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





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# Forages for Smallholders Project Phase - II

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Cover photo (P. Asis): harvesting of planting material of Setaria sphacelata.

# 1. Project background.

The project "RETA 5866: Fourth Agriculture and Natural Resources Research at CGAIR Centers: Developing Sustainable Forage Technologies for Resource - Poor Upland Farmers in Asia", in short called "Forages for Smallholders Project Phase (FSP) – Phase II", started in January 2000. It is funded by the Asian Development Bank for a period of three years. The goal of the project is: "to improve the livelihood of upland farmers by enhancing available feed sources to increase livestock production and strategic use of grasses and legumes to conserve soil and to enhance nutrient management (Asian Development Bank, 1999). The participating countries are China, Indonesia, Lao PDR, Philippines, Thailand and Vietnam.

### 1.1 Objectives and outputs

The objectives of the project are to:

- Develop sustainable forage technologies for resource-poor farmers in upland farming systems in Asia.
- Strengthen the capacity of National Agricultural Research Systems in the Bank's Developing Member Countries to develop and deliver these technologies to farmers.

The project has five outputs:

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

FSP – phase II is 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 are:

China	Tropical Pasture Research Centre (CATAS), Hainan
Indonesia	Dinas Peternakan, Samarinda and Directorate General of Livestock
	Services (DGLS), Jakarta
Lao PDR	Livestock and Fisheries, NAFRI, Vientiane

Philippines	Philippine Council for Agriculture, Forestry and Natural Resources				
	Research and Development (PCARRD), Los Baños, and Department of				
	Agriculture, Region 10				
Thailand	Department of Livestock Development, Ministry of Livestock				
	Development, Bangkok				
Vietnam	National Institute of Animal Husbandry (NIAH), Ministry of Agriculture				
	and Forestry, Hanoi				

The project operates in 12 focus sites (table 1), which had been originally developed in the FSP – phase I, funded by AusAID.

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

#### Table 1. Focus sites in phase II of FSP and their dominant farming system

# 2. Adoption of forage technologies by farmers

#### 2.1 Philippines

'Forage technology' has been defined as a forage species managed in a particular manner by farmers. There are more than 30 species and accessions of forages currently being adopted by farmers in the focus district. Species are managed in different ways, depending on the farming system and the individual farmer's practice.

		Fo	orage Sy	/stem <sup>1</sup>			Total frequency of technologies
Forage Species	CH	IC&C	E/M	GP	LF	GC	
Andropogon gayanus	3	5	6				14
Arachis pintoi CIAT 22160	2	14	18	3	1	8	46
Brachiaria brizantha	1	5	3				9
Brachiaria decumbens CIAT	2	13	9	1			25
606							
Brachiaria dictyoneura		4	3				7
Brachiaria ruziziensis	4	13	10	1			28
Calliandra calothyrsus	1				1		2
Centrosema macrocarpum		1					1
Centrosema pubescens			4	6			10
Desmodium rensonii	1		2				3
Flemingia macrophylla		1	3		3		7
Gliricidia sepium prov.	2	1			8		11
Retalhuleu							
Leucaena leucocephala K636	3	1	2		4		10
Panicum maximum CIAT 6299	6	24	11				41
Panicum maximum TD 58	47	16	4				67
Paspalum atratum	3	5					8
Paspalum atratum BRA 961	56	18	12		1		87
Pennisetum purpureum	56	39	22		2		119
Setaria sphacelata var.	76	34	11				121
splendida							
Setaria sphacelata - Nandi		1					1
Stylosanthes guianensis CIAT	1	7	11				19
184							
TOTAL	264	202	131	11	20	8	636

Table 2. Number of farmers who have adopted forage technologies in Malitbog, Philippines, recorded in December 2000.

<sup>1</sup>Forage systems:

CH - Contour Hedgerow

IC&C - Intensive Cut & Carry

E/M - Evaluation/Multiplication

GP - Grazed Plots LF - Living Fences

GC - Ground Cover

In Malitbog, the Philippines, an inventory was made of forage species and practices on 163 different farms. Table 2 shows that growing forages on contour hedgerows is the most common method. 'Cut-and-carry' of intensively managed plots is the second most common method. Considering that the forages on contour hedgerows are also mostly harvested by the 'cut-and-carry' method, this practice is much more common than grazing. Table 3 shows that *Panicum maximum* TD 58, *Paspalum atratum* BRA 961, *Pennisetum purpureum*, and *Setaria sphacelata* are the most commonly planted forage species among new farmers. *Setaria sphacelata* and *Paspalum atratum* BRA 961 are the species most often expanded within the farm, after the first planting.

	Adoption Classification					
Forage Species	New	Stopped	Expanded	Decreased	Maintained	
Andropogon gayanus		3	1		10	
Arachis pintoi CIAT 22160	3	3	9		31	
Brachiaria brizantha					9	
Brachiaria decumbens CIAT 606	2		5		18	
Brachiaria dictyoneura			1		6	
Brachiaria ruziziensis	6	1	5		16	
Calliandra calothyrsus					2	
Centrosema macrocarpum					1	
Centrosema pubescens			1		9	
Desmodium rensonii					3	
Flemingia macrophylla		1			7	
Gliricidia sepium prov. Retalhuleu		1			10	
Leucaena leucocephala K636		1			8	
Panicum maximum CIAT 6299	2		8		32	
Panicum maximum TD 58	42		4		21	
Paspalum atratum	1		4		3	
Paspalum atratum BRA 961	47		7		33	
Pennisetum purpureum	44	3	1		67	
Setaria sphacelata var. splendida	68	1	11	1	42	
Setaria sphacelata - Nandi					1	
Stylosanthes guianensis CIAT 184			1		18	
TOTAL	216	14	58	1	347	

 Table 3.
 Number of farmers adopting forage species in Malitbog, Philippines, recorded December 2000.

#### 2.2 Thailand

At Sung Nuen District, Nakornratchasima Province, from the 20 farmers who evaluated new *Brachiaria sp.* since 1999, there were 4 farmers who wanted to expand the area planted with these new species. Additionally this year, there were 9 new dairy farmers who want to evaluate new *Brachiaria sp.* for 'cut-and-carry' in dairy farming systems. Farmers were given seeds of *Brachiaria brizantha* CIAT 16835, 6387, 6780 and *Paspalum atratum.* Participatory evaluation (PE) was conducted in July, September and December, 2000. Some comments from the PE are shown in Table 4.

Varieties	Positive	Negative
Brachiria ruziziensis	<ul> <li>Easy to establish</li> <li>Fast growth after cutting</li> <li>Cattle like to eat</li> <li>Easy to manage</li> <li>Easy to get seed for establishment</li> <li>Enough to fed animal during rainy season</li> <li>Grazing tolerance</li> </ul>	<ul> <li>Poor growth during dry season</li> </ul>
Brachiaria brizantha CIAT6780	<ul> <li>Cattle like it</li> <li>Drought tolerance</li> <li>Soft</li> <li>Increases milk yield</li> <li>Easy to harvest</li> </ul>	<ul> <li>Impossible to harvest seed for expanding the area</li> <li>Low germination compared to Ruzi grass seed</li> </ul>
Brachiaria brizantha CIAT6387	<ul><li>Cattle like it</li><li>Easy to cut</li></ul>	<ul> <li>Impossible to harvest seed for expanding the area</li> <li>Low germination compared to Ruzi grass seed</li> </ul>
Paspalum atratum	Cattle like it	<ul> <li>Difficult to harvest when mature</li> </ul>
<i>Stylosanthes hamata</i> cv. Verano	<ul> <li>Drought tolerant</li> <li>Grazing tolerant</li> <li>Cattle like it</li> <li>Good regeneration</li> </ul>	
Stylosanthes guianensis CIAT184	<ul><li>Increases milk yield</li><li>Cattle like it</li></ul>	Poor regrowth after cutting
<i>Centrosema</i> <i>pascuorum</i> cv. Cavalcade	Increase fat percentage in milk	<ul><li>Difficult to harvest</li><li>Poor regrowth after cutting</li></ul>

Table 4. Results of participatory evaluation on forage species in Thailand.

#### 2.3 China

In Hainan, problems were defined for forage production by smallholder farmers. On-farm research was started in Baisha, Danzhou and Ledong counties. Twenty farmers from three sites were selected for the participatory evaluation of forage evaluation. In Guangxi, a survey was conducted on natural conditions, population, land-use, agricultural data, organizations, and services. Four communes and 10 farmers were selected for forage evaluation. Shrub legumes seeds of 6 accessions and some other grasses are now being evaluated by farmers. In Sichuan, 5 farmers have started to evaluate15 species of grasses and legumes. Some forage species with cold and poor soil tolerant will be needed. In Fujian, 5 farmers are involved in testing of 10 grass and legume species. In Yunnan, 5 farmers are evaluating 15 grasses and legumes.



Local cattle for beef production in China (Photo: R. Roothaert)

#### 2.4 Vietnam

Types of forages systems being developed in Tuyen Quang and Daklak provinces in Vietnam are listed in Appendices 3 and 4.

# 3. Dissemination of forage technologies to new areas

A total of 45 participatory diagnoses on the demand for forages were carried out in the 6 FSP countries in 2000 (Table 5). Fifty villages, and 1087 farmers participated, resulting in more than 800 new farmers planting improved forages. The average area planted by new farmers is likely to fall between 200 and 400 m<sup>2</sup>. Cut and carry seems to be the most preferred system of forage production for the new farmers. A wide range of species were planted by the new farmers (Table 6).

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Table 5. Participatory diagnoses (PD) conducted with farmers in 2000 and their impact on dissemination of forage technologies

Country	Site	No.of PDs	No. of villages involved in PDs	No. of farmer groups involved in PDs	No. of households participating in PDs	No. of new farmers who planted forages	Range of area planted	Forage management
Indonesia	Pasir	2	2	4	67	40	100 - 2500 m <sup>2</sup>	C&C, grazing, live fence
	Kutai	3	3	5	107	47	100 - 2500 m <sup>2</sup>	C&C, grazing, live fence
	Balikpapan	1	1	2	20	7	100 - 2500 m <sup>2</sup>	C&C, grazing, live fence
	Samarinda	2	2	2	48	17	100 - 2500 m <sup>2</sup>	C&C, grazing, live fence
Philippines	Malitbog	11	11	11	160	68	50 - 3600 m <sup>2</sup>	C&C, grazing, contour strips, live fence, ornamental
	Cagayan de Oro	2	2	2	75	90	2 - 10,000 m <sup>2</sup>	C&C, grazing, contour strips, live fence, ornamental
	Manolo Fortich	2	2	2	80	To be plant	ed next season	
Vietnam	Tuyen Quang	4	4	9	145	205	50 - 400 m <sup>2</sup>	C&C, Cover crop
	Daklak	5	5	12	125	125	100 - 500 m <sup>2</sup>	C&C, Cover crop
China	Hainan	3	3	3	20	20	100 - 300 m <sup>2</sup>	C&C
Thailand	Sung Nuen	2	1		22	10	400 m <sup>2</sup>	C&C
	Seekew	1	3		40	To be plant	ed next season	
	Dankhuntod	1	5		35	To be plant	ed next season	
Lao	Luangphabang	3	3		99	119	100 - 800 m <sup>2</sup>	C&C, hedgerows
	Xiengkhuang	3	3		44	73	100 - 800 m <sup>2</sup>	C&C
Total		45	50	52	1087	821		

Country	Site	Species
Indonesia	Pasir, Kutai, Balikoapan,	A. gayanus, B. humidicola Tully and 6133, B. decumbens Basilisk, P. atratum 9610, S. sphacelata Splendida, P. maximum Mott, S.
	Samarinda	guianensis 184, C. pubescens 15160, G. sepium, C. calothyrsus, L. leucocephala, S. grandiflora
Philippines	Malitbog	A. gayanus, B. decumbens, B. brizantha, B. ruziziensis, P. purpureum, P. atratum 9610, S. sphacelata Splendida, P. maximum 6299, A. pintoi, F. macrophylla, D. cinerea, S. guianensis, C. pubescens, G. sepium, L. leucocephala,
	Cagayan de Oro	B. decumbens, B. brizantha, P. purpureum, P. atratum 9610, S. sphacelata Splendida, P. maximum T58, Tripsacum andersonii, A. pintoi, D. cinerea, S. guianensis, C. pubescens, G. sepium, L. leucocephala, C. calothyrsus, D. virgatus
Vietnam	Tuyen Quang	P. maximum, P. atratum, B. brizantha 6780, S. guianensis 184, Vigna sp.
	Daklak	P. maximum, P. atratum, B. brizantha 6780, S. guianensis 184, A. pintoi, C. macrocarpum, F, congesta, G. sepium, B. ruziziensis, B. decumbens
China	Hainan	P. purpureum King, B. decumbens, B. brizantha, P. maximum, P. atratum, S. guianensis, L. leucocephala, C. argentea, M. atropurpureum
Thailand	Sung Nuen	B. brizantha, S. guianensis, C. pascuorum, S. hamata, B. ruziziensis
Lao	Luangphabang, Xiengkhuang	B. brizantha, B. decumbens, P. maximum, S. guianensis

#### Table 6. Species which were planted by new farmers in 2000



Lunch with farmers following a participatory diagnosis exercise (Photo: L.H. Binh)

#### 3.1 Philippines

At the focus site, Malitbog, Bukidnon Province, a total of ninety-one farmers, in five villages, planted forages (Table 7). Most of these farmers were new collaborators and a few were former collaborators (FSP-I) who expanded planting forages on their farm. In Malitbog, there are now 164 farmers using forages, including farmers that started planting forages in 1995, when FSP-Phase I started. There was a wide range in the area planted to forages. The areas planted ranged from a single row of 50 meters to areas as large as 3,600 m<sup>2</sup>. The project is now working in 6 barangays of Malitbog, Bukidnon.

In Cagayan de Oro City, Misamis Oriental Province, 77 farmers planted forages during the year 2000 (Table 8). Most were new collaborators of the project apart from 15 farmers of Pagalungan, the original site of FSP-Phase 1. The choice of forage species planted per farm varied from 1 to 12 species. The area planted per farm ranged from 2 m<sup>2</sup> to about 10,000 m<sup>2</sup>.

Forage plots were smaller in Malitbog than in Cagayan de Oro. It seems that farmers in Malitbog are still in a stage of evaluating small plots of different species, while in Cagayan de Oro more farmers are now in the stage of expanding and using forages. This might have been influenced by the fact that a significant number of animals were dispersed in Cagayan de Oro from the Livestock Development Program of Philippine Carabao Center, the National Dairy Authority and the local government. Something similar appears to be absent in Malitbog, Budkidnon. The role of livestock dispersal programmes in the expansion of forage fields deserves further investigation. Long term effects of the dairy cattle dispersal programmes also need to be assessed, as the market for fresh milk already seems to have reached saturation.

	No. of farmers involved		No. of species	Range of area planted
Barangay (village)	Year 2000	Cumulative Total <sup>1</sup>	planted per farm	per farm
San Luis	62 (8*)	100	1-12	1 row (50 m) – 3600 m²
Silo-o	(4*)	20	1-9	2 – 300 m <sup>2</sup>
Sta. Inez	(1*)	13	2-13	2 – 500 m <sup>2</sup>
Poblacion	(2*)	2	4-10	6 - 50 m²
Patpat	÷	3	5-12	30 - 1,000 m <sup>2</sup>
Mindaga	22	26	2-5	2 rows (75 m) – 250 m <sup>2</sup>

 Table 7. Dissemination of forage technologies in Malitbog, Bukidnon Province

<sup>1</sup> Cumulative total includes farmer collaborators from FSP (Phase 1).

Note: \*Expanded existing forage areas.

	No. of farmer	s involved	No. of species	Area planted
Barangay (village)	Year 2000	Cumulative Total <sup>1</sup>	planted per farm	per farm
Pagalungan	47 (15*)	57	1-12	2 - 10,000 m <sup>2</sup>
Tagpangi	11	11	1-3	200 - 5,000 m <sup>2</sup>
Indahag	5	5	1-5	100 - 500 m <sup>2</sup>
Dansolihon	15	15	2	200 - 1,000 m <sup>2</sup>

 Table 8. Dissemination of forage technologies in Cagayan de Oro City, Misamis Oriental

 Province.

<sup>1</sup>Cumulative total includes farmer collaborators from FSP (Phase 1).

\*Expanded existing forage areas



Farmers evaluating the growth of Paspalum atratum in the Philippines (Photo: P. Asis)

#### 3.2 Factors that affect adoption of forage technologies

A study was conducted by a student from ISTOM College, Cergy-Pontoise, France, between July and December 2000, in Northern Mindanao, Philippines. Two villages were selected, Pagalungan and Lumbia, 10 - 20 km away from Cagayan de Oro City. Thirty-nine farmers were interviewed with semi-structured questionnaires. Twenty-five farmers who had adopted forage technologies were selected, 13 who had not used improved forages were selected and one farmer was selected who had stopped using forages. The objective of the study was to assess factors that influence the adoption of forage technologies within the FSP project.

#### Results

Among the farmers who had adopted forages, the most common reasons for planting forages were to increase the number of animals, to increase milk production, and to make access to feed easier (Table 9)

Reason	No. of respon dents (n = 25)
More forage results in more animals and more milk	19
Forages are available anytime (easy access to feed resources)	16
Soil erosion control	6
Not enough natural forages to feed animals	6
Helps to receive animals from Government Programmes	6
Good association of forages with other crops	5
Improvement of soil fertility	4
Can save time for other activities	2
Source of seed production	2
Livestock like eating a variety of forages	1
Don't need to plant again each year	1
Better quality than native grass	1
Excess of forages can be sold	1

#### Table 9. Reasons for adopting improved forages

All farmers consider livestock to be a capital; sale of a cattle or buffaloes allows them to buy basic needs such as food, clothes, land and to send the children in school. Livestock is the family savings. The main purpose of every farmer is to increase the number of animals (Table 9). Therefore, they need to increase their cultivated area and to establish more forage in order to adequately feed their animals and their offspring. According to the farmers, the reproductive performance of animals has improved, thanks to the good quality of forages and daily availability. This also results in more milk. Milk has become a new way generating income. It provides income daily by selling the milk in the market or in the neighbourhood. At the moment there is a surplus of milk in the locally, which necessitates transport to the city. The farmers in Pagalungan have also created a little business of "pastillas" (a candy with ingredients of carabao's milk, sugar, and cornstarch). It is rich in calcium, proteins, amino acids, vitamins A and B. Farmers provide it to their children in order to improve their nutrition.

Some farmers produce and sell seeds and planting materials to other farmers who want to establish or increase this new technology in their farms. Two farmers from Lumbia have mastered seed production. Other farmers sell the excess of forages to other farmers who don't have enough.

The main factor that limits the extension of forage crops is limited labour (Table 10). In general, the men prepare and weed the land, even though they are very busy with the other farm activities. However, there is also collaboration among farmers; they help each through community groups. Farmers often have forage plots at some distance from each other, resulting in increased time and effort for transportation of forages to the animals. Some farmers needed to buy insecticides, because diseases affect seed production. The insect *Heteropsylla cubana* affects the seeds of Leucaena leucocephala, and the *tiyangaw* (rice bug) affects *Desmodium cinerea*.

Reason	No. of respondents	
Limited labour/ lack of time	17	the statement
Not enough seeds and planting materials	4	
Weeds during initial establishment	4	
Preparation of land	3	
Transportation of forages	2	DE FIGURACIÓN Y
Fertilisers and insecticides	2	JUUMENTACION

 Table 10.
 Reasons preventing adoption of improved forages

It was difficult to find farmers to interview who have stopped using improved forage technologies; only one was interviewed. Most appear to have ceased activities because they left the barangay and moved to the city. Some other farmers who had stopped growing forages did not agree to be interviewed.

Of the thirteen farmers who had not adopted forage technologies, approximately half owned their land, while the other half were tenant farmers. From this finding one can conclude that ownership of land is not a factor influencing adoption of forage technologies. Non-adopting farmers use the natural or common grassland around the farm or beside the roads to feed the animals. Generally, they have only one or two cattle, and they find the natural grass enough for their livestock. Sometimes they feed a combination of natural grass, banana waste and napier grass. Some farmers are not planning to increase their number of livestock because they are already too busy and know that they will not have the time to plant forage crops for the animals. For some older farmers, livestock are not kept for milk or fattening, but only for ploughing and transportation; they consider livestock as tools, not as a source of income. Another hypothesis was the constraint of adequate water supply. If farmers don't have sufficient water, they are not interested in rearing cattle and don't plant forages. However, all farmers who wanted to adopt improved grass and to increase their livestock prefer cattle fattening, which is less demanding on water supply, to milk production. Most farms are near a water supply.

Some farmers ddi not understand all the advantages of improved forage crops. We need to give more information about improved forage technologies through training, meetings or fact sheets and brochures.

Membership in a cooperative is not a factor affecting the adoption of forage crops. All farmers, whether they are a member of a cooperative or not, are supported by the Barangay Livestock Breeding Loan Program (BLBLP). One criteria for selecting beneficiaries is the availability of the feed resource for the animal. The BLBLP is therefor a very important factor in the adoption of forage technologies.

In February 2000, a milk production programme was launched. Most of the farmers who have adopted the improved grass have now a production between 1 and 5 kg of milk per day. The milk is turned into pastillas, chocolate milk or simply sold in fresh milk. The National Dairy Authority and the Philippine Carabao Center help in local milk processing through providing recipes and organising demonstrations, but an outlet for fresh milk is lacking. Two barangays have taken their own initiatives:

- The members of the cooperative of Pagalungan (PTSMPC) sell the milk (20 Pesos per litre) to the cooperative. The milk is transformed into in pastillas and chocolate milk, and sold to employees at the City Hall and the City Veterinary Office at Cagayan de Oro.
- The cooperative of Lumbia (LUFARMCO) collects the milk of all members and sells it in directly to the Highland Fresh Dairy Processing Plant, a dairy cooperative situated in El Salvador, Northern Mindanao. Every day a farmer from LUFARMCO will travel 40 km by public transport to sell the fresh milk, at a price of PhP 14 per kg milk. The Highland Fresh Dairy Processing Plant will provide a collection service when the farmers produce 1,000 kg per day, but currently they are only producing 100 kg per day.

# 4. Forage planting materials

#### 4.1 Vietnam

In Tuyen Quang, Vietnam, 25 farmers have established multiplication plots of *P. maximum* TD58, *Paspalum atratum*, *Brachiaria brizantha* and *P. atratum*, benefiting 105 new farmers. Forage seed was produced by some farmers in Tuyen Quang. In Daklak Province, farmers were able to produce seeds of *B. brizantha*, *P. maximum*, *G. sepium*, *S. guianensis* and *P. atratum*, while cuttings were produced of *A. pintoi*.

#### 4.2 Thailand

In the year 2000, forage legumes seed were produced by both Divison of Animal Nutrition of the Department of Livestock Development (DLD) and by farmers under contract with the Division of Animal Nutrition.

 Table 11. Forage legume seed produced in Thailand in the year 2000.

Varieties	Produced	Produced by	Total
	by DLD(kg)	farmers(kg)	(kg)
Stylosanthes hamata cv.Verano	3,000	49,000	52,000
Stylosanthes guianensis CIAT184	3,521	15,000	18,521
Centrosema pascuorum cv.Cavalcade	29,268	24,000	53,268
Centrosema pascuorum cv.Bundey	1,104	-	1,104
Desmanthus virgatus	1,285	2,200	3,485
Arachis pintoi	117	10	117

Table 12. Forage grass seed produced in Thailand in the year 2000.

Varieties	Produced	Produced by	Total
	by DLD(kg)	farmers(kg)	(kg)
Brachiaria ruziziensis	67,410	52,500	119,910
Brachiaria brizantha	42	-	42
Panicum maximum 'Simuang'	17,765	10,000	27,765
Paspalum atratum	25,017	3,000	28,017
Paspalum plicatulum	13,985	-	13,985
Setaria sphacelata	330	-	330
Chloris gayana	2,314	-	2,314

#### 4.3 China

Seven species and varieties including *Cratylia argentea*, *Desmodium velutinum*, *Flemingia macrophylla*, *Leucaena leucocephala* and *Acacia spp.*, *P. maximum*, *B. decumbens*, *B. brizantha*, *P. atratum*, and *Melinis sp*. were planted in Danzhou and Ledong for seed production in April. 200 kilos of seed of these species has been harvested.

#### 4.4 Philippines

Two on-farm nurseries were established in Bukidnon, Philippines, providing seedlings of *Calliandra calothyrsus*, *Gliricidia sepium*, *Leucaena leucocephala* K636, and *L. leucocephala* K584.



Farmer producing seed of Centrosema pubescens, Philippines (Photo: P. Asis)

#### 4.5 Indonesia

Five multiplication plots have been established on-farm. The plots are either managed by farmer groups or individual farmers. Farmer groups come together once a week when they weed the plots, harvest vegetative planting material and sell it to FSP. The farmer who provides land for the multiplication plots has the right to harvest foliage, if the grasses grow to tall. A total of 400.000 splits have been sold and distributed so far. Species propagated are: *Brachiaria humidicola* CIAT 6133, *Brachiaria humidicola* cv. Tully, *Brachiaria brizantha* CIAT 6780, *Setaria sphacelata* cv. Splendida, *Paspalum atratum* BRA 9610, and *Andropogon gayanus* CIAT 621.

# 5. Training activities

#### 5.1 Philippines

The international workshop "Monitoring and Evaluation of Forage Projects in SE Asia – Practical guidelines" was held in Cagayan de Oro, Philippines from 14-18 August 2000. Keynote speakers presented papers on theoretical and practical aspects of monitoring and evaluation (M&E), and on participatory aspects of M&E. Some field exercises with farmers were held, and a general framework or guideline for M&E was developed (Appendix 2). Sites are adapting this framework to suit their particular needs (e.g. see Appendices 3 and 4 for Vietnam). Twenty FSP staff from all six member countries and resource people attended the meeting. The cost of holding the meeting was supported by a grant from ACIAR.

The following training courses were conducted for development workers:

- Developing Forage Technologies with farmers, 17-28 July 2000. The training course
  was attended by 23 participants, 3 being farmer leaders and 20 technicians of the
  local government units in Bukidnon where dissemination of improved forage systems
  is planned.
- Participatory Development and Gender analysis, 27 November 1 December 2000. Seventeen technicians of the local government units and two regional staff of the Department of Agriculture attended the training.

Farmers were trained on management of leucaena and animal feeding practices in the following Barangays:

- Lumbia, Cagayan de Oro City, 24 October 2000. Twelve farmers attended
- Pagalungan, Cagayan de Oro City, 25 October 2000. Thirty-seven farmers attended
- Lindaban, Manolo Fortich, Bukidnon, 26 October 2000. Forty-farmers attended
- Kalugmanan, Manolo Fortich, Bukidnon, 27 October 2000. Fifty farmers attended.

Farmers were also trained on milk production and milk processing:

- Pagalungan, Cagayan de Oro City, 29 August 2000. Twenty-five farmers attended.
- Lumbia, Cagayan de Oro City, 29 September and 5 October 2000. Eighteen farmers attended.

Several farmer groups from other villages visited FSP sites at Cagayan de Oro City, among these farmer groups were;

- Highland Fresh Dairy cooperators visited Lumbia on 8 July 2000.
- Twenty-six farmers from Manticao, Misamis Oriental visited on 20 July 2000.
- San Simon Farmers maunlad Cooperative visited Pagalungan and Lumbia on 23 November 2000 (5 farmers)
- Five farmers from Indahag visited Lumbia, on 11 December 2000.

Hundred fifty-two farmers from Malitbog joined cross visits to ICRAF Claveria, Misamis Oriental observing how ordinary grasses, pineapple, forest trees, fruit trees and even root crops were used as hedgerows. These activities are listed below:

- July, 3 farmer groups consisting of 46 farmers (30% women) from sitios san Migara (Upper and Lower), Tagmaray and Sabanga-an.
- August, 2 farmer groups consisting of 88 farmers from sitios Villa Nazareth and Purok 2, kalingking.
- September, 1 farmer group consisting of 18 farmers coming from different sitios of Barangay Poblacion.



Training of development workers in Samarinda, Indonesia (Photo: R. Roothaert).

#### 5.2 Indonesia

Five key farmers were trained in forage technology in Makroman to assist in dissemination of improved forages to new areas. In September, field days were conducted for farmers and field workers in the new areas where dissemination is taking place, and cross visits were conducted for farmers from the new areas to the focus sites. Farmers from Loakulu, Sidomulyo, Sindang Sari went to Makroman, to visit Maju and Sidodadi farmers groups with experience in using improved forages. The key farmers at the focus site, explained and talked about the benefits of forages and differences among forage species in terms of management, palatability, drought resistance and the ability to cover *Imperata cylindrica*. They also explained how to prepare land, how to plant the cuttings or planting material, and how to manage a dynamic farmer group. Many questions were raised by farmers from the new areas and subsequently answered by key farmers. Before the farmers returned to their homes, they were given planting material of all available species.

In October 2000, Farmers from Sepaku I, and Sepaku IV went to Sepaku II, to the Lestari Farmer group. Two experienced key farmers talked about their experience in forages.

#### 5.3 Lao PDR

An on-site training on Participatory Diagnosis was conducted in Luangphabang and Xiengkhuang where about 7 district staff attended. Three staffs attended a workshop on M&E in Luangphabang.

#### 5.4 Vietnam

In July 2000, 16 staff from provinces, districts and communes were trained on 'Developing Forage Technologies with Farmers. Among the participants, 10 were development workers. Cross visits were organised for two staff from Hue and one from Daklak, who went to Tuyen Quang and exchanged experiences on developing forage species under a variety of farm conditions.

Hundred forty-five farmers from old and new communes in Tuyen Quang took part in training courses on forage technologies, and cross visits, between July and October 2000.

In collaboration with Tuyen Quang Agriculture and Rural Development Department and SIDA (Sweden), 450 leaflets on planting and use of *Panicum maximum* TD 58 and *B. Brizantha* were produced and distributed.

In Daklak Province, 5 researchers, 10 development workers and 2 officials had been trained in forage technologies and participatory research in 2000. A total of 185 farmers were trained.

#### 5.5 Thailand

Two training courses on forage agronomy and FPR were held for 24 extension workers and researchers during 20 – 24 November 2000 at Pakchong Animal Nutrition Research Centre. On site training on participatory evaluation for extension worker was conducted during conducted participatory evaluation at Sung Nuen site. Informal training on forage establishment, management and utilization were done at Sung Nuen site for 10 farmers who participated in developing forage technology.

# 6. Networking

#### 6.1 Philippines

In response to the request of the Regional Office of the Department of Agriculture (Region 10), the Program Coordinator conducted two training session on "Forage technology development with Smallholder Farmers." The course were conducted on November 13 to 25, 2000. Forty three technician from local government units in the 4 provinces of Northern Mindanao attended the course. These training courses were locally funded. One training course was conducted for the farmers of Sinacaban, Misamis Occidental on "Forage production for dairy development". This training was also locally funded.

Twenty development workers from Manolo Fortich, Impasug-ong and Lantapan Bukidnon visited forage sites in Malitbog in July 2000. One development worker from Malitbog was invited by the Department of Agriculture Region 10 as resource speaker in the conduct of forage agronomy training held in Tangub City, Misamis Occidental and Dalwangan, Malaybalay, Bukidnon. The FSP team in Malitbog has regular contacts with the International Centre for Research in Agroforestry (ICRAF). Several cross visits have been organised, taking farmers and extension workers from Malitbog to on-farm sites of ICRAF in Claveria, Misamis Oriental. Farmers working with ICRAF have widely adopted the practice of natural vegetative strips along contours, preventing soil and water erosion on sloping farms. FSP farmers contribute their knowledge of improved forages, which can increase the productivity of the natural vegetative strips.

#### 6.2 Indonesia

In November 2000, the FSP national coordinator of Indonesia gave a presentation on 'Development forage technology with farmers in East Kalimantan' at the 'Workshop in Livestock Development and Development of Forage Technology' in Cisarua, Bogor.

#### 6.3 Lao PDR

FSP in Laos works in collaboration with the 'Forages and Livestock Systems Project', funded by AusAid. In October, several international consultants were hired by the FSLP project to conduct a thorough Participatory Rural Appraisal. The results of the appraisal will be fully utilised by FSP.

#### 6.4 Vietnam

In Vietnam, an efficient network has been established among the FSP colleagues in the provinces of Tuyen Quang, Daklak and Hue. Cross visits among provinces are regularly organised. The network is also using the comparative advantage of the different provinces, for the purpose of multiplication of forages. The relatively dry Daklak province is ideal for seed production, while in Tuyen Quang there is an abundance of *Flemingia Macrophylla*, which easily produces seeds.

#### 6.5 China

Although FSP focuses in the first year on Hainan Province, visits have been made to Guangxi and Fujian Provinces. Farmers have started to plant forages provided by FSP. Local Ministry staff will make follow-up visits.

#### 6.6 SEAFRAD Newsletter

The SEAFRAD Newsletter no. 10 was produced in May 2000 but had not been sent to the majority of readers on the mailing list due to logistical problems at the editor's office in Vietnam. Action has been taken and the newsletter was sent to the readers in January 2001. The next issue is in press in the new editor's country, Thailand.

#### 6.7 Centre for Natural Resources and Development (CNRD), Oxford

A joint proposal has been written with CNRD on 'Improving the sustainable livelihoods of resource-poor upland livestock farmers in Southeast Asia'. The purpose of the new project is to develop sustainable seed multiplication systems of fodder trees and to enhance on-farm tree nurseries. Funding is being sought from DFID, UK.

# 7. Monitoring and Evaluation

A framework was developed for monitoring and evaluation, with inputs from farmers, development workers, coordinators, and researchers (Appendix 2). This framework can be used as a guideline for all FSP sites. Many of the M&E questions are similar in the different sites. However, the indicators, measures, gender issues, methods for collection of information, source, timing and scale need to be addressed locally and modified to suit each local condition. FSP in Tuyen Quang and Daklak, Vietnam, have used the framework already. They modified it and collected data which are presented in Appendices 3 and 4.

## 8. Publications

Two radio interviews and 2 TV interviews with project staff were recorded and broadcast in East Kalimantan, Indonesia, reaching farmers in all rural areas.

The Chinese translation for FSP booklet "Developing forage technologies with smallholder farmers----how to select the best varieties to offer farmers in Southeast Asia" was completed and published.

#### 8.1 Previous publications:

Horne, P.M. and Stür, 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.

Chinese, Vietnamese and Indonesian translation of Developing forage technologies with smallholder farmers.

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.

SEAFRAD News, Issue 10, May 2000.

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

# 9. Regional visits made by CIAT Coordinators

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

# 10. FSP co-ordinators and counterparts

Dr. Peter Kerridge, Coordinator CIAT – Asia, Los Baños, Philippines.
Dr. Ralph Roothaert, Regional Coordinator FSP, Los Baños, Philippines.
Mr. Eduedo Magboo, FSP Coordinator Philippines, Los Baños.
Mr. Phonepaseuth Phengsavanh, 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 China, Hainan.
Mr. Truong Tan Khanh, Daklak, Vietnam.
Mr. Vanthong Phengvichith, Vientiane, Laos PDR.
Mr. Willie Nacalaban, Malitbog, Philippines.
Dr. Perla Asis, Cagayan de Oro, Philippines.
Mrs. Ganda Nakamanee, Pakchong, Thailand.

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# 11. References

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



Andropogon gayanus is one of the few fodder species that grow well on infertile acidic soils in Laos (Photo: R. Roothaert).

Appendix 1. Common and botanical names of forages mentioned in text

Botanical name	Common name
Andropogon gayanus	Gamba
Arachis pintoi CIAT 22160	Arachis
Brachiaria brizantha	Brizantha
Brachiaria decumbens CIAT 606	Signal
Brachiaria dictyoneura	-
Brachiaria ruziziensis	Ruzi
Calliandra calothyrsus	Calliandra
Centrosema macrocarpum	Centrosema
Centrosema pubescens	Ucayali
Cratylia argentea	Cratylia
Desmanthus virgatus	Desmanthus
Desmodium rensonii	Desmodium
Flemingia macrophylla	Flemingia
Gliricidia sepium	Gliricidia
Gliricidia sepium accession Retalhuleu	Retalhuleu
Leucaena leucocephala variety K 636	Leucaena K636
Panicum maximum	Guinea
Panicum maximum CIAT 6299	Tobiata
Panicum maximum T 58	Purple guinea
Paspalum atratum BRA 961	Paspalum
Pennisetum purpureum	Napier
Setaria sphacelata - Nandi	Nandi
Setaria sphacelata var. splendida	Splendida
Stylosanthes guianensis CIAT 184	Stylo
Sesbania grandiflora	Turi

Project objectives	M&E questions (common set)	Indicators (examples)	Measures (examples)	Gender, equity, ethnicity	Methods/ Tools	Source of Informati on	Timing and scale	Who will use information	Who collects
1. Develop forage technologi es	T1.1 Which forage systems are being adopted?	<ul> <li>Farmers evaluating</li> <li>Type of forage system being developed &amp; species used</li> <li>Expansion of particular forage system above threshold value e.g. &lt; 200m<sup>2</sup> sward, 100 meters of fence line</li> <li>How forages are being utilized</li> </ul>	# farmers     Name system,     species     # farmers expanding     forage systems     # farmers who have     stopped growing     forages	Who in household plants. harvests etc., by wealth, gender, ethnic group	Field reports by DW	All farmers Farmers in focus groups	Information collected during regular visits by DW to each village Summarised in yearly reports	Development Worker (DW) Coordinators/ (C) Province (Pv) Project (P) Donor (D)	DW
	T1.2 Has animal production system been improved?	(Indicators agreed to by focus groups e.g. - Fatter animals - More animals - Stronger draft animal - Fewer deaths - Reduced labor requirement - Less theft - More milk	Measure set by farmers - Score body condition - # calves, adults - area ploughed/day - # dying by class animal - labor hrs to feed animal - # thefts - kg milk produced	Note how different household members are affected by outcomes	Survey Focus groups Case studies	Farmers in focus groups	Yearly meetings by several interested groups Annual survey of adopters and non- adopters	Farmer (F), DW,C,P, Pv, D	F, DW, P
	T1.3 What are the environmental effects of introduction of forage systems?	Indicators will vary with forage systems - Reduced soil erosion due to establishment of hedgerows - Reduced soil erosion due to use of stoloniferous forages for soil cover - Gulty erosion reduced - Improved water quality & stream flow Increase in soil fertility	-length of hedgerow established (m) - % soil cover - proportion of gullies stablised - farmer observation - higher crop yield	Note effects at the farm, within focus group, community, watershed levels	Village mapping Combine with data on forage system. Soil, water analyses	Focus groups, DW, Project study	Annual survey of adopters and non- adopters	F, DW, C, P, Pv, D	DW, F, Project Researc her

Appendix 2. Monitoring and evaluation framework which can be used as a guideline.

Project objectives	M&E questions (common set)	Indicators (examples)	Measures (examples)	Gender, equity, ethnicity	Methods/ Tools	Source of informati on	Timing and scale	Who will use information	Who collects
	T1.4 What has been the improvement in livelihood?	<ul> <li>Total cash income</li> <li>Income from sale of livestock products</li> <li>Funds available for education</li> <li>&amp; health</li> </ul>	Income (defined by farmers), food security - interview	Information obtained from men and women, stratified by wealth groups and ethnic groups	Stratified survey	Farmers	Annual survey of adopters and non- adopters	DW. C, P, Pv, D	DW, P
	T1.5 What has been the impact on the farming system?	Change in use of feed resources over time     Land use change over time     Productivity increasing or decreasing	<ul> <li>Type of feed system used</li> <li>change in area used for different enterprises</li> <li>District records</li> </ul>	As above	Case studies	Farmers, District office	Annual studies	DW, C, P, Pv, D	DW, P
2. Increased dissematio n of forages	D2.1 Where is dissemination occuring?	<ul> <li>New villages and districts where forages are being evaluated</li> </ul>	<ul> <li>names of villages and districts and # farmers evaluating</li> </ul>	As above	DW field visits	Farmer groups	6-monthly	P, Pv	P, Pv
	D2.2 How is dissemination occurring ?	<ul> <li>Strategy for dissemination</li> <li>Number and names of development workers involved</li> <li>Number of farmer-to-farmer visits</li> </ul>	<ul> <li>strategy paper accepted at provincial level</li> <li>schematic plan of who is involved in dissemination</li> <li>record of F-to-F visits</li> </ul>		- Paper - District data - District data	P, Pr - DW reports - DW reports	- Annually update - 6-monthly - 6-monthly	- P, Pv -P, Pv - D, P. Pv	- CC, P, Pv - Pv, CC
	D2.3 Is the approach for disseminating forage systems effective?	<ul> <li>High adoption rate of forages among new farmers</li> <li>Amount of seeds and multiplication material distributed</li> </ul>	<ul> <li># new farmers planting forages every season</li> <li>% of farmers who have participated in cross visits and subsequently plant forages</li> </ul>	As above	- Survey - Interviews with F, DW	F, DW	- Bi-annually, all sites	- DW, P, Pv	Ρ
3. Improved availability of planting materialise ed	M3.1 Are forage multiplication systems effective?	<ul> <li>Farmer managed forage nurseries</li> <li>Profitability of multiplication systems</li> <li>Adequate supplies of seed and cuttings</li> </ul>	- # multiplication nurseries - profit earned - amount of material distributed/sold - Demand for material/ seed	Who produces seeds and planting materials?	-Field reports of DW's - Survey	F, DW	Annual survey	D, P, Pv, C	DW, Provinci al officer,

Project objectives	M&E questions (common set)	Indicators (examples)	Measures (examples)	Gender, equity, ethnicity	Methods/ Tools	Source of informati on	Timing and scale	Who will use information	Who collects
	M3.2 How are multiplication systems organised? M3.3 Are								
	multiplication systems sustainable?								
4. Increased capacity at all levels	C4.1 How effective has been the training in FPR and forage agronomy?	- Capacity in PA improved	<ul> <li># of persons trained in PA</li> <li>improved skills in PA</li> <li>increased ability to use skills</li> </ul>	Who attends the training	-self- evaluation - Reg. Coord. Report	F, DW, CC, P	Annual	CC, P, D	CC. P
		Capacity in forage agronomy improved	<ul> <li># of persons trained</li> <li>farmers receiving information</li> </ul>				Annual		
	C4.2 Has the participatory process been institutionalized?	<ul> <li>Provincial policy for supporting PA</li> <li>Recognition of role of PA by supervisors</li> <li>Demand driven R&amp;D</li> </ul>	Prov. policy paper     resource allocation for PA     refresher training     % staff using PA     Attitude, rewards for DW     use of F-to-F     extension     # projects adopting PA		Self- assessment	D, Pr officers DW, supervisor			
	C3.3 Has capacity among farrmers been improved?	Farmers receiving training     Farmers forming interest groups to provide mutual support     Farmer needs have been met     Farmer extension workers	- # farmers - Number of interest groups - survey # extension workers	Note who are members of interest groups	Field reports by DW's -survey	DW's	6-monthly summary annual survey	D, P, Pv	D & Pvofficer s

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District	Commune	# farmers	Initial	Types of forage systems being	# farmers	Expanded	How are forage	es being used?		
		evaluating	area m <sup>2</sup>	developed	expanding *	area m²	What time of day /season	Where grown on farm	Fed to which animals	Managed by men/women
Yen Son	Tu Quan	55	150-200	Intensive cut-and-carry for fish P.maximum, P.atratum, S. splendida	31	300-400	Morning., all year	Around fish pond	Fish	Planting - all family
		Same	group	Intensive cut and carry for cattle/buffalo P. maximum, B. brizantha, B.decumbens, P. atratum, Stylo 184			Afternoon,night; all year	Intercrop with fruit tree&food crop, home garden	Cattle, buffaloes	Women manages, all family cuts&feeds
		3 of above farmers	100 m	Tree legumes for shade & living fence G.sepium, L. leucocephala, C. calothyrsus	no seed		Little use	Tea& home garden	pigs, cattle, buffaloes	Men & women
	Phu Lam	59	250-300	Intensive cut and carry for cattle/buffalo P. maximum, B. brizantha, B.decumbens, P. atratum, Stylo 184	40	500-600	Afternoon,night; all year	Intercrop with fruit tree&food crop, home garden	Cattle, buffalos	Women manages, all family cuts&feeds
		40% of above		Intensive cut-and-carry for fish P.maximum, P.atratum, S. solendida			Morning., all year	Around fish pond	Fish	Planting - all family
		2	100 m	Tree legumes for living fence G.sepium, L. leucocephala, C. calothyrsus	no seed		In dry season	Hill garden	pigs, cattle, buffaloes	Men & women
		4	300 m	Erosion barriers P.maximum, Stylo 184, L. Jeucocenbala	1	500 m	Cut in sequence	steep land	Pigs,cattle, buffaloes	Men
Ham Yen	Duc Ninh	99	150-200	Intensive cut-and-carry for fish P.maximum, P.atratum, S. solendida	60	500-600	Morning., all year	Around fish pond	Fish	Planting - all family
				Intensive cut and carry for cattle/buffalo P. maximum, B. brizantha, B.decumbens, P. atratum, Stylo 184			Afternoon,night; all year	Intercrop with fruit tree&food crop, home garden	Cattle, buffalces	Women manages, all family cuts&feeds
		5	100 m	Tree legumes for living fence G.sepium, C. calothyrsus, F. congesta	no seed		All year	Around home garden	fish, cattle, buffaloes	Men
		4	300 m	Erosion barriers P.maximum, Stylo 184, P. atratum	2	500 m	All year	steep land	all animals	

Appendix 3. Results of monitoring and evaluation in Tuyen Quang Province, Vietnam.

\* Criteria for expansion is a 'threshold' level obtained in consultation with farmers and extension workers e.g. Cut-and-Carry for cattle >200 m2; Contour strips, >100m length; cover crops >400m2

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District	Commune	Village	#	Initial area	Types of forage systems being	#	Expanded	How are forages being	used?		
			farmers evalua- ting	m²	developed	farmers expandi ng*	area m²	What time of day /season	Where grown on farm	Fed to which animals	Managed by men/women
M'Drak	Cu Roa (Focus Commune)	6 villages	70	200-500	Intensive cut and carry for beef cattle P. maximum, B. brizantha, P. purpureum, P. atratum, Stylo 184	60	500- 10,000	At night for all cattle day & night day for special cattle (calving cows, sick cattle)	Crop land, garden area, new land	Cattle	Mainly by women and children
			20	100	Intensive cut-and-carry for fish P.maximum and P. atratum	new		During day	Near fish pond	Fish	Mainly by women and children
			3	300-500	Forages for grazing Brachiarias and P.maximum	3	5,000- 10,000	End grazing time on natural pasture in days of heavy rain	Open grassland	Cattle	Women & children
			6	500 m	Forages sown in strips in natural grassland Brachiarias and A. pintoi	New		All day for farmers with few cattle & limited time for others	Open grassland	Cattle	Women & children
			6	200 m	Tree legumes along contours Gliricidia and Flemingia	2 (4 new 2000)		Not yet	Crop land	Cattle	Women and men
			20	500	Cover crop in coffee (feed for cattle & pigs) Stylo 184	17	500- 10,000	For cattle at night, after calving, calves, pigs every day. By green material or leaf meal	crop land	Cattle, pigs	Mainly women
M'Drak	M'Drak Cu M'Ta	7 villages	58	100-200	Intensive cut and carry for beef cattle P. maximum, B. brizantha, P. purpureum, P. atratum, Stylo 184						
			6	300-500	Cover crop in coffee (feed for cattle & pigs) Stylo 184						
Ea Kar	Cu Ni Ea So Ea Ty	8 villages	55	100-200	Intensive cut and carry for beef cattle P. maximum, B. brizantha, P. purpureum, P. atratum, Stylo 184						
	×		7	300-500	Cover crop in coffee (feed for cattle & pigs) Stylo 184						

Appendix 4. Results of monitoring and evaluation in Daklak Province, Vietnam.

\* Criteria for expansion is a 'threshold' level obtained in consultation with farmers and extension workers e.g. Cut-and-Carry for cattle >200 m<sup>2</sup>; Contour strips, >100m length; cover crops >400m<sup>2</sup>

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