Annual Report 2001

Proyect PE-5 Sustainable Systems for smallholders: Integrating improved germplasm and resource management for enhanced crop and livestock production systems

CIAT
Centro Internacional de Agricultura Tropical
International Center for Tropical Agriculture

Annual Report 2001

Project PE-5

Sustainable systems for Smallholders: integrating improved germplasm and resources management for enhanced crop and livestock production systems

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Strategy

CIAT's mission is:

To contribute to the eradication of hunger and poverty in tropical developing countries by generating technology and information with partners through scientific research and dissemination that leads to lasting increases in agricultural productivity while preserving the natural resource base.

PE-5's contributes to this mission by collaborating with a range of partners to develop sustainable and productive technologies that integrate improved germplasm with conservative land management practices.

Improved germplasm is taken from germplasm improvement projects at CIAT and other sources and incorporated with improved management practices through farmer participatory research to develop generic technologies at the farm level.

Alternative technologies from CIAT and other organizations are evaluated at the watershed level for their biological, social and economic effects on productivity and resource management. An analysis of trade-offs between productivity and environmental benefit offers a range of integrated options for local and national policy makers.

Process

Research is conducted in a systems context.

In developing generic technologies at the farm/community level, there is diagnosis and evaluation of opportunities for new technologies within the overall farming system, participatory development of the technology with farmers and local partners, monitoring and impact assessment, feedback to applied researchers, and dissemination of the results.

Developing a range of integrated options at the watershed level, involves facilitating the formation and operation of multi-disciplinary research teams from organizations working in the area, characterization of the area, diagnosis of problems and opportunities, facilitating adaptive research to work on priority issues, monitoring and impact assessment. Concurrently there is an analysis and synthesis of results for community, researchers and policy makers.

Research focuses on both improving productivity and environmental protection with a balance between intervention in the evaluation of potentially useful technologies, and modeling to target research, integrate results, assess impact and extrapolate results.

We have a team of agronomists, livestock specialist, soil scientist, agricultural anthroplogist, resource economist, systems modeler and specialist in participatory research. Individual team members work on developing component technologies and integrated options at the watershed level. The research is dependent on effective partnerships within CIAT and with national and international organizations.

Strategic outputs

Integrated land use options that contribute to sustaining the natural resource base

Appropriate generic technologies, particularly in areas for which CIAT has a mandate

Decision support tools for use by farmers and researchers at the local level and planners and policy makers at the local and national levels

Increased capacity of national institutions to conduct component and systems research using participatory approaches

Where we work

We work in upland areas where there is a high incidence of poor rural families, low productivity and problems of resource degradation. At present, PE-5 in involved in the development of component technologies for cassava, forages and rice in the forest margins, hillsides and savannas of Latin America, Asia and Africa and in watershed level research in the forest margins, Pucallpa, Peru and a steep upland watershed in Vietnam.

Project Log-frame

CIAT

Area: Natural Resources

Project: PE-5 – Sustainable Systems for Smallholders: Integrating Improved Germplasm and Resource Management for Enhanced Crop and Livestock Production

Manager: Peter Kerridge

Narrative Summary	**Measurable Indicators/Milestones**	**Means of Verification**	**Assumptions**
Goal Knowledge, tools, technologies, skills and organizational principles that contribute to the improved management of natural resources are accessible to NARS and beneficiaries	- Use of CIAT NRM research outputs in 3 reference sites in 5 years, related to changes in land management and associated with increases in per capita income and food availability, improved soil-water-nutrient use efficiency, increased biodiversity in production systems, and stakeholders participating in land use planning. - Use of the CIAT NRM research outputs beyond the 3 reference sites in the 3 target agroecosystems (savannas, hillsides, forest margins) by stakeholders in 5 years. - CIAT NRM research outputs applied by at least 3 other institutions outside LAC by the end of the 5th year.	Projects, plans and reports of national sector agencies, donors, NGO's and community-based organization in the 3 reference sites in LAC mandate agroecosystems which refer to use of CIAT's NRM research outputs.	CIAT's partners are willing to use these research outputs to improve NRM.
Purpose To collaborate with national organizations in developing integrated crop, livestock and arboreal technologies that are adoptable, productive and sustainable	- % increase in income of smallholders - no. of new component technologies - % decrease in soil loss, and increase in soil fertility & water retention - changes in functional aspects of biodiversity - decreases in deforestation and burning - widespread adoption of sustainable practices	- impact evaluation studies	- donor and client support for sustainable land use research

Outputs

Narrative summary	Eco.	Personnel	Indicators (Intermediate impact) / Milestones	Means of Verification	Assumptions
Outputs 1. **System components assessed to provide alternative land use options**			Synthesis of research outputs available for local and national planners		
	FM	DW	02 Land use alternatives assessed for use in local and national planning for the forest margins	Workshop and technical reports	collaboration and integration of research activities in Pucallpa
	Asia	PK	01 Community involved in improving productivity and management of resources at a mountainous site, central Vietnam	technical report	Continued donor support
	H, S FM	CEL. FH	00 Options and incentives necessary to develop and utilize feed resources in a sustainable manner in dual-purpose cattle systems in Latin America	workshop and technical report	Continued collaboration with NARS partners - Additional financial support obtained
	FM	TM	01 Determinants of health and nutritional status in the Aguaytia watershed 01 Community action plans developed in relation to health goals of individuals and communities in the Aguaytia watershed 01 Synthesis of results of research on health and nutrition conveyed to national health authorities	final report to donor	
	Asia	PK	02 Synthesis of options for an integrated approach to improving feed resources for livestock in SE Asia 04 A synthesis of options for sustainable management of cassava-based systems in Thailand, Vietnam and China	operational plans of government agencies - Final report to donor	Maintenance of close relations with NARS IP-3 continues to support R&D in Asia
	Asia	RH			
Activities **(CIAT collaborators)**			Milestones	Annual report PE-5	
1.1 Characterize and diagnose problems and opportunities at the system level through community participation (with PE-2, PE-4, SN1, SN3)	FM	SF, DW,GH,	00 Synthesis of stakeholder analysis of farmer needs and research issues in land use in the Aguaytia watershed		
	FM	GH, DW	00 Analysis of poverty and land use in the Aguaytia watershed		
	FM	SF, DW, FH	00 Diagnose of needs and opportunities in Moyobamba site		
		DH,DW, RL	00 Examine farmer decision making through participatory mapping		
	LAC	FH	00 Economic impact of spittlebug in Brachiaria pastures		
	Asia	Univ. Hue SF, PK, LVA	00 Interpretation of data on characterization in Hong Ha watershed and research opportunities diagnosed with Hue team		
1.2 Assess biological and socio-economic impact of alternative land use options (PE-2, PE-4, BP-1)	FM	DW	00 Analysis of economic benefits to farmers associated with alternative land use options in Aguaytia using profit-maximization		
		DW,GH	01 Riverine flood risk mapped in Aguaytia watershed		
		FH	00 Analysis of intensification of milk prod.systems, Colombia		
1.3 Determine social indictors of health in Aguatyia watershed	Asia	UnivHue,PK	00 Economic analyses of crop alternatives in Hong Ha, Vietnam		
	FM	TM, SF, PK,			

Narrative summary	Eco.	Personnel	Indicators (Intermediate impact) / Milestones	Means of Verification	Assumptions
		DW	00 Collect and analyze data on current health and nutritional status of 8 communities in Ucayali Department, Peru		
1.4 Evaluate social and private trade-off of alternative land use options (BP-1)			00 Conduct enthographic study at 3 sites in the Ucayali, Peru		
	FM	DW	00 Develop plans for a course in ecosystem approaches to human health		
1.5 Synthesize results to show implications of various policy options (PE-4, BP-1)		DW	00 Analyze of economic value of fallow periods in Aguaytia watershed 00 Evaluate the impact of open-access land policy upon NR use and economic viability of farm settlers in comparison with those in Brazil		
	LAC	FH, CEL bbb	00 Analyse impact of new forage technology options for dual-purpose cattle in LAC in relation to market and policy incentives		

Narrative summary	Eco.	Personnel	Indicators (Intermediate impact) / Milestones	Means of Verification	Assumptions
Output 2. **Generic technologies for sustainable production developed through farmer participatory research**			Farmers using new technologies that are more productive and conserve natural resources		
	FM	DH	02 New technology options developed for Aguaytia watershed	Annual report	
	Asia	PK	01 New technologies being used by farmers in Hong Ha, Vietnam	Annual report	
	H	CEL	00 30% increase in milk production in dry season, CA	Report Tropileche	
	H	MP	02 Increased use of forage legumes by small farmers in CA	Annual report	
	S	CEL	03 New forage options for Llanos	Annual report	
	Asia	PK	02 A core group of farmers using productive and sustaionable forage technologies at 6 sites, one each in Indonesia, Lao PDR, PRC, Philippines, Thailand and Vietnam,	Impact evaluation	
	Asia	PK	02 Seed and planting materials of promising forages easily accessible to farmers at 6 sites (as above)	Impact evaluation	
	Asia	RH	04 Increased net benefits to farmers at 15 sites with less erosion in cassava-based systems in Asia	- Impact evaluation	
Activities			Milestones	Annual report	
2.1 Farmer experimentation to adapt technologies	FM	DH	00 FPR Rice and plantain trials evaluated 00 Development and evaluation of DRAU to conduct demand-driven		

			systems research and extension		
		DW	00 00 Application of economic model for analysis of technology alternatives in the Aguytia watershed		
	Asia	PK, RH	00 A range of system options being evaluated by farmers at watershed site, Hong Ha, Vietnam		
2.2 Improving feed quality and resource management in dual-purpose cattle production systems (IP-5, PE-2)	H, FM	FH,PJA,	00 Continued farmer evaluation of new forage technologies		
	H	FH	00 Commence scaling up of new technologies in benchmark sites		
	H	PJA	00 Study impact of on-farm research on NRM indicators in CA		
	H	MP, FH	00 Study on early adoption of Arachis pintoi in CR		
	H	PJA,FH	00 Introduce technologies to other countries		
	H	CEL	99 On-farm trials maintained for evaluating new forages, Llanos		
2.3 Evaluating legumes for feed supply, nutrient cycling and improved fallows (IP-5, PE-2)	Africa	MP, PJA	02 Increased use of forages legumes by small farmers in CA.		
		MP, PJA	00 Pilot sites established.		
	Asia	RR	00 New legumes being evaluated for soil fertility improvement and feed supply		
2.4 Developing sustainable forage technologies for upland farming systems	Asia	PK, RR	00 Implementation of new ADB project, site selection and partner identification		
2.5 Developing improved soil management practices in cassava-based systems	Asia	RH	00 FPR trials to investigate the effects of new varieties, intercropping, fertilizer and erosion barriers on cassava prodn.establ. at 6 sites		
			00 Investigation of improved surface management at 2 sites		
2.6 Establish and maintain databases of information and results	All	Team	00 Databases maintained		

Narrative summary	Eco.	Personnel	Indicators (Intermediate impact) / Milestones	Means of Verification	Assumptions
Output 3. **Models/frameworks developed to target research, integrate results, assess impact and extrapolate results**			Farmers and technicians using models/approaches that assist decision making at the farm and watershed levels		
	FM	DW	00 Economic model available for ex-ante evaluation of research proposals in Pucallpa, Peru	Working document	Collaboration with PE-3 and funding available
	FM	DW	00 Indicator framework linking immediate outputs and development goals forest margins, Pucallpa	Working document	Data available
	Asia	TP,PK, SF	00 Participatory evaluation and monitoring framework to assess FPR technologies in SE Asia	Working document	Collaboration with partners Need perceived by partners Partners trained
	H	MP, LHF	01 GIS-based DSS of forage adaptation in CA used by extension staff	Final report	
	Asia	RH	01 Decision guides available on soil fertility management for use by extension workers and farmers	Extension material	
Activities			Milestones	Annual report	
3.1 Develop economic models to assess technology/land use options	FM	DW	00 Economic model for ex-ante evaluation of research interventions in Aguaytia watershed		
	FM	DW,GH,RL	00 Economic model developed to assess potential of riverine plains in Ucayali		
	FM	DW,SV,CC, WG	00 Coordinate modeling approaches with ASB-Brazil researchers		
3.2 Framework for monitoring and assessing impact of research in the forest margins	FM	DW,GH DH,AI	00 Provide lead in refining impact assessment framework Synthesize with other benchmark sites		
3.3 Develop FPR methodologies A. Develop participatory monitoring and evaluation methods for technology development (SN-1, PRGA)	Asia	TP, PK	00 Participatory evaluation and monitoring framework to assess FPR technologies 00 Workshop on application of this framework		
B. Development of a framework for scientists working in the Forest Margins that will lead to more effective interaction among scientists, extension workers and farmers C. Develop methodologies for scaling-up FPR technologies	FM	DH	00 Experience based learning strategy 00 Nucleus PR team that provide mutual support 00 Introduction of techniques for open process evaluation 00 Farmer group initiating research		
3.4 Integrate information on variety adaptation and appropriate technologies with GIS databases to target germplasm	Asia	PK, RR	00 Workshops held, report on alternatives		

use (IP-5, PE-4)	H	MP, LHF	01 GIS-based DSS for forage adaptation 00 Secondary sites established for verification		
3.5 Develop decision guides on soil fertility management (PE-2)					
3.6 Manuals	Asia	RH	01 Utility of information on soil fertility management packaged for use by extension staff and farmers evaluated		
	Asia	WS, PH	00 Manuals on forage species, FPR and Forage Agronomy		

Narrative summary	Eco.	Personnel	Indicators (Intermediate impact) / Milestones	Means of Verification	Assumptions
Output 4 . **Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices**			Organizations with trained staff using new strategies for R&D		
	All		00 Coordinated approach to systems oriented research and funding in place	Annual report, CCER	Consensus within team
	FM	PK, DH, SF	00 A multi-institutional and participatory approach to R&D accepted by NARS in Pucallpa and operational at Hue, Vietnam	Site visit	Approach achieves successes Need and collaboration
	All	Team	00 Functional partnerships – Tropileche, DEPAM, SEAFRAD, Cassava R&D network, Univ. Hue	Annual report	
			02 Strategy for scaling up technologies developed using FPR in SE Asia		New projects funded
	Asia	PK, RH, PH	00 Manuals on training approaches for applying PR in SE Asia	Working document	
			00 Technicians at pilot and satellite sites trained in participatory technology development	Manual available	Special project funding maintained
	All	Team		Training courses	
Activities			Milestones	Annual report	
4.1 Funding and coordination of PE-5	All	JAA DW PK Team	00 Funding obtained for on-going and new activities 00 Coordinate local CIAT activities in Pucallpa 00 Coordinate CIAT activities in Asia 00 Project development for Special Project funding		
4.2 Facilitate multi-institutional research at the watershed level for R&D (SN-1, SN-3)	FM	DH, DW	00 Regular meetings and collaboration within DEPAM team		
	Asia	PK	00 Facilitate research at watershed site, Vietnam		
4.3 Facilitate regional partnerships/ networks (IP-3, IP-5)	All	RR FH DW DW	00 Coordination meetings of FSP 00 Coordination meeting of Tropileche 00 Facilitate private partnerships for Tropileche 00 Coordination of CIAT activities in Pucallpa		
Compare effectiveness of different	All	DH	00 Analysis of results of action research and content analysis in output		

institutional models for effecting changes in NRM		Asia team	02 Review achievements in scaling up technologies developed using FPR		
4.5 Develop training approaches and materials on targeting, development and diffusion of new technologies and land use systems, and provide training for partners (SN-3)	FM Asia	WWS DW DH DH RR, PCK RH, SF PK, RH	00 Manuals on FPR approaches 00 Training provided on use of economic model in Peru and in CIAT 00 PR training courses in Pucallpa **00 Learning project** **00 Workshop on scaling up in Asia in July, August** **00 FPR courses in Vietnam and Thailand** 01 Approaches to scaling up new technologies		
4.6 Communicate results through networks, workshops and journals	All All	RH RR Team	**00 Workshop – Asian Cassava Research Network** **00 FSP Planning workshop** **Yearly output of papers, newsletters and internet**		

1. Latin American Component

1.1. Annual Report – Forest Margins, Pucallpa, Peru 2001

1.1.1. Output 1. System components assessed to provide alternative land use options

1.1.1.1. Assess biological and socioeconomic impact of alternative land use options

Milestone 1:
The Feasibility of Agricultural Technology Adoption by Smallholder Frontier Farmers and the Role of Seasonal Labor

A seasonally adjusted value of labor, calculated with the monthly opportunity costs of labor estimates, quantifies the effect of varying labor restrictions for a typical farm. Altering traditional technologies (rice, maize, cassava) in order to reduce seasonal labor shortages, permits both larger and more diverse harvests, and thus should become a research priority.

Development projects often promote agricultural technologies that provide little benefit to farmers. This paper analyzes the relationship between technology use and seasonal labor demands within a context of abundant land and scarce capital. An agro-economic mathematical model reveals that with respect to traditional agricultural practices, the allocation of farmer labor resources to new crops is either complementary or competitive. Crop technologies that are complementary are little affected by seasonal labor restrictions and are more apt to be adopted. In contrast, labor-competitive agricultural technologies require labor inputs during the same months as traditional systems. Theoretical and empirical analyses compare two characteristics of agricultural technologies: 1) seasonal labor requirements (complementarity -v- competitiveness) with that of 2) product output destination (household and market -v- market only). Both analyses point to a greater earnings potential of technology change not through productivity increases but by changing the seasonal characteristics of their cultivation.

To more accurately measure the value of seasonal labor within a farm (Figure 1), we suggest an alternative measure: returns to opportunity-costed labor (ROTCL). This measure uses a differentiated or seasonally adjusted value of labor, which is calculated by the monthly opportunity costs of labor estimates for a typical farm producing traditional crops. The opportunity cost of labor reflects the value of labor as represented by the overall farm earnings decrease that a farmer would experience if he or she had one less unit of labor (workday) in that month. RTOCL are the returns to labor activity, which accounts for the differentiated monthly costs (i.e. opportunity costs). During the months of peak labor demand (e.g. harvest, land preparation) the opportunity cost of labor can be markedly higher than the wage rate. The opportunity cost component of RTOCL captures a farmer's management strategy for the established and traditional agricultural systems. Agro-economic modeling of a traditional farming system facilitates the calculation of monthly opportunity costs. By virtue of opportunity costs being based upon current traditional management practices, their estimates factor in farmer preferences and responses to external uncertainties such as weather variability, pests and diseases, unreliable markets and erratic prices.

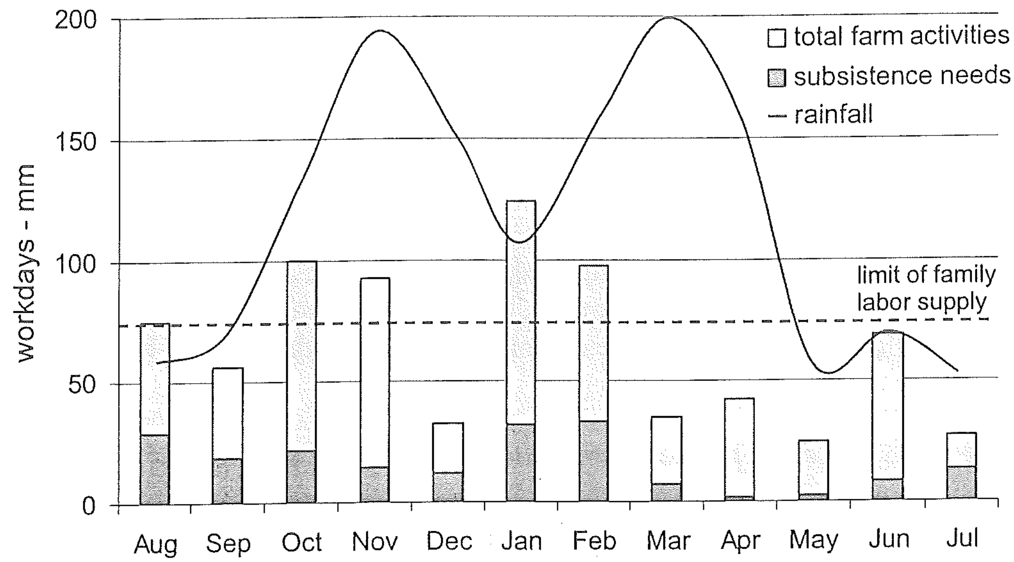

Figure 1. Monthly rainfall and labor requirements of total and subsistence production activities of a typical pioneer farm

Quantifying the impact that seasonal labor shortages have upon specific agricultural technologies permits researchers to better understand conditions facing smallholder farmers. The difference between RTL and RTOCL represents the average opportunity cost of labor above the standard wage rate and serves as a complementarity-competitiveness measure of an agricultural technology. Subtracting the measures contrasts standard wage and the average monthly opportunity costs of labor, corresponding to use of the technology: $w - \left[\left(\sum_{i=1}^{12} w_i L_i \right) \Big/ L \right]$, where w = wage, L= total labor require for the agricultural activity, w_i = opportunity cost of labor in month i, and L_i= the amount of labor required in month i. Higher values imply greater labor competitivity.

Figure 2 summarizes the results of the RTL and RTOCL measures. To illustrate, the crop technology with the greatest opportunity cost of labor is that of maize. Thus, the opportunity cost above the standard wage rate of increasing maize production is $8.4 per workday, on average. Two factors justify its planting despite the apparently high estimate: 1) maize production includes the cost of preparing fallow land and 2) maize is part of an intercropping system, thus other more lucrative crops subsidize its production. For instance, beans, which are vines, use maize as climbing support. On the other extreme, citrus technology reveals no difference between the standard wage and the average of the monthly opportunity costs of labor since citrus labor demands are complementary to the scarce labor months inherent with traditional production. Beans are also a purely complementary technology. All the rice technologies are relatively labor competitive, with the fast maturing scenarios being less so. For alternative crops, pineapple and oil palm are more labor complementary than cocoa and cotton production. Despite this labor complementary trait, these two crops remain unattractive to farmers due to low product prices.

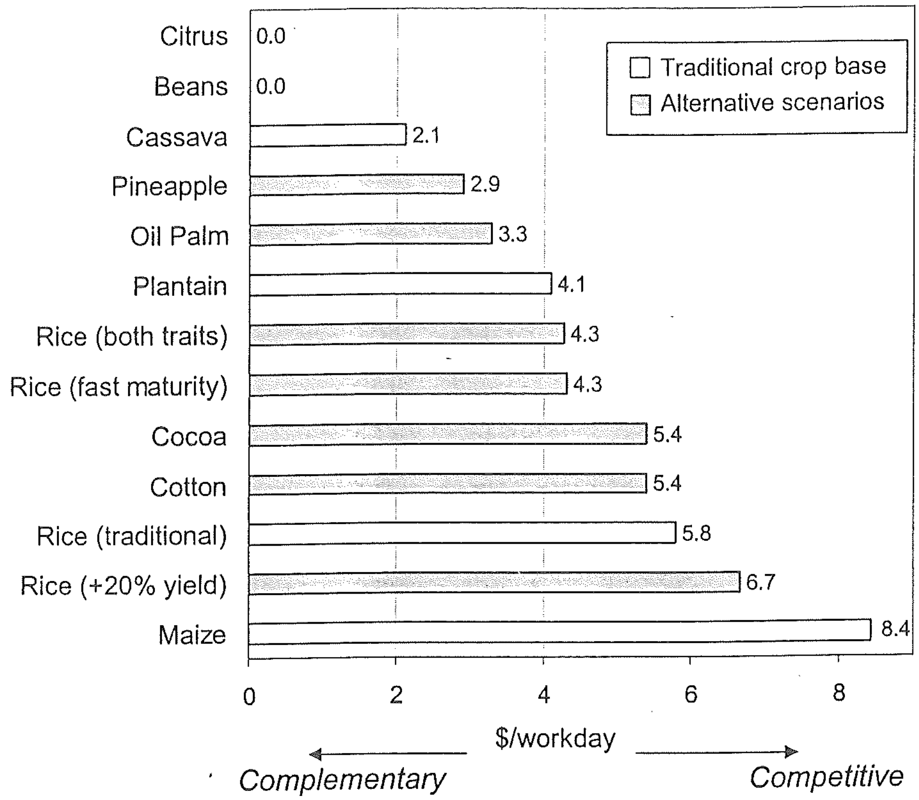

Figure 2. Labor complementarity measures of agricultural crops with respect to base farming system (with 2 persons hired during January harvest)

Seasonal labor use is one of many factors that farmers consider when adopting agricultural technologies. Intermediate stage frontier farmers also have extreme challenges marketing their harvests and could prefer to produce for local and national markets rather than risk severe price declines inherent with export crops. Combining the analysis of seasonal labor requirements (complementarity -v- competitiveness) with that of product output characteristics (household and market -v- market only), produces four contrasting scenarios of agricultural technologies depicted in the quadrants of Figure 3. Since there are few absolute examples that have pure complementary or purely competitive seasonal labor characteristics, two boxes span the quadrants in order to more accurately summarize the results.

Quadrant B refers to an improved household and market crop technology that is labor-competitive with traditional crop production. Increased yield rice serves as an example. The labor competitive characteristic of this crop compromises the potential earnings increase. Although greater production results, it occurs during the typical harvest period. Other traditional crops such as maize fit in this category.

Quadrant C represents a technology improvement of a labor-complementary household and market oriented crop. Beans correspond to this case. Farmers can increase production without exacerbating seasonal labor shortages. Under the more restrictive labor purchase circumstance, the fast maturing rice essentially fits within this case. Harvest occurs earlier during a month when there is surplus family labor supply, thereby reducing the seasonal labor shortage. Thus a farmer can attain a double benefit of increasing production of the traditional crop and producing others concurrently.

Quadrant D illustrates a labor-complementary technology improvement of a market-traded crop. Spontaneous adoption of both citrus and pastures by intermediate stage farmers demonstrates their positive attributes of labor complementarity and potential earnings.

Quadrant E depicts an improvement in a labor-competitive market-traded crop. The commonly promoted agricultural technologies of national and international development institutions correspond to this case. Oil palm, pineapple, cocoa, and cotton (Scenarios 2-4) are specific crops that are both adopted and avoided by farmers, depending upon market prices and levels of financial support. An important factor inherent to perennial and semi-perennial technology is a greater difficulty of changing land useonce establishment has occurred.

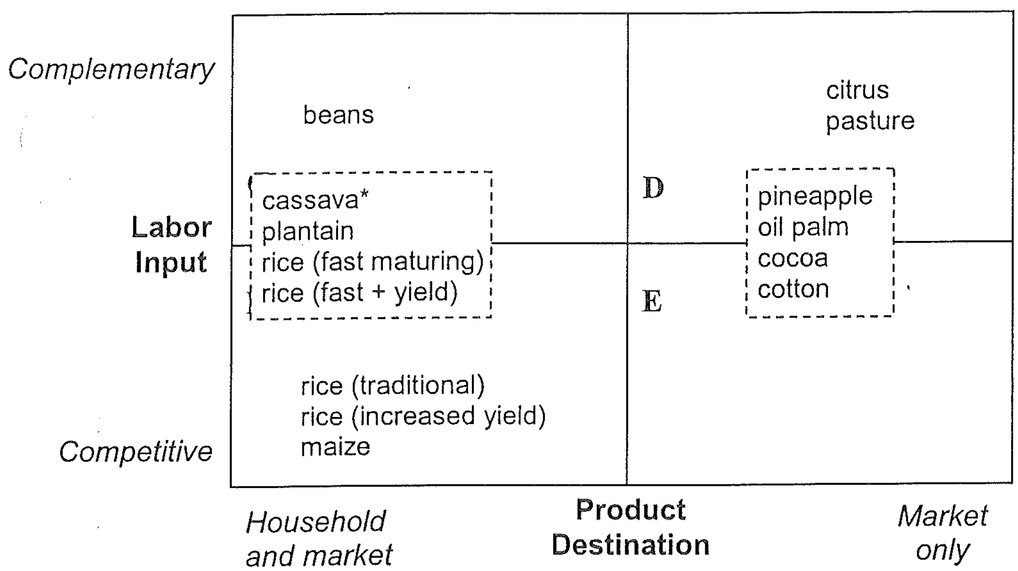

Figure 3. The relation of agricultural technologies with labor inputs and product destination

Agricultural technology development for smallholder farmers in tropical frontier regions requires special consideration of seasonal labor restrictions. Analyses based upon homogenous farming systems and standard yearly averages are sure to misrepresent the diverse reality. In a context of rapid change, analysis needs to be adjusted accordingly as demonstrated by the contrasting results of the distinct capital availability assumptions. Relatedly, the adoption of technology inputs changes the base scenario of the typical farmer. Different patterns of seasonal labor can result. Therefore, adopted technologies become a new basis from which to determine complementarity of future technologies. Within Figure 3, this is represented by adopted technologies shifting down to the lower two competitive quadrants. Altering the traditional technologies (rice, maize, cassava) in order to reduce seasonal labor shortages, permits both larger and more diverse harvests, and thus should become a research priority.

Douglas White and Ricardo Labarta
Challenges: During the past two years Peruvian government instability has made coordination with national partners difficult. CIAT has continued the analysis and writing phases of the project.
2002 plans: work with national partners (researcher and extensionists) in model development and refinement.

Milestone 2:
Amazon Riverine Agriculture: Productive but Unprofitable?

Although alluvial soils produce greater harvests of many agricultural crops, high transport costs and potential flooding problems limit their profitability

Riverine areas of the Peruvian Amazon have been the first settle sites for both indigenous people and colonists. The water system of the Amazon basin provided both the means of arrival and communication. Settlers near the rivers have developed a diversity of activities including fishing, hunting and agriculture. Agriculture is typically an activity that requires the most amount of labor. Studies undertaken in the Amazon region have identified the riverine soils as being the best for agriculture and various researchers have suggested that agriculture should be concentrated in the riverine regions. Nevertheless, good soils do not guarantee excellent condition upon which to base productive agriculture. Unfortunately, very few studies have been undertaken to understand economic aspects of riverine agricultural systems, whereas anthropologic and biophysical aspects receive more attention (Hiraoka, 1986;Padoch and De Jong, 1992;Chibnik, 1998)).

This research paper analyzes the economic earnings from riverine agricultural systems in the Ucayali region of Peru. Analysis takes into account the socio-economic and biophyiscal conditions that riverine producers face. The study focuses upon two distinct groups of farmers near the city of Pucallpa: 1) full time colonist farmers and 2) temporary farmers. The objective is to analyze the interrelation between profitability of agricultural crops and marketing conditions. This permits the determination whether riverine areas can be a future key to development in Amazon region. We conclude that although alluvial soils produce greater harvests of many agricultural crops, high transport costs and potential flooding problems limit their profitability.

CIAT- Ricardo Labarta, Douglas White, Efraín Leguía, Jhon Avilés
Wagner Guzman (ICRAF), Javier Soto (MinAg), Héctor Campos (INIA)

Challenges: During the past two years Peruvian government instability has made coordination with national partners difficult. CIAT has continued the analysis and writing phases of the project.
2002 plans: work with national partners (researcher and extensionists) in model development and refinement.

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Milestone 3:
Forest Cover and Household Economic Security on the Amazon Frontier: An Environmental-Economic Tradeoff with the Adoption of Agricultural Technologies?

Detailed analysis of farm management strategies via agro-economic modeling reveals how agricultural technologies are likely to impact on-farm forest cover and household economic security.

The objective of this research is to examine how agricultural technologies affect both on-farm forest cover and household economic security within a context of abundant land. In order to understand the use of agricultural technologies by farmers, we construct an agro-economic mathematical programming model of a 'typical' smallholder pioneer farm. Modeling enables inquiry into the complex interaction between household needs, agricultural practices and available farmer resources. Modeling also provides a framework with which to 1) conduct ex-ante analysis of farmer incentives and management decisions, and 2) determine probable environmental-economic impacts of introducing new technologies. These impacts range from changes in farm earnings and household economic security to the tendency to convert greater amounts of forest for agricultural use.

The improvement of agricultural performance is one means by which research and development institutions, both national and international, attempt to enhance the condition of farmers. Yet in the forest margins, a challenge facing policymakers is to determine the probable effects of introducing agricultural technologies upon human well-being and the environment.[1] To illustrate, let us pose the question: could a new crop or variety lead to more deforestation? Higher yield varieties may lead to faster deforestation if fertile soils are required. Consequently, farmers would redirect their agricultural practices away from the utilization of fallow land and instead convert high forests at a faster rate. Or let us ask: does a technology increase the earnings of farmers? In many cases, with technology interventions come increased market involvement and even market dependence. Household economic security can be gravely affected when crop prices decline, especially if market-oriented crops have replaced subsistence crops.

The analysis focuses on three farm management choices of pioneer settlers that affect the use of agricultural technologies: a) the destination of product output (for market trade or household use), b) the use seasonal labor inputs (the complementarity or competitiveness with respect to traditional agriculture production), and c) the use of land quality inputs

[1] This policy decision can be taken earlier during the earlier prioritization phase of new technology creation.

(requiring fertile recently-cleared forest or the less productive fallow lands). Taken together, the balance between these decisions sheds light upon potential environmental and economic impacts of agricultural technologies. The analysis of environmental-economic tradeoffs highlights the importance of recognizing the socio-economic and bio-physical context of the region.

Management choices of pioneer farmers and technology adoption

In contrast to the exogenous variables, farmers have influence over and can choose their labor and land inputs, and the types of crops to produce. This trio is crucial to the management decisions of swidden agricultural systems and is the basis of the analytical framework. Standard analysis of agricultural systems overlooks the subtle characteristics swidden agriculture and their influence upon farm management including technology adoption.

To illustrate, farmers can cultivate larger areas when more **labor** is available and produce more harvests by planting a variety of crops and during the year. This diversification strategy enables farmers to alleviate labor shortages during peak demand seasons of the agricultural calendar (in addition to taking advantage of different land qualities mentioned below). However, smallholder farmers often can not easily change their established traditional farming systems, given the product the restrictive context of the pioneer swidden farm (i.e. marketing difficulties). Hence, farm management strategies result in high demand seasons for labor and impede the adoption of new agricultural technologies. Technologies that require labor in shortage months are termed labor-competitive, whereas those technologies with requiring labor inputs during month of surplus are labor-complementary (White and Labarta, 2001).

Similar to labor, increasing the amount of **land** under cultivation is but one manner by which to increase production. Swidden lands also possess a heterogeneous quality. Yields are typically higher in converted high forests, decrease in converted secondary forests or fallows, and are lowest in previously cultivated areas that form part of a rotational cropping activity (Ruthenberg, 1976). Crops and varieties that are more demanding of soil fertility and susceptible to weeds have a tendency to be planted in recently-cleared high forest plots. Heartier crops that can withstand degraded soils and weed invasions are planted in formerly cropped land parcels. The importance of land quality relative to land quantity stems from the abundance of available land with respect to the other factors of production. Nevertheless, higher soil fertility and fewer weeds come with an increased cost of land preparation. The conversion of high forest to agricultural use typically requires more labor than preparing fallowed land and considerably more preparation time than continuous cultivation.

The third choice available to pioneer farmers is that of **farm output**. Unlike larger-scale commercial agriculture, smallholder farmers often cultivate crops for household use in addition to crops for market sale. Traditional crops have the dual purpose of supplying the household with foodstuffs and providing income with the sale of the surplus. Although prices for traditional crops are rarely high, they are more stable than market-only crops such as pineapple, oil palm, and cocoa. Smallholder farmers are exposed to financial losses since governments in tropical countries have few resources with which to support agriculture (i.e.

subsidies, marketing initiatives, insurance or credit programs). Therefore most swidden farmers do not plant export-oriented crops even if they may be more profitable.

The likelihood of agricultural technology adoption can be surmised by carefully examining the interrelations amongst the three management choices available to swidden farmers (Figure 4). Agro-economic modeling enables researchers to contrast scenarios according to different in labor and land inputs, and product outputs in much the same way a smallholder farmer evaluates both constraints and opportunities, and the associated environmental-economic tradeoffs.

Management choices and environmental-economic tradeoffs

Determining the potential impacts of an agricultural technology upon the well being of farmers and the environment are closely related to analyzing the viability of technology adoption. While the economic impacts of a new technology are mirror the farmer incentives to adopt them, environmental impacts are less likely to have a direct association with the technology decision. Below we discuss the economic and environmental impacts separately and subsequently their tradeoffs.

For smallholder swidden farms, the **economic impacts** of the technology adoption decision are best examined by contrasting seasonal labor inputs and product destination characteristics (depicted as interrelation (**a**) in (Figure 4). New agricultural technologies can be characterized as being complementary or competitive to traditional farming practices. Similarly technology products are principally for market sale or also have household uses. Farm management decisions balance the benefits with the potential costs producing products with these attributes. Farmers typically prefer to produce traditional crops, which have stable but low prices, rather than riskier market-oriented crops. Analysis points to a greater earnings potential of new technologie that do not merely increase productivity but instead change the seasonal characteristics of their cultivation. Altering the planting requirements of traditional crops (rice, maize, cassava, plantain) that cause seasonal labor shortages, enables farmers to plant more traditional crops and perhaps other market oriented crops. These larger and more diverse harvests will likely provide greater farm earnings (White and Labarta, 2001).

Examination of the **environmental impacts** resulting from technology adoption requires a further analysis into the interrelation between seasonal labor inputs and land quality inputs (**b**). Unlike the above labor - product output interrelation, the labor - land interrelation is one of imperfect factor substitutes. The ability of one input to substitute another centers on the particular labor and land requirements per agricultural technology. Similar to the qualitative characteristics of labor (complementarity or competitivity) that result from traditional production, land inputs also have different qualities. These are most easily seen from an agronomic viewpoint. Levels of soil fertility and the pervasiveness of weeds best characterize the land qualities. Converted forest plots are of best agronomic quality and decreasing in converted fallows and further so with subsequent plantings. However, the input substitutibility between land and labor stems from the distinct preparation and weeding requirements of the land qualities, whereby either or both of the requirements can cause labor inputs to become a limiting factor.

Labor scarcities are typically most severe during land preparation season. Thus farmers again need to balance their farm management strategies according to the benefits and costs of both inputs and outputs per agricultural activity. Agro-economic modeling permits researchers to analyze these benefits and costs. In the case of pioneer stage farmers, both land qualities are accessible, thus technology adoption is typically not constricted by land quality as much as those farms that have little high forest to convert. In other words, farm earnings are of paramount concern; impact upon the composition of on-farm forest cover is secondary.

The **environmental-economic tradeoff** is a tenuous relationship between labor, land and farm markets. This interdependence of labor and land inputs within the management of the farm can easily be short-circuited by a change in one or more exogenous factors. Any change that enables farmers to earn markedly more than the typical modest subsistence farm can upset the delicate balance of the management strategy. Changes include, for example, the availability of subsidized credit, greater product price for one or more crops or reduced transport costs to market. The increased earnings permit a farmer to contract significantly more labor than the seasonal arrangements made with one or two non-family members. The labor constraint inherent to the swidden production system is bypassed, resulting in a direct land input - product output interrelation (**c**).

Non-marginal or drastic alterations of the site context cause ex-ante estimates of farm management strategy changes and associated environmental and economic impacts are extremely difficult. Other analysis methods including general equilibrium models and input output analysis and if attempted can be inaccurate. In other tropical countries similar changes have occurred with dramatic results. For example in Brazil, roads and government subsidies lead to the expansion of cattle ranches and concomitant deforestation (Schneider, 1995;Walker et al., 2000). Similarly in Bolivia, forest conversion and soybean production increased after (Kaimowitz et al., 1999)

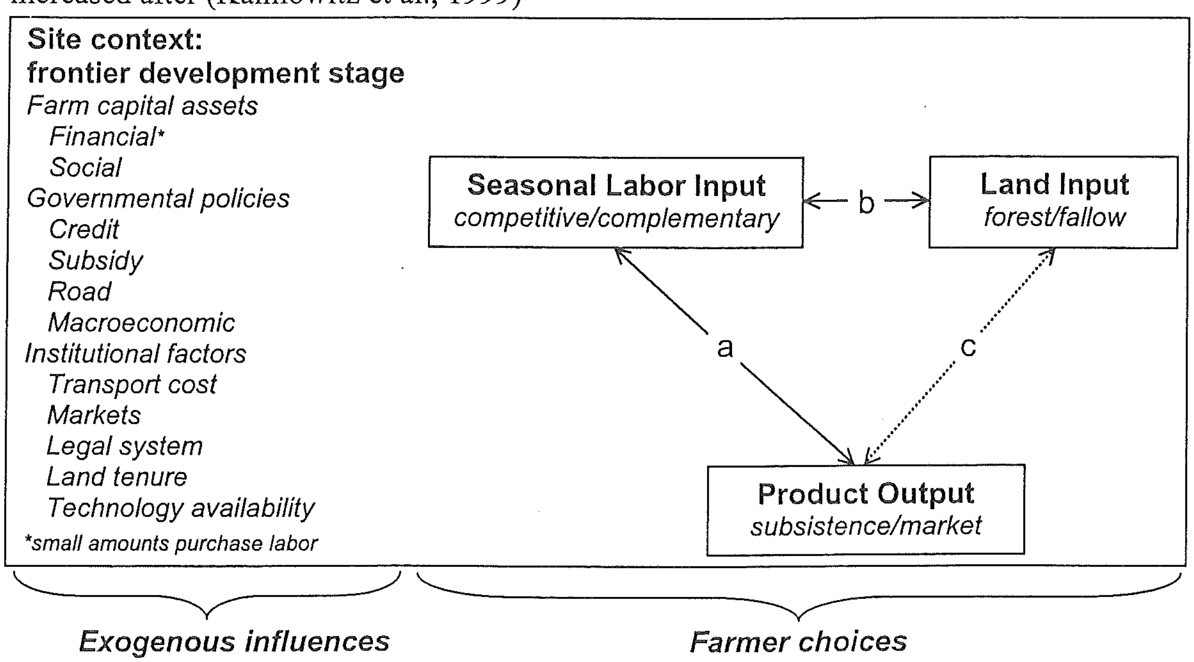

Figure 4. Analysis framework to examine the impacts of agricultural technology adoption in land abundant regions

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CIAT- Douglas White, Ricardo Labarta and Efraín Leguía
Wagner Guzmán (Universidad of Alcalá de Henares and ICRAF), Héctor Campos (INIA) and Javier Soto (MinAg)

Challenges: During the past two years Peruvian government instability has made coordination with national partners difficult. CIAT has continued the analysis and writing phases of the project.
2002 plans: work with national partners (researcher and extensionists) in model development and refinement.

1.1.2. Output 3. Models/frameworks developed to target research, integrate results, assess impact and extrapolate results

1.1.2.1. Framework for monitoring and assessing impact of research

Milestone:
Assessing the Impact of Integrated Natural Resource Management (INRM): Challenges and Experiences

CIAT impact assessment research for INRM is mixed, reflecting the multi-faceted demands of INRM research. Advances will enable cross-site comparison of the reference sites and could raise new interesting research hypotheses.

Assessing the impact of integrated natural resource management (INRM) research challenges scientists. The complexity of INRM interventions requires a more holistic impact assessment approach, beyond the plot and farm levels and beyond traditional analysis economic of returns. Impact assessment of INRM combines the traditional "what and where" factors of economic and environmental priorities with newer "who and how" aspects of social actors and institutions. This paper presents an analytical framework and methodology to assess the impact of INRM. A key feature of the proposed methodology is

that it starts with a detailed planning process that develops a well-defined, shared, and holistic strategy to achieve development impact. The methodology includes the mapping of research outputs, intermediate outcomes, and development impact, called "paths to development impact". A central challenge is to find a balance between employing generalizable measures that facilitate cross-site comparison and slower participatory process methods that empower local stakeholders. Sufficient funding for IA and distinct stakeholder interests are also difficulties faced. Two hillside sites of Central America and one forest margin site in Peru serve as case studies.
Challenges: During the past years funding for impact assessment has been scarce.
2002 plans: CIAT with other CGIAR centers plans to work on develop methods to analyze and compare the relative importance of the five capitals approach.

1.1.3. Output 4. Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices

Milestone:
Alternatives to Slash and Burn (ASB) in Peru: Challenges, Research and Impact

By conducting research in a collaborative manner, scientists within the ASB consortium are exposed to new research methods and ideas. Researchers also gain important local insights from other disciplines to better adapt and prioritize research thereby maximizing development impact.

Peru with its distinct biophysical and socioeconmic conditions, provides an important contrast to the more-familiar Brazilian Amazon case of land use dynamics. This paper summarizes ASB research activities conducted in the two reference sites of Pucallpa and Yurimaguas. Principle themes include land use characterization, above- and below- ground biodiversity, greenhouse gases emissions, environmental-economic tradeoffs, tree genetic resource management, and improved germplasm of agricultural and tree crops.

A central premise of ASB research is to have research make an impact at the field level. With demonstration plots and on-farm experiments, more sustainable land-use technologies are made available to farmers who cultivate tropical lands. A second central premise is the production of international public goods. By documenting the bio-physical and socio-economic characteristics at each site, important comparisons can be made both nationally and internationally. With a database of information, researchers can hypothesize which factors have a positive and negative effect upon land-use so that national governments can develop more effective research and policy options. These two central premises can also be considered respectively: processes and products. In other words, ASB research creates products such as scientific articles in journals, along with a closely-related process of capacity building to ensure that the information generated can be used by rural dwellers.

Douglas White, Manuel Arca (INIA), Julio Alegre (ICRAF), David Yanggen (ICRAF), John Weber (ICRAF).

Challenges: During the past three there have been no funds from ASB for work in Latin America. CIAT and ASB partners hope to revive efforts in the Amazon.

2002 plans: CIAT is currently coordinating presentations with donors to conduct extensive Amazon research.

Current Staff

Douglas White
Ricardo Labarta (until August 2000)
Efrain Leguia
Carmen Andi

1.2. Forage-based feeding systems to intensify small-holder dairy farms in tropical Latin America (TROPILECHE).

Investigators

Federico Holmann, Livestock Economist, leader, HQ (100% PE-5)
Pedro Argel, Forage Agronomist, Costa Rica (75% PE-5; 25% IP-5)
Carlos Lascano, Animal Nutritionist, HQ (10% PE-5; 90% IP-5)

Cooperators

Within CIAT:
Michael Peters, Axel Schmidt, Camilo Plazas (IP-5)
Douglas White (PE-5)
Libardo Rivas (BP-2)
Manuel Winnograd, Andrew Farrow (PE-4)
Nathan Russell, Lynn Menendez (Communication Unit)

Outside CIAT:
William Thorpe, Steve Staal, Tineke de Wolff, Isabelle Battlenweck (ILRI-Nairobi)
Carlos Hidalgo, Marco Lobo (MAG, Costa Rica)
Carlos Jimenez (UCR, Costa Rica)
Francisco Romero, Jesus Gonzalez (ECAG, Costa Rica)
Muhammad Ibrahim (CATIE, Costa Rica)
Tito Fariñas (IDR, Nicaragua)
Dionisio Soto (MAGFOR, Nicaragua)
Conrado Burgos, Ernesto Ehrler, Fredi Maradiaga (DICTA, Honduras)
Juan Carulla (UN-Bogotá, Colombia)
Luis A. Giraldo (UN-Medellin, Colombia)
Manuel Martinez (Unillanos, Colombia)
Bernardo Rivera (U. Caldas, Colombia)
Silvio Guzman (F. San Martin, Colombia)
Deisy Lara (FUNDAAM, Peru)

Budget

Source	Amount (US$)	Proportion (%)
Special project[1]	192,424	73.7
Carry over from 2000	68,486	26.3
Total	**260,910**	**100.0**

[1] Systemwide Livestock Program

1.2.1. Activity reports under PE-5 Outputs

Output 1. System components assessed to provide alternative land use options
Output 3. Models/frameworks developed to target research, integrate results, assess impact and extrapolate results

Activity reports under IP-5 Outputs

1.2.2. Output 4. Superior and diverse grasses and legumes delivered to NARS partners are evaluated and released to farmers.

Develop partnerships with NARS, NGO's IARC's, ARIS and private sector in LAC, Asia and Africa to undertake evaluation and diffusion of a range of grasses and legumes for multipurpose use

Ex-ante analysis of the legume Cratylia argentea in dual-purpose production systems of the Llanos piedmont in Colombia.

Introduction

About 90% of the milk produced in the Llanos comes from dual-purpose herds where pastures are the main source of feed. However, the quality of existing forages are low. On the other hand, shrub legumes have the potential to improve the feed quality of offered forages. Shrub species produce more biomass than herbaceous legumes, have a higher regrowth capacity, and produce a good quality forage in areas with prolonged dry season. Among the shrub legumes that have been evaluated and selected by CIAT is Cratylia argentea (Desv) O. Kuntze, a shrub of Southamerican origin.

The objective of this study is to analyze the potential role of the legume Cratylia argentea to substitute the use of feed supplements in dual-purpose production systems found in the Llanos piedmont to reduce feed costs. The specific objectives of the study is to look at the role of Cratylia to reduce feed costs (a) offered alone in cut-and-carry systems at milking time; (b) mixed with molasses and offered at milking time; and (c) under direct grazing once it is established in the producer's paddocks.

Materials and Methods

Data for this study was obtained from direct interviews with 32 farmers using dual-purpose production systems located in the municipality of Villavicencio, Department of Meta, in order to understand their production systems, technologies used, use of resources, and input and output prices, as well as data from secondary sources from the region where farms are located.

To meet the objectives a linear programming (LP) model was utilized as the main tool of analysis. This LP model was initially developed by the Tropical Agronomical Center for Teaching and Research (CATIE) and the International Network of Animal Production Systems of Latin America (RISPAL), which was later expanded by CIAT. The LP model was developed in an electronic spreadsheet with the objective to evaluate ex-ante the costs and benefits of the current and potential land use and their interactions between the technological components and the biological productivity.

Results

Table 1 contains descriptive statistics about the current dual-purpose production systems found in the Llanos piedmont. As can be observed, about 85% of total farm area is under pastures with very little area allocated to crops (1.5 ha/farm), consisting mainly of fruit trees and annual crops for self-consumption. Mean herd size is about 63 animals/farm of which 27 are mature cows. Milk productivity is about 5.9 kg/cow/day, which is significantly higher than the average for the whole of the region, which is 3.4 kg/cow/day. This difference can be explained because the county of Villavicencio is the most human populated and with the best infrastructure and provider of services. The amount of feed supplements offered to milking cows is low, which suggests that producers used them strategically.

Table 2 contains the forage parameters used in the linear programming model to do the ex-ante analysis for the scenarios considered in this study. These parameters were determined based on field data collected from several years.

It is expected that the simulation runs for the ex-ante analysis and the discussion of results will be completed by December of this year.

Table 1. Means for land use, livestock inventory, stocking rate, milk production, and feed supplements for 32 farms representative of production systems in the Llanos piedmont.

Paramater	Quantity
Total farm area (ha/farm)	59.6
Area under pastures (ha/farm)	50.7
Total number of cattle (heads/farm)	63.1
Number of cows (#/farm)	26.9
Stocking rate (AU/ha)	0.92
Milk production (kg/farm/day)	112
Milking cows (#/farm)	19
Milk productivity (kg/cow/day)	5.9
Feed supplements used (kg/milking cow/day)	
* Oilpalm cake	0.43
* Feed concentrates	0.42
* Molasses	0.41
* Mineralized salt	0.12

Table 2. Forage parameters utilized to run the linear programming model to do the ex-ante analysis in dual-purpose farms in Villavicencio.

Parameter	B. decumbens	B. humidicola	Napier Grass	Cratylia argentea	
				Cut and carry	Direct grazing
Crop duration (years)	10	10	10	20	3, 6, 9
High rainfall season					
* Available biomass (tm DM/ha)	4	4	8	16	4
* Crude protein (%)	6	4.5	8	15	23
* Degradability of CP (%)	60	50	60	70	70
* IVDMD (%)	55	50	55	50	60
Low rainfall season					
* Available biomass (tm DM/ha)	2	2	2	8	2
* Crude protein (%)	5	3.5	7	15	23
* Degradability of CP (%)	55	45	55	65	65
* IVDMD (%)	50	45	55	50	60
Lost forage to trampling (%)					
* High rainfall season	30	30	0	0	10
* Low rainfall season	25	25	0	0	10
Biomass transfer from high to low rainfall season (tm DM/ha)[1]	1	1	2	4	1

[1] Equivalent to 25% of biomass production during high rainfall season for grasses and Cratylia under direct grazing system and 100% for Cratylia in cut-and-carry sistems.

1.2.2.1. Analysis of intensification of milk production systems in Colombia.

Introduction

From 1992 to 1999, milk production in Colombia grew at an annual rate of 4.3% and dairy imports during the same period represented 2.6% of domestic production. Thus, Colombia is practically self-sufficient in milk production. On the other hand, Colombia has always been a net exporter of beef, but with a clear loss in relative importance throughout this decade. In 1991 Colombia exported about 5% of its domestic production. Since then, the reduction in exports has been noticeable, dropping to less than 1% in 1999.

Nonetheless, Colombia has a significant potential to increase livestock production given the high proportion of land under pastures and abundant feed resources, good public infrastructure, genetic potential of its livestock inventory, human resources, and availability of technologies and livestock services. However, internal discusion exists within Colombia as to whether its farmers will be able to survive and compete in a scenario of free trade without tariff barriers.

The objectives of this study were to (1) identify the technologies that have a positive effect in the productivity and profitability of milk in five contrasting regions of Colombia; (2) quantify the effect of these technologies on the productivity and profitability of milk; (3) quantify the investment needed to adopt these technologies at the farm level; (4) geo-reference farms in Colombia to identify patterns of adoption with regards to level of infrastructure, human population, and market access; and (5) analyze the comparative advantages in each region to increase the future supply of milk.

This study is a collaborative project between CIAT and five institutions in Colombia: Universidad Nacional (Bogota and Medellin sites), Universidad de Caldas, Universidad de los Llanos, and Fundacion San Martin. In addition, this study is an integral part of a transregional analysis led by ILRI.

Materials and Methods

Data for this study came from direct surveys to 545 producers between February and November of 2000 in five contrasting regions of Colombia distributed as follows: (1) 145 farms in the Eastern plains (Arauca, Casanare, and Meta); (2) 116 farms in the Caribbean region (Atlantico, Guajira, Magdalena, Cesar, Bolivar, and Cordoba); (3) 105 farms in the coffee region (Quindio, Valle, Caldas, and Risaralda); (4) 97 farms in Antioquia; and (5) 82 farms in the highlands of Cundinamarca and Boyaca.

The survey information was then developed into a data base using Access and completed in April of 2001. The statistical analysis of the database started in May of 2001 and it is expected to be finished in May of 2002.

For the geo-reference analysis a new software developed at CIAT (ie., accessibility wizard) will be used to identify patterns of intensification in order to complement farm-level data and to better understand the drivers of adoption of technologies.

Results

The final product of this study pretends to be a book which includes (a) an analysis of the milk production systems found in each of the five regions studied (ie., 5 chapters); (b) an additional chapter which integrates the five regions as a country; (c) a chapter using GIS which analyzes market access and identify patterns of intensification; and (d) a final chapter analyzing the comparative advantages and disadvantages of different milk production systems to meet the future supply of milk.

1.2.2.2. Opportunities and constraints to adoption of Cratylia argentea in Costa Rica.

Introduction

Although many factors influence animal production, the availability of feed is undoubtedly one of the most important. Scientists and farmers are jointly seeking alternative sources of animal feed for the dry season. The legume Cratylia argentea was introduced to Costa Rica as an alternative source of feed for cattle during the 6-month dry season. Since 1995, an increasing number of farmers are now using this legume, but the process of incorporating this new feeding alternative into production systems and changing farmers' attitudes will take some time. Since then, information about this legume has spread and its use has become more common. To facilitate its adoption, this study was carried out to learn more about the knowledge, experience, and benefits of Cratylia by early users in Costa Rica.

Materials and Methods

Data was obtained by direct interviews with farmers located at three sites in Central-Pacific Costa Rica during March-April 2001. Two groups of farmers were interviewed; one group consisted of 39 Cratylia users and the other, of 25 non-users. Users were asked about their experiences in the initial years of establishment and non-users provided information on potential uses of this legume.

Results

More than 50% of farmers who had planted Cratylia were still not using it as feed because of its recent establishment. Of the farmers surveyed, 80% indicated that the most important reason for planting Cratylia was its availability as feed during the dry season and 65% indicated that it was mostly offered fresh, mixed with other feed sources. Cratylia was well accepted by cattle and mostly fed to the most productive animals, according to 80% of the participants.

Leaf retention, regrowth after cutting, and seed production were considered, on average, as good by 70% of the respondents; 60% thought Cratylia helped prevent soil erosion.

Although no major problems were reported, some disadvantages of planting Cratylia were indicated. The legume's slow initial growth and sometimes difficult establishment are seen as negative aspects, as well as the high labor costs involved in cutting the forage and in initial land preparation. Cratylia's biggest advantages are its excellent resistance to drought and its potential to reduce production costs. With proper management, Cratylia can completely replace chicken manure, thereby substantially reducing feeding costs during the dry season. Figure 1 shows the different opinions about Cratylia by early adopters.

Over the last five years, the average area sown to Cratylia per farm has been maintained because of the failed attempts of several producers who lacked know-how and technical assistance. Perspectives for the future are, however, optimistic. Of the farmers currently using Cratylia, 85% are planning to increase the area planted over the next five years, with an average of 0.7 ha/farm. Most of the farmers not using Cratylia have no objections about changing their farming practices and adopting the legume; 88% opined that it could actually benefit their farms.

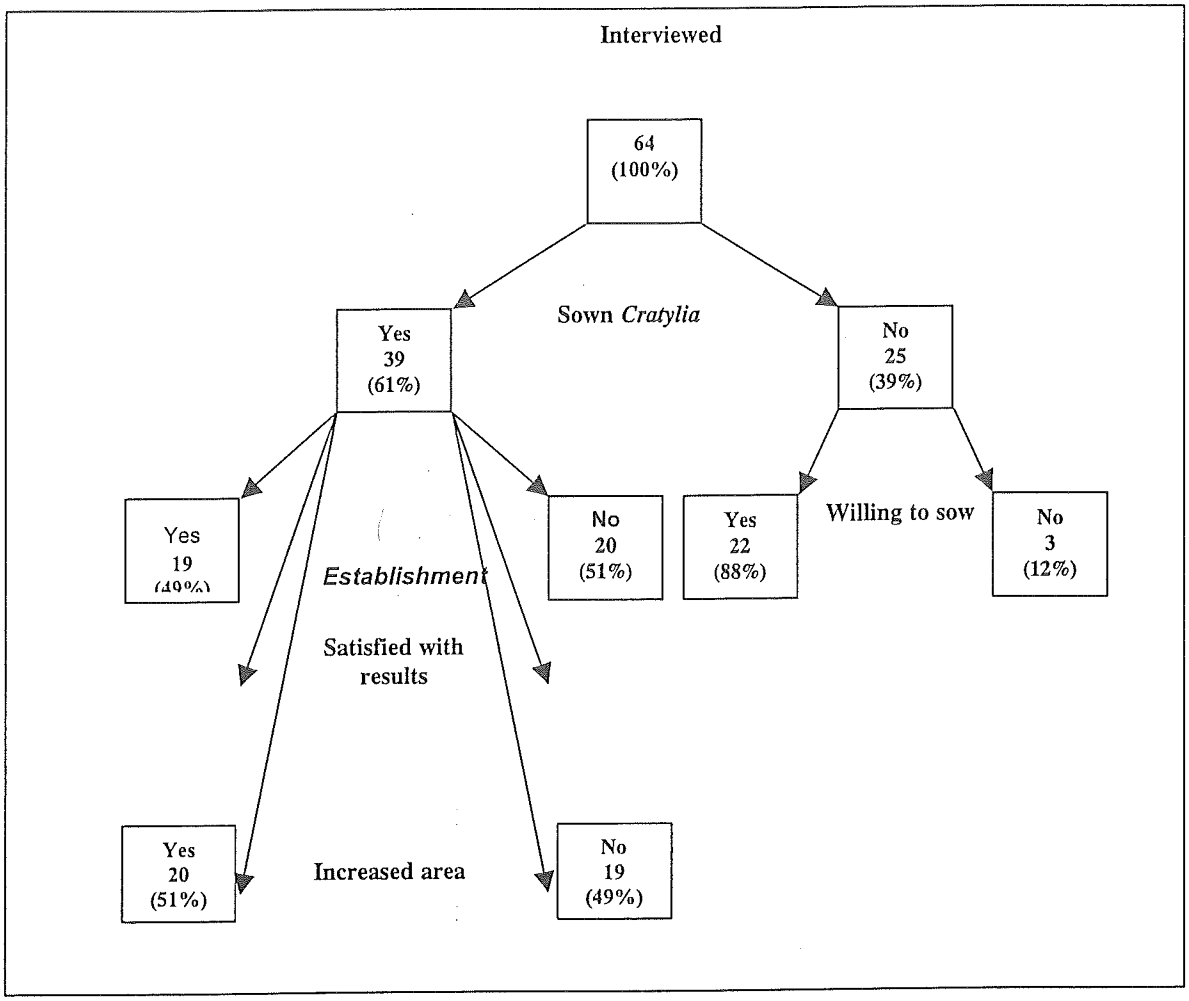

Figure 1. Overview of number of farmers with different adoption characteristics of Cratylia argentea In Costa Rica.

Impact

The lack of information and deficient technical assistance are the major constraints to increasing the rate of adoption of Cratylia in Costa Rica. The communication between producers and researchers is mainly through the offices of the Ministry of Agriculture (MAG). The future of Cratylia could prove promising with improved services and communications toward farmers.

1.2.2.3. Early adoption of Arachis pintoi in Costa Rica.

Introduction

Degradation of pure grass pastures is a frequent problem in the tropics. Reason for that is, among others, the problem of insufficiently adapted pasture species. The legume Arachis pintoi was found to show a number of characteristics which can contribute to the development of sustainable and productive pastures in the tropics. Arachis pintoi originates in South America and was introduced in Costa Rica in 1987. The legume is used as a pasture plant, as a cover crop in plantations, as a ground cover on roadsides and steep slopes, and as an ornamental plant. It can be grown pure to form protein banks or it can be grown in association with grass species. A. pintoi can be fed to various animals including horses, donkeys, sheep, goats, pigs and chicken. The leaves have a high protein content and good digestibility. With relatively little area of pure A. pintoi good extra weight gains can be achieved. Pasture associations with A. pintoi are more profitable than improved, grass-alone pasture systems.

Tthe objective of this study was to learn about the adoption process by livestock farmers at an early stage in order to accelerate the diffusion process using as a case study the region of Huetar Norte of Costa Rica.

Materials and Methods

Huetar Norte was chosen to be the study region because both milk and beef production are predominant farming activities. It was decided to gain relevant information by means of thoroughly structured interviews. The farmers were visited on their properties to be directly and personally interviewed. Target population were livestock holders and owners of pastures. The frame population was a list of 7131 livestock holders. A simple random sampling was applied to the frame population. 115 interviews were conducted within the simple random sample. 34 more farmers were interviewed in a directed sample. Two questionnaires were used in the interviews. A smaller version for the random sample, and a longer version for farmers known to have already worked with A. pintoi. Interviews were conducted by 21 MAG extension workers and the author of this study. All interviews were conducted between January and March 2000.

Results

The average farm size in the random sample was 69.8 ha. The average farm was made up of 52.5 ha of pasture, 3.3 ha of perennial plantations, 1.9 ha of annual crops and 12.1 ha of land with other uses like woods. The average herd size was 86.4 head of cattle per farmer. The most frequent pasture species was Ratana (Ischaemum indicum). The most frequent improved pasture species was Estrella (cynodon nlemfuensis). 104 farmers (90.4%) had already heard about A. pintoi and 29 farmers (25.2%) had already sown the legume on their land, mostly for ornamental purposes. 8 farmers said to have sown it for farming reasons. Of these, 6 sowed it for the use as forage legume. Of these 2 had already rejected it.

Comparison of adopters and non-adopters

Adopters acquire information about farming matters more intensely than non-adopters do. For example, 66.6% of adopters and only 34.3% of non-adopters have visited at least one workshop in 1999. In addition, adopters have an average farm area of 128.2 ha and an average herd size of 196 animals compared non-adopters with an average farm area of 69.9 ha and an average herd size of 86 animals. Adopters have herds with an average of 49.8% being dairy cattle, whereas non-adopters have herds with only 19.8% of dairy cattle. 42.4% of adopters and only 15.0% of non-adopters belong to the highest gross income category. Similarly, only 9.1% of adopters and 17.8% of non-adopters belong to the lowest income category. Thus, adopters of A. pintoi tend to be larger producers obtaining higher incomes with more emphasis on milk production and who are more interested in obtaining new information about forage technologies.

Adopters and their experiences with A. pintoi as a forage legume

The majority of adopters received information about A. pintoi through the MAG (40.6%) and the ITCR (15.6%). 59.4% of the adopters acquired the planting material from one of the three "Arachis pintoi centres". The majority of plots were sown with stolons (82.2%). The reason for planting A. pintoi was in 50% of all answers intention to improve pasture quality. 51.5% of all adopters planted A. pintoi in association with grasses. 48.5% planted it pure. The majority of farmers feed it to all types of cattle, some only to milk cows, calves or sick cattle. The 4 adopters in the randomly selected sample have planted a total area of 3,65 ha with the legume, which is only 0.0006% of total pastureland in this group. Within the group of all interviewed adopters (33 farmers) the total area planted with the legume was 73.87 ha.

Of all adopters 87.9% or 29 farmers said to be satisfied with the results they have so far obtained. 3 farmers (9.1%) said to be more or less satisfied and 1 farmer (3.0%) said to be not satisfied. Advantages of the legume were seen in "good quality feed" (36.6%), "increases cattle production" (15.9%), "persistence" and "ability to improve soil fertility". Most frequent disadvantages mentioned by adopters were "attracts slugs" (12.8%) and "difficulty of broad leaf weed control". The majority of the adopters found that the establishment of A. pintoi is slow. 73.1% of the adopters said that their cattle did not need time to get used to the legume. 37.5% of adopters said A. pintoi can disappear when mixed with improved grasses. Nearly a third of the adopters found it performed better than other improved grass species in the dry season. 81.8% of adopters want to increase the area planted with A. pintoi in the next five years.

Establishment and maintenance costs differed substantially within the group of adopters. The establishment costs ranged from 57.60 US$ to 348.67 US$ per ha. The maintenance costs ranged from 6.40 US$ to 91.39 US$ per year. The maintenance costs for other pastures ranged from 34.67 US$ to 156.67 US$ per year. On nearly all interviewed farms the maintenance of the A. pintoi establishment was less cost intensive than the maintenance of another pasture. The largest difference in maintenance costs between an A. pintoi establishment and another pasture on the same farm was 114.00 US$ per year. Not a single farmer who had planted Maní forrajero had taken credit to pay for the investment.

Non-adopters and their perceptions of A. pintoi

Of 109 interviewed non-adopters, 98 (89.9%) have already heard about A. pintoi and of these 22 said to have already sown it on their farm, mostly for ornamental purposes. The majority of non-adopters (51.6%) has obtained information about the legume from colleagues, neighbours or friends. 62.4% of the non-adopters expressed the knowledge that the A. pintoi is used as a feed for cattle. 55 (58.5%) of the farmers think that the legume could serve them on their farm. The majority of these farmers would use it in association with grasses for grazing (51.7%). Most frequent reasons for not using the forage peanut for farming purposes on own land was "lack of information" (27.9%) followed by "seed is not readily available" (13.4%).

Impact

It was shown that the estimated adoption rate of Arachis pintoi as a forage legume is very low in Huetar Norte. An estimated 3.48%, or 248 farmers had planted an estimated 0.0006% (252 ha) of total pastureland. Thus the diffusion process is at a very early stage. The future development of the adoption process is very unstable because the percentage of adopters and area is very small and some of the adopters are still in the trial stage.

Most critical experiences that have been made with A. pintoi are those encountered during the establishment of the legume and those regarding persistence. The establishment was seen by a lot of farmers as a very time consuming, costly and longsome matter. Persistence was often seen to be missing. After establishment farmers generally reduced expenditures in maintenance and thus experienced an economical benefit from the legume.

In order to accelerate the adoption process it is recommended to find technologies that ensure a relatively cost extensive and secure establishment of the legume as well as technologies that ensure its persistence. Moreover, it is recommended to intensely train extension workers and ensure a number of establishments in a very good state.

Proposals Developed

"Profitable and environmentally friendly small dairy enterprises in Honduras", submitted to the Government of Japan on behalf of CIAT in March 2001, a 5-yr project with a total cost of USD 3,044,300

"The competitiveness of milk production systems in Latin America: Lessons learned and policy implications of case studies from the ecoregions of the Andes and Central America", submitted to the Systemwide Livestock Program in March 2001, a 2-yr project with a total cost of USD 394,400

"Enhancing beef productivity, quality, safety and trade in Central America", submitted to the Common Fund for Commodities (CFC) of the European Union on behalf of ILRI in September 2001, a 4-yr project with a total cost of USD 5 million.

"Increasing options for intensifying smallholder dairy farms and expanding new market opportunities in Central America", on-hold, to be submitted to the Systemwide Livestock Program when funding is available, a 3-yr project with a total cost of USD 604,800

1.3. Tropical Grasses and Legumes

1.3.1. Evaluation of legumes as cover crops in plantations in the llanos of Colombia

Contributors: C. Plazas, M. Peters, L.H. Franco, B. Hincapie (CIAT) and Oil Palm and Rubber Growers of the Colombian Llanos

Rationale

There is a need in plantations of the Llanos of Colombia to find sustainable ways to reduce weed infestation, to maintain and improve soil fertility, to control erosion and increase soil fauna biomass. There is currently a trend to promote plantation systems in the Llanos. In the rubber plantation the target group for this promotion are small to medium size farmers who want to diversify there farming operations. In the oil palm plantations plots of up to 5 ha are rented out to landless farmers to manage the oil palms for the oil palm industry.

In 1999 a range of legume accessions of the species Arachis pintoi, Desmodium heterocarpon subsp. ovalifolium and Pueraria phaseoloides were sown under shade and no-shade conditions in the Meta department of Colombia. Based on initial results, this work was expanded to include the evaluation of different establishment procedures for the most promising cover (Desmodium heterocarpon subsp. ovalifolium CIAT 13651) in comparison with the most commonly used cover Pueraria phaseoloides.

Material and Methods

In plots of 80 m^2 we established of legumes covers in commercial young and old rubber and oil palm plantations in the savannas and piedemont areas of the Llanos.

The following legumes were sown in a Randomized Block Design with three replications: Arachis pintoi: 17434, 18744, 18748, 22159, 22160 (seed rate 10 kg/ha); Desmodium heterocarpon subsp. ovalifolium: 350, 13105, 13110, 13651, 23762 (0.5 kg/ha); Pueraria phaseoloides: 8042, 9900 (3 kg/ha). Additionally a mixture of Arachis pintoi CIAT 18744 and Desmodium ovalifolium CIAT 13651 was sown. Measurements carried out include: % cover, DM yield and weeds.

Results and Discussion

In table 1 we show the effects of different establishment procedures for Desmodium ovalifolium. Planting was in August 2000, and measurements were taken 6 months (dry season) and 15 months (wet season) after planting.

Table 1 . Soil cover of Desmodium heterocarpon subsp. ovalifolium in rubber and oil palm (palma) plantations under different establishment procedures in two sites in the Llanos of Colombia

Treatments	Savanna (rubber)		Piedemont (oil palm)	
	Season			
	Dry	Wet	Dry	Wet
	Cover (%)			
Soil preparation + D. ovalifolium CIAT 13651 (1 kg/ha)	26	85	10	2
Soil preparation + D. ovalifolium CIAT 13651 + Fusilade	24	84	13	3
Soil preparation + Roundup + D. ovalifolium CIAT 13651	24	84	4	0
Soil preparation + Kudzu. (3 kg/ha).	54	55	16	5

Establishment and development of Desmodium under rubber in the Altillanura has been very good as indicated by more than 80% cover in the wet season, which is better than the cover obtained with the traditional kudzu. However, during the early establishment phase measured in the dry period the kudzu treatment had a higher cover. In denser oil palm plantations, establishment of the legume covers was not as good as in rubber, as a result of shading caused by the trees.

In table 2 we present results on soil cover with different legumes in plantations two years after establishment.

Under rubber in savannas Desmodium and the Desmodium/Arachis mixture maintained soil covers > 80% between rubber rows (open). Cover with A. pintoi and P. phaseoloides was much lower, oscillating between 15 and 23 % for Arachis and between 17 and 55% for Pueraria.

Performance of the different legume covers under palm trees in the Piedemont was not recorded in the dry season as management of palm trees includes slashing down the vegetation. In the wet season best covers were achieved with D. ovalifolium CIAT 13651 and the Arachis/Desmodium mixture.

Table 2. Soil cover of different forage legumes in plantations two years after sowing in two sites in the Llanos of Colombia

Treatments	Savannas - Rubber				Piedemont - Oil Palm	
	Dry Old Plantation		Wet		Dry Young Plantation	Wet
	Shade	Open	Shade	Open		
	Cover (%)					
A.p 17434	20	15	50	47		35
A.p 18744	65	37	83	70		63
A.p 18748	32	23	75	68		47
A.p 22159	27	18	63	62		62
A.p 22160	27	23	62	63		67
D.h 350	90	93	30	83		68
D.h 13105	93	88	17	75		68
D.h 13110	92	93	12	60		77
D.h 13651	87	90	43	95		87
D.h 23762	92	92	27	82		53
P.p 8042	17	33	30	40		37
P.p 9900	25	55	30	57		37
Asoc. Ap/Dh	83	87	63	90		87

The results from this year confirm those from last year (Annual Report 2000), but also indicate that in old rubber plantations soil cover by legumes improved substantially form one year to another. While soil covers of D. ovalifolium and A. pintoi increased in the second year, soil covers achieved with P. phaseoloides increased only in old rubber plantations. Under oil palm tress, soil covers obtained with P. phaseoloides were substantially reduced from one year to another.

In this study we have identified D. ovalifolium CIAT 13651 as an excellent legume cover for plantations in the Colombian Llanos. The low establishment cost and superior soil cover obtained with Desmodium as compared to the traditionally used kudzu (Pueraria phaseoloides) makes it an interesting option to plantation owners. Of interest is also the association of Arachis pintoi CIAT 18744/D. ovalifolium CIAT 13651, since combining these two species led a to a more stable soil covers across seasons

Based on results from two years, we will now start promoting the use of Desmodium as a legume cover in plantations in the llanos. Actions needed include seed multiplication by selected farmers, demonstration field days, technical brochures and training events for farmers and technicians.

1.3.2. Evaluation of green manures in the llanos of Colombia

Contributors: C. Plazas, M. Peters, and B. Hincapie, CIAT

Rationale

One of the aims of the Forage Project is to develop green manures for rice and maize based systems in the Llanos colombianos. It is expected that suitable legumes will reduce the need for external inputs and make thus make the crops more competitive.

Material and Methods

Based on prior experience, several l" best bet" legume accessions were selected to evaluate as green manures in the llanos:

Mucuna pruriens CIAT 9349,
Canavalia ensiformis CIAT 715,
C. brasiliensis CIAT 17009,
Pueraria phaseoloides CIAT 9900, 8042, 7182
Stylosanthes guianensis CIAT 11844, 184,
Chamaecrista rotundifolia CIAT 8990,
Centrosema pubescens CIAT 15160,
C. rotundifolium CIAT 5260,
Arachis pintoi CIAT 17434,18744,
Desmodium heterocarpum var. ovalifolium CIAT 13651, 13105,

The legumes were established in 25 m^2 plots in a Randomized Complete Block Design with three replicates at the Santa Rosa Rice station. A subset of legumes (Vigna unguiculata 288,716 and 733; S. guianensis 11844, 11833; and Mucuna pruriens 9394) were also established at La Libertad Station of CORPOICA and subsequently incorporated prior to planting rice.

To determine the effect of the legume green manures we compared rice yields in: a) green manure + 0 N, b) green manure + 40N c) fallow and d) fallow+ 6 increasing levels of N.

Results and Discussion

In Santa Rosa we found significant differences among legume species and accessions in soil cover and biomass yield at time of incorporation of the plant material (2 to 3 months after planting). The highest soil covers (> 60%)and ability to compete with weeds was observed with S. guianensis CIAT 11844 and 184, Canavalia brasiliensis CIAT 17009, C. ensiformis CIAT 715, Pueraria phaseoloides CIAT 8042. Other legumes, such as D. ovalifolium CIAT 13105, 13651, Arachis pintoi CIAT18744, 17434 and Centrosema rotundifolia CIAT 5260 had soil covers below 40%.

On the other hand, the highest above ground DM yields were obtained with S. guianensis CIAT 11844 (6.7 t DM/ha), followed by S. guianensis CIAT 184 and Ch. rotundifolia CIAT 8990 with yields above the mean of treatments of 2.1 t DM/ha (Table 3).

Given that rice yields were not affected by green manure + 0 N or by green manure + 40 N, data were pooled for comparing yields after green manures with yields obtained with different levels of N fertilizer (Table 3).

The incorporation of different legume species into the soil did not result in a significant increase (P >0.05) in rice yield relative to the fallow control (weeds incorporated). On the other hand, it was evident that yields of rice responded linearly from 0 to 120 Kg N, but declined at higher levels (160 and 240 kg of N).

The highest rice grain yields in the first harvest (2000) were obtained after using S. guianensis CIAT 184, 11844, C. ensiformis CIAT 715 and P. phaseoloides CIAT 7182 as green manures, but yields were not different form those recorded in the natural fallow. The highest rice yield obtained with a green manure (S. guianensis 184) was comparable to the yield obtained with 40 N.

Table 3. Dry matter yield of green manure and grain before soil incorporation and grain and dry matter yield of subsequent rice crops en Santa Rosa, Villavicencio, Llanos de Colombia.

Treatment	Herbage	Rice	
		Yield (2000)*	Yield (2001) **
	(kg/ha)		
S. guianensis CIAT 11844	**6757**	**3905**	**3187**
S. guianensis CIAT 184	**4627**	**4171**	**4335**
C. rotundifolia CIAT 8990	3303	2887	4297
Fallow Control	**3129**	**3401**	**3933**
C. pubescens CIAT 15160	2085	2512	3401
P. phaseoloides CIAT 8042	2081	3099	3914
P. phaseoloides CIAT 9900	2079	3417	3407
C. brasiliensis CIAT 17009	1967	2848	3184
P. phaseoloides CIAT 7182	1695	3609	3802
C. ensiformis CIAT 715	1543	3802	4029
D. heterocarpon CIAT 13651	1501	3440	3393
D. heterocarpon CIAT 13105	1411	3052	3064
M. pruriens CIAT 9349	591	3420	3614
A. pintoi CIAT 18744	585	3308	3238
A. pintoi CIAT 17434	293	3030	4312
C. rotundifolium CIAT 5260	227	2405	3465
120 N		5797	3848
80 N		4928	4435
40 N		4431	5506
240 N		4316	2550
160 N		4000	3317
0 N		3286	3159
LSD (P<0.05)	**2226**	**1478**	**1115**

* After incorporation of legumes

** Residual effect of legume green manures incorporated the previous year

The 2nd rice yields (2001) were not significantly affected by the residual effect of legume green manures when compared with yields recorded in the natural fallow. However, it was interesting to observe that with some green manures (i.e. Ch. rotundifolia CIAT 8990, A. pintoi CIAT 17434, C. rotundifolium CIAT 5260 and C. pubescens CIAT 15160) rice yields were increased by 35% or more in the second crop as compared to the first crop, but that yields were still bellow those recorded with 40 or 80 kg/N.

In the legume green manure experiment established in 2001 in La Libertad the cowpea (Vigna unguiculata) accessions were the quickest to cover the soil when compared with S. guianensis accessions. Highest DM yields were also achieved with cowpea with yields above 4 t/ha DM in 80 days, confirming results obtained at other sites. (Table 4.) In this experiment rice yields were not affected by green manure treatments (data not shown).

Table 4. Dry matter yield (kg/ha) of green manure herbage before soil incorporation for subsequent rice crop at La Libertad, Villavicencio, Llanos of Colombia.

Treatment	Herbage	
	Cover (%)	Kg/Ha
Vigna unguiculata (IT86D-716) *	100	4917
Vigna unguiculata (IT6D-733) *	100	4132
Vigna unguiculata (IT89KD-288) *	100	4065
Vigna unguiculata cv CN	99	3971
M. pruriens CIAT 9349	100	2422
Fallow control	95	2218
S. guianensis CIAT 11844	78	2071
S. guianensis CIAT 11833	73	1680
S. guianensis CIAT 184	53	1205
S. guianensis pobl 3	74	966
LSD (P<0.05)	11.9	1275

IITA numbers

In general, our results indicate that we have some excellent legume options for use as short -term green manures in cropping systems in the llanos. Among the species we are particularly interested in Cowpeas developed in IITA, given their fast growth and high biomass production. However, it is evident from our results that the use of short -term green manures to increase soil N in the piedemont rice production systems will not pay off. Thus, in 2002 we plan to test selected legumes as green manure in maize grown in savannas soils, since it may be more responsive to green manures than rice. It is import to indicate that maize is gaining importance as a crop in the llanos and that a legume green manure technology may be an option attractive to farmers.

1.3.3. On- farm evaluation of new grasses and legume options for livestock systems in the llanos of Colombia

Contributors C. Plazas, J. Miles and C. Lascano, CIAT

Rationale

One major limitation for beef and milk production in Neotropical savannas is the degradation of introduced grasses, as a result of nitrogen deficiencies and overgrazing. Thus CIAT's Forage Project (IP-5) has been developing improved grasses and legumes that can contribute to reclaim large areas of degraded pastures in tropical regions where livestock is a major land use system.

In collaboration with PE-5, and CORPOICA we initiated in 1998 evaluation of new grasses and legumes in representative farms of the llanos of Colombia. A total of four farms (two in the well-drained savannas and two in the piedmont) were initially selected to evaluate new grass and legume alternatives. Selected farms were representative of the two sub-ecosystems and have large areas of degraded pastures. In addition, farmers participating in the Project indicated their willingness to cover some of the cost of the work done in their farms.

Introduction of legumes to reclaim degraded pastures

The introduction of Arachis to reclaim degraded Brachiaria pastures in the piedmont of the llanos has been successful. Results from two farms in the llanos piedmont indicate that after 2- 3 years the legume content in the pastures range from 22% when in association with B. humidicola (Figure) to 40% when in association with B. decumbens (Figure)

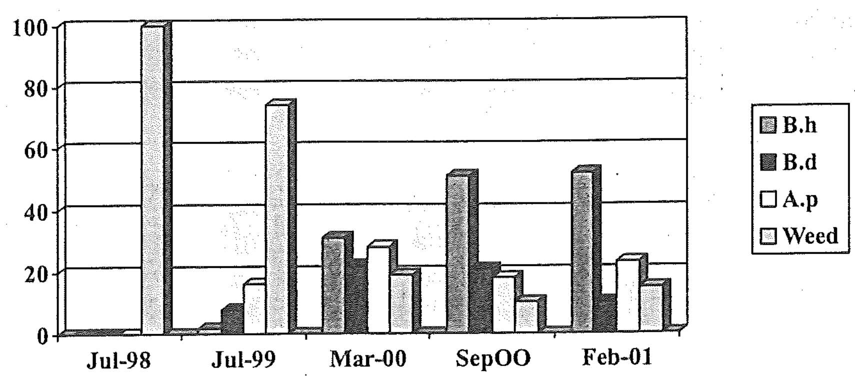

Figure. Botanical composition of *B. humidicola* pasture reclaimed with *Arachis pintoi* in the llanos piedmont (Farm 1)

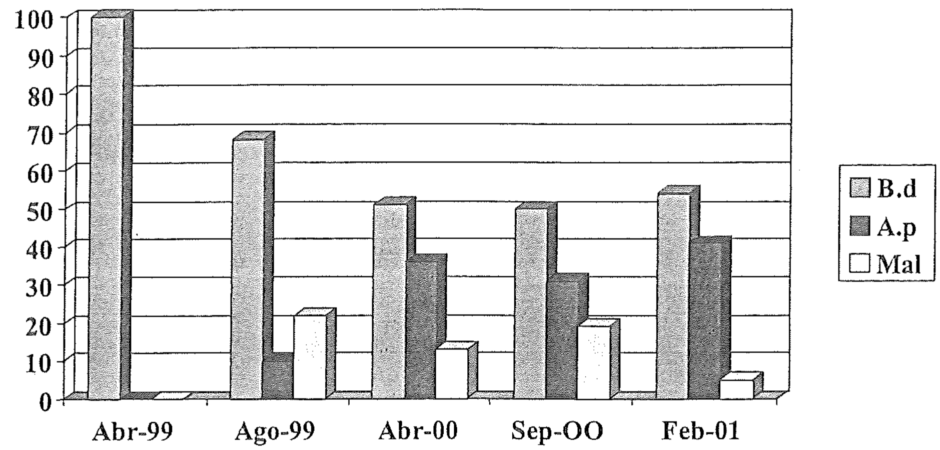

Figure. Botanical composition of *B. decumbens* pasture reclaimed with *Arachis pintoi* in a farm in llanos piedmont (Farm 2)

In Farm 1, the Arachis –based pasture has been managed with high stocking rates because of heavy spittlebug attack on B. decumbens pastures in the property. This heavy grazing of the Arachis-based pasture has favored the legume and has allowed the farmer to release pressure on pastures damaged by spittlebug. The alternative was to sell animals to reduce stoking rate or to graze the spittlebug damaged pastures, with negative consequences on animal performance and on productivity of the pastures. In Farm 2, the pasture reclaimed with Arachis in April 1999 is now very productive and with a high legume content as shown in Figure. The CP content in Brachiaria has increased form 5 % to 10%, which has had a significant impact on productivity of the pasture.

Last year we reported that the introduction of Arachis in degraded pastures in well- drained savanna sites was not successful, regardless of ecotype used or planting density. Even though the establishment of the legume was adequate, soon after the initiation of grazing the proportion in the vegetation dropped significantly as results of competition with the grass.

We have now established the use of Arachis to reclaim degraded pastures in well drained sites in the llanos will require high use of management and fertilizer inputs, but it is unlikely that farmers would be willing to pay the extra cost. The alternative is the use of Desmodium ovalifolium, which is better adapted to acid-low fertility soils.

The value of D. ovalifolium to reclaim degraded pastures was evaluated in one farm located in well-drained site in the llanos. The pasture reclaimed had low availability of B. decumbens and high proportion of weeds. To reclaim the pasture, we plowed the land and introduced Desmodium (250 g of seed /ha) in May 2000. One year after the pasture has 20% legume and it is being successfully used to fatten steers (25 steers/ ha) (See Figure)

Given the successful introduction of D. ovalifolium, farmers have shown interest in its use to reclaim degraded pastures. A total of 140 ha of degraded pasture in well- drained savannas have been recuperated by the initiative of farmers. Farmers in the piedmont have also reclaimed more pastures (180 ha) using D. ovalifolium rather than Arachis due to lower seed cost. We have estimated that the cost of reclaiming degraded pastures with D. ovalifolium is ½ of what it is with Arachis ($ US 70 vs. 152 / ha) and this cost differential is a driving force in the adoption of legumes in the llanos.

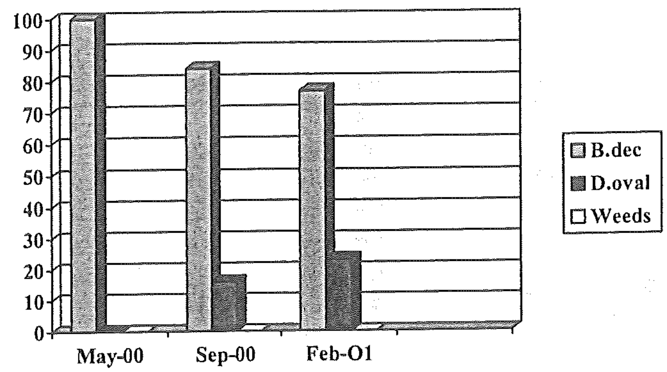

Figure. Botanical composition of a pasture reclaimed *with Desmodium ovalifolium* in a farm in the llanos

Introduction of new grasses to reclaim degraded pastures

Last year we reported that in one farm located in a well-drained savanna site with acid -low fertility soils we introduced in 1999 two new B. brizantha accessions (CIAT 26110 and 26318). In 2000 we introduced in the same farm B. brizantha 26556 G and B. brizantha 26124. In addition, we introduced B. brizantha 26110 in one farm in the piedmont.

Results on performance of these pastures are shown in Figure. In the dry season (February 2001), B. brizantha 26610 produced more biomass than the other accessions being evaluated in a well- drained savanna site. However, in the wet season (May 2001) B. brizantha 26556 G and 26124 have been more productive than the other grasses being tested in savannas. We have also observed that B. brizantha 26110 is more productive in the piedmont (P) than in a well-drained savanna (WDS) site (See Figure).

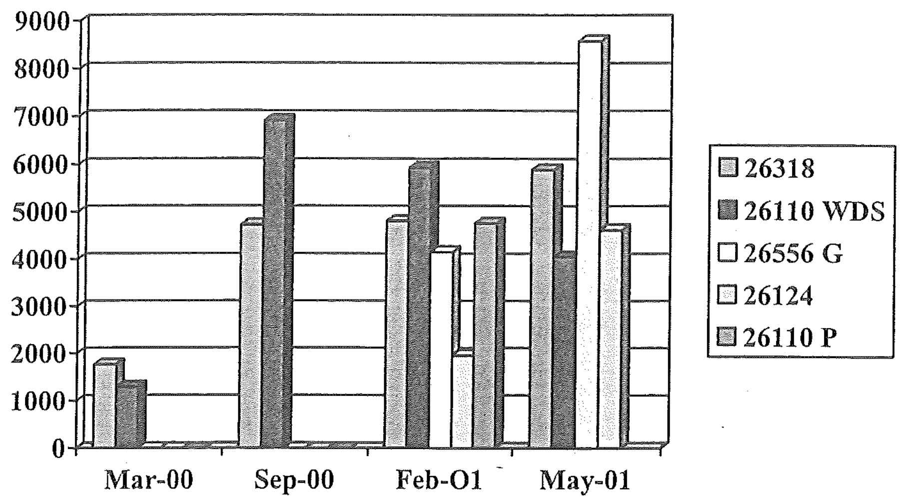

Figure. Forage on offer of different *Brachiaria brizantha* accessions under grazing in the llanos

The following feedback was obtained from a participatory evaluation of the new grasses being tested in the llanos:

B. brizantha 26318: It recovers fast after grazing but does not seem to be very palatable to cattle given it high stem content. Poor overall rating.
B. brizantha 26110: High forage production and this can result in forage loosing quality if not properly managed. Most farmers like CIAT 22610 but concur that it needs to be well managed (high stocking rates, short rest periods) to obtain good animal performance.
B. brizantha 26556 G: This grass was ranked No 2 by producers due to green intense color, high leaf content, large leafs and soft leaves. Unfortunately this accession was heavily attacked by spittlebug and recovery following grazing is slow. In spite of the susceptibility of this accession to spittlebug farmers expressed an interest in this genotype.
B. brizantha 26124: This accession was given the highest rating by producers given its high leaf content, large and soft leaves. One advantage farmers see with his accession is that it recovers fast after grazing and that it produces stolons that root.

Thus from the results on evaluation of new B. brizantha accessions, it would seem that CIAT 226110 (cv Toledo) is better adapted to the piedmont with better soils than to the more acid-low fertility soils found in well- drained savannas. In addition, it is clear that for farmers in the llanos important selection criteria for grasses include plant factors associated with quality and palatability such as leaf: stem ratio and leaf softness. Recovery of the grass after grazing is also an important selection criterion of farmers.
Finally, there is an urgent need to multiply seed of selected grasses in order to expand the on-farm evaluation of the new grasses. An alternative is to make seed available to private seed companies that have interest in establishing a multilocational-testing program with new grass alternatives.

2. Asia Component

2.1. Integrated Cassava-based Cropping Systems in Asia: Farming Practices to Enhance Sustainability

A Special Project funded by the NIPPON Foundation

Research Highlights in 2001
In Thailand farmers in 21 pilot sites are conducting a total of 106 FPR trials on many aspects of cassava cultivation, and 622 farmers have now planted a total of 123 km of vetiver grass hedgerows to control erosion.
In Vietnam farmers in 21 pilot sites are conducting a total of 155 FPR trials, and many farmers have adopted a combination of new practices such as new varieties, intercropping, hedgerows for erosion control and balanced fertilization.

Project Background

Due to high population density, cassava in Asia is generally grown more or less continuously on small plots and on sloping land. In many areas farmers harvest all plant parts, i.e. roots, stems and leaves (in some cases even fallen leaves). This has led to serious nutrient depletion and a deterioration of both the chemical and physical conditions of the soil. Where grown on slopes (even gentle slopes of 5-10%), cassava production can cause serious erosion, leading to a further degradation of the soil resource. Research has shown that soil fertility decline and erosion can be countered by a number of simple agronomic practices, but that most of these practices do require some additional inputs of labor or capital, and in some cases may take a portion of the land out of production. For that reason, farmers themselves must be directly involved in the testing of alternative ways to improve the sustainability of their cropping systems, so they can select those practices that are most suitable for their own conditions.

This special project, funded by the Nippon Foundation in Tokyo, Japan, was initiated in 1994, with the objective of using Farmer Participatory Research (FPR) methodology to test and develop with farmers the best practices to control erosion and maintain soil fertility in cassava-based systems in Asia, and to enhance the adoption of these selected technologies. The first phase of the project (1994-1998) was conducted in Thailand, Vietnam, China and Indonesia in close collaboration with various research and extension organizations in those countries. The second phase (1999-2003) intends to build on the FPR methodologies developed in the first phase, and to use farmer participatory extension (FPE) methodologies to disseminate and enhance adoption of the best farmer-selected practices. This second phase is being implemented in collaboration with five research and extension organization in Thailand, six institutions in Vietnam and three in China.

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Budget 2001: $360,242 from Nippon Foundation, Tokyo, Japan

Details of Activities 2001

2.1.1. PE-5 Output 2. Generic technologies for sustainable production developed through farmer participatory research.

SP Output: Increased net benefits to farmers in 15 sites with less erosion in cassava-based systems in Asia by 2004.

1. Erosion control

Main achievements:

In Thailand six FPR erosion control trials are being conducted in three sites, and most farmers have adopted the planting of vetiver grass contour hedgerows to control erosion. A

total of 622 farmers have so far planted 123 km of vetiver grass hedgerows, covering an area of about 600 ha of cassava fields.
In Vietnam 30 FPR erosion control trials are being conducted in 13 sites, and many farmers have adopted the planting of Tephrosia candida, vetiver grass, pineapple or Paspalum atratum as contour hedgerows to control erosion, while others have adopted intercropping and better fertilization practices to increase income and reduce erosion in their cassava fields.
Rationale: Due to its wide spacing and slow initial growth, during the first three months after planting cassava much of the soil remains exposed to the direct impact of rain drops. When the crop is grown on sloping land, this may result in serious erosion. In small plots and on steeper slopes (such as in north Vietnam) this tends to be mainly sheet and rill erosion, while on larger plots and on gentle slopes (such as in Thailand) massive amounts of runoff water may accumulate in natural drainage ways, which can lead to both sheet erosion and serious gulley formation. To determine which practices are most suitable to reduce these two types of erosion, farmers were encouraged and assisted in conducting simple FPR erosion control trials on their own fields.

Methods: After visiting erosion control demonstration plots with a wide range of treatment options to reduce erosion, and/or a cross-visit to another village where farmers had already conducted FPR erosion control trials or had started to implement some selected practices, farmers from new FPR sites discussed among themselves which treatments they wanted to test in their own village. Once four or five treatments were selected, project staff helped the volunteer farmers to select a suitable area with a uniform slope on their own farm and to layout 4-5 plots along the contour. Along the lower end of each plot a trench was dug and then covered with plastic sheet. Runoff water and eroded soil sediments would be trapped in these trenches. The water was allowed to seep away through small holes made in the plastic, while the eroded sediments were collected and weighed at the middle and end of the growth cycle. After drying samples of wet sediments, the dry soil loss due to erosion was calculated for each treatment. Gross incomes were determined from the yields of cassava and intercrops in each treatment, and after substracting the production cost, the net income was obtained. From these data farmers could make their own decisions about which practices were most effective in controlling erosion and increasing income.

Outputs: After having conducted several years of FPR erosion control trials, farmers in Thailand have almost invariably selected the planting of contour hedgerows of vetiver grass as the most suitable measure to control erosion. However, vetiver grass can only be planted from vegetative planting material, which is bulky, has high transport cost and requires a lot of labor for planting. Moreover, the grass has little value as an animal feed and has few other uses. In Thailand planting material is generally available free of charge from the Land Development Dept. (LDD), but in other countries farmers have to produce their own plants. For that reason, research was conducted in Thailand and in Hainan island of China, to evaluate other grasses that can be propagated either from seed or vegetatively, that have other uses, are effective in erosion control, and that do not compete excessively with neighboring cassava plants. Figure 1 shows the competitive effect of various grass species on the two neighboring cassava rows, when three rows of cassava were planted between hedgerows of each grass species in Khaw Hin Sorn, Thailand. In spite of being cut back three times during the year, all grass species competed with cassava in the row immediately adjacent to the hedgerow (0.7 m between cassava and center of hedgerow), especially

Brachiaria brizantha and natural weeds (which included the very aggressive Pennisetum pedicellatum, known as "communist grass" in Thailand). Lemon grass and vetiver grass were least competitive and Setaria spacelata and Paspalum atratum had an intermediate effect.

Table 1 shows similar results obtained in CATAS, Hainan, China. Highest cassava yields were obtained with lemon grass hedgerows (due to very poor growth in the third year), vetiver grass, Paspalum atratum and hybrid elephant grass, while Panicum maximum TD 56, dwarf or common elephant grass, and king grass were excessively competitive, reducing cassava yields in two rows adjacent to the grass; Brach. brizantha was intermediately competitive. Thus, lemon grass, Paspalum atratum and Brach. brizantha continue to be the most promising alternatives to vetiver grass. All are quite effective in erosion control (data not shown).

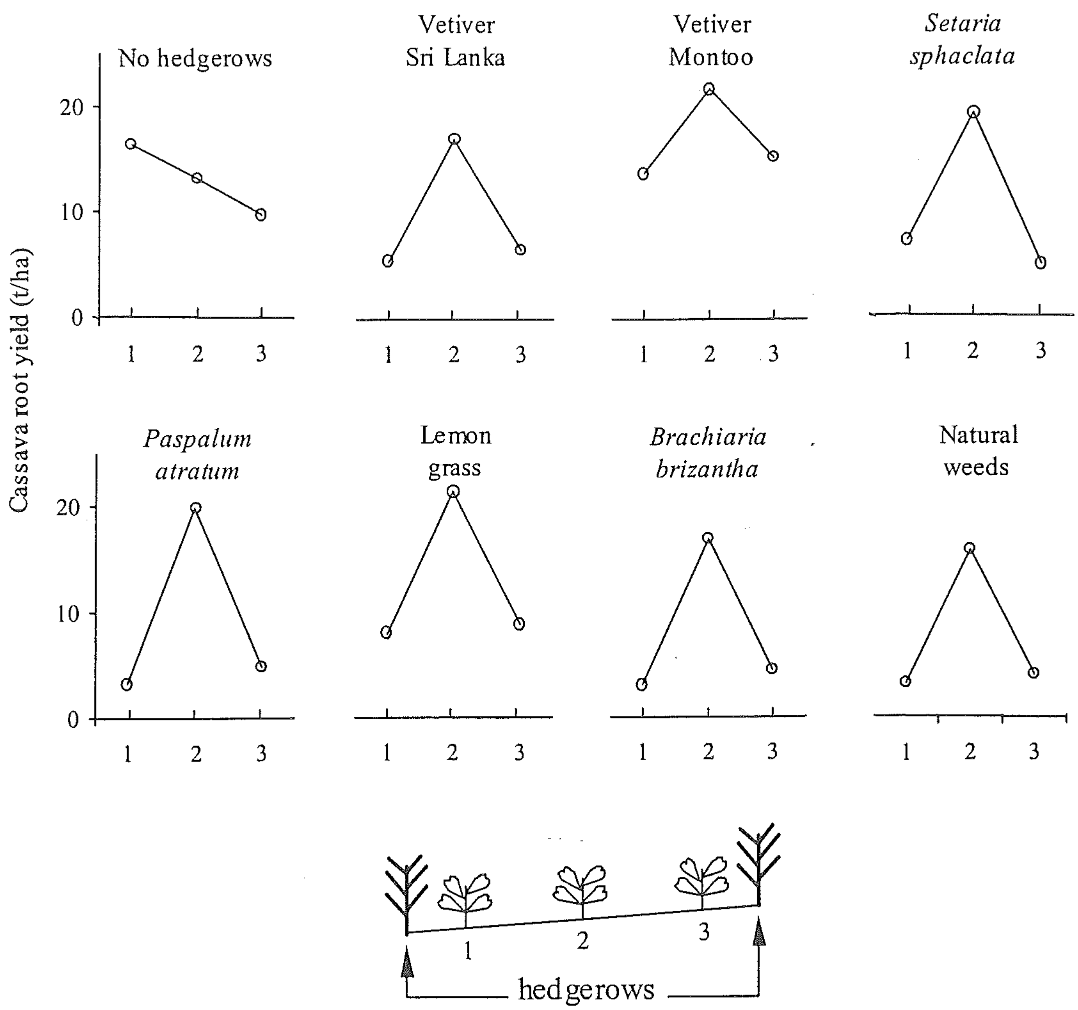

Figure 1. The effect of different grass species as contour hedgerows on the fresh root yield of cassava, cv KU 50, grown in three rows between hedgerows in Khaw Hin Sorn, Chachoengsao, Thailand in 2000/01 (2d year).
Note: *vetiver Montoo was planted in 2000; all others in 1999.*

Table 1. The effect of different grass species planted as contour hedgerows on the fresh root yield of cassava and the yield of the grasses when cassava was grown in three rows between hedgerows in CATAS, Danzhou, Hainan, China in 2000 (third year).

Grass species	Cassava yield (t/ha)				Fresh grass yield (t/ha)				% DM
	Bottom	Middle	Top	Av.	Bottom	Middle	Top	Av.	
1. vetiver grass	29.75	35.75	35.00	33.50	15.3	9.0	19.2	14.5	31.3
2. dwarf elephant grass	5.00	9.50	12.00	8.84	53.2	44.5	45.1	47.6	21.5
3. common elephant grass	11.50	17.75	11.00	13.42	106.4	64.7	58.6	76.6	32.3
4. king grass	11.50	22.50	14.75	16.25	102.3	70.3	98.0	90.2	33.1
5. sugarcane	20.25	20.00	15.75	18.67	-[1)]	-	-	-	-
6. Brachiaria ruziziensis	19.75	23.75	11.25	18.25	19.0	13.1	22.1	18.1	18.0
7. Brachiaria decumbens	17.00	38.50	16.75	24.08	24.1	17.0	30.2	23.8	25.8
8. Brachiaria brizantha	15.75	40.00	26.75	27.50	35.2	22.9	22.5	26.9	25.8
9. Paspalum atratum	34.50	34.50	28.75	32.58	18.6	11.4	13.0	14.3	20.9
10. Panicum maximum TD 56	3.25	5.00	9.25	5.83	63.7	51.9	64.9	60.2	25.7
11. lemon grass	43.25	38.25	53.50	45.00	0.5	0.3	0.6	0.5	30.4
12. hybrid elephant grass	26.00	42.00	27.00	31.67	19.7	10.9	26.9	19.2	16.2
Average	19.79	27.29	21.81	22.96	41.6	28.7	36.5	35.6	

Sugarcane was stolen before harvest

Table 2 shows the results of an FPR demonstration conducted at Thai Nguyen University in north Vietnam in 2000. It is clear that erosion was quite severe in the unfertilized check plot, but that soil losses could be effectively controlled by fertilizer application in combination with either contour ridges or contour hedgerows of various species. Vetiver grass or combinations of vetiver and Tephrosia candida were most effective. Gross and net income tended to be highest when either cassava was planted at close spacing (0.6x0.8 m) or was intercropped with peanut. Both treatments resulted in a more rapid covering of the soil leading to reduced runoff and erosion.

Tables 3 and 4 show the results of FPR erosion control trials conducted in two villages in north and south Vietnam, respectively. In both cases, contour hedgerows of Tephrosia candida, vetiver grass, Paspalum atratum or closely spaced pineapple were very effective in reducing soil erosion; soil losses were reduced to one half to one third of those obtained without hedgerows. In general, farmers showed a preference for those treatments producing a high net income and low levels of erosion. This usually included intercropping with peanut combined with hedgerows of vetiver grass or Tephrosia candida. In areas of south Vietnam (Table 4) where some farmers raise cattle, they are also very interested in hedgerows of Paspalum atratum, which, unlike vetiver grass, can be utilized as cattle feed.

Table 2. Results of an FPR demonstration conducted on 8-10% slope at Thai Nguyen University, Thai Nguyen, Vietnam in 2000.

Treatments	Dry soil loss (t/ha)	Yield (t/ha) cassava	Yield (t/ha) peanut	Gross income[1)]	Production costs[2)]	Net income
				('000 dong/ha)		
1. C monoculture, no fertilizer, no hedgerows, no ridges, 1x0.8 m	49.53	2.30	-	1,150	2,800	-1,650
2. C monoculture, with fertilizer, no hedgerows, contour ridges, 1x0.8 m	8.45	15.83	-	7,915	4,364	3,551
3. C monoculture, with fertilizer, Paspalum hedgerows, no ridges, 1x0.8 m	9.82	16.00	-	8,000	4,164	3,836
4. C monoculture, with fertilizer, vetiver+ Tephrosia hedgerows, no ridges 1x0.8 m	3.74	16.33	-	8,165	5,464	2,701
5. C+P, with fertilizer, Tephrosia hedgerows, no ridges, 1x0.8 m	5.03	16.26	0.47	10,480	5,464	5,016
6. C+P, with fertilizer, Tephrosia+pineapple hedgerows, no ridges, 1x0.8 m	4.82	16.33	0.37	10,015	5,464	4,551
7. C+P, with fertilizer, natural grass hedgerows, no ridges, 1x0.8 m	6.13	15.85	0.34	9,625	5,164	4,461
8. C+P, with fertilizer, vetiver hedgerows, no ridges, 1x0.8 m	2.62	17.15	0.37	10,425	5,464	4,961
9. C+P, with fertilizer, vetiver+ Tephrosia hedgerows, no ridges, 1x0.8 m	3.99	15.72	0.41	9,910	5,464	4,446
10. C monoculture, with fertilizer, Brach brizantha hedgerows, no ridges, 0.6x0.8 m	3.05	20.16	-	10,080	4,664	5,416

[1)]Prices: cassava dong 500/ kg fresh roots
peanut 5,000/ kg dry pods
urea (45% N) 2,100/ kg
SSP (17% P_2O_5) 950/ kg
KCl (60% K_2O) 2,300/ kg
Labor 10,000/ manday

[2)]Cost of cassava cultivation: 2.8 mil. dong/ha
Cost of fertilizers ($60N+40P_2O_5+120K_2O$): 0.964 mil. dong/ha
Cost of fertilizer application: 0.10 mil. dong/ha
Cost of hedgerow seed, planting and maintenance: 0.30 mil. dong/ha
Labor cost of intercropping with peanut: 1.00 mil. dong/ha
Cost of peanut seed: 0.30 mil. dong/ha
Cost of contour ridging: 0.50 mil. dong/ha

Table 3. Agerage results of two FPR erosion control trials conducted by farmers in Minh Duc village, Pho Yen district, Thai Nguyen, Vietnam in 2000.

Treatments[1)]	Dry soil loss (t/ha)	Yield (t/ha) cassava	Yield (t/ha) peanut	Gross income[2)] ('000 dong/ha)	Product. costs[3)] ('000 dong/ha)	Net income ('000 dong/ha)	Farmers' preference (%)
1. Farmer's practice	21.30	13.12	-	6,560	2,800	3,760	0
2. C+P, no hedgerows	18.51	18.68	0.31	10,890	4,100	6,790	50
3. C+P, vetiver hedgerows	10.35	20.00	0.28	11,400	4,400	7,000	73
4. C+P, Tephrosia hedgerows	11.22	19.87	0.27	11,285	4,400	6,885	67
5. C+P, Teph.+vetiver hedgerows	9.87	21.81	0.27	12,255	4,400	7,855	97

[1)]Farmers' practice: 12 t/ha FYM +45N + $30P_2O_5$ = 1.626 mil. dong/ha
Treatments 2-5: 10 t/ha FYM+80N+$40P_2O_5$+$80K_2O$=2.013 mil. dong/ha

[2)]Prices:
- cassava dong 500/ kg fresh roots
- peanut 5,000/ kg dry pods
- urea (45% N) 2,500/ kg
- SSP (17% P_2O_5) 1,000/ kg
- KCl (60% K_2O) 2,500/ kg
- FYM 100/ kg
- labor 10,000/ manday

[3)]Cost of cassava monocropping: 2.8 mil. dong/ha
Labor cost of peanut intercropping: 1.0 mil dong/ha
Cost of peanut seed: 0.3 mil. dong/ha
Labor cost of hedgerow planting+maintenance: 0.1 mil. dong/ha
Cost of hedgerow seed: 0.2 mil dong/ha

Table 4. Average results of two FPR erosion control trials conducted by farmers in Suoi Rao village, Chau Duc district, Baria-Vungtau, Vietnam in 2000/01.

Treatments	Dry soil loss (t/ha)	Cassava yield (t/ha)	Maize yield (t/ha)	Gross income[1] ('000 dong/ha)	Product. costs[1]	Net income	Farmers' preference (%)
1. Cassava monoculture	31.76	48.85	-	14,655	6,843	7,812	0
2. C+pineapple hedgerows	11.20	43.54	-	13,062	7,043	6,019	0
3. C+Paspalum hedgerows	15.49	40.54	-	12,162	7,043	5,119	71
4. C+vetiver hedgerows	13.15	47.16	-	14,148	7,043	7,105	100
5. C+maize intercrop	11.82	33.24	4.468	14.529	8,345	6,184	17

[1] Prices: cassava dong 300/ kg fresh roots
maize 1,020/ kg dry grain
cassava fertilizers 1,143,600/ha
casava stake 500,000/ ha
maize seed 400,000/ ha
labor in cassava 5,000,000/ ha = 200 mandays
maize fertilizers 568,000/ ha
labor in maize 534,000/ ha = 21.4 mandays
labor in hedgerow planting 200,000/ ha = 8 mandays
labor in fertilizer application 200,000/ ha = 8 mandays

Tables 5 and 6 show that similar FPR erosion control trials are being conducted in 2001 by six farmers in three locations in Thailand, and by 30 farmers in 13 locations in Vietnam. These trials not only help farmers select the best options for their own conditions, but they also clearly show the amount of soil lost each year due to erosion; this makes farmers aware of the need to reduce the problem. By observing the eroded sediments in these FPR trials, soil erosion is no longer an abstract concept, but becomes something real and tangible; being aware of the problem is the first step on the way to solving it.

Once the vetiver grass technology was scaled up to production fields, other problems arose. Large fields inevitably have irregular slopes, and large amounts of runoff water can rush down the slope along the concave parts of the landscape. Where soils are light textured and poorly aggregated, this can lead to serious gulley formation. Vetiver grass planted across these natural drainage ways is often washed out before plants can get established, leaving a hole in the hedgerow precisely where the hedgerow is most needed. Attempts at stopping or slowing the water by building barricades of bricks, trees, bundles of cassava stems or sand bags across the gulley have all failed because these are generally washed out, or the water cuts into the banks to go around the obstacles. Attempts to plant other grasses from seed early in the rainy season have also failed as the seed did not germinate due to lack of moisture, while later in the season the seed was washed away. Farmers in Thailand are now experimenting with placing a row of soil-filled bags across the gulley and securing the bags by hammering bamboo posts into the soil just behind the bags.

Table 5. Number of FPR trials conducted by farmers in various sites in Thailand in 2001, and the adoption of vetiver grass for erosion control in those sites.

Province	District	Subdistrict	Village	FPR trials (no. farmers/rai) Varie-ties	Org. manures	Chem. fert.	Erosion control	Herbi-cides	Green manures	Inter-crop	Planting distance	Adoption of erosion control practices No. of farmers	Cassava area (rai)[1)]	Vetiver (No. of plants)	Vetiver hedgerows (km)
Nakhon Rachasima	Daan Khun Thot	Baan Kaw	Khut Dook	1/2	1/1.5	1/1.5	1/0.25	1/0.5	-	-	-	53	309	130,000	15
	Thephaarak	Bueng Prue	3 and 6	5/5	4/8	5/5	-	2/8	-	8/4	-	26	214	80,000	11
	Soeng Saang	Noon Sombuun	Sapphong Phoot	2/8	3/12	1/5	-	-	-			60	828	80,000	20
		Sratakhian	Sratakhian*	-	-	-	-	-	-	-	-		30	20,000	2
	Khonburi	Maabtago-en	Lampiak*											20,000	
Prachinburi	Naadii	KaengDinso	Aang Thong Khao Khaat	1/4	-	3/15	-	1/5	-	-		34	170	60,000	4.5
Kalasin	Mueang	Phuu Po Khamin	Noon Sawan Khamplaa*	-	-	1/2	-	2/4	1/2	2/4	-	61	306	85,500	8.6
	Nongkungsri	Nong Bua	Khamsri	1/2	-	1/2	-	1/2	1/2	1/2	1/2	67	690	111,600	11.2
	Sahatsakhan	Noonburi	Noon Sawaat	1/2	-	1/2	-	1/2	1/2	1/2	1/2	63	370	86,170	8.6
		Noonnamklian g	Huay Suea Ten	1/2	-	1/2	-	1/2	1/2	1/2	1/2	42	254	128,330	12.8
Chachoengsao	Sanaamchaikhet	Thung Phrayaa	Paa Kluay Thaachiwit Mai	-	-	-	-	-	-	-	-	6	45	50,000	2
	Thaatakiab	Khlong Takraw	Nong Yai*	-	1/5	1/5	-	1/5	1/5	1/5	-	42	170	100,000	5.3
Kamphaengphet	Khanuwaralak-burii	Bo Tham	Siiyaek* Ton Thoo	1/5	-	1/5	-	1/5	1/5	1/5	-	42	170	68,000	3
Chaiyapuum	Thep Sathit	Naayaang Klak	Khook Anu*	2/2	-	6/6	2/0.5	6/9	6/6	-	-	42	170	68,000	4
Kaanchanaburi	Law Khwan	Thung Krabam	Nong Kae*	1/4	1/4	1/5	3/0.75	-	1/4	1/3	-	42	170	80,000	3
Srakaew	Wang Sombuun	Wang Sombuun	Noon Thong	-	-	-	-	-	-	-	-	42		90,000	12
(Total) 8	**14**	**17**	**21**	**16/39**	**10/30.5**	**23/55.5**	**6/1.5**	**17/43.5**	**13/28**	**16/21**	**3/6**	**622**	**3,896 =623 ha**	**1,256,600**	**123**

* initiated in 2001

1) 1 hectare = 6.25 rai

Table 6. Number of FPR trials conducted by farmers in various sites in Vietnam in 2001, and the adoption of new technologies in those sites.

Village, district, province	Number of FPR trials							Adoption (no. farmers)				
	Varieties	Erosion control	Inter-cropping	Fertilization	Plant spacing	Spacing for leaf product.	Pig feeding	Varieties	Fertilization	Erosion contr.	Inter-crop.	Sila mal
Tien Phong, Pho Yen, Thai Nguyen	-	-	4	-	-	-	-	-	-	-	-	-
Dac Son, Pho Yen, Thai Nguyen	-	-	-	-	-	-	-	-	-	-	-	-
Minh Duc, Pho Yen, Thai Nguyen	2	2	3	1	-	-	-	-	-	-	-	-
Hong Tien, Pho Yen, Thai Nguyen	-	-	-	-	-	-	-	-	-	-	-	-
Am Thang, Son Duong, Tuyen Quang	5	1	2	2	1	-	-	-	-	-	-	-
Hong Tien, Son Duong, Tuyen Quang	5	3	-	2	1	-	-	-	-	-	-	-
Yen Hung, Van Yen, Yen Bai	-	-	1	-	-	-	-	-	-	-	-	-
Dong Rang, Luong Son, Hao Binh	-	4	2	5	-	-	-	-	-	45	45	-
Kieu Tung, Thanh Ba, Phu Tho	-	1	-	4	-	-	-	-	-	-	-	-
Thong Nhat, Phu Ninh, Phu Tho	3	3	-	3	2	-	-	-	-	-	-	-
Bao Thanh, Phu Ninh, Phu Tho	3	1	-	3	-	-	-	-	-	-	-	-
Thach Hoa, Thach That, Ha Tay	1	2	3	3	-	-	-	-	-	-	-	-
Tran Phu, Chuong Mi, Ha Tay	5	-	3	-	-	-	-	-	-	-	66	-
Hong Ha, A Luoi, Thua Thien-Hue	3	3	3	3	2	1	6	12	12	25	5	15
Thuong Long, Nam Dong, Thua Thien-Hue	1	2	2	2	2	1	-	10	-	-	-	6
Huong Van, Huong Tra, Thua Thien-Hue	-	-	-	-	-	-	5	-	-	-	-	40
An Vien, Thong Nhat, Dong Nai	-	-	-	3	-	-	-	>30	2	-	5	-
Dong Tam, Dong Xoai, Binh Phuoc	5	4	-	2	-	-	-	-	5	-	5	-
Minh Lap, Dong Xoai, Binh Phuoc	-	-	-	3	-	-	-	-	10	-	5	-
Suoi Rao, Chau Duc, Baria Vungtau	2	2	2	2	-	-	-	-	-	-	-	-
Son Binh, Chau Duc, Baria Vungtau	2	2	2	2	-	-	-	-	-	-	-	-
Total	**37**	**30**	**27**	**40**	**8**	**2**	**11**					

One or two rows of vetiver grass are planted across the gulley just above the bags. Eroded soil and moisture accumulating in the gulley before the bags provide excellent conditions for the vetiver grass to get established and grow, while the bags provide protection and prevent the young plants from being washed away. Once well established the vetiver grass barrier functions as a sieve, slowing down the runoff water in the gulley and trapping sediments above the hedgerow, resulting in natural terrace formation. Once the speed of water is reduced, natural weeds can get established in the bottom of the gulley providing additional protection. In Nongkungsri district of Kalasin, farmers experimented with various alternatives and had most success with the above described technology. Above the bags soil sediments accumulated to 60 cm depth during four months of wet season and further gulley erosion was prevented. This methodology is now being tested by farmers in other sites with similar problems.

2. Fertility maintenance

Main achievements:

Besides testing chemical fertilizers, farmers in Thailand are starting to test the use of animal manures and green manures to maintain soil fertility and improve the physical conditions of their soil.

In Vietnam, more and more farmers are applying some chemical fertilizers high in N and K in addition to pig manure to their cassava crops, markedly increasing yields and net income.

Rationale: Like most other crops, when grown on poor soils cassava responds markedly to fertilizer application. Especially in areas where cassava has been grown continuously for many years without adequate inputs of fertilizers or manures, yields can often be increased 2-3 fold by fertilizer application. By doing FPR fertilizer or manure trials on their own fields, farmers become aware of the potential yield increases that can be obtained by the judicious use of chemical and organic fertilizers.

Outputs: Long- term fertilizer trials were continued in two locations of Vietnam, one in Hainan province of China, and one in Lampung province of Indonesia. Figure 2 shows the effect of N, P and K applications on cassava yields and soil fertility parameters during 11 years of continuous cassava cropping at Thai Nguyen University in north Vietnam. High yields of 20 t/ha could be maintained with the annual application of 80 kg N, 40 P_2O_5 and 80 K_2O/ha. Doubling those levels increased yields only slightly (Figure 3). Potassium was the most limiting nutrient for cassava production in these soils, followed by N and P. However, over time, lack of N decreased and lack of P increased in importance with successive cropping cycles. Without fertilizers or without K, yields were only 1-2 t/ha in the 11^{th} cropping cycle. From a similar long-term experiment conducted in CATAS, Hainan, China, critical levels (corresponding to 95% of maximum yield) of 4.25%

N, 0.35% P and 1.7% K in youngest fully expanded leaf (YFEL) blades could be determined. These levels are slightly lower for N, but are otherwise similar to those reported earlier (Howeler, 2001). These critical levels are used for diagnosing deficiencies of N, P or K.

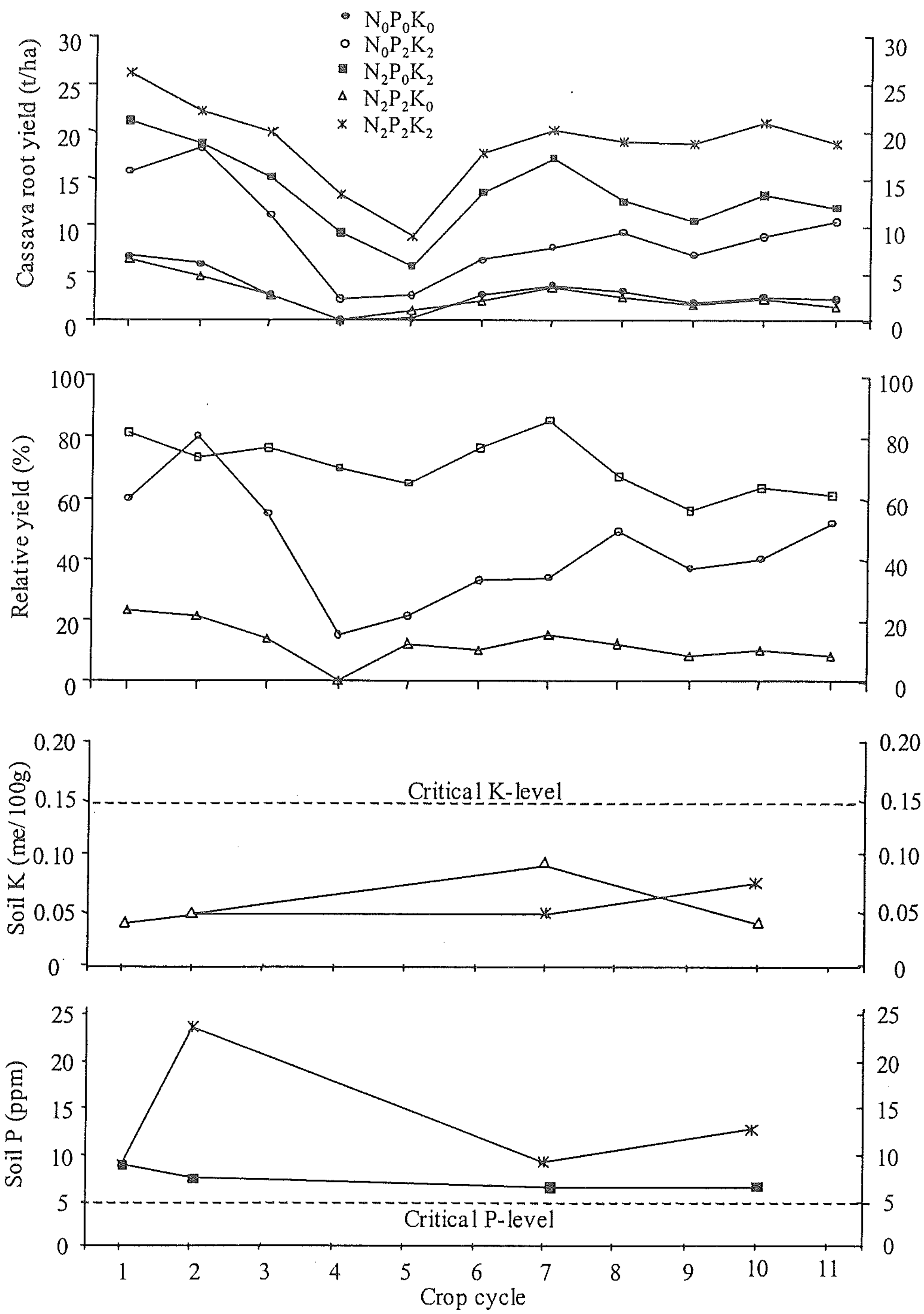

Figure 2. Effect of annual applications of N, P and K on cassava root yield, relative yield (yield without the nutrient over the highest yield with the nutrient) and the exchangeable K and available P (Bray 2) content of the soil during eleven years of continuous cropping in Agro-forestry College of Thai Nguyen University, Thai Nguyen, Vietnam.

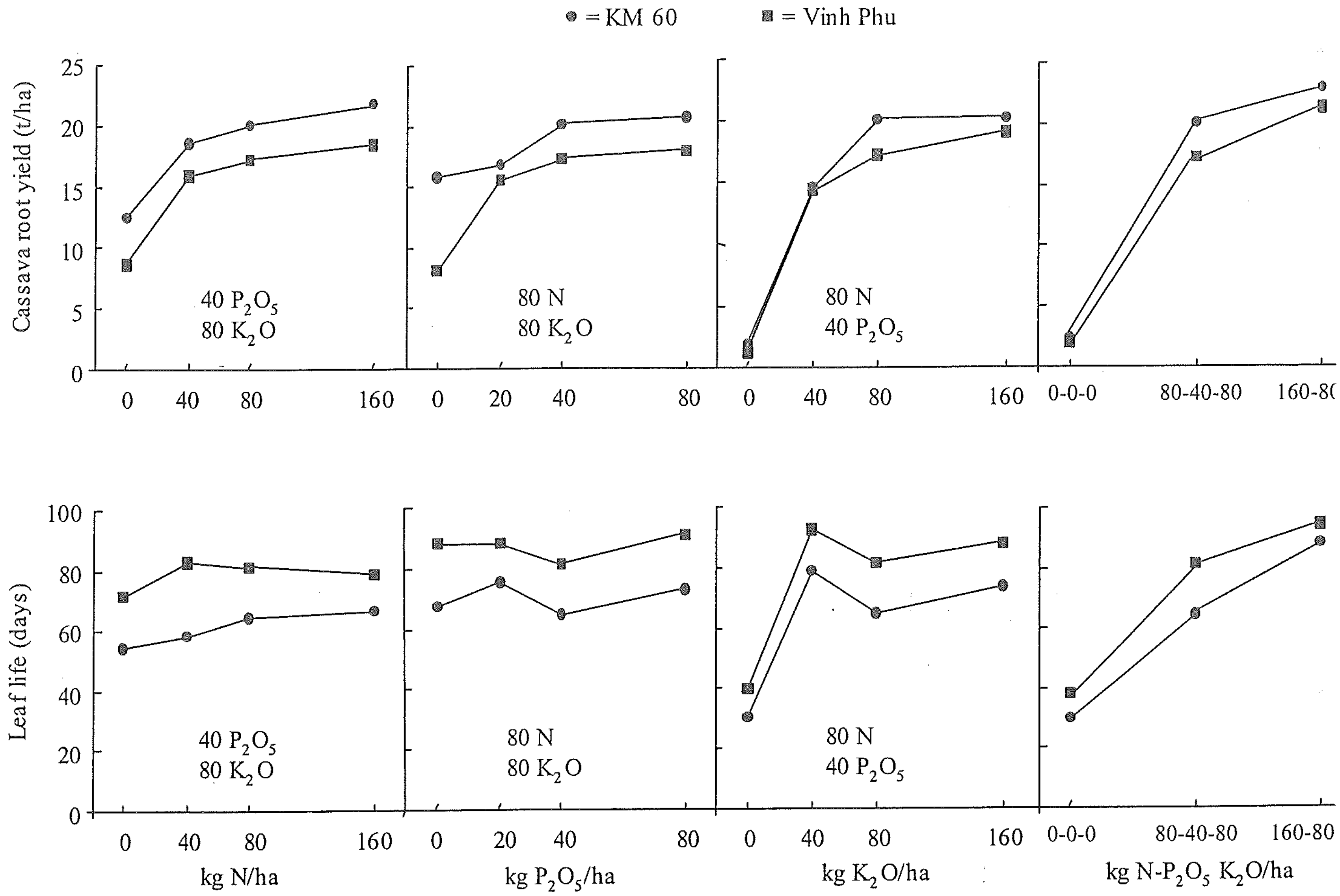

Figure 3. Effect of annual applications of N, P and K on the root yield at harvest and leaf life at 90 DAP of t cassava varieties grown at Thai Nguyen University, Thai Nguyen, Vietnam in 2000 (11th year).

These trials show that high yields of cassava can be maintained with application of only chemical fertilizers. However, a recent experiment at Thai Nguyen University (Table 7) indicate that at least during the first year the same yield levels can be obtained with high applications (15 t/ha) of pig manure as with lower applications of pig manure (5 t/ha) combined with 80 kg N+80 K_2O/ha. Depending on the value put on the pig manure, these two alternatives may produce similar net incomes, and those are definitely much higher than when low levels of either manure or fertilizers are applyied.

Table 7. Effect of the application of various levels of pig manure with or without NK fertilizers on cassava yield and economic returns in Thai Nguyen University, Thai Nguyen, Vietnam.

Marure and fertilizer treatments	Cassava root yield (t/ha)	Gross income[1)]	Fertilizer costs[1)]	Producttio n costs[2)]	Net income
		('000 dong/ha)		———	
1. 0 FYM; 0 NPK	5.50	2,750	0	2,800	-50
2. 5 t/ha FYM; 0 NPK	16.97	8,485	500	3,400	5,085
3. 10 t/ha FYM; 0 NPK	18.10	9,050	1,000	3,900	5,150
4. 15 t/ha FYM; 0 NPK	21.32	10,660	1,500	4,400	6,260
5. 0 FYM; 80N+80K_2O	17.41	8,705	778	3,728	4,977
6. 5 t/ha FYM; 80N+80K_2O	20.97	10,485	1,278	4,228	6,257
7. 10 t/ha FYM; 80N+80K_2O	21.66	10,830	1,778	4,728	6,102
8. 15 t/ha FYM; 80N+80K_2O	22.66	11,330	2,278	5,228	6,102

1)Prices: cassava dong 500/ kg fresh roots
urea (45% N) 2,500/ kg
SSP (15% P_2O_5) 1,000/ kg
KCl (60% K_2O) 2,500/ kg
FYM 100/ kg

2)Cost of cassava cultivation: 2.8 mil. dong/ha
Cost of manure application : 0.1 mil. dong/ha
Cost of fertilizer application: 0.05 mil. dong/ha

In 2001, FPR fertilizer trials are being conducted by 23 farmers in 12 sites in Thailand and by 40 farmers in 15 sites in Vietnam. Tables 8 and 9 show the results of two such trials conducted in 2000. Table 8 shows that the combined application of medium levels of pig manure with NPK fertilizers doubled yields and more than doubled net income. Similar results were obtained in almost all trials. However, Table 9 shows that in one location in Thailand the application of 15-7-18 fertilizers increased yields but decreased net income. This was due to the low cassava price this year, and unfavorable weather conditions resulting in very low yields.

Having seen the effect of fertilizers on their own fields, most farmers in the FPR pilot sites in Vietnam are now applying a more balanced fertilization, consisting of both manure and chemical fertilizers. In Thailand, however, most farmers do not raise animals and application of animal manures may be too expensive. Nevertheless, this year farmers have become interested in testing both animal and green manures in their FPR trials. Results are not yet available, but at least the interest in improving their soil's productivity is there. Most likely, a combination of small amounts of animal manures with chemical fertilizers high in N and K is the most suitable practice under Thai conditions. Intercropping cassava with green manures such as Canavalia ensiformis, Crotalaria juncia or mungbean, as is presently being tried, is unlikely to increase cassava yields due to severe competition from the green manures during the early stages of crop development. More fine-tuning of relative planting time and plant spacing will be required to make this system work effectively.

Table 8. Average results of three FPR fertilizer trials conducted by farmers in Dong Tam village, Dong Xoai district, Binh Phuoc, Vietnam in 2000/01.

Treatments	Cassava yield (t/ha)	Gross income[1)]	Production costs[1)]	Net income	Farmers' preference[2)] (%)
		('000 dong/ha)			
0N-0P-0K	16.6	4,482	2,900	1,582	20
$80N-40P_2O_5-80K_2O$	25.8	6,966	3,879	3,087	50
$80N-40P_2O_5-80K_2O$+5t FYM/ha	30.4	8,208	4,429	3,779	30

[1)]Prices: cassava dong 270/ kg fresh roots
urea (46% N) 2300/ kg
SSP (18% P_2O_5) 1000/ kg
KCl (60% K_2O) 2300/ kg
FYM 100/ kg
[2)]Number of participating farmers: 24

Table 9. Average results of four FPR fertilizer trials conducted by farmers in Kaengdinso subdistrict, Naadi district of Prachinburi, Thailand in 2000/01.

Fertilizer treatments[1)]	Cassava yield (t/ha)	Starch content (%)	Gross income[2)]	Fertil. cost[2)]	Product. costs[3)]	Net income	Farmers' ranking
			(baht/ha)				
1. No fertilizers	8.60	21.9	6,777	0	5,907	870	4
2. 25 kg/rai of 15-15-15 fert.	8.79	21.4	6,839	1,406	7,812	-973	3
3. 50 kg/rai of 15-15-15 fert.	7.10	22.7	5,708	2,812	8,948	-3,240	5
4. 25 kg/rai of 15-7-18 fert.	9.36	23.1	7,600	1,250	7,798	-148	1
5. 50 kg/rai of 15-7-18 fert.	9.21	22.6	7,386	2,500	8,974	-1,588	2

[1)]1 ha = 6.25 rai
[2)]Prices:cassava baht 0.95/kg fresh roots at 30% starch with 0.02 baht/kg reduction for every 1% lower starch content
15-15-15 fertilizers 9.00/kg
15-7-18 fertilizers 8.00/kg
[3)]Production costs without fertilizers: 4531 baht/ha plus 160 baht/tonne fresh roots for harvest and transport
Cost of fertilizer application: 469 baht/ha

3. Intercropping

Main achiements:

In Thailand and Vietnam 16 and 27 farmers, respectively, are experimenting with various intercropping systems.

In Tran Phu commune of Ha Tay province of Vietnam, a women's group representing 66 households have all planted cassava intercropped with peanut. They have also planted 2 ha of peanut for seed increase so that next year all farmers will be able to intercrop cassava with peanut.

Rationale: Intercropping cassava with grain legumes, maize, pumpkin or watermelon is an effective way to increase the farmers' income, while at the same time covering the soil between young cassava plants to reduce erosion. Very intensive cassava-based intercropping systems have been used for generations by farmers in Indonesia but are seldom used in other countries, except for intercropping with maize in the Philippines and in limited areas in Thailand and southern Vietnam, and intercropping with watermelon in parts of China.

Outputs: In Thailand 16 FPR intercropping trials are being conducted in eight sites, testing mostly intercropping with sweet corn and various types of melons, gourds and pumpkins. In Vietnam 27 FPR intercropping trials are being conducted in 11 sites, testing mainly peanut and blackbeans in north Vietnam, and peanut, soybean, mungbean, cowpea and maize in south Vietnam. Table 10 is a good example of FPR intercropping trials conducted in Tran Phu commune of Ha Tay province in north Vietnam. Intercropping with two rows of peanut between cassava rows did not effect cassava yields while producing 1.7 t/ha of peanuts, which resulted in a 160% increase in net income. Based on these promising results of three FPR trials conducted in 2000, the local women's group with 66 members have all planted cassava intercropped with peanut this year. A new peanut variety, recently released by VASI, is being incremented so that next year all farmers in the village can intercrop cassava with peanut. Similarly, intercropping with peanut or blackbean is now widely practiced in Pho Yen district of Thai Nguyen province, in Dong Rang and in Kieu Tung, as well as by some farmers in Hong Ha village of Hue. Intercropping is less feasible in Thailand and China because of lack of labor and/or unsuitable climatic and soil conditions.

Table 10. Average results of three FPR intercropping trials conducted by farmers in Tran Phu commune, Chuong My district, Ha Tay, Vietnam in 2000/01.

Treatments	Cassava yield (t/ha)	Intercrop yield (t/ha)	Gross income[2] ('000 dong/ha)	Product. costs[3]	Net income
Cassava monoculture	29.03	-	8,709	3,900	4,809
C+peanut (1 row)	32.50	0.887	14,185	5,143	9,042
C+peanut (2 rows)	30.43	1.760	17,929	5,386	12,543
C+black bean (1 row)	27.27	0[1]	8,181	5,020	3,161
C+black bean (2 rows)	25.83	0[1]	7,749	5,140	2,609

[1]No yield of black bean due to drought

[2]Prices: cassava dong 300/ kg fresh roots
peanut 5,000/ kg dry pods

[3]Costs: peanut seed 6,000/ kg dry grain (need 40.5 kg/ha for 1 row, 81 kg/ha for 2 rows)
black bean seed 6,000/ kg dry grain (need 20 kg/ha for 1 row, 40 kg/ha for 2 rows)
Cost cassava production 2.8 mil. dong/ha
Labor costs intercropping 1.0 mil. dong/ha
Cost manure and application 1.1 mil. dong/ha

4. Weed control

Rationale: In areas where fields are large and labor is expensive (mainly south Vietnam and Thailand) the use of herbicides instead of hand weeding is an attractive option. Hand weeding may require 20-80 mandays/ha and constitute a major part of production costs.

Outputs: Research conducted at Hung Loc Agric. Research Center in south Vietnam has consistently shown that the application of the pre-emergence herbicide metolachlor (Dual) can replace 2-3 hand weedings, thus reducing the cost of weeding and increasing net income (Table 11). Similar results were obtained in three FPR weed control trials conducted by farmers in An Vien village of Dong Nai province (Table 12), where application of Dual plus one hand weeding produced higher yields and at lower cost than the customary three hand weedings. Herbicide use is now quite common in Thailand where about 30% of cassava farmers use mostly Glyphosate and Gramoxone to control weeds, while in Hainan island of China these two post-emergence herbicides are also commonly used. On-farm testing of pre-emergence herbicides is urgently needed in both countries.

Table 11. Effect of various methods of weed control on cassava yield and economic returns in Hung Loc Agric. Research Center, Dong Nai, Vietnam in 2000/01.

Weed control treatments	Cassava root yield (t/ha)	Gross income[1)]	Weed control costs	Product. costs[2)]	Net income
		('000 dong/ha)			
Weeding by hand, 3 times	17.78	5156	1,200	4,179	977
Applic. of Dual, 2.4 l/ha	17.46	5063	400	3,379	1,684
Applic. of Dual, 1.6 l/ha	14.47	4196	280	3,259	937
Applic. of Dual, 0.8 l/ha	14.60	4234	160	3,139	1,095
Applic. of Roundup, 2 l/ha	7.05	2044	200	3,179	-1,135
Applic. of Gramoxone, 1.6 l/ha	10.76	3120	174	3,153	-33

[1)]Prices: cassava dong 290/ kg fresh roots
Dual 150,000/ liter
Roundup 80,000/ liter
Gramoxone 67,000/ liter
labor 25,000/ manday

[2)]Cost of cassava cultivation without weeding: 2.169 mil. dong/ha

Table 12. Average results of three FPR weed control trials conducted by farmers in An Vien village, Thong Nhat district, Dong Nai, Vietnam in 2000/01.

Weed control treatments	Cassava root yield (t/ha)	Gross income[1)]	Product costs[1)]	Net income	Farmers' preference (%)
		('000 dong/ha)			
Weed control by hand	26.66	7,731	4,298	3,433	30
Weed control by 2.0 l Dual/ha+1HW	29.40	8,526	3,878	4,648	70

[1)]Prices: cassava dong 290/ kg fresh roots.
Dual 150,000/ liter
labor 25,000/ manday

5. New varieties

Main achievements:

In Thailand farmers continue to test new lines and varieties developed by the Dept. of Agriculture, but about 87% (more than 1 million ha) of the total cassava area in the country is already planted with new high-yielding varieties.

In Vietnam 37 FPR variety trials are being conducted in 12 sites, and more and more farmers are now planting improved varieties, especially in the south.

In five pilot sites in north Vietnam, the adoption of improved technologies, including new varieties, resulted in gross incomes that were 4-5 times higher than those reported in 1994/95 at the beginning of the project.

Rationale: Planting new higher-yielding varieties is the easiest and most cost-effective way of increasing farmers' income. For that reason farmers are always interested in trying out new varieties. FPR variety trials are thus a good entry point for getting farmers interested and involved in other types of trials, such as erosion control and fertility maintenance.

Outputs: Tables 13 and 14 are examples of FPR variety trials conducted in Hong Ha commune in Thua Thien-Hue province of Vietnam, and in Kongba village of Hainan province of China, respectively. In Hong Ha commune the yields of some introduced varieties were double those of the local variety Nep. The latter is a very tasty but low yielding eating variety. Farmers clearly showed a preference for KM 98-1 and SM1447-7. The former is sweet and high yielding but not quite as tasty as Nep or Vinh Phu.

Table 13. Results of FPR variety trials conducted by a farmer in Thuong Long village, Hong Ha commune, A Luoi district, Thua Thien-Hue, Vietnam in 1999 and 2000.

	Root yield (t/ha)		Starch content (%)		Farmers' preference (%)	
Varieties	1999	2000	1999	2000	1999	2000
1. Nep (check)	18.9	15.6	29.8	28.8	69.2	67
2. Vinh Phu	23.9	24.2	30.6	30.5	30.7	35
3. KM94	25.7	24.9	31.1	31.8	7.1	0
4. KM98-1	33.6	34.8	30.8	31.1	46.1	100
5. KM99-3	21.7	22.5	31.5	30.8	38.4	0
6. KM99-5	23.8	29.4	30.0	30.1	58.4	86
7. SM1447-7	29.8	30.3	29.9	30.3	38.4	100

Table 14. Results of four FPR variety trials conducted by farmers in Xinglian village, Taiping town, Wuming county, Guangxi, China in 2000.

	Mr. Pan	Mr. Lu	Mr. Li	Mr. Li	Av.	Observations
SC 201 (check)	31.4	26.8	27.5	28.4	28.5	
GR 891	28.0	37.5	31.4	29.4	31.6	Sweet, good taste
GR 911	33.2	38.2	36.7	40.6	37.2	
SM 1600	25.4	28.0	32.4	32.6	29.6	
SM 1741	29.0	28.5	30.2	28.2	29.0	
OMR 36-31-1	44.9	41.3	35.8	39.5	40.4	
OMR 36-34-4	33.9	32.8	29.8	31.8	32.1	

In Wuming county of Guangxi, China, four farmers conducted FPR variety trials on rather fertile lowland soils. Yields of all varieties were high, but those of OMR36-31-1 (selected from sexual seed from Thailand) and GR 891 (selected from seed from CIAT/Colombia and recently released as a new variety) were clearly superior. These and other varieties were further tested in large plots by officials from the provincial government. OMR36-31-1 produced the second highest fresh root yield and the highest starch yield. The highest fresh root yield (42 t/ha) was obtained with Nanzhi-199, a newly released variety from the South China Institute of Botany, selected from tissue culture plants introduced from CIAT/Colombia more than ten years ago.

Tables 5 and 6 show that in 2001 FPR variety trials are being conducted by 16 farmers in 10 sites in Thailand, and by 37 farmers in 12 sites in Vietnam. New varieties are now planted in over 1 million ha (87% of the cassava area) in Thailand, and also in large areas (about 60,000 ha) in southern Vietnam. In north Vietnam the planting of new varieties is widespread only in certain areas, mainly in those villages involved in the Nippon Foundation project. Table 15 summarizes the extent of dissemination of new technologies, such as new varieties, intercropping, contour hedgerows and fertilizer application, in five pilot sites in north Vietnam. The cassava yields obtained with some of the new varieties was 50-60% higher than those of the local check, Vinh Phu, which also produced very high yields due to better fertilization and crop management. In 2000, the average gross incomes obtained from a large number of farmers' fields, ranging from 12.6 to 18.7 mil. dong/ha, was 4-5 times higher than those reported (3.4 mil. dong) in the same villages in 1994/95 at the start of the project.

Table 15. Dissemination of new technologies in cassava-based cropping systems in FPR pilot sites in Pho Yen district of Thai Nguyen province and in Son Duong district of Tuyen Quang province, Vietnam in 2000.

1. New varieties

District, village	Number of farmers	Cassava yield (t/ha)				
		KM60	KM95-3	KM98-7	KM94	Vinh Phu (local)
Pho Yen, Tien Phong	25	28.3	31.0	33.5	-	21.5
Pho Yen, Dac Son	11	19.0	25.6	31.1	-	-
Pho Yen, Minh Duc	5	14.4	15.7	17.5	-	11.5
Pho Yen, Hong Tien	9	24.7	31.3	33.5	-	21.1
Son Duong, Am Thang	10	17.5	18.1	-	21.7	-

2. Intercropping

District, village	Number of farmers	Yield/(t/ha)		Gross income ('000 dong/ha)
		cassava	peanut	
Pho Yen, Tien Phuong	37	29.3	0.81	18,700

3. Contour hedgerows

Pho Yen, Tien Phong	4	24.7	0.45	14,587
Pho Yen, Dac Son	3	21.7	0.35	12,600
Son Duong, Am Thang	10	-	-	-

4. Balanced fertilizers

Son Duong, Am Thang: 12 farmers use 555 kg/ha of 7:4:7 fertilizers

PE-5 Output 4. Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices.

Activity Milestone 2001: Continued close collaboration with national partners.

Main achievements:
The Nippon Foundation project is implemented in close collaboration with five research and extension institutes in Thailand, six in Vietnam, three in China and one in Indonesia.

Rationale: The objective of the second phase of the Nippon Foundation project is to further develop appropriate and sustainable production practices for cassava-based cropping systems and then to disseminate the best selected practices to as many farmers as possible. This can best be done by directly working with many farmers at many sites. To be able to do this it is essential to work in close collaboration not only with researchers and extensionists at the national level, but also at the provincial, district and subdistrict levels. Farmers have most contact with officials at the village and subdistrict levels so it is extremely important for the success of the project to maintain good relations with, and to provide training for, extensionist at the subdistrict level and key farmers in the selected pilot sites.

Output: In order to move gradually from farmer participatory research (FPR) to farmer participatory extension (FPE) the project is collaborating mainly with five research and extension organization in Thailand (including the non-government Thai Tapioca Development Institute) and six research organizations and universities in Vietnam (Table 16).

Table 16. Institutions collaborating in the Nippon Foundation-funded Cassava Project in Asia.

Country	Institution	Location
China	Chinese Academy Trop. Agric. Sciences (CATAS	Danzhou, Hainan
	Guangxi Subtropical Crops Research Institute (GSCRI)	Nanning, Guangxi
	Animal Husbandry and Veterinary Station of Yunnan	Mengzhe, Yunnan
Indonesia	Central Food Crops Research Institute (CRIFC)	Bogor, W. Java
Thailand	Department of Agriculture (DOA), Field Crops Research Institute	Chatuchak, Bangkok
	Dept. of Agric. Extension (DOAE), Rice and Field Crops Prom. Div.	Chatuchak, Bangkok
	Land Development Department (LDD), Soil and Water Cons. Div.	Chatuchak, Bangkok
	Kasetsart University, Soils Department	Chatuchak, Bangkok
	Thai Tapioca Development Institute (TTDI)	Bangkok
Vietnam	Thai Nguyen University (TNU), Agro-forestry College	Thai Nguyen, Thai Nguyen
	National Institute of Soils and Fertilizers (NISF)	Tu Liem, Hanoi
	Vietnam Agric. Science Institute (VASI), Root Crops Res. Center	Thanh Tri, Hanoi
	Hue University of Agriculture and Forestry (HUAF)	Hue, Tuan Tien-Hue
	Institute of Agric. Sciences (IAS)	Ho Chi Minh city
	University of Agriculture and Forestry (UAF)	Thu Duc, Ho Chi Minh city

With additional and substantial financing from the Dept. of Agric. Extension (DOAE) in Thailand, the project was able to extend to an additional seven villages in 2001. Table 5 shows that the project is now working with about 622 farmers in 21 villages in 17 subdistricts of 14 districts in 8 provinces. Through the national project coordinator, Mr. Watana Watananonta of DOA in

Bangkok, close cooperation is achieved with the Dept. of Agric-Extension (DOAE), the Land Development Dept. (LDD), Kasetsart University (KU) and the Thai Tapioca Development Institute (TTDI), which all have their main offices in Bangkok. During a yearly planning meeting the overall goals and principal activities for the year are decided, and these are implemented through a network of officials at all levels, with major emphasis on the district and subdistrict levels. Junior officials from DOAE in Bangkok are each assigned one province where they work together with officials from DOA and LDD, as well as with local officials of DOAE and farmers to implement the project.

In Vietnam, each institution works fairly independently in 2-3 selected provinces where they work directly with extensionists and officials of the local (district and commune) government. The national project coordinator, Dr. Tran Ngoc Ngoan from Thai Nguyen University, convenes an annual planning meeting to discuss the results so far obtained and the activities planned for the coming year. He visits the pilot sites 2-3 times a year. In Vietnam the Nippon Foundation project is an integral part of the Vietnamese Cassava Research and Development Network, which includes researchers and extensionists of the major cassava growing provinces in the country. The project is largely implemented in collaboration with provincial and district extensionists. In Pho Yen district of Thai Nguyen province, one district extensionist has been assigned full time to work with the project, and to disseminate the FPR methodology and the new technologies to other extensionists so as to cover the whole district.

In China, the project works mainly with the Trop. Field Crops and Animal Husbandry Research Institute of the Chinese Academy of Tropical Agric. Sciences (CATAS) in Hainan, and with the Guangxi Subtropical Crops Research Inst. in Nanning, Guangxi. In 2001 the project in Hainan has extended to include three villages in Baisha county, as well as one site each in Qiongzhong and Dunchang counties, while in Guangxi there are FPR trials in two villages in Wuming district. Because of a limited number of cassava researchers in these two institutes the project has not expanded as fast in China as in Thailand or Vietnam. Four new cassava researchers are learning English and are being trained in cassava research so as to allow further expansion of the project in the coming years.

The project coordinator at the CIAT Cassava Office for Asia visits the various collaborating institutions regularly and tries to visit the many pilot sites at least once or twice every year. As the secretary of the Asian Cassava Research Network he is also directly involved with the organization of the triennial Regional Cassava Workshops, and the editing and publication of the Workshop Proceedings. When necessary, he liases between the Cassava Project (IP-3) in CIAT/Colombia and the national cassava programs in Asia, especially in the area of germplasm distribution and the transfer of the CIAT cassava core collection to Thailand. In addition, a collaborative project with CIP on the production of cassava leaves and sweetpotato vines for the making of silage for pig feeding in Hue is planned for 2002.

Activity Milestone 2001: New Materials and training approaches for NRM- related research

A 15-minute video on the Farmer Participatory Research with cassava was produced in Thai and English.

Activity Milestone 2001: Partners in national programs and pilot sites trained in participatory technology development and dissemination
Major achievements:

In south and central Vietnam about 60 local extensionists and key farmers from the various pilot sites received training in participatory technology development with major emphasis on soil erosion control and fertility maintenance in cassava-based cropping systems.

In Thailand about 15 officials of LDD were trained in FPR methodologies and visited an FPR pilot site to become familiar with the use of the farmer participatory approach in technology development and dissemination.

Rationale: As mentioned above, training of researchers, extensionists and key farmers is an essential component of the project, as it allows more people to become familiar with, and enthusiastic about, the use of a farmer participatory approach to technology development and dissemination. After participating in an FPR training course, researchers and extensionists are often eager to participate in the project, as they see the benefit of the approach in enhancing the development and dissemination of truly useful and appropriate technologies. The trained key farmers often become the leaders of the project in the village and several have set up a community-based organization that coordinates the project in the village.

Outputs: In Vietnam about 60 key farmers and local extensionists (2-3 farmers and one extensionist from each pilot site) participated in two 4-day FPR training courses organized in early March in Ho Chi Minh city and in late August in Hue city. These training courses were combined with 2-day cassava workshops in each location, so that researchers could share their results with the participating extensionists and farmers and obtain additional feedback.

At the time of harvest in north Vietnam in November, and in Binh Phuoc province of south Vietnam in December, farmer field days will be organized in several pilot sites with participation from collaborating farmers from other nearby sites. Plots of the various FPR trials will be partially harvested so the visiting farmers can discuss the pros and cons of each treatment and decide among themselves which treatments they consider most useful, and which practices they want to try out next year on their own fields. These cross-visits of farmers to other villages where similar trials are conducted to find solutions to similar problems, is a very effective way to disseminate the selected technologies to neighbors and neighboring villages and to enhance their adoption.

In Thailand, 15 LDD staff participated in a 2-day FPR training course and visited an FPR pilot site in order to become familiar with the FPR approach, especially for the development and dissemination of erosion control practices. The participation in the course of several high level officials of LDD was instrumental in their decision to set up their own FPR pilot sites next year in close collaboration with the Nippon Foundation cassava project. In return, LDD will train key farmers from our project sites in the multiplication and management of vetiver and other grasses that can serve as contour hedgerows to reduce erosion. These trained farmers will then be able to set up local nurseries for vetiver grass and other species to supply planting material for the further extension of hedgerows in their own village. Also, six groups of farmers from the new pilot sites not only visited demonstration plots at TTDI, but also a nearby FPR pilot site where they could see the activities of a well-managed and enthusiastic cassava soil conservation group, including FPR trials and the large-scale planting of vetiver grass contour hedgerows. In addition, farmer field days were organized by provincial and district staff of DOAE in five pilot sites with participation of 300-1000 farmers and officials to disseminate the new cassava technologies and soil conservation practices.

In China, an FPR training course for farmers and district extensionists of the five pilot sites in Hainan is planned for Dec 2001, which corresponds with the harvest season.

Activity Milestone 2001: Effective communication of results

Main achievements:
The Proceedings of the 6th Regional Cassava Workshop was published.

Rationale: The 6th Regional Cassava Workshop, titled "Cassava's Potential in Asia in the 21st Century: Present Situation and Future Research and Development Needs", was held in Ho Chi Minh city, Vietnam from Feb 21 to 25, 2000. The 44 papers presented at the workshop reviewed the present situation of cassava in each country and in the region, the research on cassava breeding and agronomy conducted in each country during the past 20-30 years, the results of the first phase of the Nippon Foundation funded FPR project in four countries, and the future potential of new cassava-based products. These papers were edited and the Proceedings were printed in Sept 2001. These will be distributed to all workshop participants, to the major libraries on tropical agriculture in the world, and to any person interested in the subject. This 666 page volume contains a wealth of information and will provide a useful reference on cassava production in Asia and on the first phase of the Nippon Foundation project.

Problems encountered and their solution

No serious problems were encountered in the implementation of the project in 2001. In fact, the project benefited greatly from the substantial financial support provided by the Thai government, which allowed extension of the project to an additional seven sites, called "cassava development villages".

As mentioned above, implementation in China is slower than in Thailand and Vietnam, mainly because of a very limited number of cassava researchers in the two collaborating research institutes. This problem was partially solved by the hiring of four young researchers to join the cassava programs. It will take time, however, before they can communicate well in English and have experience in cassava research and FPR.

A more general problem in cassava research in Asia is the lack of coordinated effort into cassava improvement, similar to that which has occurred over the last 15 years. There is opportunity to commence a new round of strategic genetic improvement using molecular markers and gene transfer. However, we have been unsuccessful in attracting funds for a regional project in cassava improvment.

Plans for 2002

During the fourth year of the second phase, the project will only expand slightly, mainly to neighboring villages near existing sites. Dissemination of results will be extended to more farmers through farmer-to-farmer extension. The target will be to work directly with at least 1000 farmers in both Thailand and Vietnam, and to reach indirectly another 2000 farmers through various extension activities. This will be accomplished through more FPR training courses for farmers and extensionists, the production of additional training materials such as pamphlets, posters, videos (in Vietnam), and the organization of several types of farmers' field days. Training booklets about various aspects of cassava production will be produced in Vietnamese (they already exist in Thaï), while two handbooks, one on cassava agronomy and one on farmer participatory approaches will be produced in English.

The 17th World Congress of Soil Science will be held in Bangkok in Aug 2002, which will be an opportunity to present and possibly showcase to an international audience the results of the participatory approach used in the project. In addition, the 7th Regional Cassava Workshop will be held in Thailand in Nov 2002, which will be another opportunity for participants in the FPR project to present their results and exchange ideas.

Total No. FPR trials: 155

2.2. Forages and Livestock Systems Project

A Special Project funded by AusAID

Research highlights

Field evaluations of ten forage technologies have commenced using participatory approaches with 250 farmers in 18 villages in four districts facilitated by 9 field teams, two provincial teams and 4 national partner staff.
Robust strategies, based on long field experience, are being tested for Extension &Training, Gender & Equity and Monitoring & Evaluation.
A book on promising forage species for Southeast Asia was published in six languages. Another book on forage agronomy was completed and is in translation. A third book on participatory approaches to developing agricultural technologies was written.

Project background

The bi-lateral Forages and Livestock Systems Project (FLSP), which commenced in July 2000 in Lao PDR, grew out of the AusAID-funded regional Forages for Smallholders Project, which ran from 1995 to 1999 in 7 countries. The FSP identified a small suite of robust, broadly adapted forage varieties that had the potential to deliver significant benefits to smallholder livestock farmers in Southeast Asia. The FLSP was designed to build on this progress by i) scaling-up the demonstrated benefits of forages to smallholder farmers in the uplands of Laos and ii) developing a broader range of technology options for improved livestock production in the uplands of Laos.
The broad objective of the project is to integrate forage and improved livestock management strategies into upland farming systems which will:

i) increase income by improving the productivity of small and large livestock;
ii) increase labour efficiency and reduce women's workloads
iii)enhance sustainable cropping systems by increasing soil fertility and reducing soil erosion
iv) sustain livestock production within the national policy of stabilising shifting cultivation
The project has three main components:

(i) Technical Development
The Technical Development component focuses on introducing improved forage, feed and management systems to increase farm productivity and farm income using farmer participatory approaches. The FLSP will target 27 villages in each of four districts over its five year term. It is expected that more than 1400 households will receive income benefits from improved forages and better livestock management, 450 households from legumes improving soil fertility and forages reducing soil erosion, and 400 women from improved feeding and management systems for their small livestock.
(ii) Institutional Development
The FLSP will contribute to increasing capacity in participatory research approaches and technical skills in forage and livestock management of 36 Lao Subject Matter Specialists (SMS) and Farming Systems Extension Workers (FSEW). These trained staff will work with and assist farmers in developing and disseminating improved livestock technologies. Through these people the project

will help foster a system of participatory extension using forage and livestock technologies as a model.

(iii) Monitoring and Evaluation
The FLSP will develop and implement a practical framework for Monitoring and Evaluation to quantify both 'outputs' and 'impacts' and provide feedback into the development and extension process.

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Budget:

Budget: approx US$300,00/year for five years Donor: AusAID

Progress Report:

2.2.1. PE-5 Output 1. System Components assessed to provide alternative land use options

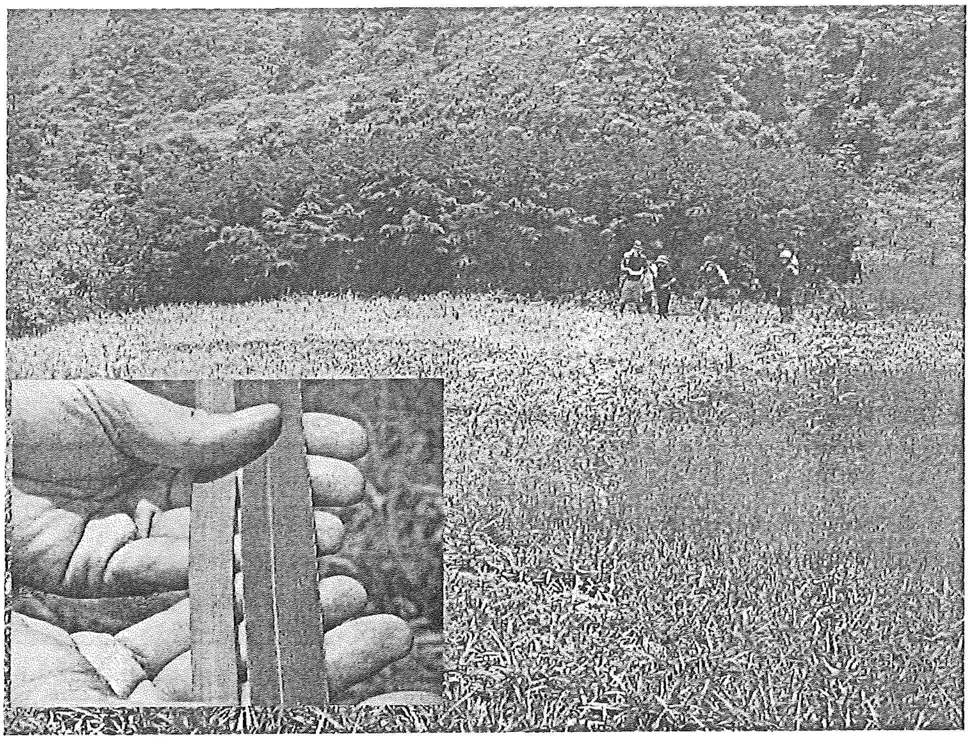
2005 **New forage and livestock technologies integrated into upland farming systems in Lao PDR providing alternatives to slash and burn agriculture**

01 Demonstrations of forage systems established that have the potential to improve NRM in the uplands of Laos.

The forage trees Leucaena leucocephala 'K636', Calliandra calothyrsus 'Besakih' and Gliricidia sepium 'Retalhuleu' and 'Belan Rivas' have significant potential to provide positive impacts on natural resource management in the upands, by improving soil fertility directly from leaf fall and indirectly through manure from animals. To demonstrate this potential, we established nineteen forage tree legume nurseries in 13 villages of Luang Phabang and Xieng Khouang provinces (see Table). These will be used as a resource for farmer training and cross-visits as well as a potential source of planting material in future on-farm evaluations.

Location	Number of nurseries	Nursery description
Xieng Ngeun district, Luang Phabang Province	13 nurseries in 11 villages	8 nurseries of Gliricidia sepium (total of 5000 trees) 3 nurseries with Leucaena leucocephala (400 – 500 trees per nursery) 2 nurseries with Calliandra calothyrsus (400 – 500 trees per nursery)
Pek district , Xieng Khouang Province	6 nurseries in 2 villages	3 nurseries with Leucaena leucocephala (400 – 500 trees per nursery) 3 nurseries with Calliandra calothyrsus (400 – 500 trees per nursery)

The potential of these trees to impact on soil fertility is demonstrated by the photo below, which was taken in one of the Calliandra calothrysus nurseries. This nursery was planted on land abandoned by the farmers, as it was no longer sufficiently productive to grow rice. Instead they planted forage species around the nursery. In this case, after only 14 months of growth, the Calliandra trees are already 3 metres high. They have already had a significant effect on soil fertility. Panicum maximum that was growing in the open field and being regularly cut was yellow and growing slowly (see left side of inset photo). Panicum maximum that was growing close to the tree plot, where Calliandra leaves had fallen to the ground during the last dry season, was growing vigorously , with broad green leaves (see right side of inset photo).



2.2.2. PE-5 Output 2 Generic technologies for sustainable production developed through farmer participatory research.

2005 New forage and livestock technologies integrated into upland farming systems in Lao PDR to increase farmer livelihood and improve NRM

During this first year, Participatory Diagnoses (PD's) were conducted in 18 villages in the four target districts of northern Laos. Based on the results of the PD's, nine forage technologies were identified that have potential to deliver benefits to smallholder farmers in these upland farming systems:

Forage grasses in cut & carry plots
Forages in grazed plots
Forage tree legumes in fencelines
Legumes for feeding pigs
Tree legumes for goats
Forages to control erosion gullies
Forages for contour hedgerows
Forages for improved fallows

Forage cover crops in annual crops

Using participatory approaches, 9 field teams started working with 250 farmers in the 18 villages to evaluate these forage technologies. The field teams were supported by specialists from provincial and national level organizations in a mentored learning process in the field. Details of the field work are presented in the table below.

Forage technologies are only one component of the livestock systems that can be improved. The FLSP is developing alternative feed resources and strategies in animal health for evaluation by farmers, using the same process, in coming years.

illage	Wealth Status	Market Access	Farming System	Ethnic Group	Number of farmers			Forage (area m^2)	Sweet potato (# farmers)	Gliricidia (number)	Tree Nurseries (number)
					ex-FSP	New	TOTAL				
Xieng Ngeun District							**50**	**17500**			
Phonesaad	M	Close	Upland	Theung / Soung	7	0	7	1900	0	0	13 nurseries in 11 villages
Kieuwchaluang	P	Far	Upland	Theung (Kamu)	11	14	25	14500	0	0	
Kieuw Talun Noi	P	Close	Upland	Theung	0	6	6	200	6	0	
Kieuw Talun Nyai	M	Far	Upland	Loum/Theung / Soung	2	10	12	900	8	0	
Luang Phabang District							**99**	**9484**			
LongLao 2	M	Close	Mostly upland with a little lowland	Soung	8	19	27	4600	0	610	0
Nongtawk	M	Close	Mostly upland with a little lowland	Soung / Theung	0	9	9	1500	0	0	0
Kokwan	M	Close	Mostly lowland with a little upland	Theung / Loum	0	13	13	650	0	237	0
Bo He	M	Close	Mostly upland with a little lowland	Loum/Theung / Soung	0	16	16	1730	0	1660	0
Densavang	P	Close	Upland	Theung	0	18	18	1000	0	1900	0
Houay Leuk	M	Close	Mostly upland with a little lowland	Theung	0	16	16	0	0	1630	0

Village	Wealth Status	Market Access	Farming System	Ethnic Group	Number of farmers			Forage (area m^2)	Sweet potato (# farmers)	Gliricidia (number)	Tree Nurseries (number)
					ex-FSP	New	TOTAL				
Pek district							**63**	**19050**			
Dong	M	Close	Lowland	Loum/Theung / Soung	3	4	7	750	5	0	0
Xang	P	Far	Mostly upland with a little lowland	Soung	6	6	12	6400	0	0	0
Ta	M	Close	Half lowland half upland	Soung	8	0	8	7400	0	0	6
Phonekham	M	Far	Lowland	Loum	0	36	36	4500	0	0	0
Nonghet District							**38**	**8000**			
Paklak	P	Far	Upland	Soung	0	8	8	1300	0	0	0
Khangpanien	W	Close	Mostly upland with a little lowland	Soung	0	14	14	2800	0	0	0
Houaykhiling	M	Far	Upland	Soung	0	8	8	2500	0	0	0
Nonghettai	M	Close	Upland	Soung	0	8	8	1400	0	0	0
SUMMARY 18 Villages in four districts	5 'poor',12 'medium' and 1 'wealthy' village	6 villages are 'far' from markets and 12 are close	15 villages are "upland" or "mostly upland" farming systems	Working with a mix of Lao Loum, Lao Theung and Lao Soung farmers	45 ex-FSP farmers	205 new farmers	250 farmers (total)	5.4 ha of forages sown	19 farmers evaluating sweet potato	6000 Gliricidia trees	19 legume tree nurseries

The forage varieties being evaluated by these farmers are:
Grasses
Andropogon gayanus 'Gamba'
Brachiaria brizantha 'Marandu'
Brachiaria decumbens 'Basilisk'
Brachiaria ruziziensis 'Ruzi'
Panicum maximum 'Si Muang'
Paspalum atratum 'Terenos'
Setaria sphacelata 'Solander'
Legumes
Arachis pintoi 'Amarillo'
Calliandra calothyrsus 'Besakih'
Gliricidia sepium 'Retalhuleu', 'Belen Rivas'
Leucaena leucocephala 'K636', 'K584'
Stylosanthes guianensis 'Stylo 184'

2.2.3. PE-5 Output 3. Models/frameworks developed to target research, integrate results, assess impact and extrapolate results

2001 Monitoring and Evaluation Framework – Laos

A Monitoring and Evaluation (M&E) framework was developed by one of the consultants to the FLSP, Dr. Werner Stür, building on the results of the ACIAR-funded Project 'Participatory monitoring and evaluation of new technologies developed with smallholders'. This project showed that participatory methods such as farmer focus groups are highly effective in identifying and quantifying social, economic and environmental impacts.

The M&E strategy of the FLSP (summarized in the figure below) consists of:

A Benchmark Survey; providing a comparison for a 'before' and 'after' impact assessment (small sample size, well targeted, stratified information collection).

Village Characterisation; summary of information collected from secondary sources, participatory diagnosis and planning.

Informal Observations; by district extension workers and other project partners.
Adoption Tree Survey; providing annual information on farmers' evaluation and adoption of project innovations.

Farmer Focus Groups; summarising and interpreting outcomes and impact of project innovations.
Quantifying Impacts, which have been identified by Farmer Focus Groups, by conducting well-targeted, small surveys of adopters and non-adopters (as well as comparing back to the Benchmark Survey), and through direct measurements in the field or evaluation by Farmer Focus Groups.

Laying a baseline for impact assessment:

- Stratified sample (gender, wealth and degree of market access) of households in project villages, conducted once during dry season (in the second year before there has been large-scale adoption of project innovations).

Village characterisation

From secondary information and results of participatory diagnosis and initial planning with communities:

- Summarised in a common format for each village.
- Annual survey of social and economic indicators of village development.

Monitoring evaluation and adoption of innovations offered by the FLSP:

- Annually, during the dry season.
- Entered immediately into a central database with results of key M&E questions being available at 'finger tips'.

Informal observations

District extension workers and other project partners informally monitor the situation at each village, summarise their observations and discuss them with farmers and other Project partners:

- Discuss with individual farmers and farmer focus groups
- Reports to project partners.

Common interest groups of farmers in villages working together with the FLSP on a particular issue (e.g. women working on improving pig production):

- Reflection of experiences and results at the end of each growing season (or evaluation cycle) including cost and benefits, and advantages and disadvantages of each innovation.
- Concluding who is benefiting from innovations and how? Who in the household and village is positively and negatively affected by the innovations? What are the implications for the farming system and the environment?
- Determine importance of identified impacts. Set indicators for impact measurements with the farmer groups.
- Discussion is facilitated by the FLSP.

Differential impacts identified by Farmer Focus Groups are followed up with:

- Targeted surveys to quantify impacts, comparing adopters vs. non-adopters (affected vs. not affected by the innovation) and over time to benchmark survey.
- Direct measurements of impacts through field demonstrations involving farmers and through farmer focus groups.

This strategy is being progressively incorporated into the project's activities as shown in the following table:

Quarter	Planned Activity	Achievement
Oct-Dec 2000	M&E Workshop in Luang Phabang Develop M&E questions and first draft of M&E matrix	Workshop held M&E questions and M&E matrix were developed
Jan-Mar 2001	Complete Draft M&E Strategy and submit to AusAID Design Adoption Tree survey and FLSP Database, and discuss with partners	Draft M&E strategy completed and submitted Adoption tree survey designed. FLSP Database in preparation
Apr-Jun 2001	Test Adoption Tree survey and database in villages where farmers have adopted forages Complete 'Village characterisation' for the initial set of 12 villages Appoint M&E Coordinator at national level, and submit annual M&E report	Adoption tree survey tested in villages FLSP Database completed and training in its use provided M&E coordinator yet to be appointed.
Jul-Sep 2001	Improve survey questionnaire and database Design reporting format for 'Informal observations' by DEWs; also decide on frequency of reporting	Further training in database management The reporting format for informal observations will be developed in November 2001
Oct-Dec 2001	Training of DEWs in 1) capturing and reporting of 'Informal observations', and 2) structured interview techniques for 'Adoption Tree' survey and data input	Training will be provided
Jan-Mar 2002	Conduct 'Adoption Tree' survey Follow-up training (for 1 and 2) and querying of FLSP Database Conduct Baseline survey	Both surveys and the training are planned

A detailed outline of the M&E strategy is available.

A database application to be used for storing, processing and querying the information gathered in the M&E strategy has been developed by a consultant to the project (Dr. John Durdin) and is being implemented in the field. The application, which uses Microsoft Access 2000, has been designed paying particular attention to ease of use and extendibility. Data entry has been simplified as far as possible, following the Adoption Tree questionnaires that are used for collecting information from farmers, and both enforced relationships and specific testing are used to ensure the integrity of the data. Most information can be entered using Lao language or by selecting items from a list, and most explanatory messages that can arise during data entry will be shown in Lao, removing the need for field users to understand English well.

Data entry will be done in the provincial offices of the FLSP and concatenated into the central database in Vientiane, which will then be shared with the provincial offices. To simplify the task of querying the database, a "Query Builder" has been developed that allows a wide variety of queries to be created and run on the data and the results grouped in different ways (according to village and farmer characteristics) using a standard report format, without requiring any knowledge of Access programming.

2001 Decision guides available for new technologies

Three decision guides are in various stages of preparation:

1. Horne, P.M. and W.W. Stür (2000). "Developing forage technologies with smallholder farmers -how to select the best varieties to offer farmers in Southeast Asia". ACIAR Mono. 62. 80pp.

This book was published in English in early 2000. During this year, versions in Chinese, Indonesian, Lao, Thai and Vietnamese were produced and distributed.

2. Stür, W.W. and P.M. Horne (in press). "Developing forage technologies with smallholder farmers – how to grow, manage and use forages". ACIAR Monograph series.

The English version of this book has been completed and sent out for translation into Chinese, Indonesian, Lao, Thai and Vietnamese. All language versions are to be printed in a single print run.

3. Horne, P.M. and W.W. Stür (in press). "Developing agricultural solutions with smallholder farmers – participatory approaches for getting it right the first time". ACIAR Monograph series.

The English version of this book has been drafted and is being prepared for layout.

2.2.4. PE-5 Output 4 . Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices

2001 Courses for FLSP staff on Forage Technologies, Participatory Approaches, Gender & Equity and M&E

During this year, thirty two national, provincial and district partner staff were trained in participatory methods, forage agronomy, the extension process and gender & equity through the following workshops linked to on-the-job training:

A workshop on Participatory Diagnosis (PD) was held in Xieng Khouang from 29 January to 03 February 2001 for 28 project partners. This workshop followed the FLSP training strategy by linking skills development directly with mentored on-the-job training.

A workshop was held in Vientiane on 23 and 24 February to discuss the technical options available for farmers to evaluate in the 2001 wet season and how to match these options with the problems and opportunities identified by farmers during the PD's. The workshop was attended by 11 national and provincial partners.

A workshop on Gender and Equity in Development (GED) and Extension Methodologies was held in Vientiane from 19 – 22 March 2001 for 11 national and provincial partners.

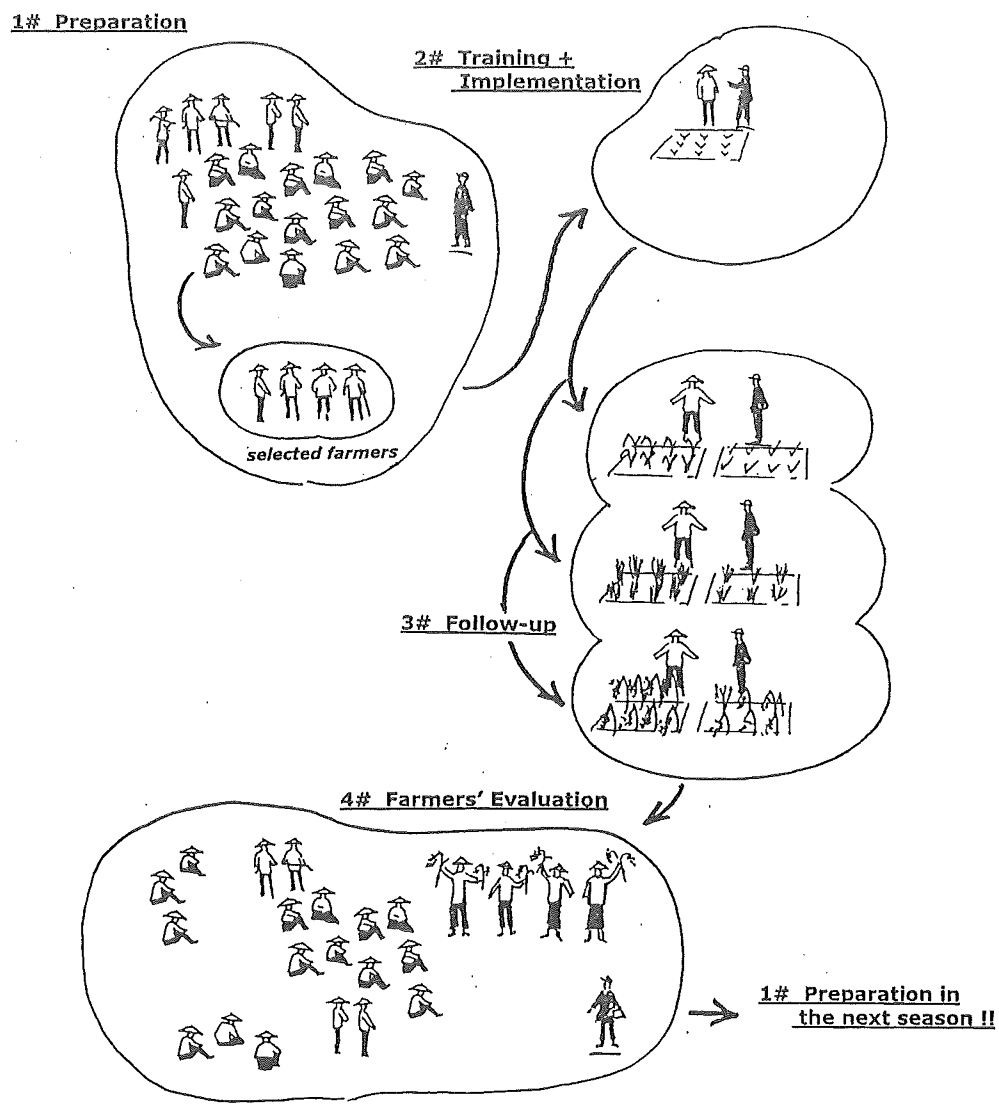
A workshop on Gender and Equity, Technology Options and Extension Approaches was held in Luang Phabang from 09 – 12 April 2001 for 29 project partners. This workshop followed the FLSP training strategy of national and provincial specialists receiving training which they share with DAFO teams in a replicated training event.

A workshop "Developing forage technologies with farmers" was then held at Nam Suang from 08 – 12 May 2001 for 27 project partners (national, provincial and district). The workshop focused on technical issues related to forage varieties, their establishment and management on smallholder farms.

A workshop on the M&E database was held in Vientiane on 12 and 13 June 2001, for 11 national; and provincial partners. This training was an introduction to the system prior to collection of the first Adoption Tree data.

2001 Strategy for Extension and On-the –Job Training developed and being evaluated

The approach being taken by the FLSP to forage technology development and scaling-up is to encourage farmer experimentation within a community-based extension framework. Given that the upland environment is so diverse and the issues facing livestock production are so complex, it is essential that field workers do not simply promote the best 'off-the-shelf' technologies, but engage farmers in a process of adaptive research. This will require that the process is initiated in not just a few villages to identify an appropriate technology, but generally in all villages as part of the general extension process. The first year of this process is described in the diagram below.



The first step ('Preparation'), involves conducting Participatory Diagnosis (PD) with the whole community to
identify and prioritise problems and opportunities for development,
identify particular interest groups in the village livestock systems

reach a convergence about common objectives and solutions to be tried
decide which farmers would try these technology options on behalf of the community

The second step ('Training and Implementation'), involves
building teams of field staff who are both confident and capable in participatory approaches, extension methods and the forage technologies
identifying technology options which match the problems and opportunities identified by communities during the PD's
providing farmers with the materials and technical information required for them to start evaluating these technology options

The third step ('Follow-Up') involves providing farmers with continuing support as they gain experience with the new technology options and, perhaps, encounter difficulties.

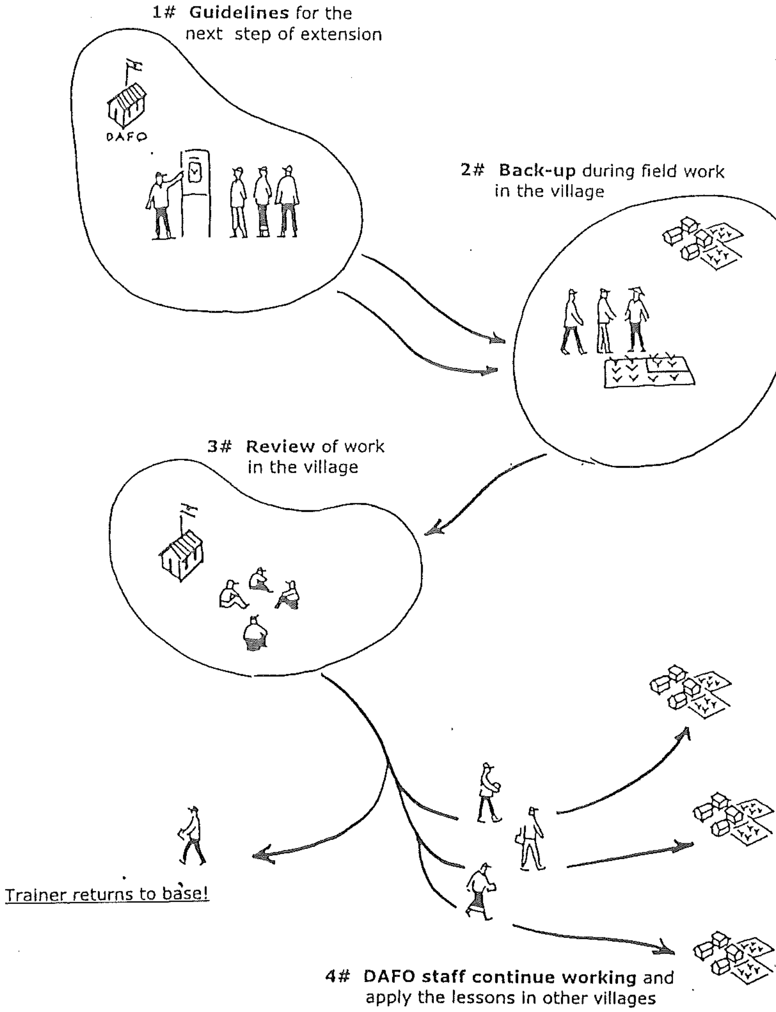
The fourth step ('Farmers Evaluation') involves
evaluating the outcomes of the field trials
reporting these back to the interest-group and whole community and
planning what to do in the following year

During this first year of the project we have implemented the first two steps of the Extension Strategy. Given the extremely limited experience and skills of field staff in extension work, however, capacity building is an essential precursor to achieving any results with farmers to improve livestock production. To do this we have implemented a process of 'active mentoring' or On-the-Job Training (OJT) to lead staff through the extension dynamics and processes (se figure).

OJT is not simply putting staff in the field and allowing them to learn from experience. OJT is structured mentoring following these steps:

before each field event, national and provincial teams provide guidelines and training to field staff about the activities that will be conducted. Guidelines include objectives of the activity, expected outputs, processes to be employed and extension tools to be used.
both field staff and mentors (from the national and provincial teams) work together in one village, with the mentors taking an active role in demonstrating how to conduct the field activity.
mentors and field staff review the outcomes of the activity and plan for the next village
field staff continue to work in remaining villages with mentors in a passive role or independently of their mentors

Given that training and capacity building of the field staff is a key objective of the FLSP in the initial years of the project, we have selected target villages which are a suitable training environment and where staff are very likely to make some impact within the first season.



It is common for the Heads of the district offices where the field staff work to assign staff to a particular project and then pay little attention to what their staff are doing. This can be regarded as benign neglect, and may allow project work to progress, but means staff will lack active support from their head and leaves little chance that the ideas and methods applied by the project will be taken on-board.

Thus an additional training dimension has been introduced, for the Extension Administrators, (particularly the Heads of the district offices) and also for key administrators in the provinces. As these are senior staff, the training will have the following three components:

Study trips: to sites where extension development, structure and planning has already undergoing improvement, e.g. in old PEP sites.
Workshops: on key extension concepts, dynamics and implementation steps
give a practical role to these staff in the M&E, and so engage them in a functional role, appropriate to their position, in an on-going basis.

Plans for 2002:

The following plans have been made for the project year July 2001 – June 2002:

Consolidate the progress that has been made in the initial 18 villages by working through the extension process and assisting farmers to achieve their goals in expanding forage technologies in the second wet season.
Strengthen the field teams through a series of workshops reviewing issues in extension, forage technologies, other livestock technologies and gender & equity issues.
Increase the number of villages working with the project to at least 30.
Expand the number of technologies being evaluated by farmers to include other feed resources apart from forages and to include animal health options.
Fully implement the project's M&E strategy and database so that we can monitor both 'outputs' and 'impacts' resulting from project activities.
Publish and distribute the second book in our decision support tool series (this one on forage management) in six languages.
Finalise the third book in our decision support tool series (this one on participatory approaches) and prepare translations in five languages.
Develop a research project proposal to look at nutrient cycling issues at the crop-livestock interface in smallholder upland farming systems of three countries in Southeast Asia

2.3. Forages for Smallholders Project

A Special Project funded by ADB

Research highlights in 2001

Bauhinia variegata, Trema orientalis, Broussonetia papyrifera and Ficus hispida are among the most preferred local fodder tree species that are used by Hmong and Kasah upland farmers in Lao PDR. Farmers rated these species high using criteria such as palatability for cattle, availability, accessibility, nutritive value and regrowth.

A curriculum was developed for a training course on monitoring and evaluation of participatory forage research projects. The modules are: Leveling off concepts and experiences, Field work, Data analysis and reporting, Development of workplan. In many countries in SE Asia, simultaneous translation throughout the course is essential.

The Forages for Smallholders Project has established a network of 49 institutions and organisations, through which participatory approaches and forage technologies are spreading in six countries in SE Asia.

Project background

This project is funded by ADB under their Agriculture and Natural Resources Research at CGIAR Centers Program for 2000-2002. The goal of the project "Developing Sustainable Forage Technologies for Resource - Poor Upland Farmers in Asia" is to improve the livelihood of upland farmers by enhancing available feed sources to increase livestock production and strategic use of grasses and legumes to conserve soil and to enhance nutrient management. The participating countries are China, Indonesia, Lao PDR, Philippines, Thailand and Vietnam. The project continues on the Foundation laid by an earlier project funded by AusAID.

The objectives of the project are to:

Develop sustainable forage technologies for resource-poor farmers in upland farming systems in Asia.

Strengthen the capacity of National Agricultural Research Systems in the Bank's Developing Member Countries to develop and deliver these technologies to farmers.

The project has five outputs:

Productive and sustainable forage technologies for upland farming systems developed and tested by farmers.

Forage technologies extended to other farmers using participatory approaches for scaling-up from farm level to the community and provincial levels.

Effective local seed and planting material multiplication systems established and operational.

Capability in Developing Member Countries for developing and disseminating forage technologies using farmer participatory approach (FPA) strengthened.

Network for sharing information among NARSs and in the region continued based on the Southeast Asia Feed Resources Research and Development (SEAFRAD) newsletter.

Focus sites in the FSP and their dominant farming system

Country	Province	Focus district/ municipality	Dominant farming system
Indonesia	East Kalimantan	Makroman, Samarinda	Rain fed lowland, intensive sedentary upland.
		Sepaku II, Pasir	Extensive sedentary upland, grasslands.
Lao PDR	Luang Phabang	Xieng Ngeun	Extensive sedentary upland, short rotation slash and burn.
	Xieng Khouang	Pek	Short rotation slash and burn, intensive sedentary upland (Rice), grasslands
	Savannakhet	Savannakhet	Grasslands
Philippines	Misamis Oriental	Cagayan de Oro	Extensive sedentary upland
	Bukidnon	Malitbog	Extensive sedentary upland.
Vietnam	Daklak	M'Drak	Extensive sedentary upland, grasslands.
	Tuyen Quang	Tu Quan, Phu Lam, Duc Ninh	Intensive sedentary upland.
	Thua Thien Hue	Xuan Loc	Intensive sedentary upland, short rotation slash and burn.
Thailand	Nakornratchasima	Sung Nuen	Extensive sedentary upland.
China	Hainan	Baisha, Danzhou and Ledong	Extensive sedentary upland.

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Mr. Le Hoa Binh, FSP Coordinator Vietnam, Hanoi.
Ir. Ibrahim, FSP Coordinator Indonesia, Samarinda.
Assoc. Prof. Yi Kexian, FSP Coordinator China, Hainan.
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Mrs. J. Sahuinhon, Malitbog, Philippines
Mrs. Ganda Nakamanee, Pakchong, Thailand.
Mr. Francisco Gabunada, Leyte, Philippines.
Budget:
$330,000/year for 3 years 2000-2002 provided by ADB

Progress Report

2.3.1. PE-5 Output 2. Generic technologies for sustainable production developed through farmer participatory research.

2001 - Update on new forage legumes being evaluated in the FSP project

On-station. An experiment on evaluation of 37 accessions of shrub legumes from CIAT and China was started in 1999 at CATAS, Hainan. The results up to now show that Cratylia argentea, Desmodium velutinum, Flemingia macrophylla, Leucaena leucocephala K636, Grilicidia sepium are promising species and varieties. A new experiment was designed and planted in July 2001 at CATAS, evaluating the 20 most promising shrub legumes from the previous study.

New stylo accessions were selected and screened for anthracnose resistance and early flowering, including GC1579, GC1517, GC1463, GC1480, GC1576, Semilla negra, FM07-2. CIAT184 was treated as a control. The experiment was planted in June 2001 at CATAS, Hainan. The preliminarily results show that FM07-2 and GC 1463 are higher yield and early flowering. Eight accessions of Arachis pintoi are being evaluated on the CATAS experimental farm: 18750, IRFL3019,17434,18744, 22160, CPI93483,18748, and one from Guangxi.

Another stylo experiment was established on-station in Thailand. The objective of the trial was to find alternative stylo varieties to Stylosanthes guianensis CIAT 184, which are more resistant to anthracnose. Treatments are i)control (CIAT 184), ii) selection of black-seed stylo 184 from China, iii) composite hybrid 1 of S. guianensis, and iv) composite hybrid 2 of S. guianensis
The treatments were arranged in 3 randomised complete blocks. The plots aree 6 m x 8 m. To build up natural inoculum of anthracnose in the area, rows of susceptible Stylosanthes guianensis cv. Graham were established around the experiment as well as in between blocks. Germination of composite hybrid 1 and 2, stylo 184 and Graham stylo was good but black seeded stylo was poor. From planting in June until the end of September there were no anthracnose symptoms.
Fourteen accessions of Lablab purpureus of last year's Lablab evaluation trial (45 accessions) are being evaluated in Thailand. The design of the experiment is a randomised complete block design with 3 replications. A plot consists of 3 rows 7.5 m long with an inter-row spacing of 30 cm, and a 1 m path between plots. Lablab was planted on 25 May, 2001.
Data being measured are:

i) Date of first flowering (the average date when 5 plants per accessions have set flowers).
ii) Dry matter yield at 100 days after planting, and then every 60 days (cut at 10 cm height).
Fresh weights are recorded and samples of 1 kg are taken. The sample are oven dried at $70^{\circ C}$ for 72 hrs to estimate dry matter percentage and chemical analysis is carried out for CP, NDF, ADF and lignin.

On-farm. On-farm research is being conducted in Baisha, Danzhou and Ledong counties, China. Stylosanthes guianensis is intercropped in fruit trees such as Mango, Lychee, and Longan; and in young rubber and eucalyptus plantations.
An on-farm trial fattening of goats with Stylo CIAT 184 and Brachiaria decumbens is being carried out in Yaxin, Danzhou city. The results show that goats can gain 1.38kg/ head in 30 days when fed on a Stylo and B. decumbens mixture, compared to only 1.13 kg/ head on local grass.

(Ralph Roothaert)

2002 A core group of farmers using productive and sustainable forage technologies at 6 sites, in each of Indonesia, Lao PDR, PRC, Philippines, Thailand and Vietnam

In addition to introduction of improved forages into farming systems, research is also being carried out on indigenous forages. The following is an article prepared following a study in Lao PDR.

2001 Assessing the use of indigenous fodder trees in Laos

Introduction

Cattle in Luang Phabang Province, Lao PDR, are grazing or fed on low quality roughage during the major part of the year and especially during the dry season. As a result productivity is low, animal health problems are common and livestock are not strong enough to plough the fields when they are needed. Farmers have started to respond to this problem by cultivating forages and feeding them to selected animals in the herd. Farmers also collect leaves from trees and shrubs from the natural vegetation, which provide a concentrated form of high quality protein and minerals for the animals. There is no information in the literature about the use, farmers' preferences and nutritive value of this perennial fodder in Laos. One of FSP's aim is to provide information on local and improved forages to enable farmers to optimise feed rations for animal production.

The hypothesis tested in this study was that farmers have extensive knowledge about the use and quality of local fodder trees and shrubs, which can help improve feeding recommendations once combined with researchers' knowledge. The objectives were as follows:
to make an inventory of the indigenous fodder trees and shrubs that farmers use to feed their cattle, and to identify their botanical names.

to assess how and when farmers use these species, where they grow, and if they practice strategic feeding.

to assess farmers criteria for assessing quality of fodder tree species.
to assess farmers' preferences of fodder tree species, using their own criteria.
to compare nutritive value of most preferred or most common species through chemical analysis.

Methods

Four villages in the upland of Luang Phrabang Province were selected for the study (table 1). People in the uplands live close to the forests, and tree fodder was likely to play an important role in the diets of livestock. Our team consisted of two researchers and several extension workers. In every village general discussions were held with a group of farmers about the purpose of our visit, the general history of the village, the farming system, the tree species used to feed cattle, the criteria for assessing qualities of tree fodder, and other uses of the trees. The group was then asked to select villagers who had good knowledge and experience of the use of tree fodder ('key informants'), and who would be interviewed individually. The individual farmers were asked to rate the tree species with the criteria suggested by the group. They were also asked to rank their preferred species, to explain how they harvested the tree fodder, whether there was any strategic use for animals, whether the use and availability was seasonal, whether trees were planted or found on-farm, whether the trees served other purposes, and if they had any other comments. After the interviews, samples of the trees were collected and pressed for verification of local names with farmers, and for botanical identification. Electronic pictures were taken of various morphological parts of trees. Other samples were collected for laboratory analysis of nutritive value.

Table 1. Description of 4 villages in study area

	Keawjaloung	Keawtalonyai	Longlao II[2]	Phonesaat
Ethnic group	Kasah	Hmong	Hmong	Hmong and Kmu
Geographic position	N 19° 43' E 102° 13'	N 19° 36' E 102° 14'	N 19° 48' E 102° 05'	N 19° 42' E 102° 12'
Altitude	856 m	1380 m	956 m	956 m
History	Established 500 years ago. Started raising cattle 6 years ago.	Established in 1966, they used to live nearer to Vientiane. Village has moved several times	Established in 1979. Outsiders are now settling in the village. Population increases, land becomes scarcer.	Moved from northern Lao in 1970, and settled in mountains. Moved to roadside in 1999.
Farming system	Shifting cultivation. Rice, pigs, cattle.	Shifting cultivation. Rice, pigs, cattle, buffaloes, goats.	Shifting cultivation. Upland rice, maize, cassava, cattle, buffaloes, pigs. No goats, they harm crops.	Shifting cultivation. Upland rice, maize, cassava, vegetables, cattle.
No. of farmers in group discussion (male: female)	10:8	6:6	30:0	20:3
No. of farmers interviewed (male: female)	8:2	5:3	5:0	7:2
Date of discussions and interviews	7 March 01	8 March 01	10 March 01	9 March 01

Results

A variety of species were used, ranging from 6 to 17 species in each village. Three species were common in all villages: Ban, Po Sa and Sa Hou (Table 2). Mak Not Pa and Mak Va were used in three villages. An attempt was made to identify the botanical names with reference books of Vidal (1959) and Engel and Phummai (2000). Some names still need further identification (Table 3). The most preferred species differed by village, but Ban and Po Sa appeared in the top 3 of three villages (Table 4).

Farmers in all villages mentioned palatability, availability and accessibility as criteria for qualities of fodder trees. Availability was usually described by farmers as number of trees present, or amount of fodder available. Accessibility related to the time that was needed to reach the tree from home. Criteria that were only mentioned once were: availability throughout the year, regrowth after harvesting, and quantity of leaves on the tree (Table 5). The criteria 'nutritive value' and 'regrowth' were added to the matrix by the research team during the interviews in every village (Table 6).

[2] Position and altitude of Longlao 5 km outside village, on road to Luang Prabang.

The trees in this study did have several other uses: sale of bark for paper production (Po Sa); firewood (all species); construction material (Ton Mon, Mailieng, Sakham); roofs (Po Hou); flowers, fruits and young leaves for human food (Ban, Po Sa, Mak Va); material for ropes (Po Hou); and medicine (Ton Mon).
Results from laboratory analysis of nutritive value of the tree samples are not available yet.

Table 2. Species used in 4 villages of Luang Prabang.

Species in Keawjaloung	Species in Keawtalonyai	Species in Longlao II	Species in Phonesaat
Ban	Ban	Ban	Ban
Bay Had	Mailen	Deua	Mailieng
Deua	Mak Not Pa	Mailen	Makok
Deua Pong	Po Sa	Makok	Mak Va
Dokleap	Sa Hou	Mak Not Pa	Po Sa
Eng Leng	Sieo	Mak Va	Sa Hou
Laveung		Po Sa	Sa Kham
Mailieng		Sa Hou	Ton Mon Pa
Mak Linmai			Tow Chon
Mak Not Pa			
Mak Va			
Po Sa			
Sa Hou			
Sa Kham			
Sai Ma			
Sieo			
Sorsien			

Table 3. Species that farmers used for feeding cattle in Lao, and samples that were sent for chemical analysis in Thailand.

Lao name	Hmong name	Preliminary botanical identification	Chemical analysis
	Tow Chon	Not yet determined	
Ban, Ton Ban, Bai Ban		Bauhinia variegata	✓
Bayhad		Artocarpus sp.	
Deua		Ficus sp.	
Deua pong		Ficus hispida	✓
Dok leap		Not yet determined	✓
Eng Leng		Not yet determined	✓
Houng Keo, Houng Sa	Laveung	Ricinus communis, Eclipta alba	
Kok Mailen		Albizia odoratissima	
Mailiang, Mailieng		Berrya mollis, Eriolaena candollei	✓
Makok,	Ton Molu, Kao Mo Leu, Hai Hiad Pa	Spondias Magnifera, S. dullis	
Mak Lin Mai		Oroxylum indicum	
Mak Not Pa, Not Nam		Ficus heterophylla, F. pyriformis, F. variolosa	✓
Mak Va, Ton Va, Kok Va		Ficus racemosa, Eugenia jambolana, E. compongensis	
Posa		Broussonetia papyrifera	
Sa Hou, Po Hou		Trema orientalis, T. velutina	
Saima		Not yet determined	
Sakham		Garuga pinnata	✓
Si Hai Ton		Cinnamomum iners, Eucalyptus sp.	✓
Sieo, Sieo lieng, Sieo ngeun lieng, Sieo lap		Bauhinia purpurea, B. viridescens, B. acuminata, B. prabangensis	✓
Sorsien, Som Sien		Sinapis alba	✓
Ton Mon Pa		Morus sp.	✓

Table 4. Farmers' most preferred fodder tree species in 4 villages of Luang Prabang.

Species in Keawjaloung	No. of respondents (n = 5)	Species in Keawtalonyai	No. of respondents (n = 8)	Species in Longlao II	No. of respondents (n = 5)	Species in Phonesaat	No. of respondents (n = 9)
Ban	5	Sa Hou	8	Sa Hou	5	Ban	8
Deua Pong	3	Po Sa	7	Po Sa	4	Tow Chon	6
Po Sa and Sieo	2	Mak Not Pa	4	Ban	4	Makok	5

Table 5. Farmers' criteria for assessing quality of fodder trees.

Criterion	Keawjaloung	Keawtalonyai	Longlao II	Phonesaat
Palatability[3]	●	●	●	●
Availability (many trees)	●	●	●	●
Availability (throughout the year)				●
Easy access (distance)	●	●	●	●
Regrowth		●		
Leafiness				●

Table 6. Use of trees for dry season feeding.

Species	Ban	Sa Hou	Po Sa	Tow Chon	Makok	Mak Not Pa
No. of farmers who mentioned	13	10	9	7	5	3

Discussion

Although nutritive value is an important criterion from animal production point of view, many farmers refused to rate the species by this criterion, as they could not assess it. This finding is in sharp contrast with findings in Kenya (Roothaert and Franzel, 2001) and Nepal (Thorne et al., 1999), where farmers have detailed knowledge about nutritive qualities of local tree fodder. In Kenya, cattle are often used for milk production, in which case feeding gives immediate results. In Nepal, nutritive characteristics of tree fodder have an immediate impact on manure quality, one of cattle's primary products. In Lao, however, cattle are raised to reproduce and to be sold. The mixture of tree leaves fed over a long period makes it very difficult to judge the nutritive value of the individual tree species. Only 10 farmers reported that they used tree fodder to fatten thin animals. The most common species for this was Ban. The majority of farmers said they fed tree fodder to all cattle, cows after calving, or calves. Farmers' knowledge about nutritive value could be found, perhaps, through a group of farmers who would use a specific species for thin animals or calves. In Keawjaloung, farmers interpreted nutritive value as the amount of water in the leaves. Water content is a positive attribute, as streams for drinking can often be far away, especially when they dry up in the dry season

[3] Farmers were asked to consider feed for cattle only

Table 7. Farmers' scoring of local fodder tree species on selected criteria using matrix rating (Mean score and standard deviation in parentheses. A rating of 3 indicates good, 2 indicates medium, and 1 indicates poor).

Species	Village	n	Palatability	Availability (quantity)	Access	Nutritive value	Regrowth	Leafiness	Available year
Ban	K.loung	5	3 (0)	3 (0)	3 (0)	3 (0)	3 (0)		
	K.yai	8	1.8 (0.71)	2.1 (0.83)	1.9 (0.64)	1.1 (0.38)	2.8 (0.46)		
	L.lao	5	2.6 (0.55)	3 (0)	2.8 (0.45)		3 (0)		
	P.saat	9	3 (0)	2.9 (0.33)	3 (0)		2.9 (0.35)	3 (0)	2.8 (0.67)
Sa Hou	K.loung	5	3 (0)	2.4 (0.89)	1.8 (0.84)	2.3 (1.15)	1.5 (0.71)		
	K.yai	8	3 (0)	2.9 (0.35)	2.8 (0.71)	3 (0)	1 (0)		
	L.lao	5	2.6 (0.55)	2.8 (0.45)	2.6 (0.55)		1.2 (0.45)		
	P.saat	8	1.5 (0.53)	1.5 (0.53)	1.8 (0.71)		1.4 (0.79)	1.5 (0.53)	1.5 (0.76)
Po Sa	K.loung	5	2.8 (0.45)	2.6 (0.55)	1.8 (0.45)	2.5 (1)	2 (1.41)		
	K.yai	8	2.9 (0.35)	2 (0.35)	2 (0.93)	3 (0)	2.3 (0.89)		
	L.lao	5	2.8 (0.45)	2.8 (0.45)	2.6 (0.55)		1.8 (0.45)		
	P.saat	9	2.7 (0.5)	2.1 (0.78)	2.1 (0.6)		1.8 (0.89)	2.1 (0.6)	1.6 (0.73)
Mak Va	K.loung	5	1.8 (0.84)	2.2 (0.84)	2.2 (1.1)	2.3 (1.15)	2.5 (0.71)		
	L.lao	5	2.6 (0.55)	2.6 (0.55)	2.4 (0.89)		2.6 (0.55)		
	P.saat	9	1.8 (0.67)	2.1 (0.93)	2.1 (0.78)		2.1 (0.83)	1.8 (0.83)	1.7 (0.95)
Mak Not Pa	K.loung	5	1.8 (0.84)	1.6 (0.55)	2.2 (1.1)	2.3 (1.15)	2.5 (0.71)		
	K.yai	8	1.6 (0.52)	1.3 (0.46)	1.4 (0.52)	1.4 (0.53)	2 (0.76)		
	L.lao	5	2 (0.71)	2.2 (0.84)	2 (1)		2.4 (0.55)		
Tow chon	P.saat	8	2.6 (0.74)	2.4 (0.92)	2.8 (0.46)		2.5 (0.76)	2.5 (0.53)	2.6 (0.52)

One of the aims of the study was to determine whether there are local trees that would compete with exotic fodder trees. The Forages for Smallholders Project is already offering tree or shrub based technologies to farmers which can address problems of seasonal feed shortage, lack of protein in animal's diet, soil and water erosion in farm land, and nutrient depleted soils. Factors that are taken in consideration when selecting a species for a particular technology are adaptability to climate and soil, pruning resilience, biomass productivity, compatibility with other crops in the farm, degradability, palatability to livestock, nutritive value, drought resistance, and multiple uses. Local tree species would have some advantages over exotic ones as there is no need for lengthy seed quarantine procedures; there is extensive farmers knowledge and familiarity; and natural selection of climatic and soil adaptability has already taken place.

Biomass productivity is the result of many other tree factors; climatic and soil adaptability of the species, pruning resilience, leafiness, and compatibility with other crops. The criterion 'regrowth' was one way of assessing pruning resilience by farmers. There were big differences among species in terms of regrowth. Ban, for instance scored very high, while Sa Hou scored very low. More dramatically, 20 farmers mentioned during the interviews that Sa Hou dies after being lopped. This information corresponds with experiences in central Kenya, where a plot of 9 months old Trema orientalis trees had been subjected to coppicing, and more than 50 % died. 'Leafiness' was a marvellous criterion that was unfortunately mentioned towards the end of the field study, and therefor only farmers in one village rated the species to it. There are big differences among species according to leafiness. Compatibility with other crops was not used as a criterion. However, 21 farmers mentioned that Po Sa grew on their farm land, 12 farmers farmers said Sa Hou grew on their farm, and 9 farmers said Ban grew on their farm. Ban and Po Sa regenerated from stumps after clearing and burning fallow land, whereas Sa Hou regenerated from seeds. Sometimes Po Sa was planted. All other species were found in the forest and uncultivated land. Soliciting information about compatibility with other crops would be difficult as all trees are categorically removed from fallow land before cultivation of crops. However, in some vegetable gardens near the village, large trees could be found. This might be the most appropriate site for future testing of tree or shrub based technologies. In Longlao II there was very little interest in planting local trees. When asked why, farmers answered that they appear naturally in fallow land.

Soil degradability of green manure derived from tree biomass has a strong correlation with rumen degradability. Tree leaves contain tannins that prevent organic matter being rapidly degraded by either rumen or soil micro-organisms. There are many unknown tannins in woody fodder plants, and many laboratory studies focus on their effect in animal nutrition. In this study there is still insufficient information about degradability.

As is the case with exotic fodder trees, there is large variation in palatability among local fodder trees. Po Sa was consistently rated highly palatable. Palatability also seems to be correlated to availability and accessibility. In other words, the more of the trees there are to utilise, the more experience farmers and their animals have with the tree. Palatability is a dynamic quality, as it generally increases when an animal gets used to a type of fodder.
Several species are used for feeding during the dry season (Table 7), which could be an indication of drought resistance. In Keawjaloung, farmers mentioned that Sieo, Bai Had and Sakham dropped their leaves during the dry season.

Farmers' preferences for species might be based on a complex combination of al fodder related aspects described. However, our experience with forages in general is that multipurpose use is also a very important factor. Of the preferred species in Table 4, the suitability of Ban and Po Sa for human food, the sale of bark of Po Sa for the paper industry, and the use of Sa Hou for roofing and making ropes, could be confounding factors for their preferred status.

Conclusions and recommendations

The study revealed new information on the use of indigenous fodder trees in Laos, and the attributes that are valued by different communities. The criteria can be used to select trees that deserve further research. The effect of tree fodder on animal productivity could be assessed in additional studies with certain farmers or groups. The on-going nutritive analysis in the laboratory will also reveal information that can be used to determine the potential for animal production. Back-yard farming research could reveal the opportunities for intensive cultivation of local fodder trees.

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(Ralph Roothaert and Phonepaseuth Phengsavanh)

2001 Update on evaluation and expansion of the use of improved forages

The following table illustrates the Participatory diagnosis (PD), new villages and new households involved in forage evaluation and expansion. FSP, Jan. 2000 – Sep. 2001.

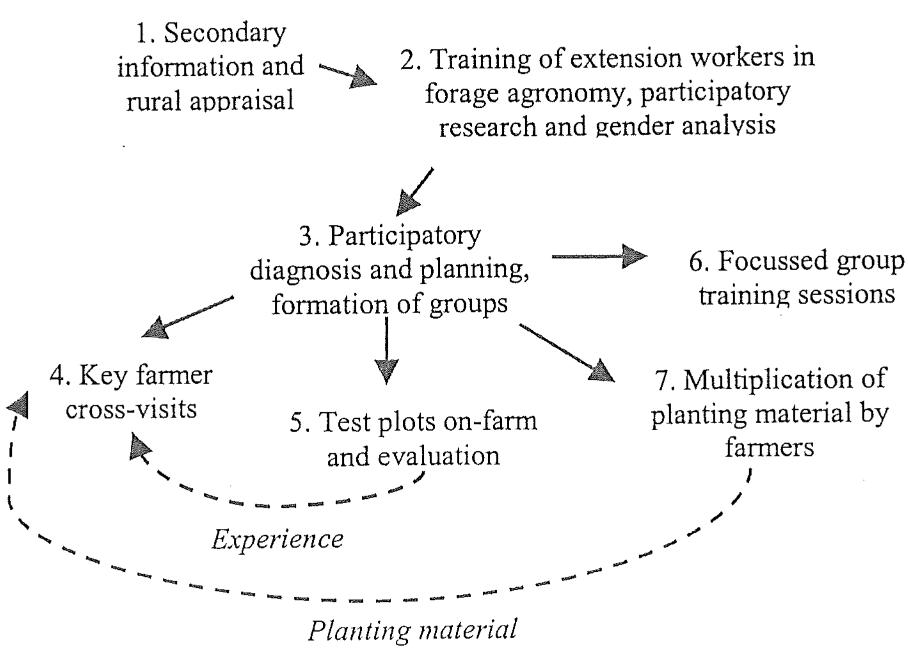
Country	Site	No.of PDs in 2000	No.of PDs in 2001	No. of new villages in 2000	No. of new villages in 2001	No. of new house-holds in PD's in 2000	No. of new house-holds in PD's in 2001	No. of new farmers who planted forages in 2000	Range of area planted	Forage management
Indonesia	Pasir, Kutai, Balikpapan and Samarinda	8	8	8	8	242	NA	111	100 - 2500 m^2	C&C, grazing, live fence
Philippines	Malitbog	11	9	11	9	160	185	68	50 - 3600 m^2	C&C, grazing, contour strips, live fence, ornamental
	Cagayan de Oro	2	6	2	6	75	200	90	2 - 10,000 m^2	C&C, grazing, contour strips, live fence, ornamental
	Manolo Fortich and Impasugong	2	3	2	3	80	46	NA		C&C, grazing, contour strips, live fence, ornamental
Vietnam	Tuyen Quang	4	8	4	NA	145	370	205	50 - 400 m^2	C&C, Cover crop
	Daklak	5	19	5	NA	125	337	125	100 - 500 m^2	C&C, Cover crop
China	Hainan	3	2	3	2	20	10	20	100 - 300 m^2	C&C
Thailand	Sung Nuen	2		1	NA	22	NA	10	400 m^2	C&C
	Seekew	1	3	3	3	40	NA	NA		
	Dankhuntod	1		5	NA	35	NA	NA		
Lao	Luangphabang and Xiengkhuang	6	24	6	18	143	316[4]	192	100 - 800 m^2	C&C, hedgerows
Total		**45**	**82**	**50**	**49**	**1087**	**1464**	**821**		

[4] 271 farmers in villages where FSP and FLSP work together, 65 farmers in villages where FSP works without FLSP.

2.3.2. PE-5 Output 3. Models/frameworks developed to target research, integrate results, assess impact and extrapolate results

Update in 2001 - Methodology for scaling up technologies developed using FPR

1. Experiences in Scaling Up (Report of discussion on scaling up at the annual planning meeting of the Forage for Smallholders Project, Samarinda, Indonesia, 15 – 19 January 2001)
Scaling-up and participatory approaches were the themes of the meeting. The FSP started with participatory research to develop forage technologies, and we believe that a solid relationship with farmers is needed before one can can attempt to scale-up. The teams in Indonesia, Lao, Philippines and Vietnam do have this solid background and have been successful in scaling-up. China and Thailand, on the other hand, still have to invest in the establishment of focus sites where farmers become confident enough to act as agents in the process of scaling-up. Building confidence among resource poor farmers requires good facilitation of field workers, and it requires patience. Not surprisingly, one of the problems mentioned in Thailand was the lack of trained field staff and their allocation of time to this new process. It stresses the importance of training, and our network should be used to exchange skilled trainers to train other trainers. Training activities are therefore a priority for China and Thailand. This initial investment might seem much and slow, but it pays of. In Indonesia, Lao, Philippines and Vietnam, the investment was made several years ago, and it is resulting in an exponential scaling-out, with more and more farmers adopting forage technologies.
A striking similarity emerging from the presentations, was the central role of the experienced and enthusiastic farmers in the focus sites, whom we called key farmers. When cross visits were made, i.e. farmers visiting other farmers, key farmers played a vital role in educating the new farmers. In some countries, key farmers acted as extension workers and visited farms in new areas (Indonesia); in other countries farmers from new areas visited key farmers in focus sites. Sometimes both happened. Common criteria for identifying key farmers were: head of a group, having good ideas, enthusiastic, they identify themselves, successful farmer, good communication skills, having time and good relationships with other farmers. Figure 1 shows the usual flow of activities in scaling-up.
Figure 1. Flow diagram of activities in the scaling-up process of forage technologies happening in FSP. Activities 4 –7 sometimes happen simultaneously or in a different order.



During the discussions, different views were presented on the issue of payment of honoraria to farmers for their activities in extension. In Indonesia, Philippines and Vietnam farmers receive money for their services from the project, in Thailand, Lao and China they do not. There was confusion about who should get payment and how much they should get. Lack of standards for payment was considered a problem in some places. In some cases, farmers who carry out extension work were compensated for the time they spent, equivalent to the amount of money they would earn working on their own farm. This seems to be a formula that can easily be worked out in each country, while in some countries the standards are higher than in other countries. FSP would support this system, but the rates and payments need to be transparent in order to promote acceptance at the national host institutions. Expenses of transportation and food were also covered by the project. Connected to this, the issue of allowances for field workers was brought up. The difference between farmers and field workers, however, is that field workers do receive a salary already, which is not discontinued when they go to the field, unlike the interruption of farmers' daily work. Field workers do get incentives from FSP in terms of lunches, and participation in training courses. Only in Lao, the salary of field workers is too low to sustain someone's life, and a formula has been developed to supplement their salary based on field visits.

As the earlier AusAID-funded FSP had sometimes been criticised for not addressing gender issues enough, there is a risk that this next phase of the project will be criticised for not working enough with marginalised ethnic groups. Participants of the workshop gave reasons for not working with these groups, such as: they are difficult to gather in a meeting, they have different activities, their livestock keeping is not intensive, they don't use animal draught power, they have difficult attitudes, and they are very poor. Which of these arguments are facts and which are prejudices? In fact, some could be used as arguments in favour of working with them (they are very poor). Luckily, not all votes were negative, and in Lao for instance, minority groups are the main target group of the project.

In 1996, during FSP phase I, an international workshop took place in Thailand about forage seed supply systems (Horne, Phaikaew and Stür, Eds.). Although the workshop in Thailand concentrated largely on seed production rather than on production of vegetative planting materials, it was concluded that vegetative material was preferable for remote smallholder farms, due to logistical and institutional difficulties associated with seed production. Since then, it has become apparent that the role of vegetative planting materials has become more important, in both remote and accessible areas, when scaling up. Together with this shift, we see a shift from on-station to on-farm production of planting materials. The drive for scaling-up has certainly enhanced the decentralisation of planting material production, as its availability is essential for the process. Vegetative material is now the most important source of planting for new farmers in the Philippines and Indonesia. In Thailand and Vietnam the weather is dry enough to allow good harvesting and handling of grass seeds. Farmers produced 37 % of the registered forage seed trade in Thailand in 2000. In Vietnam, a market for forage seeds has still not formed though. In Indonesia and the Philippines, vegetative planting materials and seeds are sold by farmers on a small scale.

(Ralph Roothaert)

2. The Role Of Farmers In Spreading New Forages Technologies In East Kalimantan

The Forages for Smallholders Project (FSP) has carried out extensive research on improved forages between 1995 and 1999, leading to wide adoption of forage technologies by farmers in S.E. Asia. FSP – Phase II, funded by the Asian Development Bank, Centro International de Agricultura Tropical (CIAT) and national partners, continues with the work and operates now in six countries in S.E. Asia.

In Indonesia FSP – Phase II operates in one province, East Kalimantan. A major challenge for the project is to extend the successful forage technologies to new areas, where more farmers will be able to benefit from them. The forage species that new farmers accept are often similar to the ones accepted by experienced farmers. At a first glance you might notice that the places where farmers plant forages in their farm are also similar in each village. However, every farm is unique in a sense and every farmer has an agenda which is never fully exposed. This results in the management of forages in many different ways. Differences in forage management are a welcome inspiration for FSP workers in the field, and they form the basis of discussions during meetings of farmers' groups. The implications of these differences are that forage technologies are difficult to replicate from one district to another without farmer to farmer interaction. New farmers need to learn from experienced ones.

When new districts in East Kalimantan are selected for the introduction of forage technologies, a rural appraisal is carried out first. The Livestock Service (Dinas Peternakan) has field staff in every District and has a good understanding of the potential of improved livestock production in the various areas. Secondary data are compared, indicating population density, natural resources, numbers of livestock, physical and climatic conditions, and market opportunities. In meetings organised by Dinas Peternakan, different stakeholders air their views. In July 2000, some potential new Districts for dissemination of forage technologies had been identified. Development workers from those districts were invited and trained in forage agronomy, management and participatory research. An important skill that they learned was how to conduct a participatory diagnosis (PD) with farmers. Trainees who had mastered the skill, consequently conducted PDs in villages in their Districts with the help of experienced FSP staff. Problems of livestock production were discussed and possible solutions were identified. Among the proposed solutions was introduction of new forages.

In East Kalimantan, a new approach was used to facilitate the extension of forage technologies to the new Districts. There were some experienced farmers in Makroman village who had been very successful in cultivating new forage varieties and who had achieved rapid growth rates of their young livestock. These farmers were so enthusiastic that they felt they wanted to tell everyone about their success. They were given the opportunity by FSP; groups of farmers from new Districts were brought to the communal meeting rooms of the farmer group in Makroman. Three experienced key farmers talked about the benefits of forages and the differences among forage species in terms of management, palatability, drought resistance and the ability to cover Imperata cylindrica fields. They also explained how to prepare land, how to prepare planting material for sale, and how to manage a dynamic farmer group. After the meeting, farmers had a chance to see the farms were forages were cultivated. Many questions were raised and subsequently answered by the key farmers.

Before the farmers returned to their homes, they were given planting material of all available species. The idea was that new farmers try small plots of many different species: the favorite species as well as ones that only show moderate growth. The species which are performing not so well in the focus sites, might in become favorite ones in different soil conditions of the new districts and under the unique environments of the new host farms and hosts.

The method of farmer to farmer extension is simple and very effective. It also tackles the problem of lack of field staff, especially crucial after many countries were forced to slash their team of civil servants as part of the SAP programme of the World Bank. The FSP is going to facilitate more of these new practices, in East Kalimantan and in other countries.

(Ralph Roothaert and Ibrahim)

Update in 2001 - Evaluation and monitoring framework - Asia

Activities of the FSP in this area included training in the use of M&E. This is reported in the next section on training.

2.3.3. PE-5 Output 4 . Increased effectiveness of CIAT and partners to conduct appropriate research for developing productive and sustainable land use practices

Training

Training course on Monitoring and Evaluation of the Forages for Smallholders Project

Introduction

The goal of the FSP is to improve the livelihood of upland farmers, by enhancing available feed sources to increase livestock production, and strategic use of grasses and legumes to conserve soil and to enhance nutrient management. Monitoring and evaluation exercises help us to judge whether the project is achieving its goal. The project uses a range of methods, allowing aspects of conventional and participatory ME, or crosses of the two.

In August 2000, an international workshop was organised by CIAT and the University of Queensland (Australia), to develop a practical guideline for undertaking ME in the FSP. During the workshop scientists of CIAT, UQ and countries in SE Asia reviewed theoretical concepts of ME and current practices. More insight was gained and practical recommendation were summarized in a comprehensive report of 65 pages (Cramb and Purcell, 2000). In the meanwhile, field workers in the Philippines and Vietnam had used a matrix that was developed during the workshop for implementing ME. Although in theory the matrix could be used for both participatory and conventional ME, in practice it was still used in a rather rigid and conventional way. A general complaints in both countries was that ME increased the workload of field workers to unacceptable levels. In the Philippines the teams felt there was no local capacity to analyse and report the data collected through ME exercises.

In 2001, two local ME workshops were organised in the Philippines and Vietnam, not only for scientists and managers, but more specifically for field workers and key farmers, involved in FSP. The aim of the workshops were to develop more practical methods of ME, to practice analysis of data, to practice reporting, and to develop ME workplans for the whole project cycle. A secondary objective was to be able to use a diversity of methods, allowing more scope for participatory ME.

Structure of ME workshop in Tuyen Quang, Vietnam

There were 2 resource people and 13 participants from Vietnam, some of whom also acted as resource people at appropriate sessions, and some had to translate simultaneously from English into

Vietnamese and vice versa. The language barrier in all countries where FSP works, except in the Philippines, is big. The structure of the course, with comments about improvements are presented in Table 1. The whole workshop lasted 8 parts of half a day (5 days).

Outputs

The workshop in Vietnam generated several outputs:
Understanding of concepts of participatory and conventional monitoring and evaluation.
Reflection on current practices.
Design of field questionnaires.
Analysis of field information and data, and reports.
ME workplans for Tuyen Quang and Daklak (e.g. Table .....).

Lessons learned

Everything that is said needs to be translated in Vietnamese or English, and everything that is written on white boards, cards, overhead sheet or in-focus needs to be translated as well (in either language). It is time consuming but absolutely essential.
Non of the participants had attended the previous international workshop on ME. Concepts of PME and ME needed to be explained well.
People were unfamiliar with most terminology. A small dictionary of key words evolved as the workshop went on. Some of the difficult key words are: Adaptation, Adoption, Bottom up, Capacity building, Conventional, Dissemination, Empowerment, Evaluation, Farmer, case studies, Focus group, Forage technology, Formal interviews, Impact, Indicator, Informal interviews, Monitoring, Multiplication systems, Networks, Participatory, Social capital, Survey, Tools, Top down.
Analysis and reporting of information derived from open ended interviews or discussions seemed to be more difficult than that from formal questionnaires. Analysis and reporting of both types of information need to be practised.
If participants have limited pre-knowledge about ME, as was the case in Tuyen Quang, more time is needed for analysing, reporting and planning sessions.
Many participants had little knowledge and experience with participatory methods and wanted to learn more about participatory tools. Training sessions on some tools that are highly relevant for ME can be added to the programme.
Pre-workshop information about knowledge, experience and designations of participants would help to focus the programme.
A longer workshop is desirable, but organising availability of resource people and organisers in Vietnam over a longer duration is difficult.

Conclusions

The structure in Table 1 provides a workable basis for a training course on ME. Concepts of PME are well documented in the report of Cramb and Purcell, which serves as a resource book for lecture like presentations in a training course, and for reference material. Understanding the concept is only one objective of the training; practical skills on planning, collecting information, analysing and reporting are other important objectives. More than 75 % of the time in a course needs to be spent on training of those skills.

(Ralph Roothaert)

Table 1. Structure of ME course for field workers in Tuyen Quang, Sept. 2001.

Activity	Time	Method	Resource people	Suggestions for improvement/ modifications
Opening	30 min	Speech Learning each other exercise, practicing names	Course organisers	Invite high ranking officials to open the course, it would create an opportunity to scale-up ME.
Leveling-off knowledge on ME: difference and relationship between monitoring and evaluation purpose of ME in forage projects difference between conventional and participatory ME levels of ME indicators methods of ME	3 hours	Card and chart method on 'What' is ME and 'Why' is it done. PowerPoint presentation addressing all issues Plenary inventory of ME questions at different levels Definition of 'key words' (e.g. monitoring, evaluation, adoption, dissemination) in Vietnamese	Course organiser	Add indicators in the plenary inventory of ME questions.
Reviewing ME activities, methods, results and problems of FSP in Vietnam and Philippines	2 hours	Presentations discussions	Site co-ordinators	
Planning for field exercise (What shall we monitor in the field, why and how?)	1 hour	Discussions	Course organiser	Needs more time, at least another hour. For logistical reasons, farm visits have already been planned at this stage.
Field visits to farmers who have been with FSP for more than one year	Half day	Group discussion with a group of farmers (focus group) and all participants. Methods of measuring impacts and indicators are discussed with the focus group. One or two types of impacts are discussed e.g. animal productivity (cattle, fish, buffalo). Demonstration on use of girth measurements	Course organisers and site co-ordinators	Forms (questionnaires) need to be translated in local language. Time is too short to visit 5 farmers.

Activity	Time	Method	Resource people	Suggestions for improvement/ modifications
		Two groups of 7 participants each interview 5 farmers each with questionnaires that have been used before in other sites of the project.		
Measuring livestock productivity and scoring cattle condition	45 min	Using field data and tables to calculate liveweights. Visualise 1 to 5 scale for condition scoring. Discussion on the role of this method.	Course organiser	This session can be extended with a discussion on farmer methods to evaluate livestock productivity.
Random sampling	30 min	List of farmers with project id no. is used. Practicing random sampling from list using random tables. Discussion on advantages and disadvantages of the method.	Course organiser	
Field visits to farmers who have been with FSP for more than one year	1 day	Two groups of 7 participants each interview 5 farmers each with questionnaires that have been used before in other sites of the project (same or improved questionnaires as used before) Open ended (informal) interviews on methods of measuring environmental impact of forages.	Course organisers and site co-ordinators	If accessibility by road permits, a few more farmers can be interviewed.
Structure of reports	10 min	Presentation	Course organiser	
Analysis of data from field trips and writing of report	6 hours	Two groups of participants analyse data from forms, information from focus group and open ended interviews. Examples of how to present data in tables are displayed on white board. Reports are typed directly in computer.	Course organisers	
Presentation of reports	1.5 hours	Presentations from computers with in-focus. Discussions.	Group delegates	Participants did not report on focus group discussion, nor on open ended interviews. Perhaps time was too short for analysis, or it was something they were unable to do. It deserves more

Activity	Time	Method	Resource people	Suggestions for improvement/ modifications
				attention.
Use of ME matrix for planning	1.5 hour	Draw open matrix on white board. Participants fill in cells for 2 or 3 examples of different impact levels, in plenary session.	Course organiser	
Development of ME workplan for FSP sites	2 hours	Participants group themselves by site. They develop workplans using ME matrix. Typing in computers.	Course organisers	Needs more time
Presentation of workplans	1.5 hours	Presentation of report using computer and in-focus.	Group delegates	
Evaluation of workshop	1 hour	Card and charts method.	Course organisers	
Closing	15 min	Invite official	Guest	

Table 2. Monitoring and evaluation plan for Daklak, Vietnam.

Impact levels	**Question**	Indicators and measure	Method	Information sources	Time and scale
Processes and activities	What are the process during implementation of the project? What are the lessons learned?	Steps of implementation	Workshops with facilitator teams, development workers, and local authorities	Khanh	Every year with all staff.
Capacity building	How many farmers were trained in the year, content of these courses?	No. of farmers	Regular reports	Khanh	Yearly and at the end project
	Training for trainers?	No. of technicians			
Forage multiplication systems	-How many farmers are producing planting materials (seeds, vegetable materials)?	No. of farmers	Formal interviews	Individual farmers	Random selection of 30 households every year
	- How big an area they use for producing planting material?	Area (m^2) per species			
	- What is the destination of the material?	No. farmers, locations			
Forage technologies development	-What forage species are planted on farm?	- List of species	Formal survey	Individual farmer	Random selection of 30 households every year
	- What forage systems are used by farmers? (Species + forage management)	- Forage systems			
	-.Date and area planted for each species?	- Area of each forages (m^2)			
	- Which dissemination methods were used?	- Dissemination method			
Forage Productivity and preference	- What is the yield of each species?	Yield (kg/ m^2)	- Focus farmer group experiments and discussions. - Preference ranking - Matrix ranking	Focus group	Every year (5 farmers)
	- What are criteria that farmers use to evaluate forage? How do they rank the criteria?	-Criteria, rank of criteria			

Impact levels	**Question**	Indicators and measure	Method	Information sources	Time and scale
	- What species do farmers prefer? How do they rank?	- Rank of species			
Animal productivity	- What is the effect of forages on animals?	- Body weight gain - Body condition (score 1- 5)	- Focus farmer group experiments and discussions. - formal survey -informal interview	Focus group	every six months (5 farmers)
	- What are other criteria and what are the results if these criteria are used?	List of criteria			
Dissemination and scaling up	-How many farmers, farmer groups, villages, commune, districts planted forage in 1998, 1999, 2000, 2001,2002.	- Number of farmers, villages	Regular reports.	Farmers and developmen t workers	Yearly and at the end of project (all farmers)
	- How big an area of forages did farmers plant?	- Range of area (Average, max, min)			
Household benefits	What are the impacts of project to household livelihood ? How do farmers measure it? How do they rank?	Impacts, benefits and ranks.	Case study	Khanh	Every year 3 typical farmers

Problems encountered and their solution

Problem: There is political instability in the Philippines and Indonesia. Consultants and visitors are hesitant to travel to project sites and our host institution IRRI gives over cautious travel advise. The solution has been to obtain regular information from the local sources about security issues for foreigners is extremely important, and enables us to continue working in most sites.

Problem: Many of our local partners are from agricultural ministries and lack experience in carrying out research. Participatory research is flexible by nature, resulting in less rigid research procedures, where our partners sometimes get lost. They also lack skills in analyzing data and writing. To improve this situation some target research projects are carried out by CIAT staff and consultants. Local partners are sent for formal training.

Problem: Most reports by partners are written in the local language, and do not reach us. A solution is to report titles in English so as to identify important reports can be identified and arrangements made for translation.

Plans for 2002

A synthesis will be made of the demands, ideas and recommendations of all partners for a possible next phase of the project. This will result in the writing of a new project proposal.

FSP will continue its efforts in developing forage technologies with farmers; disseminating to new areas; training of collaborators, field staff and key farmers; and publishing project outputs. There will be an increased component of impact assessment for all activities, as this is the final year of the project.

2.4. Community-Based Upland Natural Resources Management in Aluoi District, Thua Thien Hue Province, Vietnam

A Special Project funded by IDRC 1998-2001

Highlights in 2001

It was easier to achieve success in increasing crop productivity and improving food security in an upland community than in introducing institutional arrangements such as co-managment of resources to ensure long-term sustainability of livelihoods
A community-based approach to resource management should involve policy and decision makers from the inception rather than when problems arise
Likewise issues such as improving the livelihood of the poorest in the community and dissemination of information and successful technologies to all within a community and to other communities needs to be addressed during the inception stage of a project

Project background

Hong Ha is an upland commune, located 50 km to the west of Hue city, in a mountainous area. This commune was selected for the site of the Community-Based Natural Resource Management (CBNRM) research project because it is representative of the situation in many other communes in central Vietnam. This commune is one of 21 mountainous communes of A Luoi district and located along the road from Hue City to the district centre of A Luoi. Hong Ha is known as starting point for small rivers flowing into the Bo River. There are 4 ethnic minorities Catu, TaOi, Paco and Pahy. Traditionally the local people practiced 'slash-and-burn' farming. They are now moving towards sedentary agriculture systems with permanent houses, which is seen by the government as a means to improve their livelihood. Due to many reasons, the forest area has become badly degraded and government projects are being carried out to regenerate the forest resource and protect watershed. Therefore, there was a need to implement research in the area on managing natural resources for sustainable development. However, the most urgent problem was food security. Families identified themselves as belonging to four wealth categories:
Better-off households having sufficient food, including protein, and sources of cash -16%
Middle level households havimg enough food and labour, know how to save money, but lack material goods -26%
Poor families lacking food and capital, but with sufficient labour -37%
d) Very poor families lacking food, capital, and labour - 22%
The project is being carried out by a team from the Agricultural and Forestry University, Hue, with technical support from CIAT and IDRC.

Investigators: Hue University of Agriculture and Forestry

Le Van An, Project leader
Le Quang Bao, Social forestry
Hoang Thi Sen, Gender study
Le Duc Ngoan, Animal science
Nguyen Thi Cach, Agronomy
Nguyen Minh Hieu, Agronomy
Hoang Huu Hoa, Agricultural economic
Nguyen Xuan Hong, Sociology

Nguyen Phi Nam, Aquaculture
Tran Minh Tri, Agricultural economic
Nguyen Thi Thanh, Agricultural extensionist
Ngo Huu Toan, Animal science
Nguyen My Van, Project administrative
Nguyen Khac My, Field technician
Cooperators: CIAT
Reinhardt Howeler, CIAT
Peter Kerridge, CIAT
Sam Fujisaka, CIAT
John Graham, IDRC
Budget: CIAT US$20,000

2.4.1. Progress Report - An assessment of Phase I - 1998-2000

The overall goal of the project was to develop sustainable and equitable resource use and management options with villagers in fragile upland areas in central Vietnam and to build capacity in research and development based on participatory approaches.

Summary of results in relation to objectives

The assessment, facilitated by CIAT and IDRC , was that made during group discussions by Hue University team members and with focus groups of community members. It was made preparatory to developing a new project proposal

Objective 1. To characterize the site with respect to the status of water, soil, agriculture, forestry, livestock and human resources, to determine the key processes and direction of changes
The research team produced a general resources and land use map based on district data; a map of areas targeted by different projects and agencies working in the area; a farmers' map of land and resources use; and a farmers' map of grazing resources.

Villagers' access to land and forest resources was analyzed. In general, government re-forestation projects and associated policies have barred villagers from land which they otherwise would have used for shifting cultivation. Higher population pressure on land, policy restrictions on access to land, and resulting decrease in fallow periods have led to degraded land and soil conditions and to a decrease in the villagers' ability to meet their food security needs.
Farmers' indigenous knowledge related to slash-and-burn agriculture was described. Shifting cultivation while producing reasonable crop yields is not well suited to the current economic and policy environment. However, farmers are applying appropriate traditional technical knowledge on shifting agriculture and livestock raising to their sedentary farming activities.
An analysis of gender roles in Hong Ha showed that women contributed substantially more labor to household and productive activities than men, but had less decision-making power.
Information characterizing the farming and resource use systems of Hong Ha was collected at the begining of the project in late 1998 and again at the beginning of 2001.

The changes in livelihood patterns have been quite dynamic. There has been an increase in the value of production from agriculture, a decrease from forest extraction of timber and NTFP's but an increase from forest services such as payments for planting and maintenace of replanted forests.

Changes in the source of production have also been accompanied by changes in services. Of the approx. 200 families, 150 now have electricity and 100 piped water. There has been a decrease in proportion of households considered poor and very poor from 60 to 25% of households. Average income has doubled from US$40 to US$80. The main expenditure continues to be on food but the proportion spent has decreased slighty from 70 to 60 percent.

Objective 2. To study central government policies and local regulations and how these policies are implemented in the commune and their effect on the livelihoods of villagers and natural resources

Government policies and projects supporting re-forestation restrict villagers' access to lands which villagers would otherwise use for agriculture. Related policies restrict access to forested and sloping lands. Villagers thought that agricultural land would not be a constraint if re-forestation project lands were available to them.

The Project organized a meeting of institutional stakeholders in the 2000 where each presented their viewpoints on management of natural resources. The Bo River Watershed Management Board, the Department of Forestry Development and the State Forest Enterprise have objectives related to meeting re-forestation targets defined in terms of area covered. On the other hand, the people of Hong Ha, the project, and the Department of Settlement and Sedentary Agriculture are trying to develop strategies that improve local welfare while maintaining the resource base. The group agreed that regular and continued communication among these stakeholders is necessary and could be coordinated by the project. There was talk about sharing and delegating more responsibility to the community and suggestions for co-management. However, there has been little advance in terms of action, except for i) the Department of Settlement and Sedentary Agriculture seeking advice from the University on redistribution of land previously earmarked for growing sugar cane and ii) some fertile alluvial land being redistributed to the community for growing agricultural crops. The project has not yet been successful in facilitating some form of co-manangement of forest resources which continues to be the major opportunity to increase the asset base of the community.

Policies supporting infrastructure development have recently led to road and communications improvements. Impacts of such development can and should be measured in the next project phase. Villagers noted that communications with the outside have improved; inputs are more available; government services are better; settlement has increasingly concentrated along the road; and land use intensification has increased. On the other hand, road improvement has brought more middlemen and sedimentation of streams from the actual construction.

Objective 3. To carry out farmer participatory research to improve productivity of crops, livestock, home-gardens and other options to enhance the food and income security of farmers
The project made substantial progress in facilitating farmer testing and adoption of innovations in wet-rice cultivation, pig multiplication and fattening, potable water infrastructure, fish production, and vegetable, and cassava improvement and management. Wet-rice yields were increased from 1.9-2.0 tons/ ha to 2.7-4.3 tons/ ha per crop. Crops were diversified with the introduction of maize and various beans. Through specific interest groups, home gardens were improved with introduction of different fruits and vegetables, and fish and pig husbandry were improved. The results of these activities were covered in more detail in annual reports for 1999 and 2000. Food insecurity, as assessed by availability of rice has decreased from 4 to 1 1/2 months per year.

Farmers thought that the project was the most successful in its work with paddy rice, fish production, and pigs. Farmers also appreciated project contributions in terms of technical knowledge and training, "technologies", new crops and varieties, and cassava production.

Objective 4. Options for utilizing Imperata grassland
In some instances, farmers have had to cultivate Imperata grasslands in place of forest plots as access to the forest has become limited. They view the Imperata grasslands as a resource in terms of quality rather than as a "problem" (although they likewise were clear that their forest plots used in the past were far more productive). Grasslands far from the village were seen as a source of grazing and roofing thatch. The major problem associated with cultivation of those grasslands suitable for agriculture, that is, relatively fertile and close to home, was the high amount of labor required for removal, drying, and burning of Imperata plants, especially the roots.

In the Imperata areas, the project has worked with farmers on cover crops, hedgerows for soil conservation, pineapple, cassava, and perennial crops. Although farmers have shown some interest in Stylosanthes, Panicum maximum, and other grasses, little investment has been made towards improving productivity of the Imperata grassland.

One of the main problems in bringing apparently larger areas of this 'waste' land into productivity is that it is outside the area officially assigned for agriculture and therefore farmers do not want to invest much labor in rehabilitating it. However, in the case where the land initially allocated for sugar cane production was assigned for permanent settlement, the farmers moved very quickly, dug out the Imperata and planted a mixture of annual and perennial crops.

Objective 5. To strengthen participatory approaches within institutions, provide technical training to villagers and district staff and to communicate and disseminate results
The project team succeeded in creating a close empathy with village leaders and the community as a whole. The community responded by cooperating closely with the project team and willingly became involved in evaluation of new varieties and management practices. There was a certain degree of empowerment of the village leadership who demonstrated confidence in meeting with and making requests from both district and provincial officials. However there was little activity directed towards strengthening the participatory approaches used by other government staff or organizations, that is, except by example.

The project team demonstrated increased responsiveness to farmers' expressed desires and to lessons learned with farmers. This led the team to give increased attention paid to food security issues, increase women's participation through involving a womens' group in improving pig management and focus on income earning enterprises such as bean, pepper, pig and fish production. However, farmers ideas and interests also changed with time. Initially there was little interest in cassava improvement. However, with increased attention to pig and fish raising they realized the importance of higher yields for producing animal feed and, with project input, began evaluating cassava varieties and improved management practices.

A large effort was made in training farmers in improved crop and animal management. Farmers responded positively and continued to request additional training. Various approaches were used, from farmer-to-farmer visits (which were very popular but results of which were not well evaluated), field days at sites of farmer evaluation trials and technical instruction to the various interest groups.

Objective 6. To monitor and evaluate changes in socio-economic conditions and in the natural resources environment as effected by changing practices and conditions.

Monitoring and evaluation were carried out using non-participatory (a base and follow up survey) and participatory (with focus and interest groups) methods and have been noted above. An advantage of participatory evaluation is that results are available immediately both to the farmers and the researchers. Participatory evaluation has contributed to the 'learning approach' adopted by the project. Modifications made following such evaluations have included i) giving increasing attention to achieving food security, ii) moving from a 'model' farmer to a farmer-to-farmer approach in technology generation and dissemination, iii) forming interest groups and iv) modifying membership so as to focus on women.

Participatory evaluation has also been useful in defining problems and interests of different wealth groups, and men and women. For example women focus on issues such as health, education and capital more than men. By involving both participating and non-participating farmers, the impact to other farmers can can also be assessed. That non-participanting farmers also thought that the project contributions to wet-rice and pig production was impressive suggests that they are aware of project results and wish to follow the lead of participanting farmers. Indeed though rice variety and fertilizer trials were only formally carried out on 5 farms, 75 farmers were evaluating improved varieties after one year and all farmers were using improved varieties and fertilizers by the end of the project.

Farmers in Hong Ha have expressed their preferences for future project inputs. Training and credit received high priorities from participating and non-participating farmers and men and women. Non-participating farmers wanted to receive more assistance with technical interventions. Women considered the lack of technical knowledge as a major problem suggesting that they had been left out of training programs. Indeed this was the case when the training was held at the commune center, as mostly men attended these sessions. However, some women did attend training given to interest groups.

Some reflections and specific lessons learnt

Building an interdisciplinary research team

Researchers from different disciplines, came with a range experience and often subjective attitudes and ideas on how to approach and solve the problems in Hong Ha. The diversity of ideas was useful in discussing issues. But the reality was that the farmers themselves were facing too many problems affecting their livelihood and they had priorities as to when and how they could collaborate with the researchers. Thus the researchers not only had to learn to develop a spirit of cooperation among themselves but had to develop an understanding with farmers and the community, build trust and take farmers' ideas into consideration.

Thus the lesson learnt by the researchers was that other participants such as farmers and district staff were part of the team involved in solving the problems. While many interventions were tried the ones that worked were those that the farmers gave priority. Being aware of this will enhance selection of research topics in the future.

Participatory Research (PR)
Project members used tools of PRA, PD, PTD and PM&E in implementing the project. During the project, the degree of farmer participation increased. With a greater degree of farmer participation, the results were more readily and widely adopted. Farmers were quicker to adopt techniques that were simple. As farmers developed confidence in the researchers they more readily accepted other suggestions from them and also expressed their own ideas more openly.
For ethnic minorities in the uplands, conducting research with the participation of some farmers, draws the interest of other farmers. Action research where farmers can see what is happening increases their understanding and invites their opinions more than just making recommendations. It was considered that involving farmers in participation, helped to increase the capacity of the community as a whole.

Using a participatory approach helped direct attention to the role and needs of women. While men talked it was often the women who did most of the work in the fields. Some activities, e.g. improving pig production, were then designed with the involvement of women;s groups.
Farmer participation was also useful in evaluating project results. Group meetings and on-farm workshops gave farmers opportunity for self-assessment. As researchers gained the confidence of farmers, the latter were prepared to evaluate more complex and time consuming technologies such as the use of contour hedgerows to control erosion.

Another thing learned was that all members of the team needed to have similar points of view when approaching farmers so as not to cause confusion.
Community-based approach.

A community-based approach provides an opportunity for building capacity at the community level where all receive benefits and assists in building confidence in local leadership. Strong and experienced leaders in turn can strongly influence participation of all members.
A small collaborative activity in providing an improved water supply to some households led to the leaders of the community requesting and obtaining similar facilities for all the villages in the commune. Encouragement of social activities helped to build a sense of community and close relationships between the researchers and the community.

Most farmers in the community of four villages with irrigated rice fields rapidly adopted new varieties of rice and use of fertilizer which led to greatly increased yields. Visits by groups of farmers to outside villages brought new ideas into the community. However other interventions were often made through interested groups of farmers, e.g. in pig and fish production. While these were successful for the farmers involved, the benefits did not flow on to the community as a whole. This was due to various reasons such as lack of funds to purchase fish or labor to build fish ponds. Thus some members of the community saw benefits flowing to some persons and not to others. The poorest families,those with the least resources, often did not benefit even if they had received some training.

Strong leadership and a united community are important pre-conditions for implementing co-management of natural resources by the community and the government agencies.

Capacity building for villagers
Hong Ha people were used to practicing 'slash-and-burn' cultivation and had few opportunities of contact and exchange with the outside world. Their education was and still is low and their

knowledge on modern agricultural production was limited. So the project created conditions for them to have more contact with outside communities, provide training and build confidence to make decisions about changing their production systems. Activities designed to enhance the capacity of local villagers were:

Farmer to farmer exchange: Study tours in Aluoi and Nam Dong districts for local villagers and study tour to China for commune leaders.

Technical training courses: pig raising; rice planting; pest management; making compost; pepper planting; cassava production, fish culture, and growing vegetables.
Establishing interest groups (pig raising, fish raising, homegardens) to train members in new technologies and share experience between themselves.

Improving the villagers' capacity in project planning, implementation and management.

These activities resulted in building confidence among the villagers, especially the women, and improving awareness of local people. Awareness was increased of marketing issues, of availability of new varieties and management techniques. Also they became more informed of the value of correct fertilizer and pesticide application and other inputs in increasing crop productivity and maintaining soil fertility. They are now more aware of the possibilities of replacing shifting agriculture with a more permanent farming system.

Improving food security and agricultural production
Farmers gave priority to increasing wetland rice production and introducing more diverse crops, fruit and vegetables together with improving pig and fish production. Wetland rice yields were increased from 1.9-2.0 tons/ ha to 2.7-4.3 tons/ ha per crop over the term of the project. The impact from other interventions at the commune level was less as evaluation and adapation of new breeds and management practices takes time. Also whereas almost all farmers with lowland rice became involved in evaluation and benefited from the improved rice management practices only selected families who were members of interest groups benefited from the other interventions. There is a need to examine how improved practices evaluated and adopted by a few farmers can be disseminated more quickly so that all families benefit.
Farmers priorities changed with time. For example, whereas there was no initial interest in evaluating improved cassava management practices when it was consumed for food, with an increased interest in raising improved pigs, farmers became interested in higher producing cassava varieties for feeding pigs.

Co-management
The concept of co-management has been developed to allow greater sharing of assets and to ensure improved resource management. But certain questions need to be answered:
Are farmers really able to manage well the natural resources in their region?
Do local people have the capacity to negotiate and collaborate with different government agencies to develop policies and programs on joint management of natural resources?
Can local people carry out the changes needed so the policies have some impact in improving management of the natural resource and providing equal benefits to all in the community?
- How can the capacity of local communities be enhanced for resource management and use?
The Upland team has made a start in facilitating answers to some of these questions. A workshop was organized where leaders of the different agencies and the community put forward their ideas on

long term management of the resource. There was vigorous discussion. Agencies recognized the need to get the community involved in forest management but were not sure how power and responsibility could be devolved to the community. There were individual instances where agencies realised that they needed to consult with the project and community in planning new activities. One of these was in the distribution of additional agricultural land to the community that had been assigned for a failed sugar cane scheme. The community was asked by the Settlement Board to select families for the more allocation of land which they did in an equitable manner.

The Upland team is in regular contact with the various government agencies and often acts on behalf of the community. These agencies now often consult with the University on issues affecting Hong Ha. This process needs to evolve to where the community leaders and agencies talk directly with each other or come together to the University team for advice. It is starting as the village leaders are beginning to directly approach Provincial agencies on the issue of land allocation. However, there is still a need to negotiate a long-term strategy and action plan for co-management that takes into account the demands of the local people and the role given the agencies.

Problems encountered and their solution

While this was a learning process for University team members to learn to work together in a multi-disciplinary team and with farmers using a participatory approach, it was also a learning experience for CIAT members in working alongside a national team who made all of the decisions. While some more experienced outsiders could see some problems and limitations arising, the University team had to experience these themselves before they were accepted by them and solutions sought. These included such things as appreciation of the contribution that could be made by the indigenous knowledge of the community, initially working as individuals rather than as a team, failure to focus on involving all wealth groups equitably, failure to fully involve the district officers in the process so as to establish a mechanism for extending the approach beyond the research site.
The project has proved to be a useful exercise in capacity building for NARS in Integrated Natural Resource Management and for CIAT in moving from a commodity-based focus in Asia to a holistic systems based approach in INRM.

Plans for 2002

A second phase has been designed to overcome some of the above shortcomings. The new objectives are:
To build farmer to farmer learning and action processes that will reach the poor in two communities.
To develop process that enable district offices of the Department of Agriculture and Rural Development (DARD) to adopt and adapt CBNRM approaches in their action research agendas in other communes.
To explore approaches intended to modify the operational policies and programs of departments or line agencies working in the two communes.
To develop approaches that will increase access to natural (land and forest) capital, and that will increase human, social and financial capital.
To monitor and evaluate changes in socio-economic conditions and in sustainable livelihood options as effected by changing practices and conditions.
The project will continue to be managed by the University with CIAT as partners.

2.5. Seeds of Life – East Timor

A Inter-CGIAR project funded by ACIAR

Research Highlights
Some cassava varieties introduced to East Timor in 2000 produced twice the yield of the local check varieties (28-35 vs 14t/ha roots)

Project Background
During the violence associated with the vote for independence in Aug 1999, much of the population of East Timor was temporarily displaced to the mountains or to West Timor, resulting in the loss of many crops and livestock, and the loss of seed or planting material for the subsequent planting season in late 1999. Seed brought in from other countries to cover this emergency was often poorly adapted to the dry climate and calcareous soils, and to the pests and diseases prevalent in East Timor. To remedy this situation, the Australian Center for International Agric. Research (ACIAR) invited the CGIAR Centers with offices in Asia to collaborate in a project aimed at introducing and testing promising germplasm of the major food crops in East Timor. Thus, representatives of IRRI, CIMMYT, CIP, CIAT and ICRISAT met in Dili, East Timor, in Nov 2000 and introduced promising seed or planting materials of rice, maize, potato, sweet potato, cassava, beans, soybean, mungbean, cowpea, peanut and forages to be tested in six representative sites during the following wet season of December 2000 to April 2001.

Investigators

Within CIAT:
Reinhardt H. Howeler, PE-5, cassava agronomist, Bangkok, Thailand

Outside CIAT:
Dr. Colin Piggin, Crop Program Manager, ACIAR, Canberry, Australia
Dr. Edwin Javier, IRRI, Los Baños, Philippines
Dr. Fernando Gonzalez, CIMMYT, New Delhi, India
Dr. Upali Jayasinghe, CIP, Bogor, Indonesia
Dr. Shyam Nigam, ICRISAT, Patancheru, India
Dr. Bryan Palmer, CNRT, Dili, East Timor
Mr. Genaro San Valentin, ETTA, Dili, East Timor
Mr. Patrick Kapuka, World Vision International, Dili, East Timor
Mr. Afoso De Oliveira, Catholic Relief Services, Dili, East Timor

Budget: For CIAT- $16,500 per year for three years (2000-2003) from ACIAR.

2.5.1. Progress Report

In Nov 2000, the five CGIAR representatives met in Dili, East Timor, with Dr. Colin Piggin of ACIAR, Dr. Brian Palmer, the Project Coordinator in East Timor and other local staff from the ET Transitonal Administration and two NGOs who had agreed to help in the implementation of the project. Each CG representative brought in seed or planting material of promising varieties of their respective crops to be tested in replicated yield trials in six representative sites in East Timor; they also provided the protocols for the planting of the various trials. The cassava planting material consisted of 10 eating varieties from Indonesia, provided by RILET in Malang, and two eating varieties from Thailand provided by Rayong Center. The 12 bean varieties came from Malawi, Kenya and Uganda and were provided by Dr. Paul Kimani of the CIAT Bean program in Africa. The soybean, mungbean and cowpea varieties were also supplied by RILET and DOA-Thailand, and the forage seed by the CIAT-FLSP project in Laos.

During this first visit to East Timor, the group traveled to Baucau in the north eastern part of the island and to Aileu and Maubisse in the central highlands south of Dili to see three of the possible testing sites. It was decided to plant the cassava trials in Los Palos and Baucau in the dry coastal area in the NE, in Maubisse in the highlands at 1300 masl, at Viqueque in the southeastern coastal area and in Maliana in the south western foothills. Beans were to be planted in Los Palos, Baucau, Aileu, Maubisse and Maliana. A total of about 35 trials were to be planted in six sites, representing the major agro-ecological zones of East Timor. Of the two NGOs participating in the project, World Vision International would be responsible for the two highland and the one western site, and Catholic Relieve Services for the three eastern sites, while Mr. San Valentine (former employee of IRRI) would be responsible for the rice trials.

Unfortunately, many problems were encountered during the establishment of the trials, mainly due to a delay in the signing of the MOU between ACIAR and ETTA and the disbursement of money to the local organizations, problems in negotiating and managing the selected sites (there are no functioning experiment stations in East Timor, and East Timorese researchers/extensionists had not yet been appointed), problems in obtaining labor for conducting the trials, and lack of fences for protecting the trials from animals and people. In addition, the Viqueque site had to be eliminated for security reasons and access problems. Planting of some of the trials was therefore delayed, resulting in poor establishment of some cassava varieties that had been stored for too long in plastic wrapping. Some bean trials established well but later succumbed due to excessive rainfall, some were planted too late and others were damaged by cattle and chickens. Of the four cassava, five bean and five pulses (soybean, mungbean, cowpea) trials planted, only one cassava and one pulses trial provided reasonably good data. **Table 1** and **2** show the results of those two trials.

The cassava trial in Maliana, located at about 300 masl in the western part of the country, received 1375 mm of rainfall, but 85% of that was concentrated in three months, from Jan to March 2001. Plant establishment was reasonably good for the Indonesian varieties but quite low for the two Thai and two local varieties. The yield of OMM90-3-100, an open pollinated breeding line from RILET, was 35.4 t/ha compared to about 14 t/ha for the two local varieties. The local variety "Mantega" is probably the same as "Mentega" from Indonesia, while the local variety "Nona Metan" looks very similar to the Thai eating variety "Hanatee".

The pulses trial conducted in Los Palos (**Table 2**) produced reasonable but not exceptional yields of mungbean, soybean and cowpea. For all three crops the varieties from Indonesia outyielded those from other areas, possibly due to a better adaptation to the very dry climate and calcareous soils in the eastern part of East Timor. The forages trial was never planted due to the elimination of the Viqueque site. Because of communication problems there was no opportunity to visit the trials in the field.

In Oct 2001 the collaborators in the project met again in Dili to discuss the results, bring in new germplasm for testing in the 2001/02 rainy season, to select new sites, and to provide some basic training in the various crops to the recently appointed Timorese district agricultural officers.

There was a brief meeting with the newly appointed Minister of Agriculture, Mr. Estanislau Aleixo da Silva, to explain the objectives of the project, while Mr. Francisco Tilman Benevides, the Chief of the Crop Production Division in the DA, took part in all discussions and traveled to all the sites with us as the Timorese counterpart in the project. Hopefully, this will greatly facilitate the implementation of the project during the coming cropping season, as he will make available some of the new cropping system specialists in the various districts to assist in the management and supervision of the trials.

New sites were visited and selected in Betano on the southern coast, and in Loes along the northwestern coast. New cassava trials will be planted in Betano, Loes, Baucau and Maubisse; bean trials in Betano, Maliana, Aileu and Maubisse; and pulses trials in Betano, Loes and Baucau. New planting material of cassava, beans and pulses will need to be brought in again before the start of the rainy season in Dec 2001.

Table 1. Average cassava yield and plant stand of 14 varieties evaluated in Maliana site of Bobonaro, East Timor in 2000/2001.

Variety	Origin	Plant stand (%)	Root yield (t/ha)[1)]
1. Hanatee	Thailand	58	15.9
2. Rayong 2	Thailand	17	6.9
3. Adira 1	Indonesia	83	9.5
4. Mentega	Indonesia	50	10.0
5. Ketan	Indonesia	92	14.7
6. Tambak Urang	Indonesia	83	14.5
7. Randu	Indonesia	96	22.1
8. Malang 2	Indonesia	96	27.8
9. UB ½	Indonesia	92	26.7
10. SM 477-2	Indonesia	100	28.9
11. SM 881-5	Indonesia	92	26.3
12. OMM 90-3-100	Indonesia	96	35.4
13. Montega	East Timor	54	14.9
14. Nona Metan	East Timor	79	13.5

[1)] Based on area ($12m^2$) harvested.

Table 2. Yields of mungbean, soybean and cowpea in Los Palos, East Timor in 2000/01.

Mungbean	Dry grain (kg/ha)	Origin
Sriti	835	Indonesia
Kenari	889	Indonesia
Local	782	East Timor

Soybean	Dry grain (kg/ha)	Origin
Kawi	578	Indonesia
Buangrang	529	Indonesia
Lichhardt	507	Australia

Cowpea	Dry grain (kg/ha)	Origin
KT-5	671	Indonesia
KT-9	795	Indonesia
KVC-7	640	Thailand
BS-6	755	Thailand

2.6. CIAT Regional Office

Highlights in 2001

An MOU was signed between CIAT and the Goverment of Lao PDR allowing CIAT to set up a regional office for Asia in Vientiane.
The regional office has been established at the Headquarter site for the National Agriculture and Forestry Research Institute at Dong Dok, Vientiane Province.
A visit organized by persons from Asia to CIAT HQ for discussions on future CIAT Strategy in Asia resulted in some firm recommendations for regional activities

Person responsible

Peter Kerridge, Systems agronomist, Vientiane, Lao PDR

Cooperators

Within CIAT
Barun Gurung, Anthropologist, Vientiane, Lao PDR
Peter Horne, Forage agronomist, Vientiane, Lao PDR
Reinhardt Howeler, Cassava agronomist, Bangkok, Thailand
Ralph Roothaert, animal nutritionist, Los Banos, Philippines
Outside CIAT:
Dr. Ty Phommasack, Director-General NAFRI, MAF, Vientiane, Lao PDR

Budget:

$180,000

2.6.1. Progress Report

Coordination of PE-5 activities in Asia

The Coordinator is responsible for signing off on reports to donors,general financial oversight, liaison with donors and setting annual workplans. However, the Leaders of the Special Projects manage the overall planning, execution and writing of the reports for donors.
Forages for Smallholders project, managed by Ralph Roothaert. The coordinator participated in the annual reporting and planning meeting held in Samarinda, Indonesia in January 2001, and visited sites in north Vietnam and Laos. A visit was made to the donor office in June.
Forages and Livestock Systems project, managed by Peter Horne. The coordinator attended a workshop on Monitoring and Evaluation and has worked with the project manager on planning and financial management and maintains constant contact with the donors offices in Canberra and Vientiane.
Intergrated Cassava-based Cropping Systems for Asia project, managed by Reinhardt Howeler. The coordinator visited the donor office in Japan and has assisted in planning.

Establishment of a Regional Office in Vientiane, Lao PDR

A Memorandum of Understanding, dated 25 May 2001, was signed between CIAT and the Ministry of Agriculture and Forestry, Lao PDR. This allowed CIAT to proceed with establishing a Regional Office.

Staff. A new staff member, Dr. Rod Lefroy, specialist in Soils and Land Management, was recruited. He will join CIAT in November 2001, and move to Vientiane in January 2002. Rod Lefroy will replace Peter Kerridge as Regional Coordinator for Asia in July 2002. Dr. Barun Gurung, Anthropologist, and Coordinator of the Systemwide PRGA Program in Asia moved to Vientiane in July 2001.

It is planned to recruit additional scientists in competency areas of economics and social sciences, agronomy, and agroententerprise development in Vientiane as funding becomes available from Special Projects.

Office. The regional office has now been located at NAFRI headquarters at Dong Dok, 10 km from Vientiane. An old building was renovated and space created for 4 staff and a meeting room. Wireless connection has been established with Vientiane for receiving e-mail through the internet though phone lines are not yet available.

Other activities of the Regional Office

Integrated Upland Agricultural Research Project, Lao PDR. This project is under the leadership of NAFRI. It provides the opportunity for the various research divisions within NAFRI to evaluate potential technologies at the farm and community level. CIAT, IRRI, and CIAT collaborate through their respective projects and provide some financial input. Input by CIAT is through the Forages and Livestock Systems project and the Regional Coordinator. The Coordinator is a member of the Technical and Steering Committees. A presentation on Monitoring and Evaluation was made at a Technical Committtee meeting 24-27 September, at which time a field visit and review were also carried out.

Training in Participatory Research for Lao-IRRI project. Peter Horne and Barun Gurung, with a FLSP consultant, designed and gave an introductory course in participatory research to provincial and district officers who work in collaboration with this SDC-funded project.

Regional Coordination Forum. The coordinator attended a regional meeting, 27-28 June, in Los Banos, Philippines hosted by IRRI, PCCARD and APAARI. The aim was to hear what were the priorities of the NARS and to share information on CGIAR activities in Southeast Asia. The meeting provided the CGIAR with an opportunity to make an inventory of its activities in the region. There was limited ouput in terms of how the Centers might work in closer collaboration between each other and collectively with the NARS. CIAT will become a member of the NARS regional organization, APAARI.

CIAT Activities in Thailand. A presentation was made at the Ministry of Agriculture and Cooperatives offices in Bangkok on current and proposed CIAT activities in Thailand. The presentation was made to officers in different departments of MOAC, Kasetsart University, and the Thai Tapioca Development Insitutue, with whom CIAT collaborates. The main reason was to give more exposure to CIAT activities which are located within Branches of Departments within the Ministry but with little awarenesss of theses activities at the Ministry level. Similar presentations are planned for other countries in the region in 2002.

Visit to CIAT by Asian Directors to CIAT HQ

Representatives from Lao PDR, P.R. China, Thailand and Vietnam were accompanied on their visit to CIAT HQ at the end of August. This gave them the opportunity to visit research staff and facilities at CIAT HQ. It was also an opportunity to learn of the new Strategic Plan for 2001-2010 being proposed by CIAT Management, provide some feedback and together make suggestions how CIAT might collaborate in Asia. They were also able to attend sessions of the Center-wide Integrated Natural Resource Management meeting being held at CIAT HQ. The following is a summary of their feedback and suggestions to CIAT Management.

"Areas for interaction between CIAT and national organizations in Southeast Asia"

CIAT's vision for enhancing Sustainable Rural Livelihoods through
Competitive Agriculture
Agro-ecosystem health
Building social (community) capital for rural innovation
is consistent with the strategic plans of China, Lao PDR, Thailand and Vietnam.

Ministries of Agriculture in Asia include poverty alleviation and improving management of natural resource management within their mandates. While their mandates are broader, it is appropriate to focus collaboration with CIAT on these two issues. It is also appropriate that this work focus on the poorer multi-ethnic communities in the mountainous/steep hillsides.
However, countries also request that

i) CIAT continue to provide support with provision of improved germplasm, technical training of scientists in both technical and socio-economic areas and
ii) endeavor to integrate its activities with those of national programs and other international centers and agencies.

In turn, the country representatives agreed that this is a two-way commitment. Research results and other outputs from one country will be shared with other countries in the region and with CIAT HQ.. Genetic resources provided by CIAT to one country will be made available by that country to the others. Countries will support CIAT regional networks. Dr Ty, NAFRI, Lao PDR, emphasized that they give strong support to CIAT engaging in regional activities from its new regional office in Vientiane.

Specifically, it is seen that CIAT can contribute in the following areas:

1. Natural Resource Management
i) Facilitating INRM as a framework to implement research, development and extension activities to increase productivity and rural welfare while preserving the natural resource base. CIAT could assist in facilitating exchange between countries, sites and themes.
ii) Providing a lead in integrating disciplinary areas e.g.

- ecology and management of disease,
- soil ecology and land management and
- research on market opportunities with technology development

so as to make technologies more sustainable.

iii) Adapting tools and guidelines developed in Latin America and Africa for Asia through training and facilitation of local researchers.

iv) Facilitating a regional forum in natural resource management to add $$value to what has already been done.

- gather knowledge that is available on NRM.
- review the knowledge gaps and
- set up a system to train persons in exchanging knowledge so it is more readily available and useful to others.

v) Facilitating research on regeneration of degraded lands

What are degraded and potentially degraded ecosystems? These may not only be those that are degraded in some physical sense, both inland and coastal, but also those that are caused by external shocks. Solution will require socio-economic and biophysical scientists working together.

vi) Focusing on practical aspects of implementing participation by all stakeholders, not just at the community level in a manner that is acceptable to local institutions (avoid romanticizing participatory approaches).

2. Plant improvement and agro biodiversity

i) CIAT might provide or facilitate better characterization of diversity in existing crops

ii) Focus more on high value crops, improving product quality and adding value to agricultural products

iii) Extend its interest in tropical fruit production and IPM to Asia to solve specific disease problems

iv) Provide some lead in areas of biosafety and introduction of GMO's.

3. Capacity building

i) Continue to provide training in Asia and at CIAT HQ

ii) Facilitate scientific exchange

iii) Assist in definition of indicators and measures wrt introduction of biological conventions. How do we monitor these conventions?

4. Implementation of collaborative programs in Asia

Develop regional projects on:

i) INRM and Knowledge Management

A regional forum might be organized in which would examine knowledge gaps with the idea of setting up a program similar to that for training Asian persons in Resource Economics. (In this program, national scientists are taught how to understand and identify problems and then provided with some seed funds to commence the research).

ii) Improving quality and adding value to agricultural crops

This will contribute to more competitive agricultural systems. There is a need to integrate INRM concepts such as improved varieties, water and nutrient management, integrated pest management, integrated crop management.

Continue with CIAT commodity strengths but focus on the whole system, e.g. cassava-based cropping systems that may involve intercropping and rotation with other crops.

iii) Adaptation of resource management guidelines for Asia

e.g. Soil Quality Indicators, agroenterprise development and other relevant units

iv) Enhancing Sustainable Livelihoods
Complement proposed project on Integrated Upland Agricultural Development in China, Lao PDR and Vietnam which focuses on the process of technology development.

Compiled by:

Mr. Ty Phommasack, DG, National Agriculture and Forestry Research Institute, MAF, Lao PDR
Prof. Dr. Nguyen Van Bo, Dir., Dep.of Science, Technology and Product Quality, MARD, Vietnam
Dr. Orapan Nabangchang, Advisor, Ministry of Agriculture and Cooperatives, Thailand
Prof.Chen Qiubo, Vice-president, Chinese Academy of Tropical Animal Science, Hainan, P.R. China
Dr Peter Kerridge and Dr Rod Lefroy, CIAT Regional Office, Vientiane
Management team, Project Managers and Scientists, CIAT-HQ

Interaction with the donor community

Visits have been made with the following donor offices;
Bangkok - DFID, Rockefeller Foundation
Canberra - ACIAR, AusAID
Hanoi - Danida, Ford Foundation, SDC
Manila - ADB
Rome - IFAD
Stockholm - SIDA
Vientiane - AusAID, Danida (representative), SIDA

Opportunities for Funding

IFAD - A conccpt note in Integrated Agriculture Development has been submitted to IFAD for funding under their TAG program. This project would operate within locations of IFAD Loan projects in Lao PDR, Vietnam and China. One of the aims is to increase the efficiency with which technologies, based on indigenous and new knowledge can be generated and disseminated using participatory approaches.

SDC - CIAT is presently carrying out a review, "Development Analysis of Sustainable Upland Livelihoods in Vietnam and Laos", with a view to project development in areas where there are opportunites for innovative research.
SIDA - CIAT has been invited to submit a concept note for funding in the area of socio-economics which would complement existing SIDA bi-lateral and regional programs in the region.
DFID - There is an opportunity for applying for funds to evaluate the Decision Support Tools for Resource Management developed by CIAT Hillsides in Central America.
ACIAR - A proposal to fund research on cassava improvement in Asia was rejected. They are open to a proposal on Nutrient Cycling in Upland Farming Systems.

Rockefeller are currently reviewing their program for Southeast Asia. It is anticipated that it will be directed towards the Education and Health sectors rather than agriculture.

The Ford Foundation has relatively large funding available for application by NARS in Vietnam with which Centers might be associated by invitation of the NARS.

Linkages with CIAT HQ projects

CIAT research in Asia will be operate through CIAT HQ projects. The strategy is to (i) continue systems oriented research where cassava and forages are grown, with a view to developing generic technologies, and (ii) to undertake systems research at the landscape or watershed level in upland areas with a focus on overcoming poverty and improving the management of natural resources. In the mountainous areas of Lao PDR and Vietnam, shifting agriculture remains the dominat system of agriculture. However, this system is undergoing rapid change due to increasing population and government policy which is encouraging more intensive and market-oriented sedentary systems.

There is opportunity for stronger linkages with all CIAT HQ projects that focus on problems of upland/hillside agriculture. This year scientists in Asia have commenced interacting with the following projects:

IP-1 (Bean Improvement) and IP-2 (Beans for Africa)
- evaluating dry and green climbing beans in Lao PDR and East Timor, Indonesia

IP-3 (Cassava Improvement)
- Evaluatiing cassava lines in Lao PDR and East Timor, Indonesia
- Developing a proposal for introducing molecular markers into cassava improvement programs in Asia

IP-4 (Rice Improvement)
- Evaluating of upland varieties selected in LAC in Lao PDR and China

IP-5 (Tropical Forages)
- Collaborating in a global project for entering information on forage evaluation, socio-economic conditions and farming systems, and climate into GIS databases to better predict where forage species may be utilized.

PE-2 (Soils)
- Plans have been made to introduce, evaluate and adapt the Soil Quality Decision Support tool in Asia in 2002 as has been done in East Africa.

PE-4 (Land Use)
- Visits were made by Simon Cook and Thomas Oberthur from CIAT HQ and an Asian site has been included in a new proposal submitted to BMZ on how to better link farmer and scientists perceptions of land use and land management.

SN-1 (Agroenterprises)
- A course on agroenterprise development was conducted jointly with CIP and SEARCA in the Philippines
- a strategy has been developed for extending activities to link with CIAT projects in Asia

PE-1 (IPM)
- research on white fly in association with AVRDC

Systemwide PRGA Program
- contribution to training and project development

Problems encountered and their solution

Lao PDR remains one of the poorest and least developed countries in Asia. The problems of poverty and resource degradation in the uplands epitomize what CIAT research is attempting to overcome. The Lao Government has been most cooperative in supporting the establishment of a

regional office. However, there are also restrictions on the efficiency with which research and administrative proceedures can be carried out and personal needs met because of limited infrastructure and communication systems, a limited number of trained professional counterparts, and poor health and educational facilities. There are no immediate solutions other than to make the necessary adjustments in allocating additional time to achieve research objectives and to modify ones initial expectations. These are also reasons why it may be necessary to locate CIAT staff in Asia at different locations depending on family needs.
Interaction with CIAT HQ staff could be further strengthened. Cross-visits and planning new projects jointly with HQ staff will facilitate closer interaction. Visits in 2001 from HQ staff in Cassava, Land Use, and Administration were much appreciated. Meanwhile the position of Regional Coordinator remains somewhat in limbo until current discussions on responsibilities and lines for reporting are finalized.

There is a medium-term policy to more closely integrate research activities in LAC, Africa and Asia. The rather innovative provision of seed funds by Management in 2001 to allow an appointment of a specialist in Soils and Land Managment in Asia will assist in integrating programs in the area of Soil Fertility and Soil Biology. Land Use is developing a global project that will have a site in Asia. Systemwide and the new Global Challenge programs also offer the opportunity of integrating research with that of other CGIAR Centers.

Plans for 2002

The main plans in the Coordination area are to strengthen the research in Asia through additional inputs and to integrate activities between Special Projects where feasible. These issues will be discussed during the Planning Week in CIAT at the end of November 2001.
Strengthening the CIAT research in Asia. This can be achieved through a combination CIAT HQ projects allocating a portion of their budget for research in Asia and obtaining additional funds through Special Projects that are in development (see Opportunities for Funding above).
Collaborative activities between Special Projects. The main opportunity is in the area of training. However, cross visits between Special Projects would also assist in creating more synergy.

We will continue to i) align our research more closely with the needs of the NARS and ii) develop closer collaboration with research of other CGIAR Centers working in Asia. Some ways to achieve this are presentations to national policy and decision makers of CIAT research in particular countries, as was done for Thailand this year, and developing bi-lateral and regional projects with input from NARS and other Centers.

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Two radio interviews with project staff were recorded and broadcast in East Kalimantan, Indonesia, reaching farmers in all rural areas.

Publication on internet: www.ciat-asia.org/02-FSP/fsp.htm
The site will be modified after reactions have been received from users.

Poster Paper

J. Samson and R. Roothaert 2001. The Challenge of Adoption: Scaling-up of Participatory Research in Forage Technologies. Poster presented at the 6th National Grassland Congress, Legaspi, Philippines. Awarded with Best Poster Award.

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Funding: Health, diversity and Natural Resources use in the Western Amazonian Lowlands An Integrated agro-ecosystem approach

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Funding: Supplementary funds to assist University of Hue Community-based Upland Natural Resources Management in Hong Ha, Hue, Vietnam

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Funding: Legume-based forage systems for dual-purpose cattle farm

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The Nippon Foundation, Tokyo, Japan

Funding: Integrated Cassava-based Croping Systems in Asia: Farming Practices to enhance Sustainability

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