Cassava's Potential in Asia in the 21st Century:

Present Situation and Future Research and Development Needs

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IMPLEMENTATION OF FARMER PARTICIPATORY RESEARCH (FPR) IN THE TRANSFER OF CASSAVA TECHNOLOGIES IN INDONESIA

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ABSTRACT

A Farmer Participatory Research (FPR) approach has been used in two pilot sites located in Malang and Blitar districts of East Java. The objective of the work, which was executed since l994, was to enchance the development and adoption of efficient cassava production technologies that are able to maintain soil productivity, reduce erosion, and increase the income of cassava farmers.

To achieve this objective, a Rapid Rural Appraisal method was employed. The involvement of farmers started from the identification of the problems and discussion of possible solutions. The results show that most farmers in the pilot site had been aware of soil degradation problems in their fields, as well as some technologies to overcome the problems. However, they hardly practiced the technologies on their field, because they thought that the technologies were too complicated and costly. After discussion with the project staff, they realized that some cassava production technologies are not as difficult and costly as they had earlier thought. They decided to establish demonstration plots to test their ideas. The technologies tested in the demonstration plots included erosion control practices, fertilizer application and the introduction of new cassava varieties.

After the experiences obtained in the demonstration plots during the first year, collaborating farmers decided to test some promising technologies in their own fields during the following years. The number of collaborating farmers, as well as the farmers doing FPR trials in their own fields, increased in the third year. In addition, some farmers at the Wates site in Blitar district started to adopt the preferred technologies in their whole field. The numbers of farmers adopting soil conservation practices increased significantly in the following year (1998/99). In the Dampit site in Malang district, the adoption process started in 1999/2000.

Farmers in Wates and Dampit are happy with the FPR approach. This approach increased the ability of farmers to try new technologies that they thought might increase their income, although the results were not yet sure. This approach also motivated farmers to actively obtain new knowledge by discussing their problems and ideas with extension personnel and others.

INTRODUCTION

Cassava is the most important root crop in Indonesia, but is less important than rice, maize and soybean. It is grown extensively throughout Indonesia with a harvested area of about 1.2 million ha/year and a yearly production between 15 and 17 million tonnes. Most of the production is used for human consumption (about 71% of total production), and the rest is used for industrial purposes (about 13%), for export (about 6.5%), and for animal feed (about 2%) and waste (about 7.5%) (CBS, 1998).

Most cassava is planted on marginal land in relatively dry areas, such as in the central and eastern parts of Java and in Nusa Tenggara. Cassava is also found in transmigration areas of Sumatra, Kalimantan and other islands. In these areas cassava is

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grown by small-scale farmers with limited land, capital, technology, and labor. Therefore the crop is usually grown with traditional technologies. Farmers grow the locally available varieties with no or insufficient application of fertilizer and improper land management. As a result, the yield is low (about 13 t/ha), and soil fertility tends to deteriorate.

On the other hand, the government and researchers have developed many new technologies to increase crop yields and to reduce soil degradation. Researchers have developed technologies that are capable of obtaining cassava yields as high as 30-40 t/ha, and at the same time decrease the rate of soil degradation and maintain soil productivity.

So far, most of these technologies have been developed based on the ideas of the government or researchers. The technologies are usually developed on experiment stations, or, if the experiment is conducted on farmer's land, the experiment is largely managed by researchers. Then, if the technologies seem useful, the government disseminates them through conventional methods used by the extension services. With this approach, a lot of technologies are developed that are technically sound but are hardly adopted by the farmers, or if there is any adoption it will last a short time. Soon after the project ends, farmers will go back practicing the old traditional technology.

Farmers may agree that the technology is good, but they may think that the technology is too expensive, too complicated, too laborious and often does not yield immediate benefits. Oftentimes, the technologies developed by researchers do not meet their needs and may not be suitable for their conditions.

Lately, some sociologists and anthrophologists (e.g. Fujisaka, 1989; Saragih and Tampubolon, 1991) suggested a more farmer oriented approach in developing crop production technologies. It is expected that the technologies thus developed would be more appropriate for the farmer's needs and conditions. Hence, the farmers would be happy to adopt them. A lot of approaches have been developed and tested. These include On-farm Research, Farming Systems Research and Farmer Participatory Research. The differences among these approaches is mainly in the degree of involvement of the farmers in the planning and implementation.

The success of the application of Farmer Participatory Research in the development and transfer of soil conservation technologies has been shown by Fujisaka (1989). Henry and Hernandez (1994) have also successfully used this approach for the development and dissemination of new cassava varieties in Colombia. This approach was also used to improve the soil fertility status in Africa by Defour *et al*. (1998), and was extensively used for watershed management in India (Chennamaneni, 1998). The strengths, weaknesses and prospective future of the participatory approach for the development and dissemination of soil management technologies has been extensively discussed by Fujisaka (1991).

The work reported here discusses the experiences of the application of Farmer Participatory Research to develop and transfer cassava production technologies in Blitar and Dampit districts of East Java, Indonesia. The work was started in 1994/95 and executed for five years.

LOCATION OF PILOT SITES

The study was conducted in two pilot sites: Ringinrejo village, Wates sub-district of Blitar district; and in Sumbersuko village, Dampit sub-district of Malang district, both in

East Java province. Farmers in Ringinrejo grow cassava intercropped with maize, and the cassava is mainly used for human consumption as a security food. Farmers in Dampit grow cassava mostly in monoculture as a cash crop, selling the fresh roots to factories.

The cassava fields in Wates are dominated by very poor and shallow Alfisols with many limestone outcroppings. The soil in Dampit is an acid Inceptisol with a relatively better fertility status. The general biophysical conditions in the two sties and farmers characteristics in the study area have been reported by Utomo *et al*. (1998).

FPR METHODOLOGY

The project started with a Rapid Rural Appraisal (RRA) in the pilot sites to identify the cassava farmers' problems, and to understand the perception of the farmers to their problems and the possible technologies to overcome these problems. After this initial discussion we asked the farmers to select the most appropriate technologies and then let them test these in demonstration plots. All activities in the demonstration plots were done by the farmers, and the project staff helped only with the design and lay-out of the experiment.

Field days were organized to let the farmers (collaborating farmers and surrounding non-collaborating farmers) see and discuss the performance and the results of the technologies tested in the demonstration plots. Several farmers in Ringinrejo were pleased with some technologies shown in the demonstration plots, so in the second year they tested these preferred technologies in FPR trials on their own fields.

In the following year, in addition to continuing the previous activities, the project facilitated the adoption process and farmer-to-farmer extension. These activities were done in Wates. In Sumbersuko village farmers still concentrated on various types of demonstrations and on-farm trials, while they also started to do FPR trials in their own fields.

RESULTS AND DISCUSSION

1. Awareness of Farmers of their Problems

As reported in the first part of the project (Utomo *et al*., 1998), most farmers in the study area were well aware of the problems they encountered. The farmers know well that their land is in a very poor condition, and that a lot of work and capital must be expanded to get a reasonable yield. They are also well aware that soil degradation due to soil erosion is occurring very rapidly. Hence, soil conservation practices, which would result in a decrease in erosion and improvement in soil fertility, should be implemented.

The problem is that due to the fact that farmers own a very small land area, their income is too low to manage their land properly. Actually, the farmers are very eager to practice better soil management in their fields. However, based on their experiences with previous extension activities, they think that the recommended management practices are expensive, complicated and need a lot of labor, either for establishment or maintenance.

2. FPR Demonstration Plots

The results of the first year demonstration plots have been reported by Utomo *et al*. (1998). After this first year, the land for the demonstration plots in Wates district were used for other purposes; therefore, a new demonstration plot was established. The results are presented in **Table 1**. In general, the various treatments produced lower levels of erosion than the traditional farmer's practice. Except for Taiwan grass hedgerows in the first year (1997/98), the soil losses in all hedgerow treatments were lower than that of the no-hedgerow treatment. In contrast with the soil loss, there were no great differences in the yield of cassava and maize among treatments. In the second year after hedgerow establishment, these treatments again did not have any effect on crop yields. The lower yield of cassava in the no-hedgerow treatment shown in **Table 1** could not be attributed to the treatment effect; this was merely due to experimental variability.

Table 1. Crop yield and dry soil loss due to erosion in the FPR demonstration plots conducted on 5-10% slope in Ringinrejo, Wates, in 1997/98 and 1998/99.

Treatment (hedgerows)	Crop yield (t/ha) Cassava 97/98	Crop yield (t/ha) Cassava 98/99	Crop yield (t/ha) Maize 97/98	Crop yield (t/ha) Maize 98/99	Soil loss (t/ha) 97/98	Soil loss (t/ha) 98/99
Farmers' practice (no hedgerows)	19.41	24.40	1.55	1.76	49.11	36.24
Vetiver grass	28.73	28.16	1.63	2.04	26.79	24.56
Elephant grass	24.97	22.48	1.03	1.96	35.71	22.19
Taiwan grass	23.11	24.17	1.29	2.10	49.11	28.65
Gliricidia sepium	30.36	27.16	1.80	2.24	41.07	25.16
Leucaena leucocephala	25.80	24.18	2.15	1.98	39.29	28.17

Similar results were obtained in the Dampit demonstration plot (**Table 2**). The average results for three years in Dampit (**Table 3**) show that some very simple erosion control technologies, consisting of making ridges across the slope or in-line mounds, were able to reduce erosion rates by 40 to 50% as compared to that of the farmer's practice. Again, there were no significant differences in cassava and maize yields, except that treatment 6 (intercropping with peanut and cowpea in addition to maize) resulted in lower cassava and maize yields; this latter treatment, however, produced the highest gross and net income, but had also a very high soil loss due to erosion. Farmers will need to decide whether the higher income is justified by the higher level of soil degradation.

The average results of two on-farm variety trials conducted in Dampit (**Table 4**) indicate that the introduced varieties produced a lower yield compared to the local Caspro variety. Actually, Caspro and Sembung are not real local varieties. These are high yield national varieties which have been cultivated by Indonesian cassava farmers for many years; nevertheless, farmers consider these as local varieties. Among the introduced varieties, UB ½, a variety developed by Brawijaya University, produced the highest root yield; however, the widely grown industrial variety, Adira 4, had by far the highest starch content, which resulted in a higher starch yield.

It is interesting to note the results of the on-farm fertilizer experiment conducted in Dampit (**Table 5**). Application of manure and/or fertilizer did not increase cassava yields. Considering the high yield obtained without fertilizers (42.3 t/ha) this is not surprising. A cassava yield of 40 t/ha is already very high and approaching the maximum yield. Therefore, application of fertilizers is unlikely to further increase the yield. There may even be a decrease in the yield due to a nutrient imbalance or excess.

Table 2. Results of FPR Demonstration plots conducted in Sumbersuko village, Dampit, Malang, East Java, Indonesia, in 1997/98 (4th cycle).

Treatments[1]	Yield (t/ha)		Gross income[3]	Production costs[4]	Net income	Dry soil loss
	Cassava	Maize	('000 Rp/ha)			(t/ha)
1. C+M, farmer's practice, up-down ridging	17.10	1.25	5,617	2,247	3,370	24.45
2. C+M, recom. practices, contour ridging, vetiver HR	14.60	1.30	4,982	2,399	2,583	3.00
3. C+M, recom. practices, staggered mounds	17.60	1.40	5,845	2,399	3,446	10.44
4. C+M, recom. practices, contour ridging, lemon grass HR	15.20	1.25	5,104	2,399	2,705	7.83
5. C+M, recom. practices, in-line mounds	12.50	1.25	4,375	2,399	1,976	6.92
6. C+M+P-Cp[2], recom. practices, contour ridging of cassava rows	5.55	0.95	7,723	3,051	4,672	13.13
7. C+M, recom. practices, contour ridging	14.60	1.35	5,022	2,399	2,623	9.93
8. C+M, recom. practices, contour ridging, *Gliricidia* HR	12.30	1.30	4,361	2,399	1,962	6.27
9. C+M, recom. practices, contour ridging, *Flemingia* HR	15.00	1.30	5,090	2,399	2,691	9.45
10. C+M, recom. practices, contour ridging, *Leucaena* HR	14.55	1.25	4,928	2,399	2,529	7.50
11. C+M, recom. practices, contour ridging, *Calliandra* HR	16.25	1.35	5,467	2,399	3,068	3.69
12. C+M, recom. practices, contour ridging, elephant grass HR	16.45	1.30	5,481	2,399	3,082	2.28

[1] C = cassava, M = maize, P = peanut, Cp = cowpea; HR = contour hedgerows

[2] Yields of peanut: 850kg/ha; cowpea: 410 kg/ha

[3] Prices:

cassava	Rp 270/kg fresh roots	seed maize	Rp 2,500/kg	urea	Rp 1,200/kg
maize	800/kg dry grain	seed peanut	4,500/kg	SP-36	1,500/kg
peanut	4,500/kg dry grain	seed cowpea	4,000/kg	KCl	1,700/kg
cowpea	4,000/kg dry grain			FYM	20/kg

[4] Cost of production ('000 Rp/ha):

	T_1	T_{2-5}, T_{7-12}	T_6
seed	87	87	190
fertilizers	1,035	1,130	1,350
pesticides	-	57	111
labor	1,125	1,125	1,400
	2,247	2,399	3,051

[5] 1US $ = Rp 8,000 in 1997/98.

Table 3. Crop yield and dry soil loss in the FPR demonstration plots conducted on 12% slope in Sumbersuko village, Dampit, Malang. Data are average values for 1996/97, 1997/98 and 1998/99.

Treatments[1)]		Soil loss (t/ha)	Yield (t/ha) Cassava	Yield (t/ha) Maize	Net income ('000 Rp/ha)
1. C+M	Farmers' practices; up and down ridging	19.22	16.54	1.21	1,724
2. C+M	recom. practice; contour ridging; vetiver hedgerows	4.37	13.82	1.16	1,228
3. C+M	recom. practice; staggered mounds	11.02	14.95	1.22	1,577
4. C+M	recom. practice; contour ridging; lemongrass hedgerows	7.92	13.78	1.17	1,294
5. C+M	recom. practice; in-line mounds	7.19	13.60	1.16	1,079
6. C+M+P-Cp[2)]	recom. practice; contour ridging on cassava line	15.41	5.09	0.98	2,771
7. C+M	recom. practice; contour ridging	9.22	12.67	1.21	1,158
8. C+M	recom. practice; contour ridging; *Gliricidia* hedgerows	7.10	12.71	1.25	1,004
9. C+M	recom. practice; contour ridging; *Flemingia* hedgerows	9.39	14.14	1.14	1,283
10. C+M	recom. practice; contour ridging; *Leucaena* hedgerows	8.02	13.31	1.16	1,178
11. C+M	recom. practice; contour ridging; *Calliandra* hedgerows	4.93	12.55	1.20	1,277
12. C+M	recom. practice; contour ridging; elephant grass hedgerows	3.21	14.75	1.17	1,463

[1)]C=cassava; M=maize, P=peanut, Cp=cowpea

Table 4. Average results of two on-farm variety trials of cassava intercropped with maize conducted in Sumbersuko village, Dampit, Malang, E. Java, in 1997/98 and 1998/99.

Variety/clone	Plant height (cm)	Cassava yield (t/ha)	Starch content[1)] (%)	Starch yield (t/ha)
1. Local Caspro	336	46.1	20.0	9.22
2. Local Sembung[2)]	294	36.4	19.0	6.92
3. OMM 90-6-89	363	30.9	16.5	5.10
4. OMM 90-6-72	315	38.5	19.5	7.51
5. OMM 90-5-42	297	31.9	15.5	4.94
6. Adira 4	317	37.6	24.0	9.02
7. Malang 2	286	33.1	21.5	7.12
8. UB 1/2	309	40.6	19.5	7.92
9. UB 881-5	289	37.9	18.5	7.01
10. UB 477-2	292	37.4	19.0	7.11
11. OMM 90-2-66	278	32.9	16.5	5.43

[1)] Measured by Reihmann scale
[2)]=Faroka

Table 5. Crop yield and gross and net income in the on-farm fertilizer trial conducted in Sumbersuko village Dampit, Malang, E. Java, in 1997/98.

Treatments[1)]	Cassava yield (t/ha)	Maize yield (t/ha)	Gross income	Cost fert+ manure	Net income
			——(‘000 Rp/ha)——		
1. No fertilizer or manure	42.3	1.44	12,573	0	11,303
2. 10 t FYM/ha	41.5	1.39	12,317	200	10,847
3. 200 kg Urea/ha	46.2	1.53	13,698	240	12,188
4. 200 kg Urea+10 t FYM/ha	40.5	1.39	12,047	440	10,337
5. 200 kg Urea+10 t ash/ha	45.7	1.76	13,747	240	12,237
6. 200 kg Urea+100 kg KCl/ha	42.4	1.38	12,552	410	10,872
7. 200 kg Urea+100 kg SP-36/ha	45.0	1.20	13,110	390	11,450
8. 200 kg Urea+100 kg SP-36+100 kg KCl/ha	50.2	1.16	14,482	560	12,652
9. 200 kg Urea+100 kg SP-36+200 kg KCl/ha	49.6	1.25	14,392	730	12,392
10. 200 kg Urea+200 kg RP+200 kg KCl/ha	50.0	1.30	14,540	NA	NA
11. 200 kg Urea+100 kg SP-36+10 t ash/ha	44.5	1.39	13,127	590	11,467
12. 200 kg Urea+100 kg SP-36+100 kg KCl+ 10 t FYM/ha	48.4	1.53	14,292	760	12,262
LSD (P=0.05)	NS				
CV (%)	14.7				

[1)]FYM = Farm-yard manure; RP = Rock phosphate; SP-36 = Superphosphate (36% P_2O_5)
NA = data not available; NS = not significant.

3. Participating Farmer’s Experiments (FPR trials)

In the third year, 21 farmers in Wates participated in the project; of these, 12 farmers did FPR trials on their own fields, six practiced the hedgerow system on their whole fields, and three others joined in the execution of the demonstration plots. Similar to the results obtained in the demonstration plots, the practice of planting contour hedgerows decreased soil loss (**Table 6**). The local variety Ijo (Ijo is a term in Javanese meaning green) was generally superior to the introduced varieties (**Table 7**).

In Dampit, in addition to conducting more demonstration plots, farmers did experiments in their own fields. In 1997/98 and 1998/99, five and ten farmers, respectively, conducted FPR erosion control and fertilizer experiments. The results of the experiments conducted on farmers’ fields are presented in **Tables 8** to **11**. Highest gross incomes were generally obtained with applications of both farmyard manure (FYM) and NPK fertilizers. However, applications of only urea or urea with KCl (or ash) is likely to produce higher net incomes. In the FPR variety trials the local variety Caspro again produced the highest yield and gross income.

Table 6. Results of FPR trials on the use of hedgerows conducted in Ringinrejo village, Wates, Blitar, E. Java in 1997/98 and 1998/99.

Treatments	Crop yield (t/ha)				Soil loss
	Cassava		Maize		(t/ha)
(hedgerows)	97/98	98/99	97/98	98/99	98/99
No hedgerows	45.15	16.62	0.78	0.88	38.76
Calliandra calothyrsus	33.81	18.76	0.78	1.04	36.82
Gliricidia sepium	25.97	20.17	0.75	1.15	29.74
Leucaena leucocephala	35.94	16.54	0.79	0.98	-
Elephant grass	-	14.16	-	0.78	24.15
Vetiver grass	-	16.17	-	1.04	27.18

Table 7. Results of an FPR variety trial conducted by Mr. Hardy in Ringinrejo village, Wates, Blitar, E. Java, in 97/98.

Cassava varieties/clones	Cassava root yield (t/ha)	Gross income	Production costs	Net income
		('000 Rp/ha)		
Ijo (local variety)	42.55	7,233	2,430	4,803
SM 4772	41.99	7,138	2,430	4,708
UB 15/10	35.04	5,957	2,430	3,527

Table 8. Average results of ten FPR erosion control trials conducted for two years on farmers' fields in Sumbersuko village, Dampit, Malang, E. Java, in 1997/98 and 1998/99.

Treatments[1]		Dry soil loss (t/ha)	Yield (t/ha) Cassava	Yield (t/ha) Maize	Gross income	Prod. costs	Net income
					('000 Rp/ha)		
1. C+M	: farmers' practices; in-line mounds followed by up/ down ridging	17.4	17.80	1.15	4,641	1,200	3,441
2. C+M	: recom. practices; contour ridging; vetiver grass hedgerows	5.7	20.67	1.32	5,392	1,900	3,492
3. C+M+P+Cp[2]	: recom. practices; contour ridging on cassava line	14.1	7.10	0.82	6,436	2,370	4,066
4. C+M	: recom. practices; contour ridging; lemon grass hedgerows	8.6	19.30	1.25	5,086	1,900	3,186

[1] C = Cassava; M = Maize; P = Peanut; Cp = Cowpea

[2] Yield of peanut = 620 kg/ha; cowpea = 360 kg/ha in1997/98, and 750 and 400 kg/ha, resp. in 1998/99.

Table 9. Average results of five FPR fertilizer trials conducted by farmers in Sumbersuko village, Dampit, Malang, E. Java in 1997/98.

Treatments[1)]	Yield (t/ha) Cassava	Yield (t/ha) Maize	Gross income[2)] ('000 Rp/ha)	Fertilizer costs[2)] ('000 Rp/ha)	Net income ('000 Rp/ha)
1. Farmers' practice: 200 kg Urea/ha	22.60	1.50	7,302	240	7,062
2. 200 kg Urea+10 t ash/ha	25.40	1.15	7,778	440	7,338
3. 200 kg Urea+100 kg SP-36+10 t FYM/ha	26.20	1.60	8,354	590	7,764
4. 200 kg Urea+100 kg KCl+10 t FYM/ha	23.50	1.35	7,425	610	6,815
5. 200 kg Urea+100 kg SP-36+100 kg KCl+10 t FYM/ha	27.15	1.60	8,610	760	7,850

[1)]Cassava variety: Caspro

[2)]Prices: cassava Rp 270/kg fresh roots; maize 800/kg dry grain; FYM or ash 20/kg; urea Rp 1,200/kg; SP-36 1,500/kg; KCl 1,700/kg

Table 10. Average results of ten FPR fertilizer trials conducted by farmers in Sumbersuko village, Dampit, Malang, E. Java in 1998/99.

Treatments[1)]	Yield (t/ha) Cassava	Yield (t/ha) Maize	Gross income[2)] ('000 Rp/ha)	Fertilizer costs[2)] ('000 Rp/ha)	Net income ('000 Rp/ha)
1. 200 kg urea/ha	21.7	1.2	4,035	200	3,835
2. 200 kg urea +100 kg SP-36+10 t FYM/ha	24.2	1.5	4,605	530	4,075
3. 200 kg urea +100 kg SP-36+10 t ash/ha	22.5	1.0	4,025	530	3,495
4. 200 kg urea +100 kg KCl/ha	25.0	1.1	4,465	330	4,135
5. 200 kg urea +100 kg Sulphomag[3)]/ha	22.4	1.3	4,205	NA	NA

[1)]Cassava variety: Caspro

[2)]Prices: cassava Rp 150/kg fresh roots; maize 650/kg dry grain; FYM or ash 20/kg; urea Rp 1,000/kg; SP-36 1,300/kg; KCl 1,300/kg

[3)]Potasium-magnesium-sulfate: 22% K_2O, 11% Mg, 22% S

Table 11. Average results of ten FPR variety trials conducted by farmers in Sumbersuko village, Dampit, Malang, E. Java in 1998/99.

Variety	Yield (t/ha) Cassava	Yield (t/ha) Maize	Gross income[1)] ('000 Rp/ha)
1. Sembung (Faroka)	29.0	1.6	5,390
2. Caspro	35.0	1.4	6,166
3. OMM 90-6-72	31.0	1.3	5,495

[1)]Prices: cassava Rp 150/kg fresh roots; maize 650/kg dry grain

4. Technology Adoption

In the third year, there were six farmers in Wates adopting some technologies on their land. Four farmers planted *Gliricidia* hedgerows and two planted *Leucaena* hedgerows. As discussed before, until this year none of the suggested technologies increased crop yields. Thus, no direct benefits were obtained by the farmers. They adopted the technologies because they saw that these decreased soil erosion, and the application of the technologies was not so difficult and expensive as they had thought before. These results indicate that at least some farmers in Wates have a good perception of sustainable crop production. Thus, if they practice any land management technology, they do not only think about a direct benefit; indirect benefits, such as reducing soil erosion, has also become a consideration.

The reason that farmers prefer *Gliricidia* hedgerows are: the hedgerows help decrease soil erosion, it is easy to find planting material, the plants are easy to grow, leaves can be used for animal feeding and the stems for fire wood, and they are sure (based on what they saw during the field day at Jatikerto Experiment station) that the technology will eventually increase crop yields.

In the fourth year, the number of farmers in Wates adopting the technologies increased to 15 with a total land area of about 9.0 ha. The technologies adopted and the reason for the adoption are given in **Table 12**. Adoption of the technologies in Dampit started in 1999, with four farmers planting *Gliricidia* hedgerows on part of their land.

Table 12. Soil management technologies adopted by farmers in the 4th year in Ringinrejo village, Wates, Blitar, E. Java.

Technologies/Hedgerows	Number of farmers	Reasons
Gliricidia sepium	8	Decrease soil erosion Easy to find planting material Easy to grow for animal feeding and fire wood Improved crop performance Increase in crop yield
Leucaena leucocephala	4	Easy to find planting material Decrease soil erosion Animal feeding
Elephant grass (Pennisetum purpureum)	2	Animal feeding Decrease soil erosion
Calliandra calothyrsus	1	Decrease soil erosion Animal feeding

5. Farmer's Perception of the FPR Methodology

The use of the FPR methodology was evaluated by asking the collaborating farmers in Wates to answer a short questionnaire. Basically, they were happy with the FPR methodology because they obtained a better understanding about the difficulties, cost, and advantages of the technologies they developed. Soon after the technologies showed a good prospect, they already had the skill to implement the technologies. Hence the FPR method facilitated the adoption process.

Some farmers are proud that they are capable of developing by themselves new technologies for increasing crop yield and conserving their soil. Since they were involved in the development of the technologies, they consider that the technologies belong to them or their group. Therefore, they say that they have the responsibility for the success of the technologies.

The FPR method also increased the self-confidence and motivation of farmers to obtain any information concerning new technologies. They do not hestitate to come and discuss with any person, especially the extension services, when they have problems or difficulties; they will ask if there are any new technologies. The method also increases their willingness and ability to try new technologies.

CONCLUSIONS

The use of Farmer Participatory Research methodologies to develop and transfer better soil management practices for cassava farmers in Wates and Dampit has shown that:

1. Most farmers in the study area, actually have a good understanding that the low productivity of their crops is partially due to improper land management. They know that their soil is in a very poor condition and that soil degradation due to erosion has occurred.
2. Most farmers realize the importance of proper land management to both obtain a reasonable yield and to maintain or increase soil productivity. To some extent, farmers already knew how to implement soil conservation practices but they did not adopt the technology properly.
3. The reason farmers do not adopt soil conservation practices is that they think that the technology is very complicated, expensive, need a lot of labor, and does not give direct benefits.
4. Participation of the farmers in the identification of the problems and in the development of the technologies made the farmers think that the technologies belong to them, so they feel responsible for the success of the technologies. With this approach, farmers know that the use of proper land management technologies is not so complicated and costly as they had thought before.
5. The FPR approach increases the self-confidence of the farmers. The farmers do not hesitate to come and discuss their problems with other persons, especially extension personnel, and ask for information about their problems and about new technologies.

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