last three decades and presently 62% of land contains low (1.0-1.7%) soil organic matter.
- The content of soil N, K, S and some micronutrients decreased appreciably.
- Results of long term experiments with balanced fertilization with organic manure indicated the improvement status of soil organic matter and nutrient content.

Future plan

Adaptive research: The objective, approach and detail activity plan is outlined. As an approach laboratory study and on-farm trials will be done through other service provider and for that a TOR and a manual for implementation, monitoring and reporting have been developed.

Slurry extension:

Approach: Providing information to biogas plant owners & other farm households on proper collection, preservation and utilization of slurry through individual contact, training, demonstration, farmer to farmer contact and field day/farmers rally/study tour.

- Extension information, its gap, tools for dissemination of information and limitations are identified.
- Activity plan has been developed:
 - Activity 1. Selection of extension agent
 - Activity 2. Prepare a demonstration plan
 - Activity 3. Development of Extension Materials
 - Manual on slurry management and utilization for agriculture production for use of extension agents
 - Booklet on bio-slurry management and utilization for use of biogas plant owners
 - Preparation of a guidelines for demonstration

Activity 4. Training

- ★ Orientation training for IDCOL-NDBMP staff (Officers & Inspectors) on slurry management & utilization
- ★ Orientation training for coordinators of POs
- ★ Training course on use of manual on slurry management for supervisors (training of trainers)
- ★ Training course on use of demonstration guidelines for supervisors
- ★ Training for cooperator farmers on implementation of demonstration
- ★ Training course for slurry users
- ★ Inclusion of a lecture on pit construction in the training course for new mason
- ★ Inclusion of a lecture on pit construction in the refresher course for existing mason
- ★ Training staff of NGOs, DAE, DoF and other local organizations
- ★ Integration with other activities

Three approaches are suggested for training and implementation of bio-slurry program

Approach 1: At present practice training participants are either male or female.

Proposed Approach is **Whole Family Approach** as suggested by CIMMYT Mexico.

Approach 2: At present practice training is given for individual farmer (male or female).

Proposed Approach is **Farmer Field School Approach.**

Approach 3: For implementation - **Integrated Plant Nutrition System (IPNS) Approach for use of bio-slurry as fertilizer – *IPNS is the management of all available plant nutrient sources to provide optimum and sustainable crop production conditions within the prevailing farming system.***

For sustainable development of Biogas & Bio-manure Sector, formation of Bio-slurry User's Club/Association at different levels is proposed:

- Global Bio-slurry Users Association
- Regional Bio-slurry Users Association
- National Bio-slurry Users Association
- District Bio-slurry Users Association
- Upazila* (Sub-district) Bio-slurry Users Association
- Local Bio-slurry Users Association

Activity 5. Promotion of use of slurry

Approach: Promotion of use of bio-slurry through mass gathering, mass media and inclusion in academic curriculum through:

- Organizing seminar and workshop
- Advertisement through TV, Radio & Newspaper
- Popular article publish in Newspaper & magazine
- Radio & TV talk show

- Organizing local cultural activities

The following slurry promotion means have been identified

- Promotion material development
- Inclusion of topics in curriculum of school & higher studies
- Inclusion of bio-slurry as fertilizer in the Fertilizer Recommendation Guide
- Inclusion of regulation for production, storage and marketing of organic fertilizer by amending Fertilizer Law 2006 or by making organic fertilizer control order or Ordinance or organic fertilizer Act
- Arrange fair/exhibition

Activity 6. Monitoring

- Internal and external monitoring plan has been developed

Limitations and Some Options of Slurry Extension

- ♣ Limited space in homestead for pit construction
Option: Collection of slurry in plastic container e.g. drum, bucket etc
- ♣ High rainfall and flooding in monsoon
Option: Protect slurry pit by making shade or roof and boundary around pit
- ♣ Mostly seasonal use of slurry in crop production
Option: Alternate use of slurry e.g. use in fish culture, nurseries, mushroom cultivation etc.
- ♣ Slurry management is mainly a subject of agriculture but persons involved in the program have no academic agriculture background
Option: Intensive training for existing staff

c. Discussion Highlights (Question/comments and Answer)

Question from Mr. Ram Prasad Dhital of Nepal-How do you plan to link your program with DAE?

Answer-Activities for management of bio-slurry is related to agriculture and DAE could be a good partner of our program by signing an MoU with them.

Question from Dr. Getachew Eshete from Ethiopia-what is your experience regarding NGO-GO partnership?

Answer-The government organizations like DAE is now motivated to work with NGOs which was not the case before. Many donor or INGO supported programs/projects are implemented by GO in collaboration with NGOs.

Question from Mr. Kong Kea, NBP, Cambodia-How Farmers Field School (FFS) Approach will work where biogas users are located in scattered?

Answer-FFS approach is difficult to apply that condition but most applicable when many users are located in one area.

Question from Ms. Le Thi from Vietnam- What is the role of the users association you proposed?

Answer-Through these associations farmers can raise their voice to the companies and policy levels and make their own plan how their program can best sustain.

Country Paper from Ethiopia

a. General

Presenting 'A Country Report on Bio-slurry utilization in Ethiopia' Dr. Getachew Eshete, SNV Ethiopia highlighted on the Potential, Constraints, and Opportunities of use of bio-slurry in Ethiopia. He gave a list of institutes involved in research and promotion of organic fertilizer in Ethiopia.

Prospect and potential of use of bio-slurry in Ethiopia

- More than 24 million tons of dung is produced per year
- Farmers have indigenous knowledge of using dung as manure in crops since time immemorial. Recent study (2006) by the EEA indicates that 56 % of households in Ethiopia use organic soil amelioration practices (animal dung, FYM, and compost)
- The increasing price of commercial fertilizer has heightened interest in the use of livestock manure for supplying crop nutrients and has significantly increased the value of manure as a nutrient source.
- The price of organic products can stimulate the increased utilization of Organic fertilizer
- Policy encourages organic farming - Environmental policy of Ethiopia Chapter III.3.1
- With the new biogas program the production of a high valued fertilizer from properly treated slurry is eminent.
- Scientific information and knowledge is available - A lot of research has been conducted on the efficient use of manure as fertilizer by ILRI, EARO, Agricultural colleges and universities, ISD, Bio-farm etc.
- Adequate well trained extension workers are now working close to farmers

Experience in Ethiopia

- Only < 1000 bio-digesters have been used during the last 30 years
- BIOFARM is pioneer in practical application
- Major research focused only on feed assimilation of animals in relation to manure (a number of publications by ILRI)
- Major focus was given on the use of gas rather than use of slurry
- The use of manure without anaerobic digestion is still very common in Ethiopia and its value can not be ignored

Problems/Gaps

- About 90 % of the cattle manure is used as fuel for cooking in the highlands of Ethiopia
 - Losses to crop production from burning dung and soil erosion are estimated at over 600, 000 tons annually or twice the average yearly request for food aid in Ethiopia (Hailu and Edwards, 2006)
- Present dung storage system has significantly reduced the quality of manure. Research results indicate that with the present storage system the composition of organic matter,

N, P, K in manure is reduced by 7, 28, 17, and 19 % than improved system (Kumsa, 2002)

- With the diminishing area of landholding the number of cattle-holding per house hold has been decreased significantly.

Country Paper from Nepal

a. General

Mr. Ramesh Nath Regmi of BSP-Nepal, presented the **Country Report on Bio-slurry Program in Nepal**. The presentation consisted of history of biogas and bioslurry utilization in Nepal, present activities with bio-slurry, handling and application of bio-slurry, extension and training programs being undertaken in Nepal and success and limitations of the program. Concluding his presentations Mr. Dhital suggested some recommendations for ensuring effective utilisation of bioslurry in the days to come.

b. Presentation Highlights

Bio-slurry extension and promotion activities implemented in 2007

- Cattle shed improvement program to input the urine and dung properly in the biogas plants.
- Demonstration of different application of bio-slurry.
- Design modification to provide access to outlet for collecting slurry using bucket.
- Learning sharing from the demonstration.
- Preparing standard prescription for slurry to different crops.
- ToT on bio-slurry to agricultural officers of Department of Agriculture.
- One day bio-slurry training to JT, JTA at district level.
- Promotions of trading bio-slurry/bio-compost for organic farming.
- Bonus to Biogas Company for slurry management.
- Slurry training to biogas users'.
- Interaction program on exploring the potential of bio-slurry.

Bio-slurry handling and application

Mr. Regmi described in brief some of the major findings of Biogas Users Survey carried out in July 2007 in 100 randomly sampled households that represented different ecological zones of Nepal.

- Potential of slurry is being realized by the farmers and its utilization is getting popular along with the increasing awareness created due to various extension programs. However, to overcome the social and technical constraints in slurry use and optimize its utilization, more extensive training programs are necessary to transfer the knowledge on slurry use to farmers.
- Pit and Heap methods of composting are recommended and become popular to the users. Maximum users (70%) use pit method having 1 or 2 pits. Majority users have turned the pit materials in one time (45%) or twice (38%) for producing better quality of compost. More than 50 per cent of the users keep compost in the pits for 4 months.

- Some common storage practices of bio-slurry or slurry compost as used by the Nepalese farmers are as follows:

Table 1: Storage practices of bio-slurry or slurry compost used by farmers

Storage practices	% of respondent use
1. Spread & dried in ground	05.5
2. Keep in heap uncovered	16.3
3. Keep cover on heap	03.3
4. Pile under a shed	03.9
5. Pile temporary in field	03.1
6. Spread in field into small heaps uncovered	06.1
7. Transported & spread in field with cover until field application	05.7
8. Transported in field, spread & plough immediately	10.0
9. Transport to field & spread during slack season & applied to soil only at time of land preparation	23.5

Source: Bio-slurry Users Survey, 2007

- About 75 % biogas users use different form of bio-slurry like 52% use as slurry compost, 25% as dried slurry and 14% as liquid slurry.
- Application of bio-slurry increased the yield of paddy, maize, wheat, potato and vegetables by 38%, 33%, 34%, 42% and 30%, respectively. About 55% of biogas users reported that crop yield is increased when slurry-composed is used. Farmers perception regarding the change of crop yield due to application of bio-slurry is given in Table 2.

Table-2: Perception of farmers about the changes in crop productivity due to application of bio-slurry

Crop	Increased (Respondents %)	Decreased (Respondents %)	No Change (Respondents %)
Paddy	41.6	6.2	52.1
Maize	38.1	12.9	48.9
Wheat	35.2	2.7	63.2
Pulses	34.4	2.4	53.2
Oil Crops	28.9	6.6	64.5
Vegetable	40.3	2.5	57.1
Potato	46.6	7.3	46.0

Bio-slurry activities on progress

Improvement of cattle shed and urine collection

- A program of cattle shed improvement and urine collection was undertaken with 50 households in terai and 25 in hills where concrete floor is constructed in the cattle shed and a urine collection concrete pit is also constructed at one corner of the shed.

Training

- Two training manuals one for use of officers and another for field staffs are prepared.
- A ToT course on use of bio-slurry was organized for 22 officers of the Department of Agriculture (DoA) who will act as trainers for various training on use of bio-slurry to be conducted by BSP-Nepal.
- A training course on bio-slurry management is planned for field staffs of BSP-Nepal and Soil Management Directorate of DoA in 20 batches.
- BSP-Nepal organized an Interaction Workshop with the participation of all stakeholders related with agriculture development in Nepal. Several issues were identified for better extension and promotion of bio-slurry program.
- BSP-Nepal provides training on proper use of bio-slurry to the personnel of biogas Construction Company who organizes regular training for biogas users. In those training topics on bio-slurry management is included.

Bio-slurry extension methods and vehicles

- The following extension methods and vehicles are using for slurry extension program in Nepal

Ext. method	Vehicles
1. Training	Lectures, field visit, discussions etc
2. Demonstration	Result and method
3. Exhibition	Through different organizations
4. TV, radio program	Success story, interview with experts and bio-slurry users
5. Awareness program	Group discussion, poster distribution, wall painting, hoarding board etc
6. Farmer tour	Study tour to those areas where bio-slurry program is successful

Success and Limitations

Success

- Chemical fertilizer and farmyard manure are replacing by the bio-compost to some extent. (BUS 2007)
- Farmers who have not required number of cattle are beginning to rearing cattle with installation of biogas plant after aware of the manure value of bio-slurry.
- Department of Agriculture, donor agencies, NGOs and CBO and Private Biogas Companies are promoting the use of bio-slurry in organic farming.
- Most of the farmers save money by purchase of reduced amount of chemical fertilizer and insecticides.
- Income generation by selling of bio-compost for vermi composting as largely practice by the users.

Limitations

The limitations to achieve the target are:

- The farmers are still following the traditional method of cultivation.
- Some biogas users still do not believe that the slurry is good organic manure.
- The Biogas Company concentrates more on plant construction.
- The farmers have small and scattered land holding.
- Co-ordination of line agencies is weak
- The easy availability and application of chemical fertilizer.
- Composting process is labor intensive and time consuming.

Future plan

- Update training manual and promotional materials and publish these in local languages.
- Collaboration with organic tea growers.
- Developing strong network with Department of Agriculture for effective extension of bio-slurry.
- Slurry management is to be included in the quality control and grading system
- Continuity of on-going activities.

c. Discussion Highlights (Question/comments and Answer)

There were less comments and questions as the presentation ended at the time of dinner.

Question from Dr. Fokhrul Islam-How the bonus system is introduced in BSP-Nepal?

Answer-A rating procedure has been developed to evaluate the performance of company activities and user cooperation and performance regarding bio-slurry management.

Remarks from session chairman

First of all chairman thanks all the presenters and participants for their nice presentations and cooperation extended to him for smoothly conducting the session. He optioned to mechanization of slurry handling and management considering the local socio-economic condition. He suggested analysing the economic aspects of bio-slurry management. He also suggested promoting bio-slurry as a regular practice of using as organic fertilizer for organic farming.

6.4 Display and distribution of extension and promotion materials

Different extension and promotion materials such as posters, leaflets, manuals, wall-hangings and pamphlets prepared for the promotion of bio-slurry were displayed. Copies of some printed materials related to biogas and bio-slurry were distributed to the participants.

6.5 Elephant Riding

The participants joined the elephant riding in deep forest and that event was highly appreciated by the participants as it was a new experience to most of them including Nepalese.

6.6 Technical Session II

6.6.1 Group Exercise

The next agenda after the presentation of country paper was the group exercise. Mr. Uttam P. Jha of SNV, Nepal was act as moderator. The participants were divided into four groups (Table 3) to work with two themes (i) Extension methods, vehicles, success and failures - Group 1 & 3 (ii) Slurry storage and use under wet condition – Group 2 & 4. In addition to specific theme there was special consideration for each group ‘Recommendation on making linkages for slurry extension with different programs and organizations’.

Table 3. Group division of participants

<i>Group-1</i>	<i>Group-2</i>	<i>Group-3</i>	<i>Group-4</i>
Prof. Nguyen Lan Dung	Mr. Nivath Phanaphet	Dr. Fokhrul Islam	Mr. Saroj Rai
Mr. Phouvy Vilay	Mr. Kong Kea	Dr. Getachew Beyene	Ms. Le Thi Xuan Thu
Ms. Bindu Manandhar	Mr. Ndahimana Anaclet	Mr. Chhong Sophal	Mr. Wahidur Rahman
Mr. Keshav Dawadi	Mr. Ramesh Nath Regmi	Mr. Ram Prasad Dhital	

There was thread bare discussion among the group members.

6.6.2 Presentation and compilation of outcome of group exercise

Ms. Bindu Manandhar, Mr. Ramesh Nath Regmi, Mr. Ram Prasad Dhital and Ms. Le Thi Xuan respectively from group-1,2,3 & 4, presented the outcome of discussions as follows:

Group I

Extension methods	Vehicles
1. Training for personnel at different levels of different organization - MoA (Rural development) - Province/District - Village	Department of Agriculture/National Institute of Animal husbandry incorporation with National Biogas Project
2. Demonstration at farmers field	National University of Agriculture
3. Study visit (in country) for farmers	National Biogas Program
4. TV/Radio/Publications (book, articles, Poster etc.)	National Biogas Program collaboration with related government organizations.
5. Farmers to farmers extension	Satisfied farmers
6. Documentary film/CDs	National Biogas Program
7. Arrange visit for leader farmers to near foreign country to observe and learn new information	Association of farmers/NBP/MoA

Success	Limitation
1. Increased agricultural production	Difficult to transport slurry in liquid form in the field

2. Use as feed (for pig and fish)	Loss of nitrogen if management is not good
3. Ensure better environment	Resource poor farmers can not afford to establish biogas plant without support
4. Pathogens/parasite eggs killed by high temperature in composting	Lack of awareness among the farmers
5. Energy and fertilizer at same time	Farmers hesitate to use slurry from the toilet attached biogas plant
6. Save some money	

Recommendation

1. After completion of the project, government has to continue the program
2. Research on microbiological aspects e.g. to identify high activity anaerobic bacteria for quickly production of methane, e.g. Cellulose to CH₄
3. Coordination among Government, Project and Stakeholders

Group III

Extension methods	Vehicle
1. Training for concerned personnel: - Extensionists - Users - Masons	Standard training manuals, booklets, leaflets, lectures & discussions
2. Demonstration	Selection of representative sites & innovative farmers following guidelines
3. Farmers to farmers contact (external & internal)	Best practices, exposure visits, tours, display through TV
4. Individual contacts with farmers	Visit by extension workers
5. On-farm trial	Organize field day/farmers rally at trial site
6. Awareness to all extension agents including policy makers	

Success and Limitation

A. Success

1. User's perception is good (understanding on bio-slurry)
 - Application of bio-slurry increased yield and maintains soil fertility
 - 78 % of digester owners use bio-slurry – Cambodia
 - 75 % users use bio-slurry – Nepal
2. Domestic biogas programs of Bangladesh, Cambodia and Rwanda have started with focus on use of bio-slurry in addition to use of gas for cooking
3. Policy makers and planners have realized the importance of use of bio-slurry – Bangladesh
4. University and academic institutes have started to give due attention on bio-slurry research (Ethiopia, NAARC)

B. Limitations

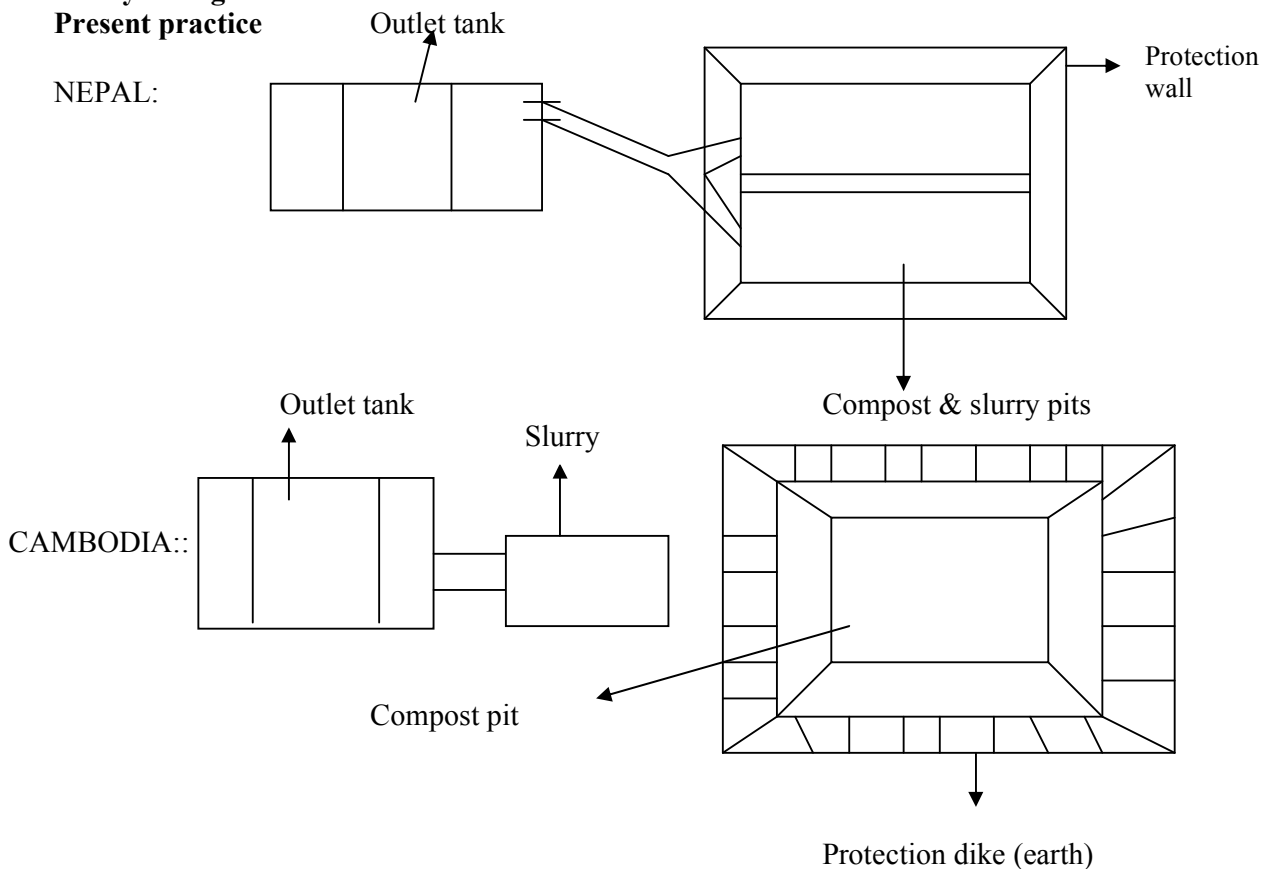
1. Use of bio-slurry is purely an agricultural activity but companies pay more attention on plant construction
 - Policy is not favourable for slurry extension.
2. Extension personnel of companies have limited agricultural academic background and experiences with different aspects of bio-slurry
3. Dung cakes are commercial commodity in Ethiopia

Recommendations

1. Due attention should be given on research
2. Establish linkages between concerned organizations
3. Form bio-slurry network among the programme countries
4. Form bio-slurry users association
5. Share best practices through seminars, workshops, study visit

Group II

1. Slurry storage Present practice



Recommendation for storage in wet condition:

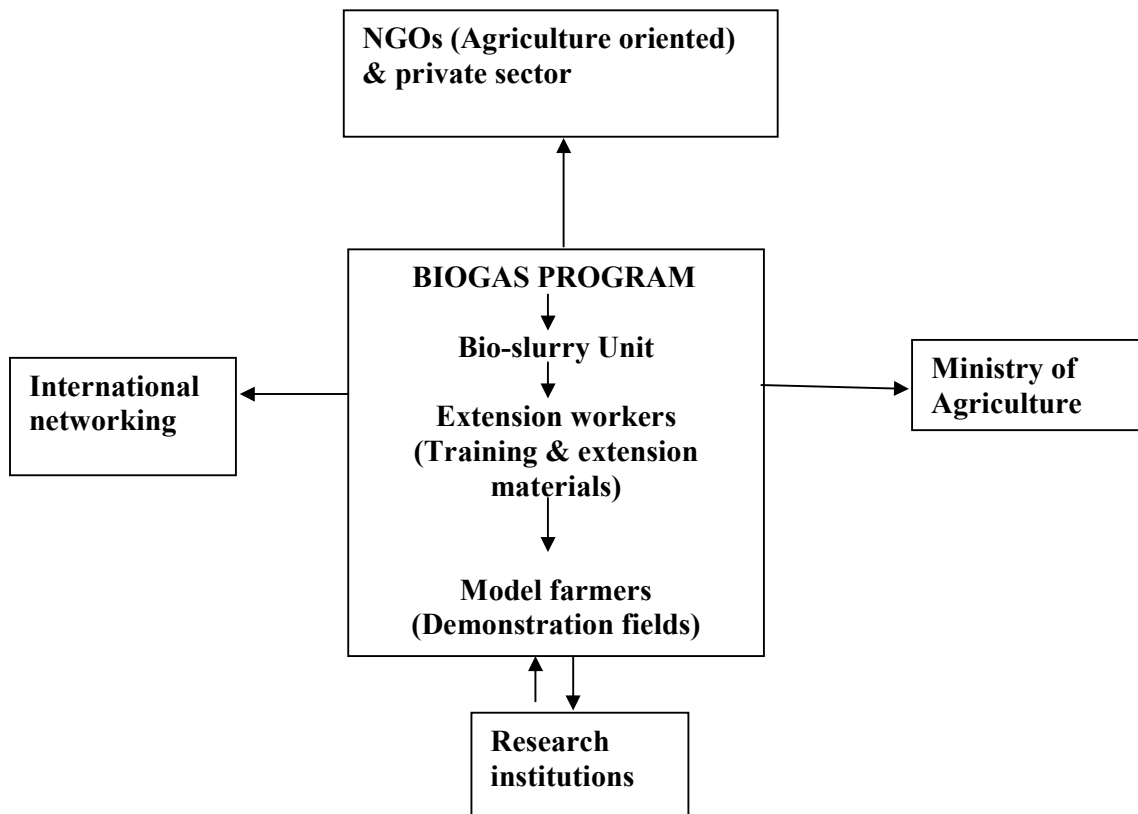
1. Protection of pits with protection walls (use local materials: stones, mud, stones & mud, soil or with concrete if possible)
2. Cover the slurry and compost pits with any locally available roofing materials (palm leaves, grass, elephant grass, plastic sheet, tiles, if possible)
3. Drainage around the slurry and compost pits, especially for low land areas.

2. Slurry use under wet conditions

Recommendations

1. Semi- dry form or dry slurry is more suitable for basal fertilizing (especially for home garden)
2. For fruit, vegetables or trees we can apply liquid slurry in ditches surrounding those trees.

II. Linkages on slurry extension.



Group IV

Bio-slurry storage and use under wet condition.

1. Storage

-Slurry pits/compost pits with proper roofing

- sunlight – nutrients loss
- rain – leaching

- Composting:

- quality
- quantity
- easy handle and transport

- Use of dry slurry should be discouraged
- Vermi-composting
- Lining slurry pits with good quality plastic sheet
-

2. Transportation

- Gravity flow
- Irrigation channel
- Containers and available means of transportation

3. Use of bio-slurry as

- Organic manure to reduce the required amount of chemical fertilizers
- Fish pond
- Pig feed
- Cattle feed
-

4. Urine feed into digester

- Increase gas production
- Increase nitrogen content of slurry

6.7 Field visit

Participants visited Elephant Breeding Centre. They also visited five biogas plants and shared experiences with biogas owners at Nawalparasi. Improved cattle shade, urine collection and toilet attachment was found there. Number of pits is less in most cases and pit management and slurry management was not at satisfactory standard level. Farmers use slurry in different crops in different forms in different seasons. They are not aware about the rate of slurry to be used for different crops. They also use inorganic fertilizer. They are not much aware about the recommended rate of organic or inorganic fertilizer for their specific crop and location. They use general dose. They do not know how much inorganic fertilizer could be reduced if they use slurry. In most cases they use slurry as bonus or in addition to inorganic fertilizer.

Participants visited and discussed with officials of a biogas company and an appliances workshop.

6.8 Recapitulation of the study tour events

The following views and observations were expressed by the participants:

- Interactions between participants from different countries are beneficial. There is lots of learning which could be applied at the work place. The application of the learning needs to be targeted towards the end-users.
- The issues discussed in relation to bio-slurry collection, handling, transportation and application under wet condition at the farm level have to be given importance.
- The IPNS approach should be followed in case of research, extension and application of bio-slurry.
- A bio-slurry unit should be established within the biogas program in each participating countries.
- A coordinated effort is needed among the sector institutions to effectively convey the right message to the end-users.
- The experience of field visit realize that we have to do more on awareness building among farmers regarding improve management practices of bio-slurry and integrated use of slurry and inorganic fertilizers.
- The event of elephant riding will remain in the memory of the all participants

6.9 Evaluation of the study tour

Ms. Bindhu, coordinator of the program facilitated the session on evaluation of the study tour from participants' perspectives. Recapitulating the three main activities during the tour – (i) Information exchange between participants through presentations and discussions on country papers as well as informal exchange during breaks and evening programmes (ii) Field visit and (iii) Group exercise and logistic support provided by the organizer. Each participant has given his/her written comments.

All the participants (100%) agreed that overall objective of the study tour has been achieved. However, the following remarks were made by some of the participants:

- Time for discussion was short and not enough.
- No air conditioning in the workshop hall and in dormitory
- Audio-visual facility was inadequate.

6.10 Follow-up plan

- All the percipients agreed to share knowledge and information on bio-slurry via emails and other suitable means.
- Similar study tour program should be arranged twice in a year to see the wet and dry season management of bio-slurry and its effect on seasonal crops.

6.11 Informal Closing

Dr. Fokhrul Islam gave a summary of the presentations and field visits and on behalf of participants gave thanks to the organizers for arranging such a wonderful learning and sharing event. Chairperson Mr. Soraj Raj, gave his closing remarks as follows:

- Knowledge and information exchanged during the workshop would be translated in the workplace for the betterment of the end users.
- Such kind of study tour as a learning and sharing event should be continued in future
- More attention should be given for research on bio-slurry
- More linkage is needed with universities and research organizations and other stakeholders of agriculture sector
- Things should be done in a very systematic ways
- There is a need to form a bio-slurry forum
- He gave thanks SNV to put us together

The workshop came to an end with vote of thanks from Ms. Bindhu to all the participants for their active contributions during the entire period of the study tour. With the permission of the chairperson she closed the workshop with an invitation to all the participants to join the lunch.

7. CONCLUSION

The international study tour has been instrumental in providing an organised platform for those working in domestic biogas sector in different countries to share best practices on the use of bioslurry at the micro level and to identify potential stimulus as well as barriers to further optimise the use of bioslurry. The study tour findings clearly indicated that lot of efforts have to be paid from program personnel to motivate potential farmers to use bioslurry effectively and efficient extension services will be instrumental in this process. In all new programs bio-slurry component should be initiated at the time of biogas activities started. In countries with matured growth and established biogas programs such as Nepal and Vietnam, the focus should be on enhancing the quality of extension services being delivered while in countries where the technology is relatively new quality as well as quantity of extension activities should be taken care and slurry application should be one of the topics for promotion. Therefore, there is need to contextualise the extension activities based upon the level of understanding of the people, availability of extension network and media, accessibility of information etc. The evaluation results clearly indicated that the study tour has been successful in achieving its objectives.

ANNEXES

Annex-1: Study tour schedule

Tuesday, 11 September 2007		
14:00-	Travel to Sauraha, Chitwan	All
Wednesday, 12 September 2007		
08:00-09:00	Break fast	
09:00-09:30	Registration	All
09:30-09:50	Welcome, Opening and Introduction of the program	Mr. Saroj Rai Ms. Bindu Manandhar
09:50-10:00	Personal Introduction	
Technical Session I, Chairman : Mr. Saroj Rai		
10:00-10:20	Presentation of country report-Vietnam	Ms. Le Thi Xuan Thu
10:20-10:40	Presentation of country report-Cambodia	Mr. Kong Kea
10:40-11:00	Discussion	
11:00-11:30	Coffee/Tea break	
11:30-11:50	Presentation of country report-LAO PDR	
11:50-12:10	Presentation of country report-Bangladesh	Dr. M.Fokhrul Islam
12:10-12:30	Discussion	
12.30-13.30	Lunch	
13:30-15:30	Elephant Riding	All
16:40-17:00	Presentation of country report-Ethiopia	
17:00-17:20	Presentation of country report-Nepal	
17:20-17:40	Discussion	
17:40-17:50	Chairman's Remark	
18:00-19:00	Tribal dance with light snacks and tea	
19:30	Dinner	
Thursday, 13 September 2007		
06:00-06:30	Break fast	
06:30-09:30	Canoeing Elephant Breeding Centre	All
09:30-10:30	Lunch	
10:30-18:00	Field visit to Nawalparasi	All
19:00	Cocktail Reception + Dinner	
Friday, 14 September 2007		
08:00-09:00	Break fast	
09:00-12:00	Group discussion and presentation of plenary discussion	All
12:00-12:30	Study tour evaluation	
12:30-13:00	Summary and closure	Dr.M.Fokhrul Islam Mr. Saroj Rai Ms. Bindu Manandhar
13:00-14:00	Lunch	
Saturday, 15 September 2007		
	Departure of international participants	

Annex-2: List of participants

Name	E-mail	Organisation/function
<i>From Bangladesh:</i>		
Dr. M.Fokhrul Islam	fislam@snnworld.org	SNV/Bangladesh, Bio-Manure Management Advisor
Mr. Wahidur Rahman	wahid@idcol.org	IDCOL, National Domestic Biogas and Manure Programme, Investment Officer (Technical)
<i>From Cambodia:</i>		
Mr. Kong Kea	kongkea@nbp.org.kh	National Bio-digester Programme, Bio-slurry Extension Officer
Mr. Chhong Sophal	012810101@mobitel.com.kh	CEDAC, Field Coordinator
<i>From Ethiopia:</i>		
Dr. Getachew Eshete Beyene	geshetebeyene@snnworld.org	SNV, Ethiopia, Addis Ababa
<i>From Lao PDR:</i>		
Mr. Nivath Phanaphet	nivath@biogaslao.org	Project Director, Biogas Pilot Program, LAO-PDR
Mr. Phouvee Vilay	phouvee@biogaslao.org	Training and Promotion Officer, Biogas Pilot Program, LAO-PDR
<i>From Nepal:</i>		
Mr. Saroj Rai	srai@bspnepal.wlink.com.np	BSP-Nepal, Executive Director
Ms. Bindu Manandhar	bindu@bspnepal.wlink.com.np	Senior Officer, BSP-Nepal
Mr. Uttam P. Jha	ujha@snnworld.org	SNV, Nepal, Organisational Strengthening/Institutional Development Advisor
Mr. Ram Prasad Dhital	ram.dhital@aepc.gov.np	Alternative Energy Promotion Centre, RESS Coordinator
Mr. Ramesh N. Regmi	ramesh_regmi57@yahoo.com	BSP-Nepal, Slurry Coordinator
Mr. Keshav D. Dawadi	kddawadi@hotmail.com	Nepal Biogas Promotion Group, Slurry Specialist
<i>From Rwanda:</i>		
Mr. Anaclet Ndahimana	andahimana@snnworld.org	SNV, East & South Africa Region, Renewable Energy Advisor
<i>From Vietnam:</i>		
Prof. Dr. Nguyen Lan Dung	dung.nguyenlan@yahoo.com	Member of the Vietnam National Assembly
Ms. Le Thi Xuan Thu	thultx@biogas.org.vn	MARD/Biogas Project Division, Biogas Agricultural Engineer