RETA 5866: Fourth Agriculture and Natural Resources Research at CGIAR Centers: Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia

Final report, 2000 - 2003

ADB

FSP

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Table of contents

Summary

The project "RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia in short called the 'Forages for Smallholders Project" (FSP) started in February 2000 and ended in July 2003

The **goal** of the project was to improve the livelihood of resource-poor farmers in the uplands of Asia The **performance target** was income from livestock products increased while protecting the natural resource base Improved livelihood and increased income were achieved through higher ruminant and fish pond productivity mostly for sale Increased animal productivity was achieved through increased availability of forages cultivated by farmers in six member countries The adoption of forage technologies also had a remarkable effect on the reduction of labour, while farmers used to walk for hours collecting native forages at various places or herding their animals they saved time when they started to cultivate and harvest forage from plots near their houses In the Philippines and in Vietnam women and children benefited through reduced labour and drudgery, and subsequently had more time for education and leisure There was also a significant investment of saved labour into expanding farm activities either crops or livestock in Vietnam, Philippines and Indonesia Forages had positive effects on soil and water conservation and retention of fertiliser

Many training courses were organised at various levels The largest group of people trained were field workers who were responsible for the routine facilitation of farmer experimentation with forages Training of field workers continued throughout the project duration as more sites were targeted for scaling out Training topics varied from technical to methodological all of which were essential for building knowledge skills and shaping attitudes of working with farmers Specialised training was given to researchers at project management level to improve communication skills and skills in research and development methodologies

A participatory monitoring and evaluation system was developed, which helped to track the different forage technologies developed and adopted by farmers Thirteen improved grass species and accessions eight legumes and two non-legume tree species were adopted by farmers and grown in more than 55 different forage systems in six different countries The project started with farmer groups at 23 sites in the region A strategy for scaling up was developed and implemented which resulted in active farmer participatory research at 34 sites in 2002 The number of farmers growing forages increased from 800 in the year 2000, to 4 700 at the end of 2002 Participatory diagnosis and planning farmer cross-visits training of field staff farmer owned multiplication systems and production of extension publications proved powerful tools for scaling up The capacity to produce large quantities of forage seeds was strengthened in P R China and Thailand and the project contributed to diversification of seeds produced in those countries Multiplication systems were established in all member countries, both at rural level and national level At rural level vegetative multiplication systems proved more practical and sustainable In 2000 263 farmer groups and 345 individual farmers were producing planting materials and seeds

Six international workshops were organised by the project providing opportunities for participants from all member countries to exchange experiences and learn from each other Staff participated in two additional international workshops organised by ILRI and FAO Four new issues of the Southeast Asia Feed Resources Research and Development (SEAFRAD) network were published and distributed worldwide ILRI's CASREN project and SEAFRAD shared mailing lists, which increased the efficiency and efficacy of the newsletter A web site for the project was launched and updated regularly A total of 7 books 8 reports, 7 papers 7 proceedings, and 4 popular articles were published as well as 2 radio interviews in Indonesia and 4 in the Philippines

Background

The project "RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia", in short called the "Forages for Smallholders Project' (FSP), started in January 2000 It was funded by the Asian Development Bank for a period of three years, and had an extension of 6 months The **goal** of the project was '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 (ADB 1999) The participating countries were P R China Indonesia Lao PDR Philippines, Thailand and Vietnam

Objectives and outputs

The objectives of the project were to

1 Develop sustainable forage technologies for resource-poor farmers in upland farming systems in Asia
2 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 had five outputs

1 Productive and sustainable forage technologies for upland farming systems developed and tested by farmers
2 Forage technologies extended to other farmers using participatory approaches for scaling up from farm level to the community and provincial levels
3 Effective local seed and planting material multiplication systems established and operational
4 Capability in DMCs for developing and disseminating forage technologies using farmer participatory approaches (FPA) strengthened
5 Network for sharing information among NARSs and in the region continued based on the Southeast Asia Feed Resources Research and Development (SEAFRAD) and electronic communications

The FSP was co-ordinated by the Centro International de Agricultura Tropical (CIAT), which is part of the Consultative Group on International Agricultural Research (CGIAR) The implementing agencies in the participating countries were

P R China	Tropical Pasture Research Centre Chinese Academy of Tropical Agricultural Sciences (CATAS) Hainan
Indonesia	Dinas Peternakan, Samarinda and Directorate General of Livestock Services (DGLS), Jakarta
Lao PDR	National Agriculture and Forestry Research Institute, (NAFRI) Vientiane
Philippines	Philippine Council for Agriculture Forestry and Natural Resources Research and Development (PCARRD) Los Baños, Visayas State College of Agriculture (ViSCA) and Department of Agriculture Region 10
Thailand	Department of Livestock Development Ministry of Agriculture and Cooperatives Bangkok
Vietnam	National Institute of Animal Husbandry (NIAH) Ministry of Agriculture and Rural Development (MARD), Hanoi

Project framework and accomplishments

Objective 1 Develop sustainable forage technologies for resource-poor farmers in upland farming systems

Performance targets

- Forage availability increased
- Ruminant productivity increased
- Labor requirements for feeding livestock reduced

Forage availability per country

From the start of the project there have been several monitoring mechanisms in place

- Six monthly reporting by country coordinators on all outputs of the project
- The development of a participatory monitoring and evaluation (PME) mechanism
- Papers presented at annual workshops
- Regular site visits
- Impact studies carried out in Indonesia the Philippines and Vietnam (Bosma et al , 2001, 2003)

In most countries part of the PME consisted of periodic surveys of a sample of farmers to assess changes in forage technologies areas planted, and multiplication materials and seeds produced The farmer for these surveys had been selected randomly, yet weighted by districts or barangays In Lao PDR surveys covered 100% of the farmers Average area of forages cultivated per household varied from 188 m^2 (Lao) to 4 210 m^2 (Thailand) (Table 1) The largest area of forages at one site is in East Kalimantan as many farmers adopted forages, with relatively large areas per farmer

Table 1 Areas of forage cultivated in sample areas according to the most recent surveys and extrapolation of forages to the whole project area

	Sample Area			Total Project Area	
Country and site	Sample size	Total area (m^2)	Area per h'hold (m^2)	No of households	Extrapolated area (ha)
Philippines					
Malitbog	24	31 418	1,309	385	50 4
Cagayan de Oro	31	48 514	1 565	372	58 2
Cebu and Leyte				670	96 3
Impasugong and Manolo Fortich				236	33 9
Indonesia					
East Kalimantan	30	63,083	2 103	740	155 6
Vietnam					
Tuyen Quang	99	70 510	712	976	69 5
Daklak	60	81,882	1 365	671	91 6
P R China					
Hainan	30	36 627	1 221	176	21 5
Thailand					
Nakornratchasima	19	80 000	4 210	276	116 2
Lao PDR					
Luang Prabang and Xieng Khuang[1]	343	64 400	188	343	64 5
Total				4 845	758

[1]FLSP (AusAID) has been operating in Xieng Khuang

Summary of results from impact study in East Kalimantan, Indonesia

The study was conducted with 85 farmers in three villages Makroman, Sepaku and Samboja Livestock systems varied from stall feeding improved goats (Makroman) grazing under coconuts on improved pasture by Bali cattle (Samboja) to grazing and stall feeding improved forages to Ongole cattle (Sepaku)

Forage availability

Before introduction of new forages, some farmers already used King grass for cut and carry The participatory work on forages with farmers resulted in four technology changes 1) reduction or stopping of grazing on communal rangeland and increased pasture fencing (Samboja), 2) prolonged time at home-plot pastures (Sepaku), 3) pasture fencing in upland and old rice fields (Sepaku) and 4) planting of forages in contour lines and as cover crop associated with food and cash crops (Makroman and Sepaku) The average availability of improved forage area was 0 4 ha per farm Most farmers in Samboja who adopted new forage had enough improved pastures to provide fodder for their cattle In Sepaku and Makroman, forage availability was still not high enough for optimum livestock production

Ruminant productivity

Introduction of new forage species increased off-take of animals due to shorter inter-parturition periods, in all species and breeds Twinning rate in goat increased in some herds Improvement was also perceived through better body condition of animals resulting in better carcass quality and higher prices paid by butchers Since the introduction of forage in Makroman farmers doubled their herd size of goats Increases in cattle numbers were less pronounced Reproduction rate of Bali cattle in Samboja was higher than for cattle and goats in Sepaku and Makroman Off-take rate (animals sold in a period divided by the mean herd size during the period) in Samboja increased from 21 to 23 5% after adoption of forages In Makroman and Sepaku, new forages associated to food and cash crops enhanced soil fertility and prevented soil erosion

Labour requirements and gender

The adoption of new forage technologies reduced the time needed to collect fodder as well as for forage crop maintenance The saved time was put to good use either for feeding more animals or by increasing off-farm work Mean time saved was close to 20% The effects of new forage technologies on labour division were generally gender neutral In one sub-district youth were less often involved and in another women were slightly more frequently involved Sometimes women were more frequently involved in fodder collection as some women took over this task from their husbands who went for off-farm activities Both women and men appreciated the introduction of new forages as the impact on household income was high Participation in FSP improved fodder balance and increased the possibilities to extend livestock ownership, a major generator of rural income

Other benefits and economic performance

Manure applied to food and cash crops contributed approximately 40% to farm household income from livestock in Makroman and Sepaku This indicates the dependency of households on manure for soil fertility maintenance In these two sub-districts the market value of manure was approximately ten times its estimated mineral value Apart from application on crops, farmers sold manure for cash income and estimated they applied less then 15% of manure on forage crops As a result productivity and quality of new forages was low The use of manure on food and cash crops does not conflict however with the overall objectives of FSP namely to improve livelihoods

On average increased ruminant productivity in the study area, in terms of cash income from sales of livestock and manure, resulted in an increased gross margin of 35% per household In addition to increased animal productivity on average 24% labour input was saved in the new forage systems in terms of days worked per year The saving of labour amounts to an extra 28% increase in income from the livestock system, if time is valued as a cash equivalent

The average rural income in the province in 2001 was US$184 per capita per year The average income from livestock in the three villages increased from US$73 to US$92 per capita per year This corresponds to an increase of 10 3% in total income per capita per year Saved labour contributed an additional 11% to total income per capita depending on the availability of casual labour opportunities or the investment of saved labour in farm enterprises New forages species contributed to a reduction in the income gap between rural and urban areas and induced greater integration into the market economy as farmers invested more in fences to reduce labour inputs for herding and to protect their investment in improved pasture

Summary of results from the impact study in Mindanao, Philippines

Livelihoods consisted of a variety of crops dairy cattle, dairy buffaloes, beef cattle, goats and other small livestock The average number of large ruminants per farm was 4 2

Forage availability

Before the introduction of new forages no cutting and carrying was practised Animals were tethered on roadsides or fields or herded on hillside rangelands and fed with crop residues The project had a significant effect on the quantity and quality of available forage, farmers who were growing forages derived 67% of the feed resources from these forages

Ruminant productivity

Farmers mentioned several benefits of new forage introduction improved body condition and overall health of animals, increased quantity and quality of work by draught animals, greater pig and poultry production, larger amounts of collectable manure due to reduced herding-time and more animals Farmers observed increased numbers of offspring and shortened anoestrus after parturition from three to one month in goats, one year to three months in cattle and 10 to four months in buffaloes

Labour requirements and gender

Time saved due to new forages was estimated at between 30 minutes and 2 hours per day This time was either invested in increasing the number of animals or other farm activities such as tending to vegetables and fishponds off-farm trading, and roadside food selling Farmers could also make themselves and their animal available for hire for off-farm work or use the time to attend meetings and pursue administrative errands More time and energy was available for social activities within households and in the community In some areas the reduction in time needed in the wet season was limited as the forages for cutting and carrying often were a long way from the village

Life became more relaxed as it was easier to plan activities when animals were not grazing The reduction or disappearance of tethering and herding also resulted in less destruction of crops Consequently the production of maize, banana and vegetables and the income from animals' work outside the farm, increased Most farm households that had ruminants prior to forage adoption increased their herd size after joining FSP More labour input was required due to the increase in livestock numbers and as a consequence the time available for non-

farm work decreased The increased need for on-farm labour had a negative trade-off on the income from firewood as farmers did not have time to cut in nearby forests However this was a positive change for the environment

The introduction of new forages had a gender effect in the Philippines the involvement of women and children in tasks like herding and cutting diminished and men were responsible for more livestock tasks A large increase in the number of animals owned by early adopters resulted in the need for greater labour input This created labour in rural areas and contributed to reduced labour migration by young people

Other benefits and economic performance

In the Philippines improved forage species increased animal production improved soil conservation and saved farmers time Net yearly income per household from animal production increased from $54 to $157 in the farming community at Malitbog and from $68 to $503 in Cagayan de Oro Planting forages in contour lines increased crop production slightly and contributed another $22 50 to yearly income The reduction in labour requirements allowed households to make $36 per year from other activities

Summary of results from impact study in Tuyen Quang, Vietnam

Livelihoods consisted of a variety of crops a variety of animals including fish ponds, and several sources of off-farm income The average number of large ruminants per farm was 0 8 The impacts of new forage technologies were assessed by comparing farmers who had adopted forages several years ago with farmers who had started less than one year ago

Forage availability

Farmers reported higher yields of forages compared to native grass The high yields of new forages allowed farmers to keep more animals or to keep animals in zero grazing feeding systems Improved forages enabled other farmers to start keeping animals, as they were able to produce sufficient fodder from their small plots The average estimated contribution of new forages to animals diets was 53% during summer and 32% during winter

Ruminant and fish productivity

Ruminant productivity increased through faster growth of animals, higher price received for the animals at the market due to better body condition increased working capacity of draught animals, and increased amounts of manure The productivity of fish increased as the period until marketing was reduced from 11 months to 9 months due to the availability of new forages

Labour requirements and gender

Saved time was an important benefit for most farmers keeping ruminants This was not the case for those who had increased their number of animals or had just started keeping buffalo or cattle since the introduction of new forages The number of labour days per year required for raising large ruminants was 258 for farmers without forages and 149 for farmers with forages On average, farmers with forages saved 120 days per year in the ruminant system The mean number of saved days for fish production was 30 days per year which corresponds to approximately 40 minutes per day Two-thirds of the time saved by adults was used for productive farm activities Family members used the remaining saved time for leisure training and study

Positive gender effects were significant in Vietnam Women and children benefited most from the reduction in time spent cutting, carrying and herding They used this extra time for

educational and cultural activities According to women, forages had a positive effect on other crops due to soil conservation and manure availability Labour saved from livestock was used to better manage crops, resulting in higher yields Higher yielding crops then required increased labour time for harvesting and processing Saved time was invested in a range of farm activities including cash crops like rice cassava, beans sugarcane and fruit trees Activities women appreciated more were planting forages and feeding fish

Other benefits and economic performance

In Vietnam improved forage systems also had a pronounced effect on income levels and welfare Net income from ruminant-fish production systems increased from $99 to $199 per year The time saved allowed households to increase their income from other mainly agricultural, activities This contributed to an additional yearly income of $52 per household Farmers were grouped in four income classes, the majority were in the class that earned between US$301 and US$736 per year per household An increase of $152 from the livestock system therefore corresponds on average to an increase in total household income of 29%

Poorer farmers who depended more on livestock due to small land areas, benefited the most from the improved forages Improved forages allowed them to keep large ruminants - increasing their income from livestock - and intensify their production systems Other positive effects on rural development included a reduction in the number of farming conflicts rehabilitation of barren land and reduced use of pesticides

Objective 2 Strengthen the capacity of participating Bank countries to develop and deliver these technologies to farmers

Performance targets

- Number of skilled researchers and extension workers increased and improved

Many training courses were organised at various levels The largest group of people trained were field workers who were responsible for the routine facilitation of farmer experimentation with forages Training of field workers continued throughout the project duration as more sites were targeted for scaling out Training topics varied from technical to methodological, all of which were essential for building knowledge, skills and shaping the attitudes of working with farmers (Table 15) The number of districts or municipalities in which the project worked increased from 23 in 2000 to 34 in 2003 (Table 9) The project worked with partners such as Ministries of Agriculture and National Research Institutes at all levels with the largest number of staff operating at the field level The project capacity building efforts ensured smooth operation at these various levels Specialised training was given to researchers at project management level (Table 16) to improve communication skills and skills in research and development methodologies

Case studies that describe the impact of forage technologies on resource-poor rural families were documented in early 2003 for sites in Indonesia Lao PDR Philippines and Vietnam These case studies show the considerable range of approaches used and benefits gained by farmers in applying forage technologies and show how families have used these benefits to improve their livelihood The individual studies have been compiled and are being prepared for publication in a booklet that will be available to project partners for extension purposes and to assist with institutionalisation of participatory approaches The final publication is likely to include 17 main cases with each case augmented by a number of related examples These very diverse examples of impacts are being used already to benefit other households

in the same and nearby villages Posters of these case studies are proving useful and the case studies booklet, when available, should prove highly beneficial

Output 1 Productive and sustainable forage technologies for upland farming systems developed and tested by farmers

Performance target

- A core group of farmers using productive and sustainable forage technologies at six sites with contrasting upland farming systems one each in People s Republic of P R China Indonesia Lao People s Democratic Republic (PDR) Philippines Thailand and Viet Nam

The extension booklet written by Horne and Stur (1999) provides information about forage species and accessions that were promising during FSP Phase I[1] In FSP Phase II, many of these species were still grown by farmers and many farmers expanded the areas covered by these crops However, there are large differences in terms of which species were adopted at different locations and how they are used Some factors that determine the adoption of a particular forage system are suitability to climate soil quality resistance to pests and diseases land availability traditional forage use, palatability by animals ease of establishment ease of propagation, longevity of the plant, weediness drought resistance, and the availability of labour During the life of the project a participatory monitoring and evaluation (PME) system was developed for most focus sites, consisting of periodic surveys and community driven tools Through the PME it was possible to determine which forage species were adopted, and how they were used at some sites The results are presented in tables 2 to 8 The species in the tables are ranked by number of farmers growing the species at the study site The tables show that most common forage systems vary by site

Hainan, P R China

Farming system

The farming system in Hainan is extensive sedentary upland At Baisha county, where the project started its activities with farming communities households belong to ethnic minorities such as the Li and are in the poorest wealth category The landscape is hilly, and most land is above 100 m ASL Annual rainfall is 1800-2000mm with a rainy season from June to October and dry season from November to May Agricultural activities include production of rubber, rice sugarcane, vegetables corn, sweet potato, cassava, pigs goats, buffalo ducks chicken and fish Rice vegetables and pigs are the most important products for consumption and rice rubber pigs and goats the most important for sale

Improved forage technologies

Stylosanthes guianensis CIAT 184 has been the most successful forage in Hainan Of all the project farmers, 74% grow this species for a range of purposes in various farm niches (Table 2) Forages benefit farmers in several stages of the livestock production chain The smallest farmers typically cultivate plots of 300 to 800 m^2 with stylo, primarily to produce seeds and feed the hay by-product to their livestock Many of the FSP farmers fall in this category They sell the seeds to larger-scale farmers who cultivate larger areas of stylo to produce high quality hay and leaf meal Some of the farmers in the second category feed this hay to their livestock, but many process the stylo into leaf meal which they sell for use by a third category of farmers the commercial dairy farmers

[1] The Forages for Smallholders Project (FSP) was initially funded by AusAID from 1995 to 1999 ADB funded FSP from 2000 to 2003 In this document the AusAID funded project is referred to as FSP Phase I whereas the ADB funded project is referred to as FSP Phase II

Twenty-seven farmers are using *Stylosanthes guianensis* CIAT 184 as cover crops in fruit plantations An on-farm experiment was carried out to measure the effect of stylo and other cover crops on the growth of young mango trees on fruit production and on production from cover crops Stylo caused slightly slower growth rates of mangoes in terms of stem diameter and crown size however yields of mangoes were higher with the stylo cover crop than the control the sweet potato cover crop or the peanut cover crop

Recognising the importance of stylo to the livestock systems in Hainan and dairy systems in the mainland, FSP has carried out experiments to screen accessions derived from *Stylosanthes guianensis* CIAT 184 Early results show large variations among these accessions in anthracnose resistance early flowering seed production and forage production It has been possible to further improve on the original CIAT forage, which will have positive implications for farmers growing this crop

Table 2 Forage systems adopted in Hainan P R China

Species (in order of number of farmers using)	Planting and harvesting systems	Types of animals fed (in order of importance) and other uses
Stylosanthes guianensis CIAT 184	Monoculture cut & carry plots cover crops in fruit trees Some contour planting and grazing plots	Main use to produce seeds Feed for buffaloes pigs ducks chickens goats and cattle Soil fertility improvement and control of soil and water erosion
Pennisetum purpureum	Cut and carry plots live fences	Feed for buffaloes pigs rabbits chickens cattle goats geese and fish Planting materials
Panicum maximum	Cut and carry plots	Feed for rabbits buffaloes goats Planting materials
Paspalum atratum	Cut and carry plots	Feed for rabbits goats pigs chickens buffaloes Planting materials
Brachiara brizantha	Cut and carry plots	Feed for rabbits buffaloes pigs chickens goats cattle Planting materials
Macroptilium gracile	Cut and carry plots and cover crops	Feed for rabbits goats pigs buffaloes chickens Planting materials
Leucaena leucocephala	Cut and carry plots and along boundaries	Feed for rabbits buffaloes pigs buffaloes chickens Planting materials
Arachis pintoi	Grazing areas and boundaries Cover crop	Feed for buffaloes chickens pigs and rabbits Planting materials Control of soil and water erosion

Improved pasture

An on-farm grazing experiment with goats was carried out on improved pasture sown with stylo CIAT 184 and *Brachiaria brizantha* It was compared with natural pasture, which was composed of *Imperata cylindrica, Leptochloa chinensis, Axonopus compressus, Eupatorium cordatum Miscanthus floridulus* and some shrubs The result showed a liveweight gain of 1 50kg/30d/hd on improved pasture in contrast to 1 13 kg/30d/hd on natural pasture, which is an improvement of 33%

Future directions for forage technologies in Hainan

Breeding work on stylo will continue Although stylo has made an impact on the livestock systems in tropical China, its full potential has not been realised yet Many of the poorest farmers could add this crop to their farming systems and benefit from sales of seeds Livestock production can be further increased if more farmers feed stylo as a high protein source in the diets of beef dairy cattle and small livestock *Macroptilium gracile* is another legume that is popular and has a potential to benefit many more small livestock The two legumes will provide maximum livestock productivity impacts if fed together with the widely cultivated grasses such as *Pennisetum purpureum* and *Panicum maximum*

FSP in Hainan has been able to demonstrate to government officials that farmers can take their fate in their own hands and don t need to rely solely on government financial aid to improve their livelihoods The newly funded project (LLSP), with strong support from the national partner CATAS, will continue to serve as an example in Hainan for more sustainable approaches towards rural development

East Kalimantan, Indonesia

Farming system

The farming system in east Kalimantan (Indonesia) is rain-fed lowland and intensive sedentary upland Samarinda Ilir is a transmigration area that was settled by Javanese farmers in 1974 Land holdings vary from 2 to 3 ha per family Most families own 1 to 2 ha of lowland and 1 ha of upland In most years farmer can grow 2 rice crops/year Apart from rice farmers grow maize cassava, sweet potatoes baby corn and peanuts on their upland areas Also, farmers maintain intensive home gardens with fruit trees and vegetables around their houses Not all upland areas are planted with crops The area is a mixture of lowland (60%) and hilly upland areas (40%) which are dominated by *Imperata cylindrica* Soils vary from moderately fertile to infertile clay loams, with pHs of 4 8 to 5 3 Altitude is less than 100m ASL Average annual rainfall is about 2000mm, with peak rainfall during the months of December to March and dry months from June to October In Sepaku transmigrants arrived in the early 1970s to settle the area and to work in the logging schemes After logging, farmers started to crop the upland areas with upland rice maize and other upland crops Rolling hills dominate the landscape in Sepaku

Improved forage technologies and future directions

FSP in East Kalimantan has been very successful with improved grass species such as *Paspalum atratum, Pennisetum* hybrid (King), *Setaria splendida Brachiaria humidicola* and *B decumbens* (Table 3) Paspalum has replaced the King grass that was there before the project started The new forage species are better suited to the acidic soils Feed shortage has been a major constraint to intensive livestock production and these new grasses are capable of producing large amounts of feed They are propagated easily by root splits or cuttings, and farmers have mastered the art of this type of propagation These improved grasses continue to spread actively from farmer to farmer to the extent that it is difficult to monitor There is a large potential for further expansion not only within East Kalimantan, but also for neighbouring provinces

Glincidia sepium is a shrub legume that is used widely in the area Its advantage is that it can be propagated by cuttings contrary to most of the other legumes with which the project has worked which need to be propagated from seed Farmers have discovered ways of multiplying stylo by cuttings, but as yet this method of propagation has not been used by large numbers of farmers There is potential for stylo CIAT 184 and improved varieties of

Gliricidia and leucaena to improve the diets of animals kept intensively for fattening FSP deserves credit for recognising and promoting gliricidia as a high quality feed and overcoming the initial palatability constraints Traditional use of this legume in this region was solely as a living fence

FSP is embedded in the Provincial Government Dinas Peternakan, and as such improved forage technologies will continue to be promoted within this large province Dinas Peternakan will use more farmer voluntary field workers to complement the extension activities of their regular field staff Continued strong links with the national government through the Directorate General of Livestock Services (DGLS) will help further expansion There are high demands from other provinces to be included in the FSP program

Table 3 Forage systems adopted in East Kalimantan Indonesia

Species (in order of number of farmers growing them)	Planting and harvesting system	Type of animals fed to (in order of importance) and other uses
Paspalum atratum BRA 9610 (Terenos)	Cut and carry in fodder banks and on contour lines Between other crops	Fed to cattle and goats Very good for erosion control To suppress weeds
Pennisetum hybrid (King grass)	Cut and carry from fodder banks and from contour lines Live fences	Fed to cattle and goats Erosion control and to suppress weeds
Gliricidia sepium	Cut and carry from live fences and from trees used to support pepper	Fed to cattle and goats Erosion control Soil fertility improvement
Setaria sphacelata var Splendida	Cut and carry in fodder banks and on contour lines	Fed to cattle and goats Very good for Imperata grassland improvement Erosion control
Brachiaria humidicola CIAT 6133 (Yanero) and CIAT 679 (Tully)	Pasture under coconut trees	Grazed by cattle and goats Imperata grassland improvement erosion control
Andropogon gayanus CIAT 621 (cv Kent)	Cut and carry in fodder banks and in lines between crops	Feed for cattle and goats Imperata grassland improvement erosion control
Brachiaria decumbens CIAT 606 (Basilisk)	Cut and carry plots	Fed to cattle and goats Imperata grassland improvement erosion control
Brachiaria brizantha CIAT 6780 (Marandu)	Cut and carry plots	Fed to cattle and goats Erosion control
Stylosanthes guianensis CIAT 184	Cut and carry plots cover crop	Fed to cattle and goats Soil fertility improvement
Leucaena leucocephala	Cut and carry from live fences	Fed to goats

Luang Prabang, Lao PDR

Farming system

The farming system in Luang Prabang (Lao PDR) is extensive shifting and sedentary upland farming The area is mountainous with altitudes from 300 to 1900 m The agricultural land is used for rice production in both upland and lowland areas In upland areas shifting cultivation is widely practiced through slash and burn and short rotations Paddy rice is practiced on flat areas and in valley bottoms Maize is the second most important field crop especially for the

Lao Sung people Other crops, such as peanuts mung bean soybean, sesame and cucumber are planted also Vegetables are usually cultivated around the house or in a garden near the rice fields Fruit crops include pineapple papaya jack fruit and mango The annual rainfall varies from 1000 to 1800mm The wet season lasts from April to October and the dry season from November to March Due to the high latitude (19 to 21° N) the temperature fluctuates through the year, with mean maximum temperatures ranging from 28°C in January to 35°C in April, and mean minimum temperatures range from 14°C in January to 24°C in July The soils are moderately acid and classified as sandy to loamy sandy The soils tend to be low in organic matter content and have low base saturation The soil pH ranges from 5 to 7

Table 4 Forages systems adopted in Luang Prabang Lao PDR

Species (ranked in order of number of farmers growing them)	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses
Panicum maximum T58	Cut and carry plots	Feed for draught animals especially wet season
Brachiaria brizantha CIAT 6780	Cut and carry plots	Feed for draught animals during dry season to prepare for ploughing
Brachiaria decumbens CIAT 606 (Basilisk)	Cut and carry plots	Feed for draught animals during dry season to prepare for ploughing
Stylosanthes guianensis CIAT 184	Cut and carry plots	Feed for draught animals during dry season to prepare for ploughing Feed for pigs
Andropogon gayanus CIAT 621 (cv Kent)	Cut and carry plots	Feed for animals in dry season in infertile areas
Paspalum atratum	Cut and carry plots	

Improved forage technologies and future directions

Traditionally, livestock systems, especially cattle raising, have been based on extensive grazing in Luang Prabang, and this remains the norm Grazing resources are open areas in the hilly forests, and the areas that are left fallow for some seasons Indigenous forages contribute a large proportion of the livestock diets A study was conducted in which 17 local fodder tree and shrub species were identified (Roothaert and Phengsavanh 2001) Farmers in three villages preferred *Bauhinia variegata, Trema orientalis* and *Broussonetia papyrifera* each for a variety of reasons Only few individual animals of the herds are kept separately near the home compounds and fed on cut and carry forages, usually these are the sick, the very young, or cows around the time of delivering Forages that are grown for these animals are mostly grasses, with the exception of stylo (Table 4) Legumes will become more important in the near future Farmers are realising that cut and carry plots with grasses only mine the soil of nutrients and therefore are not sustainable More manure needs to be returned to the plots, and the inclusion of legumes will provide extra inputs of nitrogen In another province where the AusAID - FLSP project is active farmers are experimenting with tree legumes such as calliandra and gliricidia, which have the additional advantage of having deep root systems that can tap nutrients that are not available to other herbaceous forages AusAID FLSP is continuing the work on improved forages with focus on increasing the impact of forages at the farm level

Malitbog, Philippines

Farming system

The farming system in the Malitbog (Philippines) is extensive sedentary upland Original inhabitants of the province were Bukidnons but nowadays the majority of the population are descendants from the Visayas More than 90% of the area has slopes steeper than 8% Average annual rainfall is 1830mm The average rainfall pattern consists of a rainy season from June to December, and a dry season from February to April The pattern is somewhat unreliable, however, and it can rain in any month The main crops are corn rice banana, coffee, coconut, a range of root crops and vegetables Corn and banana are the main sources of income Common livestock are cattle, carabao, goats horses pigs, chickens and ducks There are still large areas of forest and degraded *Imperata cylindrica* grasslands on steep hills Soils range from sandy loam to clay loam with colours ranging from black to red The pH is between 6 0 and 6 5 The original focus site in Malitbog (San Luis) has an elevation of 700 m ASL

Table 5 Forage systems adopted in Malitbog Philippines

Species (ranked in order of number of farmers growing them)	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses
Setaria sphacelata var Splendida and cv Nandi	Contour lines along steep slopes cut and carry from lines and plots Grazing	Feed for cattle goats pigs horses[2] and carabao Planting materials Soil and water conservation
Pennisetum purpureum ex-Xavier[3]	Contour lines along steep slopes cut and carry from lines and plots	Feed for cattle goats horses and carabao Planting materials Soil and water conservation
Paspalum atratum	Contour lines along steep slopes cut and carry from lines and plots	Feed for cattle goats horses and carabao Planting materials Soil and water conservation
Panicum maximum CIAT 6299 (Tobiata) and T58 (Simuang)	Contour lines along steep slopes for T58 only Cut and carry from lines and plots Grazing of contour lines after harvest of maize	Feed for goats cattle carabao horses Planting materials Soil and water conservation
Brachiana ruziziensis	Contour lines along steep slopes cut and carry from lines and plots	Feed for cattle goats carabao and horses Planting materials Soil and water conservation
Arachis pintoi	Plots for cut and carry or for grazing Little is planted along contours or as cover crop	Feed for goats cattle carabao and horses Planting materials Soil and water conservation Soil fertility improvement
Flemingia macrophylla	Plots contour lines along steep slopes and hedges All for cut and carry	Feed for cattle goats and carabao Planting materials Soil and water conservation Soil fertility improvement
Glincidia sepium var Retalhuleo	Plots and hedges All for cut and carry	Feed for cattle and goats Planting materials Soil and water conservation

[2] Setaria is toxic to horses only when fed in big amounts

[3] This variety was obtained from Xavier University Cagayan de Oro in the early nineties The plants are tall broad leaved and non-hairy It distinguishes itself from other many other *P purpureum* varieties in a characteristic that it is glabrous at the upper side of the leave blades In appearance it compares to King grass from Indonesia and to Pennisetum hybrid cv Merker

Improved forage technologies and future directions

The adoption of forage technologies in Malitbog is largely driven by a combined need for feed not far away from the house and the need to protect the hilly farm land from erosion, with forages planted in rows along the contours The most appropriate and effective crops for these purposes are grasses (Table 5) In the absence of dairy animals, farmers feel little direct need to feed legumes Beef cattle would benefit from legumes, but the returns are not as immediate as is the case dairy animals producing with milk There is a tendency among innovative farmers to stall feed beef cattle and goats, and if this tendency increases, grass-legume mixture feeds are likely to increase Intensive cattle fattening would also require better market orientation of the Malitbog farmers In the neighbouring province in Cagayan de Oro City, many FSP farmers adopted legumes such as arachis, calliandra leucaena and gliricidia Cagayan de Oro local government had a successful scheme of distributing dairy cattle and buffaloes, which enhanced the demand for these legumes

In Malitbog partnerships exist between the implementing FSP the Municipal Agriculture Office, and other organasations such as ICRAF and Landcare Collaboration is continuing to be mutually beneficial, FSP gains from expertise on land conservation technologies while ICRAF and Landcare benefit from new forage varieties Forage multiplication systems are now well developed in Malitbog on many private farms

Nakorn Ratchasima, Thailand

Farming system

The farming system in Nakorn Ratchasima (Thailand) is extensive sedentary upland Nakorn Ratchasima is located on the northeastern plateau of Thailand, 100 to 300 m above sea level It receives an average annual rainfall of 1250mm with 85% falling in mid April to mid October Average monthly temperatures range from a minimum of 17°C and maximum of 30°C in December to a minimum of 24°C to a maximum of 36°C in April Principal land use in the region is rainfed arable crops forest land and grazing land The main arable crops are paddy rice cassava corn sugar cane, fruit trees and vegetables Rice, corn cassava and fruit trees are important sources of income Minor crops are jute sesame castor oil, cotton, soybean peanut and mung bean There are 27 000 beef farmers in the province with average herd sizes of 9 5 There are more than 40,000 dairy farmers with average herd sizes of 27 Dairy farming is relatively intensive, with the use of tractors milking machines, large improved pastures and significant amounts of concentrates Beef cattle are kept on unimproved communal grasslands, and crop residues

Improved forage technologies and future directions

Thailand is relatively advanced in pasture development, it has the largest area of forage per household (Table 1) The term smallholder has a different meaning with average herd sizes of 9 5 beef cattle or 27 dairy cattle per farm Averages in other DMC countries are more within the range of 1 to 4 Also in contrast with the other countries grazing is common practice in Nakorn Ratchasima province (Table 6) Grasses and legumes are both adopted enabling optimum production levels especially in the dairy sector The growing of forages for beef cattle is relatively new and has received much emphasis in the FSP

Intensive cut and carry for dairy cattle was developed in Sung Nuen district The farmers expanded to 1,430 m^2 of *Brachiaria brizantha* CIAT 6387 and 10 980 m^2 of *Brachiaria brizantha* CIAT 6780 Also, three forage legume species, *Centrosema pascuorum* cv Cavalcade *Stylosanthes guianensis* CIAT 184 and *Stylosanthes hamata* cv Verano were integrated into the systems with a total of 11 620 m^2 planted Farmers are planting these

three legumes in association with ruzi grass, with a total of 80,000 m^2 Both men and women manage the feeding of forages

Farmers have realised the effectiveness of *Brachiaria brizantha* in increasing milk yield with a consequent reduction of 41% in the amount of concentrate feed used In the case of beef cattle farmers, instead of using only rice straw or native grass in communal grazing land farmers are benefiting from planting forage species Animals are fed with ruzi grass stylo 184 and Verano stylo which stay green long into the dry period and prevents the livestock from losing weight

Brachiaria ruziziensis and *Centrosema pascuorum* have been cultivated by farmers since before the start of FSP FSP introduced new forages such as *Brachiaria brizantha* and stylo 184 Widening the option of forages that farmers could grow resulted in (i) greater yields as new forages are better adapted to infertile soils (ii) more feed during the dry season, (iii) greater yields of legumes, and (iv) suitable species for cut and carry systems Thailand has a strong forage extension network with the development of new options being supported easily by the DLD The challenge remains to extend these options to the less wealthy and more remote beef cattle farmers

Table 6 Adopted forage systems in Nakorn Ratchasima Thailand

Species	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses
Brachiaria ruziziensis	Plots for grazing and cut and carry Sometimes mixed pastures with legumes	Feed for dairy and beef cattle
Panicum maximum T58	Pastures for grazing and cut and carry Sometimes mixed pastures with legumes	Feed for dairy cattle
Brachiaria brizantha CIAT 6780 (Marandu) and CIAT 6387 (Serengeti)	Cut and carry during the rainy season grazing during the dry season	Feed for dairy cattle
Stylosanthes guianensis CIAT 184	Mixed pastures with B ruziziensis or with P maximum Cut and carry during the rainy season grazing during the dry season	Feed for dairy or beef cattle (plain stylo plots)
Stylosanthes hamata (Verano)	Mixed pastures for grazing Mixed pastures with *B ruziziensis* or with *P maximum* Cut and carry during the rainy season grazing during the dry season	Feed for dairy cattle
Centrosema pascuorum cv Cavalcade	Mixed pastures with *B ruziziensis* or with *P maximum* Cut and carry during the rainy season grazing during the dry season quality hay	Feed for dairy cattle

Vietnam

Farming system

The farming system in Daklak (Vietnam) is extensive sedentary upland The average rainfall is 1900mm and the rainy season is from April to November The soils are sandy loams well drained moderately fertile but P deficient with pH between 5 and 5 5 The altitude of the focus commune, Cu'roa, is 550 masl The commune was established in 1987 by immigrants from over-populated areas of north Vietnam There are two ethnic groups, the Ede and the Kinh The Ede have been living in Daklak for a long time They used to practice shifting cultivation with corn and upland rice, but have been forced to settle and have expanded their

activities to include paddy rice, beans, cassava sweet potato, forest lots and livestock The Kinh came from the north and practice upland cropping irrigated rice, and livestock husbandry Livestock are cattle, pigs fish and chickens Cattle graze on *Imperata cylindrica* fields all year round Coffee has become an important cash crop

Improved forage technologies and future directions

Progress has been made in the following areas in Daklak province

- The improvement of natural pastures through introduction of new grasses and legumes *Brachiana* spp and stylo CIAT 184 were able to cover 50 to 60% of natural *Imperata cylindrica* grasslands
- Evaluation of legumes as cover crops in coffee plantations Stylo CIAT 184 was appreciated by farmers for feed weed control and green manure, while *Arachis pintoi* was preferred for soil erosion control
- Use of improved forages to fatten cattle Mixtures of stylo CIAT 184 leucaena and gliricidia can replace concentrates result in 0 86 kg liveweight gain per day and significantly increase profitability
- Impact of forages on fish production Profit per hectare of fishpond is 16% higher for farmers with planted forages than the profit of those farmers without planted forages

In terms of farmers adopting forages during FSP phase II paspalum and panicum have had major impacts in Daklak (Table 7) These versatile species are used to improve the natural grasslands and to provide forage for cut and carry Livestock systems will continue to have components of grazed pasture and separate fodder banks for intensive harvesting The improved technologies have provided the extension workers of MARD confidence to visit farmers and disseminate results

Table 7 Adopted forage systems in Daklak, Vietnam

Species (ranked in order of number of farmers growing them)	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses
Paspalum atratum	Improving natural grassland intensive cut and carry plots	Feeding Beef cattle grass carp and pigs Seed and vegetation planting production
Panicum maximum	Improving natural grassland intensive cut and carry plots	Feeding Beef cattle grass carp Seed and vegetation planting production
Stylosanthes guianensis CIAT 184	Cover crop intensive cut and carry plots improving natural grassland	Feeding Beef cattle, grass carp and pigs Seed production and soil erosion control soil improvement
Brachiana brizantha	Improving natural grassland	Beef cattle
Brachiana decumbens	Improving natural grassland	Beef cattle
Brachiana ruziziensis	Improving natural grassland	Beef cattle
Arachis pintoi	Improving natural grassland	Beef cattle soil cover and erosion control
Leucaena leucocephala	Cut and carry from live fences	Cattle pigs fire wood
Gliricidia sepium	Cut and carry from live fences	Cattle fire wood

Although not an original focus site the highest numbers of farmers adopting forages among all FSP sites were found in Tuyen Quang province (Table 1) *Panicum maximum* is the most common forage and is fed to fish and other livestock (Table 8) Fish production in ponds is a

profitable enterprise and many poor smallholder farmers are engaged in this system To complement the forage production activities, many farmers have now engaged successfully in seed production of *P maximum*, and benefit from additional income through sales of seeds Both MARD and NIAH have prioritised rural livestock production in their rural development strategies

Table 8 Adopted forage systems in Tuyen Quang Vietnam

Species (ranked in order of number of farmers growing them)	Planting and harvesting system	Type of animal fed to (in order of importance) and other uses
Panicum maximum	Cut and carry from fodder banks Intercropped with fruit trees	Fed to fish buffaloes cattle and pigs Erosion control Sale of planting materials and seeds
Paspalum atratum	Cut and carry from fodder banks Intercropped with fruit trees	Fed to buffaloes and cattle Sale of planting materials and seeds
Pennisetum purpureum	Cut and carry from fodder banks	Fed to buffaloes and cattle
Stylosanthes guianensis CIAT 184	Cut and carry from fodder banks Intercropped with fruit trees Some contour hedgerows	Fed to pigs and cattle Soil fertility improvement Erosion control
Brachiaria brizantha	Cut and carry from fodder banks	Fed to buffaloes and cattle
Boehmeria nivea	Cut and carry from fodder banks intercropped in fruit trees	Fed to pigs fish buffaloes and cattle
Trichantera gigantea	Cut and carry from fodder banks	Fed to buffaloes and pigs
Leucaena leucocephala	Cut and carry from live fences Contour hedgerows	Fed to buffaloes and cattle
Gliricidia sepium	Live fences	Fencing

Output 2 Forage technologies extended to other farmers using participatory approaches for scaling up from farm to community and provincial levels

Performance targets

- Widespread adoption of forage technologies by farming communities in Indonesia Lao PDR Philippines and Vietnam
- A practical manual on scaling up technologies developed through farmer participation published for use by the national agricultural research systems (NARSs) in DMCs

Table 9 Scaling out to new sites within countries

Year	Indonesia (East Kalimantan province)	Philippines (Mindanao and Visayas)	Vietnam (Daklak and Tuyen Quang province)	Lao PDR	Thailand (Nakorn Ratchasima province)	China (Hainan province)
2000	• Penajam Paser Utara1 • Samarinda1 • Kutai • Balikpapan • Bulungan • Berau	• Malitbog1 • Cagayan de Oro1 • Impasugong • Manolo Fortich	• Madrak1 • Ea Kar • Han Yen1 • Yen Son • Son Duong • Na Hang	• Luang Prabang	• Sungnuen • Sikhew • Dankhuntod	• Baisha • Ledong • Danzhou
2001	• Penajam Paser Utara • Samarinda • Kutai • Balikpapan • Bulungan • Berau	• Malitbog • Cagayan de Oro • Impasugong • Manolo Fortich • Cebu •	• Madrak • Ea Kar • Buon Don • Cu Jut • Buon Ma Thuot • Han Yen • Yen Son • Son Duong • Na Hang	• Luang Prabang • Savannakhet	• Sungnuen • Sikhew • Dankhuntod	• Baisha • Ledong • Danzhou
2002	• Penajam Paser Utara • Samarinda • Kutai • Balikpapan • Bulungan • Berau • East Kutai • Central Kutai	• Malitbog • Cagayan de Oro • Impasugong • Manolo Fortich • Cebu • Leyte	• Madrak • Ea Kar • Buon Don • Cu Jut • Buon Ma Thuot • Krong Bach • Han Yen • Yen Son • Son Duong • Na Hang	• Luang Prabang • Savannakhet	• Sungnuen • Sikhew • Dankhuntod • Packhong	• Baisha • Ledong • Danzhou • Dongfang

[1] Adopted sites from FSP phase 1

At the end of 1999, as the FSP project funded by AusAID (phase I) was concluding there were about 1750 farmers spread over 19 sites in Indonesia Philippines Vietnam and Lao PDR who were evaluating forages on-farm In 2000 the ADB funded FSP project adopted several sites from the earlier project East Kalimantan in Indonesia, Malitbog and Cagayan de Oro in the Philippines, Tuyen Quang and Daklak in Vietnam, and Luang Prabang in Lao PDR Some other sites were added in 2000 Nakorn Ratchasima in Thailand and Hainan in P R China A strategy for scaling out was developed with the focus sites playing a central role The expertise of researchers and field workers at the focus sites in research on forages and facilitating the technology development was used to train other new staff in neighbouring districts or provinces Participatory diagnosis (PD) and planning remained a key activity for starting the technology development process at new sites Farmers at the focus sites who had been experimenting with forages for several years were asked to host cross-visits and receive farmers from the neighbouring villages districts and provinces Table 10 gives an overview of how many PD and cross visits were conducted, how many farmers participated and how this led to new farmers experimenting with forages on their farms On average about 18 farmers would participate per PD Many of these farmers were encouraged by what they saw and heard during the cross visits and about three-quarters of participating farmers

would start planting forages As a result a total of 4 155 new farmers have started to grow and experiment with forages during the project period

Table 10 Scaling out activities and number of new farmers experimenting with forages

Year	No of participatory diagnoses (PD) conducted	No of farmers who participated in the PD	No of new groups	No of cross visits organised	No of farmers participating in cross visits	No of new farmers planting forages
2000	45	1087	52			748
2001	151	2173	179	187	1330	1537
2002	101	2148	52	141	1833	1870
Total	297	5408				4155

There have been efforts to monitor what happened to the initial and subsequent farmer experimenters in terms of adoption, expansion within their farm, and continuation to grow forages A large drop out was observed in Luang Prabang, where at the beginning of the wet season in Luang Prabang there were 262 farmers growing forages, eight months later there were 170 farmers remaining Another big drop out was observed at Malitbog Some farmers naturally drop out due to reasons such as

- Feed shortage was not a problem (e g in Luang Prabang)
- They expected livestock dispersal on loan from the government, but no animals were received (e g in Malitbog)
- They no longer have ruminant livestock due to emergency sales
- They abandon their farm to seek employment elsewhere
- They get absorbed in other dominating farm activities such as cash crops
- Forages were overgrown by weeds due to labour pressure in the early stage of establishment

Farmers had been growing forages at the focus sites that were inherited from the FSP phase I Out of those 1750 early farmers about 800 were found in the focus sites of the FSP phase II At the end of 2002 there were 4662 farmers, including early adopters, growing forages at the sites where FSP phase II was active (Table 11) The total number of dropouts therefore was about 300 (4662 minus 800, minus 4155) or 17%

Table 11 Total number of farmers growing forages at FSP sites at December 2002, by country

Country	Indonesia (East Kalimantan)	Philippines (Mindanao & Visayas)	Vietnam (Daklak & Tuyen Quang)	Lao PDR (Luang Prabang)	Thailand (Nakorn Ratchasima)	P R China (Hainan)
No of farmers	740	1663	1647	160	276	176
Total	4662					

Appendix 1 shows a graphical representation of the increase in numbers of farmers per country by year during the two phases of FSP It is apparent that in the second phase the strategy and investment in scaling out has paid off farmers growing forages increased many fold In Vietnam Philippines and Indonesia the pattern of increase has been exponential

Guidelines for scaling up forage technologies

The FSP is an example of how a research project started in a conventional way with little farmer participation before 1995, with on-farm experiments being largely contractual More than 500 species and varieties of forages were screened in a few locations From 1995 FSP phase I and II engaged farmers in research on forages with increasing levels of participation Research went from centralized community plots of well laid out test plots of 10 to 20 best-bet species and varieties to plots on-farm where farmers decided on the species and varieties to test the lay out of the plots, and the methods of harvesting There are three new dimensions that this phase of research entered (i) the move from test plots to forages integrated with other food or cash crops, either as cover crops intercrops relay crops live erosion barriers or live fences (ii) the forage crops were evaluated not only for growth characteristics but also for feed for livestock (iii) larger areas of one or two preferred species or varieties were grown at the farm level (Figure 1)

The process described in Figure 1 occurs within the boundaries of a farm or a localised area Scaling out[4] and scaling up however imply spreading of technologies across farm boundaries There are principles to be considered for successful and sustainable scaling out The FSP has developed a conceptual framework to guide national teams of fieldworkers scientists administrators and policy makers in this process (Figure 2)

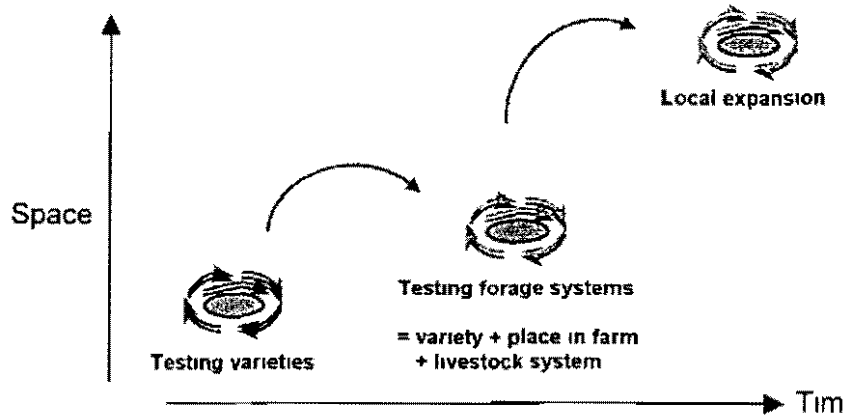


Figure 1 Adoption from on-farm test plots to on-farm expansion (Adapted from Horne et al 2000)

There is a natural sequence of research activities (stages 1 – 11 of Figure 2) The first step for either starting research at a focus site or scaling out to a new site is to gather secondary information and to carry out a rapid rural appraisal with a wide range of stakeholders If a need for forage R&D is perceived, extension workers of the Local Government Units (LGU) are trained in forage agronomy participatory research and gender analysis During these courses the more active and motivated extension workers who can effectively lead work in the project are identified (step 2) The selected extension workers are assisted in their first participatory diagnosis and planning exercises with their communities (step 3) Community inventories of existing feed resources greatly assist the identification of suitable improved

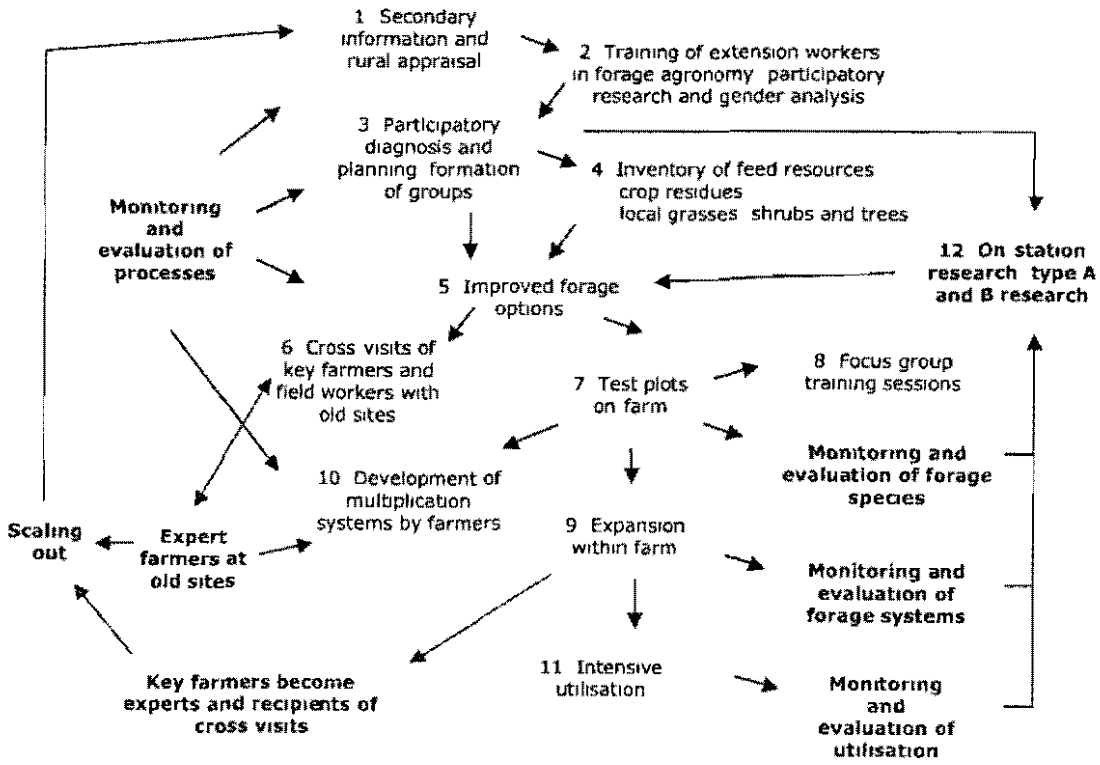
[4] The following definitions are used in this document regarding scaling up and scaling out **Horizontal scaling up / Scaling out** is geographical spread to cover more people and communities through replication and adaptation and involves expansion within the same sector or stakeholder group Decision making is at the same social scale **Vertical scaling up** is moving higher up the ladder It is institutional in nature and involves other sectors/ stakeholder groups in the process of expansion – from the level of grass-roots organizations to policymakers donors development institutions and investors at international levels Vertical scaling up includes **institutionalisation** (often referred to as mainstreaming especially in the participatory literature) This implies getting institutions to accept and internalise the underlying principles of an innovation so that these will remain as guiding principles of practice even after the initial innovative project or program has come to an end

potential forage systems, which are offered to farmers (steps 4 and 5) If focus sites with experienced farmers exist elsewhere cross-visits are facilitated for farmers to visit them at the new sites, even if it might involve extensive travel (step 6) About 1 year after initial planting, farmers are likely to perceive effects on animal productivity soil fertility, or erosion control Farmer groups are sometimes trained on specific issues relevant to their stage of research or development with forages Multiplication of planting materials or seeds is an essential step in the scaling out process (steps 7 to 11)

The green arrows in the diagram pointing left indicate the processes of scaling out whereas the purple arrows indicate the different levels of monitoring and evaluation which provided feedback to stakeholders and assisted in identifying strategic research issues (step 12) Many tools were used to facilitate the scaling out process (Figure 3) A case study was written entitled 'Issues and Strategies for Going to Scale A Case Study of the Forages for Smallholders Project in the Philippines (Roothaert and Kaaria in press)

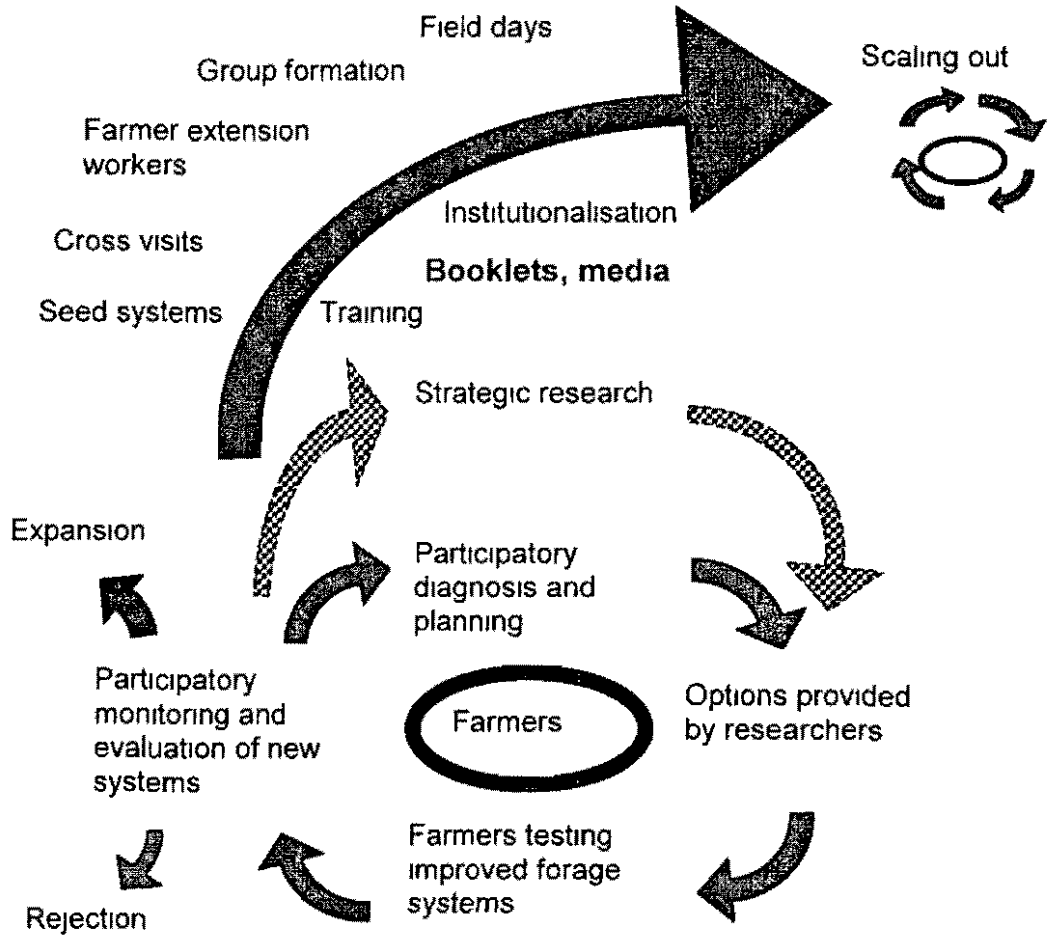
The most appropriate methods for scaling out vary greatly with the location and situation As such it is difficult to develop a detailed practical manual on these methods for use by the NARS however, the principles of the major tools options, and approaches used successfully in the project are outlined clearly in the publications referred to in Figures 2 and 3 (Roothaert and Kerridge in press Roothaert and Kaaria in press)

Figure 2 Research and development processes in FSP



Source Roothaert and Kerridge in press

Figure 3 Farmer research process and tools for scaling out



Output 3 Effective local seed and planting material multiplication systems established and operational

Performance targets

- Seed and planting material of promising forages is easily accessible to farmers at four sites by 2002
- Multiplication of preferred forages at national level to ensure supply to other areas in participating countries by 2002

Thailand and P R China had been forage seed producers even before the FSP phase II Thailand traditionally produced mainly seeds of *Brachiaria ruziziensis* and P R China mainly of *Stylosanthes guianensis* While FSP was experimenting with other species and farmers subsequently adopted new species and varieties a demand for seeds of these species arose During the annual meeting in Lao PDR 2002 the seed availability within FSP was analysed *Panicum maximum* T 58, *B ruziziensis, Paspalum atratum, Centrosema pascuorum Desmanthus virgatus Stylosanthes hamata* and *S guianensis* CIAT 184 were available in large amounts (>100 kg per species) in Thailand and sufficient to supply the needs within the country and the needs of other FSP countries Thailand produced less of *B brizantha* 'Marandu 6780, *B brizantha* Karanga' 16835, and *B brizantha* Serengeti' 6387, but nevertheless enough to meet the demands In P R China, seed production diversified to the point that now large amounts of *Brachiaria decumbens, Melinis minutiflora, S guianensis* CIAT 184 *S guianensis* Black seed' *Leucaena leucocephala* CATAS 1 and *Macroptilium atropurpureum* are produced Import and export regulations of the different member countries have been documented, which contributed to clarity of the procedures to follow for all parties concerned and resulted in reduced time needed to import seeds

During the international FSP workshops in Thailand in 1996 and the annual planning meeting in Indonesia in 2001 methods of improving availability of forage seeds and planting materials in rural areas were discussed Although seeds are an effective way to plant large areas of forages quickly production and distribution of seeds of a wide array of wanted species is still a problem Some of these problems are low seed setting due to climatic constraints short duration of viability without proper storage, and the high level of expertise required for seed production The alternative is production of vegetative planting materials As indicated by step 10 in Figure 2 multiplication systems are a prerequisite for scaling out forage technologies FSP started by stimulating farmer groups to produce planting materials for distribution and sale to other groups Forage multiplication added another dimension to farmers' livelihoods and many groups became experts in producing materials, especially vegetative propagation (Table 12) Seed production remained in the hands of individual expert farmers As farmers gained confidence, more individual farmers started the multiplication business (Table 13) Also in 2002, there was a remarkable increase in the number of groups engaged in seed production

Parallel to the efforts to develop rural multiplication systems systems were established at national level to ensure distribution of seeds and planting materials to other areas and to provide a central place where the whole collection of forage species and accessions could be accessed (Table 14) Such genebanks preserve species that suit the variety of climatic, soil and socio-cultural conditions and agricultural practices within the country

Table 12 Production of seeds and planting materials in 2001

Country	New groups producing planting materials or seeds	New individual farmers producing planting materials or seeds	Total no farmers producing seeds	No of splits produced	Total no of on-farm nurseries for legume seedlings
Vietnam	8	0	13	352,000	0
Indonesia	14	6	29	1 100 000	5
Thailand	2	0	66	na	3
P R China	3	0	16	25 000	21
Philippines	17	37	4	30 000	10
Lao PDR	10	0	0	na	0
Total	54	43	128	1 507,000	39

Table 13 Production of seeds and planting materials in 2002

Country	New groups producing planting materials			New individual farmers producing planting materials			Quantity of splits and cuttings	New on-farm nurseries for legumes and trees
	Veg[1]	Seeds	V + S[2]	Veg[1]	Seeds	V + S[2]		
Vietnam	5	65	40	3	3	10	10 000 000	1
Indonesia	11	28	0	0	0	0	1 400 000	3
Thailand	0	0	21	0	0	0	0	0
P R China	5	0	0	45	20	0	50 000	12
Philippines	31	36	21	211	37	16	136 sacks 81 000 splits	13
Total	52	129	82	259	60	26		29

[1]Veg = Production of vegetative planting materials [2]V + S = Vegetative and seeds

Table 14 Forage multiplication systems established at national level

Country	Place
Philippines	Leyte State University, Leyte
Indonesia	Dinas Peternakan Samarinda East Kalimantan
Vietnam	National Institute of Animal Husbandry, Hanoi
P R China	Chinese Academy of Tropical Agriculture, Danzhou Hainan
Thailand	Animal Nutrition Research Centre Pakchong Nakorn Ratchasima
Lao PDR	Livestock Research Centre NAFRI Namsuang

Output 4 Capability in 'Developing Member Countries' for developing and disseminating forage technologies using farmer participatory approach (FPA) strengthened

Performance targets More personnel skilled in forage science and effective FPA techniques for technology development and dissemination in six participating countries by 2002

Many training activities have been conducted towards capacity building of project staff and their partners in P R China Indonesia Lao PDR Philippines, Thailand and Vietnam Training activities were either technical or methodological in nature or a combination of the two An example of a technical course is the course on Forage growing and animal production held in September 2001 in Hainan, P R China An example of a methodological course is the course on Participatory Diagnosis held in January 2001 in Lao PDR An example of where both technical and methodological issues were combined in one course is the course on 'Development of forage technologies with farmers held in June 2001 Samarinda, Indonesia Table 15 provides an overview of the number of courses held in each country, the level of project staff trained, and the topics taught This table summarises detailed information reported in the 6-monthly progress reports

Key staff were sent for international courses to improve English proficiency and skills and knowledge on participatory research methods (Table 16)

Table 15 Capacity building on technical and methodological topics

Type of training	Year	Project staff trained	Farmers trained	Training topics
Forage science and related technologies	2000	3	653	Forage management animal nutrition livestock management legume trees forage utilisation milk production and processing forage technologies forage production body weight monitoring agronomy fodder tree nursery management goat raising animal health duck raising utilisation of fodder trees seed production cattle fattening integrated farming system conservation farming
	2001	44	1 805	
	2002	87	2 464	
Participatory research approaches	2000	32	0	Participatory diagnosis, participatory development and gender analysis, dissemination of forage technologies participatory monitoring and evaluation participatory extension participatory tools data recording and analysis
	2001	57	35	
	2002	45	40	
Combination of science and participatory approaches in one course	2000	120	0	Developing forage technologies with farmers
	2001	100	13	
	2002	33	4	
Total 3 years		521	5 014	

Table 16 International training courses

Title of workshop	Organising Institute, Place and duration	Number and type of project staff trained
English language course	IRRI Vientiane Lao PDR 6 weeks 2000	1 provincial officer from Vietnam
English language course	IRRI Vientiane Lao PDR 2 Jul – 10 Aug 2001	2 field technicians from Thailand and Indonesia
International course on participatory research and development	UPWARD/CIP Los Baños Philippines 24 Sept - 12 Oct -2001	1 scientists from Vietnam 2 scientists from Philippines 1 Municipal Officer from Philippines
International course on participatory research and development	UPWARD/CIP Calamba Philippines 4 – 22 Mar 2002	1 scientists from P R China 1 City Officer from Philippines

Output 5 Network for sharing information among NARSs and in the region continued based on the Southeast Asia Feed Resources Research and Development (SEAFRAD) newsletter

Performance targets

- Effective information network in six participating countries through SEAFRAD Newsletter by 2002
- Results publicized widely in the region by 2002

The SEAFRAD network has used several mechanisms to share information and publicise research results

- International annual planning meetings
- Other international workshops
- SEAFRAD newsletters
- FSP web site and CD
- Publication of books, reports papers proceedings popular articles and radio broadcasting

SEAFRAD newsletters

The following SEAFRAD newsletters were published

- Issue 10 May 2000 produced and edited by Le Hoa Binh, Vietnam
- Issue 11, July 2001, produced and edited by Chaisang Phaikaew, Thailand
- Issue 12, April 2002 produced and edited by Chaisang Phaikaew,
- Issue 13, December 2002, produced and edited by Yi Kexian P R China

Web site

A web site was developed sharing the latest news ands developments of the project Most relevant publications were made available in easily downloadable and printable electronic files It is accessible at www.ciat-asia.org/02-FSP/fsp.htm A CD with the web contents and printable files was produced and widely distributed Part of the site has now been updated by the new ADB project 'Improving Livelihoods of Upland Farmers Using Participatory Approaches to Develop More Efficient Livestock Systems and can be accessed via the new CIAT in Asia website http //www ciat cgiar org/asia

International workshops

Table 17 International workshops organised by FSP phase II

Title of workshop	Organising Institute Place and time	Number of FSP participants and countries
Inception meeting of CIAT/ADB project	CIAT Los Baños Philippines 17-18 Feb 2000	18 Indonesia Lao PDR Philippines Thailand Vietnam Australia
Analysing Gender and Interest Groups in Agricultural and Natural Resources Management Research	CIAT/ UPWARD/ PRGA Hanoi 20 – 25 March 2000	31 Indonesia Lao PDR Philippines Thailand Vietnam
Monitoring and evaluation of forage projects in SE Asia	CIAT Cagayan de Oro Philippines 14-18 Aug 2000	24 presenters researchers and field techicians from Indonesia Lao P D R Philippines P R China Thailand and Vietnam
Annual Regional Planning Meeting of the Forages for Smallholders Project – Phase II	FSP - Dinas Peternakan Samarinda Indonesia 15 19 Jan 2001	39 Indonesia, Lao P D R Philippines P R China Thailand and Vietnam
Forage Demand and Adoption by Smallholder Livestock Keepers	ILRI Addis Ababa Ethiopia 18-20 June 2001	3 Philippines Indonesia Thailand
Seventh Meeting of the Working Group on Grazing and Feed Resources for S E Asia	FAO Manado Indonesia 3-7 July 2001	2 Indonesia Thailand
Annual Regional Program Meeting of the Forages for Smallholders Project	FSP NAFRI Luang Prabang Lao PDR 28 Jan – 2 Feb 2002	42 Indonesia Lao PDR Philippines P R China Thailand Vietnam and Colombia
Inception Meeting Improving Livelihoods of Upland Farmers Using Participatory Approaches to Develop More Efficient Livestock Systems	FSP – CATAS Danzhou P R China 26 31 Jan 2003	43 Indonesia Lao PDR Philippines P R China Thailand and Vietnam

Publications

A total of 7 books 8 reports 7 papers, 7 proceedings, 4 popular articles were published along with 2 radio interviews in Indonesia and 4 in the Philippines (Appendix 5)

The third booklet in the CIAT in Asia Research for Development Series (CARDS) "Developing agricultural solutions with smallholder farmers - how to get started with participatory approaches" (Horne and Stur 2003) has been published in English and will be published in Chinese, Indonesian Thai, Lao Vietnamese, Khmer and Burmese All the translations have been completed and the process of layout and checking is well advanced with some booklets delivered to the printers already

The first two booklets in this series Developing forage technologies with smallholder farmers – how to select the best varieties to offer farmers in Southeast Asia (Horne and Stur 1999) and "Developing forage technologies with smallholder farmers - How to grow, manage and

use forages" (Stur and Horne, 2002), where published in Chinese, Indonesian, Thai Lao,and Vietnamese and have been translated into Khmer and Burmese for publication in the near future once layout and checking are completed

Evaluation of terms of reference for the Technical Assistance and financial inputs

The background, rationale objectives and scope for the project were clearly formulated in the Proposed Technical Assistance for the Fourth Agriculture and Natural Resources Research at CGIAR Centres TAR RES 33120 (ADB, 1999) Implementation arrangements were largely followed as described in the document While implementing agencies in the six DMC did not change, there was some turn over in contact persons, new people took over these positions in Indonesia, Lao PDR, and China The first CIAT project coordinator, Dr Peter Kerridge was transferred from the Philippines to Lao PDR in 2000, and the resource specialist Dr Ralph Roothaert took over the leadership of the project from the start of 2001 Dr Kerridge continued to have an input in the project within his capacity as coordinator for CIAT in Asia, until Dr Rod Lefroy took over from him in late 2002 An extension to the project of 6 months was granted by ADB from January through June 2003 Within this period Dr Roothaert moved from the Philippines to Ethiopia and Dr Werner Stur led the project to its completion on 30th June 2003

International annual planning workshops were organised at the beginning of each of the three years of the project During these workshops progress was reviewed experiences and lessons learned exchanged, and workplans made for each individual country, and for focus sites within each country for the next year Annual contracts were drawn up based on these workplans, and they were backed up by the Memoranda of Agreement letters which had been signed with each implementing agency at the onset of the project This system was instrumental in the smooth running of the project Reporting was done on quarterly, six-monthly and yearly basis to ADB The quarterly reporting presented problems for the project leader, as it was difficult to obtain all of the country reports and not always possible to report progress in such a short period

Due to the extraordinary strain on human resources in the Lao PDR the project was not able to deliver on its workplan and overall country objectives As a result no contract was signed in 2002 for the project in Lao and no financial research support was used At the same time though the AusAID-funded project FLSP continued to operate in Lao and continued the forage research that FSP had started in different provinces of the country Strong links were maintained with FSP throughout the project duration facilitated by the CIAT management of FLSP

In the third year, adjustments were made to the Cost estimates and financial plan as published in the project proposal (ADB, 1999, see also App 6) US$90,000 for contingencies were transferred to A2 Resource specialist (US$30 000) and to C1 Research support (60 000), these budget lines had been underestimated at the start At the end of 2002 surpluses remained for B International and local travel C3 Supplies and communications, D Training and human resources, and E2 3 Networking and publications (Appendices 7) The strength of the US dollar during most of the project duration contributed to the savings on international and local travel Costs for communication and networking were greatly reduced after all project scientists and collaborators were provided with email facilities and after launching of the FSP web site on the internet where many of its publications were downloadable Expenses for training and human resources were reduced after effective training of trainers in each country who successfully assumed the responsibility for capacity

building of other national staff and field workers Training within each country by national partners has been much cheaper than international courses A six-month extension, with an associated workplan and amendments to the project budget was approved in early 2003 to utilise the unspent funds

The project has received substantial support from CIAT Headquarters in Cali, Colombia Inputs were provided by scientists from the Tropical Forages Program the CIAT and systemwide programs on participatory research (IPRA and PRGA respectively), and the CIAT management team Two international consultants were employed during the three project, Mr Bob Hill assisted in documenting case studies in Vietnam and the Philippines, and Mr Roel Bosma implemented impact studies with partners in Indonesia Philippines and Vietnam In addition Mr John Connell and Mr Jim Holmes were employed as consultants during the 6-month extension to document and photograph case studies Publications derived from these consultancies have been instrumental for public relations and dissemination The time allocation for consultants was found a bit tight An estimated 250 - 300 scientists lecturers development officers and field staff employed by NARS from six countries have contributed to the success of the project (see also Appendix 3) Expenses for research support travel, equipment and training have been effectively matched in all participating countries

References cited

Asian Development Bank 1999 Proposed Technical Assistance for the Fourth Agriculture and Natural Resources Research at CGIAR Centres Manila Philippines

Bosma R H , Roothaert , R L Ibrahim 2001 Economic and social benefits of new forage technologies in East Kalimantan Indonesia CIAT Working Document No 190 Centro Internacional de Agricultura Tropical Cali pp 65

Bosma R H Roothaert R L Asis, P Saguinhon J Binh, L H Yen, V H 2003 Economic and social benefits of new forage technologies in Mindanao Philippines and Tuyen Quang Vietnam CIAT Working Document No 191 Centro Internacional de Agricultura Tropical, Los Baños, Philippines pp 92

Horne, P M Stur, W W , 1999 Developing forage technologies with farmers - how to select the best variety to offer farmers in Southeast Asia ACIAR Monograph No 62 ACIAR Canberra, pp 80

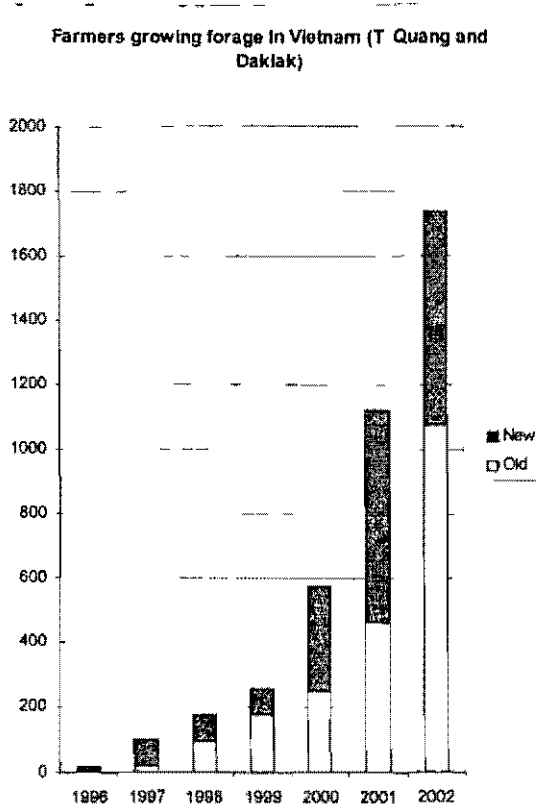
Horne P M , Magboo, E Kerridge P C Tuhulele M , Pimphachanhvongsod V , Gabunada Jr , F Le Hoa Binh and Stur W W 2000 Participatory Approaches to Forage Technology Development with Smallholders in Southeast Asia In P M H W W Stur J B Hacker and P C Kerridge (ed) Working with farmers the key to adoption of forage technologies Australian Centre for International Agricultural Research Canberra pp 23-31

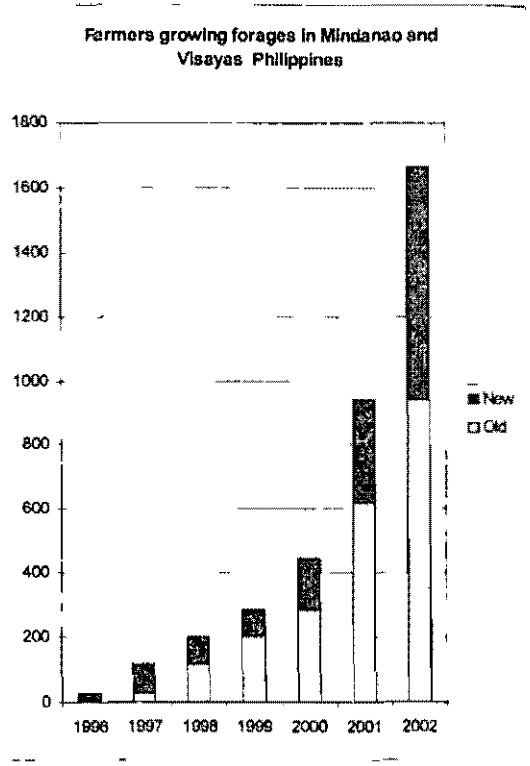
Roothaert R L and Phengsavanh, P 2001 Assessing the use of indigenous fodder trees in Laos Annual Report 2001 Project PE-5 Sustainable Systems for Smallholders Integrating Improved Germplasm and Resource Management for Enhanced Crop and Livestock Production Systems Cali Centro Internacional de Agricultura Tropical 88-95

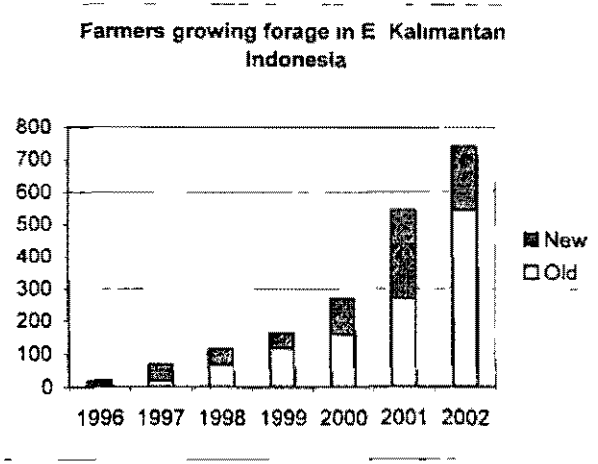
Roothaert R Kaaria S in press Issues and strategies for going to scale A case study of the forages for smallholders project in the Philippines In D Pachico (ed) Scaling up and out Achieving widespread impact through agricultural research Centro Internacional de Agricultura Tropical, Cali Colombia

Roothaert, R Kerridge, P , in press Adoption and scaling out - strategies and experiences of the forages for smallholders project In C Conroy (ed) Participatory Livestock Research A Guide ITDG

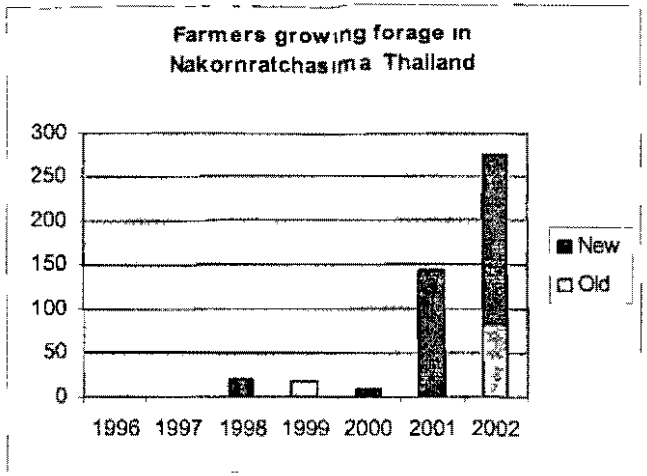
Appendix 1 Increase in number of farmers growing forages per year in FSP phase I (1995-1999) and phase II (2000-2002)

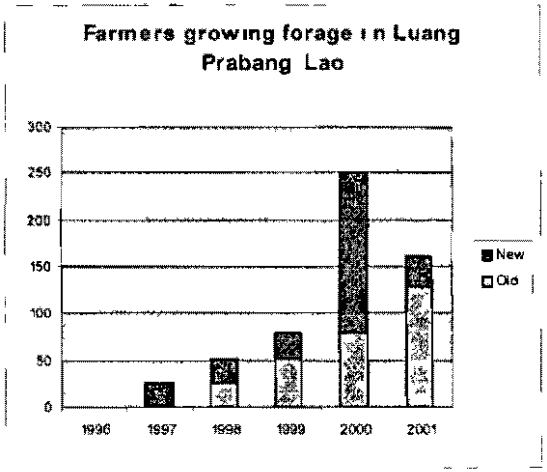


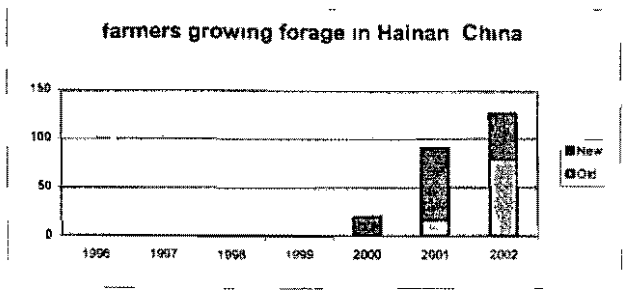




Remark In 2001 Cebu and Leyte provinces (Visayas Philippines) were included in the project There had already been 265 farmers growing forages in these provinces which are included in the value for old'


Farmers growing forage in Nakornratchasima Thailand
300
250
200
150
100
50
0
1996 1997 1998 1999 2000 2001 2002
New
Old


Farmers growing forage in Luang Prabang Lao
300
250
200
150
100
50
0
1996 1997 1998 1999 2000 2001
New
Old


farmers growing forage in Hainan China
150
100
50
0
1996 1997 1998 1999 2000 2001 2002
New
Old

Appendix 2 International travel of project staff

Dates (2000)	Traveller	Countries visited
13 – 19 Aug	R Roothaert	Philippines
28 Aug - 1 Sep	R Roothaert	Vietnam
9 – 15 Sep	R Roothaert	China
15 Oct – 1 Nov	R Roothaert	Lao PDR
20-28 July	P Kerridge	Lao PDR Thailand
13 - 19 Aug	P Kerridge	Philippines
26 Aug -1 Sep	P Kerridge	Vietnam
9 – 17 Sep	P Kerridge	China
24 Oct - 6 Nov	P Kerridge	Indonesia Philippines
12-17 Nov	P Kerridge	Lao PDR

Dates (2001)	Traveller	Countries visited	Purpose
11 – 21 Jan	All FSP national coordinators and selected field workers	Indonesia	FSP Annual Program Meeting
18 – 26 Feb	R Roothaert F Gabunada	P R China	Technician s training
4 – 14 March	R Roothaert	Lao PDR	Field study
1 – 9 April	R Roothaert F Gabunada	Thailand	Field study and facilitation
15 – 25 June	R Roothaert Ibrahim C Phaikaew	Ethiopia	ILRI workshop
27 – 28 June	P Kerridge Bounthong	Philippines	Research priority setting meeting
3 – 7 July	Ibrahim C Phaikaew	Indonesia	FAO workshop Manado Sulawesi
7 – 15 July	R Roothaert	Indonesia	Preparation of study
16 – 26 Sep	R Roothaert J Samson	Vietnam	Course on monitoring and evaluation
21 Nov – 16 Dec	R Roothaert	Colombia	CIAT Annual meeting

Dates (2002)	Traveller	Countries visited	Purpose
26 Jan – 5 Feb	FSP delegates from all member countries	Lao PDR	Third annual planning meeting of FSP
11 14 March	R Roothaert	Thailand	Regional livestock research priority setting workshop FAO ILRI
18 23 March	R Roothaert J Samson	Mindanao Philippines	Finalise workplans and review research process
3 - 12 April	R Roothaert N Johnson	Lao PDR Vietnam	To plan monitoring and evaluation systems and to prepare socio economic study
9 – 15 April	J Samson	Indonesia	To conduct a workshop on Participatory Monitoring and Evaluation
14 – 18 April	P Kerridge	Philippines	To assist in writing new ADB proposal
2 – 7 June	R Roothaert	Lao PDR Vietnam	To attend CIAT regional meeting in Lao and visit field sites in Vietnam
8 19 July	R Roothaert J Samson	Hainan P R China	To conduct a workshop on Participatory Monitoring and Evaluation
6 – 10 Aug	R Roothaert S Kaaria R Delve	Philippines	To conduct field study on information flows
19 – 24 Aug	P Kerridge	Vietnam	To evaluate and facilitate on going research at Tuyen Quang and Daklak
6 – 10 Oct	R Roothaert R Lefroy	Cambodia	To discuss with NARS implementation of new RETA proposal

Dates (2003) (Project Extension)	Traveller	Countries visited	Purpose
12 – 18 May	J Connell J Holmes	Lao PDR	Visit field sites to document and photograph case studies
25 May – 1 June	J Connell J Holmes	Philippines	Visit field sites to document and photograph case studies
2 – 10 June	J Connell J Holmes	Indonesia	Visit field sites to document and photograph case studies
15 – 22 June	J Connell J Holmes	Vietnam	Visit field sites to document and photograph case studies
24 – 27 June	J Connell J Holmes	Lao PRD	Visit field sites to document and photograph case studies

Appendix 3 Human resources

FSP co-ordinators and counterparts

Dr Ralph Roothaert Project Leader FSP Los Baños Philippines
Dr Werner Stur Resource Specialist for the project extension Brisbane Australia
Dr Peter Kerridge Coordinator CIAT – Asia Vientiane, Lao PDR (up to October 2002)
Dr Rod Lefroy Coordinator CIAT – Asia, Vientiane Lao PDR (from October 2002)
Mr Eduedo Magboo FSP Coordinator Philippines Los Baños
Mr Viengsavanh Phimphachanhvongsod, FSP Coordinator, Laos PDR, Vientiane
Mrs Chaisang Phaikaew FSP Coordinator Thailand Bangkok
Mr Le Hoa Binh FSP Coordinator Vietnam, Hanoi
Ir Ibrahim FSP Coordinator Indonesia, Samarinda
Assoc Prof Yi Kexian, FSP Coordinator P R China, Hainan
Mr Truong Tan Khanh Daklak Vietnam
Mr Willie Nacalaban Malitbog Philippines
Dr Perla Asis, Cagayan de Oro Philippines
Mrs J Saguinhon Malitbog Philippines
Mrs Ganda Nakamanee, Pakchong Thailand
Mr Francisco Gabunada Leyte Philippines
Mrs Elsie Gabonada Impasugong Philippines
Mrs Jindra Samson, Research Assistant, Philippines
Mrs Vu Hai Yen Tuyen Quang Vietnam
Mr Leonardo Moneva Cebu Philippines

Appendix 4 Addresses of country offices

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Appendix 5 List of project publications, 2000-2003

Books

Bosma, R H , Roothaert, R L Asis P , Saguinhon J , Binh, L H and Yen, V H 2003 Economic and social benefits of new forage technologies in Mindanao, Philippines and Tuyen Quang, Vietnam CIAT Working Document No 191 Centro Internacional de Agricultura Tropical Los Baños Philippines pp 92

Horne P M , Stur, W W , 2003 Developing agricultural solutions with smallholder farmers - how to get started with participatory approaches ACIAR Monograph No 99 ACIAR Canberra pp 120 Published in English and being translated into Chinese, Indonesian Thai Lao, Vietnamese Khmer and Burmese

Roothaert R Karanja G M Kariuki I , Paterson, R Tuwei, P Kiruiro E Mugwe, J and Franzel S , 2002 Calliandra for livestock 2nd edition Technical Bulletin No 1

Stur W W Horne P M 2002 Developing forage technologies with smallholder farmers - How to grow manage and use forages ACIAR Monograph No 88 ACIAR Canberra pp 94 Published in English Chinese Indonesian, Thai Lao and Vietnamese, and being translated into Khmer and Burmese

Bosma R H , Roothaert R L and Ibrahim 2001 Economic and social benefits of new forage technologies in East Kalimantan Indonesia CIAT Working Document No 190 Centro Internacional de Agricultura Tropical Cali Colombia

Cramb R , Purcell T 2001 How to Monitor and Evaluate Impacts of Participatory Research Projects A Case Study of the Forages for Smallholders Project *CIAT Working Document No 185*, Centro Internacional de Agricultura Tropical Cali, pp 55

Horne P M and Stur W W 1999 Developing forage technologies with smallholder farmers – how to select the best varieties to offer farmers in Southeast Asia ACIAR Monograph No 62 Australia 80 pp
Published in English Chinese Indonesian, Thai Lao and Vietnamese and being translated into Khmer and Burmese

Progress reports

Roothaert R Asis P Binh L H Bosma R Gabonada E Gabunada F Ibrahim Kerridge P Kexian, Y Khanh, T T , Magboo E , Moneva L , Nakamanee, G Phaikaew C Saguinhon J , Samson, J Yen, V H , 2002 RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia Forages for Smallholders Project Six-Monthly Report, 1 July - 31 December 2002 CIAT Los Banos Philippines pp 57

Roothaert R , Asis, P , Binh, L H , Bosma, R , Gabonada, E , Gabunada, F , Ibrahim, Kerridge, P Kexian Y , Khanh, T T , Magboo E , Moneva L Nakamanee G , Phaikaew, C , J Saguinhon, J , Samson, J , Yen, V H 2002 RETA 5866 Fourth Agriculture and Natural Resource Research at CGIAR Centres Developing Sustainable Forage Technologies for Resource Poor Upland Farmers in Asia - Six monthly report 1 January - 30 June 2002 CIAT, Los Banos Laguna Philippines pp 68

R Roothaert P Asis L H Binh R Bosma, E Gabonada F Gagunada Ibrahim P Kerridge, Y Kexian T T Khanh E Magboo L Moneva G Nakamanee C Phaikaew, V Phimphachanhvongsod J Saguinhon, J Samson and V H Yen 2001 RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia Forages for Smallholders Project Six-monthly report, 1 July – 31 December 2001, 38 pp

R Roothaert C Phaikaew J Samson P Kerridge E Magboo L H Binh, P Phengsavanh Y Kexian Ibrahim T T Khanh, P Asis W Nacalaban J Saguinhon G Nakamanee 2001 RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia Forages for Smallholders Project, Six-monthly report, 1 January – 30 June 2001 37 pp

R Roothaert P Kerridge, J Samson E Magboo L H Binh C Phaikaew P Phengsavanh Y Kexian Ibrahim T T Khanh P Asis W Nacalaban J Saguinhon G Nakamanee and A Schermesser 2000 RETA 5866 Fourth Agriculture and Natural Resources Research at CGIAR Centers Developing Sustainable Forage Technologies for Resource-Poor Upland Farmers in Asia Forages for Smallholders Project Six-monthly report 1 July – 31 December 2000, 31 pp

Developing Sustainable Forage Technologies for Resource-Poor Upland farmers in Asia Six-Monthly Report, 1 January – 31 July 2000 Forages for Smallholders Project 15 pp

Papers

Roothaert, R , Kerridge P , in press Adoption and scaling out - strategies and experiences of the forages for smallholders project In C Conroy (ed) Participatory Livestock Research A Guide ITDG

Roothaert, R , Franzel S , Kiura M , 2003 On-farm evaluation of fodder trees and shrubs preferrred by farmers in central Kenya Experimental Agriculture 39

Roothaert, R Kaaria S , in press Issues and strategies for going to scale A case study of the forages for smallholders project in the Philippines In D Pachico (ed) Scaling up and out Achieving widespread impact through agricultural research Centro Internacional de Agricultura Tropical Cali Colombia

Peters M Lascano C E Roothaert R and de Haan N C (in press) Linking research on forage germplasm to farmers - the way to increased adoption A CIAT ILRI and IITA perspective Field Crops Research Special Issue submitted

Stur, W W , Horne P M , Gabunada Jr , F G Phengsavanh P , Kerridge P C , 2002 Forage options for smallholder crop-animal systems in Southeast Asia Working with farmers to find solutions Agricultural Systems 71 75-98

Ralph Roothaert, Peter Horne and Werner Stur 2001 Integrating forage technologies on smallholder farms in the upland tropics Paper presented at the International Workshop "Forage Demand and Adoption by Smallholder Livestock Keepers" June 18-20 Addis Ababa Ethiopia

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

Proceedings

Roothaert, R L , Kerridge, P C , 2002 Adoption strategies for forages - experiences of the Forages for Smallholders Project In A S Frio, Gray, G D (ed) Research and Development Strategies for the Livestock Sector in South East Asia through National and International Partnerships Proceedings of a workshop held in Bangkok, 11-15 March 2002 ILRI, Nairobi Kenya pp 140-152

Jindra Nuella Genio-Samson and Ralph Roothaert (in press) Emerging Integrated Forage Technologies and their Benefits to Farmers The Forages for Smallholders Project Experience Paper presented during the Cordillera Agroforestry Innovations Conference in Benguet State University, Benguet Province Nov 24-26 2002

Stur, W W Ed 2002 Proceedings of the Third Regional Meeting of the Forages for Smallholders Project held at the Agency for Livestock Services of East Kalimantan, Indonesia CIAT Working Document 188 Los Baños 219 pp

Ralph L Roothaert and Jindra Samson 2001 Management of forage crops for smallholders in S E Asia and its possible implications on the quality of farm land Paper presented at the Asian Agriculture Congress 24 – 27 April 2001, Manila Philippines

R L Roothaert and J N Samson Eds 2001 Proceedings of the Annual Regional Program Meeting of the Forages for Smallholders Project, Scaling up of participatory forage technology development', Samarinda East Kalimantan Indonesia, 15 – 19 January 2001, CIAT, Los Baños

Horne, P M Stur W W Hacker, J and Kerridge, P C (Eds) 2000 Working with farmers the key to adoption of forage technologies Australian Centre for International Agricultural Research Canberra pp 325

Roothaert R L 2000 Proceedings of the Inception Meeting of CIAT/ADB Project "Development of Sustainable Technologies for Resource-Poor Upland Farmers in Asia" 17-18 February 2000 Los Baños Philippines CIAT Los Baños Philippines

News articles

Nourishing the Dairy Industry, Manila Times 15 Oct 2002

Participatory research makes the difference, Nation Today 14 Oct 2002

Hill B , Roothaert R , When farmers are the scientists ADB Review, March-April 2002 12-14 (2002)

Ralph Roothaert 2000 Forages for Smallholders in Asia CIAT Project begins new Phase UPWARD Fieldnotes Vol 9(2) p 9

Theses

Genio-Samson, J N 2002 Participatory Interactive Research on the Evaluation of Soil Conservation Options in San Migara Malitbog, Bukidnon, Philippines MSc-University of the Philippines Los Banos Los Banos

Other publications

Improving livelihoods of upland farmers History of Centro Internacional de Agricultura Tropical (CIAT) in the Philippines 10 pages report in a special publication of the Bureau of Agriculture Philippines, at the occasion of the Philippine Day during the AGM of CGIAR 2002

Roothaert R (Editor) CIAT in Asia 2002 CD

Forages for Smallholders Project 2001 Internet web pages www ciat-asia org/02-FSP/fsp htm

Two radio interviews with project staff were recorded and broadcast in East Kalimantan Indonesia reaching farmers in all rural areas, 2000

An interview recorded with the FSP coordinator in the Philippines Mr Eduedo Mabgoo was broadcast on four radio shows "Paksang PCARRD' (DZRM - 1278kHz), hosted by Ms Susan P Layos, on May 22, 2001, "Mga Paksa Mula sa PCARRD" (DZRB - 738 kHz), hosted by Ms Melly C Tenorio on May 26 2001, "Action Tulong" (DWAN - 1206kHz), hosted by Ms Divine Reyes on January 19 2002, Kabalikat sa Pagsasaka (DWSS - 1497kHz), hosted by Ms Divine Reyes on January 20 2002

Appendix 6 Original cost estimates (US$ '000)

Item	Bank	CIAT	NARSs	Total
Research Personnel				
International				
CIAT Project Coordinator (18 pm)	-	195	-	195
Resource Specialists (36 pm)	170	-	-	170
Short-term Resource Experts (6 p-m)	60	-	-	60
Local				
NARSs Personnel (1,152 p-m)	-	-	576	576
Project Support Staff (72 p-m)	39	-	-	39
International and Local Travel				
International	90	30	-	120
Local	48	-	74	122
Research Work Equipment and Materials				
Research Support	220	-	240	460
Equipment (computers peripherals)	25	20	40	85
Supplies/Communications	43	15	90	148
Training and Human Resources Development				
Training and Exchange Visits	162	-	60	222
Dissemination of Results Networking Technical Support (Workshops Reports, Coordination)				
Workshops	60	-	-	60
Networking	18	-	-	18
Reports and Publications	30	-	-	30
Technical Support	-	120	-	120
Administrative Support	145	-	-	145
Contingencies	90	-	-	90
Total	1,200	380	1 080	2,660

Appendix 7 Financial Statement (January 2000 – June 2003)

CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL - CIAT
Developing Sustainable Forage Technologies for Resource - Poor Upland Farmers in Asia
Funded by Asian Development Bank RETA 5866
In U S Dollars

Grant Period 20 January 2000 to 30 June 2003
Grant Amount US$ 1 200 000

	Code	Approved Budget 10-Mar-03 (US$)	Total Expenditure 2000-2003 (US$)	Proposed Reallocation (US$)	Balance
A Research Personnel					
International					
Resource Specialist	A 2	213 962	225 717	11 755	-
Short-term Resource Experts	A 3	96 591	92 266	-4 325	-
Local					
Project Support Staff	A 5	40 094	40 094		-
Sub-total Personnel		**350,647**	**358,077**	**7,430**	-
B Travel					
International	B 1	70 367	70 368	1	-
Local	B 2	30 207	30 207	0	-
Sub-total Travel		**100,574**	**100,575**	**1**	-
C Research & Materials					
Research Support	C 1	289 310	288 446	-864	
Equipment	C 2	34 818	35 502	684	-
Supplies/Communications	C 3	24 147	24 147	0	-
Sub-total Res & Materials		**348,275**	**348,095**	**-180**	-
D Training & HRD	D 1	**92,068**	**92,068**	**0**	-
E Dissemination, networking					
Workshops	E 1	61 936	61 936	0	-
Networking	E 2	6 237	6 237	0	-
Reports & Publications	E 3	97 709	88 229	-9 480	-
Sub total Dissemination		**165,882**	**156,402**	**-9,480**	-
F Administrative Support	F 1	**142,554**	**144,783**	**2,229**	-
G Contingencies	G 1	0	0	0	-