REPORT 10

Strategies for improved fodder production in the dry season in the mid-hills of Nepal, using participatory research techniques.

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Summary reports from village-level workshops and Kathmandu farmer and NGO workshop, held during March and April 2000.

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LIST OF ABBREVIATIONS

CBO	Community Based Organisation
DfID	Department for International Development
DFRS	Department for Forest Research and Survey
HMGN	His Majesty's Government of Nepal
LPP	Livestock Production Programme
NAF	Nepal Agroforestry Foundation
NGO	Non-government organisation
NRI	Natural Resources Institute
RNRKS	Renewable Natural Resources Research Strategy
TOT	Training of trainers
VDC	Village Development Committee

GLOSSARY OF NEPALI SPECIES TERMS

Amriso	*Thysanolaena maxima*
Badahar	*Artocarpus lakoocha*
Bakaino	*Melia azedarach*
Bakhre	?
Banjh	*Quercus lanata*
Barro	*Terminalia bellerica*
Bhatmase	*Flemingia congesta*
Chieuri	*Aesandra butyracea*
Dabdabe	*Garuga pinnata*
Dar	*Erythrina arborescens*
Dhumre	*Ficus racemosa*
Dinanath	*Pennisetum pedicillatum*
Dudhilo	*Ficus neriifolia*
Gauzuma	*Gauuma ulmifolia*
Gayo	*Bridelia retusa*
Gedulo	*Ficus clavata*
Gideri	*Premna barbata*
Gogan	*Sauraria nepalensis*
Harro	*Terminalia chebula*
Hathi paile	*Brassiopsis polycantha*
Ipil	*Leucaena diversifolia*
Jai ghans	*Avena sativa*
Jalma	?
Karam	*Adina cordifolia*
Katus	*Castanopsis indica*
Kavro	*Ficus lacor*
Khanyu	*Ficus semicordata*
Khasreto	*Ficus hispida*
Khasru	*Quercus semicarpifolia*
Kimbu	*Morus alba*
Koiralo	*Bauhinia variegata*
Kutmiro	*Litsea monopetala*
Lapsi	*Choreospondias axillaris*
Mausam	*Citrus sinensis*
Molasses	*Melinus minutifloria*
Muhni	?
Naspati	*Pyrus communis*
NB21	*Pennisetum spp.(cross)*
Nibuwa	*Citrus limon*
Nimarro	*Ficus auriculata*
Painyu	*Prunus cerasoides*
Pati	*Buddleia asiatica*
Pipal	*Ficus religiosa*
Sajh	*Terminalia alata*
Sal	*Shorea robusta*
Sandan	*Ougenia dalbergioides*
Saur	*Betula alnoides*
Stylo	*Styloxanthes guianensis*
Sunhemp	*Crotalaria juncea*
Suntala	*Citrus reticulata*
Tanki	*Bauhinia purpurea*
Timila	*Ficus auriculata*
Velvet bean	*Stizolobium pruriens*

GLOSSARY OF OTHER NEPALI TERMS:

Bari	Rainfed terraced land
Bhari	One back-load of material (weight varies depending on material, who's carrying it, location and time of the year).
Doko	Straw basket carried on back
Khet	Irrigated terraced land
Khumre	Beetle larva that feeds on roots of seedlings and crops, esp. maize
Lahi	A type of aphid
Mutha	An armload (approx. ¼ *doko*)
Selroti	Sweet bread made from batter

One of the group discussions during the Kathmandu workshop

REPORT FROM THE FIVE RESEARCH-VILLAGE WORKSHOPS

Summary:
The workshops began with an introduction to the objectives of the meeting as identified by the project (outlined below) and the participants were asked to submit their own suggestions for topics to include in the workshop. These suggestions varied between locations and gave each workshop a slightly different focus. The first item for discussion was the results from the bi-monthly survey. This was facilitated by the use of diagrams showing seasonal fodder supply and deficits, with constituent breakdown, seasonal milk production and seasonal use of the most popular local fodder tree species (see appendices 1, 2, 3). Each set of diagrams averaged results over the whole village and highlighted comparative rather than absolute values. Copies of individual survey results were available at the workshops to refer to in the event of any queries, or uncertainties, on the farmers' behalf. These diagrams were intended to encourage farmers to discuss results that appeared surprising to them and to formulate a clear picture in their minds of the current situation and relationships between fodder supply, deficit and livestock productivity. In the light of this information, the diagrams of seasonal lopping patterns helped farmers to consider possible alterations to management regimes of local species in preparation for more detailed discussions later in the workshop.
This was followed by a presentation by DFRS staff of a prepared table summarising individual trial plot and soil analysis results. NAF and DFRS staff explained the significance of these results with respect to the potential for further promotion of introduced species. The third topic concerned overall performance and management of introduced fodder species. Tables were completed by participants to summarise overall performance of introduced species to date, farmers' assessment of these species and management information regarding local fodder species. In these exercises, farmers were encouraged to explore possible solutions to any existing problems related to fodder management, particularly those concerning introduced species. The workshops concluded with a discussion on the group's priorities for further development work.

Objectives
The project's overall objectives for the village level workshops can be summarised as follows:

- To provide information on performance of introduced species for discussion
- To present a summary of results from soil analysis and trial plot measurements
- To present a summary of results from bi-monthly surveys for discussion
- To discuss future plans for the extension and use of introduced species
- To discuss the local groups' possible future development programmes

Chankhubesi: 28th March 2000:

Participants were asked to give their expectations of the workshop. Their responses were as follows:

- To improve their understanding of the research programme
- To discuss the successes and problems relating to the project to date
- To discuss possible future group development activities
- To discuss problems arising from the fodder nursery and plantation programme
- To secure assistance for a livestock development programme

Discussions on fodder supply and deficit diagrams highlighted problems with the July deficit figures. Survey results indicated this as the season with the highest deficit but farmers' disagreed with this, saying that the results must have arisen through confusion over the questions. (The confusion has subsequently been traced to the presence of a new enumerator who was asking the question about deficits in a different way. This influenced data collected in all villages in this month and to a lesser extent in November.).
The highest deficit months were identified as March to May. In the colder months of December to February livestock slept longer hours and required less food to be satisfied. Rice straw was also still generally available during this period. While this feed with high dry matter content was available, the total volume of feed required was reduced. While discussing the level of deficit in the November season, one farmer suggested using silage as a possible alternative source of feed. This had been tried before after the same farmer had received training in the appropriate technology several years earlier but disputes over use of the product and lack of follow-up support led to the work being discontinued. The participants were, however, keen for further exposure to silage production techniques.

Diagrams of concentrate intake against seasonal milk production showed no clear pattern over the village but, overall, the season with the highest milk output per day was March. The villagers identified August to September as usually the most productive season, due to the high number of lactating buffalo. In other villages further discussions looking at the detailed production data led to a realisation that it had been an unusual year. Detailed production data was not available at the workshop for cross-checking purposes and so this will be arranged for a future field trip.
Farmers did suggest that a local grass named *armale*, which was known as very good for milk production, was available during March and might be involved in increased productivity in some households during this season. However, this grass was never mentioned during the bi-monthly surveys and its significance is therefore probably minimal.

The diagrams showing seasonal local tree fodder use were used to illustrate the idea of adjusting the lopping times of some trees to cover periods when shortages were pronounced. The participants found this idea hard to grasp but concluded that there was no realistic option for altering management patterns of these species.

Table 1.1: Summary of soil analysis and trial plot results:

Name and household no.	Average soil pH	Species performance* and average height after 7 months (cm)			
		Ipil	Kimbu	Tanki	Badahar
Menuka	5.11	VG - 61.66	G - 29.35	G - 56	G - 29.08
2 Subhadra	5.23	OK - 59.13	VG - 50.89	VG - 51.71	G - 24
3 Chhetra	5.44	G - 49.12	G - 46.48	VG - 46.67	VG - 32.83
4 Kaili	5.44	G - 66.21	OK - 42.1	OK - 30.25	OK - 60.5
5 Sushmita	4.84	OK - 46.48	OK - 25.73	NG - 41.67	OK - 22.5
6 Sherada	5.2	OK - 42.17	G - 48.23	G - 52.5	G - 35.17
8 Parvati	4.96	NG	NG	NG	NG
9 Chandra	5.56	OK - 37.98	OK - 39	G - 57.42	G - 42.25
10 Manamaya	5.28	OK - 41.64	OK - 24.5	OK - 50.5	G - 38

* VG - very good, G - good, OK - adequate, NG - poor

NB: Soil pH readings from four depths between 20 and 200 cm. were averaged as there was not a large difference between different depths.

Menuka was included in the trial plot exercise as a replacement for Krishna Parajuli (HH1) who was no longer able to participate in the project. Laxmi Tamang (HH7), left the project in January 1999. Soil type was given as loam for all locations except Subhadra's, which was sandy loam. It was also noted that Kimbu and Tanki performed best on Subhadra's plot, which was located at the lowest altitude. The group was advised that any other significant differences in species performance were unlikely to be attributable to differences in soil type or pH but were more likely to be due to individual management practices.

Table 1.2: Overall species performance on farm (outside of trial plots) over 2 years:

Species	**Survival**	**Growth**	**Lopping regime to date**
NB21	Good	Good	July-February: 3 times per month. Once a month at other times
Ipil	Good in 1st year	Good (3m)	July/November/March
Kimbu	Good	Good (2m)	September
Gauzuma	OK	Good (3m)	December-January
Molasses	Good	Good	July-August/October-November
Bhatmase	Good	Good (2m)	January/November
Jai ghaans	Good (since Jan)	Good	-
Tanki	Good (plot only)	Good	-
Badahar	Good (plot only)	Good	-
Velvet bean	Good	Good	November-December

The group listed other species they would like to encourage or promote as Dudhilo, Gogan, Kavro and Koiralo.

To encourage more individual involvement in discussions the participants were divided into two groups to complete the following two tables concurrently.

Table 1.3: Local tree fodder information:

Species	Change in fodder availability (over 3 yrs)	Reasons for change / Comments
Kutmiro	33% more	Transplant wild seedlings to bari land. Learned this technique from women's development training in 1986
Timila	No change	Lowers water table in surrounding area therefore not encouraged
Painyu	13% more	Prolific regeneration, produces goat fodder all year round, including dry season, therefore actively encouraged
Bakaino	39% more	
Pati	No change	Prolific regeneration

It proved difficult to explain the concept of increased fodder availability in terms of total output from all trees of a particular species in one year. Therefore the percentage figures in the above table are the farmers' estimate of the increase in number of seedlings of the relevant species present on their bari land over the last three years.

Table 1.4: Farmers' assessment of introduced species' performance and management:

Species	Rank	Best features	Problems	Solutions	Fodder
Ipil	1	- Quick growth - Dry season fodder	- Germination - Seed viability - Insects	- Good nursery practice - Test seed at source	Very high quality
Kimbu	3	- Quick growth	- Cuttings dry out - Insects	- Avoid small cuttings - Control insects	Very high output
Bhatmase	4	- Soil improvement	- Slow growth - Seed viability	- Test seed	Average
Tanki	5		- Seed rotted	- Test seed	Very high output
Gauzuma	2	- High quality fodder - Large tree	- Germination	- Seed treatment	Very high output

Data on Badahar and the various introduced grass species will be collected during future field trips and group meetings.

The participants listed future activities they would like to be involved in as follows:

- Veterinary training
- Continue fodder nursery and plantation programme
- Fruit seedlings
- Community forest formation and management for Nayagaon
- Irrigation scheme for vegetables
- Learn research conclusions and plot results in more detail

Tawari: 30th March 2000:

Due to security concerns the workshop was held in Khopasi, rather than in Tawari village, with facilities provided by a local NGO. The village group members arrived together and the workshop began close to the desired time. Participants gave their expectations from the workshop as follows:

- Income generation
- Project activities to date
- NAF's working methods and action areas
- Possible activities for the newly registered youth club and collaboration with NAF
- Community forest training

Discussions on the fodder supply and deficit diagrams again concentrated on the apparent large deficit in July. The farmers, as in Chankhubesi, did not agree with this result and cited March to May as the period of the highest deficit. However, they admitted that there usually is a slight deficit in July, albeit not as pronounced as the survey results suggest. The main reason for this shortage is that grasses collected in this season are young and tender, with a high moisture content. Livestock therefore require larger volumes of grass in order to be satisfied, compared with the smaller amounts of mature grasses fed in the late monsoon. In addition to this, the rainfall during this period adds to the weight of each *doko* of grass and therefore reduces the volume of an average backload. Two households in particular, Ranjana (HH7) and Chameli (HH5), have been recorded as reporting large deficits during this period. When reminded of the responses given in the July survey, they both assured the group that these figures were inaccurate and they reduced their deficit estimate by 75%. The reason given for the greater recorded deficit in November than in January was similar to that given in Chankhubesi: the livestock require less feed in the coldest weather due to longer hours of sleep.

Milk production figures for the village show significantly less production between July and September than the rest of the year. However, the farmers identified this season as usually their highest production period. As in Chankhubesi, the detailed production figures need to be discussed with farmers. The influence on milk production of the opening of the milk collection centre in Tawari in October 1998 will also be further explored.

Table 2.1: Summary of soil analysis and trial plot results:

Name and household no.	Average soil pH	Species performance* and average height at 7 months (cm)		
		Ipil	Bhatmase	Kimbu
1 Kavita	5.44	VG - 31.25	G - 27.09	VG - 27.25
Man bdr	5.46	OK - 28.09	NG	G - 29.67
3 Sunita	5.42	G - 23.09	G - 8.74	G - 15.94
4 Rupadevi	5.5	VG - 58.64	VG - 25.9	VG - 30.41
5 Chameli	5.44	OK - 24.59	G - 24.1	OK - 11
6 Samjhana	5.63	VG - 31	G - 33.65	VG - 29.03
7 Ranjana	5.31	OK - 26.06	NG - 15.5	G - 33.07
8 Laxmi	5.71	G - 31.1	NG	OK - 46.86
9 Urmila	5.71	NG - 23.8	NG	G - 49.12
10 Rumila	5.53	NG	OK - 16	G - 38.64

* VG - very good, G - good, OK - adequate, NG - poor

Man bahadur Tamang joined the trial plot programme to replace Anita Tamang (HH2) who left the village in May 1999. Soil type for all plots was given as silty loam. Farmers were told that overall soil conditions in the village were favourable for all introduced species. Climate was likely to be a more significant factor in any failures.

Table 2.2: Overall species performance on farm (outside of trial plots) over 2 years:

Species	Survival	Growth	Lopping regime to date
Ipil	Good - 66%	Poor - 2m in 2 years	Low output to date - only 5 trees cut: October and May
Bhatmase	Poor - 25%	Good - 1.5m	2 farmers cut in October-November
Gedulo	Good	OK - 0.5m	Not yet cut - plan for May
Kimbu	V.Good - 75%	OK - 1m Rupadevi's VG	Low output to date. One farmer cut in November. Will cut next in June.
Sunhemp	Good	Good	Cut once in October. Will cut in June
Dinanath	Good	Good	Plant June, cut in January-February then dies
Jai ghans	Good	Good	Not yet cut
NB21	Good	Good	Max 3 cuts so far. Possible cutting regime once a week between June and October. Once a month other times.
Molasses	V.Good	V.Good	Available July to December. Either cut once and produce seed or cut twice for fodder only. Once a month possible on best soil
Velvet bean	Good	Good	Cut once between July and October. So far cut only for seed.
Stylo	Poor	Poor	Not cut

The participants divided into two groups to complete the following tables.

Table 2.3: Local tree fodder information:

Species	Rank and best feature	Information
Timila	2 - high output	Adjusted lopping regime for maximum output. Now cut once between November and February and once in June
Gogan	3 - high output	Fodder available all year. Usually cut between November and June
Dudhilo	1 - quality fodder	Cut either in wet season (June) or in winter (Nov-Feb). Trees managed so some are cut in one season, some in other
Painyu	4 - firewood	Resinous in winter - reduces fodder quality. Best fodder available after resin flow ends - April to June. Usually cut once a year
Hathi paile		Used for fodder after 5-6 years old. Cut once in January
Khanyu		As for Dudhilo - cut either in November or in July
Dar		Cut once between February and April. Bark produces soda for making selroti
Saur		Cut once between February and April. Leaf fall in Nov-Dec
Banjh		Small cuts available all year. Main cut between December and March, low quality
Katus		Cut once between December and April
Khasru		Small quantities available all year - low quality

During the main shortage season (February to June) some local trees could be promoted to reduce the fodder deficit. The farmers listed the possible species as Gogan, Dar, Saur, Katus and Khasru. Of these only Gogan is considered good quality fodder. The participants were unable to make any accurate judgements on the rate of change of fodder availabilty from local species over recent years. They agreed, however, that fodder collection from all local species had been steadily increasing.

Table 2.4: Farmers' assessment of introduced species' performance and management:

Species	Rank	Best features	Problems	Solutions	Fodder
Ipil	7	Fodder available in dry season	- Slow growth - Leaf fall due to frost	Weeding to improve growth rate	Twice: October and May
Bhatmase	8	" "	- Insects		Oct-Nov
Kimbu	4	" "	- Yellow leaves - Insects	Avoid cutting when leaves discoloured	November
Gedulo	6	" "	- Slow growth - Germination	Weeding	October to January
Molasses	1	High output			July to December
Dinanath	3	Fulfils grass shortage	Can only be cut once before dying		December
NB21	5	" "	Roots penetrate into bari	Plant further down terrace	mostly July to January
Sunhemp	2	" "	- No seed due to damage by *lahi* insects	Manage seed collection training through local institutions	September

It was notable that only Ipil had so far been cut during the high deficit season (by only two farmers). Cold weather damaged the leaves of both Kimbu and Ipil and reduced the value of fodder during the dry season. Grass species, all of which are harvested before the dry season, are much preferred to tree species in this location. However, all farmers were keen to replant tree species and expected Kimbu, Bhatmase and Ipil to contribute towards their dry season fodder supply in future.

Participants listed priorities for future activities as follows:

- Increase Tawari group members to 20
- Form new groups in the nearby communities of Bhedamas, Chhapdanda and Siurani with help from Tawari group
- Continue fodder nursery and planting programme
- Discuss research findings at group and VDC level
- Investigate assistance for chicken and goat raising programmes
- Income generation from lapsi, cardamom, amriso and chieuri
- Promotion of fruit species suntala, nibuwa, mausam, apple, naspati

Ange: 1st April 2000:

Participants gave their expectations of the workshop as follows:

- Learn more about management patterns for introduced fodder species
- How to use manuring, soil treatments and irrigation to improve soil quality
- Which species are performing best
- Talk about goat raising as a follow-up to improved fodder programme

As with the previous two workshops, the central item for discussion from the survey results was the high reported deficit in July. This was even more marked in Ange than in Tawari and Chankhubesi. Participants suggested several possible explanations for the deficit, including the high moisture content of grasses collected in this season. This leads to a low overall dry matter content per bari and a consequent apparently high level of feed supply required to satisfy livestock. Participants confirmed that livestock required a lower total volume of feed in September than in July due to the maturity and lower moisture content of grass collected in September. They also mentioned that July and August included the peak period of oxen draught labour and a corresponding increase in oxen feed requirement. Day length was also suggested as a possible factor in increased feed requirement. However, despite these factors, they did not agree with the survey results showing July as the period of highest fodder deficit. All were agreed that April to May were the most critical months.

The low supply and deficit levels in January compared to November were also discussed. Participants agreed with these results, explaining that the tree and grass fodders available in January were generally of high nutrient content and therefore lower volumes were required than in November to satisfy livestock.

On being shown the diagrams representing seasonal milk production the farmers initially questioned the results, which showed the highest levels of production in November and January. They were unanimous in identifying August and September as the months of peak milk production. However, when the individual figures for the months concerned were checked with the participants it transpired that several buffalo in the village had given birth towards November and the lactating mothers had therefore given rise to an increase in the average levels of milk production. The farmers stated, however, that this was not the normal pattern for annual milk production.

While discussing the lopping patterns for local fodder tree species, the participants brought up the problem of *tapkan,* or the damage to cropland from the impact of raindrops falling from large tree leaves. While lopping large trees for fodder during the monsoon would alleviate this problem, they said that any recently cut branches, devoid of foliage, were liable to rot when exposed to the heavy monsoon rains.

Table 3.1: Summary of soil analysis and trial plot results:

Name and household no.	Average soil pH	Species performance* and average height at 7 months (cm)			
		Ipil	Bhatmase	Kimbu	Badahar
1 Bhim	5.17	OK - 59.01	VG - 38.17	VG - 66.11	OK - 11.67
2 Shanta	5.32	VG - 29.17	VG - 33.05	VG - 66.11	OK - 15
3 Rani	5.42	OK - 20.25	G - 19.8	G - 46.17	G - 12
4 Phultunga	5.43	NG	NG	NG	NG
5 Man	5.62	G - 32.89	VG - 36.16	G - 84.73	G - 26.67
6 Dev	5.23	G - 55.92	OK - 49.25	G - 24.1	NG
7 Shuku	5.23	NG	NG - 42.88	NG - 41	OK - 20
8 Lok	5.32	OK - 28.4	OK - 18.42	OK - 46.23	OK - 28.54
9 Savitri	5.48	OK - 17.55	OK - 26.88	OK - 41.38	NG - 16
10 Ram	5.42	G - 30.98	G - 34.8	G - 35.68	G - 20

* VG - very good, G - good, OK - adequate, NG - poor

Soil type in all locations was given as sandy loam. The participants were keen to discuss the details of the soil analysis results and particularly wished for more information regarding how these results related to their decision making when planning planting strategy. They were assured that a more detailed report would be produced.

Table 3.2: Overall species performance on farm (outside of trial plots) over 2 years:

Species	Survival	Growth	Lopping regime to date
Ipil	OK - 40%	Poor - 1m in 2 years	Only 2 trees cut so far by one farmer - in Jan-Feb
Bhatmase	Good - 60%	Good - 1m	Cut once in Oct-Nov
Badahar	OK	Good - 3m	Not yet cut
Gauzuma	Good	VG - 2.5m	One farmer lopped once - in Jan-Feb
Kimbu	Good - 50%	V.Good - 2m	Cut once in Oct-Nov
Dinanath	Good	Good	Cut in September. Each farmer less than 1 *mutha*
Stylo	Poor	OK	One farmer cut once - in Jan-Feb
Molasses	Good	Good	2 cuts of 1 *mutha* each between August and January
Sunhemp	Good	V.Good- up to 2m	3 cuts per year
NB21	Good - 60%	Good	3 times per month between June and September. Twice per month at all other times

Only three local species (Kutmiro, Khanyu and Pati) are used for tree fodder at this location since the closure of the local forest. After a short discussion, the participants concluded that availability of these species had not changed over the last three years and, due to the severity of shortages over all seasons, it was not feasible to consider altering management patterns of these species in the near future.

A matrix ranking exercise was used to rank the introduced species (divided into trees and grasses) by order of overall preference.

Table 3.3: Farmers' assessment of introduced species' performance and management:

Species	Rank	Best features	Problems	Solutions	Fodder
Ipil	5	- Dry season fodder - Soil improvement	- Slow growth - Khumre and other insects	- Weeding - Apply compost	Average quality. Cut in Oct-Nov and Feb-March
Bhatmase	3	- Quality fodder - Soil improvement - High output per plant			High output and quality. Cut in Oct-Nov and Jan-Feb
Badahar	1	- Both fodder and fuelwood available	Very sensitive to nursery practice	Pay particular attention to correct watering regime	High quality. No opinion on lopping times
Gauzuma	4	Quality fodder			February
Kimbu	2	Dry season fodder	Insect damage	Apply compost instead of fresh manure when planting out	High quality. Cut in April
Dinanath	5	Quality fodder			August
Stylo	4	Quality fodder			Aug-Sept
Molasses	1	- Quality fodder - High output			Sept-Oct
Sunhemp	3	Fast growth			September
NB21	2	- Fast growth - High output - Quality fodder - Amenity value			3 times a month in June to Sept. Twice a month other times

Participants agreed that they would like to continue planting all the new species so far introduced through the home nursery programme. It was emphasised that this site had shown particularly good results with Bhatmase and Badahar and poor results with Ipil.

Priorities for future activities were listed as follows:

- Discuss research at group and VDC levels
- Form new group nearby in Langarche village
- Continue agroforestry programme (home nursery, terrace planting)
- Explore opportunities for new programmes in goat breeding, vegetables and irrigation

Gajuri Chhap: 8th April 2000:

Participants listed their priorities for discussion at this workshop as follows:

- Grazing control
- How to manage fodder in deficit periods
- Landslide prevention
- New information on agroforestry practices
- Promotion of agroforestry for dry season fodder use

Prior to the presentation of the survey summary diagrams a table was completed, with information from the participants, to indicate the general consensus on the relative seasonal availability of different fodder types and overall fodder deficit. This exercise was intended to encourage farmers to compare this 'cold-start' assessment of their fodder supply situation with the survey data and respond critically to the data if appropriate. The table was completed as follows:

Table 4.1: Participatory assessment of seasonal fodder supply and deficit patterns:

Season	CR	Grass	TF	CT	Grazing	Tot supply	Tot deficit
mid-April to mid-June	*		**		**	**	**
mid-June to mid-August		**		**	*	***	
mid-August to mid-October		**		**	*	***	
mid-October to mid-December		*	*		**	**	
mid-December to mid-February	*		***		**	**	
mid-February to mid-April	**		**		**	**	**

* Low
** Medium
*** High levels of supply or deficit relative to other seasons

Similar anomalies in reported deficits for July and to a lesser extent for November were identified by farmers. This was later traced to enumerator error as in Chankhubesi. Farmers identified young grasses having a higher moisture content during July which leads to the need for the collection of greater volumes to satisfy livestock. Participants were asked if they had considered silage production as a possible method of alleviating winter and dry season deficits. They replied that they had no knowledge of the required technology.

Survey data showed November as the month during which the highest levels of milk were produced. The farmers disagreed with this, identifying September as the month of highest production, corresponding with the peak calving season. However, farmers mentioned that the tree species Gideri and Tanki are lopped mostly in November, both of which are considered to stimulate milk production.

Considerably lower volumes of crop residues are fed in Gajuri Chhap than in the sites in Kavre and Sindhupalchowk. Farmers explained that they feed all their thinnings and residues from the maize crop while they are still green. They had tried storing the material for the dry season but problems with mould and termites made the fodder useless. Furthermore, their holdings of *khet* land are lower than those in neighbouring communities, which limits the volume of rice straw they can produce.

The diagrams representing seasonal use of prominent local tree fodder species prompted more discussion than in previous workshops on the potential for altering management systems. The main points are outlined in the local fodder management table below.

Table 4.2: Summary of soil analysis and trial plot results:

Name and household no.	Average soil pH	Species performance* and average growth rates (cm)			
		Ipil	Bhatmase	Kimbu	Badahar
1 Buddhi	5.92	G - 120.6	OK - 32.3	OK - 46.8	OK - 35.67
2 Sumitra	5.96	G - 51.56	NG	G - 66.67	OK - 37.63
3 Top	5.79	G - 52.72	NG	OK - 27	OK - 28.85
4 Hari	6.01	VG - 97.38	OK - 16	OK - 23.11	OK - 45.17
5 Man	5.87	G - 48.55	NG - 13	OK - 35.71	NG
6 Lila	6.45	VG - 90.56	G - 20.67	OK - 49.43	OK - 30.6
7 Ek	5.81	G - 39.2	OK - 8	VG - 126.14	G - 50.5
8 Ganesh	6.41	G - 42.86	OK - 16.67	G - 73.17	G - 34.29
9 Ammar	6.39	G - 93.78	OK - 21.76	NG - 47.25	OK - 65
10 Dhan	6.34	G - 114.5	NG - 13	G - 51.46	G - 31.87

* VG - very good, G - good, OK - adequate, NG - poor

Soil type for all sites was given as loam (except for household 1 - clay loam). Although not evident from the figures given above, attention was drawn to the significantly better performance of plants in Lila's plot compared with those of Hari and Ganesh. All three are in the same location and have similar soil conditions but Lila's plot was extensively weeded before planting.

Table 4.3: Overall species performance on farm (outside of trial plots) over 2 years:

Species	Survival	Growth	Lopping regime to date
Ipil	Good - 60%	V.Good - up to 4m (in 2 years)	3 times a year - April to May/Aug to Sept/Dec to Jan
Bhatmase	Poor	Poor	Not cut
Badahar	Good	Good - 0.5m	Not yet cut
Kimbu	Poor	Poor in 1st year, better in 2nd.	Cut once so far in April , plan for two more cuts per year
NB21	OK	Good in rainy season	Twice a month on average
Molasses	Good	Good	Twice a year - July-Aug and Oct-Nov
Dinanath	Good	Good	Twice a year - July-Aug and Oct-Nov
Stylo	Poor	Good	Very few cut in Oct-Nov
Sunhemp	Good	Good	Few cut in Sept-Oct

Poor growth of some plants, especially Kimbu and NB21 in the first year was due to exceptionally poor weather - a prolonged dry season in particular. Both these species fell out of favour with the farmers but after the few which were planted in the second year showed good growth they have now made plans to expand planting and have established a community nursery for Kimbu cuttings.

The participants divided into two groups to complete the following tables.

Table 4.4: Local tree fodder information:

Species	Information
Khasreto	Can be cut any time of year. Used to be cut before dry season but since introduction of new species farmers now delay cutting till the dry season. Favoured feed for cattle
Tanki	Cut once a year on a one year rotation. Timing of lopping of individual trees can be changed over time incrementally
Kavro	Main local fodder for dry season - April to May. Cannot be lopped at other times.
Kutmiro	Currently mostly cut before March. If a tree is not lopped its foliage will fall in March and the new shoots can be cut for fodder in April to May. This cannot be done if the tree is lopped before leaf fall.
Bakhre	Cut mainly between October and January. Leaf fall in February - lopping time cannot be adjusted
Gayo	Not a favoured fodder. Cut on a one year rotation as with Tanki. Lopping of individual trees can be seasonally adjusted according to farmer's need
Khanyu	Fodder available all year round. Lopped twice a year - older branches before dry season and younger branches between March and May
Dhumre	As with Khanyu - older branches in Jan-Feb and younger branches in Apr-May
Pipal	Branches can be cut once a year, usually in March. However, if foliage is collected in March without cutting the branches, new leaf shoots can be used for fodder in April-May
Harro	As with Tanki and Gayo - cut once on a one year rotation. Usually managed as a dry season fodder

Farmers agreed that availability of all local fodders has gradually increased over recent years. Propagation trials of Kavro and Bakhre cuttings are currently being carried out in the communal Kimbu nursery. Discussions continued on local species. Farmers agreed that quality of fodder varies greatly not only with species but also with the timing of collection. The topic of using more maize crop residue as a dry season fodder supplement was re-examined. Farmers from the nearby NAF agroforestry demonstration site in Majhitar village suggested that maize stover could be saved for the dry season without risk if it was stored on a raised, shaded platform. Gajuri Chhap farmers agreed that maize leaves and tops could be saved, if stored in this way, without much risk of degradation. Several farmers said that they would try this technique.

A matrix ranking exercise was used to rank the introduced species (divided into trees and grasses) by order of overall preference.

Table 4.5: Farmers' assessment of introduced species' performance and management:

Species	Rank	Best features	Problems	Solutions	Fodder
Ipil	1	- soil improvement - quick growth - vertical roots - multiple cuts including dry season	Leaf curl in cold weather, possibly due to insects		High quality. Cut in April-May, Aug-Sept and Dec-Jan
Bhatmase	4		- slow growth - low output		Average quality Cut twice a year in November and March*
Badahar	3	fodder improves milk quality			High quality Cut once in March
Kimbu	2	- multiple cuts - income from sale of cuttings	- adverse effect on soil fertility - insects in nursery*	plant further down terrace bund	High quality Three cuts in April, June, Oct
NB21	1	- improves milk quality	not a dry season fodder		Three cuts a month between

		- high output			June and November only
Molasses	3	easy to propagate from own seed*	- dries out quickly - low output	plant in cool, shaded location	Average quality Cut twice between July and November
Stylo	4		- germination - low output		Cut once in Oct-Nov
Sunhemp	5	Easy to propagate from own seed*	Unpalatable to livestock		Poor quality Cut once in Aug-Sept
Dinanath	2	- high output - self seeding			High quality Cut twice in Jul-Aug and Oct-Nov

Information with * came from farmers from the non-survey group in Nalang.

Discussions on plans for future activities mainly concentrated on the continuation of the fodder nursery and plantation programme.

Gauthale 9th April 2000:

The participants gave their priorities for discussion as follows:

- Discussion of research results
- Future plans
- Assistance for new youth club

It was decided that the participatory supply and deficit assessment exercise carried out at Gajuri Chhap was of limited value and was therefore not repeated at this workshop. Discussions on the survey results produced similar answers to those in Gajuri Chhap, with over estimates in survey data for deficits in July and November.
The high total supply of fodder in July was due to the availability of young grasses with the rains and the need to collect many back loads because of the bulky/ heavy character of this fodder. It was also suggested that the green maize fodder fed during this season was particularly bulky and that one back load of this fodder therefore constituted a lower total volume than that of other fodder types.

Farmers in Gauthale said that they saved some maize stover to feed during the winter and dry seasons and did not report any problems with storage. They use raised and covered platforms to protect the fodder from termite attack and inclement weather.

Summaries of data on milk production showed a peak in November and January. The farmers agreed with this, saying that calving was also high during this season. They were asked whether the calving season could be adjusted to a period when fodder was more plentiful but replied that they could only respond to signals that their females were in heat and that efforts to inseminate them out of season would be unsuccessful.

Table 5.1: Summary of soil analysis and trial plot results:

Name and household no.	Average soil pH	Species performance* and average growth rates (cm)				
		Ipil	Kimbu	Badahar	Gauzuma	Bhatmase
1 Thulo Toya	5.98	G - 52.27	G - 12.67	OK - 32	VG - 39.17	-
2 Krishna	5.95	VG - 157.5	OK - 16	G - 38	VG - 56.83	-
3 Chabbi	5.73	OK - 45.25	G - 15	VG - 33.6	VG - 47.83	OK - 22
4 Lok	6.42	G - 107.4	VG - 67.17	VG - 40.67	VG - 92.33	NG
5 Kul	5.91	G - 61.6	VG - 37.67	G - 26	VG - 32.2	OK - 9.33
6 Bhim	6.01	G - 67.18	G - 38.5	G - 30.2	G - 74.6	NG - 7
7 Yam	5.94	VG - 55.4	VG - 32.63	G - 35.83	VG - 35.67	G - 12
8 Lal	5.61	G - 43.78	OK - 49.8	G - 36.5	G - 47	OK - 7
9 Khum	5.80	G - 67.5	OK - 41	VG - 34.67	G - 53.8	NG
10 Dhan	5.72	G - 114.73	G - 33.44	OK - 23.33	G - 39.2	OK - 13.4

* VG - very good, G - good, OK - adequate, NG - poor

Participants divided into three groups to create the following tables.

Table 5.2: Overall species performance on farm (outside of trial plots) over 2 years:

Species	Survival	Growth	Lopping regime to date
Ipil	V.Good - 80%	V.Good - 3.5m in 2 years	Up to three times per year - first cut one year after planting
Bhatmase	Poor	Poor	Once between November and December
Badahar	OK - 40%	Good	Not yet cut
Kimbu	V.Good	Good	Cut first one year after planting and every six months thereafter
Gauzuma	Low germination - good survival	V.Good, equal to ipil growth	Cut twice per year in December and in March-April
NB21	V.Good	Good	3 times per month between June and September and once per month in April-May and Oct-Dec
Molasses	Good	Good in monsoon	Twice between July and October
Dinanath	Good	Good	Twice in late monsoon
Stylo	Poor	Poor	Twice in monsoon
Sunhemp	Good	Good	Twice per year
Jai ghans	Good	Good	Once in winter, once in dry season

Prior to this project's on-farm fodder development activities, Gauthale had received help in nursery establishment through Dhusa Bikas Samaj, the local NGO, for two years. This was therefore the best site for studying the performance of introduced species over an extended period of time. The community also manages a communal nursery for Kimbu and Ipil seedlings.

Table 5.3: Local tree fodder information:

Species	Information
Kavro	Cut once a year between March and June
Pipal	" "
Dhumre	" "
Nimarro	Planted recently - farmers have no experience of appropriate lopping regime
Badahar	Only 6 mature trees in village. Cut once a year any time between September and June
Khanyu	Prolific natural regen. Older branches cut in Sep-Oct, younger branches cut May-June
Gayo	Cut once a year between September and March. Leaf fall in March
Tanki	Cut once a year - either in Sep-Oct or in April-May
Bakhre	Cut once a year between November and March. Leaf fall in March
Jalma	Cut twice a year - main branches in Sep-Oct and new shoots in April-May
Dabdabe	" "
Sandan	Twice a year - main branches Sep-Oct, new shoots in May-June. Very fast growing
Sajh	Main cut between November and January, small amount available in May-June
Barro	Cut once a year between September and April. Timing depends on leaf fall. Farmers cut at first sign of leaf fall as immature leaves can cause premature abortion in cattle
Khasreto	Usually cut between September and November. Insect damage to leaves after November degrades fodder. If protected from insects it could be lopped in April-May
Kutmiro	Cut only after other tree fodders are running short - usually in April-May

There has been no change in the availability of fodder from Sandan, Sajh, Barro, Khasreto or Kutmiro in recent years. All other species show an increasing trend in fodder availability. Research findings showed farmers in Gauthale collect the majority of their tree fodder off-farm, the most abundant species being Sal, Karam and Muhni. However, Sal is a very poor quality fodder and Karam is available only between July and September and therefore have no potential for use in the dry season. Detailed discussions regarding off-farm fodder management will be carried out during future field trips.

Table 5.4: Farmers' assessment of introduced species' performance and management (including matrix ranking exercise):

Species	Rank	Best features	Problems	Solutions	Fodder
Ipil	2	- quick growth - quality fodder - soil improvement	Damaged by pesticides used on a vegetable crop	Do not plant in a vegetable bari or avoid using chemical pesticides	Cut twice a year for fodder and pole production: Oct and June. Cut 3 times for fodder only: Sept, Feb and June
Kimbu	4	- quality fodder - high output - sericulture	Lowers soil fertility	Plant further down terrace riser	3 cuts per year: Aug-Sept, Nov-Oct and Mar-April
Gauzuma	3	- quality fodder - quick growth - high output			Cut twice a year: Nov-Jan and Mar-April
Bhatmase	5	- produces fodder - soil improvement	- slow growth - poor fodder - insect damage		Cut once in Nov-Dec
Badahar	1	- high quality fodder - high output			Cut once a year, either Nov-Dec or April-May
NB21	1	multiple cuts	- lowers soil fertility - rats	kill rats	Cut three times a month June-Sept and once a month Apr-May and Oct-Dec
Molasses	2	high output	rats		Cut in June-July and November
Dinanath	5	high output	can spread and choke crops in bari	plant in middle of terrace riser and cut before reaches bari	Cut twice a year in July and Oct-Nov
Sunhemp	6	- prevents landslides - produces fodder	fodder only suitable for goats		Cut in June-July and Nov-Dec
Stylo	4	- quick growth - good fodder			Cut twice a year in July and Oct
Jai ghans	3	- all season fodder			Cut Nov-Dec and Jan-Feb

Priorities for future activities mainly concerned the development of the newly registered youth club and continuation of the fodder nursery and plantation programme.

PROCEEDINGS OF FARMER'S WORKSHOP HELD ON 15/16th APRIL 2000 IN KATHMANDU AT NAF OFFICES.

Participants:

S.N	Name	Name and address of associated agroforestry group	Associated Organisation / Project
1	Gita Bohora	Patle group, Pangretar, Sindhupalchowk	ISARD NRI project (non-survey group)
2	Asmita Timilsina		
3	Nawa Raj Subedi		
4	Ebhindra Neupane*		
5	Chandramani Satyal*	Ange group, Langarche, Sindhupalchowk	IJSS NRI project (survey)
6	Ram Sharan Karki*	Chankhubesi group, Dhulikhel, Kavre	NAWB NRI project (survey)
7	Sushmita Parajuli		
8	Putali Nagarkoti	Nayagaon group, Dhulikhel, Kavre	
9	Dhan Bahadur Praja	Shaktikor group, Chitwan	Praja Agroforestry Research Project
10	Khem Raj Praja		
11	Top Bahadur Magar	Gajuri Chhap group, Kumpur, Dhading	MSBK NRI project (survey)
12	Hari Bahadur Magar		
13	Chopnidhi Nepal*		
14	Savitri Lamsal	Nalang group, Dhading	NMBC NRI project (non-survey)
15	Nirmala Timilsina*		
16	Resham Lal Shrestha	Gajuri group, Dhading	Galaundu Khola sub-watershed management project
17	Tika Bahadur Ale*	Gauthale group, Dhading	DBS NRI project (survey)

* *Local NGO representative*

Welcome of participants by Regmi Neupane (NAF Director)

Mr. Regmi welcomed the participants on behalf of the collaborators. "We welcome the presence of all, representing NGOs and farmer's groups involved and not involved in research. The workshop is based on the series of village level workshops held and will provide the opportunity to ask questions, share experiences between farmers/ NGO staff. We hope your stay during the workshop period will be comfortable. Should you have any logistic problem please contact NAF staff. If you have any questions or comments you wish to share at any time, please write these on a card and pin on the "ideas" board. We will review these during the workshop, provide answers where possible and discuss further where appropriate. Some of you are already aware that this is a collaborative project run by NAF, DFRS and NRI. The funding support is from DFID, UK".

Address by Dr. Amatya (abridged):

Following the village-level workshops, this workshop was intended to give the participants the opportunity to share knowledge and experiences with each other. For the benefit of participants from other NAF projects, a brief description of the NRI/NAF/DFRS collaborative research project was given, including all activities in research and development work completed to date. Dr. Amatya gave a summary of the trial plot and soil analysis results but stressed that it was still too early to make sound judgements on the relative success of each species or the condition of each site. He invited participants to visit DFRS if they required any information on the cultivation or uses of particular fodder species, thanked them

for their interest and assistance over the duration of the project and expressed hope that the workshop would be stimulating and beneficial for them all.

Questions after Dr Amatya's presentation:

1. How to collect seed and propagate the species Dhumre (*Ficus racemosa*). The species has very fine seeds which in their experience have low viability and germination success (Chitwan group).
Ans. Dr Amatya invited them to visit DFRS where he thought information on this species would be available.
2. Which of the species mentioned is suited for growing at which altitudes?
Ans. From the current studies it is clear that Ipil and Flemingia perform better at lower altitudes (below 1500m) and that Molasses and Sunhemp do well at all altitudes (up to 1800m). Altitude is not the only factor, however, that affects species performance as soil type, aspect and location may also have a large effect. More detailed information will be available after monitoring further growth of the experimental plots

Introduction to the workshop

The workshop is meant to be for the participants. It offers the opportunity to raise questions, compare experiences between different villages/ areas and for farmers and NGO staff to exchange experiences and information. Farmers and NGOs not involved in the research, but involved in other NAF Agroforestry activities are also here. This is to stimulate the sharing of experiences across a wider area.
The agenda has been built around suggestions from the village-level workshops, for example looking further into the potential for green fodder preservation through silage making and how best to combine the new fodder species in livestock diets. The agenda is flexible, however, and we encourage participants to speak to project staff, or use the "ideas" board to write, or pin questions, or suggestions for additional points to discuss. This can be done at any time throughout the two days.

A further workshop will be held at the beginning of September (5-6th) to report findings from the project to other researchers, extensionists and government policy makers. We would like the farmers and NGOs to be represented at this workshop, both in person and in terms of feeding back ideas and messages. At the future workshop there will be the opportunity to suggest what sort of research and extension support is required with regard to improving livestock production at village level. This workshop is an opportunity to discuss and decide what messages they want sent to Government and National NGOs on these issues.

Workshop objectives:

1. Forum for experience sharing among farmers and local NGOs from a wide range of different sites, all with experience of NAF supported activities in agroforestry
2. To share findings to date from the research project, both between villages involved in the research and between research sites and non-research sites.
3. To look in depth at issues raised in the village-level workshops:

a) Management of new species in terms of cutting frequency, timing and suitability as feed for different livestock types.
b) How best to combine new fodders in livestock diets.
c) Potential for preservation of green fodders through ensiling for use in the dry season.
d) Problems and solutions to propagation and cultivation of new species

4. To further clarify for the project the nature of fodder deficits in terms of which animals are most affected in which locations.
5. Discuss and plan farmer and local NGO inputs into the National level workshop in August
6. Discuss and identify further priority topics for research at village level.

In the session that discussed participants' expectations it became clear that the four non-research groups present had considerably different expectations and background to the research groups. The presence of farmer participants from only two of the five research groups also limited the degree to which planned objectives of comparing experiences between sites could be met.

1st Session: Sharing and comparing experiences between sites

a) Species performance at each site:

Exploring differences in farmer's use and rankings:

- Bhatmase is identified as a high quality fodder, with high output and as a species that does not reduce the fertility of the soil, by farmers in Ange and Nalang. On this basis the species should also be suited to GajuriChhap and Gauthale conditions, however it has not been favoured there. Invite Ange, Nalang and other farmers with experience to talk about their experiences with Bhatmase.

Ange and Nalang farmers confirmed their evaluation of Bhatmase as a good fodder. Gajuri Chhap farmers were not convinced that it was a different species to the one growing wild in the local forests (as they look very similar). Not interested in the species, as they did not consider it a particularly high yielding, or good quality fodder. Dhan Bahadur Praja from the Chitwan group has planted both wild and improved Bhatmase on his farmland. Improved Bhatmase has larger leaves than the wild variety and its leaves are a lighter shade of green. He could not identify differences between the varieties with regard to fodder quality.

- Sunhemp is identified by farmers at Tawari as a useful fodder to fulfil the grass shortage during the dry season. They have been able to get cows and buffalo to eat it as well as goats. At other locations, although the species has grown well, farmers have not found it very useful as a fodder. Would be particularly useful for Chankhubesi who are very short of goat fodder during the dry season. Get Tawari farmers and others to talk of experiences of feeding sunhemp to livestock.

Sunhemp is eaten by large ruminants when other green fodder is not available, however they much prefer tanki (GC) if available and they will refuse the sunhemp. Experience from Chitwan group on use of sunhemp in hedges to control soil erosion and to make terrraces on gently sloping land. They have also used the species as a green manure on light soil to improve water retention as well as soil fertility. They have not experienced major problems in producing seed and have 4 kg available at present. Flowers are good for beekeeping.

- Other points farmers want to raise about differences in rankings and ask each other about use?

b) Propagation and cultivation of new species: Problems encountered and solutions found.

- Preserving occasional plants of Dinananth allows for self-seeding which ensures production from year to year without the need for collecting and sowing seed. Useful to discuss, as not all farmers follow this practice. Are there any problems associated with this practice?

GC have tried this self-seeding practice and have experienced the species becoming a weed on khet land. It can create a problem on bari land also, with self-seeding occurring over wide areas, not only where required. The self-seeding technique is only suitable for areas away from cropped land. Farmers favour more controlled method of seed collection and purposeful sowing when conducted near to cropped areas.

- Khimbu has tendency to put roots into the lower bari and make it difficult to plough. What have farmers done to over come this problem?

Cut roots when they encroach into crop land. Plant the trees higher-up the terraces.

- Tawari has found problem in production of seed of sunhemp due to insect infestation of the flowers. Have other farmers come across this problem? In which locations and how much of the crop was effected? Have farmers any experience of using Neem extract as an insecticide?

Some experience with home-made insecticides at Chitwan.

This is an indigenous technique for controlling aphids and other pests affecting sunhemp, pigeon pea and other beans at the nursery stage.
Materials: Mint leaves - *Mentha spicata* (Babari), Leaves and twigs of *Tagetes erecta L.* (Sayapatri), Leaves of *Artemesis vulgaris* (Titepati), Leaves and stem of Himalayan nettle - *Artica dioca* (Sisnoo), Chilli powder - *Capsicum frutescens* (Khursani), *Acorus calamus* (Bojho), Chieuri cake (*Bassia butyracea*), Tobacco leaves, Garlic, Onion, Soap and water

Preparation:

- Dry and grind nettles
- Grind Chieuri cake
- Soak tobacco in water until water becomes red
- Dry and grind bojho
- Grind garlic, onion and chilli powder together
- Grind leaves and twigs of sayapatri
- Grind titepati
- Mix all above ingredients and add soapy water
- Stir for several minutes
- Pour mixture through clean, permeable cloth to remove residue
- Collect resultant liquid and use as a spray on the affected part of the plant
- Repeat spraying frequently

The process is slow but effective if continued long-term.

- Ange farmers suggest additions of compost to reduce insect damage. Is this at nursery stage, or when planting out? Ask them to talk about their practice and how it helps control insects.

This treatment refers to protection against *khumre* insects in particular. These beetle larvae thrive on fresh manure and attack the roots of crops, especially maize, and seedlings which are planted in areas where fresh, untreated manure is spread. Some farmers in Ange habitually spread fresh manure on their bari land and these are the households that are most affected by the larvae. Addition of compost is advisable for all soil types, particularly very light soils that seem particularly prone to insect attack. Well-decomposed compost should be used as immature compost will attract *khumre* insects. With addition of mature compost attack seems to be less, both in nursery and when planted out, as the larvae are starved of their main food source.

- Other problems, or solutions farmers want to raise and ask/ share with the group?

Qu Are earthworms good, or can they cause damage in a nursery?

Earthworms are generally good for the soil and will not damage growing plants.

c) Use of new species, time of year cut and frequency of cutting

- Dinanath is used as a green fodder in Tawari in early dry season, - Jan to Feb. Our records show Ange using it in August. Wouldn't it be more useful to use as a dry-season fodder? Get farmers to discuss different management.

Ange farmers are not cutting in the dry season at present as they are restricting cutting to once a year in order to be able to collect seed. Plan to cut during the dry season when sufficient areas have been sown.

- Molasses is generally cut twice a year at all sites, unless it is being kept for seed production. It is only cut once a year at Ange, in June-July. Other farmers delay the first cut to Jul-Aug and then are able to cut again in Oct-Nov. Could Ange farmers manage differently to get two cuts per year?

Again, Ange farmers collecting seed and so not cutting twice. They plan to cut more frequently once sufficient areas have been sown.

- Sunhemp is cut twice a year in Gauthale and Tawari, in June-July and Oct-Nov. In Gajuri Chhap it is only cut once in June-July. Encourage farmers to discuss differences in quantity and quality of fodder when plants are managed differently. Why do Gajuri Chhap farmers only cut once?

Farmers in Gajuri Chhap are collecting seed from most plants. During June-July the sprouts are particularly palatable for livestock and so it is cut then. As the plant ages, fodder becomes less palatable. It is possible to cut each plant three times a year.

- Other practices farmers want to discuss, or ask about with regard to use and management of the new species?

Farmers in Gajuri Chhap have started to experiment with changing the timing/ frequency of cutting of indigenous species. For example they have found that Tanki can be cut twice a year, during the dry season in Nov/ Dec and again during the rains in June/July, rather than just once a year as previously. This leads to greater amounts of fodder being collected per tree.

Farmers from Nalang described managing Khanyu in a way that allowed three harvests per year per tree. In the first week of April they collect just leaves from the tree, in June they lop small branches and in December are able to lop larger branches.

Table 6 Propagation and cultivation of new species of fodder: Problems encountered and solutions found:

Species	Gajuri Chhap	Gauthale	Chankhubesi	Tawari	Ange
Ipil	Leaf curl in cold weather (possibly due to insects?)	Damaged by pesticides used on vegetables (which ones?)- avoid planting on vegetable bari, avoiding using…….pesticide.	Germination- seed treatment Seed viability- test seed at source Insects -	Slow growth-weed to improve growth rate Leaf fall due to frost	Slow growth-weed to reduce competition Khumre and other insects- apply compost (how does this help?)
Kimbu	Adverse effect on soil fertility-plant further down terrace face. Insects in nursery (Nalang)-?	Lowers soil fertility- plant further down terrace riser	Cuttings drying out-avoid small cuttings Insects – control insects?	Yellow leaves-avoid cutting when discoloured Insects- ?	Insect damage- apply compost (at nursery, or plantation stage? How does it help?)
Bhatmase	Slow growth Low output	Slow growth Poor quality fodder-discuss with farmers in Ange (explain different variety to indigenous one, palatable and nutritious) Insect damage	Slow growth- Seed viability-test seed	Insects-?	No problems
Tanki	N/A		Seed viability- test seed (seed rotted)		
Gauzuma	N/A	No problems	Germination – seed treatment		
Molasses	Dries-up quickly Low output	Encourages rats-?		No problems!	
Dinanath	No problems	Tendency to spread and choke crops on bari-plant middle of terrace riser and cut before it reaches the bari.		Can only be cut once before plant dies. (do not cut all, leave some plants to self-seed for next year)	No problems
NB21	Not a dry season fodder-plant near to water source	Lowers soil fertility- plant on well manured terraces Encourages rats-?		Roots penetrate into bari-plant further down the terrace face.	No problems
Sunhemp	Unpalatable to livestock-compare experiences with farmers from Tawari	Fodder only suited to goats-discuss with farmers from Tawari, experience feeding to buff and cattle.		No seed due to insect infection of flowers-purchase/ exchange seed with NAFSCOL.	No problems
Badahar	No problems	No problems			Very sensitive to nursery practice- be very careful with watering regime.
Stylo	Poor germination Low output	No problems			No problems
Jai ghans	No problems				

Table 7 Use of new species: time of year cut, frequency of cutting and ranking.

Species	Gajuri Chhap	Gauthale	Chankhubesi	Tawari	Ange
Ipil	**1** Cut three times a year. A/May, Aug/Sep and Dec/ Jan	**2** Cut twice a year for pole and fodder production, Oct/Nov and May/June. Up to three times per year for fodder, June/July, Jan/Feb and May/June.	**1** Cut three times a year. June/July, Oct/Nov and Feb/March	**2** Cut twice a year, October and May	**5** Cut twice a year, October/Nov and Feb/March
Kimbu	**2** Cut three times a year. A/Sept, Nov/Dec and March/April	**4** Cut three times a year. A/Sept, Nov/Dec and March/April. First cut one year after planting	**3** Cut once in Aug/Sept	**1** One farmer only has cut, Nov. Will cut next in June.	**2** Only one cut so far Cut in May
Bhatmase	**4** Cut twice a year in Nov and March (Nalang).	**5** Once in Nov/Dec	**4** Cut twice a year, Jan and Nov/Dec	**3** Only two farmers have cut, in Oct/Nov	**3** Cut twice a year in Oct/Nov and Jan/Feb
Tanki	N/A	N/A	**5** No information	N/A	N/ A
Gauzuma	N/A	**3** Cut twice a year. Dec and March/April	**2** Cut once in Dec/Jan	N/A	**4** Cut in February.
Badahar	**3** Cut once in March	**1** Cut once a year, either Nov/Dec, or April/May.	No information	N/A	**1** No opinions on lopping times? No opinion given - not yet cut
Molasses	**3** Cut twice a year in July/Aug and Oct/Nov.	**2** Cut twice a year In June/July and Nov.	Cut twice a year in July/Aug and Oct/Nov	**1** Available in Aug-Dec. Can cut twice a year for fodder. Or once a year and then produce seed. Cutting once a month possible on the best soil (between Aug-Dec)	**1** Cut once a year in June/July
Dinanath	**2** Cut twice a year, July/Aug and Oct/Nov	**5** Cut twice a year in late monsoon, July and Oct/Nov	N/A	**3** Plant June/July, cut in Jan/Feb, then it dies.	**5** Cut once a year in August (why so different to Tawari? Could it be left for

					fodder in Jan/Feb?)
NB21	**1** Cut three times a month from June/July to Oct/Nov. (Only possible in irrigated areas)	**1** Cut three times a month from June/July to Aug/Sept, and once a month in May and October and early Nov. (only possible in irrigated areas)	Cut three times a month during June/July to Jan/Feb. Cut once a month at other times. (Irrigated area)	**4** Maximum of three cuts obtained so far. Will be possible to cut more frequently June/July to Sept/Oct. Once a month at other times.	**2** Cut three times a month from late June to early September. Cut twice a month at other times. (Irrigated land)
Sunhemp	**5** Cut once in June/July (compare quality and quantity with Gauthale, cutting twice a year)	**6** Cut twice a year, June/July and Nov/Dec	N/A	**2** Cut once in Oct. Will cut in June and twice a year thereafter	**3** Cut once a year Bado-Asoj
Stylo	**4** Cut once a year in Oct/Nov.	**4** Cut twice a year during the monsoon, July and Oct	N/A	**5** Not cut	**4** Cut once a year in Aug/Sept
Jai Ghans	N/A	**3** Cut twice a year, Nov/Dec and Jan	No information	N/A	N/A
Velvet bean			N/A	(Not ranked) So far used only to produce more seed	

NB Tree and grass species ranked separately (Lack rankings for grasses at Chankhubesi)

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2nd Session: Interim soils report from the research sites:

Soil samples were taken from the terrace riser faces at depths of 20, 40,100 and 200cms below the top of the terrace. This was to enable a picture to be built of differences in nutrient content of the soil that may occur at different positions along the terrace face. Properties measured were soil texture, acidity (pH), organic carbon (measure of organic matter content of the soil), available potassium, available phosphorus and total nitrogen.
Soil texture is important for interpretation of the levels of NPK found, as in clay soils greater amounts are held in unavailable form than in sandy soils.
In general large differences in pH were not found between depths on the terrace face. In contrast large differences were found in nitrogen, potassium, carbon and particularly phosphorus between depths. In general, amounts reduced with depth making lower locations on the terrace face less fertile than upper locations. At a few locations, however, the 200cm depth figures were similar to 20cm depth ones, suggesting similar fertility levels. This occurred where the 200cm measurement was close to the surface of the lower terrace, giving similar top soil conditions to the 20cm depth.

This is an interim report because Mr Malla is still working on possible linkages between soil factors and species performance. These results will be presented when completed at each village. It should be remembered that the results are from the terrace face, which is exposed to erosion and does not receive the compost and fertiliser given to the main bari field. Nutrient content and pH figures are therefore not necessarily representative of the cultivated bari fields.

Ange

Generally the soils at Ange were of a low pH 5.0-5.5, had low levels of nitrogen, but adequate levels of potassium and phosphorus. Some households had particularly high levels of phosphorus in the soil, suggesting high fertiliser use. If chemical fertilisers are to be used on this soil, after 2-5 years liming will be required to keep the pH above 5. Lowering pH values tend to lead to lower productivity over time.

Gajuri Chhap

Generally higher pH soils than at Ange and other sites, ranging between 5.8 to 6.5. However soils showed the lowest nutrient content, with 6 out of 8 farms showing low phosphorus levels, 2 low potassium and 4 low nitrogen. Suggests soil would respond particularly well to greater applications of compost and/or chemical fertilisers.

Gauthale

Generally good pH of soil, ranging between 5.5 and 6.5. Soils rather low in nutrients, with 4 out of 10 farms showing low phosphorus and one low nitrogen. All potassium levels were on the low side. Again suggests that soils would respond well to greater applications of compost and /or chemical fertilisers.

Tawari

Tendency to low pH, ranging from 5.3 to 5.8. Other nutrients present in OK levels. The tendency towards acidity means that care needs to be taken with use of chemical fertilisers. Use of urea, for example, is likely to make the soil too acidic in quite a

short time. Use of a complex fertiliser (NPK) would have less acidifying effect. Addition of compost also reduces acidifying effect of chemical fertilisers.

Chankhubesi

Shows the most acid soil of all sites, with pH values ranging between 4.6 to 5.8. Nutrients generally present in sufficient amounts, with some particularly high levels of phosphorus. Again this suggests heavy use of chemical fertilisers. It can be expected that the soil will become more acidic over time with continued use of chemical fertilisers and it is generally suggested that lime be used to reduce this effect. Initially 2 x 50kg sacks of agricultural lime per ropani could be used on soils showing negative effects of acidity. The liming effect should last for approximately 4-5 years, after which further applications will be required.

Questions:

If lime is added to the soil, does chemical fertiliser also have to be added to have an effect?

Where a soil is very acidic (below pH 4.5) addition of lime alone to rain-fed land is likely to improve yields, particularly in crops such as maize and beans. If the improvement in yield is great, larger additions of organic and/or chemical fertiliser may be required to maintain the increased yield in subsequent years. Liming is recommended on less strongly acidic soils(pH 4.5-5.0) when there is a trend of increasing acidity (declining pH values) due to use of chemical fertiliser. In this case additions of chemical fertiliser are still required to maintain yields.

Is there a need to inoculate Ipil and Bhatmase with N-fixing bacteria to stimulate the fixation of nitrogen?

When Ipil was first introduced into Nepal in the early 1980's inoculum was also introduced. The practice of inoculation of Ipil seed with soil collected under established Ipil trees was encouraged. However, in many areas farmers have not followed this practice, and still seedling grow well. Bhatmase (*Flemengia congesta*) does not appear to require inoculation either, probably because of the presence of a native *Flemengia* spp which will have associate bacteria.

Comments:

In the experience of farmers from Chitwan, pigeon pea (*Cajanus cajans*) is not so good for the soil as Ipil. They observe that soil is not so friable below the plants, even though both are legumes.

3rd Session: Nature of Dry Season Fodder Deficits:

Deficit charts were filled-in for each location:

In response to graph showing difference in feeding levels between different livestock types, farmers present agreed that buffalo tend to eat double the volume of fodder eaten by cows during the rainy season. That buffalo are "never satisfied" in that they always seem to manage to eat more, particularly grasses, if these are offered. During the dry season there are less grasses available and these tend to be shared equally between the buffalo and cows. Farmers identify feeding a greater amount of crop residues and other feeds to buffalo as compared to cows at this time.

a) Diet composition

How is it best to introduce new species into livestock diets?

Draw-out farmers experiences of how they have introduced new species.

Which species do cows, buff and goats eat immediately? Which species do they need to be coaxed to eat and how is this best done?

Farmers have found all the new species, except sunhemp, to be palatable to all ruminant animals. Ipil and Mulberry are particularly favoured by the animals. To encourage animals to eat different species, farmers offer to just one animal first. The others tend to get very jealous and try to reach the new fodder. After 2-3 days all are eating the new species.

New species may be mixed with crop residues so that the animal has to eat some as they consume the residue. This gets them accustomed to the taste.

Salt, or wheat/rice flour may be sprinkled over the new fodder to make it more appetising.

Only feed new fodder to livestock, they will eat when they are hungry enough (seen as rather a risky approach by most farmers).

Leader farmers know that it is better to feed a mixture of species to livestock, but there is a tendency for farmers to feed all of one species at one time, as it is cut from the field. It is time consuming for farmers to cut fodder from different areas each day, so they tend to cut everything available in one area at a time. Large trees are also lopped in one go (for ease and for tree health) and fed over a short period, to avoid loss of condition. The planting of a mixture of species (as recommended with the new species) makes mixed feeding easier. However there is a tendency if one species performs/ propagates better than others, for that species then to take over an area.

One farmer (Gauthale) pointed out that if the livestock are strong enough they can cope with an unmixed diet, but that it is better for animal health to provide a mixed diet.

Farmers mentioned the experience of a red coloration in the urine of large ruminants if NB21 is fed as 100% of the diet in the first month after giving birth.

How is it best to mix new species in the diet?

How do farmers include the new fodders in the diet? Do they feed separately, or feed mixed with other feeds? If mixed, which feeds do they mix them with and in what proportions?

These areas were covered in discussions around point one. The following suggestions on improved practice were made:

Introduce new species slowly into the diet and mix grasses with crop residues. This should increase palatability of the crop residues and increase total feed intake.

It is best to feed one or two handfuls of the new species to milking animals each day over a longer period, than to feed them all in a week or two. This will have the most beneficial effect on milk production.

Ipil should not make-up more than 30% of diet as it can induce abortion at rates above this.

b) Management of indigenous species as dry season feed

Suggestions from Gajuri Chhap farmers about how management of indigenous species can be modified to produce fodder during the dry season. Production from introduced species has enabled them to start re-adjusting lopping times of the following species:

Discuss these ideas with all farmers, particularly the following points.

- Will the changed management effect fodder quantity, or quality obtained? If so in what way, for which species?
- Can the new management be used by farmers at other locations? Explore reasons for answers.

Table 8 Modifications to harvest of indigenous tree species to supply more fodder at the times of year most required.

Species	Information
Khasreto	Can be cut at any time of the year. Used to be cut before dry season, but since the introduction of new species, farmers now delay cutting until the dry season. Favoured feed for cattle.
Tanki	Cut once a year on a one year rotation. Timing of lopping of individual trees can be changed over time incrementally.
Gayo	Not a favoured fodder, but cutting time can be adjusted in a similar manner to Tanki's.
Harro	As for Gayo and Tanki
Khanyu	Fodder available all year round. Lopped twice, older branches before dry season (Jan/Feb) and young branches in April
Dhumre	As with Khanyu
Pipal	Branches can be cut once a year, usually in March. However, if foliage is collected in March without cutting branches (leaves stripped from stems), new leaf shoots can be used for fodder in April/ May.
Kutmiro	Currently mostly cut before March. If a tree is not lopped its foliage will fall in March and the new shoots can be cut for fodder in April to May. This cannot be done if the tree is lopped before leaf fall.

c) Potential at each site for ensiling grass, maize, millet or rice residues to preserve fodder for dry season.

At each site what green materials are available in excess during the wet season that could be ensiled to preserve them for the dry season?

Location	Materials available	Time available	Previous experience of ensiling/ Comments
Gajuri Chhap	Cut grass (banso, khar, musekhari, dubo, siru), maize leaves, millet straw, upland rice straw, bean climber (bodi), legume residue	July to September and October to December	Dry and keep in secure place, usually inside house
Gauthale	Same as in Gajuri Chhap, but less millet straw	As in Gajuri Chhap	As in Gajuri Chhap
Chankhubesi	Rice straw, millet straw and maize cob sheaths.		Chankhubesi farmers have some limited

			experience with silage making. Womens' Development Office supported a training several years ago. Each group member collected one bhari of grass and kept for 90 days in a pit, resulting in one mutha of feed each. The livestock did not like it.
Ange	Rice straw, millet straw, legume straw, wheat straw, maize stover, maize cob sheaths, mustard residue		
Nalang	Rice straw, millet straw, legume straw, wheat straw, maize stover, maize cob sheaths, cowpea		
Patle	Rice straw, millet straw, legume straw, wheat straw, maize stover, maize cob sheaths		Farmers have tried chopping maize stover into small pieces before feeding. This increased palatibility of maize stover to 75%
Chitwan	Rice straw, millet straw, legume straw, wheat straw, maize stover, maize cob sheaths, buckwheat		
Galandu	Rice straw, millet straw, legume straw, wheat straw, maize stover, maize cob sheaths		

Farmers at Chankubesi keep grasses for a number of days after cutting, when the weather is dry, and spread-out feeding to the livestock. During the rains this is not possible.

The women's group at Chankhubesi have tried silage making, using siru (young khar) and urea in a pit system (about 9 years ago). They were disappointed at the outcome as they put considerable effort into the pit construction, but from the initial bhari of grass each supplied, only a small bundle of silage was forthcoming and this was not palatable to the livestock. They are interested to try again, as they have additional grasses during the wet season and think that with greater technical support they could be successful.

Maize stover is generally stored after drying in ricks, or trees. Farmers in Gajuri Chhap have trouble with this method due to infestation with termites.

Ideas/ Questions board:
A wide range of questions and ideas for future activities/ inputs were placed on the board over the two days that reflected the diverse backgrounds of the participants.

Areas that the project will be able to pick-up on during the last 6-months:
1. Beekeeping course for certain villages and demonstration hives.
2. Group fund management and mobilisation.
3. Training in Co-operative development
4. Subsidy on fruit seedling establishment
5. Fruit tree management training

Closing remarks:
Chandramani Satyal, in the closing speech, stressed the importance of outputs from the research project at the village and individual farmer levels. Farmers in the project areas have gained knowledge and experience of agroforestry promotion and forest management systems in great detail. Through this workshop, they and the other participants have benefitted greatly from sharing experience and pooling knowledge from a wide variety of NAF's working areas.