

Assessing the use of indigenous fodder trees in Lao PDR

ການສຳຫລວດ ແລະ ປະເມີນການນຳໃຊ້ຕົ້ນໄມ້ພື້ນເມືອງ ທີ່ ເປັນອາຫານສັດ ຢູ່

ສປປ ລາວ

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(ຕົ້ນມອນປ່າ Morus sp)

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Introduction

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

The hypothesis tested in this study was that farmers have extensive knowledge about the use and quality of local fodder trees and shrubs, which can help improve feeding recommendations once combined with researchers' knowledge. The objectives were as follows:

- to make an inventory of the indigenous fodder trees and shrubs that farmers use to feed their cattle, and to identify their botanical names.
- to assess how and when farmers use these species, where they grow, and if they practice strategic feeding.
- to assess farmers criteria for assessing quality of fodder tree species.
- to assess farmers' preferences of fodder tree species, using their own criteria.
- to compare nutritive value of most preferred or most common species through chemical analysis.

Methods

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

botanical identification. Electronic pictures were taken of various morphological parts of trees. Other samples were collected for laboratory analysis of nutritive value.

Table 1. Description of 4 villages in study area

	Keawjaloung	Keawtalonyai	Longlao II¹	Phonesaat
Ethnic group	Kasah	Hmong	Hmong	Hmong and Kmu
Geographic position	N 19° 43' E 102° 13'	N 19° 36' E 102° 14'	N 19° 48' E 102° 05'	N 19° 42' E 102° 12'
Altitude	856 m	1380 m	956 m	956 m
History	Established 500 years ago. Started raising cattle 6 years ago.	Established in 1966, they used to live nearer to Vientiane. Village has moved several times	Established in 1979. Outsiders are now settling in the village. Population increases, land becomes scarcer.	Moved from northern Lao in 1970, and settled in mountains. Moved to roadside in 1999.
Farming system	Shifting cultivation. Rice, pigs, cattle.	Shifting cultivation. Rice, pigs, cattle, buffaloes, goats.	Shifting cultivation. Upland rice, maize, cassava, cattle, buffaloes, pigs. No goats, they harm crops.	Shifting cultivation. Upland rice, maize, cassava, vegetables, cattle.
No. of farmers in group discussion (male: female)	10:8	6:6	30:0	20:3
No. of farmers interviewed (male: female)	8:2	5:3	5:0	7:2
Date of discussions and interviews	7 March 01	8 March 01	10 March 01	9 March 01

¹ Position and altitude of Longlao 5 km outside village, on road to Luang Prabang.

Results

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

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

The trees in this study did have several other uses: sale of bark for paper production (Po Sa); firewood (all species); construction material (Ton Mon, Mailieng, Sakham); roofs (Po Hou); flowers, fruits and young leaves for human food (Ban, Po Sa, Mak Va); material for ropes (Po Hou); and medicine (Ton Mon).

Results from laboratory analysis of nutritive value of the tree samples are shown in table 7.

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

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

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

Lao name	Hmong name	Preliminary botanical identification	Chemical analysis
Ban, Ton Ban, Bai Ban	Tow Chon	Not yet determined <i>Bauhinia variegata</i>	4
Bayhad		<i>Artocarpus sp.</i>	
Deua		<i>Ficus sp.</i>	
Deua pong		<i>Ficus hispida</i>	4
Dok leap		Not yet determined	4
Eng Leng		Not yet determined	4
Houng Keo, Houng Sa	Laveung	<i>Ricinus communis, Eclipta alba</i>	
Kok Mailen		<i>Albizia odoratissima</i>	
Mailiang, Mailieng		<i>Berrya mollis, Eriolaena candollei</i>	4
Makok,	Ton Molu, Kao	<i>Spondias Magnifera, S. dullis</i>	
	Mo Leu, Hai		
	Hiad Pa		
Mak Lin Mai		<i>Oroxylum indicum</i>	
Mak Not Pa, Not Nam		<i>Ficus heterophylla, F. pyriformis, F. variolosa</i>	4
Mak Va, Ton Va, Kok		<i>Ficus racemosa, Eugenia jambolana, E. compongensis</i>	
Va			
Posa		<i>Broussonetia papyrifera</i>	
Sa Hou, Po Hou		<i>Trema orientalis, T. velutina</i>	
Saima		Not yet determined	
Sakham		<i>Garuga pinnata</i>	4
Si Hai Ton		<i>Cinnamomum iners, Eucalyptus sp.</i>	4
Sieo, Sieo lieng, Sieo		<i>Bauhinia purpurea, B. viridescens, B. acuminata, B. prabangensis</i>	4
ngeun lieng, Sieo lap			
Sorsien, Som Sien		<i>Sinapis alba</i>	4
Ton Mon Pa		<i>Morus sp.</i>	4

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

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

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

Criterion	Keawjaloung	Keawtalonyai	Longlao II	Phonesaat
Palatability ¹	●	●	●	●
Availability (many trees)	●	●	●	●
Availability (throughout the year)				●
Easy access (distance)	●	●	●	●
Regrowth		●		
Leafiness				●

¹ Farmers were asked to consider feed for cattle only.

Table 6. Use of trees for dry season feeding.

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

Table 7. Chemical composition and digestibility.

Sample	DM	CP	Ash	NDF	% DOM (Nylon bag technique)			
	%	% on DM basis			0h	12h	24h	48h
T1 Maknot Pa	92.47	13.50	11.64	54.74	12.38	23.14	30.69	45.53
T2 Sa Kham	94.33	15.46	11.49	48.04	21.60	34.34	40.54	46.23
T3 Ton Sikhaipa	92.41	14.06	3.32	63.05	15.87	25.64	38.11	50.41
T4 Ton Mon Pa	91.07	17.44	9.98	39.56	21.15	63.75	86.95	87.09
T5 Ton Lieng	91.83	15.58	8.79	56.39	16.37	24.49	30.30	38.11
T6 Ton Tin Nok	92.46	15.82	7.60	54.16	16.07	32.60	48.26	58.57
T7 Po Hou	93.11	15.92	8.66	58.17	11.84	26.07	39.68	46.12
T8 Bay Had	93.85	13.66	19.51	43.31	27.89	46.63	65.48	72.11
T9 Sor Sian	93.69	12.29	12.88	49.15	20.16	44.46	62.24	64.52
T10 Ton Ban	92.60	19.25	5.21	65.90	14.59	28.08	40.00	43.26
T11 Dava Pong	91.93	18.27	15.12	41.68	21.24	57.67	82.89	85.13
T12 Ton Len	93.38	15.91	4.52	72.74	11.20	14.72	16.87	20.50
T13 Dok Leap	93.17	12.18	7.19	50.01	20.50	29.41	37.84	46.95

Note: T1-ຕົ້ນຫມາກນອດປ່າ; T2-ຕົ້ນສະຄຳ; T3-ຕົ້ນສີໄຄປ່າ; T4-ຕົ້ນມອນປ່າ; T5-ຕົ້ນລຽງ; T6-ຕົ້ນຕີນນົກ; T7-ຕົ້ນປ່າຫຼາຍ; T8-ຕົ້ນຫາດ; T9-ຕົ້ນຊື່ງຽນ; T10-ຕົ້ນບານ; T11- ຕົ້ນເດື່ອປ່ອງ; T12-ຕົ້ນເລນ; T13- ຕົ້ນດອກລົບ

Discussion

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

Table 8. Farmers' scoring of local fodder tree species on selected criteria using matrix rating (Mean score and standard deviation in parentheses. A rating of 3 indicates good, 2 indicates medium, and 1 indicates poor).

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

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

Biomass productivity is the result of many other tree factors; climatic and soil adaptability of the species, pruning resilience, leafiness, and compatibility with other crops. The criterion 'regrowth' was one way of assessing pruning resilience by farmers. There were big differences among species in terms of regrowth. Ban, for instance scored very high, while Sa Hou scored very low. More dramatically, 20 farmers mentioned during the interviews that Sa Hou dies after being lopped. This information corresponds with experiences in central Kenya, where a plot of 9 months old *Trema orientalis* trees had been subjected to coppicing, and more than 50 % died. 'Leafiness' was a marvellous criterion that was unfortunately mentioned towards the end of the field study, and

therefor only farmers in one village rated the species to it. There are big differences among species according to leafiness. Compatibility with other crops was not used as a criterion. However, 21 farmers mentioned that Po Sa grew on their farm land, 12 farmers farmers said Sa Hou grew on their farm, and 9 farmers said Ban grew on their farm. Ban and Po Sa regenerated from stumps after clearing and burning fallow land, whereas Sa Hou regenerated from seeds. Sometimes Po Sa was planted. All other species were found in the forest and uncultivated land. Soliciting information about compatibility with other crops would be difficult as all trees are categorically removed from fallow land before cultivation of crops. However, in some vegetable gardens near the village, large trees could be found. This might be the most appropriate site for future testing of tree or shrub based technologies. In Longlao II there was very little interest in planting local trees. When asked why, farmers answered that they appear naturally in fallow land.

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

As is the case with exotic fodder trees, there is large variation in palatability among local fodder trees. Po Sa was consistently rated highly palatable. Palatability also seems to be correlated to availability and accessibility. In other words, the more of the trees there are to utilise, the more experience farmers and their animals have with the tree. Palatability is a dynamic quality, as it generally increases when an animal gets used to a type of fodder.

The quality was quite high in all species, with CP content ranges from 12-19 %, especially it was high in T10 Ton Ban (19.25%) and digestibility is about 38-87%, highest in Ton Mon Pa T4 and T11 Deua Pong.

Several species are used for feeding during the dry season (Table 8), which could be an indication of drought resistance. In Keawjaloung, farmers mentioned that Sieo, Bai Had and Sakham dropped their leaves during the dry season.

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

Conclusions and recommendations

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

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