FARMER PARTICIPATORY RESEARCH (FPR) IN THE NIPPON FOUNDATION CASSAVA PROJECT IN HAINAN PROVINCE OF CHINA

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ABSTRACT

The FPR Cassava Project in China is a cooperative project between CIAT and CATAS, and is financially supported by the Nippon Foundation of Japan. This paper mainly describes results of the FPR trials conducted in Hainan province of China during 2000-2002, and discusses the benefits of the FPR approach in the transfer of cassava technologies, the existing problems and our development prospects.

This project involves the following aspects of research: cassava varieties, soil and water conservation, fertilizer management etc. Several tropical pasture species, peanut and grain legume crops have been tested as contour barrier crops to protect the soil from erosion.

During 2000-2002, five towns with 600 farmers joined the FPR project. More than 200 people have been trained directly in Hainan.

More than 50,000 bags of vetiver grass have been distributed.

More than 2 km of vetiver grass contour barriers have been established.

About 800 farmers have tested new cassava varieties in Tunchang county, and the area of new varieties has now reached about 1,000 ha.

Planting material of new varieties have been distributed to plant 98% of the cassava area in Baisha county where the area of new varieties reached about 2,000 ha. Six farmers participated in the FPR project in Qiongzhong county, and the planting area of new varieties was about 20 ha.

Some students of the University have been trained and will participate in our FPR project. Another PRA was conducted in some new villages and some new pilot sites will be set up. More and more farmers will join our project in the future.

INTRODUCTION

Since the 1970s, various ways of involving farmers in agricultural research have been proposed and studied in many parts of the world, including Farmer Participatory Research (FPR) and Extension (FPE). Guided by researchers, farmers participate in the diagnosis of their problems, then select the type of experiments they want to do and the treatments to be tested; they conduct the trials, evaluate the trial results and then select and possibly adopt the most suitable treatments.

From 1994 to 2003, farmer participatory research (FPR) has been conducted in Hainan as part of a cooperative project between CIAT and CATAS, supported by the Nippon Foundation in Japan. The first phase, from 1994 to 1998, had as its objectives: a) to reconcile the short-term needs of farmers to increase crop yields and income with the long-term objective of preserving the soil's productivity, i.e., to provide benefits to both farmers and society; and b) the essence of this approach is that farmers own the process: they develop the most suitable practices for their own conditions by testing a range of options on their own fields.

The second phase of this project, from 1999 to 2003, had as its main objective to enhance and accelerate the extension of improved varieties and efficient cassava production practices that had been identified in the first phase. The results of the FPR project indicate

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that there are many ways to reduce erosion, maintain or increase soil productivity and increase the income of cassava farmers in Hainan.

The methodology used and the results obtained during the first phase of the project have been described in detail by Zhang Weite *et al.* (1998) and Huang Jie *et al*. (2001).

Demonstration Plots at CATAS, Danzhou, Hainan, 2000-2002.

***1. Comparison of various tropical grasses, legume species and pineapple used as* contour barrier crops for protecting the soil from erosion**

An erosion control experiment was conducted on 5-10% slope at CATAS since 1995. Results of the earlier trials have been reported by Huang Jie *et al*. (2001). Results of the trials conducted from 1999 to 2001 are shown in **Table 1**. They indicate that:

1) dry soil loss due to erosion decreased year by year, while cassava yields remained fairly constant
2) after three years, all the live barrier treatments were very effective in decreasing soil loss by erosion. Dry soil loss (4.1-15.1 t/ha) decreased by 68-91% as compared to the check treatment (47.1 t/ha)
3) some of these live barriers, such as vetiver grass, *Clitoria ternatea, Cassia rotundifolia*, and *Tephrosia candida*, became more effective in controlling erosion over the years and showed less competition with cassava, resulting in slight increases in root yield as compared to the check plots without barriers. On the other hand, *Arachis pintoi, Brachiaria* and king grass competed strongly with nearby cassava, resulting in lower yields.

Table 1. Result of the soil erosion control demonstration plots at CATAS, Hainan, China, 1999-2001.

Barrier species[1)]	Dry soil loss (t/ha)				Fresh root yield (t/ha)			
	1999	2000	2001	**Average**	1999	2000	2001	**Average**
Check without barriers	97.8	31.2	12.2	**47.1**	19.9	21.7	21.6	**21.1**
King grass	12.4	3.8	2.8	**6.3**	19.6	14.3	18.7	**17.5**
Vetiver grass	20.2	5.7	2.0	**9.3**	24.8	21.4	22.4	**22.9**
Clitoria ternatea	14.6	10.8	5.4	**10.3**	28.7	25.7	20.8	**25.1**
Cassia rotundifolia	17.3	8.9	6.5	**10.9**	23.1	22.4	23.5	**23.0**
Paspalum atratum	-	7.7	2.6	**5.2**	-	18.6	17.4	**18.0**
Arachis pintoi	5.6	8.3	1.4	**5.1**	13.4	19.0	15.2	**15.9**
Tephrosia candida	20.5	10.6	10.6	**13.9**	22.0	22.1	21.0	**21.7**
Desmodium ovalifolium	34.1	5.9	5.4	**15.1**	21.4	17.3	19.6	**19.4**
Brachiaria brizantha CIAT 26110	-	9.6	3.0	**6.3**	-	17.8	18.8	**18.3**
Brachiaria decumbens CIAT 606	-	5.7	2.5	**4.1**	-	17.9	16.3	**17.1**
Pineapple	18.1	5.9	5.3	**9.8**	22.9	20.4	18.0	**20.4**
Lemon grass	-	6.5	5.2	**5.9**	-	20.1	20.4	**20.2**

[1)] Only two rows of barriers in each plot.

2. The competitive effect of vegetative barriers used for erosion control on cassava grown on 6-8% slope at CATAS

Vetiver grass contour barriers were found to be very effective in reducing erosion in cassava fields. However, farmers do not easily adopt the use of vetiver due to the fact that it can not be used to any great extent as animal feed. In order to further select the best vegetative barriers, a preliminary trial on the competitive effect of vegetative barriers was conducted at CATAS from 1998-2001. Average results for the first two years were reported by Huang Jie *et* al. (2001). The results, shown in **Table 2**, indicate that cassava yields varied from year to year; lemon grass, vetiver grass, *Paspalum atratum* and hybrid elephant grass were the least competitive species and will therefore be recommended for erosion control barriers. *Panicum maximum,* dwarf and common elephant grass, king grass, sugarcane and *B. ruzuziensis* were found to be too competitive, resulting in low cassava yields when used as barriers for erosion control.

Table 2. Effect of grass barriers of various species used for erosion control on the fresh root yield of cassava planted between these barriers in CATAS, Danzhou, Hainan, China from 1998 to 2001.

	Cassava yield (t/ha)				
Treatments[1)]	1998	1999	2000	2001	**Average**
Vetiver grass	19.0	47.2	33.5	30.6	**32.6**
Lemon grass	20.0	47.0	45.0	32.1	**36.0**[3)]
Dwarf elephant grass	19.8	20.3	8.8	7.2	**14.0**
Common elephant grass	17.1	28.2	13.4	10.5	**17.3**
Hybrid elephant grass	19.7	40.3	31.7	25.5	**29.3**
King grass	18.9	26.8	16.3	11.6	**18.4**
Sugarcane	14.3	35.2	18.7	7.8	**19.0**
Brachiaria ruziziensis	20.6	25.3	18.3	12.8	**19.2**
Brachiaria decumbens	16.2	36.3	24.1	16.0	**23.2**
Brachiaria brizantha CIAT 26110	17.6	36.7	27.5	17.7	**24.9**
Paspalum atratum	17.3	39.5	32.6	28.7	**29.5**
Panicum maximum TD 58	14.1	22.5	5.8[2)]	6.1	**12.1**
Average	**17.9**	**33.8**	**23.0**	**17.2**	**23.0**

[1)] Three rows of cassava were grown between two rows of grass; 1 meter space between cassava rows and 0.5 m space between grass row and cassava row. The six cassava rows were harvested separately (10 plants in each row). The grass species (except sugarcane) were cut back at 30 cm above the soil whenever necessary.

[2)] Low yield due to root rot

[3)] High yield because lemon grass grew poorly

3. New demonstration plots on erosion control conducted on 6-8% slope at CATAS in 2002.

Based on the best options selected by farmers and researchers during the first phase of the project, some new treatments for erosion control were established in 2002 in new demonstration plots located on 6-8% slope at CATAS. Results for the first year, shown in **Table 3**, indicate that all the treatments were quite effective in decreasing soil loss by erosion, but intercropping with peanut was less effective than the grass contour hedgerows, while the use of plastic mulch or barriers of closely spaced cassava stems were most

effective. Dry soil loss (8.5-50.5 t/ha) decreased by 37-89% compared to the check treatment (80.0 t/ha). Although the highest yield (35.67 t/ha) and the lowest soil loss (8.5 t/ha) were obtained by the treatment of soil covered with plastic, it seems that its cost is higher than that of other treatments.

Table 3. Result of the soil erosion control trial established at CATAS, Hainan, China in 2002.

	Dry soil loss (t/ha)			Fresh root yield (t/ha)		
Treatments[1)]	I	II	**Mean**	I	II	**Mean**
Check without soil conservation	57.92	102.11	**80.02**	35.16	27.58	**31.37**
C+peanut intercrop	50.94	50.13	**50.54**	29.14	27.19	**28.17**
C+*Panicum maximum* hedgerows	44.53	18.63	**31.58**	21.41	21.17	**21.29**
C+*Brachiaria decumbens* hedgerows	59.22	19.67	**39.45**	33.42	27.66	**30.54**
C+vetiver grass[1)] hedgerows	38.00	24.88	**31.44**	36.64	23.59	**30.12**
C+plastic mulch	7.84	9.20	**8.52**	36.56	34.77	**35.67**
Closely-spaced cassava hedgerows	7.11	11.67	**9.39**	28.20	30.47	**29.34**

[1)] Planting: 2002/3/26; Harvest: 2003/2/23; only two rows of barriers in each plot

Trials at Farmers' Fields

During 1999-2002, most FPR trials conducted on farmers' fields or outside of CATAS were varietal evaluation trials. Results, shown in **Tables 4-9**, indicate that two new varieties had excellent performance in many places and were selected for release by farmers themselves: SC5=ZM9057 and SC6=OMR33-10-4. They also identified several promising clones, such as CMR38-120-10, OMR36-40-9 and KU 50, which might be released on a large scale in the near future in China.

Table 4. FPR variety trials conducted in Qiongzhong county, Tunchang county and Danzhou city of Hainan province in 2002.

Location	Variety or clone	Fresh root yield (t/ha)	Relative yield (% of SC205)
Old Songtao village, Qiongzhong county	SC205	23.25	100.0
	SC5	27.50	118.3
	SC6	33.25	143.0
	OMR36-40-9	24.00	103.2
	ZM8639	28.75	123.7
	ZM8229	21.00	90.3
	ZM8641	27.00	116.1
	ZM8803	21.25	91.4
	BRA900	21.50	92.5
Nanlao village, Nankun town, Tunchang county	SC205	24.06	100.0
	SC5	34.38	142.9
	SC8002	31.25	129.9
	SC124	24.69	102.6
Maling village, Nankun town, Tunchang county	SC5	81.25	
Qiaozhi farm, Danzhou city	SC5	57.81	

Table 5. Variety trial conducted on October Field farm, Changjiang county, Hainan, province in 2002.

	Fresh root yield (kg/5 plants)		Fresh root yield (t/ha)[2)]		
Variety or clone[1)]	I	II	I	II	**Av.**
SC205	**6.0**	**4.0**	**15.00**	**10.00**	**12.50**
ZM8316	6.7	5.0	16.75	12.50	**14.62**
ZM35-70-1	0.5[3)]	4.5	2.28	11.25	**6.76**
BRA900	9.0	5.8	22.50	14.50	**18.50**
SC6=OMR34-10-4	6.6	8.5	16.50	21.25	**18.87**
ZM8803	9.0	5.9	22.50	14.75	**18.62**
OMR36-40-9	5.5	5.6	13.75	14.00	**13.87**
CMR36-40-12	6.0	6.5	15.00	16.25	**15.62**
ZM8641	5.5	3.1	13.75	7.75	**10.75**
ZM8229	5.2	4.0	13.00	12.50	**12.75**

[1)] Planting: 2002/4/22; Harvest: 2002/11/29; Plant spacing: 1.0x0.8 m
[2)] Low germination because of dry weather
[3)] Only harvested 3 plants

Table 6. FPR variety trial conducted in Qifang town, Baisha county, Hainan province in 2002.

	Fresh root yield (kg/5 plants)		Fresh root yield (t/ha)		
Variety or clone[1)]	I	II	I	II	**Av.**
SC205	**9.6**	**8.3**	**24.00**	**20.75**	**22.37**
SC6 = OMR33-10-4	9.3	17.0	23.25	42.50	**32.87**
ZM8639	11.8[2)]	22.5	49.17	56.25	**52.60**
BRA900	10.9	15.0	27.25	37.50	**32.37**
ZM8803	11.0	12.5	27.50	31.25	**29.37**
ZM8229	14.5	11.0	36.25	27.50	**31.87**
ZM8316	13.5	11.5	33.75	28.75	**31.25**
OMR36-40-9	13.5	14.0	33.75	35.00	**34.37**
ZM8641	10.0	11.0	25.00	27.50	**26.25**

[1)] Planting: 2002/4/11; Harvest: 2002/11/28; Plant spacing: 1.0x0.8 m
[2)] Only harvested 3 plants

Training Course at CATAS

During 1999-2002, two training courses were organized at CATAS. There were about 80 participants from Hainan, Guangxi and Yunnan provinces, including farmers and officials of the Agricultural Bureau and extension agents. Besides class room lectures, they also went to see the demonstration plots and other cassava trials at CATAS. Farmers seemed to be most interested in the new varieties and in fertilizer application.

Table 7. Variety trial conducted at GSCRI in Nanning city, Guangxi province in 2002.

Variety or clone[1)]	Fresh root yield (kg/5 plants)	Fresh root yield (t/ha)[2)]
SC5	9.0	22.50
SC8013	17.5	43.75
ZM8229	9.0	22.50
ZM6068	8.4	21.00
ZM8641	19.0	47.50
KU 50	21.5	53.75
Rayong 5	15.0	37.50
Rayong 72	8.5	21.25
Rayong 90	10.0	25.00

[1)] Planting: 2002/4/11; Harvest: 2002/11/26; Plant spacing: 1.0x0.8 m
[2)] Low germination because of dry weather, but SC8013, ZM8641, KU 50, Rayong 5 and Rayong 90 had bigger roots.

Table 8. FPR variety trial conducted at Shan Xu, Guangxi province in 2002.

Variety or clone[1)]	Fresh root yield (kg/5 plants)			Fresh root yield (t/ha)[2)]				Relative yield
	I	II	III	I	II	III	Av.[3)]	(% of SC 205)
SC205	**16.0**	**27.5**	**26.5**	**40.00**	**68.75**	**66.25**	**58.33**	**100.00**
OMR36-40-9	15.5	24.0	17.5	38.75	60.00	43.75	47.50	81.43
OMR33-10-4	10.5	11.5	13.0	26.25	28.75	32.50	29.17	50.01
KU50	14.5	22.0	13.0	36.25	55.00	32.50	41.25	70.72
CMR38-120-10	17.5	18.0[2)] (3 plants)	-[2)]	43.75	75.00	-[2)]	59.38[3)]	101.80[3)]
ZM8639	21.5	15.5	27.0	53.75	38.75	67.50	53.33	91.43
SM2300-1	26.0	33.5[2)] (4 plants)	-[2)]	65.00	104.69	-[2)]	84.85[3)]	145.47[3)]
BRA900	11.0	11.0	14.0	27.50	27.50	35.00	30.00	51.43
ZM8803	14.5	21.0	14.5	36.25	52.50	36.25	41.67	71.44
SC5	12.0	8.0	11.0	30.00	20.00	27.50	25.83	44.28
SC201	11.0	17.5	45.5[2)]	27.50	43.75	113.75	61.67[3)]	105.73
OMR36-31-1	21.0	23.0	21.5	52.50	57.50	53.75	54.58	93.57
GR911	20.0	21.5	21.0	50.00	53.75	52.50	52.08	89.29
SM1600	9.5	25.0	25.5	23.75	62.50	63.75	50.00	85.72
GR891	17.5	16.5[2)] (3 plants)	-[2)]	43.75	68.75[2)]	-[2)]	56.25[3)]	96.43[3)]

[1)] Planting: 2002/3/26; Harvest: 2002/11/22; Plant spacing: 1.0x0.8 m
[2)] CMR 38-120-10, GR 891 of II only 3 plants; SM 2300-1 of II only 4 plants; SC 201 of III only 5 plants; GR 891 and CMR 38-120-10 of III all plants had root rot. No plants of SM 2300-1 in III
[3)] It may be difficult to calculate yields because of many missing plants

Table 9. FPR variety trial conducted in Wuming county, Guangxi province in 2002.

Variety or clone[1)]	Fresh root yield (kg/5 plants)	Fresh root yield (t/ha)	Relative yield (% of SC205)
SC205**	**13.08**	**36.33**	**100.00**
ZM8639*	24.58	45.52	125.30
SC5*	19.58	36.26	99.81
GR891*	18.58	34.41	94.72
OMR36-34-4*	15.58	28.85	79.41
KU50*	30.58	56.63	156.01
Rayong 72*	14.68	27.19	74.84
OMR36-31-1*	18.08	33.48	92.16
GR911**	15.58	43.28	119.13
ZM8316**	16.18	44.94	123.70
ZM8803**	16.58	46.06	126.78
Nanzhi 199**	13.68	38.00	104.60
CMR38-120-10**	19.08	53.00	145.88
BRA900**	18.98	52.72	145.11
OMR36-40-9**	15.58	43.28	119.13

[1)] Planting: 2002/3/7; Harvest: 2002/11/23; * Plant spacing: 0.9x1.2 m; ** = 0.9x0.8 m

Impact of the FPR Project on the Transfer and Adoption of New Cassava Technologies

- Two promising clones, ZM9057 and OMR33-10-4, showed excellent performance in FPR trials and were selected for release by the farmers themselves; these were officially approved as new varieties and named SC5 and SC6, respectively, by the Variety Examination Committee of China.
- During 2000-2002, five towns with about 600 farmers joined the FPR project.
- More than 200 people have been trained directly in Hainan.
- More than 50,000 bags with vetiver grass plants have been distributed.
- More than 2 km of vetiver grass barriers have been established.
- About 800 farmers tested new varieties in Tunchang county, while the total area under new varieties reached about 1,000 ha.
- In Baisha county, new varieties have been planted in 98% of the cassava area and the areas with new varieties reached about 2,000 ha. Six farmers participated in the FPR project in Qiongzhong county, where the planting area of new varieties is now about 20 ha.
- Some students of the University have been trained and will participate in our FPR project.
- PRA were conducted in some new villages, and new pilot sites will be set up. More and more farmers will join our project in the future.

Work Plan for the Future

The following activities are planned at CATAS:

1. Another training course will be organized for 30 persons during three days; the course contents will include cassava varieties, fertilization, erosion control etc. We will also keep the demonstration plots on the use of vegetative barriers for erosion control.

2. Some demonstration trials will be set up in various parts of Hainan province: about 10 trials on cassava varieties or clones; 3-5 trials on cassava fertilization; 3 erosion-control trials on vegetative barriers in mountainous areas.
3. Three cooperative trials on cassava varieties or clones will be conducted in Guangdong, Guangxi and Yunnan provinces.
4. In 2003-2004, we will try to reach this goal: more than 1,000 farmers participating in the FPR project; 5 varieties will be recommended to be extended to up to 10,000 ha. Adapted fertilizers from CATAS will be recommended in different cassava growing areas and used in up to 2,000 ha. About 5 km of vertiver grass contour barriers will be planted for erosion control.

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