FARMER PARTICIPATION IN RESEARCH AND EXTENSION: THE KEY TO ACHIEVING ADOPTION OF MORE SUSTAINABLE CASSAVA PRODUCTION ON SLOPING LAND IN ASIA AND THEIR IMPACT ON FARMERS' INCOME

Reinhardt Howeler and Tin Maung Aye
CIAT Cassava Office for Asia, Dept. of Agriculture, Chatuchak, Bangkok,Thailand

INTRODUCTION

Cassava (*Manihot esculenta* Crantz) is the third most important agricultural crop grown in southeast Asia. It is an upland crop, generally grown by smallholder farmers on poor soils and in areas with a prolonged dry season. When grown on slopes, even on very gentle slopes, it can cause serious erosion.

Research has shown that soil losses due to erosion can be markedly reduced by simple agronomic and soil conservation practices. However, these are seldom used by farmers as farmers may be unaware of the seriousness of soil erosion, they do not know how to control erosion, or they consider the recommended practices unsuitable, too expensive or too labor intensive. In order to develop the most suitable soil conservation practices for a particular region and to enhance their widespread adoption, a bottom-up approach was used, in which farmers participate in all steps of the process, from diagnosing the problem, suggesting and testing solutions on their own fields, selecting the most suitable practices and disseminating their experiences to other farmers. This is called Farmer Participatory Research (FPR) and Extension (FPE), also known as Farmer Participatory Technology Development (FPTD).

MATERIALS AND METHODS

A Farmer Participatory Approach

In this approach, farmers are directly involved in all aspects of the process, from diagnosis, selection of promising options, testing those options on their own fields (FPR trials), selecting the most suitable treatments, scaling up to production fields and extending their experiences to other farmers (FPE). Farmers make all decisions, while researchers and extensionists facilitate the process and provide alternative options and germplasm for testing.

After conducting a participatory diagnosis of existing problems, farmers from the selected pilot sites visited research plots in which different varieties and a wide range of more sustainable practices were demonstrated. Farmers evaluated those plots and after discussion selected the types of trials they wanted to conduct on their own farms and the treatments to be tested. Researchers and extension workers helped farmers set out the trials, and helped during harvest to determine the yields, root starch contents and the net income in each treatment. During the field day at harvest, many farmers visited the FPR trials, evaluated and discussed the treatments and results and selected the best practices for future testing or for scaling up and adoption.

To get farmers interested in conducting FPR erosion control trials, and to develop an integrated package of suitable practices, other types of FPR trials were conducted in the community simultaneously, such as evaluations of varieties, green manures, intercropping systems, weed control, etc. (**Table 1**).

Table 1. Number and types of FPR trials conducted in the 2nd phase of the Nippon Foundation Project (1999-2003) in China, Thailand and Vietnam.

Type of trial	China	Thailand	Vietnam	**Total**
Erosion control	41	126	33	**200**
Varieties	87	161	127	**375**
Fertilization	79	108	4	**191**
Intercropping	23	103	9	**135**
Plant spacing	5	35	-	**40**
Green manures	39	-	-	**39**
Organic manures	32	-	-	**32**
Weed control	32	6	-	**38**
Leaf production	-	5	-	**5**
Pig feeding	-	40	59	**55**
Total	**338**	**584**	**232**	**1,154**

Farmer selected practices were disseminated to other farmers by various FPE methodologies, such as:
1. cross visits of farmers from new sites to those of older sites.
2. field days at time of harvest of FPR trials to evaluate and discuss the results.
3. large-scale field days with many participating farmers, school children, government officials and press/TV.
4. setting up of community-based groups to help each other implement the selected soil conservation practices.
5. pamphlets, videos, TV programs, newspaper articles, etc.

Partnerships
The project has been funded by the Nippon Foundation in Tokyo, Japan from 1994 to 2003, and was implemented by the CIAT Cassava Office for Asia in Bangkok, in collaboration with national research and extension institutions in Thailand, Vietnam, China and Indonesia. A similar approach is currently being used in Lao PDR, Cambodia and Timor Leste.

Pilot sites

The first phase (1994-1998) of the project was conducted in 2-3 pilot sites (villages) each in Thailand, Vietnam, China and Indonesia; in the second phase (1999-2003) the number of pilot sites increased year by year, reaching a total of 99 sites in Thailand, Vietnam and China by the end of 2003.

Figure 1 shows that the adoption of new technologies, tested and selected by farmers themselves, greatly increased cassava yields during the second 5-year phase of the project, not only of farmers that actively participated but also those of nearby farmers as well as in the two countries as a whole.

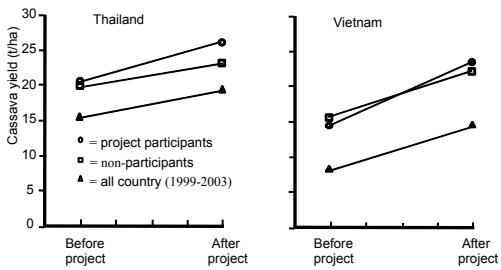

Figure 1. Average cassava yields of farmers participating in the Nippon Foundation cassava project or of nearby but non-participating farmers, before the project started and at the end of the project.

ADOPTION AND IMPACT

Table 2 Summarizes the extent of adoption of the various practices in Thailand and Vietnam by the end of the project.

Table 2. Extent of adoption (percent of households) of new technologies by both participating[1)] and non-participating farmers in the Nippon Foundation project in Thailand and Vietnam in 2003, based on a survey of 832 farm households in Thailand and Vietnam.

Technology	Thailand	Vietnam	Total
Varieties			
->75% of area under improved varieties	90.2	46.1	69.4
Soil conservation practices			
-contour ridging	30.3	29.8	30.0
-hedgerows -vetiver grass	23.5	6.6	15.5
-Tephrosia candida	0	16.5	7.8
-Paspalum atratum	0.2	5.6	2.8
-other hedgerows	1.1	5.3	3.1
-no soil conservation	57.4	48.1	53.0
Intercropping			
-with peanut	0.7	34.6	16.7
-with beans	0	26.0	12.3
-with maize	4.8	3.3	4.1
-with green manures	8.4	0	4.4
-other species	1.8	29.8	15.0
-no intercropping	85.4	37.4	62.7
Fertilization			
-chemical fertilizers	88.2	79.9	84.3
-farm-yard or green manure	33.7	59.0	45.7
-no fertilizer	9.1	15.0	11.9

[1)] Participating farmers are those that conducted FPR trials and/or participated in training courses; non-participating farmers are those living nearby but who did not directly participate in these activities.
Source: Impact Assessment (Tim Purcell, 2004)

Table 3 indicates that in 2006/07 about 50% (nearly 2 million ha) of the cassava area in Asia was planted with CIAT-related varieties, i.e. varieties derived from crosses in which one or both parents contain genes introduced from Latin America. In some countries, such as Thailand, Cambodia and Vietnam this is as high as 98, 80 and 70%, respectively.

Table 3. Total area under cassava and estimated area under improved varieties in various countries in Asia in 2006/07

	Area under cassava (ha)	Area under CIAT-related varieties	
Country	FAO[1)]	ha	(%)
Cambodia	96,000	76,800	80
China	268,850	80,655	30
India	242,000	0	0
Indonesia	1,206,904	229,311	19
Malaysia	41,000	100	5
Philippines	210,000	12,600	6
Thailand	1,152,199	1,129,155	98
Vietnam	560,000	392,000	70
Myanmar	16,500	3,300	20
Laos	17,000	1,700	10
Others	34,725	3,170	10
Total	**3,845,178**	**1,932,791**	**50**

FAOSTAT, Aug 2008; data for 2007.

The adoption of new varieties and improved cultural practices, have markedly increased cassava yields in almost all cassava growing countries in Asia. The annual additional gross income farmers received due to the higher cassava yields obtained in 2007 as compared to 1984 (when the CIAT Cassava Office was established in Asia), is estimated to exceed 900 million US dollars in 2007 (**Table 4**), and is likely to be more than 1 billion dollars in all of Asia in 2008. In addition, many farmers are now more aware of the need to control soil erosion and to maintain soil fertility, and many have adopted various soil conservation measures when planting cassava on slopes, and are applying both chemical and organic fertilizers to make cassava production not only more profitable but also more sustainable.

Table 4. Estimated increase in gross income of cassava farming households (hh) in various countries in Asia as a result of increased cassava yields in 2007 as compared to 1984.

	Total cassava area (ha)[1)]	Cassava yield (t/ha)		Increased gross income due to higher yields[2)]	Estimated no. of hh growing cassava	Estimated additional gross gross income/hh[3)]
		1984	2007[1)]	(mil. US$)	(million)	(US $)
Cambodia	96,000	6.20	20.83	56.179	0.096	585.20
China	268,850	15.81	16.25	4.732	0.896	5.28
India	242,000	18.43	31.40	125.550	0.302	415.73
Indonesia	1,206,904	10.49	16.25	278.071	3.017	92.17
Laos	17,000	13.60	10.29	-2.251	0.039	-
Malaysia	41,000	10.86	10.49	-0.607	-	-
Myanmar	16,500	11.77	12.79	0.673	-	-
Philippines	210,000	7.40	8.71	11.004	0.210	52.40
Sri Lanka	22,560	12.02	9.75	-2.048	-	-
Thailand	1,152,199	14.97	22.92	366.399	0.448	817.85
Timor Leste	12,000	4.19	4.14	-0.024	-	-
Vietnam	560,000	8.79	15.89	159.040	2.074	76.68
Total	**3,845,013**	**12.71**	**18.67**	**916.651**	**7.120**	**128.74**

[1)] Data from FAOSTAT, for 1984 and 2006/07.
[2)] The fresh root price in 2007 was about US$ 40/tonne
[3)] Additional gross income per household due to cassava yield increases since 1984.

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