REDUCING SOIL EROSION IN CASSAVA PRODUCTION SYSTEMS IN THAILAND – A FARMER PARTICIPATORY APPROACH

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ABSTRACT

The project on Cassava Production System Adjustment to Reduce Soil Erosion is a cooperative project among the Department of Agricultural Extension (DOAE), Department of Agricultural (DOA) and the Centro Internacional de Agricultura Tropical (CIAT). The purpose of the project is to make farmers aware of the importance of soil erosion and to develop and disseminate suitable and effective measures to reduce the problem. This is done by the use of a farmer participatory approach, in which farmers are asked to select and test in their own fields cassava production practices that reduce soil erosion. The first phase of the project had a duration of five years (1994-1998) and was implemented in two pilot sites in Nakhon Ratchasima and Sra Kaew provinces.

The results of the project indicate that once farmers saw the amounts of soil loss in their own erosion control trials, they realized the importance of erosion and the need to control soil degradation in cassava areas. They also tested, evaluated and selected suitable methods for reducing soil erosion. The farmers in the two pilot sites selected mainly the use of vetiver grass contour barriers as the most effective and suitable technique. They now grow vetiver grass for this purpose on about 48 hectares, while the planting of vetiver grass is still expanding.

The method of participatory research involves farmers directly in decision making at every step, from planning the project to obtaining results and drawing conclusions, and lets farmers select the treatments to be tried by themselves. This encourages them to learn how to analyze problems and find solutions collectively that are in line with the needs of the community as a whole. The method of implementing this project is considered to be efficient for the development and transfer of new technologies to farmers and rural communities, in order to enhance the adoption of more sustainable and more productive agronomic practices.

INTRODUCTION

Cassava is an important cash crop in Thailand. Due to its favorable characteristics, such as relatively ease of cultivation, drought tolerance and adaptation to poor soils, cassava has become very popular, especially for poor farmers. During the past five years (1995-1999) the total planted area of cassava in Thailand ranged from 1.12-1.28 million hectares. The annual production of fresh roots was 16.2-18.1 million tonnes, while the value of exports of dry cassava products was more than 22 billion baht (U$ 578.95 million) per year. Most cassava is grown on light-textured and very poor soils and in drought–prone areas in the northeastern and eastern parts of Thailand.

Despite the poor soil and droughty conditions in these areas, cassava grows fairly well. However, when cassava is grown on slopy land, soil erosion may be serious even in

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areas with gentle slopes of less than 10%. Moreover, experiments have shown that under the soil and climatic conditions of Thailand, cassava cultivation may cause twice as much soil erosion as the cultivation of mungbean, and three times as much as that caused by maize, sorghum and peanut (Putthacharoen, 1992; Putthacharoen *et al*., 1998)

Due to the wide spacing used in planting cassava and its rather slow early growth during the first three months after planting, a lot of the soil surface remains exposed to the direct impact of falling rain, causing severe soil erosion. Therefore, the Department of Agriculture (DOA), Kasetsart University and the Centro Internacional de Agricultura Tropical (CIAT) have conducted collaborative research into practical ways to reduce erosion in cassava production areas. The research showed that there are many ways to manage or improve cassava-cropping systems that would result in less erosion. Each management practice has its advantages and disadvantages: for instant, some practices that control erosion require more money or more management, while the yield or income does not necessarily increase. The researchers did not know whether farmers would adopt these practices or not. Therefore, CIAT initiated, in collaboration with the Department of Agricultural Extension (DOAE) and DOA, a project to improve the sustainability of cassava–based cropping systems using a farmer participatory research approach. The objectives of this project is to enhance farmers' awareness of the importance of soil conservation, to demonstrate a wide range of soil erosion control practices, to let farmers select the most appropriate ones and test these methods on their own fields, so they will develop the most useful practices for their own conditions. This, in turn, is likely to enhance adoption and the continued use of these practices even after the project terminates.

THE NIPPON FOUNDATION PROJECT – 1ST PHASE

1. Objectives

To enhance the development and adoption by farmers of improved cassava cropping systems and cultural practices that will maintain soil productivity and reduce erosion while sustaining a reasonable farm income.

2. Responsible organizations

1) Field Crops Sub-division, Rice and Field Crops Promotion Division, Dept.of Agricultural Extension (DOAE).
2) Rayong Field Crops Research Center, Field Crops Research Institute, Dept. of Agriculture (DOA).
3) Centro Internacional de Agricultura Tropical (CIAT)

3. Budget

US $ 7,000-10,000 per year, donated by Nippon Foundation through CIAT
US $ 15,000 per year, contributed by DOAE

4. Project Duration

1994-1998

5. Pilot sites

1994-1998: 1) Nakhon Ratchasima province in the lower Northeast.

2) Sra Kaew province in the eastern part of Thailand.
1997-1998: 1) Kalasin province in the upper Northeast.
2) Chachoengsao province in the eastern part of Thailand.

6. Plan of Implementation

1. Training of field staff
2. Preparation of project sites
3. Farmers meeting and training
4. Demonstration plots on soil erosion control methods
5. FPR trials on farmers field
6. Field day and meeting at harvest
7. Pilot field demonstration plots in villages
8. Scale-up to production field

7. Activities

7.1 Preparation of field staff

7.1.1 Pilot project field staff training

A training course on Farmer Participatory Research (FPR) and Rapid Rural Appraisal (RRA) methodologies was organized by CIAT for field staff from five countries, i.e. Thailand, Vietnam, China, Indonesia and the Philippines, in 1994 in Rayong province, Thailand.

7.1.2 Extension project field staff training

Another training course was held for Thai field workers from collaborating organizations, both research and extension agencies, to allow for the project's expansion to other pilot sites. This training course was conducted in Nakhon Ratchasima province in 1998.

7.2 Preparation of project sites

7.2.1 Selection of project areas

Appropriate pilot sites were selected using the following criteria: i) cassava is an important crop in the area, both at present and in the future; ii) cassava is planted on slopes and soil erosion is a serious problem. In the first year of the project (1994), Sra Kaew and Nakhon Ratchasima provinces were selected . Later on, in 1997, pilot sites in Kalasin and Chachoengsao provinces were added.

7.2.2 Exploration of agro-ecological and socio–economic conditions

Information about the selected villages were obtained by conducting a rapid rural appraisal (RRA) in each potential pilot site. The most suitable sites were selected by analyzing the RRA results (Vongkasem *et al*., 1998).

7.3 Farmers meeting and training

7.3.1 Group meeting with farmers

A meeting was held in the selected pilot sites, to discuss the objectives, principles and procedures of the project with the farmers, local extension staff and village leaders. The

farmers analyzed and decided for themselves whether they wanted to participate in the project.

7.3.2 Farmers training

Farmers from the selected sites that were interested in participating in the project were invited to join a training course with the objective of i) increasing the farmers' knowledge and understanding of soil conservation in cassava production areas; ii) to discuss with farmers how to conduct, with help of researchers and extension workers, FPR trials on their own fields. These farmers were invited to visit demonstration plots on various management practices to reduce erosion (see below), and to discuss the advantages and disadvantages of each treatment. Each farmer was asked to score the various soil erosion control treatments, considering their likely effect on yield and income, their effectiveness in reducing erosion and whether they would be useful under the farmer's own conditions in the village. The farmers then selected 4-5 soil erosion control treatments for testing in their villages.

7.4 Demonstration plots on soil erosion control method

Demonstration plots (**Table 1**) were established by the DOA and Kasetsart University with 24 treatments, including the application of chemical fertilizers, green manures, closer plant spacing, intercropping with different crops and contour hedgerows of different grasses. The size of the plot was 10 x 15 meters. Ditches were dug along the lower ends of each plot and covered with plastic to allow for the collection of soil sediments eroded from the plots. The farmers from the pilot sites visited these demonstration plots and selected those treatments they would like to try in their own fields (**Table 1**).

7.5 Farm trials on farmers' field

After the training course (7.3.2), staff from DOA and DOAE together with collaborating farmers surveyed and selected the most appropriate areas for conducting the trials in each farmer's field. For the FPR erosion control trials, the land should have at least 5% slope. The size of the plots were 10 x 10 meters. Each farmer tried 5-6 treatments. Along the lower end of each plot, a soil collecting ditch was dug, about 40 cm deep and 40 cm wide. Plastic sheets were placed in the bottom of the ditches to collect sediments eroded from the plot during the cassava production cycle. The amount of sediments from each treatment was weighed and a sample of this dried to determine dry soil loss due to erosion. This, along with yield data was shown and discussed by farmers on the field day at harvest time. Besides erosion control trials, there were also FPR variety and fertilizer trials. The FPR trials were repeated for at least two years in the same villages to confirm the results.

7.6 Harvesting field day and meeting

Collaborating farmers and project staff harvested the crops, recorded all data and calculated average results of each type of trial. Data on soil loss from every treatment were also presented to the participating farmers and others interested. The meeting then discussed the results of each trial and selected again the best treatments for next year's trials.

Table 1. Preference ranking by farmers of the best five of the 24 treatments in the demonstration plots, conducted in Pluak Daeng, Rayong in 1994/95, and the treatments selected for their own FPR erosion control trials in 1995/96.

Treatments	Farmers' ranking[1)]		Treatments selected by farmers	
	Soeng Saang	Wang Nam Yen	Soeng Saang	Wang Nam Yen
1. Traditional practice			1.up-down ridging	1.up-down ridging
2. closer spacing			2.contour ridging	2. contour ridging
3. no fertilizers applied			3.vetiver grass	3.vetiver grass
4. fertilizers	5		barriers	barriers
5. chicken manure			4.mulberry barriers	4. peanut
6. fertilizer + chicken manure	4		5.sugarcane barriers	intercrop
7. no tillage			6. peanut intercrop	5. mungbean
8. no tillage + cassava harvester			7. sweet corn	intercrop
9. reduced tillage			intercrop	6. wax gourd
10. up-down ridging				intercrop
11. contour ridging		2		7. ruzie grass
12. dry grass mulch				barriers
13. *Crotalaria* mulch				8. dry grass mulch
14. *Canavalia* mulch				
15. vetiver grass barriers	1	1		
16. elephant grass barriers				
17. ruzie grass barriers	3	4		
18. lemon grass barriers		3		
19. *Leucaena* barriers				
20. *Flemingia* barriers				
21. peanut intercrop		5		
22. mungbean intercrop				
23. maize intercrop	2			
24. water melon intercrop				

[1)] 1 = best or most useful

7.7 Scaling-up

After two years of FPR trials, farmers usually would be able to choose the most suitable methods for soil erosion control in their cassava fields. The DOAE then helped them to test these selected technologies in larger size plots (approximately 1500-3000 m^2) and make further adaptations and selections when necessary. These large plots were called pilot demonstration plots.

7.8 Adoption in production fields

Other farmers in the village also observed these pilot demonstration plots. Those who wanted to adopt the soil conservation practices from these demonstration plots were encouraged and supported to adopt these practices on a large scale in their production fields. For example, the practice of planting vetiver grass contour barriers were expanded to cover about 300 ha in Soeng Saang district of Nakhon Ratchasima and 50 ha in Wang Nam Yen district of Sra Kaew province.

8. Results Obtained

8.1 Selection of soil erosion control methods by farmers

The farmers who visited the demonstration plots at the research center observed and then discussed the advantages and disadvantages of each treatment; they also scored each treatment from 1 to 3. From these scores they selected some methods they considered most useful in their own fields and under their own conditions. In general, they selected the methods that gave higher cassava yields, provided yield and income from intercrops and were most effective in reducing soil erosion (**Table 1**). Furthermore, some farmers wanted to try out some soil conservation methods they thought of themselves, such as replacing hedgerows of elephant grass with sugarcane for chewing. They thought that those two plants are similar but they could earn more income from sugarcane.

8.2 Results from FPR trials in farmers' fields

The results of FPR trials in farmers' fields in the two pilot sites during the first phase of the project (1994-1998) can be summarized as follows:

8.2.1 Nakhon Ratchasima province

Farmers in Noong Sombuun village selected seven treatments for their FPR soil erosion control trials in the first year. In the second year, five of these treatments were reselected to confirm the results (**Table 2**). From these they selected two practices they considered most useful, i.e. contour hedgerows of vetiver grass alternated with sugarcane and intercropping with pumpkin, to conduct the pilot demonstration plots (about 1600 m^2) in the village. Finally, they selected only vetiver grass barriers to extend to the production fields at the community level (**Table 3**). Planting vetiver grass contour hedgerows was initiated on a large scale in various districts of Nakhon Ratchasima province.

8.2.2 Sra Kaew province

Farmers in Wang Sombuun village selected eight methods for the first year FPR trials and reselected five treatments for the second year (**Table 4**). In the third year farmers chose only vetiver grass barriers to test in their pilot demonstration plots and then extend this practice to about 50 ha of their production fields (**Table 5**).

During the later part of the first phase of the project two new sites were selected to conduct FPR trials. Farmers in Sahatsakhan district of Kalasin province conducted FPR trials for two years, while farmers in Sanaam Chaikhet district of Chachoengsao province joined the project only during the final year.

9. Problems and Constraints

Project staff from DOAE in the central office in Bangkok and from DOA in Rayong Field Crops Research Center were often very busy with their own routine work, so it was difficulty to find time to go and work in the FPR project in the field. And the project sites were far away in the provinces, so they could not spend much time in the project.

Since the project staff were busy and live far away from the project sites, they sometimes took temporary workers or laborers to work in the FPR trials instead of working with the farmers. The farmers generally participated only in the meetings to make

Table 2. Average results of FPR soil erosion control trials conducted by farmers in Soeng Saang district of Nakhon Ratchasima province, 1995/96 and 1996/97.

Treatments	1995/96			1996/97		
	Dry soil loss (t/ha)	Cassava yield (t/ha)	Net income ('000 baht/ha)	Dry soil loss (t/ha)	Cassava yield (t/ha)	Net income ('000 baht/ha)
1. up-down ridging	24.80	29.8	21.75	4.30	22.3	8.05
2. contour ridging	9.80	34.0	25.94	-	-	-
3. vetiver grass hedgerows	8.50	35.2	26.78	3.85	21.8	6.24
4. sugarcane hedgerows	11.80	32.2	34.71	4.23	22.2	11.03
5. mulberry barriers	16.10	40.0	32.78	-	-	-
6. peanut intercrop	13.30	28.9	30.69	-	-	-
7. sweet corn intercrop	12.60	25.5	27.76	7.02	20.5	6.96
8. pumpkin intercrop	-	-	-	5.61	21.8	9.32

Table 3. Soil erosion control treatments tested and selected by farmers in Soeng Saang district of Nakhon Ratchasima province, 1995/96 to 1998/99.

Soil erosion control treatments selected by farmers			
1995/96	1996/97	1997/98	1998/99
FPR trial plots	*FPR trial plots*	*Pilot demonstration plots*	*Production fields*
1. up-down ridging	1. up-down ridging	1. vetiver grass hedgerows	1. vetiver grass hedgerows
2. contour ridging	2. vetiver grass hedgerows	2. sugarcane alternated with vetiver grass hedgerows + pumpkin intercrop	
3. vetiver grass hedgerows	3. sugarcane hedgerows		
4. sugarcane hedgerows	4. sweet corn intercrop		
5. mulberry hedgerows	5. pumpkin intercrop		
6. peanut intercrop			
7. sweet corn intercrop			

Table 4. Average results of FPR soil erosion control trials conducted by farmers in Wang Nam Yen district of Sra Kaew province, 1995/96 and 1996/97.

Treatments	1995/96			1996/97		
	Dry soil loss (t/ha)	Cassava yield (t/ha)	Net income ('000 baht/ha)	Dry soil loss (t/ha)	Cassava yield (t/ha)	Net income ('000 baht/ha)
1 up-down ridging	18.12	28.7	23.69	47.79	22.1	9.60
1. contour ridging	8.22	26.9	21.28	28.27	20.7	8.17
2. vetiver grass hedgerows	14.61	23.1	17.12	10.16	18.1	4.98
3. ruzie grass barriers	4.54	31.6	30.30	-	-	-
4. wax gourd intercrop	12.30	26.4	21.07	-	-	-
5. peanut intercrop	14.66	16.5	21.68	-	-	-
6. mungbean intercrop	26.22	25.5	30.88	15.53	12.6	4.66
7. dry grass mulch	5.47	33.5	29.58	29.14	21.4	8.33

Table 5. Soil erosion control treatments selected and tested by farmers in Wang Nam Yen district of Sra Kaew province, 1995/96 to 1 998/99.

Soil erosion control treatments selected by farmers			
1995/96	1996/97	1997/98	1998/99
FPR trial plots	*FPR trial plots*	*Pilot demonstration plots*	*Production fields*
1. up-down ridging	1. up-down ridging	8. vetiver grass hedgerows	1. vetiver grass hedgerows
2. contour ridging	2. contour ridging		
3. vetiver grass hedgerows	3. vetiver grass hedgerows		
4. ruzie grass barriers	4. mungbean intercrop		
5. peanut intercrop	5. dry grass mulch		
6. mungbean intercrop			
7. wax gourd intercrop			
8. dry grass mulch			

decisions and plan next year's work; they would observe while the project staff and workers worked in the FPR trials.

10. Discussion

After the problems and constraints discussed above were identified, the project implementation was improved. Project staff explained more clearly to the farmers about the concept and the objectives of the project and encourage them to participate in every aspect, especially in the activities in the fields. The farmers were shown how to measure and set out contour lines and how to multiply and grow vetiver grass in their production fields. They and the project staff worked together in the fields. Furthermore, farmers were able to extend the practice in their own fields and teach their neighbors.

In the provinces that started the project in 1998 more effort was made to increase farmers' participation in the FPR trials.

11. Implementation Plan of Phase II

The Nippon Foundation approved a second phase (1999-2003) of the project. During this phase it is planned to extend the project to 10-15 new sites. Training courses on FPR methodologies for extension workers and farmers will also be conducted in this second phase in order to enhance farmer participatory dissemination of the selected technologies to a large number of farmers in the village and in neighboring communities. **Figure 1** shows a conceptial model of the various steps in the process.

CONCLUSIONS

By the end of the first phase the participating farmers recognized the importance of, and the need for, soil conservation in cassava fields. The farmers in the two pilot sites in Nakhon Ratchasima and in Sra Kaew provinces adopted mainly vetiver grass barriers as the best method to control erosion. Farmers in a neighboring village of the pilot site in Nakhon Ratchasima organized a group to grow vetiver grass barriers for erosion control in about 320 ha. They were supported by the project in setting out contour lines and in the multiplying of vetiver grass plants. Similarly in Sra Kaew province, farmers formed a group to grow vetiver grass as contour barriers in about 50 ha of hilly cassava production fields.

The method of participatory research, which involves farmers' participation and decision making in every step of implementation, from diagnosis of their problems to dissemination of results, and letting farmers select the methods to be tested by themselves, encouraged them to learn and to find opportunities and potential solutions to solve problems for themselves and their communities.

From our observation, farmers who participated in the first phase of the project were quite shy to express their ideas and opinions at the early stages. However, after some time, when they had met the project staff more often, they were able to discuss the advantages and disadvantages of each method and make decisions on trial implementation and give suggestions for project improvement.

The use of the farmer participatory method developed in this project is considered to be a suitable way to develop and transfer new technologies for farmers and rural communities. The use of a farmer participatory approach will make it more likely that the adoption of sustainable production practices will continue even after the project has been terminated.

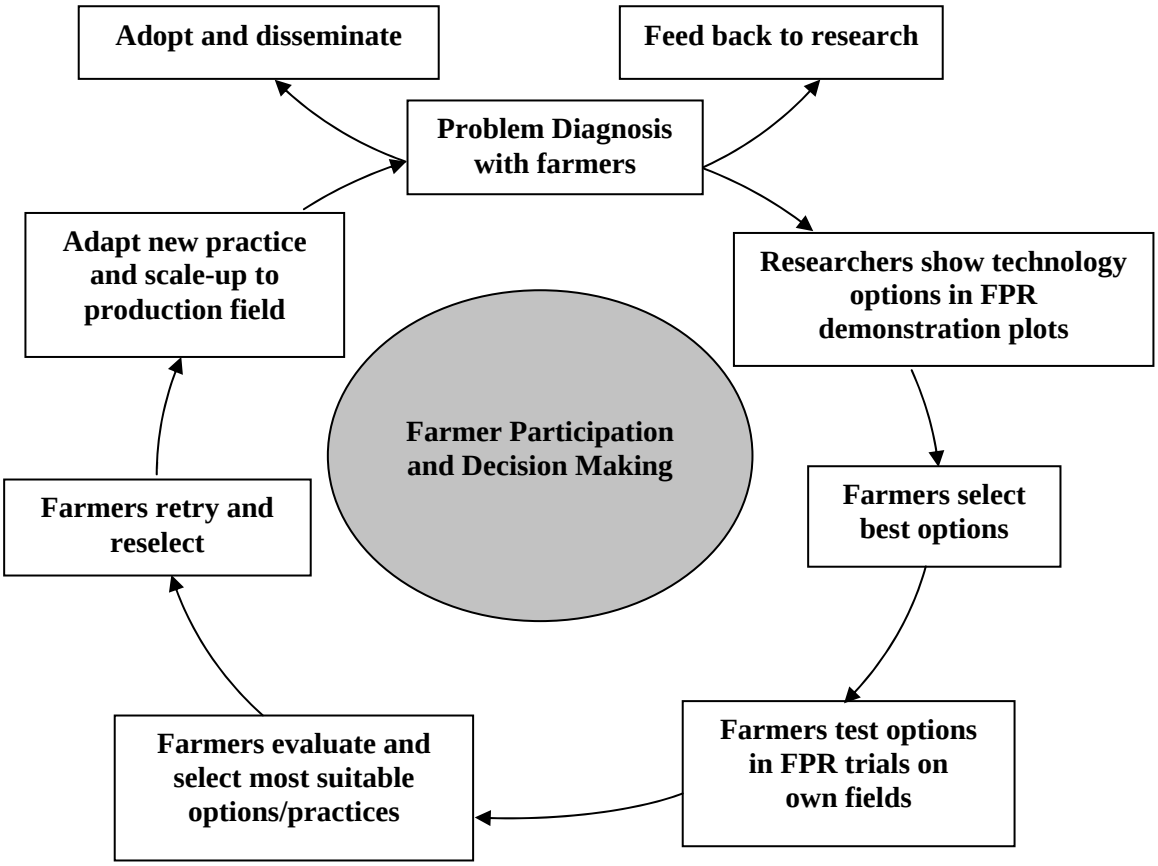

Figure 1. Farmer participatory model used for the development of sustainable cassava-based cropping systems.

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