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Final Report of Short Term Assignment

Improving the Effectiveness of the Bio-slurry Extension Component of National Biodigester Program in Cambodia

This report contains information
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List of Abbreviations

CARDI	Cambodia Agricultural Research and Development Institute
CEDAC	Cambodian Centre for Study and Development in Agriculture
CFA	Community Facilitator Assistant
DAHP	Department of Animal Health and Production
DAP	Di-ammonium phosphate
FYM	Farmyard manure
MAFF	Ministry of Agriculture, Forestry and Fisheries
MTE	Mid-Term Evaluation
NBP	National Biodigester Program
NGO	Non Government Organizations
IF	Inorganic Fertiliser
IPNS	Integrated Plant Nutrition Systems
PDA	Provincial Department of Agriculture
PBPO	Provincial Biogas Program Office
RUA	Royal University of Agriculture
SNV	The Netherlands Development Organizations
ToT	Training of Trainers

Improving the Effectiveness of the Bio-slurry Extension Component of National Biodigester Program in Cambodia

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EXECUTIVE SUMMARY

The agricultural sector in Cambodia challenges for feeding the nation's expanding population but crop production remains with constraint by inefficient irrigation management, lack of agriculture inputs (good quality seeds and fertilisers), imbalanced use of fertilisers and insufficient institutional support. From among these constraints, soil fertility and fertilizer (organic and inorganic) management issues constitute an important part of the government need to be focused in the agricultural sector.

The optimal use of digested dung from a biodigester as fertiliser is considered vital to make the investment of a farmer economically viable and therewith equally vital to come to a lasting biodigester sector in Cambodia. The benefits of the digested dung (bio-slurry) of the operated biodigesters will minimise the problem of soil fertility, increase crop yield and thereby will maximise farmers' profit. From the outset (March 2006) of the National Biodigester Program (NBP) bio-slurry extension has been an integral part of the program activities. A number of bio-slurry extension activities are planned and implemented by the NBP with the help of different stakeholders. NBP is seeking the assistance of the Bio-Slurry Management Advisor of SNV-Bangladesh to review the present activities and to come up with recommendations on how to improve the effectiveness of the slurry extension activities of NBP.

The working approach of the Advisor was a combination of review of related documents, field visits, and interviews with extension workers and farmers, meetings with project staff and national stakeholders, stakeholder training workshop involving with for presentations on bio-slurry management and utilization and verification and validation of the advisor's findings followed by discussions and joint analysis.

The information collected on existing major agricultural practices of biodigester farmers indicates that the farmers have homestead (size varies from 1200 m^2 to 6000 m^2) and main crop land of 0.5-4.0 ha comprised of 2 to 11 plots. Every household has a number of cattle, buffalos and/or pigs required for a biodigester. In every homestead a small portion of land is used for growing seasonal vegetables and fruit trees without proper planning and systematic care. Rest of the homestead area (larger portion) remains fallow.
On the other hand, the crops grown in the field are rice, water melon, sweet potato, cassava, corn, chilli etc. The most dominant cropping patterns are Rice-Rice and Rice-fallow. Mostly traditional varieties are grown in both seasons but in some irrigated areas modern varieties are grown in dry season. Rice yield varies from 2-3 t ha^{-1} in wet season and 3-4 t ha^{-1} in dry season. Farmers use both organic (bio-slurry) and inorganic fertilisers and they reduce certain quantity of inorganic fertiliser when they apply organic manure. But they do not know how much organic fertiliser needs to be applied for which crop and soil. They do not know how much inorganic fertiliser exactly can be reduced when certain amount of organic fertiliser (bio-slurry) is applied. **The extension workers are also not aware of required doses of fertiliser considering crop, varieties and soil fertility.**

Farmers do not know much more about recommended rate and method of application of fertilizers and they use fertilisers from their own past experiences. Farmers have limited access to improve crop management practices specifically to fertiliser management. Extension delivery system is inadequate and poor.

Within the NBP the bio-slurry extension activities are planed, monitored and reported by a Bio-slurry Extension Officer who is supervised by the Program Coordinator. Under the public sector partnership 2-4 staffs of PDA from Agronomy and Agricultural Extension office are assigned as Bio-slurry Extension Worker. CEDAC, an agricultural NGO assigns one Project Coordinator at national level and five Community Facilitator Assistants (CFA) one in each province for slurry extension work.

The weakness and further scope of improvement of present organizational setup of slurry extension component of NBP and subsidy system have been analysed and recommendation options are given in the report. The performance of each of the slurry extension activities (development of extension materials, imparting training, conducting farmers participatory action research, organizing study tour/exchange visit for farmers in the trial site, organizing provincial workshop, conducting monitoring and evaluation etc.) have been assessed and have provided comments, suggestions and recommendations for future strengthening the component activities.

A workshop was organized by NBP and all staff of stakeholders concerned with bio-slurry extension participated. The advisor made power point presentations on different aspects of bio-slurry management and utilization, advisor's view and analyses on the present status of the slurry extension activities of NBP and suggestions for further improvement. Copy of the files of power point presentations were handed over to NBP for future reference.

Recommendations

Organizational setup

- At PBPO a separate project coordinator with agronomic background may be considered for bio-slurry extension and all bio-slurry extension workers should have adequate background in crop husbandry. CEDAC should assign a coordinator and all CFAs at provincial and district level, respectively. CFAs should reside and perform duties at district level if there are sufficient numbers of activities.
- Bio-slurry extension activities can be placed and coordinated at district level by assigning a vice chief of district agriculture office who has background in agronomy and he will act as coordinator of the project. All bio-slurry extension workers will work under the coordinator and they should reside at their respective working places at district level and perform their duties there.
- The management of NBP may initiate dialogue with the concerned authority not to disturb assigned staffs for NBP activities and if possible make an agreement with them. NBP can make an arrangement with PDA and CEDAC for increasing

the number of extension workers and CFA depending on the area coverage and volume of activities.
- Strengthen the linkage between PBPO and CEDAC by involving CEDAC in planning process

Partner selection

- NBP may consider selection of more partners for performing specific activities when to be needed

Subsidy

- At the beginning of farmer selection give those understanding that subsidy package is for all construction including complete compost hut.

or

- Strengthen motivation of farmers by making them understanding of the benefit of proper preservation and composting of bio-slurry.

or

- Provide small subsidy to attract farmers for construction of standard compost hut along with boundaries and shade.

or

- Loan facility should cover the cost of construction and management of compost hut.

Planning

- Bottom up approach is suggested for planning. A seasonal planning meeting should be organized at province by the project director involving CEDAC provincial coordinator. Provincial proposals should be forwarded to NBP. NBP should internally review the proposals, organize a planning workshop and finalize the plan.

Development of training/extension materials

- Target group or client oriented extension material should be developed so that the leaflet/flyer is more useful for farmers and booklet for bio-slurry extension workers. A training manual covering soil-plant-fertiliser (bio-slurry) systems needs to be developed for coordinators and extension workers.
- An expatriate or national consultant may be hired for developing a training manual on soil-plant-fertiliser (bio-slurry) systems.

Training

- Expanding the present network of bio-slurry extension system and strengthening the capacity building of bio-slurry extension workers

- Strengthen user training by increasing its number, frequency, topics and time duration.
- NBP may select a small group of persons (trainer) from RUA, CARDI, National School of Agriculture and Provincial Department of Agriculture who obtained minimum bachelor degree in crop science, and may organize a ToT for that group on use of the training manual.
- This group will offer training for extension workers and CFA.
- Extension workers and CFAs will offer training for plant owners.
- Farmers training - The success of bio-slurry extension is very much dependent on the knowledge, the understanding and the skills of the farmers. Training is needed for all plant owners on bio-slurry management and utilization. In addition to users training special training may be organized by out sourcing. All demonstration co-operator farmers (model farmers) should receive appropriate training (should be organized by PBPO) to understand the technology, purpose, timing and other related activities of the demonstrations and their role in disseminating the information.
- NBP should initiate dialogue with educational institutions to include features on biogas and bio-manure in their academic course and curriculum.

Farmers Participatory Action Research

- Farmers participatory action research approach can be replaced by farmers participatory demonstration approach.

- Home garden demonstration with use of liquid slurry and field demonstration following **IPNS approach** is suggested.

Monitoring, data collection and recording, and reporting

It needs further improving of the following aspects:

- Monitoring – Monitoring system should be established as desk monitoring and field monitoring. Desk monitoring both at NBP head quarter and PBPO office needs to be further strengthened. To monitor the seasonal field activities a 2-3 member external team should be formed. The team will monitor the field activities following a monitoring guideline to be developed by NBP. Yearly users' survey should be conducted by hiring a third party.
- Data collection and recording – Standard format for data collection (related to demonstration and training) should be developed by NBP and to be provided to PBPO and CEDAC. Develop a database or excel spread sheet at NBP head quarter to preserve all information related to slurry activities including co-operator farmers and demonstration plot. This database will be the property of MAFF or the Department of Agriculture at the end of the project.
- Reporting – Each PBPO and CEDAC should prepare their half yearly and annual reports and submit to NBP. NBP should compile and prepare its own reports.

Improving the Effectiveness of the Bio-slurry Extension Component of National Biodigester Program in Cambodia

1.0 Introduction

The optimal use of digested dung from a biodigester as fertiliser is considered vital to make the investment of a farmer economically viable and therewith equally vital to come to a lasting biodigester sector in Cambodia.
From the outset of the National Biodigester Program (NBP) bio-slurry extension has been an integral part of the program activities. Extension materials have been developed, provincial extension workers trained, model farms have been set-up and a collaboration agreement on slurry extension with an agricultural NGO (CEDAC) established.
The bio-slurry extension activities under the NBP are planned, monitored and reported by a Slurry Extension Officer who is supervised by the Program Coordinator.
The program was started in March 2006 and a Mid-Term Evaluation (MTE) will be conducted by SNV in August 2008. NBP is seeking the assistance of the Bio-Slurry Management Advisor of SNV-Bangladesh to review the present activities and to come up with recommendations on how to improve the effectiveness of the slurry extension activities of NBP.

1.1 Objectives of the assignment

The main objective of the assignment is to review the present activities and to come up with recommendations on how to improve on the effectiveness of the slurry extension activities of NBP. A secondary objective is to provide the MTE team with impartial information on the present status of the slurry extension component of the NBP. For further details see attached Terms of Reference in Annex 1.

2.0 Methodology

The working approach of the Advisor was a combination of review of related documents, field visits, interviews with extension workers and farmers, meetings with project staff and national stakeholders, stakeholder training workshop involving with presentations on bio-slurry management and utilization and verification and validation of the advisor's findings followed by discussions and joint analysis (see Annex 2: Program schedule, persons met, and some pictures).


Interviews with farmers


Meetings with project staffs in provinces

3.0 Agriculture policy in Cambodia

The Advisor attempted to review the National Agriculture Policy and the National Agricultural Extension Policy documents but the policies are under preparation. The policy documents related to fertiliser use, monitoring and regulation was also not prepared. The Agricultural Sector Strategic Development Plan, 2006-2010 prepared by the Department of Planning and Statistics of MAFF has indicated the development strategies of agriculture sector. This plan is an important document of the Royal Government of Cambodia to reduce poverty in rural communities, achieve food security, and foster equitable and sustainable economic growth. The Strategic Development Plan recognizes that the development of agriculture sector especially crops production remains with constraint by inefficient irrigation management, lack of agriculture inputs (good quality seeds and fertilisers), imbalanced use of fertilisers and insufficient institutional support.

4.0 Agriculture Research, Extension and Input systems in Cambodia

Centrally three departments (Animal Health and Production, Agronomy and Agricultural Land Improvement and Agricultural Extension) under the Ministry of Agriculture, Forestry and Fisheries (MAFF) are responsible for disseminating crop production information to farmers and the department of Fisheries Administration is responsible for fisheries extension.

Provincial Department of Agriculture (Formally called Provincial Department of Agriculture, Forestry and Fisheries) is responsible for delivering agriculture extension services to farmers at provincial level. The extension service has several identified weaknesses.

Cambodia Agricultural Research and Development Institute (CARDI) and Royal University of Agriculture (RUA) are doing research on various aspects of crop improvement and crop management including soil and fertiliser management.

There is an agricultural input company under the technical management of MAFF is responsible for fertiliser regulation and marketing.

There is a good linkage exists between agriculture research and extension.

5.0 National Biodigester Program in Cambodia

National Biodigester Program (NBP) is a joint program of the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) and the Netherlands Development Organization (SNV) started in 2005 and will continue up to December 2009 in eight provinces of Cambodia.

Some of the specific objectives of NBP are as follows:

- To establish 17,500 family size quality biodigester
- To ensure the continued operation of all biodigesters installed under the program
- To maximize the benefits of the operated biodigesters

To attain objectives MAFF has nominated the Department of Animal Health and Production (DAHP) as the coordinating agency for the program, SNV provides technical assistance while DGIS provides financial assistance to the program.

The program has activities in the fields of promotion and marketing, construction, repair and maintenance, quality control, research and development, training, bio-slurry extension, monitoring and evaluation.

5.1 Existing Major Agricultural Practices of Biodigester Farmers

The following information was collected through discussion meeting with staffs of the Provincial Department of Agriculture and with biodigester farmers.

All interviewed farmers have homestead (size varies from 1200 m^2 to 6000 m^2) and main crop land of 0.5-4.0 ha comprised of 2 to 11 plots.

There are two distinct crop seasons – dry season (November-June) and wet season (July-October). Growing crops in dry season is usually limited due to lack of soil moisture. Some farmers those who have ponds grow dry season crops in some of their plots by irrigating using pond water. Dry season crops are also grown in areas where surface water irrigation facilities are available.

Every household has a number of cattle, buffalos and/or pigs required for a biodigester. In every homestead a small portion of land is used for growing seasonal vegetables and fruit trees without proper planning and systematic care. Rest of the homestead area (larger portion) remains fallow.

Crops and cropping pattern

The crops grown in the field are rice, water melon, sweet potato, cassava, corn, chilli etc. The most dominant cropping patterns are Rice-Rice and Rice-fallow. Mostly traditional varieties are grown in both seasons but in some irrigated areas modern varieties are grown in dry season. Rice yield varies from 2-3 t ha^{-1} in wet season and 3-4 t ha^{-1} in dry season.

Crop yield especially rice yield has increased from 1.82 t ha^{-1} (in 2000) to 2.47 t ha^{-1} (in 2006) because of improved technologies practiced by the farmer (Statistics of General Crops – MAFF, website). However, the agricultural production is still depending on natural condition.

Fertiliser Management

Farmers use both organic (bio-slurry) and inorganic fertilisers. Their practices in fertiliser use are summarized below:

- Bio-slurry is mostly used in rice seedbed, rice main field and in homestead vegetables,
- DAP, Urea and mixed fertilisers (15-15-0, 16-20-0) are commonly used,
- Farmers know the benefit of using organic manure (bio-slurry, FYM), they reduce certain quantity of inorganic fertiliser when they apply organic manure. But they do not know how much organic fertiliser needs to be applied for which crop and soil. They do not know how much inorganic fertiliser exactly can be reduced when certain amount of organic fertiliser (bio-slurry) is applied. **The extension workers are also not aware of required doses of fertiliser considering crop, varieties and soil fertility.**
- Farmers do not know much more about recommended rate and method of application.

- Farmers' use rate widely varies from province to province and from farmers to the farmers within the province.
- Some farmers use only bio-slurry at very high rate (9 t ha-1)
- Farmers and even extension workers are not aware of recommended fertiliser management developed by CARDI.
- Farmers use fertilisers from their own past experiences.

Comment

- Flows of research information to farmers are absent or very slow.
- Extension delivery system is inadequate and poor.
- Farmers have limited access to improve crop management practices specifically to fertiliser management.

Scope of further improvement

- Improving the farmers' knowledge by strengthening the extension delivery system.
- Expanding the present network of bio-slurry extension system and improving the capacity building of bio-slurry extension workers

5.2 Bio-slurry Extension Component of NBP

Bio-slurry Extension Component initiated its work after few months of establishment of NBP. Bio-slurry is a good source of soil organic matter and plant nutrients and thereby can improve soil fertility and increase crop yield. Bio-slurry can also be a good source of fish and animal feed and can be used for other purposes. The main focus of the component is to promote optimal management and use of bio-slurry as fertiliser and how to best reach the farmer with this message.

The present setup of the component is as follows:

The component implementation activities were started in late 2006 with the support of public sector partner and a further collaboration agreement was established with an agricultural NGO (CEDAC) in 2007.

Within the NBP the component activities are planed, monitored and reported by a Bio-slurry Extension Officer who is supervised by the Program Coordinator. Under the public sector partnership 2-4 staffs of PDA from Agronomy and Agricultural Extension office are assigned as Bio-slurry Extension Worker. CEDAC assigns one Project Coordinator at national level and five Community Facilitator Assistants (CFA) one in each province for slurry extension work.

The component planed for the following activities:

- Development of extension materials like booklet, leaflet, poster
- Imparting training
- Conducting Farmers Participatory Action Research
- Organizing study tour/exchange visit for farmers in the trial site
- Organizing provincial workshop
- Conducting monitoring and evaluation

5.3 Analysis on the present status of the slurry extension activities of NBP and recommendations for further improvement

5.3.1 Subsidy system

A subsidy support is given to the biodigester owner for construction of biogas plant only. Subsidy support does not include the construction of compost hut, boundaries around the

hut and shade of the hut. Most of the farmers are not self motivated or not make them enough motivation by the program for construction of ideal compost hut. Farmers are either reluctant or they do not have enough money to spend for construction of compost hut.

Suggestions

1. At the beginning of farmer selection give those understanding that subsidy package is for all construction including complete compost hut.

or

2. Strengthen motivation of farmers by making them understanding of the benefit of proper preservation and composting of bio-slurry.

or

3. Provide small subsidy to attract farmers for construction of standard compost hut along with boundaries and shade.

or

4. Loan facility should cover the cost of construction and management of compost hut.

Action needed

- NBP may consider suggestion nos. 1 and 2.
- Asia Biogas Program may consider the suggestion no. 3.

5.3.2 Selection of partner for slurry extension

Appropriate partners have been selected for slurry extension component of NBP. One or two more NGOs performing agricultural activities may need to be selected in future for increasing competitive quality services. For subcontracting research CARDI should be considered. Some training activities (e.g. ToT for Slurry Extension Workers and CFAs) may be subcontracted to Royal University of Agriculture (RUA) and National school of Agriculture.

Action needed

NBP may consider selection of more partners for performing specific activities when to be needed.

Sustainability of partner

Considering the nature of job provincial department of agriculture may be more sustainable partner than any NGO. NGO may switch over to other business if their bio-slurry extension service is not profitable. Extension service is considered as a development activity rather than business activity.

5.3.3 Performance and weakness of present organizational setup of slurry extension component of NBP

Bio-slurry extension activities are planned centrally at NBP office and implemented at farm level by PBPO and CEDAC. Actual implementation is done by 2-4 slurry extension workers of PBPO and coordinated by one Project Coordinator. Implementation by CEDAC is done by 1 CFA in each of 5 provinces. There are no staffs of both partners at district and commune level. The Project Director of PBPO who is also the Director of PDA engaged in management of all provincial agricultural programs. Project Coordinator is also involving in many other provincial agricultural activities and giving time for coordinating the construction, quality control and after sales services for biodigesters. Academic background of present project coordinators may not inspire or motivate them for slurry extension which is mostly crop related activity.

Observations and comments

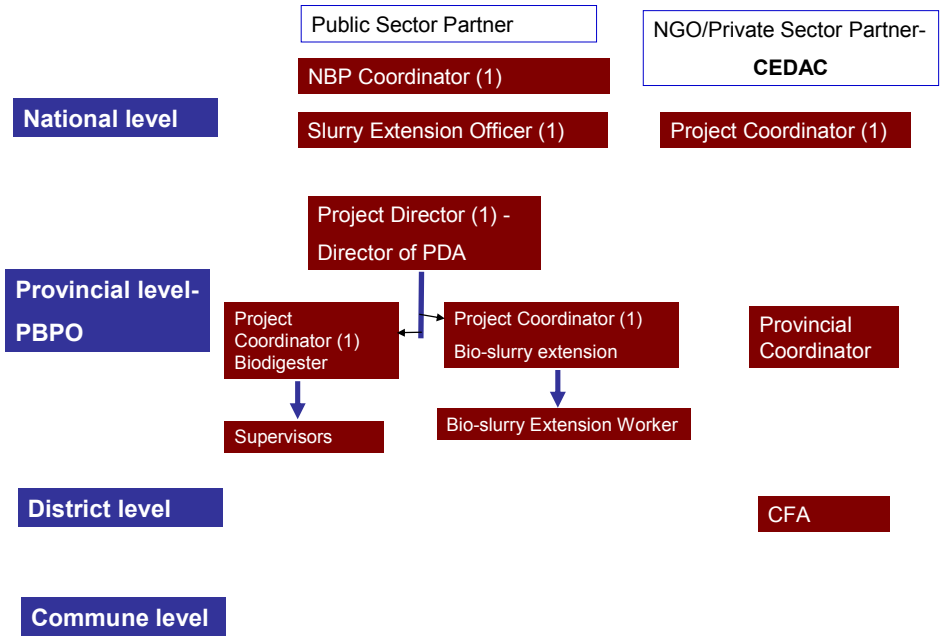
- High turnover of staffs of PBPO
- Bio-slurry extension is the additional activity of bio-slurry extension workers. Extension workers of PBPO are not only engaged in other agricultural activities but in many times they are also assigned for extra departmental activities.
- CFAs of CEDAC are more committed young staffs but bio-slurry extension is also the additional activity of CFA.
- Most of the extension workers and all CFAs reside in provincial city and perform duty at villages 40-60 km distant from their residence.

Scope of involving technical staffs of other offices

In each provincial department of agriculture there are 6-8 unit offices, technical staffs are available in AHP, Agronomy & Soil Improvement and Agriculture Extension unit out of 6-8 unit offices. The Agronomy unit is presently implementing a national compost house program. The bio-slurry extension activities can be combined and integrated with Agronomy unit.

Recommendation 1

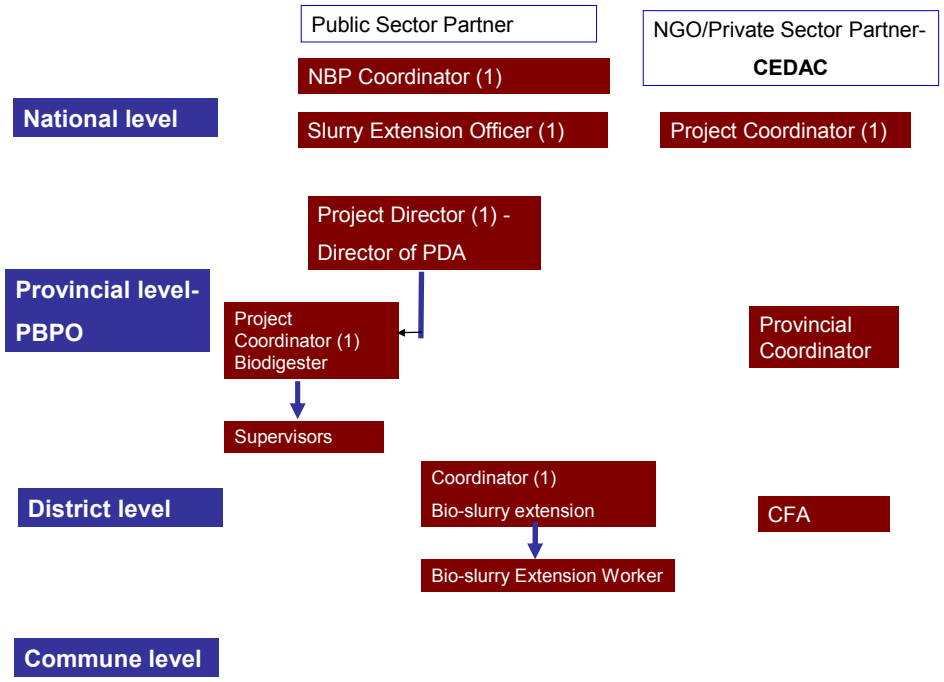
At PBPO a separate project coordinator with agronomic background may be considered for bio-slurry extension. The proposed organizational setup is given below.



All bio-slurry extension workers should have adequate background in crop husbandry. CEDAC should assign a coordinator and all CFAs at provincial and district level, respectively. CFAs should reside and perform duties at district level if there are sufficient numbers of activities.

Recommendation 2

Bio-slurry extension activities can be placed and coordinated at district level by assigning a vice chief of district agriculture office who has background in agronomy and he will act as coordinator of the project. All bio-slurry extension workers will work under the coordinator and they should reside at their respective working places at district level and perform their duties there.



Recommendation 3

The management of NBP may initiate dialogue with the concerned authority not to disturb assigned staffs for NBP activities and if possible make an agreement with them. NBP can make an arrangement with PDA and CEDAC for increasing the number of extension workers and CFA depending on the area coverage and volume of activities.

Linkage between PBPO and CEDAC

- Institutional linkage is absent but some personal linkage is there
- CEDAC should be involved in planning process
- CEDAC should strengthen its own planning system
- Duplication was observed in farmer selection
- Duplication can be avoided by proper provincial and central planning

5.3.4 Performance of slurry extension activities of NBP

The present status of bio-slurry extension activities of NBP is given in Appendix table 1.

Suggestions

Planning

Bottom up approach is suggested for planning. A seasonal planning meeting should be organized at province by the project director involving CEDAC provincial coordinator.

Provincial proposals should be forwarded to NBP. NBP should internally review the proposals, organize a planning workshop and finalize the plan.

Slurry collection

The present system of collection can be continued.

Slurry preservation and composting

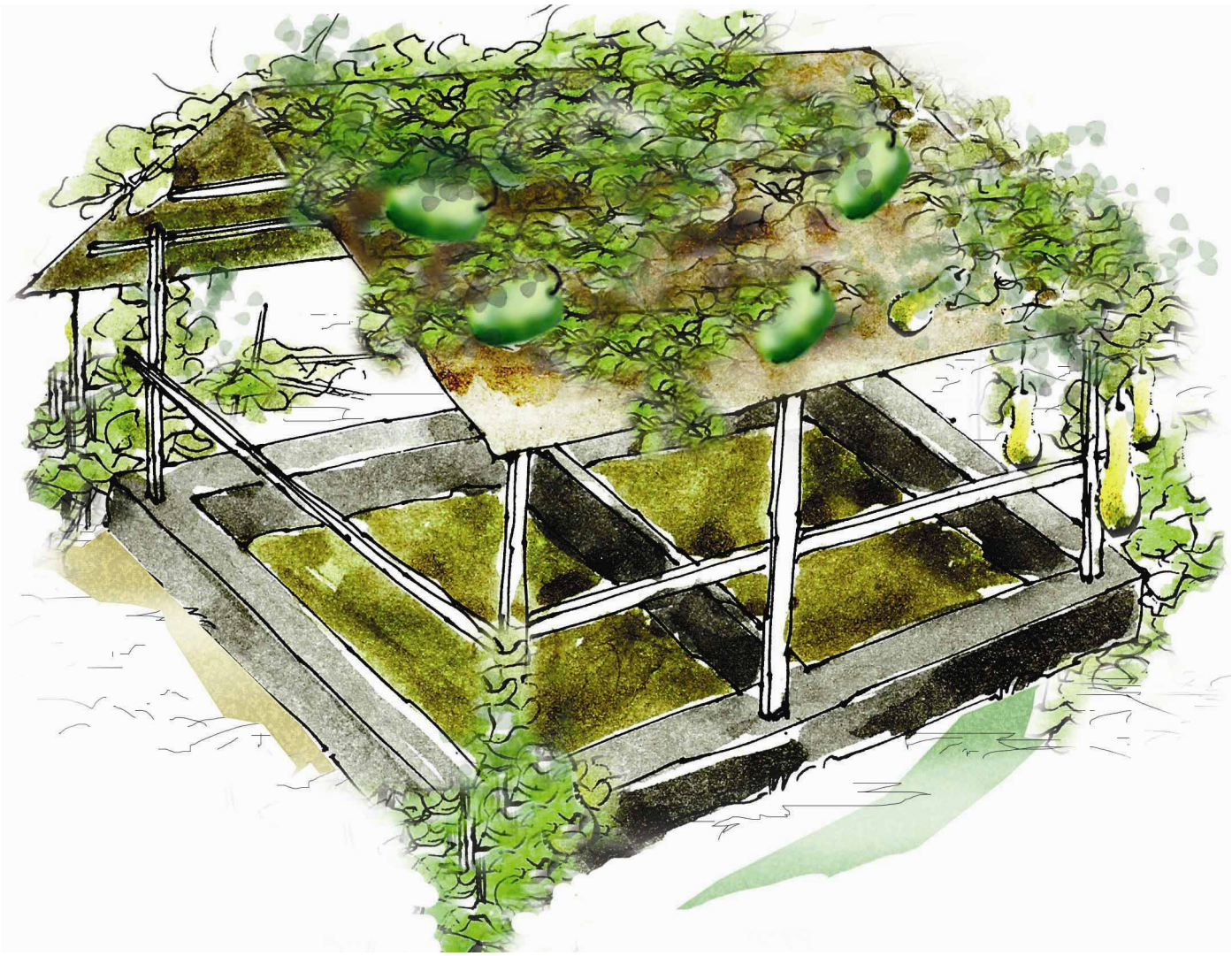
Slurry preservation in compost hut can be continued. Compost hut should be near to the collection pit to minimize transferring time and labour.

It is advisable to make two chambers in the slurry hut so that the chambers can be filled alternatively and farmers will be able to use slurry compost twice in a year.

For better preservation of slurry and slurry compost construction of standard hut boundaries and hut shade are recommended.

- ★ Hut Boundaries - Protect the hut by raising the boundaries to prevent water from entering
- ★ Hut Shade - To protect the bio-slurry in hut from direct sun light and rain water hut shade should be provided by constructing a roof made of local materials such as bamboo and palm leaf/rice straw or of corrugated iron sheet or any other more durable/long lasting materials over the pits.
    - Make the structure sufficiently strong to withstand winds.
    - Creeper vegetables can be grown on the roof of shade to maximize the benefit of roof and minimize the cost.

A picture of a standard slurry hut is given below.



Training

Development of training/extension materials

A booklet and one leaflet on bio-slurry management and utilization was prepared (appendix table 1) in local language and distributed to biodigester owners. So far informed and understood that the content of the booklet is more technical and details which may be difficult to understand by the farmers. When farmers were asked to show the extension materials they failed to show that although they received the materials.

Recommendation

Target group or client oriented extension material should be developed so that the leaflet/flyer is more useful for farmers and booklet for bio-slurry extension workers. A

training manual covering soil-plant-fertiliser (bio-slurry) systems needs to be developed for coordinators and extension workers.

Training for Bio-slurry Extension Workers

A 3 days training program on bio-slurry management and utilization, and management of component activities (e.g. establish and manage action research trials) was organized by the NBP for extension workers. It was wanted to review the content of the training program but these were not available. But it is understood from reviewing the annual plan and annual report of 2007 that so many topics were included in 3 days course.

Recommendation

It will be better to make two separate courses- one on use of training manual (proposed) for one time (5 days) and the other is on seasonal management of component activities for one day.

Users training

All biodigester owners have every right to receive information and educate themselves regarding maintenance and use of her/his biogas plants and proper management and use of bio-slurry. User training is an important event or tool to reach farmers with that information.

Users training containing 4-5 hours lectures and demonstrations on how to use and maintain biogas appliances are usually organized by PBPO for 20-30 owners for. In this training major emphasis is given on how to use and maintain biogas plants while one hour lecture is given on bio-slurry management. Bio-slurry utilization is a seasonal activity which needs seasonal training for users.

NBP constructed about 2600 biodigesters but training was given to ----- users. During field visit advisor collected information regarding the number of biodigester constructed in three provinces and owners received users training and participated in study tour or exchange visits (Table 1). It is indicated that only 64.52 % owners access information on bio-slurry management even by applying two important events (users training + study tour). It may happen that the same farmer participated in both events and in that case the above percentage would be lower.

Table 1. Percent of total biodigester owners access to information on bio-slurry management

Province visited	Total plant completed	No. of farmers participated in			% of total owners access to information
		Exchange visit*	Users Training	Total	
Kampong Cham	552	85 + 161	231	477	86
Svey Rieng	389	70 + 85	98	253	65
Takeo	728	88 + 71	188	347	48
Total	**1669**	**243 +317**	**517**	**1077**	**64.52**

* Dry season + Wet season

Recommendation

Strengthen user training by increasing its number, frequency, topics and time duration.

More Recommendations for Strengthening Training

- An expatriate or national consultant may be hired for developing a training manual on soil-plant-fertiliser (bio-slurry) systems (as suggested in previous section).
- NBP may select a small group of persons (trainer) from RUA, CARDI, National School of Agriculture and Provincial Department of Agriculture who obtained minimum bachelor degree in crop science, and may organize a ToT for that group on use of the training manual.
- This group will offer training for extension workers and CFA.
- Extension workers and CFAs will offer training for plant owners.
- Farmers training - The success of bio-slurry extension is very much dependent on the knowledge, the understanding and the skills of the farmers. Training is needed for all plant owners on bio-slurry management and utilization. In addition to users training special training may be organized by out sourcing. All demonstration co-operator farmers (model farmers) should receive appropriate training (should be organized by PBPO) to understand the technology, purpose, timing and other related activities of the demonstrations and their role in disseminating the information.
- NBP should initiate dialogue with educational institutions to include features on biogas and bio-manure in their academic course and curriculum.

Farmers Participatory Action Research

Farmers participatory action research approach can be replaced by farmers participatory demonstration approach. Action research can be subcontracted to CARDI on need based.

Home garden demonstration with use of liquid slurry and field demonstration following **IPNS approach** is suggested. The layout of field demonstration is given below.

Balanced Fertiliser IF plot "Inorganic Fertilisers" (200 m2)	**Balanced Fertiliser IPNS plot " Organic + Inorganic + Fertilisers" (200 m2)**

English version of the detail of IPNS approach along with computation procedure and the demonstration guidelines prepared by the advisor were forwarded earlier by him to all country programs of Asia Biogas Program.

Important considerations need to be taken on the following issues during bio-slurry and inorganic fertiliser application.

- **Rate**
- **Time**
- **Method**

Farmer's participatory action research plot

Organize study tours/exchange visits for farmers in the trial site

Successful **study tours/exchange visits** are the most important aspects of the demonstration program and constitute a powerful tool for extension purposes. Field days should be arranged at key times when the technology can be demonstrated; e.g. at the time of basal dressing (to clearly demonstrate the savings on inorganic fertiliser due to the use of bio-slurry/slurry compost) and/or at the time of crop harvest. Among other things, the vital issues of cost and benefits of the demonstrated practices are made clear to the visiting farmers during the exchange visit at harvest time.

Other than this official exchange visit by the co-operator farmers (model farmers) the informal visit of other farmers of the community is to be encouraged. It is, therefore, strongly recommended that the co-operator farmers should invite other farmers to see the demonstration any time during the whole crop growth period and explain the purpose of the demonstration.

The advisor attended in one such exchange visit event organized by PBPO of Takeo province and the event seemed to be effective.

Organizing provincial workshop

Provincial workshops were planned but not materialized (appendix table 1). This workshop was planned separately by NBP and CEDAC. This could be an important joint action event of PBPO and CEDAC for creating awareness about biogas and bio-manure use among local leaders, agriculture related GO and NGO officials and policy makers

Recommendation

NBP should coordinate this event and implement it in collaboration with PBPO and CEDAC.

Monitoring, data collection and recording, and reporting

It needs further improving of the following aspects:

- Monitoring – Monitoring system should be established as desk monitoring and field monitoring. Desk monitoring both at NBP head quarter and PBPO office needs to be further strengthened. To monitor the seasonal field activities a 2-3 member external team should be formed. The team will monitor the field activities following a monitoring guideline to be developed by NBP. Yearly users' survey should be conducted by hiring a third party.
- Data collection and recording – Standard format for data collection (related to demonstration and training) should be developed by NBP and to be provided to PBPO and CEDAC. Develop a database or excel spread sheet at NBP head quarter to preserve all information related to slurry activities including cooperator farmers and demonstration plot. This database will be the property of MAFF or the Department of Agriculture at the end of the project.
- Reporting – Each PBPO and CEDAC should prepare their half yearly and annual reports and submit to NBP. NBP should compile and prepare its own reports.

5.4 Organizing a workshop

A workshop was organized by NBP and all staff of stakeholders concerned with bio-slurry extension participated. The advisor made power point presentations on different aspects of bio-slurry management and utilization, advisors view and analysis on the present status of the slurry extension activities of NBP and suggestions for further improvement. A schedule of the workshop is presented in annex 3. Copy of the files of power point presentations are handed over to NBP for future reference. Participants were grouped into four and made exercise on identifying constraints and possible remedies for bio-slurry extension in their respective province. One member of each group presented the outcome of discussions (annex 4).

Participants of workshop

6.0 Conclusion

The project document (implementation plan) in respect to bio-slurry extension has not been written in detail following a weak Logical Framework Approach (LFA), which keeps some rooms for making interpretation by the NBP Management. Well defined objective(s) for bio-slurry extension component should be framed in the project document.

The overall assessment implicates that the bio-slurry extension is a relevant component of NBP as compared to the key priorities of the Department of Agriculture of MAFF and future challenges regarding sustainable maintenance of soil fertility and thereby food supply in Cambodia.

It has been found that within the scope of NBP, the bio-slurry extension component is in full compliance with the support to farmers regarding their targets for soil fertility management, crop yield increase and thereby maximization of their profit.

Within the national context NBP significantly contributes for strengthening of institutions like DAHP & PDA and CEDAC, developing capacity of their staff and establishing linkage between public and private sectors.

The bio-slurry component activities and subsequent achievements have progressed gradually, as workplans largely have been followed. Though the time has not yet come to assess the total achievements and component impact, however, yearly achievements need to be monitored and assessed properly by the NBP and found out the drawbacks for further refinements. Demonstration and training activities can be further strengthened for

ensuring the achievement of the defined objectives and targets. The results of the action research trials are not analysed and thereby do not included in practical conclusions and action.

Within the context of the above conclusion, the recommendations are provided in different sections of the text.

7.0 Acknowledgement

My heartiest gratitude to Mr. Jan Lam, Senior Biogas Adviser and Ms. Lam Saoleng, Coordinator of NBP, Cambodia for their all back-up supports and providing available relevant documents and papers which have come to invaluable help for completion of the assignment.

I would like to express my heartfelt and sincere thanks to Mr. Kong Kea, Bio-slurry Extension Officer of NBP for being abreast with untiring interpretation during field visit and in the training workshop.

I express my gratitude to SNV, Cambodia for providing financial and moral support which helped enormous to complete this assignment successfully. I would also like to express my gratitude to the Director, SNV, Bangladesh for allowing me to perform this assignment. Special thanks to Mr. Wim van Nes, Biogas Practice Leader and Mr. Sundar Bajgain, Senior Biogas Adviser, SNV, Bangladesh for their encouragement and moral support.

Special acknowledgement is accorded to the individuals, interviewed farmers and all the stakeholders of NBP for their generous support in making my assignment a success.

I am also grateful to the delegates who participated actively in the discussions followed the presentation on my each of the topics in the training workshop.

8. Annexes

Annex 1

Terms of Reference for the Assignment on Improving the effectiveness of the bio-slurry extension component of National Biodigester Program in Cambodia.

1. Introduction

The optimal use of digested dung from a biodigester as fertiliser is considered vital to make the investment of a farmer economically viable and therewith equally vital to come to a lasting biodigester sector in Cambodia.
Since the start of the programme bio-slurry extension has been an integral part of the programme's activities. Model farms have been set-up, provincial extension workers trained, user manuals and other instruction materials developed and a collaboration agreement on slurry extension with an agricultural NGO (CEDAC) established.
Within the NBP the bio-slurry extension activities are planned, monitored and reported by a Slurry Extension Officer who is supervised by the Programme Coordinator.
The programme started in March 2006 and a Mid-Term Evaluation (MTE) conducted by SNV is planned for July-August 2008. To review the present activities and to come up with recommendations on how to improve on the effectiveness of the slurry extension activities, NBP is seeking the assistance of the Bio-Slurry Extension Advisor of SNV-Bangladesh. This paper provides the Terms of Reference (ToR) for his assignment.

2. Objective of the assignment

The main objective of the assignment is to improve the effectiveness of the bio-slurry extension component of the National Biodigester Program (NBP) in Cambodia. A secondary objective is to provide the MTE team with impartial information on the present status of the slurry extension component of the NBP.

3. Activities and team composition

The activities of the assignment are presented in the schedule annexed to this ToR. The Bio-Slurry Extension Advisor is expected to work closely with the NBP Slurry Extension Officer, the NBP Coordinator, the CEDAC bio-slurry extension coordinator and the SNV Biogas Advisor attached to the NBP.

4. Expected output

At the end of the assignment, it is expected that the SNV Bio-Slurry Extension Advisor will submit a comprehensive but concise report which will provide:
- the SNV MTE team with necessary information to conduct the slurry extension part of the programme evaluation;
- the NBP with recommendations on how to make the extension activities and materials more effective.

Furthermore it is expected that the SNV Bio-Slurry Extension Advisor will get a good understanding of the agricultural activities of the biodigester farmers in Cambodia. This will enable him to provide advise 'from a distance' to the NBP when requested on topics

like the writing of a transcript for a bio-slurry promotion DVD and other activities.

5. Time frame

Six days in Cambodia are required from the SNV Bio-Slurry Extension Advisor. Besides the time in Cambodia the Bio-Slurry Extension Advisor will also need 2 days in Bangladesh to study bio-slurry extension related documents provided by NBP and 2 days (estimated) to write his report.
As the report has to be submitted before the start of the MTE, the assignment has to be completed before the second half of July. Depending on the schedule of the Bio-Slurry Extension Advisor the visit can be planned in June or early July.

6. Required budget and proposed financing

The cost of travel from Dhaka to Phnom Penh vv as well as the hotel accommodation, entrance visa and DSA in Cambodia will be covered by SNV-Cambodia. The total of this is expected not to exceed US$ 1200.00. The NBP will cover the cost for transportation within the country.

Annex 2

Activity Schedule for the NBP Bio-slurry Extension Assignment

Proposed Day & Date	Activities	Objective	Remarks
	Review of NBP slurry extension related documents (work plans, reports and training curricula) in Bangladesh.	To make maximum use of the available time in Cambodia by getting familiarized with the NBP slurry extension activities and progress.	2 days
Saturday 14 June 2008	Travel to Phnom Penh via Kualalumpur		1 day
Sunday 15 June 2008	Discussion with the concerned NBP staff on the program of the assignment	To get an idea of their program and activities.	1 day
Monday to Wednesday 16-18 June 2008	Field visit to Kampong Cham and Svey Rieng provinces. Meeting with staff involved in slurry extension and visits to farmers.	To obtain first hand information on the working conditions and practices of biodigester farmers and on the activities/knowledge of the extension staff active in the provinces. Where possible, on the job training.	3 days
Thursday 19 June 2008	Field visit to Takeo province	To obtain first hand information on the working conditions and practices of biodigester farmers and on the activities/knowledge of the extension staff active in the provinces. Where possible, on the job training.	1 day
Friday 20 June 2008	One day workshop with all staff concerned with bio-slurry extension	The one day workshop will allow the Bio-Slurry Extension Advisor to further extract information from the actors in the NBP slurry extension team. The slurry extension staff will get a training on bio-slurry properties, storing, handling and application methods.	1 day
Saturday 21-22 June 2008	Preparation of debriefing note on main findings and recommendations		2 days
Monday 23 June 2008	Presentation of the debriefing note and final meeting with NBP staff Return journey to Bangladesh	The preliminary findings and recommendations are discussed with the concerned NBP staff.	1 day
	Writing of assignment report in Bangladesh	A comprehensive but concise report with recommendations to make the extension activities more effective is available for the NBP staff and the MTE team.	3 days

Annex 3

Workshop on Improving Bio-slurry Management under NBP

Schedule

Date: 20 June 2008

Time	Topic
08:20	**Opening remarks**
08:30	**General Introduction on plant nutrient demand and contribution of bio-slurry**
09:00	**Bio-slurry properties and potentialities**
09:30	**Bio-slurry management at farm**
10:00	**Bio-slurry application**
10:30	**Bio-slurry extension techniques**
11:00	**Observation and experience of field visit and possible suggestions for further strengthening of slurry extension activities under NBP**
12:00	**Lunch**
13:30	**Group Exercise on identifying constraints and possible remedies**
14:30	**Presentation of group exercise**
15:00	**General Discussion**
16:00	**Closing remarks and Finish**

List of participants in workshop

Sl. No.	Name	Designation	Organization
1	Mrs. Lam Saoleng	Programme Coordinator	NBP, Cambodia
2	Mr. Kong Kea	Bio-slurry Extension Officer	NBP, Cambodia
3	Dr. Sar Chetra	Director Assistant in International Cooperation	DAHP, MAFF
4	Mr. Heng Bin Yik	Director	PBPO, Kampong Cham
5	Mr. Thach Ratana	Director	PBPO, Svay Rieng
6	Mr. Sok Daro	Coordinator	PBPO, Takeo
7	Mr. Khy sophan	Coordinator	PBPO, KSP
8	Mr. Men Kosal	Coordinator	PBPO, KDL
9	Mr. Seng Tha	Extension Worker	PBPO, Kampong Cham
10	Ms. Rey Thearath	Extension Worker	PBPO, Kampong Cham
11	Mr. Im Leang Song	Extension Worker	PBPO, Kampong Cham
12	Mr. Phal Phat	Extension Worker	PBPO, Kampong Cham
13	Mr. Chim Simach	Extension Worker	PBPO, Svay Rieng
14	Ms. Somala	Extension Worker	PBPO, Svay Rieng
15	Mr. Prach Salorn	Extension Worker	PBPO, Svay Rieng
16	Mr. Kao Sang Ha	Extension Worker	PBPO, Svay Rieng
17	Ms. Hang Navy	Extension Worker	PBPO, Takeo
18	Ms. Uong Touch	Extension Worker	PBPO, Takeo
19	Mr. Long Khorn	Extension Worker	PBPO, KSP
20	Mr. Me Chandara	Extension Worker	PBPO, KSP
21	Mr. Prum Phirum	Extension Worker	PBPO, KDL
22	Mr. Hin Dara	Extension Worker	PBPO, KPT
23	Mr. Ying Socheat	Extension Worker	PBPO, KPT
24	Mr. Svay Vuthanea	Extension Worker	PBPO, KPT
25	Mr. Khin Daravuth	Director	CEDAC
26	Mr. Chhong Sophal	Field Coordinator	CEDAC

Annex 4

Summary of outcome of group discussions

Mr. Kong Kea, Bio-slurry Extension Officer of NBP facilitated the session on presentation of summary of group discussions. He asked the presenters to be specific on the major findings of the discussions. Major constraints identified by the groups are as follows:

Constraints

- Rural roads are not in good condition
- Department does not provide any transport to the bio-slurry extension workers and they have to use their own motor cycle
- Allowances given to the bio-slurry extension workers are not sufficient
- Bio-slurry extension workers do not have sufficient time to supervise the research trials
- The number of bio-slurry extension workers is not sufficient to manage all slurry extension activities under PBPO
- Subsidy given to the biogas owners is inadequate and does not cover the slurry management activities
- Construction of roof over compost hut is difficult without providing money (either subsidy or credit) to the farmers
- Different designs used for different field trials are difficult to understand by the extension workers
- No standard data collection format available from NBP
- Incentive for model farmers is low
- Lack of posters and stationary items for organizing farmers training
- Farmers motivation activities and training are not sufficient
- Bio-slurry extension workers have lack of knowledge on slurry management and utilization
- DSA for bio-slurry extension workers are low
- Relationship between PBPO and Agronomy and Agriculture Extension wing of PDA is week

Annex 5

List of persons met

NBP

Mr. Jan Lam, Senior Biogas Advisor, SNV Cambodia
Mrs. Saoleng, Programme Coordinator, NBP, Cambodia
Mr. Kong Kea, Bio-slurry Extension Officer, NBP, Cambodia

SNV, Cambodia

Ms. Anne-Maria Makela, Portfolio Coordinator, SNV Cambodia
Ms. Vathna, SNV Cambodia

MAFF/DAHP

Dr. Sar Chetra, Director Assistant in International Cooperation

CEDAC

Mr. Chhong Sophal, Field Coordinator
Mr. Khin Daravuth, Director
Mr. Me Chanra, CFA

CARDI

Dr. Ouk Makara, Deputy Director for Research and Development

Provincial Department of Agriculture, Kampong Cham Province

Mr. Heng Bin Yik, Director, PDA
Mr. Deth Vannara, Coordinator of PBPO
Mr. Phuong Navuth, Vice chief of the Agronomy office
Mr. Tum Pen, Vice chief of the extension office
Ms. Rey Thearath, Bio-slurry Extension worker
Mr. Phal Phat, Bio-slurry Extension worker
Mr. Seng Tha, Bio-slurry Extension worker
Mr. Sev Noy, Farmer, Village-Trapain, Commune-Sromor, District-Cheung Prey
Mr. Saum Sim, Farmer, Village-Trapain, Commune-Sromor, District-Cheung Prey

Provincial Department of Agriculture, Svay Rieng Province

Mr. Thach Ratana, Director, PDA
Mr. Pen Chanthy, Coordinator of PBPO
Mr. Samsovan, Vice chief of the Agronomy office
Mr. Pen Phally, Vice chief of the extension office

Mr. Prach Salorn, Bio-slurry Extension worker
Ms. So Mala, Bio-slurry Extension worker
Mr. Neang Sak, Chief of District Agricultural Office, Chan Trea District
Mr. Peu V Tren, Farmer, Village-Salarean, Commune-Prasak, District-SvayChrum
Mr. Poch Pouv, Farmer, Village-Por, Commune-Mesor Thngork, District-Chantreu
Mr. Yos Min, Farmer, Village-Kandal, Commune-Kok Pring, District-

Provincial Department of Agriculture, Takeo Province

Mr. Sok Daro, Coordinator of PBPO
Mr. Seng Meng, Admin of PBPO
Ms. Uong Touch, Bio-slurry Extension worker
Ms. Hang Navy, Bio-slurry Extension worker
Mr. Meiy Chan, Farmer, Village-Svay Run, Commune-Chum Rahpen, District- Samrong
Mr. Moul Ihan, Farmer, Village-Taul, Commune-Roveang, District- Samrong

Kampong Speu Province

Ms. Ouk Kong, Farmer, Village-Chheu Lum, Commune-Moharu Sey, District- Kong Pisey
Mr. Sok Bodu, Farmer, Village-Tapouk, Commune-Prey Vihea, District- Kong Pisey

Appendix 1. Status of Bio-slurry Extension activities under NBP

Activity	Participating Organization	# planned			# executed		
		Dry season	Wet season	Total	Dry season	Wet season	Total
2007							
Development of extension materials	**NBP (HQ)**						
Manual on slurry management & utilization				01			00
NBP promotion leaflet (one leaflet)				3000			2000
Booklet/Brochure (one booklet)				5000			2500
Poster (one poster)				5000			2000
Bulletin/News letter (Bimonthly) 2500 copies for each							00
Training and Workshop							
Training for bio-slurry extension workers and CFAs	**NBP (HQ)**	One TOT course for 10 participants			One TOT course for 14 participants		
Refresher course for extension workers	**NBP**			2 courses			00
Training for provincial supervisors and masons	**NBP**				2 courses for 52 participants		
Users training	**PBPO**	25 courses & each for 20 participants i.e. 500 parti.			20 courses for 600 participants		
Village workshop							
Provincial workshop	**NBP**			5			00
Action Research	**PBPO**			100	12	50	62
	CEDAC						18
Study Tour/Exchange visit							
• **Within province**	**PBPO**	10 visits for 250 participants			1 for 15 participants	8 for 279 participants	9 for 2 participa
• **Across province**	**NBP**	2 for 40 participants					00
Monitoring and Impact Assessment Study	**NBP**			01			00
2008							
Development of extension materials	**NBP**						
Manual on slurry management & utilization				00			
Update and print the booklet prepared in 2007				2000	1000		
Revise and print the poster developed in 2007				2000			
Production of DVD on management and use of slurry 01 in Khmer & 01 in English				01 + 01			
Training and Workshop							
Refresher course for extension workers & CFAs				01	01		
Users training				-			
Provincial workshop one in each province with 60 participants in each workshop	**NBP**			04			
	CEDAC			03			
Action Research	**RUA**						
	PBPO			80	32		
	CEDAC			30	03		
Study Tour/Exchange visit							
• **Within province**	**PBPO**	41 visits for 1500 farmers			10 for 350 farmers		
	CEDAC	15 visits for 750 farmers					
• **Across province**	**NBP**						
• **Field visit for MAFF & NGO personnel**	**NBP**			01			
Case studies				20			
Monitoring and Impact Assessment Study				02	01		

Source: Annual Plan 2007 and 2008 of NBP, Annual Report 2007 of NBP
Annual Plan 2008 of CEDAC
Note: Plan and Report 2006 of NBP are not available