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Farmers' perceptions and the dynamics of adoption of a resource management technology: the case of *Mucuna* fallow in southern Benin, West Africa

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SUMMARY

Concern about the increasing degradation of natural resources in developing-country agriculture has led to the development of improved systems that make use of biological processes to promote production in a sustainable manner. The paper uses a case study on the adoption of *Mucuna* (*Mucuna pruriens* var. *utilis*) to examine the farmers' perceptions and dynamics in the adoption of such improved systems. Small-scale farmers ranked *Mucuna* fallow more highly than chemical fertilizers because of its weedicide effect, long-term improvement of soil fertility, low cost, and ease of availability at the village level. The grass roots extension organizations played a significant role in the dissemination of *Mucuna*. The removal of incentives to adopt did not adversely affect the trends in the spread of the technology. However, farmers consider insecure land tenure a constraint to adoption for (even) this non-perennial species.

Keywords : adoption, cover crop, farmers' perceptions, *Mucuna pruriens*, West Africa.

INTRODUCTION

The population of the developing world has doubled since 1965 and now stands at 5 billion. The United Nations Organization estimates that the developing-country population will reach 6.5 billion (84% of the projected world total) by 2020 and 8.2 billion (87%) by 2050 (Bongaarts and Bruce 1998). One of the main issues in food production systems in the twenty-first century is that the population is increasing while the quality and the quantity of arable land are declining in the developing world, especially in sub-Saharan Africa (SSA). There is gross nutrient mining. Average annual nutrient loss per cultivated hectare for SSA was estimated at 22 kg N, 2.5 kg P, and 15 kg K in 1982, and will be 26 kg N, 3 kg P, and 19 kg K in 2000 (Stoorvogel and Smaling 1990). Since the demand for increased food production continues to be pressing and land becomes unavailable, the only option for African farmers is the intensification of agriculture. Technological options are available, such as inorganic fertilizers. However, their use remains limited in Africa, mainly due to their high prices and inefficient marketing systems. In particular, nitrogen is the

major limiting soil nutrient. In the Mono department of Benin, nitrogen was evaluated at 68% of the total cost of chemical fertilizers required to restore soil fertility in a degraded land (van der Pol *et al.* 1993). At current prices, if imported urea fertilizer is chosen to remedy nitrogen deficiency, farmers or the Benin government finances have to support an extra cost of more than \$US 30 million. This option is out of reach for numerous small-scale African farmers. One way to remedy nitrogen deficiency and declining soil productivity is to explore natural sources of fertilizers. That is the aim of the alley cropping technology that was developed at the International Institute of Tropical Agriculture (IITA) in the 1970s and introduced in the Mono department in the early 1980s. However, the adoption of this technology by small-scale farmers lagged far behind the expectations (Recherche Appliquée en Milieu Réel – RAMR 1987). Participatory testing of alley farming with farmers indicated the complexity of its management and insecure land tenure as major problems that limit its wide adoption (Versteeg and Koudokpon 1991). Cover crops such as *Mucuna*

(*Mucuna pruriens* var. *utilis* - Leguminosae) are an alternative to the alley farming with perennial hedgerows and could contribute to sustainable agriculture in West Africa (Buckles *et al.* 1998). *Mucuna* varieties are herbaceous with an annual life cycle that ranges from 100 to 290 days. *Mucuna* varieties have a spreading/trailing or climbing growth habit except for some erect (bush type) varieties. *Mucuna* seed colours include black, white, brown, grey, or brown/black on white. The pods are pubescent and mature *Mucuna* pods are normally 5 to 13 cm long containing 4 to 12 seeds per pod (Carsky *et al.* 1998). In the study area *Mucuna* requires 150 to 180 days to reach its maturity, and then dies off, leaving thick mulch on the soil surface. *Mucuna* produces an organic biomass that may reach 6 t ha⁻¹ of dry matter at 30 WAP (Carsky *et al.* 1998) and accumulates up to 205 kg N ha⁻¹ after 3 months of growth during the rainy season in the tropics (Sanginga *et al.* 1996).

Mucuna fallow was introduced in 4 research villages of the Mono department in Benin Republic (RAMR 1987). Experiments on land productivity produced better results than from any other comparable resource management technology (Quenum 1995). Studies reported high rates of adoption, the major factors driving the adoption process and experiences of self-diffusion of the technology in the Mono department (Houndékon and Gogan 1996; Manyong *et al.* 1996; Galiba *et al.* 1998). Considerable efforts have undoubtedly been made to study the adoption in the primary areas of introduction, but no systematic study outside those areas has followed up the spread of the technology. Little is known about the farmers' perceptions and on how favourably they compare the technology to others. Information is also lacking on how farmers in the new areas of adoption reacted when the incentives to adopt that had accompanied the introduction of the technology in the primary areas were changed. Such information is essential to researchers and the national extension service to measure the persistence of the adoption process and the social relevance of the technology.

MATERIALS AND METHODS

Study area and selection of farmers

The survey was conducted from January to June 1998 in the 3 southern provinces of Benin. They represent about 10% of the country's area but contain about 70% of the whole country's population. With a population density of about 220 inhabitants km⁻², southern Benin is one of the most populated zones of SSA (Ministère du Développement Rural – MDR 1993). With the assistance of the extension services in each province a list was developed for all the villages that fulfilled the following two criteria: the farmers had had exposure to both *Mucuna* and chemical fertilizers and the villages were readily accessible. The first criterion was to compare *Mucuna*, a newly introduced resource management technology, with chemical fertilizer, an older technology well known-to-farmers. The second criterion was for easy contact with farmers during the course of the survey. Indeed,

all the villages are not easily accessible throughout the year, in particular during the high rainfall season, as a result of poor road conditions. For this practical reason we decided to retain for this study only those villages that were accessible at any time during the period of the survey. Given the limited resources available to the research team, ten villages were randomly selected. A population census was conducted in the selected villages. All the 4854 households were stratified into 4 groups: households that had used *Mucuna* only, those that had used chemical fertilizers only, those that used both *Mucuna* and chemical fertilizers, and those that had not used either technology. The sample of households reflected the proportion of the 4 groups in each village. However, only 400 households (or 8.2% of the total) were randomly selected on the basis of 40 households per village because of our limited resources. Then every farmer, either male or female, in each selected household became a potential respondent for the survey. In total, 335 out of 400 randomly selected households and 534 farmers (41.4% were women) finally agreed to participate in the survey. A structured questionnaire was administered to collect quantitative and qualitative data on socioeconomic characteristics of the farmers, land-use systems, type of resource management technologies, and the biophysical and institutional environment.

Data analysis

Evaluation of adoption

The adoption of the resource management technologies was assessed using data collected during the population census. The yearly rate of adoption between 1991 and 1997 was calculated by dividing the number of farmers who confirmed their utilisation of the technology each year by the total number of farmers in the 10 villages. The same procedure was used to calculate the proportion of farmland devoted to each technology.

Evaluation of farmers' perceptions of the technology

Farmers were asked to assess each technology against 10 criteria on a 5-point scale as follows: (0) completely disagree, (1) disagree, (2) indifferent, (3) agree, and (4) completely agree. A 'satisfactory score' on a particular criterion was considered if the rating was greater or equal to 3. A score greater than 50% of the total mark attainable (40 points) corresponded to an overall positive appreciation of the technology. The list of the 10 criteria for the evaluation of the technologies appears at the foot of Table 2.

Determinants of adoption

A simple Pearson chi-square was applied to analyse the level of significance on the relationship between some key variables and the decision to adopt (Sirkin 1995). Econometric models are often applied in adoption studies (Akinola 1987, Polson and Spencer 1991, Adesina and Zinnah 1993, Manyong *et al.* 1996; Manyong and

Houndékou 1997, Houndékou *et al.* 1998). However, the econometric models do not separate the effect of a single variable from that of its interaction with other variables. Since the aim was simply exploratory to identify factors that affect adoption, the Pearson chi-square was considered suitable.

RESULTS AND DISCUSSION

Types of resource management technologies

Any activity (material input or agricultural practice) that is voluntarily performed by farmers to maintain or improve the productivity of soil was considered a resource management technology. Six types were identified in southern Benin.

- Organic matter obtained from the clearing of land before planting. Some farmers continue, as a result of the slash and burn agriculture, to burn the shrubs and other small trees after slashing. Ash is left in the field and supplies nutrients to crops. Other farmers slash vegetation and leave it to decompose into humus without burning. These practices are considered to show farmers' awareness of the problems of soil fertility decline and of their strategies to address the issue by manipulating the biological processes.
- Home garbage, manure and compost. Waste from households and manure collected from animals are carried to and spread over the fields. Such organic inputs mostly benefit fields close to the homesteads because small quantities are produced and the cost of transportation to distant fields away from homesteads is high.
- *Cajanus cajan*. This is considered to be a resource management technology because of its dense biomass. *Cajanus cajan* is a dual purpose (grain and soil fertility) perennial shrub legume. Grain is edible and leaves may serve as forage to ruminants. However, the use of its grain for food is not popular. This limits the expansion of the crop among farmers. Therefore it is sparsely used in the study area.
- Chemical fertilizers. Their use entails the direct outlay of funds. Chemical fertilizers are usually spread on the cotton crop. They were introduced during the colonial era as far back as the early 1900s. Cotton is the major source of foreign currency for Benin. Therefore policy makers heavily support this crop through a well-organised delivery system of inputs and marketing of the output.
- Agroforestry technologies. They consist in planting trees whose branches are ultimately cut and used to fertilize the soil. Many types of tree arrangement are observed in the study area. In a forestry system, trees are grown on a piece of land, which, at the end of the period, is cleared for cultivation. Alley cropping and its variants consist of the simultaneous planting of trees and annual food crops. In southern Benin, *Acacia auriculiformis*, *Leucaena leucocephala*, and *Gliricidia sepium* are the most

commonly used trees. Palm trees (*Elaeis guineensis* Jacq.) are commonly intercropped with food crops. Palm fronds are regularly pruned as a result of the management of the growing trees, or before the tapping of palm wine on old trees, or to collect firewood. Small branches and leaves are left in the field and contribute to the recycling of soil nutrients in the cropping system.

- Mucuna planted fallow. The leguminous cover crop Mucuna is grown either in pure stands in an uncultivated piece of degraded land or in association as a relay with an annual crop such as maize. In sole cropping, Mucuna can be planted at 80 x 80 cm spacing with one seed per hole. The resulting density is 15,000 to 16,000 plants ha⁻¹ and requires about 10 to 15 kg ha⁻¹ of Mucuna seed. In intercropping, the seeding rate is reduced to minimize the competition with the companion crop. The seed quickly germinates and Mucuna can achieve nearly 100% groundcover in two months if soil fertility is adequate (Carsky *et al.* 1998), with vines up to 6 m length. For this reason Mucuna seed are sown only after 45 days in a field intercropped with food crops such as maize. In the study area the bimodal rainfall regime allows two cropping seasons a year. Therefore planting Mucuna during one cropping season results in the loss of production of edible crops in the following cropping season (Versteeg and Koudokpon 1991). However, the thick mulch left on the soil surface quickly decomposes and supplies soil nutrients to the subsequent crops, which results in higher yields in the second year cropping.

The last four resource management technologies are the most important.

Adoption rates

The calculated adoption rates are set out in Table 1. The rate of adoption for chemical fertilizers is the highest: 36% of farmers and 12% of farmland in 1997. Chemical fertilizers specifically made for cotton are commonly available in the area and only farmers who grow this crop get access to them through the cotton companies. However, farmers often use part of this fertilizer for their food crops or sell it to other farmers in the absence of other reliable sources of fertilizers in the study area. Adoption of Mucuna fallow was limited at a rate of 7% and on only 2% of farmland. This adoption rate is far lower than the 24% mentioned by Manyong *et al.* (1996). A possible explanation is the difference in the study areas. The present study includes a greater number of villages in the three provinces in southern Benin. The former study considered only research villages in one province where the technology was originally tested and promoted by researchers. Another possible explanation is in the dynamics of adoption that change over time (see section on the dynamics of the adoption). Nevertheless, the rate of 7% makes Mucuna fallow a promising new technology when compared to others already known to the farmers. For example, the calculated rate of adoption for an improved maize variety in the present study was also 7% for the same sample of farmers. If the adoption rate of 7% for Mucuna

could be extrapolated to the total number of farmers in the three southern provinces, about 14,000 farmers would be considered *Mucuna* adopters in 1997. Vissoh *et al.* (1998) mentioned 10,000 adopters in 1996. It seems that use of *Mucuna* is increasing over time. A seemingly surprising result of Table 1 is the adoption rate of agroforestry technologies, estimated at 11%. However, palm trees account for 90% of examples of agroforestry systems. Besides their use as a resource management technology, palm trees are an important component of the local economy. Palm wine is processed into a local alcohol that is highly valued in the market (Meikle, Gutierrez and Herren 1996). An average area for agroforestry technologies as large as 1.25 hectare per adopter suggests that the users were mainly owners of large holdings. The results on the dynamics in the adoption of *Mucuna* are presented later in the paper.

Farmers' perception of *Mucuna fallow*

The perception of the *Mucuna* technology was compared to that of chemical fertilizers already well known to farmers. Farmers' responses to the 10 criteria on the appreciation of both technologies are set out in Table 2.

Overall, farmers were satisfied with *Mucuna* technology since the percentage for global satisfaction (79%) was higher than the threshold of 50%. The global satisfaction index for chemical fertilizers rated 49% only. Farmers were satisfied with *Mucuna* because of its following major attributes, in decreasing order of importance: weed control, effect on soil fertility in both short and long term, low cost, ease of availability, and auto-diffusion. *Mucuna fallow* was not appreciated for use on rented land since farmers could not benefit from using the technology in the long run. Farmers preferred chemical fertilizers for their immediate effects on improving soil fertility. However, they are perceived to have no effect on weed control and long-term fertility, and are not easily available in the villages.

The detailed results on the comparison of the two technologies are strikingly revealing. Farmers were not satisfied with chemical fertilizers for 60% of criteria; the corresponding figure for *Mucuna* was only 20%. The percentage of satisfied users for *Mucuna* was higher than that for chemical fertilizers in 9 out of 10 criteria. Chemical fertilizers were assessed more highly only for being appropriate for rented land. The magnitude of the difference in the satisfaction score between the two technologies would

TABLE 1 Adoption of major resource management technologies in southern Benin, 1998

Indicators	Resource management technology			
	<i>Cajanus cajan</i>	Chemical fertilizers	<i>Mucuna fallow</i>	Agroforestry systems
Adoption rates (%) ^a	3	36	7	11
Numbers of adopters ^b	6000	72000	14000	22000
Mean area per adopter (ha) ^a	0.25	0.60	0.40	1.25
Total area (ha) ^b	1500	43200	5600	27500
Area in % of total farm size ^a	0.40	12	1.6	8

Notes: a. calculated from the sample in 10 villages (n = 580 farmers)
b. extrapolated to southern Benin (n = 200,000 households)

TABLE 2 Satisfaction score on chemical fertilizers and *Mucuna fallow* in Benin, 1998

Criteria ^a	% of farmers with a positive appreciation of the technology										Overall
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	
<i>Mucuna fallow</i> (1) (n = 168)	91	83	88	49	88	80	92	31	89	95	79
Chemical fertilizers (2) (n = 221)	84	45	49	36	74	24	7	63	27	80	49
Difference (3) (3) = (1) - (2)	+7	+38	+39	+13	+14	+56	+85	- 32	+62	+15	+30

Notes: n = number of users

a. the balance between the satisfaction score for a given criterion and 100% corresponds to the percentage of unsatisfied farmers
C1: Short-term effect on soil fertility; C2: Long-term effect on soil fertility (more than 1 cropping season); C3: Availability of the technology; C4: Does not worsen weeds problem; C5: Auto-diffusion; C6: Does not decrease soil fertility in long run; C7: Weed control; C8: Appropriate for rented land; C9: Cheap; C10: Willingness to use the technology again; Overall: global appreciation.

reveal the attributes for which farmers prefer one technology to the other (Table 2, last line). A positive sign is an indication that Mucuna is preferred to chemical fertilizers, and a negative sign gives opposite results. The greater the difference, the more a technology is preferred to the other. The greatest differences in favour of Mucuna were in its low cost, effect as a strong weapon against speargrass (*Imperata cylindrica* (L.) Rauschel), benefit to soil fertility in the long run, and availability to the poor farmers in the villages. The only difference in favour of chemical fertilizers in rented land (i.e. 32) was lower than that of Mucuna for 5 out of 10 criteria.

Dynamics of the adoption of Mucuna fallow

Between 1987 and 1991, Mucuna fallow and other agroforestry technologies were gradually introduced in 4 villages of the Mono department, one of the 3 southern provinces for participatory technology testing with farmers by RAMR. The primary objective of the project was to restore soil fertility (RAMR 1987). Farmers from the 4 research villages soon discovered that Mucuna could smother a noxious weed that is widespread in the derived savannas of West Africa. Its control by slashing is very labour-demanding (Osei-Bonsu and Buckles 1993). This positive attribute served as a 'window' for the acceptance and auto-diffusion of the technology (Manyong *et al.* 1996). Another important element in the diffusion of Mucuna fallow was the action of Sasakawa Global 2000, a non-governmental organisation that is involved in rural development. This private organisation encouraged the adoption of Mucuna between 1992 and 1996 by buying seeds from the adopters and distributing them free of charge to new users. The *de facto* market for the Mucuna seed added to the incentives for adoption. Further, Sasakawa Global 2000 provided financial support and logistics to the official extension services that were involved in the diffusion of Mucuna. Those policy interventions facilitated the quick spread of the technology (Vissoh *et al.* 1998).

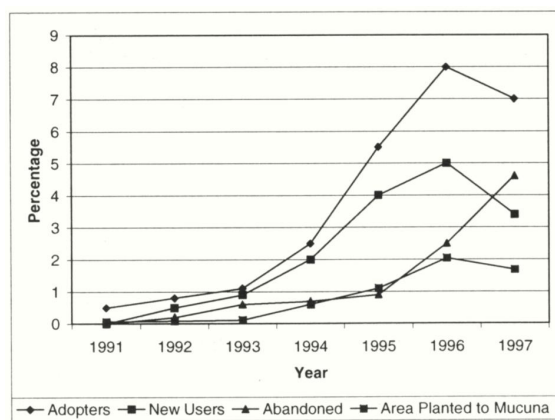


FIGURE 1 Evolution of the adoption rates of Mucuna fallow in southern Benin

Analysis on the dynamics of adoption of Mucuna indicated that the rate of adoption increased regularly from 1991 to 1996 (Figure 1). In 1996, the rate was three times that of 1994. This may be associated with the incentives for adoption from Sasakawa Global 2000 during that period. The abandonment of the Sasakawa Global 2000 intervention at the beginning of 1996 could have resulted in a steep drop in the adoption rate of Mucuna. Results for the end of 1997 indicated a small reduction of only 11% compared to the rate recorded for 1996, supporting the view that the adoption of Mucuna was for weed control and soil fertility improvement, not only because the seed could be sold. Nevertheless, for the first time since the launching of the technology in southern Benin, the rate of abandonment (4.6%) was greater than the rate of new adoption (3.4%). Moreover, the intensity of adoption remained low because the proportion of farmland devoted to Mucuna fallow had never been above 2.5%, suggesting that there were constraints to the wide integration of the technology within the existing cropping system.

Determinants of adoption

The empirical model to conduct the chi-square test includes variables that are expected to have a relationship with the adoption of a resource management technology. Those variables are on the socio-economic characteristics of farmers (sex, age, formal education, adult education, and farm size) and institutional factors (land tenure and access to formal and informal credit).

The results are summarised in Table 3. There is a significant relationship between a variable and the decision to adopt the technology if the chi-square test is significant at least at $P=0.05$ level. The significant relationship is positive if the percentage of farmers for that variable in the adoption category (column YES in Table 3) is higher than that on the 2 adoption categories together (column Total in Table 3). The significant relationship is negative if the percentage of farmers in the non-adoption category (column NO in Table 3) is higher than that of the 2 adoption categories together. If the chi-square test is not significant at $P=0.05$ level, the null hypothesis is not rejected, that is, there is no relationship between the variable and the adoption. The results in Table 3 indicate a significant positive relationship between the male sex variable and adoption because 72% of adopters are male while male farmers represent only 59% of the sample. The relationship is significant and negative between the female sex variable and the decision to adopt the technology. One possible explanation of the positive relationship between adoption and male sex is that men have larger holdings. Therefore, the opportunity cost of losing the second season cropping is lower and men are more likely to adopt the technology than women. Furthermore, as heads of households, male farmers have more access than female farmers to extension agents. Another result from Table 3 is on a positive relationship between the land availability variable and adoption. Very small farmlands are an obstacle to the adoption of Mucuna. The variables for formal education and education for adults are both positively related

to adoption and so is the access to informal credit variable. However, access to formal credit shows no significant relationship with adoption. In the study area, formal credit is almost non-existent. Farmers rely on informal credit that is socially easier to obtain and geographically nearer the potential borrowers. There was no relationship between farmer's age and adoption.

The effect of the land tenure variable was analysed in three scenarios. The first considers all plots together (scenario 'a' in Table 3). Then plots are split into two categories: first, plots for which the owners have only one type of land rights (ownership or borrowing or leasing) referred to as pure land rights (scenario 'b') and second, owners who have plots with different types of land rights referred to as mixed land rights (scenario 'c'). The hypothesis behind this clustering is that the adoption behaviours would be different: farmers in scenario 'c' are less risk-averse and

are expected to adopt the technology more readily, even in borrowed and leased plots. The results do indicate the same overall trend in the adoption decision for the 3 scenarios. Security over land (i.e. ownership of plot) positively influences the adoption of *Mucuna fallow*. Farmers who have insecurity over land (i.e. borrowing, renting or leasing) would be reluctant to adopt *Mucuna* except for mixed land rights farmers where a positive relationship is observed between the variable for the borrowing of land and adoption. This result suggests that farmers with mixed land rights on plots have a perception on the issue of land tenure that is different from that of farmers with pure land rights. Mixed land rights farmers are likely to adopt a resource management technology in plots with insecure land tenure, probably because they are less risk-averse. Indeed, the opportunity cost in losing a borrowed plot for a mixed land rights farmer is lower than for a pure land rights farmer. Therefore every

TABLE 3 Relationship between key variables and adoption of *Mucuna fallow* in southern Benin, 1998 (percentages in brackets)

		Adoption category		Total	Results
		YES	NO		
Sex	Male	74 (72)	239 (55)	313 (59)	$\chi^2=9.20^*$; c=0.13; N=534
	Female	29 (28)	192(45)	221(41)	
Age	< 40 years	49(48)	215(50)	264(49)	$\chi^2=0.026$; c=0.02; N=534
	≥ 40 years	54(52)	212(50)	268(51)	
Formal education	≤ 6 years	88(85)	397(92)	485(91)	$\chi^2=4.44^*$ c=0.10; N=534
	> 6 years	15(15)	34(8)	49(9)	
Adult education	Yes	37(36)	107(25)	144(27)	$\chi^2=5.19^*$; c=0.10; N=534
	No	66(64)	324(75)	390(73)	
Land availability	< 1 hectare	24(23)	218(51)	242(45)	$\chi^2=24.97^*$; c=0.21; N=534
	≥ 1 hectare	79(77)	213(49)	292(55)	
Access to formal credit	Yes	10(10)	31(07)	41(8)	$\chi^2=0.74$; c=0.04; N=534
	No	93(90)	400(93)	493(92)	
Access to informal credit	Yes	36(35)	85(20)	121(23)	$\chi^2=11.00^*$; c=0.15; N=534
	No	67(65)	346(80)	413(77)	
Land rights (a)	Ownership	99(69)	547(51)	646(53)	$\chi^2=23.64^*$; c=0.14; N=1210
	Borrowing	37(26)	308(29)	345(29)	
	Leasing	7(5)	212(20)	219(18)	
Land rights (b)	Ownership	76(72)	380(60)	456(62)	$\chi^2=6.51^*$; c=0.09; N=738
	Borrowing	24(23)	189(30)	213(29)	
	Leasing	5(5)	64(10)	69(9)	
Land rights (c)	Ownership	23(61)	167(39)	190(40)	$\chi^2=13.94^*$; c=0.17; N=472
	Borrowing	13(34)	119(27)	132(28)	
	Leasing	2(5)	148(34)	150(32)	

Notes: N= sample size (1210 plots for the land rights variables and 534 farmers for the other variables), χ^2 = chi-square value, c= contingency coefficient; ()= % of farmers per column total; * $P = 0.05$ or less; categories of age and land availability are formed by using approximately median points.
(a) = all plots; (b) = plots for owners of pure land rights; (c) = plots for owners of mixed land rights

plot with insecure tenure (borrowed, rented, or leased) should not be potentially excluded from targeting of the technology. Further studies would be required to validate such a hypothesis. In general, the analysis on the land tenure variables confirms to a large extent the low satisfaction score about the appropriateness of *Mucuna* for rented land.

The conclusions on the factors affecting the adoption of *Mucuna* fallow from the present study using a simple chi-square analysis are in line with those from past studies using complex multivariate econometric models (Houndékou and Gogan 1996, Manyong *et al.* 1996, Manyong and Houndékou 1997, Houndékou *et al.* 1998, Vissoh *et al.* 1998).

CONCLUSIONS

The purpose of this study was to evaluate farmers' perceptions of *Mucuna* fallow, a non-perennial resource management technology and to analyse the dynamics of its adoption in the southern provinces of Benin. Results on perceptions showed that farmers are satisfied with the technology and ranked it high above chemical fertilizers. The adoption rate was estimated at 7% of the population in the survey villages, corresponding to a total of 14,000 users for the southern provinces of Benin in 1997. Furthermore, adoption rates evaluated over a 7-year period (1991-1997) revealed dynamism in the diffusion of *Mucuna* fallow technology. A broad but simple evaluation of the determinants on adoption supports the view that education (formal or informal), credit (mainly informal), and land availability have positive effects on the probability of adoption. Also, male farmers and landowners were found to be more favourable to the technology than female farmers and tenants. However, mixed land rights farmers are more likely to use the technology in plots with insecure land tenure than pure land rights farmers. Generalisations about the effect of land tenure on the adoption of perennial and non-perennial resource management technologies by small-scale farmers should be avoided. The incentives created by Sasakawa Global 2000 for rapid diffusion of the technology could not be over-emphasised. This highlights the great role that grass roots organisations such as Sasakawa Global 2000 can play in the diffusion of complex resource management technologies. However, the removal by Sasakawa Global 2000 of incentives to promote the diffusion did not adversely affect the trends in the adoption. This is because the technology addresses basic agricultural problems and is socially relevant to the small-scale farmers. The application of a simple Pearson chi-square test led to recommendations on the determinants of *Mucuna* adoption that are similar to those from past studies using complex multivariate econometric models. Therefore, a simple statistical analysis may be adequate in an adoption study if its objective is to explore significant factors driving the adoption decisions. However, the choice of variables to test is critical and should be based on a thorough review of literature and sound hypotheses.

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