INDIGENOUS KNOWLEDGE ON USE OF LOCAL FODDER TREES IN MID HILLS OF WEST NEPAL

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ABSTRACT

Fodder shortage (quality as well as quantity) has been found throughout mid hills of Nepal. The tree fodder is particularly important as a green, nitrogen supplement to poor quality crop residues during the dry season when feeds are scarce. The nutritional values of fodders differ according to species and season therefore farmers prefer different species for different seasons to feed their livestock. The choice or preference of fodder species by farmers reflects their traditional knowledge on nutritional values, palatability, cultivation easiness and seasonal variability of tree fodder in local environment. The paper highlights an indigenous knowledge system that relates to the quality of tree fodder used by farmers in mid hills of Nepal. In total 69 plant species have been recorded as tree fodder and out of them ten best tree fodders have been listed on the basis of preferences and priority by farmers. Information was gathered through a semi structured open questionnaire by interviewing 85 respondents of different age groups of Arghakhanchi district. Though Ficus species was the most abundant among tree fodder, Grewia optiva (locally known as 'phorso') was found the most preferable tree fodder species in the study area.

Key words: Tree fodder, folk classification, indigenous knowledge, mid hills.

INTRODUCTION

Fodder shortage has been a serious problem for livestock holders throughout mid hills of Nepal. It becomes acute during the dry period and winter when livestock is generally under fed by one-third of the required amount (Sherchan and Pradhan, 1997). Fodder trees and shrubs are used in Nepal as protein supplements in ruminant diets during the long dry period (October-May). It is estimated that 12% of the total digestible nutrients come from fodder tree and shrub (New Era, 1990). Livestock has remained as an indispensable part of the traditional agriculture system in hilly regions of Nepal (Devkota and Rerkesem, 1994). However, the productivity of livestock is very low. The major region of low productivity of the livestock is insufficient and low quality feeds and fodders (Tulachan and Neupane, 1999, Pandey *et al*., 1998). Livestock requires a balance diet which has sufficient energy, proteins and vitamins. Feeding with any fodder is not enough to ensure its good health and milk production. Hence, fodder trees from forests, private agriculture lands play major role to meet the deficiency of livestock feeds in hilly region. Farmers harvest tree fodder mainly from the community or private forest.

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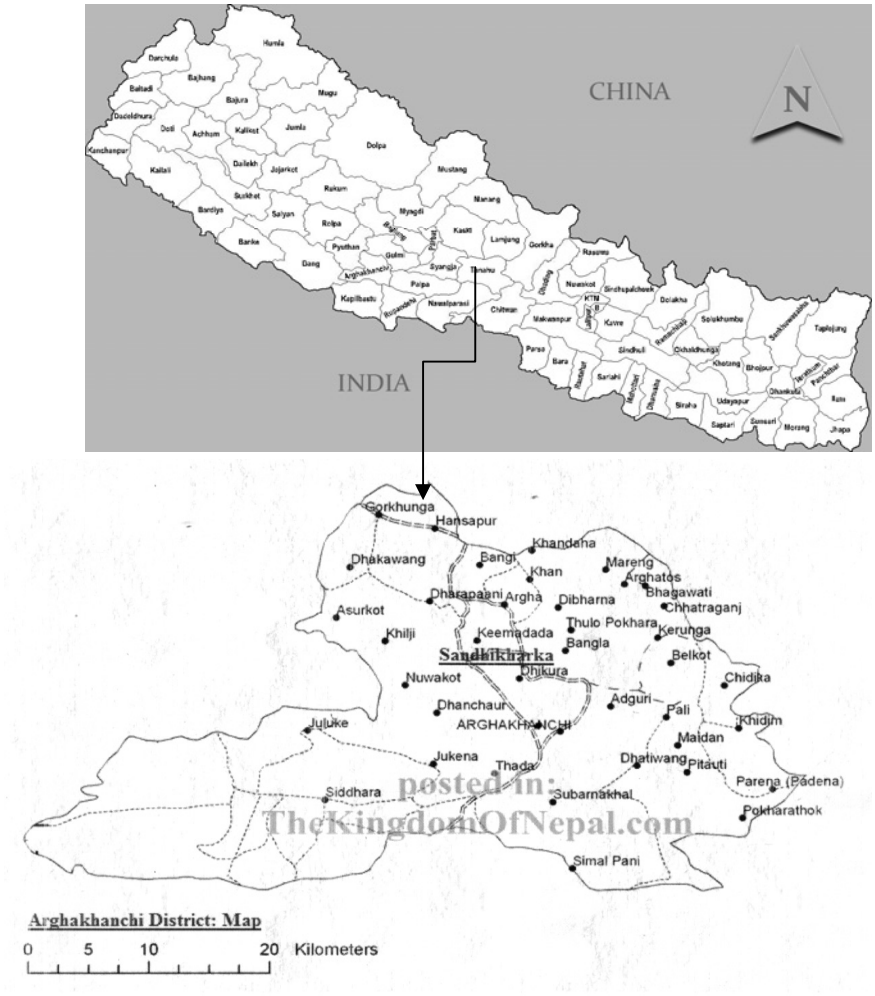
Farmer through their empirical knowledge has been practicing two local classification systems for tree fodder (Thapa *et al*., 1997); *posilo* and *obano*. *Posilo* that was perceived as an indicator of general nutrition may relate to the ability of a tree fodder to promote the supply of protein, and the other (*obano*) appeared to relate to digestibility of fodder in the body of cattle. The ideal multipurpose tree species should be able to fulfill the six 'Fs', basic objectives of fodder, fuel, fiber, fruit/food, forest and fertilizer (green manure) (Raghavan, 1990).The desirable agronomic characteristic of fodder tree are: ease to establishment, good competitive ability, high productivity and persistence under repeated cutting or grazing, require no fertilizer, resistant to local pests and diseases, ability of propagation, and have good nutritive value and reasonable palatability to animals (Ivory, 1990).

The main objective of the study was to find out farmer's preference of local fodder tree species, their criteria for assessing fodder species and best fodder in the mid hills of west Nepal. The specific objectives were (i) to list out all fodder trees, (ii) to record top ten best tree fodders, (iii) to understand nutritional values of the best tree fodder, and (iv) to know indigenous knowledge of farmers on classification system of fodder plants.

STUDY AREA

The district Arghakhanchi, a part of midhill of Western Nepal is located between 27^0 45'-28^0 06' N latitude and 80^0 54'-83^0 23' E longitude with an area of 1193 km^2. Seventy percent of population practice subsistence agriculture, but the most peasants are not self sufficient. The elevation of the district varies from 305 m to 2515 m above the sea level. The major area of the district is mid mountain and foothill, with 69.11% of area under slopes above 30 degree (ICIMOD, 1997). Of the total 119,300 ha of land in the district, 38.32% is cultivable, 23.46% of the total land area is cultivated, while forest covers 56% of the area (DADO, 2009). Community forest area per household averages 0.41 ha (FAO, 2009). Only 1.9% of farmland has year-round irrigation.

The vegetation of Arghakhanchi district basically dominated by broad leaved *Schima- Castanopsis-Diospyrus* mixed forest. The low land of south side of the district is covered by lower tropical Sal (*Shorea robusta*) forest and mixed with broad leaved forest, above this Hill Sal forest, similarly Chir-Pine (*Castanopsis-Pinus*) forest extended from west and *Schima-Castanopsis* forest extended from east meet in this area (Department of Forest, 2002). In the middle belt hill species of Sal (*Shorea robusta*) consists *Albizia* species, *Anogeissus latifolia*, *Juglans regia*, *Schima wallichii*, *Ficus semicordata*, above this belt *Pinus roxburghii* mixed with *Castanopsis indica*, *Diospyrus malabarica*, *Rhododendron arboreum*, *Quercus* species are associated with *Maesa chisia*, *Berberis asiatica*, *Rubus ellipticus*, *Justica adhatoda*, *Zanthoxylum armatum*, *Woodfordia fruticosa,* etc. (Panthi, 2003).



Map 1: Arghakhanchi, a midhill district of west Nepal

MATERIALS AND METHODS

Information was gathered through a semi-structured open questionnaire by interviewing 85 respondents in different age groups of different areas of Arghakhanchi district during 2003-2008. Each respondent was asked to list the fodder with their quality (fair, good and best) use in the area and rank the fodder in order of merit from 1 to 10 according to their preferences. Primary data obtained from field observation and secondary data (nutrient analysis of preferred and high ranked species) from different sources (FAO Report, 2002; Upreti and Shrestha, 2006; Dhungana *et al*., 2012) have been used.

RESULTS

Arghakhanchi, one of the mid hill districts of Nepal is found rich in fodder plants. It was found that all palatable plants that are browsed by livestock

are considered as fodder. Under these criteria there were 131 species of plants under 103 genera belonging to 50 families. In total 69 trees have been recorded as tree fodder (Table 1). Out of them 24 species have been listed under best (B), 36 species under good (G) and 9 species under fair (F) categories. Ten best tree fodderhave been listed in Table 2 on the basis of farmers' preferences and priority. The study revealed that majority (96.47%) of the farmers consider *Grewia optiva* as a highly preferred tree fodder species.

Table 1: List of tree fodder with their quality classes (F=Fair, G=Good and B=Best) from Arghakhanchi district.

S.N.	Botanical Name	Local Name	Family	Quality of Fodder
1.	*Acacia catechu* (L.f.) Willd.	Khayer	Leguminosae	G
2.	*Aesandra butyracea* (Roxb.) Baehni	Chiuree	Sapotaceae	F
3.	*Albizia chinensis* (Osbeck) Merr.	Rato/Lakka siris	Leguminosae	F
4.	*Antidesma acidum* Retz.	Archalo	Euphorbiaceae	G
5.	*Artocarpus lakoocha* Wall. ex Roxb.	Badahar	Moraceae	B
6.	*Arundinaria falcata* Nees	Neeyalo	Gramineae	B
7.	*Bauhinia purpurea* L.	Tanki	Leguminosae	B
8.	*Bauhinia variegata* L.	Koiralo	Leguminosae	G
9.	*Betula alnoides* Buch.-Ham. ex D. Don	Saur	Betulaceae	G
10.	*Boehmeria rugulosa* Wedd.	Geethi	Urticaceae	B
11.	*Brassaiopsis polyacantha* (Wall.) Banerjee	Kalo - chuletro	Araliaceae	G
12.	*Bridelia retusa* (L.) Spreng.	Gaayo	Euphorbiaceae	G
13.	*Buddleja asiatica* Lour.	Phurse	Loganiaceae	G
14.	*Buddleja paniculata* Wall.	Narayan Pati	Loganiaceae	G
15.	*Callicarpa arborea* Roxb. ex C.B. Clarke	Guanlo	Verbenaceae	G
16.	*Casearia graveolens* Dalzell	Kayene	Flacourtiaceae	G
17.	*Castanopsis indica* (Roxb.) Miquel	Katush	Fagaceae	G
18.	*Cordia fragrantissima* Kurz.	Bohari	Cordiaceae	B
19.	*Dalbergia sissoo* Roxb.	Sisou	Leguminosae	G
20.	*Dendrocalamus hamiltonii* Nees and Arn.	Tamabans	Gramineae	B
21.	*Duabanga grandiflora* (Roxb.exDC.)Walp.	Lampate	Lythraceae	G
22.	*Elaeagnus infundibularis* Momiy.	Madelo	Elaeagnaceae	G
23.	*Engelhardia spicata* Leschen. ex Blume	Mahuwa	Juglandaceae	G
24.	*Eriobotrya elliptica* Lindl.	Maya	Rosaceae	F
25.	*Erythrina stricta* Roxb.	Phaledo	Leguminosae	B
26.	*Euonymus pendulus* Wall.		Celastraceae	G
27.	*Ficus auriculata* Lour.	Bhutuk/Newaro	Moraceae	G
28.	*Ficus glaberrima* Blume	Pankuri	Moraceae	B
29.	*Ficus hispida* L.f.	Tote, Khasreto	Moraceae	G
30.	*Ficus lacor* Buch.- Ham.	Seto Kavro	Moraceae	B
31.	*Ficus nemoralis* Wall. ex Miq.	Dudhilo	Moraceae	B

32.	*Ficus palmata* Forssk.	Bendu	Moraceae	B
33.	*Ficus semicordata* Buch.-Ham. ex Smith	Khaneyu	Moraceae	B
34.	*Ficus subincisa* Buch.- Ham. ex Smith	Bidilno	Moraceae	B
35.	*Fraxinus floribunda* Wall.	Lankuri	Oleaceae	G
36.	*Garuga pinnata* Roxb.	Dabdabe	Burseraceae	B
37.	*Glochidion velutinum* Wight		Euphorbiaceae	F
38.	*Grewia optiva* J.R. Drumm	Phorso	Tiliaceae	B
39.	*Gymnosporia falconeria* Laws	Glodarim	Celastraceae	F
40.	*Leucosceptrum canum* Smith	Bhusure	Labiatae	G
41.	*Ligustrum indicum* (Lour.) Merr	Kanike	Oleaceae	G
42.	*Litsea monopetala* (Roxb.) Pers.	Kutmero	Lauraceae	B
43.	*Macaranga pustulata* King ex Hook. f.	Maidalo	Euphorbiaceae	F
44.	*Melia azedarach* L.	Bakaino	Meliaceae	G
45.	*Morus australis* Poir.	Kutsimal	Moraceae	F
46.	*Morus serrata* Roxb.	Kimbu	Moraceae	G
47.	*Myrica esculenta* Buch.- Ham. ex D.Don	Kaphal	Myricaceae	G
48.	*Oroxylum indicum* (L.) Kurz.	Tatelo	Bignoniaceae	G
49.	*Persea gamblei* (King ex Hook. f.) Koste.	Kathe Kaulo	Lauraceae	B
50.	*Persea odoratissima* (Nees) Kosterm.	Kaulo, Arjun	Lauraceae	B
5.1	*Premna bengalensis* C.B. Clarke	Kalo Geeneri	Verbenaceae	B
52.	*Premna latifolia* Roxb. Var. mucronata	Seto Geeneri	Verbenaceae	B
53.	*Prunus cerasoides* D. Don	Painyu	Rosaceae	G
54.	*Quercus semecarpifolia* Smith	Kharsu	Fagaceae	B
55.	*Quercus glauca* Thunb.	Sano Phalat	Fagaceae	B
56.	*Quercus lanata* Smith (*Q. lanuginosa* D. Don)	Sano Banjha, Rayat	Fagaceae	B
57.	*Quercus leucotrichophora* A. Camus (*Q. incana* Roxb.)	Banjha	Fagaceae	B
58.	*Rhus javanica* L.	Bhakimlo	Anacardiaceae	F
59.	*Salix babylonica* L.	Baish	Salicaceae	G
60.	*Saurauia napaulensis* C.	Gogon	Saurauiaceae	G
61.	*Schefflera venulosa* (Weight and Arn.) Harm.	Kutsimal	Araliaceae	G
62.	*Semecarpus anacardium* L.f.	Bhalayo	Anacardiaceae	G
63.	*Shorea robusta* Gaertn.	Sal	Dipterocarpaceae	G
64.	*Terminalia bellirica* (Gaertn.) Roxb.	Barro	Combretaceae	G
65.	*Terminalia chebula* Retz.	Harro	Combretaceae	G
66.	*Toona ciliata M.* Roem.	Tooni	Meliaceae	G
67.	*Trema cannabina* Lour.	Khakshi	Ulmaceae	G
68.	*Wendlandia coriacea* (Wall.) DC.	Tilko	Rubiaceae	G
69.	*Xylosma controversum* Clos.	Raju	Flacourtiaceae	F

Table 2: List of top ten best tree fodder species with their local name, family and percentage of preferences. (Total respondents (n) = 85)

S. No.	Species	Local Name	Family	Preferences (%)
1.	*Grewia optiva* J. R. Drumm.	Phorso	Tiliaceae	96.47
2.	*Listea monopetala* (Roxb.) Pers.	Kutmero	Lauraceae	89.41
3.	*Ficus subincisa* Buch.-Ham. ex Smith	Bidilno	Moraceae	85.88
4.	*Dendrocalamus hamiltonii* Nees and Arn.	Bans	Gramineae	84.70
5.	*Ficus nemoralis* Wall. ex Miq.	Dudhilo	Moraceae	82.35
6.	*Ficus lacor* Buch.-Ham.	Kavro	Moraceae	82.35
7.	*Ficus semicordata* Buch.-Ham. ex Smith	Khaneyu	Moraceae	81.17
8.	*Artocarpus lakoocha* Wall. ex Roxb.	Badhar	Moraceae	81.17
9.	*Quercus glauca* Thunb.	Sano phalat	Fagaceae	80.0
10.	*Premna bengalensis* C.B. Clarke	Kalo geeneri	Verbenaceae	80.0

Out of above ten tree species, 5 best fodder trees the members of family Moraceae in which 4 species come under single genus *Ficus*. This result shows that species are the best and most preferable fodder among trees found in the midhill of west Nepal. In total 8 *Ficus* species were listed as tree fodder in the study area (Annex 1).

DISCUSSION

In Nepal, tree fodder is commonly known as *daale ghans*, a term being used for woody leaves and branches coming from trees, shrubs, vines and climbers. Farmers in Nepal have a considerable knowledge of fodder trees and nutritional qualities (Mahato and Subba, 1988). The nutritional values of fodders differ according to species and season of growth and, therefore, farmers prefer different species for different seasons, and animals to be fed. The traditional and experience-based choice of fodder species by farmers reflects their indigenous knowledge on nutritional values, cultivation easiness and seasonal variability of growth in local environment.

Tree fodder is particularly important as a green, nitrogen supplement to poor quality crop residues during the dry season (November to June) when feeds are scarce (Panday, 1982). Samant *et al*. (2007) listed 150 species of fodder representing trees, shrubs and herbs used as fodder for livestock in Indian Himalayan Region. Similarly, Dhungana *et al*. (2012) studied fodder trees in the Kaski district, Panday (1982) studied in Palpa district and Chapa (1994) studied from Salyan district of midhills of Nepal. Some of the species are similar with that of present finding (Table 3) and they also ranked plants on the basis of criteria similar to this paper. Present result reveled that *G. optiva* occupies the first

position in Arghakhanchi district which coincides with finding of Chapa (1994) in Salyan, while it comes in fourth position in Palpa district. Similarly, *L. monopetala* is in second position which is similar to the finding of Panday (1982) in Palpa. But *Artocarpus liste. lakoocha* which stands in eighth position in Arghakhanchi takes first position in Palpa and Kaski districts (Table 4). Little variation in preferences may be due to the abundance of preferred trees in studied area.

The top most preferable tree fodder species *Grawia. optiva*, locally known as 'phorso', is grown on the edges of field terraces (*bari*). It has been used as multipurpose tree as leaves and young twinges are used as fodder, best quality fiber (*pautta*) is extracted from bark of branches and remaining core part of branches is used as easy fire catching fire wood (*seetha*). The main reason for considering it as the best fodder was its highly energetic, nutritious, enhancing fat production in cattle, palatability and its test. Farmer recognized it as *obno* as well as *posilo*. Out of 85 respondents 82 suggested it as highly preferred fodder tree. Similar results have been observed by Chapa (1994) in Salyan district.

The nutritive value of a fodder species is determined by its ability to provide a range of nutrients required by the animals for maintenance, growth, production and reproduction. It is related to intake, chemical composition, digestibility and the presence or absence of anti nutritional factors (Gutteridge, 1995). The nutritional value of most preferred fodder tree *G. optiva* is given in the table 3.

Table 3: Nutritional value of *Grewia optiva*

Main analysis	Unit	Avg.	Mini	Max	Nb
Crude protein	% DM	13.3	10.1	16.4	2
Crude fiber	% DM	15.4	14.1	16.6	2
Ether extract	% DM	7.6	6.8	8.4	2
Ash	% DM	14.6	14.2	14.9	2
Gross energy	MJ/Kg DM	17.7			
Minerals					
Calcium	g/Kg DM	38.8	35.7	41.8	2
Phosphorus	g/Kg DM	2.5	2.5	2.5	2

Source: FAO's Animal Feed Resources Information System (1991-2002) 2002.

Table 4: Most preferred fodder tree species by farmers in three (Kaski, Palpa and Salyan) midhill districts

Kaski district (Dhungana *et al.* 2012)	Palpa district (Panday 1982)	Salyan district (Chapa 1994)
1. *Artocarpus lakoocha*	1. *Artocarpus lakoocha*	1. *Grewia optiva*
2. *Ficus subincisa*	2. *Listea monopetala*	2. *Celtis australes*
3. *Ficus roxburghii*	3. *Ficus auriculata*	3. *Listea monopetala*
4. *Ficus semicordata*	4. *Grewia optiva*	4. *Karkale*
5. *Listea monopetala*	5. *Erythrina stricta*	5. *Bauhinia varigata*
6. *Ficus lacor*	6. *Bauhinia varigata*	6. *Ficus semicordata*
7. *Machilus odoratissima*	7. *Ficus rumphii*	7.*Saurauia napaulensis*
8. *Ficus glaberrima*	8. *Garuga pinnata*	8. *Ficus nemoralis*
9. *Brassaiopsis hainla*	9. *Ficus subincisa*	9.*Brassaiopsis polycantha*
10. *Ficus hispida*	10. *Ficus lacor*	10. *Indigofera pulchella*

Folk classification system of fodder

Local farmers categorize the fodder on the basis of defined purposes.

(a) According to effect of fodder

(i) *Obano ghans* (Warm fodder) - Those palatable plant species are generally feed in moist and cold season, so that cattle will not suffer from cold e.g. *F. semicordata*, *G. optiva*, *Bambusa* and *Dendrocalamus* species, *Cyperus* species, *Thysanolaena maxima.*

(ii) *Cheeso ghans* (Cold fodder) -Young tender parts of palatable plant species, consumed by cattle but not preferred by farmers for cattle feeding because those fodder cause loose stool disease to livestock e.g. *Litsea monopetala*, *Garuga pinata*, *Erythrina arborescens.*

(iii) *Posilo ghans* (Milk yield increasing fodder)- Quantity of milk per cattle increases after feeding such plants e.g. *Premna latifolia*, *F. nemoralis*, *A. lakoocha*, *G. optiva*, *Cynodon dactylon, Vicia angustifolia.* It is said that they also increase fat in milk of lactating animals.

(iv) *Beekhalo ghans* (Poisonous fodder) -Some fodders are poisonous in large dose or when fed new flush of leaves and buds e.g. *Lyonia ovalifolia* can be fatal in young stage; *Osyris wightiana* and *Neolistia cuipala* could be fatal in large doses. *Albizia chinensis*, *Hedychium spicatum* and *Prunus ceracoides* may cause serious problem in some conditions.

(b) According to habit of fodder

(i) *Daale ghans* (Tree fodder), and (ii) *Sapke ghans* (Herbaciuos fodder).

Conservation and management perspectives

To increase the production of preferable fodder species, the following measures would be appropriate for the conservation and management of fodder resource of mid hills.

(1) Preparation of a comprehensive inventory/ database of fodder resources.

(2) Chemical analysis of fodder plants to identity the nutritive status.

(3) Maintain record of indigenous knowledge of fodder species for sustainable use.

(4) Development and implementation of land use plans.

(5) Promote *ex-situ* and *in-situ* conservation of fodder resource.

(6) Large scale propagation of highly preferred fodder species and dissemination of packages to local inhabitants.

(7) Identify biotechnological means to improve germination/ propagation of fodder species.

(8) Impart training on lopping, nursery, propagation and plantation techniques.

(9) Ensure people's participation and create awareness through training and use of media.

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