

REPORT 4

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

Project code: R6994 A0721

Third joint field work and data analyses to cross-check bimonthly survey findings, discuss species performance with farmers and follow-up activities and reporting with local NGOs
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E Kiff, C Hendy, B N Regmi, B Vickers, R Chhetri,

Circulation:

G Richards, LPP Programme Manager

Nepal

R B Joshi, DFRS

Parajuli DFRS

S M Amatya, DFRS

R Basukala, DFRS

R Kharel, DFRS

J Abington, HARP

Bishwa Nath Regmi, NAF

M Hada, NAF

B Vickers, NAF

R Chhetri

B H Pandit

T Arens, WN

S Hunt, NACRMP

NRI

C Hendy

P Thorne

D Thomas

J Bennett

B Blake

DFID

Ms S Wardell, Director DFID office, Kathmandu

NR Advisor, Kathmandu

SD Advisor, Kathmandu

A Hall, SEADD

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Finally we would like to express our sincere thanks to all the households who have been involved in the bimonthly surveys and who now are undertaking on-farm trials (full identification of the 50 households within Appendix 5). Without their interest, dedication and knowledge our work would not be possible.

LIST OF ABBREVIATIONS

BE	British Embassy
CBO	Community Based Organisation
DFID	Department for International Development
DFRS	Department for Forest Research and Survey
FUG	Forest User Group
HARP	Hillside Agricultural Research Programme
HMGN	His Majesty's Government of Nepal
LAC	Lumle Agricultural Centre
LPP	Livestock Production Programme
NACRMP	Nepal-Australian Community Resource Management Project
NAF	Nepal Agroforestry Foundation
NRI	Natural Resources Institute
NRMP	Natural Resources Management Project
NUKCFP	Nepal-UK Community Forestry Project
PAC	Pakhribas Agricultural Centre
RNRKSP	Renewable Natural Resources Research Strategy Programme
SEADD	South East Asia Development Division
VDC	Village Development Committee
WN	World Neighbours

GLOSSARY OF NEPALI TERMS

Nepali	Definition
Bari	Rainfed land, that receives no additional water.
Bhari	One back-load of material
Gharbari	Land close to the household
Kharbari	Rainfed land unsuited to crop growing that is used to grow thatching grass.
Khet	Land that is banded and receives some additional water during the dry season. Supports two, or three crops per year
Khoriya	Land under shifting, or non-permanent cultivation (status of some kharbari land)
Kusauro	legume residues
Mana	0.5 litres
Nal	millet straw
Pakho bari	Sloping, rainfed land
Ropani	0.05 (one twentieth) of a hectare

Summary

This report covers the third joint field work and data analyses in Nepal for the project “Strategies for the improved production of fodder during the dry season, using participatory research techniques”. The project is funded by the Department for International Development (DFID), Renewable Natural Resources Knowledge Strategy Programme (RNRKSP) through the Livestock Production Programme (LPP).

The purpose of the visit was threefold, to summarise key data from the bimonthly surveys and conduct initial analyses, to plan the on-farm experimental areas, and to conduct the third joint field visits with collaborators from NRI, NAF and DFRS. The objectives of these field visits were to cross-check data and initial analyses from the bimonthly surveys, discuss species performance with farmers and plan with the research groups design of on-farm experiments in the area, and to discuss activities and reporting with local NGOs.

DFRS was unable to join the field visits due to election constrictions. Otherwise the field work was successfully conducted, with plans for the on-farm trials developed (as far as is possible before final seedling and cutting production from the household nurseries is known) and cross-checking of bimonthly data summaries conducted.

NAF and DFRS have continued to make excellent progress in carrying-out the bimonthly surveys and entering this data into the agreed excel formats. The system for cross-checking the entered data has continued and has been completed for data up to and including survey 5 which was conducted in November/ December. The research team developed further macros during the visit to graphically express types of fodder collected, and deficits, by different households across seasons. Also seasonal changes in total daily feeds offered to different types of livestock (see graphs in appendix 3). These graphs, together with full year graphs of fodder collection and deficit across seasons, were taken to each village and checked with farmers. Particularly unusual patterns were investigated and in most cases, explanations were readily supplied by farmers. A few instances of incomplete understanding of terms used by the researchers were uncovered and these areas were clarified during the visits (Appendices 2 and 4).

Background

The research project is funded, from September 1997 for 3 years, under the Livestock Production Programme of the Renewable Natural Resources Knowledge Strategy Programme of the Department for International Development. The project aims to develop improved strategies for the use and production of fodder resources in the mid-hills of Nepal, in close collaboration with farm households with different livestock and resource holdings. Research findings will map fodder use within household farming systems, and indicate relative importance of off- and on-farm resources in terms of quantity of fodder, nutritional composition and seasonal availability in supporting livestock production.

The project will also consider the impacts of community forestry initiatives on the immediate and longer-term availability of on- and off-farm fodder resources. In particular it will look at impact on management practices on private agricultural land, specifically livestock management. This will contribute to the development of integrated management strategies for the improved use and production of fodder resources for improved livestock and overall farm productivity.

Progress with visit objectives

1. Further analysis of bimonthly data was conducted, including the production of graphs to show the use of on- and off-farm sources of fodder, by village and by season. Different villages and household's level of dependence on off-farm sources are described by these graphs. Fodder allocation and deficit patterns for different livestock types were also produced in graphical form and described.
2. All field sites were visited and activities discussed with farmers' groups and NGOs. Analyses of fodder deficits were cross-checked with farmers' plans for fodder cultivation.
3. Entry of survey data into excel was reviewed. Apparent contradictions that emerged from cross-checking the data collected were explored during the field visits.
4. Farmers' plans for cultivation of new fodder resources were investigated and analysed. The factors that farmers take into consideration when making these decisions were characterised. Intra-household differences in opinion in this decision making process were explored.
5. Opportunities for enhancement of off-farm resources were explored. This aspect of the project has become more complicated, with the withdrawal of NRMP from active involvement in the research areas. Support is now channelled through local NGO's, who have to have proposals accepted to gain necessary funding. The project is going to explore opportunities for facilitating this approach.
6. Individual financial points were clarified with collaborators. The proposed 35% overspend by NAF was reduced to 10% which can be met from the project from exchange savings.
7. The scope and procedure for fodder tree sampling and analysis was clarified
8. The procedure for soil sampling and analysis from the proposed experimental plots was agreed. Composite samples from the 20m terraces will be taken at a depth of 0-20cm and 20-40cm. This will be done just before planting and a history of fertiliser application and crop production from the terrace collected at the same time.

Institutional set-up

The project involves collaboration between NRI and two Nepali institutions. The government agency, the Forest Research and Survey Centre, (FORESC) has recently reverted to being a government department and is now the Department for Forest Research and Survey (DFRS). The second collaborator is the Nepal Agroforestry Foundation (NAF), a local NGO. NAF's involvement with forest users's groups (FUGs) is largely in support of the Nepal-Australian Resource Management Project, (NARMP). NARMP was fully informed of intended project activities during the first visit and expressed interest and support for such activities in their project areas (Kavre and Sindupalchok Districts).

Methodology of approach

The research is being conducted along side the standard agroforestry extension activities of NAF. These are implemented with the support of local NGO/ CBOs, which, are able to provide more regular and locally-specific support to the farmer's group activities and development. The external support for extension activities is designed to be phased-out after three years, and the agroforestry and savings group to be self-sufficient after this time. Support for the development of further groups, if requested in the area is provided, utilising members of the original group as trainers.

Review activities planned for the forthcoming six months:

A. On-farm experiment establishment:

1. Finalisation of planting plans

This will depend on seedling numbers and survival. Also the size of terraces that farmers have identified for planting. Depth and length of these areas need to be checked (enter on farm plans if not already marked). **NAF to monitor**

2. Soil analysis of each household's plot

Composite soil samples to be taken from each experimental area at two depths, 0-20cm and 20-40cm. Mr Malla has details of analyses to be made. Feed-back to individual household and group findings of the analyses and implications for soil fertility and subsequent management. **DFRS**

3. Planting out of experimental plots.

Suggest practical training to be conducted on leader farmer's land. Find out if they plan to use manure, or not. For farmers who do use manure, try to get some estimation of quantity used per plant. Record what fertiliser they use on adjoining terraces too. Follow-up planting-out to check that the same planting pattern is followed by all. Stress that management of the trees will be up to individuals and that each household will be free to harvest when they want. We are just interested in when they harvest and how much, so please ask them to try to remember. Alternatively, offer notebooks for recording. **DFRS/ NAF**

B. Species identification and fodder quality analysis

1. Continue verification of fodder species list (matching of local terms with Botanical names/ identification)

Key researchers from NAF and DFRS during field visits. Possibly inputs from Botanical students (NAF). **NAF/DFRS**

2. Cross-check commonly used tree fodders from bimonthly survey with species for which nutrient content is available. Identify which important tree fodders in the research areas need to have nutrient analyses taken. Take representative samples during the middle of the main collecting period (sample from at least 5 trees and take range of material from different heights and aspects). **DFRS**

C. Surveys, data entry and checking, further analyses

1. One-off survey to be translated in to English and copy sent to all collaborators ASAP. **DFRS**

2. Final survey to be conducted in May together with additional questions re family size and labour availability. **NAF**

3. Continue excellent data entry and checking as previously. **NAF/ DFRS**
4. Finalise data on land holdings in preparation for further data analysis in July- September **(NRI/NAF/DFRS: June)**
5. Compile data on production objectives and priorities, outputs, and productivity of household livestock holdings through the seasons. Devise system for analysis and relating this data to collection and deficit data. **(NRI by September)**

D. Follow-up support and training for village groups

1. Follow-up TOT, vegetable cultivation and fruit propagation training as itemised in NAF work plan. **NAF**
2. Follow-up support by NGOs to village development activities as outlined in agreements with NAF. **NAF**

E. Finalisation of farm maps

1. Maps to be entered onto computer in agreed format. **DFRS**
2. Additional information required to complete all maps to be collecting during forthcoming field visits. **NAF/DFRS**
3. Investigate further the use of specific land terms for bari and khet as discovered during the farm plan development exercise. DFRS to identify which terms came from which villages. Researchers to further investigate meanings of terms during field visits. **DFRS/NAF**

F. Documentation of activities to date

DFRS idea for preparation of summary document for the bimonthly surveys as joint publication. Format for write-up of each bimonthly survey to be agreed jointly, each organisation to report on surveys for which they were responsible. **NAF and DFRS.**

Progress with survey data collection, checking and analysis

Bi-monthly survey data collection and checking

Good progress has been made with continuation of the bi-monthly surveys of fodder collection and utilisation. All surveys up to the 7th survey in March 1999 have been completed according to the planned schedules. Collection of data on seasonal changes in livestock holdings has been added in each survey from the 3rd survey (September 1998) to complement initial household data. Given the degree of change in livestock holdings by households this is considered necessary to accurately explain reported fodder collection and deficits.

Work remaining on data collection and checking in the bi-monthly survey includes the following:

1. Completion of cross-checking of data from 6th survey (of January 1999)
(NAF/DFRS: April/May)
2. Entry (into raw data files) and cross-checking of data from 7th survey (of March 1999)
(NAF/DFRS: April/May))
3. Conduct 8th and final survey (May 1999), and subsequent data entry and checking.
(NAF/DFRS: May/June)
4. Along with the 8th bi-monthly survey (May 1999), conduct a survey of household labour availability and fodder collection constraints (as indicated on the draft survey form left with NAF during the visit in March)
(NAF/DFRS: May/June)
5. Check land holdings data, during May survey visits and subsequent extension visits
(NAF/DFRS: May/June)
6. Finalise data on land holdings in preparation for further data analysis in July-September
(NRI/NAF/DFRS: June)
7. Compile data on production objectives and priorities, outputs, and productivity of household livestock holdings through the seasons. Devise system for analysis and relating this data to collection and deficit data.
(NRI by September)

Bi-monthly survey: preliminary summary and preparation for analysis

Fodder collection, deficit and allocation data

During the visit, preliminary summaries describing fodder collection and deficits, fodder sources (on- and off-farm), and fodder allocation rates and compositions for different livestock species were completed for all available data (up to and including the 6th survey of January 1999). Note that the last data still to be cross-checked. Summary data on these aspects were thus available for a full year, for presentation and discussion with farmers during the visit. The Excel spreadsheet files used to prepare these summaries are listed with explanations in Appendix 1. Copies of all these files were left with NAF and DFRS.

Indications from this data confirm earlier interim impressions that the data collection methods have been sufficiently sensitive to detect expected seasonal differences in the amounts and types of fodders collected, as well as finding interesting differences in fodder collection and

allocations between sites (villages), households and livestock species. The data thus hold good prospects for further analysis of factors affecting fodder deficits and demands for additional fodder resources.

Excel spreadsheet methods for data summary were further refined during this visit. Using these spreadsheets, it will be a relatively simple job to add the additional data from the final two surveys and to prepare final annual summaries for further discussion with farmers (if necessary) and for more investigative analysis (as outlined below).

The preliminary summarisation of the data is useful for two main purposes:

- a) to allow better checking of data accuracy than is possible from the raw data ranges alone; and
- b) to provide a tabular and graphical summary of results for easy identification of possible trends to be tested in further analyses.

In respect of the data checking, the preliminary summarisation of results undertaken during the visit allowed the identification of various unexpected or unexplained trends or findings which were discussed with farmers in all the villages during field visits. Final checks on the accuracy of data on fodder collection and allocation (and livestock holdings) will be made on the basis of various derived variables, such as the amounts of fodders allocated per head of each livestock species, to find potentially anomalous figures. These checks will be undertaken in June/July when all data are collected and available.

Few errors in data have been identified in the summaries produced to date; one necessary amendment is noted in Appendix 2. This data change has been made in the NRI files and should be amended in NAF and DFRS files (Question 2 WORK COPY.xls) (Ben Vickers to co-ordinate and confirm). It is suggested that no other changes be made until all necessary changes are identified in the completed data set in July, so that confusion may be avoided. (NB no changes have been made to data on the July survey fodder deficits in Ange village, though these are known to have been misinterpreted).

Examples of the types of summary data so far prepared are presented in Appendix 3. Complete sets of these were taken to each village to discuss data accuracy and trends at village and household levels. Summaries of the findings of these discussions are attached in Appendix 4.

Other data

Summarisation of other data from the bi-monthly survey has not yet been started. Data are available on the specific fodders within each major category of fodder collected (i.e. crop residues, grasses, and fodder trees on- and off-farm). This will provide a useful seasonal profile of the availability and use of particular resources, and allow better interpretation of the nature of reported fodder deficits. Data are also available on the production objectives and priorities, outputs, and productivity of household livestock holdings through the seasons. These data will contribute to the understanding of fodder requirements and deficits of households under different circumstances.

Bi-monthly survey data analysis

Further analysis of the data on fodder collection, deficits and allocation (to livestock) will be made once data collection and checking have been completed, starting in July to September

in NRI. The aim will be to prepare sample analyses that can be discussed with NAF and DFRS during October/November, during site visits, so that final analyses can be completed during the period January to March 2000 in both NRI and NAF/DFRS.

The purpose of these analyses will be to identify the relative importance of major factors determining fodder availability, deficits and allocations, and which will in turn affect requirements and options for additional fodder resources. The major factors will include some or all of the following:

- Site characteristics (altitude, aspect, and accessibility)
- Land holdings in relation to livestock holdings
- Relative Khet and Bari land holdings
- Access to and nature of off-farm fodder resources (including grazing or non-grazing)
- Household size, labour and labour constraints
- Livestock production objectives (milk sales, subsistence production, and draft-power needs)
- Mix of livestock species owned (proportions of total Livestock units contributed by different species) and holding sizes (itself depending on all the above factors)
- Household economic circumstances (purchase of feeds, sales of livestock products)
- Seasons

Data will be available to explore the effects of all these factors. It is expected that various multi-factorial analysis methods (eg AOV and multiple regression) will be used. Analysis methods will be discussed further with statisticians.

Data on fodder collection, deficits and allocations will be summarised to describe the seasonal patterns for different villages/sites, households and livestock species. Critical indicators of the patterns of collection, deficits, and allocations may then be identified for the further analysis of determining factors. These critical indicators have yet to be identified but will include variables such as the following:

- Amounts of daily livestock feed collections (household totals, or per livestock unit in household, or per labour unit)
- Total feeds offered daily per head of livestock (by species)
- Amounts or proportion of crop residues in daily feeds offered
- Amounts or proportion of green fodders in daily feeds offered
- Amounts or proportion of tree fodders in daily feeds offered
- Amounts of concentrates offered daily per head of livestock
- Household total fodder deficit (or deficit per livestock unit held)
- Household deficits of classes of fodders (crop residues, cut grass, tree fodders)

The nutrient composition of feeds allocated to livestock may also need to be determined, in order to assess the adequacy of current allocations and diets and to interpret reported fodder deficits. Additional critical factors might then be identified as the digestibility and crude protein content of diets offered. This level of detail may not be warranted in view of the type of data available, however, since no direct measures of actual feed intakes are recorded in the current surveys (and assumptions about the proportions of feeds offered which are actually

consumed may be difficult to substantiate). Also, existing literature data on nutrient compositions may not take adequate account of seasonal or other differences in nutritive contents of important fodders (eg anti-nutritive factor contents of tree fodders). Nevertheless an attempt to carry out such analyses will be made following completion of data collection in July to assess their likely accuracy and value in interpreting fodder deficit and need data.

Plans for on-farm trials for 1999

Rationale

Overall aim: to be able to advise farmers in the mid-hill areas on suitable introduced fodder species, their likely survival and growth rates for different aspects and altitudes, on different soil types.

Aim at village level: to help farmers assess best aspect, soil type and location in terms of land type for the different species. With the planting of the same species, at the same spacing, in the same season, farmers can see for themselves which species do best in which locations.

Following discussions with leader farmers and NGO representatives it was agreed to encourage households to manage the new species as they required. Basic guidelines will be given by the leader farmers on recommended best practice, including the use of compost for seedling establishment, and timing and methods for lopping. However households will decide whether they actually use compost, or not, and when it is convenient to harvest. Evidence from Majitar, where new species have been introduced suggest that individual households are able to successfully adapt suggested harvesting regimes to best fit their overall feed/ labour strategies (see table 1).

Specific objectives at individual farm level: to give each farmer experience of planting at the spacing and position on terrace riser that is recommended by NAF. These recommendations stem from the previous experience of farmers at other locations. The species to be included in the trials consist of those selected by the farmers' groups as preferred species, together with some species recommended by researchers. Additional species of tree and grass fodders have been recommended for two reasons; to increase that component of the livestock diet where required, and to introduce a greater mixture of species where farmers have selected only one, or a narrow range of species. A mixture of species is advisable for a number of reasons: so that poor survival, or disease attack on one species does not have too major effect on production, for optimal use of space available (both above and below ground), to produce a mixture of fodder, and to include soil enhancing as well as highly productive species. Providing a variety of fodder for livestock is important for a number of reasons; different livestock types prefer different fodder types, a mixture of fodders is required to provide a balanced diet, and there is a need to avoid possible negative effects of feeding too much a fodder with specific antinutritional factors. For example, if Ipil-Ipil constitutes >30% of feed there is an increased likelihood of inducing abortion in pregnant animals.

The project will arrange for the soil type in the experimental areas to be tested scientifically. This will consist of composite samples taken at a depth of 0-20cm and 20-40cm at each location. Tests will be conducted for the major nutrients (NPK), pH, texture, moisture holding capacity, % organic matter and CEC (ability to hold micronutrients). Results will be fed back to farmers and advice given on what is required on these soils to increase productivity.

At each of the five research sites farmers have different preferences, both in terms of selection of species and proportion of each species they require to grow. These differences stem from the agro-ecological zones in which the sites are located and present fodder resources available (including access to off-farm fodder sources).

Design of on-farm experiments at the five research sites:

Species under trial:

Trees

- A. Leucaena diversifolia 156
- B. Morus alba
- C. Crotalaria juncea
- D. Artocarpus lakoocha
- E. Ficus semicordata var. montana
- F. Flemingia congesta
- G. Guazuma

Grasses

- H. NB 21
- I. Molasses
- J. Dinananth
- K. Stylosanthes (Stylo)
- L. Velvet bean

Gauthale

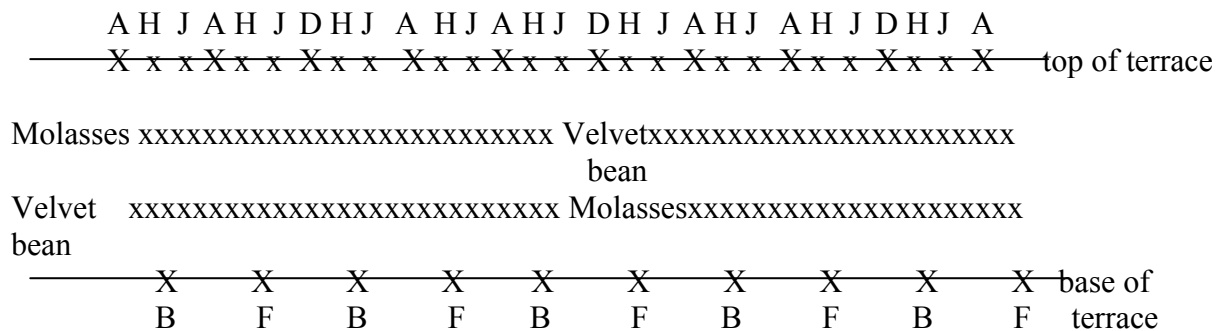
Species preference by farmers:

Trees: Ipil, Khimbu, Bhatmase, Budahar, Guazuma, (sunnhemp?)

Grasses; NB21, molasses

Ipil is very much preferred by farmers and for many this is the only species that they have so far planted. Part of the objectives of the experimental plots is to encourage more diversified planting, and to introduce farmers to different species. Dinananth and velvet bean showing promise in Gajurichhap, which as at a similar altitude.

Diagram of planting pattern, 10m length.



Seed/ seedling requirement per household:

- A. 14
- B. 10
- D. 6
- F. 10
- H. 20 slips
- J. 20 slips
- Molasses seed
- Velvet bean seed

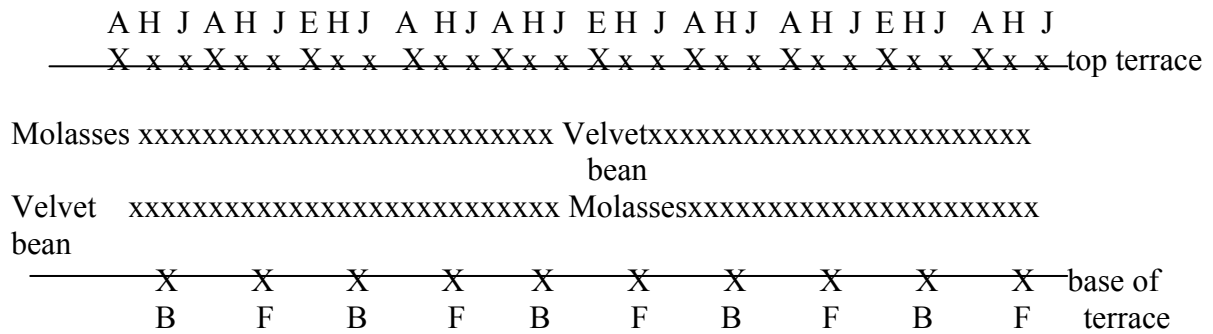
Gajurichhap

Species preference by farmers:

Trees; Ipil, Rai Khanyo, Bhatmase, (Sunnhemp?), Khimbu

Grasses; NB21, Velvet bean, Molasses, Dinananth

Diagram of planting pattern, 10m length.



Seed/ seedling requirement per household:

- A. 14
- B. 10
- E. 6
- F. 10
- H. 20 slips
- J. 20 slips
- Molasses seed
- Velvet bean seed

Chankubesi

Species preference by farmers:

Trees: Kutmero, Gogon, Khanyo, Kangiyo, Timila, Koiralo

Grasses: Molasses, NB 21, Stylo

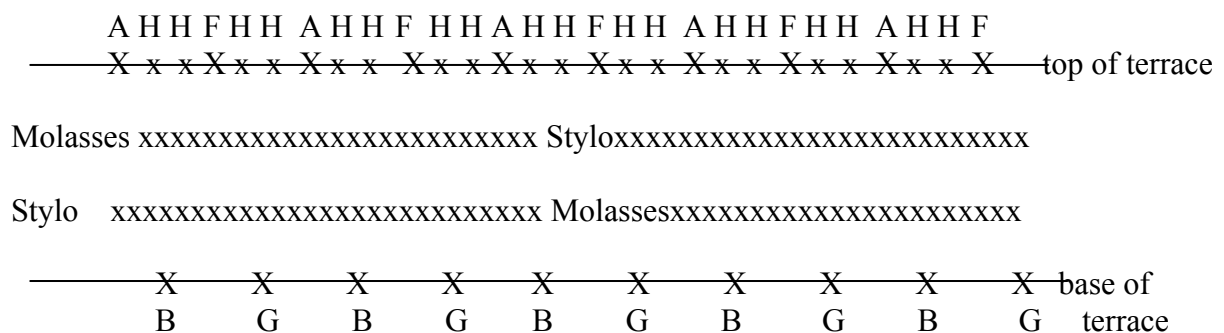
Species available from nurseries:

Trees: Khimbu, Ipil, Guazuma, Bhatmase,

Grasses: Molasses, NB21, Stylo

(Rai Khanyo and Timila seeds didn't germinate in the nurseries)

Diagram of planting pattern, 10m length.



Seed/ seedling requirement per household:

- A. 10
- B. 10
- F. 10
- G. 10
- H. 40 Slips

Molasses seed 20 metre length of terrace

Stylo seed 20 metre length of terrace

Ange

Species preference by farmers:

Trees: Ipil, Bhatmase, Kimbhu, Tanki, Koiralo, Konaiyo, Guazuma

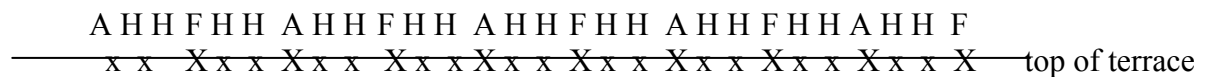
Grasses: NB21, molasses, stylo

Species available for planting:

Trees: Ipil, Bhatmase, Kimbhu, Guazuma

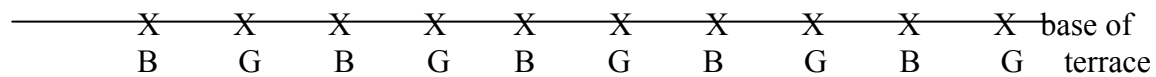
Grasses: NB 21, Molasses, Stylo

Diagram of planting pattern, 10m length.



Molasses xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Styloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Stylo xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Molassesxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx



Seed/ seedling requirement per household:

- A. 10
- B. 10
- F. 10
- G. 10
- H. 40 Slips

Molasses seed 20 metre length of terrace

Stylo seed 20 metre length of terrace

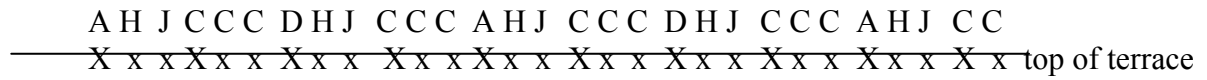
Tawari

Species preference by farmers:

Trees: Badahar, Flemengia, Ipil, Khimbu, Sunnhemp

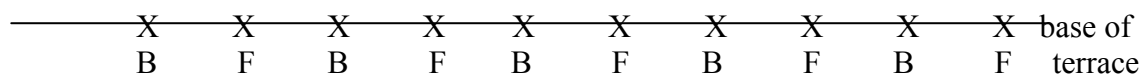
Grasses: Molasses, NB21 (want to try, grows well in nearby village), Dinanth, Stylo (want to try)

Diagram of planting pattern, 10m length.



Molasses xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Styloxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Stylo xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx Molassesxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx



Seed/ seedling requirement per household:

A. 5

B. 10

C. 10 metre length terrace

D. 5

H. 10 slips

J 10 slips

Molasses seed 20 metre length terrace

Stylo seed 20 metre length of terrace

Table 1. Use of new species, from leader farmer and NGO representative in Majhitar

Species	Pous	Marg	Phalgun	Chaitre	Baisakh	Jesth	Asad	Srawan	Bhadra	Aasoj	Kartik	Mangsir
Kimbhu			←	x X	X	x X				x X	→	
Ipil	←		X		x X	X			X	x		→
Bhatmase			←	X	X	X			X	X		→
Gauzuma	←					x (X)			x	(X)		→
Nimaro	←		→		←							→
Badahar	←→		←									→
NB 21	x x X X	x x X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X	x x x x X X X X
Molasses	←											→
Stylo	←		(X)					(X)			(X)	→
Dinanath								←				→
Napier	←											→

Key:

- ←→ time fodder available from the different species
- xxxxxx time fodder actually collected by Ram Maya (leader farmer at Majhitar).
- XXXX time fodder actually collected by Ram Bahadur Majhi, NGO representative (kimbhu cut every 2 months after first cut as needed).
- (X) Time fodder actually collected by two other farmers, who joined-in the group discussion.

Appendix 1 List of Excel spreadsheet files for summarising data from the bi-monthly survey.

(NB data taken from working files of corrected data from the bi-monthly surveys, ‘Question 1 WORK COPY.xls’, ‘Question 2 WORK COPY.xls’, to ‘Question 5 WORK COPY.xls’)

File	Contents
NPLIVSUM.xls	Livestock holding data by households; Tabular and graphical summary of frequency of holdings of all possible combinations of livestock species, within villages and seasons; Tabular and graphical summary of proportions of households holding each livestock species, and average holding sizes, summarised by village and season
NPFODDUS.xls	Fodder collection, deficit and allocation data by households: Conversion of bhari measures to feed dry matter weights to calculate offer rates to livestock; <i>(NB requires sample bhari measurements data for each fodder type, by seasons)</i> to check data feasibility, accuracy and trends; Tabular and graphical summary of seasonal allocations of amounts of different feeds and total feeds per head of different livestock species, summarised by village, season and livestock species; Graphical summary of diet compositions averaged over seasons, villages and livestock species
NPFODDEF.xls	Fodder collection and deficit data by households; Graphical summary of fodder collection and deficits by all households within villages and seasons
NPDEFPERLU.xls	Fodder collection and deficit data from NPFODDEF.xls and livestock holdings data from NPLIVSUM.xls; Calculation of fodder collection and deficits of households <i>per Livestock Unit (LU) held</i> (to check likely accuracy of household reports); Graphical presentation of collections and deficits per LU for each household, within villages and seasons
NPGRAZFD.xls	Data on daily grazing hours by each livestock species, livestock holdings and fodder collection saved by grazing; Calculation of linear regression relationships between reported grazing-livestock-hours and fodder-collection-saved (to check accuracy of reported data on grazing); Tabular and graphical summary of relationships within livestock species and seasons
ONFARM~1.xls	Fodder collection data; Graphical summary of sources of fodder, either on-farm or off-farm, for all households within villages and seasons (to check for anomalies and trends in household data)

Appendix 2 Data amendments required following data checks to date

The following data amendment is required following partial checks of the data from the first to fifth surveys. This change has been made in NRI files and summary analyses, but not in NAF and DFRS files. Other amendments may still be required after checks of completed data sets in July.

Data to be amended:

File: Question 2 WORK COPY.xls

Data: Ange village; Survey 5 (November 1998); Household 10; Allocation percentages and amounts of cut grass to each species of livestock:

Data should be amended to read as follows:

5FGBp	5FGC %	5FGCb	5FGB %	5FGBb	5FGO %	5FGOb	5FGG %	5FGGb
0.5	10	0.05	45	0.23	35	0.18	10	0.05

Appendix 3 Examples of summarised data on fodder collection, deficits, and allocation

Appendix 4 Summary of findings from discussions of bi-monthly survey data accuracy and trends in villages and households in March 1999.

The preliminary summaries of data from the bi-monthly survey were used to identify both general and household-specific queries and issues to discuss with farmers during field visits in March 1999. These questions and responses are discussed below. Table xx lists the main questions raised and responses to specific household queries.

General issues arising

Some general issues arising from the survey data included:

1. Weather conditions during survey year (from March 1998)
2. Understanding of interpretation of 'fodder deficits' questions by households taking part in surveys
3. Apparent considerable variation between households in the reported total amounts of fodders collected and deficits
4. Generally consistently higher fodder collections and allocations to livestock in Chankhubesi and Tawari villages than elsewhere.
5. Variation between households in the sources of fodders on- and off-farm (and some variation of sources between seasons within households)
6. Differences between villages and households in the amounts of crop residues available in the late dry seasons (March to May)
7. Confusion of reported fodder collections and deficits in July survey (esp. in Ange)
8. Seasonality of fodder collections and deficits
9. Apparently larger variations between seasons in the amounts and types of fodders offered to oxen compared to other classes of livestock
10. Variation between households, and variations between seasons within households, in use of grazing – especially for oxen
11. Diets of different livestock species
12. Priorities for use of additional fodders
13. Sensitivity of the survey methods

1. Weather conditions during survey year (from March 1998 to date)

All villages reported the 1997/98 dry season to have been 'average to better than average', following average rains in the 1997 season. All also reported that the 1998 rains were much lower than the long-term average and many rated the following 1998/99 dry season the driest for many years. These conditions have restricted the amount of second cropping on bari land (and thus the production of crop residues in the late dry season in Feb to May 1999) and will undoubtedly affected fodder availability through the later bi-monthly surveys. Reduced availability of cut grasses and more extensive and intensive lopping of trees for fodder is expected this year. The value of crop residue fodder produced on khet land may also increase and therefore the amounts purchased by households may decline. Reduced crop residue supplies may be partly substituted by residues from failed crops. In some case, reductions in livestock holdings may take place (and appear to have already started for some households). In these circumstances, the decision to continue the bi-monthly surveys through the full 1999 dry season, repeating the surveys of the 1998 season, will provide very useful data on fodder supplies and utilisation in a poor season.

2. Understanding of interpretation of 'fodder deficits' questions by households taking part in surveys

Within each village a check was made with several households as to their interpretation of the 'fodder deficits' questions in the surveys. It was clear that households almost universally interpreted this as intended, to estimate how much additional fodder they would need to ensure continued full (expected) production and health of livestock. The critical indicators of fodder deficit in households are (most importantly) cattle milk yields and lactation length, goat milk yields, kid growth and survival, and buffalo milk yields. The condition of oxen at peak working times, and feeding prior to these times is also important. Deficits are generally reported in terms of the types of fodder which are potentially available at the season of questioning, or to which households know they might have access. (These reports will need to be interpreted and further discussed with households to identify preferences for additional fodder supplies).

Despite this common understanding, there will be some variation and error in the reporting of deficits for several reasons. Firstly, reported figures are guestimates made by householders based on experience of fodder collection rather than any calculations of need; households undoubtedly vary in the way they make these guestimates. There may also be differences in expectations of production levels of livestock between households, which will affect estimates of deficits. The results on reported deficits should therefore be interpreted with care. Nevertheless, the seasonal patterns of deficits and differences between households observed in the surveys to date do appear to accurately reflect household experiences, livestock holdings and access to different fodder sources (as confirmed in discussions with farmers).

3. Apparent large variation between households in the reported total amounts of fodders collected and deficits

The preliminary summarisation of data on collections of fodders by households reveals large variation between households. This variation is potentially due to a great many factors such as the numbers and species/breeds of livestock kept, holdings of khet and bari land (giving access to crop residues), access to off-farm fodder sources, options for grazing of livestock, the numbers of trees on farms, labour availability, and others. Apparent differences between households in fodder collection totals are thus explainable (hopefully) by the combinations of these household circumstances. Discussions with households generally confirmed that the data were sensible in relation to these factors, which will form the basis of further more detailed analyses. In the mean time, the difficulty of interpreting household differences in relation to none or only one of the above factors at a time should be noted. For example, in the data summarisation file NPDEFPERLU.xls, the expression of household fodder collections and deficits per Livestock Unit (LU) clearly explains much but not all of the differences between households.

4. Generally consistently higher fodder collections and allocations to livestock in Chankhubesi and Tawari villages than elsewhere.

Preliminary data suggest higher collections and allocations of fodder to livestock in Chankhubesi and Tawari villages than elsewhere, particularly for cattle. Collections and allocations are higher throughout the year, with a less seasonal pattern than in other villages, and particularly high in the dry season. Explanations for these observations were sought in discussions in villages, and appeared to justify the observations. In Chankhubesi, the main reasons included the larger amounts of khet land (and therefore irrigated rice straw), the amount of double-cropping of bari land (producing wheat and other crop residues in March-

May), the availability of cash for purchase of crop residues (esp. rice straw), the keeping of crossbred cattle and the sale of milk by most households, and the availability of larger numbers of trees on farms). Further details of household holdings of crossbred cattle and buffaloes were collected in all villages as a result of these findings.

In Tawari, the explanations were less clear. While milk was produced for sale (at a local milk collection centre opened in 1998), there were no crossbred cattle in the surveyed households. There was relatively little khet land, so not so much rice straw, and no purchase of crop-residues. There was, however, relatively many trees on-farm and good access to cut grass (though not off-farm trees as the available forest land was a half-day walk distant). A major explanation may be the relative importance of grazing (carried out for cattle and oxen by Magar but not Tamang households). It may be that the method of guestimating the amounts of fodder provided to animals by grazing over-estimates the actual contribution; amounts of fodder grazed are guestimated by farmers on the basis of the bhari of fodder that do not need to be collected when animals are grazing. Guestimates of fodder provided by grazing may be particularly optimistic in the late dry season when there is little grass remaining. On the other hand, indications of generally low fodder offer rates in Gauthale and Gajuri Chhap where grazing is a more common and important feed source may suggest that the contribution of grazing is under-estimated. Further checking of the grazing data will need to be made.

The reasons for relatively lower allocations of fodders in other villages are not yet fully explained. Villagers are usually not able to compare and contrast the conditions of different villages. However, villages differ considerably in the mix of resources available and in the patterns of livestock holdings, depending on factors such as land-holdings, land productivity (a function of altitude, aspect, climate, fertility, access to external inputs etc), production objectives (for both cropland and livestock: functions of access to markets, availability of cash from non-farm sources etc) and access to off-farm resources. Recent changes in access to resources and in livestock holdings may give further clues to the relative pressures that livestock and feed supplies are under, and therefore to the nature of fodder deficits and possible solutions. It is clear, for example, that where forest grazing has been banned as part of FUG management, as in Tawari and Ange, considerable adjustment of livestock holdings and use of alternative fodder sources has become necessary. In some villages (eg Gauthale and Gajuri Chhap), relatively higher livestock holdings, especially of buffalo, with relatively low productivity, are regarded as necessary for the production of manure to maintain cropping. Villages also differ in their adoption of alternative fodder collection practices such as the deliberate sowing of excess seeds of grain crops in order to produce crop thinnings for fodder and the early harvesting of maize tops and leaves for fodder. It may be useful to conduct a survey of all households to follow-up the extent of these practices.

Some discussion of these factors was conducted in the recent visits but a more formal approach may be needed to obtain comparable data to describe the village circumstances. Further analysis of the household data on land and livestock holdings will help to illustrate some of these differences, though it should be noted that the selected sample of households does not necessarily reflect the whole village circumstances.

Some reported changes in livestock holdings by households and productivity over the last 10 years are noted in Table xx. These illustrate some of the kinds of differences that exist between villages.

Table xx Summary of changes in livestock holdings in the last 10 years in survey villages

Village	Changes in household holdings of livestock	Ratio of buffaloes to cattle	Uptake of crossbred cattle and buffaloes	Milk productivity of cows and buffaloes
Chankhubesi	Some decline in cattle holdings (conversion to crossbreds)	Unchanged (buffaloes not favoured)	All survey households have crossbred cattle (no crossbred buffaloes)	Cow yields increased (crossbreeding and milk market)
Tawari	Cattle declining, buffaloes increasing (closure of forest grazing for Tamang households)	Increasing	None	Unchanged
Ange	Some decline in cattle (closure of forest grazing)	Increasing (buffalo holdings maintained – valuable for manure)	No crossbred cattle; households with crossbred buffaloes recently	Low and may have declined
Gajuri Chhap	Unchanged (needed for manure)	Unchanged	None	Declined
Gauthale	Decline; more households	Unchanged	None	Unchanged

5. *Variation between households in the sources of fodders on- and off-farm (and some variation of sources between seasons within households)*

Some villages showed consistent patterns between households for the collection of fodders either on- or off-farm while others did not. Several reasons for these differences were noted. Major differences between villages are caused by different access to resources; thus no or very little off-farm forest for tree fodder, cut-grass or grazing is available in Chankhubesi and Ange. Some off-farm forest is accessible to Magar households in Tawari, while most households in Gajuri Chhap and Gauthale have access. Differences between households are caused partly by location within the village (eg the differences between Magar and Tamang households in Tawari), but also by the availability of more convenient resources on-farm (if land holdings are sufficient) or the availability of labour for fodder collection. The latter factor is particularly important at peak farm-work times. In view of this it was decided to conduct a survey of labour availability, use, and constraints for fodder collection across all households in the bi-monthly surveys. Other causes of differences in use of off-farm resources were the size and type of livestock holdings (reflecting the importance of livestock to the household economy) and the diligence of livestock holders. Some households were regarded as making more effort than others in providing balanced and full diets for their livestock.

6. Differences between villages and households in the amounts of crop residues available in the late dry seasons (March to May)

Notable variation exists between households in the amounts of crop residues used in the dry seasons. These differences are mainly due to differences in land holdings (total and mix of khet and bari land). Khet land is particularly important as a source of rice straw harvested from the second rice crop in April to May. Bari land provides a succession of harvests from the first crop maize in October/November, millets from November/December, second-crop legumes and oilseeds (grams and mustard) in February/March and second-crop wheat in April/May (though not all farmers will have all crops). Apart from differences in land holdings, some households purchase additional crop residues.

7. Confusion of reported fodder collections and deficits in July survey (esp. in Ange)

In some cases, there is apparent inconsistency in reported fodder collections and deficits between surveys (for example by households reporting both larger collections and larger deficits in consecutive successive surveys). This was followed-up with individual households in all villages where necessary, but particularly in Ange village, where the July 1998 survey consistently showed both greater collections and greater deficits than in the preceding May survey.

In individual cases, changes in fodder demand were caused by factors such as changes in livestock holdings (either gains or reductions) so that both collections and deficits could rise or fall together. In one case the splitting of a household resulted in changes in both land and livestock holdings. In other cases, changes in the practice of grazing between surveys also changed the requirements for and collection of other fodders. This particularly occurred with oxen as noted below.

In Ange there appeared to have been confusion over the interpretation of the questions in the July 1998 survey. July is a month of rapid change-over in the patterns of fodder availability and collection. Grass for cutting or grazing rapidly becomes plentiful and crop thinnings become available early in the rainy season. Fodder deficits, which may have been at their most severe in late June and early July, are generally completely eliminated by the end of July. Thus if questions about fodder availability and deficits are phrased 'in this month ...', confusion may arise. All households in Ange reported that once fodders become available in July, deficits are generally almost entirely eliminated (contrary to the indications of the data from the July 1998 survey). A decision about how to deal with deficit data from Ange in July 1998 will be made once further summary analyses of livestock and land holdings have also been made. In future surveys, care will need to be taken to limit the time period over which 'current practice' is reported (perhaps to only a week).

8. Seasonality of fodder collections and deficits

Apart from the above cases, data on the seasonal collections, deficits and allocations of fodder matched well with farmer's descriptions of seasonality. (Note though that a bi-monthly survey may be too infrequent to detect some smaller seasonal effects or differences between locations and households). Generally, collections and allocations increased in the rainy season and declined from November onwards in the dry season. Deficits increased from November but were not marked for most households until after the January survey. Farmers generally reported the worst deficits to begin from February to May. Deficits would then decline rapidly after the onset of the rains in mid-late-June. In some areas, cut grass and new tree leaf fodder becomes available in the pre-rains showers of May, thus reducing the worst of the deficits earlier.

Some households do show large deficits in November, however, and in some cases these are larger deficits than those shown in January. This pattern was acknowledged in discussions with some households and may be due to labour demands for harvesting first crops and planting of second crops in November. Some changes in livestock holdings may also occur at that time, with sales or slaughter of some animals either for religious celebrations or before the dry season, so that subsequent gross fodder deficits may appear smaller.

9. Apparently larger variations between seasons in the amounts and types of fodders offered to oxen compared to other classes of livestock

As noted above, the feeding patterns for oxen may change between seasons more than the patterns for other classes of livestock. Farmers also generally confirmed this observation from the summary data. The feeding of oxen depends on their required seasonal work patterns. Between working periods, they are commonly grazed for part of their feed requirements (even where no other animals are grazed) in order both to collect fodder and for exercise to remain fit for work. Feed offer rates may increase before major working periods (not all farmers report this). During working periods, smaller amounts of better quality feeds may be required as feeding time is restricted. No grazing can be practised at these times. Thus the occurrence of grazing or non-grazing and the feeding of concentrate feeds (particularly) may vary between seasons. Only some of this seasonality is captured in the bi-monthly survey data as changes in feeding practices can occur over relatively short periods. Peak working times for oxen also differ between villages and households. Some further checking of these with farmers may be required to determine more precise seasonal fodder deficits for oxen.

10. Variation between households, and variations between seasons within households, in use of grazing – especially for oxen

In the initial summaries of household data it was apparent that some households were consistent in whether or not they grazed their livestock while others were not, changing their use of grazing between seasons. These observations were generally confirmed in discussions with householders. Several general reasons for these differences were noted. In some cases, households differ even within villages in their access to grazing areas (see notes above on Tawari). Even where grazing land is available some households may choose not to graze animals often either because of small holdings of livestock or insufficient availability of labour.

Where household grazing practices differ between seasons the main reasons for this are either that the reported grazing refers to oxen which are commonly grazed in non-working periods (see above), or that labour availability varies between seasons. It may also be worthwhile grazing other animals at certain times when grazing is plentiful close to households but not when labour is required for fodder collection from more distant sources. It may be noted also that buffaloes are almost never grazed so that households with only these stock will not report grazing. Finally, practices for grazing in crop aftermaths appear to differ between villages, depending on local rules.

11. Diets of different livestock species

Summarisation of the survey data on the mixes and amounts of feeds offered to different species of livestock generally appeared to be as expected, and were in realistic ranges given the nature of the feeds offered and expected live weights of animals. It should be noted that these preliminary calculations of amounts of feeds offered are based on guestimates of the

weights and dry matter contents of bhari of different fodders (since reporting of fodder collection and allocation is done in bhari). Further sample weighings of different fodders and seasons will be needed to check these estimates.

It should be noted that the proportions of the fodder offered which are actually consumed, will vary between fodders (eg between tree fodders offered with twigs and branches which are only partially consumed, crop residues with a mixture of leaves and stalks, and cut grasses which are almost completely consumed). So it will not be easy to estimate actual feed intakes from these survey data, although detailed offer and intake data from other studies (such as by Peter Thorne in Eastern Nepal) could be used to convert the current data. In any case, such detailed analysis of diets may not be necessary in the present study, it being sufficient to demonstrate that the reported data on collections and offer of feeds are realistic and accurately reflect patterns of feeding and deficits for the different livestock species and locations.

Clear seasonal differences in the mix of feeds offered to livestock are evident in the data, as expected from the fodder collection data. Differences in feeds offered are also evident between villages and livestock species and these were checked with farmers. The principal differences notable are:

- higher proportions of crop residue and lower proportions of cut grass in cattle and buffalo diets in Gajuri Chhap and Gauthale than in other villages (also note relatively greater importance of grazing in cattle diets)
- higher proportions of crop thinnings in diets in Ange than elsewhere (combined with generally low total feed offer rates)
- lower proportions of tree fodder in cattle diets in Chankhubesi than in other villages
- slightly higher proportions of crop residues in buffalo diets than in cow diets
- variability between seasons in oxen diets
- markedly high use of tree fodder in goat diets
- high use of concentrates common over all villages and species (including goats)

Some of these differences reflect the mix and relative abundance of resources available in different locations, such as the general shortages of all feeds and lower availability of cut grass in Gauthale, Gajuri Chhap and Ange. They also reflect species preferences (eg goats preferring tree fodder to grasses which they will not consume in large quantities) and abilities (e. g. buffaloes able to consume higher proportions of lower quality crop residue feeds than cattle). They may also reflect differences in production objectives, such as the necessity to feed more animals with poorer quality diets to produce more manure in Gauthale and Gajuri Chhap, and the need for higher quality diets for milk production in Chankhubesi. These differences need to be explored more closely between households when the bi-monthly survey data on reported production objectives and livestock productivity is analysed.

The importance of tree fodder in goat diets is notable. Discussions with farmers revealed that while this includes fodders from the main fodder trees on- and off- farms, it also (and in some cases mainly) refers to fodders from bushes and shrubs not usually fed to other species of livestock. These include shrubs and herbs (including aromatic species) such as *Artemisia* spp, *Buddleia asiatica*, *Banmara* and others. To some extent therefore, goats do not compete directly with other livestock species for fodder. Some farmers reported, however, that the more conventional tree fodders are, in some cases, offered first to goats (since they will not

eat other fodder) and the remains then fed to other livestock – this occurring particularly in the dry season. (NB in general, the practice of offering more feeds to livestock than they can consume is not regarded as wasteful as remnants are used as bedding and then composted).

The almost universal use of concentrates for all species of livestock is also notable. Concentrates are used throughout the year, mainly for milking animals, including goats, but also for working oxen and in some cases for fattening male goats. The latter occurs especially in the periods prior to important celebrations when goats are slaughtered, and also where a commercial market for such animals exists (as in Chankhubesi, which has relatively easy access to markets). Concentrates clearly form an important part of diets, particularly to supplement and enable better use of the high proportions of poorer quality feeds commonly fed.

12. Priorities for use of additional fodder

Most livestock keepers report that the priority need for additional fodder is during the dry seasons. The most likely sources of fodder at these times is tree fodder. General priorities for additional fodder between livestock species and classes are milking cows, or buffaloes, and lactating goats. Oxen are priorities in working periods. Some farmers suggested that extra feeds would be best shared amongst all livestock, to ensure survival and continued manure production.

Priority types of fodder would be grasses and some higher quality tree fodder for cattle and buffalo milk production and tree fodder for goats. Many farmers reported that extra tree fodder in the dry season would be particularly important for goats (since there is little else that they will eat, while cattle and buffaloes will eat crop residues).

13. Sensitivity of the survey methods for estimation of fodder allocations and deficits

The above indications from the data so far available, suggest that the relatively simple survey procedures (asking householders to estimate the percentage allocation of each type of fodder collected to each species of livestock kept) do appear to give sufficiently accurate data to detect differences in feed allocations and diets. Differences occur between livestock species, locations (villages) and households. The results thus show promise for the further analysis of the factors influencing feed allocations and deficits. The method may be usefully developed for application in other contexts. For example, in fodder ‘needs assessment’ procedures under joint forest management approaches.

Appendix 5 Details of village visits

Chunkhubesi

NGO support to village activities

Ram Sharan Karki, the half brother of P B Karki who is the secretary of the Nepal Welfare for the Blind Society, is now the NGO contact. He has been visiting the research area regularly and has assisted NAF in the setting-up of three separate groups. The need for separate groups in Naya gaon and Naya basti in addition to the original group in Chankubesi, stemmed from two sources. The original single group consisted of members from both Naya gaon (Tamang community) and from Chankubesi, (Brahmin/ Chettri community). The different cultures, as well as physical distance between these two communities made a joint group practically unworkable. Group members requested to have separate groups. Additional households from Naya basti and Chankubesi (also part of the Brahmin community) were also keen to engage in agroforestry activities, but felt excluded by the initial limit of ten members to the original group. This caused tensions within the community. The new group in Naya gaon already has a strong identity because members are also involved together in a literacy group. The formation of homogenous groups that share a common understanding has made activities easier to organise. Now, all parties appear to be happy with the arrangements and all groups are working well.

The ten households chosen for survey remain unchanged, but now belong to separate support groups, 6 in Chunkhubesi and 4 in Naya gaon. Involvement in activities by those from Naya gaon has been much greater and enthusiastic since formation of the separate groups. The new groups have received Kimbhu cutting and nursery training, and have received cuttings and seeds in a similar way to the original research group.

Agricultural activities in the village:

Harvesting of mustard in some areas. Vegetable production conducted by all households, particularly cauliflower, onions and cabbage, some tomatoes. Seedlings of chillis and peppers being raised. Manuring of bari fields in preparation for maize which will be planted with the arrival of the rains (expected at any time).

Research Group meeting 20th March 1999

Present:

Krishna K Parajuli
Chhetra K Tamang
Kaili Tamang
Sushmita Parajuli
Sharadha Parajuli
Parvati Ghimire
Chanda K Tamang
Mana M Magar

Not present:

Suhadra Koirala as she is in India
Laxmi Thing Tamang as she has moved from the village and is working in Kathmandu with other members of her family.

Also present 3 of the 4 new, non-survey households

Suntali Pokharel
Huk K Pulami
Menuka Arayal

Further research activities:

The concept of experimental plots on each farmers' land in order to monitor favoured species performance on different soil types and aspects was explained further. Farmers were generally interested in the idea and willing to plant a 20 metre length of terrace in a prescribed way. Some farmers said that finding that length of unplanted terrace may be difficult and that only 10 metres may be available. One farmer identified northern aspect terraces as generally best for fodder trees as these maintain moisture best during droughts. There was general agreement from others.

A range of indigenous and exotic species were identified as best fodder species: Kimbhu, Ipil, Kutmero, Gogan, Kunyo, Khanyo, Timila, Tanki, Badahar and Koiralo.

From their nurseries they have available: Kimbhu, Ipil, Gauzuma, Bhatmase and are interested in planting the grasses; Molasses, NB21 and Stylo.

(Rai Khanyo and Timila have not yet germinated in the nurseries)

Exploring findings from the survey data at group level:

Research group members do not have equal access to off-farm resources. Those from Naya gaon (the Tamang community), are close to a small forest area of some 5-10 hectares in size (members are not sure of the exact size). Although the forest is quite degraded, they are able to collect grasses and some tree fodder and graze animals there. These households report a greater reliance on off farm fodder resources than others.

Purchase of fodders

Households are forced to purchase fodders when they have insufficient feeds available on farm. Rice straw is purchased to ensure survival of animals, to maintain mixed diets of milking animals and for manure production. Some households report purchase of fodders because of labour shortage for collection of fodder, or because "they are able as they have the cash resources". Households from Naya gaon do not purchase fodders because of their access to alternative off-farm resources. Rice straw is only fed to cows, oxen and buffalo, not to goats.

Differences in farmers management of fodder:

Sushmita Parajuli (farmer leader) feeds maize crop thinnings and rice straw as well as grasses to her cows in July. At this time most farmers only feed grasses that are plentiful at this time of the year. Farmers agreed that mixed feeding was a better system, but said that most did not have access to other fodders at that time. Sushmita herself had no access to other fodders by September and at that time only fed grasses.

Variable availability of fodder resources

The farmers explained that the amounts of each fodder type available varied from year to year. They would like to feed some rice straw to cows and buffalo throughout the year because they know that a mixed diet leads to greater productivity in terms of milk yield and health of the animal. However, in some years they have insufficient resources. Green grasses are important for productivity, but sometimes supplies are low and they have to feed more rice straw than is optimal, to fill the gap. In July, although the rainy season has started, supply of grasses is limited and consists of very young, tender shoots. Animals like this, but it doesn't fill them, so farmers say that best practice consists of feeding a mixture of fodders, until the grass grows stronger.

In the dry season, when farmers feed purchased rice straw to cattle and buffalo, all households feed green fodder to goats. This is because goats do not like straw and except a wider range of green fodders, including aromatic and high tannin content tree fodders not

favoured by the larger livestock. Milking animals, calves and working oxen are offered any surplus green fodder.

Are crops planted more densely on purpose, so as to produce more crop thinnings?

How many farmers feed maize leaves taken from the growing plant?

Do any farmers feed maize tops?

Allocation of new species:

Villagers are keen to have more tree fodder to feed to goats. At present a greater proportion of grasses (2-3 times as much) are fed to goats in this village compared to other villages, due to a shortage of tree fodder. Villagers would prefer to feed tree fodders as they consider them to be more nutritious for goats.

Seedlings still surviving form 1998 planting

HH	Name	Ipil		Baht. mase		Gauzuma	
		P	S	P	S	P	S
1	Krishna K Parajuli	60	10	4	0	0	0
2	Suhadra Koirala	80	40	0	0	0	0
3	Chhetra K Tamang	100	50	2	0	0	0
4	Kaili Tamang	100	50	100	50	0	0
5	Susmita Parajuli	50	50	1	1	1	1
6	Sharadha Parajuli	250	60	0	0	0	0
7	Laxmi Thing	100	5	0	0	0	0
8	Parbati Gimire	200	100	0	0	0	0
9	Chanda K Tamang	5	5	0	0	0	0
10	Mana M Magar	60	18	8	7	1	0
11	Suntali Pokharel	0	0	0	0	0	0
12	Huk K Pulami	60		0	0	0	0
13	Menuka Aryal	250	125	0	0	0	0
14	Suhadra Sapkota	150	150	30	25	5	5
Total							

Seeds and seedlings requested for 1999

HH	Ipil	Kimbu	Gauzuma	Bhat Mase	Badah ar	Gogan	Champ	Tanki	NB 21
1	100	80	60	60	0	0	0	80	100
2	0	0	0	0	60	60	60	0	100
3	70	60	50	50	0	0	0	50	100
4	50	40	50	50	0	0	0	50	0
5	100	100	0	0	30	0	30	0	0
6	100	100	0	0	0	0	0	0	0
7	70	45	50	50	0	20	30	40	25
8	100	50	100	100	0	0	0	0	0
9	60	30	40	40	0	0	0	50	0
10	100	100	100	100	0	0	0	100	0
11	50	40	50	50	0	0	0	50	0
12	50	60	50	50	0	0	0	50	0

13	100	100	40	40	30	30	30	0	100
14	200	100	50	50	100	50	0	0	0
Total	1150	905	625	640	220	160	150	470	425

Molasses and Stylo seed requested by each household, ½ kg each.

Seedlings in farmers' nurseries in March 1999

HH	Ipil	Kimbu	Gauzu ma	Bhat Mase	Badah ar	Gogan *	Champ	Tanki +	NB 21
1	60	140	25	25	0	0	0	0	
2	0	200	0	0	0	0	0	0	
3	100	65	3	9	0	0	0	10	
4	40	100	30	20	0	0	0	0	
5	90	200	150	20	0	0	0	50	
6	0	200	120	0	0	0	0	40	
7	-	-	-	-	-	-	-	-	
8	60	200	50	15	0	0	0	30	
9	54		20	20	0	0	0	10	
10	yes	200	yes	yes	0	0	0	13	
11	(100)	200	(60)	(60)	0	0	0	0	
12	45	200	10	30	0	0	0	5	
13	144	100	96	16	0	0	0	0	
14	40	150	20	20	0	0	0	15	
Total									

Figures in () not yet planted, but planned by farmer.

* Seeds of Gogan not yet supplied. This will be followed-up.

+ Supplier later admits that all Tanki seed was of poor quality this year

Individual farmer Interviews:

Krishna Kumari Parajuli HH1

Poor survival of seedlings from last year,

Poor watering of khimbu cuttings this year.

Suhadra Koirala, HH2

Suhadra has gone to India, leaving brother-in-law and daughter at home. No family members present could give any information with regard to seedling survival from last year. However some Ipil seedlings in fairly good condition and 1m tall could be seen in gharbari land. From previous mapping exercise Suhadra reported poor survival rates in lower bari land, which she does not visit regularly. She attributed this to the dry conditions this year, but plans to plant there again, hoping for more favourable weather this year. Unfortunately, she is unlikely to have many seedlings to plant as her seed supply is locked away and not yet sown.

Chhetra K Tamang, HH3

Last years seedlings were planted in two areas. One area is very dry and all seedlings planted there have died. In the other area, seedlings of Ipil and Flemingia were planted under established trees in semi shade and they have done alright. Both species show similar growth.

Nursery

Total seeds sown for this year limited by polybags available. She has chosen to sow less Guazuma and Flemengia, and to favour Ipil cultivation as she thinks that this species will do best. No Tanki sown.

Kaili Tamang, HH4

Grazing is still practised in Naya gaon and all seedlings planted in Pakho bari have been eaten. Those in ghar bari doing well. Ipil 1 meter tall in N/NW aspect. Flemengia shows less fast growth with seedlings of about 50 cm. However, planted midway down the face of the terrace where the soil is less fertile.

Nursery

Less Flemengia and Tanki sown than asked for due to shortage of polybags. Kimbhu well watered, but weedy. Rice straw mulch used.

Susmita Parajuli, HH5

Last year's planting very good on the edges of terraces growing vegetables, where the area has been watered. Ipil seedlings 1.5 meter tall and Flemengia 1 meter. Other 1-2 foot seedlings too.

The species and number of seedlings that she is cultivating differs from that ordered, however the recorded order is different to what she remembers ordering.

Nursery

200 Khimbu seedlings watered once every 2-3 days. Has planted some citrus and lopsi also in her nursery. Tanki all decayed.

Sharadha Parajuli, HH6

Approximately 20% survival of Ipil seedlings from last year.

Nursery

Khimbu nursery well set-out, but on raised, slightly sloping bed that dries very quickly.

When she ordered seeds she only knew about Ipil. Now, with new information from the TOT village training, she has sown both Tanki and Gauzuma. She is waiting for more polybags in order to sow the Ipil (this is the fastest germinating and growing species, so she has left this to last).

Parbati Gimire, HH8

Thinks that approximately 50% of seedlings from last year have survived. There has been insufficient water available to water them and this has limited seedling growth rate. She is hopeful that there will be better conditions this year and that the seedlings will show better growth on planting out.

Nursery

Kimbhu nursery has insufficient shelter and is unmulched. When watered in the morning it becomes dry by 2-3 pm. Ground preparation looks poor. The team advised her to mulch the ground. Reduced number of seedlings cultivated for this year due to polybag constraints. She has favoured Ipil and Gauzuma in sowing.

Chanda K Tamang, HH9

Last year Chanda had little assistance due to non-attendance of the Chankubesi group (due to tensions between Naya gaon and Chankubesi members). She is now leader of the new Naya gaon group and is very enthusiastic about fodder cultivation. She has no Khimbu of her own (for same reason), but could perhaps benefit by over-supply mentioned by other research

group members. She has favoured Ipil cultivation when faced with polybag constraint, reducing other species by 50%. Nursery well sited, mulched and shaded.

Man Maya, HH 10

Man Maya has a few Kimbhu trees that are 7 years old, introduced previously by the Women's Development project. She has taken a few cuttings herself and has a few 2-4 year shrubs on the farm. She says that her husband doesn't like them and wants her to cut them down. He thinks that their horizontal roots go into the terrace and take nutrients from the crops. He also thinks that their shade (Man Maya manages them as trees rather than bushes) is detrimental to the crop. She also has some NB21 that is 5-6 years old, introduced by the same project. She says that this does best if planted near a water source.

Her Ipil and Flemengia planted last year had generally not done well. Low survival of Ipil and plants generally small and spindly. The Flemengia had done better where it was planted on better soil, but on dry, poor terrace edge soil, was also very stunted. Molasses looked healthy, but did not show lushious growth. She said that all species had suffered from the particularly dry year.

Nursery

Tanki seeds have all decayed, poor seed. Few Ipil have germinated, these are the only seedlings to be showing at present. Approximately 15 days since sowing.

Suntali Pokharel, HH11

All previous years' seedlings have died, probably due to poor nursery management, as none were planted out. Khimbu nursery suggests poor land preparation and planting. Although cuttings show good aerial growth, rooting is likely to be poor. Seed nursery not yet constucted, due to lack of time. Suntali plans to constuct it within the next couple of days.

Huk K Pulami, HH12

Seedlings from last year have low survival rate, largely due to grazing problems. They have also been effected by the dry season.

Nursery

200 Kimbhu doing well. Ipil seedlings already germinated, Tanki and Guazuma not showing yet.

Menuka Aryal, HH 13

Good survival of seedlings from last year. Ipil is approximately 1m high and growing well on the edges of terraces.

Nursery

Ipil already germinated after 15 days. Tanki has all decayed. She plans to resow the plastic bags with Guazuma.

Suhadra Sapkota, HH 14

Excellent survival rates of Ipil, Bhatmase and Guazuma from last year. (Suhadra is the most successful vegetable producer in the group). There have been some recent deaths of Bhatmase due to the prolonged drought, but she has been watering some of the seedlings to try to alleviate the problem.

Nursery

Khimbu nursery appears well prepared, has been mulched and is regularly watered. Ipil all germinated and at most advanced stage of all nurseries in the village. Some Bhatmase also germinated. Tray beds with Rai Khanyu and Gedulo. Sand layer looks rather thick and has hardened over, potentially physically preventing germination of the tiny seeds.

Tawari

NGO support to the village

The facilitator in the village, the school teacher Mr Man Bahadur Tamang, has been liaising well with NAF and providing good support to the farmers group. The NGO to which he belongs, Samaj Sewa Samuha Mahankalchaur VDC, is still in the process of being registered.

Several questions were raised by Man Bahadur with regard to the one-off survey and these were discussed. It was decided that further discussions involving all NGO representatives would be useful and this was scheduled for their next meeting in Kathmandu on the 2nd April.

Agricultural activities at present

Wheat on bari and khet land is just coming to harvest. Fields not at present under cultivation are being manured. The water mills adjacent to the khet land are being used for the grinding of maize.

Research group meeting, 21st March 1999

Present:	Not present:
Kabita Tamang	Ranjana Magar
Anita Tamang	
Sunita Tamang	
Rupadevi Bhujel	
Chameli Tamang	
Samjhana Singtan	
Laxmi Magar	
Urmila Magar	
Rumila Tumsing	
Rekha Magar (new group member)	
Facilitator: Man Bahadur Tamang	

Use of crop thinnings

Farmers report use of less crop thinnings in this village than in others. Man Bahadur explained that maize is planted at approximately 0.5 metre spacing between rows, which is wider than in other areas. This is largely to accommodate the mixed cropping within the maize of soyabean, cow pea, buck wheat and millet. Other explanations included purchase of maize seed by some households and hence the expense incurred by dense planting. Farmers reported that a similar amount of time and labour is required to collect crop thinnings as to collect grasses. As the latter are available at no additional cost, farmers collect them. Crop thinning is solely conducted as a requirement for the crop, not as a purposeful production of fodder.

Livestock holdings

The phenomenon of an increasing buffalo population in the village, together with a declining cow population was further explored with regard to impact on fodder requirements. Farmers said that more green grasses and tree fodder would be required, and that they would need to buy in more Danna (concentrate made from rice, maize and wheat bran and some other added

nutrients, sample to be collected for analysis) from the bazaar. At present green grasses and tree fodder are only available during the rainy season, from May onwards.

Milk Market

A new collection point in Mugar gaon (higher settlement within Tawari) was opened last July/August. The price of milk is set by the dairy in Khapasi and depends on the milk butter fat content. It ranges between 25 Rp for 10% fat to 12.5 Rp for 5% fat. 65 litres of milk are supplied at present from Tawari, by 14 households out of the village total of 97 households.

Impact of training

Nursery training

The group say that they now know how to raise the preferred fodder species and are confident to train others in these techniques. They were interested in the fruit tree training given and requested NAF to supply satsuma and lemon seedlings. It was agreed that if NAF provided transport to the road head that they would pay for good seedlings and collect. They plan to plant in July.

Vegetable cultivation

The group also requested further training in vegetable cultivation as previous training was only an introduction. They indicated that further training was required even for home consumption production.

Community forestry

NAF offered a two-day orientation training that outlined the benefits of community forestry and how to go about contacting and working with the District Forest Office.

Feeding and management of new fodders

Farmers are most interested in extra fodder for milking buffalo and cows. The largest deficit they identify is that for buffalo, shown in reduced milk yields, reduced health and reduced fatness. Animals so not die from feed deficits in the village.

Sunnhemp has been fed, mixed with Gogan leaves, to goats. Molasses has been fed by many group members to all classes of livestock in the general mixture of fresh green grass and tree fodders offered.

Problems identified in nurseries and from seedling planting last year:

Rupadevi and Urmila have experienced problem with insect damage on Ipil seedlings, on both leaves and tender tips of stems in the nursery. On inspection, the insect damage reported was minimal, however damage was apparent and probably due to low moisture retention of the soil in the khimbu nurseries. This could be ameliorated by mulching. Gauzuma has not done well at this location, due to frosts that it can not withstand. Khimbu all died last year due probably to a combination of factors including poor nursery preparation, too thin cuttings and too young age at planting out. There was also a termite problem in the nurseries. L Pallida may do better at this altitude than the Ipil 156 supplied at present.

Experimental plots:

Preferred species as identified by the group are; Badahar, Sunnhemp Flemengia, Bhatmase, Ipil, Kimbu and Molasses, Dinananth, velvet bean and farmers would like to try NB21. Cultivation of more grasses is particularly favoured as these species perform best at this altitude and are identified as the constituent most lacking in present diets.

Management of new fodders:

Urmila Magar (leader farmer) planning to manage all for winter use.

Laxmi Magar (HH8) and Rupadevi Bhujel (HH4) would like tree fodder to be available in July when at present they have none left.

Rumila Tumsing used tree fodder in July because she was short of labour and didn't have time to cut grasses. However she would prefer to feed grasses at that time.

⇒ What is best practice? How does it vary with livestock type?

Survival of seedlings and cuttings from 1998 planting

HH	Name	Ipil		Bhat. M		Rai K.		Gujuma		Badahar	
		P	S	P	S	P	S	P	S	P	S
1	Kabita Tamang	180	3	150	10	0	0	5	0	0	0
2	Anita Tamang	40	20	30	20	0	0	0	0	0	0
3	Sunita Tamang	40	12	30	8	0	0	0	0	0	0
4	Rupadevi Bhujel	60	15	25	5	0	0	0	0	0	0
5	Chameli Tamang	40	10	30	4	0	0	1	0	0	0
6	Samjana Tamang	25	15	15	12	0	0	1	0	0	0
7	Ranjana Tamang	150	0	50	0	0	0	5	0	0	0
8	Laxmi Magar	150	5	25	2	0	0	25	0	0	0
9	Urmila Magar	150	5	20	2	0	0	5	0	0	0
10	Rumila Tumsing	50	2	10	5	0	0	0	0	0	0
Total		885	87	385	68	0	0	42	0	0	0

Seeds and seedlings requested for 1999

HH	Kimbu	Bhatm ase	Ipil	Badah ar	Rai K	Nimar o	Guazu ma	NB 21	Grass* Kg
1	50	20	10	20	10	10	30	100	0.5
2	50	10	20	50	10	15	20	50	0.5
3	20	70	25	25	10	20	25	50	0.5
4	50	15	0	50	0	10	15	50	0.5
5	30	25	20	50	40	15	30	50	0.5
6	60	0	60	50	0	10	35	50	0.5
7	25	15	20	50	0	50	50	100	0.5
8	25	25	50	50	20	15	25	50	0.5
9	150	100	200	50	50	20	50	100	0.5
10	25	25	20	50	25	10	15	50	0.5
Total	485	305	425	445	165	175	295	650	5 kg

Seedlings in farmers' nurseries March 1999

HH	Kimbu	Bhatm ase	Ipil	Badah ar	Rai K	Nimar o	Guazu ma	Apple	NB 21
1	135	65	25	0	0	0	20	5	
2	150	20	72	0	0	0	10	0	
3	110	20	72	0	0	0	10	0	
4	164	*	185	0	0	0	5	0	
5	105	20	72	0	0	0	10	0	
6	180	80	50	0	0	0	25	4	
7	175	#	140	0	0	0	10	0	
8	190	15	125	0	0	0	10	0	
9	165	#	330	0	0	0	35	0	

10	150	15	120	0	0	0	10	0	
Total	1524	235	1191	0	0	0	145	9	

seeds of Bhatmase to be planted directly as a hedgerow

* number unknown as sown in mixture with Ipil

Individual Farmer's interviews

Kabitra Tamang, HH 1

Seedlings of Ipil and Flemengia planted last year are not doing well, they are still very small. Kabitra thinks that those that have died were frosted and that the remaining seedlings are not doing well because of poor soil and the cold temperatures. She is impressed with the growth of the molasses grass and has left hers to seed. She is just about to collect the seed and plans to sow on other areas of her land.

Her Sunnhemp hedges were very productive in October/November 1998 and she hopes that they sprout again with the rains. Goats preferred this type of fodder.

Kabitra has an excellent nursery with Khimbu cuttings, Ipil and Flemengia seedlings and trays containing Rai Khanyo and Neemaro seeds. These latter two species will be transplanted into polybags on successful germination. She is also attempting propagation of Naspati (local pear) as cuttings in the Khimbu bed.

Anita Tamang, HH 2

Khimbu nursery not quite as good as the other two adjacent nurseries, HH3 and HH5, showing only about 50% survival of cuttings. Anita was not present so could not enquire about survival of seedlings from last year.

Sunita Tamang, HH 3

Sunita identifies better survival of her seedlings planted last year, compared to that of her friends as being due to their more protected location, on SE facing terraces, near the nurseries. She has a joint nursery with Anita and Chameli Tamang. This year she plans to plant more Ipil because last year she planted more Flemengia.

Rupadevi Bhujel, HH 4

Seedlings from last year still very small, with little foliage, so she has not cut them yet. The Flemengia particularly suffered from grazing by goats. She planned not to grow any more Ipil this year because of the large amount she grew last year. However, since most has died, she has decided to cultivate more. She has mixed some Flemengia seed with the Ipil in polypots. Other Flemengia seed she has reserved for planting directly as a hedgerow. Guazuma was particularly hard hit by the frosts. Rupadevi is particularly keen to try cultivation of NB 21. From reports from a nearby village she thinks that it will be more productive than Ipil and Bhatmase. As a grass, she considers that there is greater potential area on which to cultivate, than would be possible for tree fodders.

Chameli Tamang, HH 5

Low survival of seedlings from last year due to grazing problem by goats on her lower bari land, lack of water in some locations and frost damage at the higher, more exposed locations. Another excellent nursery that had the most advanced Khimbu cuttings, in a protected, warm, SE aspect location. The nursery had also been very well watered.

Samjhana Tamang, HH 6

Growth of Ipil and Flemengia seedlings from last year generally poor, although one or two individual Flemengia show good growth. Suggests that fertility and/or water are limiting factors, rather than temperature and altitude. All the Ipil seedlings show poor growth, perhaps this is not the best variety for this altitude? Ipil and Flemengia planted near the house have been grazed.

Excellent nursery, with very good protective roof. She has increased the amount of Flemengia sown this year, because it was the most successful species last year.

Rai Khanyo seeds being raised in a tray. She is also raising citrus and lopsi seedlings. New seedlings to be planted on gharbari land, though not directly adjacent to the house, where there is already some shade from trees. Her other bari land is too far away and north facing, so not protected enough for good growth of the fodders.

Ranjana Magar, HH7

No interview as in Kathmandu, but some information from brother.

Last year Ranjana had a very successful nursery, however all the seedlings were wiped out after planting by a landslide. This year she has a joint nursery with a non-survey farmer and has planted a lot more Ipil than initially requested. She has tray beds for raising Neemaro, Rai Khanyo and Gedulo seedlings as well.

Laxmi Magar, HH 8

Laxmi puts the poor survival of seedlings last year down to frost. She is trying again this year, primarily with Ipil because she thinks that it is the most resistant.

Urmila Magar, HH 9

Very low survival of seedlings from last year. Frost was a problem, especially with Guazuma. She plans to plant in the same places as last year, using less Guazuma and hoping that with less dry conditions that the seedlings will do better. Urmila has also sown tray beds with Nimaro and Rai Khanyo and these look well managed. Growing the Bhatmase as a hedgerow, rather than as individual seedlings was originally her idea, brought back from the TOT training. She plans to sow the Bhatmase in a mixture with Ipil and grasses. This idea has also been adopted by Rupadevi and Ranjana, who consider that this system will require less labour and be good for soil stabilisation.

Rumilar Magar, HH 10

Poor survival last year again attributed to frost and low temperatures. Khimbu nursery not looking very good, as situated some distance from the house (to avoid chicken problem), and is not watered enough. Rumila is cultivating a seed nursery in collaboration with Laxmi. They are sharing equally the seeds provided and maintain the nursery in shifts. (Laxmi thinks that she does more of the maintenance because Rumila has been ill and away in Kathmandu for some time.) Nursery well watered and shaded.

Ange

NGO support to the village

The project is collaborating with the Indrawati Public Services Committee NGO, whose field activities at Ange are led by Mr Mohan Dhakal. He has been active in the village over the last 6 months encouraging households other than those directly involved in the research to start home nurseries. He has also provided inputs and support to the research farmers and

good nurseries have been established by the 10 research farmers, together with 17 other village households.

Agricultural activities at present

The village was engaged in the preparation of khet land and in the transplanting of rice in khet land at the time of this visit, 23rd March 1999. Other khet land has wheat nearly ready for harvest (within next two weeks). Those households without khet are engaged in ploughing bari land, manuring of bari land and harvesting potatoes.

Research group meeting, 8.00am 23rd March 1999

Present:

Bhim Kumari Khadka

Santha Kumari Khadka

Pulthunga Khadka

Man Kumari Khadka

Dev Kumari Khadka

Shuku Rani Lama (arrived late, 10.00am)

Lok Kumari Khadka

Savitri Bdr Khadka

Ram Maya Tamang

Plus several vocal non-survey group members

Not present

Rani Tamang

Further research activities

The concept of on-farm experiments to compare species suitability on different soil types and aspects was explained. The group was interested to be involved in the experiments, but expressed concern about possible shading of adjacent bari land and reduction of crop production. Management of the species was discussed and farmers reassured that they would be able to cut the species as they required.

Different members of the group expressed preference for different species. Preferred species mentioned were Ipil, Bhatmase, Khimbu, Tanki, Koiralo, Badahar, Konaiyo, Guazuma, NB 21, Molasses and farmers would like to try Stylo and Jai ghaans (fodder oats)

The group identified three common types of soil in the area;

Chimte mato Clay soil

Kalo mato Black soil

Balaute mato Sandy soil

Sandy soil predominates in the main village area and hence in the gharbari land. This soil type makes crops particularly susceptible to dry conditions.

Exploring findings from survey data at group level

Crop thinnings

Maize and upland rice are sown more densely in order to compensate for potentially poor germination and to provide additional fodder resources.

Off-farm fodder resources

The village forest areas have been closed for three years. Previously villagers used to collect animal bedding and goat feed from the forest. They say that since the closure of the forest the nature of the forest is changing, with more timber and fuelwood available, but almost no

fodder or bedding materials. Since closure, households have had to manage feed requirements from their own land. This has increased the fodder deficit and some households had to reduce their livestock holdings, selling goats and cows. The health of animals has been affected by the reduction in feed availability, buffalo and oxen to the greatest extent.

Control of grazing

The group has been instrumental in convincing the village to control grazing on bari land, so as to allow for the cultivation of fodder species. They have introduced a fine system to deal with infringements, 10Rp for a goat and 20Rp for larger livestock caught grazing on private land. There has been some dissent, but also a lot of support for this initiative and grazing has been reduced. Now that other households are also cultivating fodder species this year (in addition to the research households), there is stronger support.

Livestock breeds

There are no cross-bred cows kept in the village. Two households keep Murrarah cross buffalo, Savitri and Lok Kumari. These animals consume more than the local breed, but are fed the same composition of feed, approximately 150% of the intake of the local

Purchase of feeds

Only one household buys rice straw, otherwise supplies last until June/July when the rains start.

Differences in farmers' management of fodders

Variable availability of fodder resources

Allocation of new species

General comments

The unusually dry year, together and interacting with the late planting of seedlings, are the main reasons given for the poor survival rates experienced by most farmers. Only those able to plant near a water source have experienced good survival. *Luecaena pallida* is less preferred than *Luecaena 156*, as growth is less vigorous and branches are not straight, making poor poles.

Survival of seedlings and cuttings from 1998 planting

HH	Name	Ipil		Bhat. M		Rai K.		Kimbhu		Badahar		NB 21	
		P	S	P	S	P	S	P	S	P	S	P	S
1	Bhim K Khadaka	60	6	50	6	15	0	0	0	5	2	200	100
2	Santa K Khadaka	100	20	20	20	3	0	20	4	5	0	200	2
3	Rani Tamang	N/A											
4	Fulhunga Khadka	30	2	50	30	0	0	100	40	5	0	200	25
5	Man K Khadaka	60	2	7	7	1	0	0	0	5	0	100	5
6	Dev K Khadaka	60	50	10	10	0	0	20	20	5	0	100	0
7	Shuku Rani Lama	50	5	30	2	0	0	100	95	5	2	200	65
8	Lok K Khadaka	60	4	20	6	0	2	0	0	5	2	200	15
9	Sabitri Khadka	60	5	20	4	0	0	0	0	5	1	102	12
10	Ram M Tamang	80	2	10	30	0	0	0	0	5	2	40	15
	Total	560	96	217	115	19	2	240	159	45	9	1342	239

HH	Name	Guazuma	
		P	S
1	Bhim K Khadaka	3	1
2	Santa K Khadaka	4	1
3	Rani Tamang	4	0
4	Fulthunga Khadka	0	0
5	Man K Khadaka	1	0
6	Dev K Khadaka	5	0
7	Shuku Rani Lama	0	0
8	Lok K Khadaka	0	0
9	Sabitri Khadka	3	0
10	Ram M Tamang	4	0
	Total	24	2

Request for seeds and seedlings for 1999

HH no.	Badahar	Bhadm	Ipil	Gauzuma	Kimbhu	NB 21	Sunnhem p	Molasses
1	10	50	50	10	500	0	3 terraces	1 terrace
2	5	5	10	5	200	100	1 ter	1 ter
3	50	40	0	40	100	20	0	1 ter
4	15	30	50	50	100	200	1 ter	1 ter
5	50	0	100	20	200	100	0	3 ter
6	10	15	50	10	100	100	1 ter	2 ter
7	10	10	10	10	100	50	1 ter	1 ter
8	5	10	20	10	300	50	1 ter	1 ter
9	5	5	10	10	200	50	1 ter	1 ter
10	5	5	10	5	100	50	2 ter	1 ter
Total	165	170	310	170	1900	720	1.5 kg	1.5 kg

Also 25m² plot to be planted with Jai Ghaans for each household.

Seedlings present in farmers' nurseries in March 1999

HH no.	Neemaro	Badahar	Bhatmase	Ipil	Gauzuma	Kimbhu
1	Tray bed		50	60	Tray bed	200
2	Tray bed		50	60	Tray bed	200
3			50	60		100
4			50	60		100
5			50	60		200
6			50	60		200
7			50	60		100
8			50	60		200
9			50	60		0
10			50	60		100
Total			500	600		1,400

Also 25m² plot to be planted with Jai Ghaans for each household.

(Some uncertainty over seedling numbers as numbers of filled polypots greater than recorded seedling numbers by NGO)

Individual farmer's interviews

Bhim Kumari Khadka, HH 1

Approximately half the NB 21 slips planted last year have survived. Those that have died were affected by the dry conditions. She planted in September and after two months was able to start harvesting the grass for fodder. This she fed to all livestock in a mixture with maize stover. Bhim fed most to the buffalo, with some also given to the cows and goats. She was able to keep cutting the grass upto early December. Her Badahar is looking good, planted in moist, shady spot. Ipil and Bhatmase seedlings were planted on more sandy soil and have suffered from dryness and soil instability. She will plant this years seedlings in different areas. Nursery shared with Santha.

Santha Kumari Khadka, HH 2

Santha has fed NB21 to all livestock, mixed with rice straw. However with the dry conditions she fears that nearly all the NB 21 has now died. She has heard from farmers in Rampur (next village) that it is not good to feed NB 21 to animals just after conception. (This is not normally the case with NB 21 and perhaps the potential danger of feeding too much Ipil at this time has been ascribed to other "new" species too.) Santha also reported that if too much of Rai Khunyo, NB 21 and Dinanath are fed this causes blood to appear in the urine and manure.

A few Ipil have done very well, reaching 1.5 metres in height.

She reports that Setaria was more affected by the dry conditions than the Molasses. The Molasses looks healthy, but has not been harvested yet as it is still small. The Molasses shows none of the robust growth found in Tiwari.

Santha's joint nursery with Bhim Kumari is well constructed and managed. They water daily, but despite this the nursery has tended to dry out in the afternoons. A mulch would help. Some cuttings display die- back after initial good sprouting. Over use of goat manure in places may be a contributing factor?

Rani Tamang, HH3

Rani left after the group meeting to help with rice planting on the khet land so we were unable to gather details of last year's seedlings.

Khimbu bed well constructed and shaded, but being vandalised by chickens taking a dirt bath. Cuttings showed good sprouting. Seed nursery had been located under good natural shade, but the polybags had been filled-up with just dry soil by the children.

Fulthunga Khadka, HH 4

Fulthunga inherited seedlings from previous group member who quit the group. She therefore did not receive the original home nursery training in March '98 and still is unclear about some basic practices. Her gharbari land is well watered and Khimbu and Bhatmase show good survival on this land. She ascribes mortality of other seedlings to dry conditions, but lack of maintenance is also a factor. Fulthunga is impressed with the growth and palatability of Dinanath which she has been feeding to livestock.

Khimbu nursery poorly constructed and maintained despite close location to a water tap. Seed nursery not yet constructed.

Man Kumari Khadka, HH 5

Good looking nursery, with many cuttings at 7 leaf stage. Some problem with die back of shoots. Cause to be further investigated.

Dev Kumari Khadka, HH 6

Success of cultivation of Ipil, Khimbu and Bhatmase seedlings from last year ascribed to where she located them, under the shade of a banana where the soil had good fertility and there was plenty of water available. She considers that growth has been curtailed due to the dry conditions which is manifested in their limited height (under 1 meter) and poor foliage growth. NB 21 was planted some distance from the house and has now died (cut too frequently for the dry conditions last year?). Dinanath has been more successful and has been fed to all animals.

Current seed nursery looks well set-up, but requires some protection as no natural shade available.

Shuku rani Lama, HH 7

Shuku reported problems with the Khimbu nursery due to mice eating the shoots. She expects only 25 or so of the 100 cuttings to survive. The household has some 3 year old *Morus alba* trees from cuttings Mohan supplied earlier. These look healthy and are showing good growth despite the present dry spell. NB 21 in khet is doing well. The NB 21 started to be cut 2 months after planting, in August. It has been cut twice a month since then, a total of 16 times and is still being cut now. Mr Lama estimates that they have collected 2 bharis from the 60 clumps on the khet, but this is also mixed with a little other grasses from the khet terraces.

Lok Kumari Khadka, HH8

Low survival of seedlings planted last year is ascribed to a number of different factors. She thinks that frost killed the Ipil, that the *Flemengia* seedlings and NB21 were affected by lack of water (drought problem), and 2 of Badahar seedlings were wiped out by a landslide. Rai Khanyo seedlings are doing well.

She has only requested a few seedlings this year due to the high mortality last year. She wants to try a few of each species and give them greater attention.

Khimbu nursery has been shaded, but now the natural shade of a banana is enough. The nursery looks in good condition with cuttings quite far advanced. The water in the nearby tap has just stopped, so that watering will now be more of a problem.

Savitri Khadka, HH 9

She attributes the poor survival rate in all species to the very dry conditions this year.

As young plants they did not have the established root system required to withstand a long dry spell.

Ram Maya Tamang, HH 10

Again dry conditions is the reason given for poor survival of the Ipil and Guazuma.

Flemengia did better because the seedlings were planted near a water source and are watered when necessary. *Flemengia* has been cut once, in early January.

NB 21 has shown good growth and was cut once a month from mid June to November. It was fed to all livestock, with most given to buffalo and oxen, only a little to the goats. She let the grass wilt for a day before feeding. Now it has died back and she is unsure if the majority of clumps situated on her upper bari are still alive. Those near the water source are still doing well, but suffer from being grazed.

Khimbu has been cut twice, once in late November and again in mid March. All livestock find the fodder palatable, but she fed this mostly to the goats, as they had least green feed at these times of the year. A little was also fed to buffalo and oxen.

Her Khimbu nursery is good, but suffering some die-back of sprouted shoots.

Gajurichhap

NGO support to the village

Majhitar Samudyik bikash kendra, MSBK, (Majhitar Farmers' development Centre) is the partner NGO for this village. The secretary, Mr Chopnidha Nepal, has been giving support to the group. Visits by the NGO have been more regular and frequent than previously. They have conducted the one-off survey, however Mr Nepal feels unsure about the correctness of data collected on land holdings. Farmers were reluctant to give this information and often said that they were unsure themselves. It is suggested that figures obtained during the mapping exercise are more likely to be correct and that these should be taken, rather than those from the survey.

Agricultural activities at present

Due to the lack of good rains since the end of July, agricultural opportunities have been limited. Many farmers tried vegetable cultivation during the winter months, but failed due to lack of water. Now they are ready to plant maize, but have to wait for one good rain.

Research group meeting at Gajurichhap, 26th March 1999

Present:	Not present
Buddhi bdr Koirala (Ram Maya, wife)	Lila bdr Magar (attending another meeting)
Sumitra Magar	Thulo Santi Magar (new member)
Top bdr Magar (leader farmer)	
Hari bdr Magar	
Man bdr Koirala	
Ammar bdr Magar, and father (sano Santi, daughter)	
Dhana bdr Magar	
Ek bdr Magar (arrived later) (sometimes his wife attends)	
Ganesh bdr Magar (arrived later)	
Til Bdr Magar (NGO representative)	

Also present:

Kul bdr Magar (new member)

In an attempt to involve more women in the fodder activities, four new households have joined the group. These are not included in survey activities, but have established nurseries. Of the ten original households, three are now frequently represented by female members, names in brackets above.

Preferred fodder species

Farmers identified Ipil, Rai Khanyo, Flemengia, Velvet bean, Sunnhemp and Khimbu as good fodder species. They had not had any experience as yet with Molasses and Stylo grasses, nor Guazuma. They explained their lack of preference for Kimbu as due to it taking fertility from the soil and making the soil dry. This makes it difficult to grow crops in adjacent bari land. They favoured growing a mixture of species in a given area as this makes it easier to harvest a mixture at one time which they require in order to be able to feed direct to livestock. A mixture of species is required for livestock, as this makes digestion of the fodder easier for the animals, and productivity from the animals higher.

Grazing problem in the village

Discussions in the group meeting frequently returned to the problem of grazing not yet being effectively controlled in the village. Feelings ran high on this issue. It appears that the

situation has been exacerbated by the present drought conditions and the shortage of alternative fodder sources. However this becomes a circular argument, as uncontrolled grazing was identified as a major factor in the poor survival rates of seedlings planted last year.

Experiences from Gauthale and Adamara villages, where grazing has been successfully controlled by “social fencing” over the last 2-3 and 5-6 years respectively, were recounted by Til bdr Magar. The village seems to clearly see control of grazing as the next necessary step in intensification of fodder production and motivated to implement necessary rules. The NAF team will explore possible ways of supporting the initiative. Possibly with cross-visits to sites that have recently implemented control, like Gauthale, and support in development of regulation for grazing.

Siting of the experimental trials

Farmers identified 5 types of soil as commonly occurring in the village;

Rato mato	red soil
Fusre mato	light brown soil
Kamero mato	white clay soil
Chimte mato	clay soil
Dungen mato	gravelly soil

They were open to the idea of structured experimentation and the need to identify species suitability with regard to soil type and aspect.

Exploring findings from survey data at group level

Community forest areas:

Three community forest areas were identified:

1. Gairigaun Khadi Gaira, consisting of 2 hectares
2. Bageswari, consisting of 3-4 separate areas of over 10 hectares
3. Bhaise Bhitta forest area that is very large (they do not really have a clear idea of its size)

1. Gairigaun Khadi Gaira is mainly Schima-Castanopsis forest type, with some hill Sal. It has been managed by Gajurichhap villagers for over 10 years and was formally handed over to the community 3 years ago. It is managed for fuel and timber production. It contains no grasses, but is open for leaf-litter collection and Katus (*Castanopsis indica*) leaves are used for thatching.

2. Bageswari forest is shared with Ward 4 villagers and is open all year round. Villagers are able to collect grasses, fuelwood and graze in the area. The forest is divided into Ward 3 and Ward 4 areas for management purposes, but is registered under one name.

3. Bhaise Bhitta forest is located further away from the village. Gajurichhap villagers are not primary users of this forest, but reported occasionally stealing grasses when their own supplies are exhausted.

Use of crop thinnings

Both the main maize and upland rice crops are purposefully sown more densely so as to provide additional fodder. This is also practised in the soyabean and buckwheat crops. Thinnings are used from mid-May to mid-July. Farmers estimated that they sow between 25% and 50% extra seed in the main cereal crops.

Purchase of feeds

No commercial concentrate feed is purchased by villagers, however rice bran is bought by some. Concentrates are fed to milking animals and to oxen at ploughing time. Goats are fed maize bran only. The high livestock holdings in relation to feed availability was explained by farmers as relating to their primary objective in keeping animals, for manure production. Animals are sold when a cash lump sum is required.

Weather

This year has been a very bad one for agricultural production. There has been no strong rain since early July. This prevented the sowing of the winter wheat crop. It has also caused earlier leaf fall in fodder trees and a longer gap between leaf fall and re-sprouting. There is now very little green grasses, or fodder to mix with crop residues. Milk production in the village has been reduced by about 50% this year due to the dry conditions.

This situation contrasts strongly with last year which was considered a very good year. There were 2-3 strong rains in each month that supported vegetable production as well as the usual major crops. Fodder resources were also plentiful.

Trends in livestock productivity

Farmers identified declining livestock productivity in the village. Milk production was greater 10 years ago than that achieved in the exceptionally good year last year (1997-8).

Survival of seedlings and cuttings from 1998 planting

HH	Name	Ipil		Kimbu		Tan ki		Guju ma		Bhat mase		NB21	
		P	S	P	S	P	S	P	S	P	S	P	S
1	Budhi Bdr Koirala	300	150	0	0	0	0	0	0	0	0	100	0
2	Sumitra Magar	250	0	300	2	0	0	0	0	0	0	100	25
3	Top Bdr Magar	300	250	200	5	0	0	0	0	0	0	100	0
4	Hari Bdr Magar	360	300	180	30	0	0	0	0	0	0	100	2
5	Man Bdr Koirala	360	100	50	25	0	0	0	0	0	0	100	2
6	Lila Bdr Magar	380	190	70	45	30	15	2	2	100	100	100	40
7	Ek Bdr Magar	300	150	100	50	100	100	2	2	0	0	1000	1000
8	Ganesh Bdr Magar	250	15	250	12	50	40	0	0	0	0	100	0
9	Ammar Bdr Magar	300	150	0	0	0	0	0	0	0	0	60	15
10	Dhana Bdr Magar	200	120	0	0	0	0	12	0	0	0	100	1
Total													

Seeds and seedlings requested for 1999

HH	Kimbu hu	Badha ha	Ipil	Nimaro	Timila	Gauzuma	Champ	Koirala	Sisso	NB21	Grass seed* kg
1	0	15	500	10	10	5	100	200	500	100	1
2	100	100	400	100	10	100	5	0	50	100	1
3	50	15	100	10	20	10	5	5	50	100	1
4	5	25	100	10	10	10	10	10	100	50	1
5	0	40	50	40	5	20	10	5	50	100	1
6	0	50	50	30	5	20	5	5	0	50	1
7	200	100	400	50	5	10	10	5	100	100	1
8	0	100	250	50	20	25	200	25	200	0	1
9	0	100	200	10	10	25	100	10	50	0	1
10	0	15	100	5	10	25	50	0	100	50	1
Total	350	560	1900	315	105	250	495	265	1200	650	10

*Grass seed request for Molasses and stylo

Plants in nursery in March 1999

HH	Kimbu	Badha	Ipil	Nimar	Timila	Gauzu	Cham	Koirala	Pear	NB21	Grass seed* kg
1	65	0	115	0	0	0	0	0	3		
2	80	0	250	0	0	0	0	0	0		
3	100	0	450	0	0	0	0	0	0		
4	72	0	360	0	0	0	0	0	0		
5	55	0	178	0	0	0	0	0	0		
6	50	0	400	0	0	0	0	0	0		
7	175	0	400	0	0	0	0	0	0		
8	75	0	295	0	0	0	0	0	0		
9	45	0	380	0	0	0	0	0	0		
10	45	0	308	0	0	0	0	0	0		
Total											

*Grass seed request for Molasses and Stylo Relative amounts required of each?

Molasses

Stylo

Individual farmer's interviews

Note: The three farmers that ordered khimbu seedlings have constructed good nurseries. All farmers are raising some khimbu, but most of those that didn't order the species have constructed very poor beds and are not looking after them very well.

Budhi Bdr Koirala, HH 1

He has some Ipil remaining from plantings last year. None of the NB 21 has survived the dry conditions.

Nursery is an open position, but semi-shaded by the house. Khimbu bed not well prepared and seedlings too close together and too sloping at the back of the bed. There has been some problem with grazing by goats on the khimbu shoots. He is growing some naspati (local pear) cuttings and vegetable seedlings next to the Ipil. Ipil seedlings 15 days old and at cotyledon stage.

Sumitra Magar, HH 2

Sumitra cut NB 21 every three weeks before the dry months (up until November). This she fed to both goats and buffalo. She also has supplies of Dinanath which she cut and fed once, in September. Almost all her plantings of Khimbu and Ipil from last year have been destroyed by grazing. She plans to plant in the same place this year and hopes very much that grazing will be successfully controlled. Her Khimbu nursery is well constructed and well watered. She has reserved the Flemengia seed for planting in hedgerows.

Seed nursery covered directly with straw. Straw used in this way, rather than constructing low shelter to protect seedlings from chickens.

Top Bdr Magar, HH 3

Top Bahadur planted the different species separately, as did Lila. All the Khimbu was lost in a landslide. NB 21, Molasses and Dinanath grasses were cut once in September/October (the Dinanath twice), but then dried out and he thinks that many have now died. He harvested 5-6 bharis in total of the new grasses. Most was fed to buffalo, some to oxen and a little to goats. He thinks that the grasses are best for buffalo. He will refill in spaces this year and in other areas of his land where there is space.

This years nursery has suffered from rat attack on the seeds in the poly bags. The khimbu cuttings look healthy and are well watered.

Hari Bdr Magar, HH 4

Hari reports some 300 Ipil still surviving from last years planting, despite being eaten in part by goats. The year old Ipil on his gharbari land at 1-2 metres in height looked very healthy. The Ipil has been cut once, in early November and was fed mainly to the goats. A small amount was also fed to other animals. Kimbhu survival was less good, due to the dry conditions and he reports some seedlings being stolen. Surviving plants are about 1 metre tall. Only a few NB21 slips have survived the harsh drought conditions this year. He has also experienced grazing of khimbu cuttings in the nursery, planted at the end of December. All have resprouted so far and look healthy. Ipil was sown 20 days ago and seedlings are at the two cotyledon stage. There are many per polybag and will require thinning at an early stage.

Man Bdr Koirala, HH 5

Poor survival of all seedlings planted last year due to both uncontrolled grazing and the very dry conditions. Man Bdr identified the dry conditions as a more crucial factor on his land than the grazing problem.

Nursery not doing well. Poor preparation of the Khimbu bed and in very dry condition, only one cutting has sprouted. Ipil seed was planted 12 days ago (14/3/99) and has not been well watered. He gave the job of watering to a young son, but the son has not bothered.

Lila Bdr Magar, HH 6

Lila planted the different species in separate areas last year, because before the TOT training he didn't know the benefits of mixed planting. He harvested the NB21 once in September/October and fed to all animals, however the buffalo consumed most. (Information with regard to seedling survival given by his son and does not equate with earlier information. To be checked with Lila on next visit.)

Nursery looks dry and is not well shaded.

Ek Bdr Magar, HH 7

Ek Bdr had very good production from the NB 21. This he planted in a "cool" place. Although he gave no extra water, the location is naturally more moist than average bari land. He reports all 1000 slips as surviving. These were cut once a month with yields varying from 1-3 bhari depending on whether summer (productive), or winter (dry) month. He fed the fodder to all livestock, but less to goats than to buffalo and oxen. This year he will plant the seedlings where there is still room on his land.

His Khimbu nursery is watered from the drainage from a tap and this has caused waterlogging in one corner. Present foliage growth of cuttings good and Ipil seedlings look well watered.

Ganesh Bdr Magar, HH 8

Ganesh planted a great number of both Kimbhu and Ipil last year, but has few remaining now. Uncontrolled grazing was largely responsible for the high mortality. Ipil was particularly effected by grazing because goats strip the bark from Ipil trees, which is more damaging than just eating the foliage. Goats do not eat the bark of Tanki and this is the main reason for better survival of these seedlings.

Ganesh identified a reduction in grazing intensity this year compared to last, illustrated by his ability to harvest fruit and fodder from bannana trees which previously have not been productive. He is hopeful that control of grazing will continue to get better and that this years seedlings will stand a better chance of survival.

The household has been busy in construction of a new house and the area in which the nursery is located has suffered from building material over flow. Kimbhu bed is poorly prepared, not been cared for and the cuttings suffered from grazing. Ipil seedlings were planted yesterday (25/03/99), soil and location of these looks good, though no shade as yet provided.

Ammar Bdr Magar, HH 9

Ammar has some older Ipil trees of about 5 years that were brought from Majhitar. He cuts these three times a year, including during the dry season December/January. He doesn't cut them during the summer, mid-June to mid-August when there are plenty of other fodders available. He cuts them every three months, so timing depends on when he first cuts, for example if he first cuts in September/October, then will cut again in December/January. The Ipil is fed to all animals in a mixture with other tree fodders. Goats and buffalo are fed equal amounts.

He identifies uncontrolled grazing as the greatest contributor to poor survival of seedlings from last year, followed by the dry conditions that affected Ipil seedlings to a greater extent than the grasses.

Khimbu nursery neglected although situated close to a water source. Daughter (Santhi) responsible for seed nursery and this is looking well watered with some germination just showing.

Dan Bdr Magar, HH 10

Dan Bdr has good survival of Ipil from last year, with those on his well fertilised gharbari showing excellent growth of 2-3 metres. Those on bari terraces are 0.5 to 1 metre tall, having been cut once.

Kimbhu in the nursery has been grazed and is in poorly prepared, open and very dry beds. Ipil has just been planted, 24/03/99.

Khul Bdr Magar, New member of group

Good Khimbu and Ipil nurseries, protected by robust fencing and situated under favourable, natural dappled shade. Khimbu set back by earlier grazing (when no protection present). Ipil seedlings of two ages, 18 days and 25 days, with the oldest at first true leaf stage. Neemaro seedlings sown in mini-bed.

Gauthale

NGO support to the village

Dhusa Bikash Samaj (DBS) is the partner NGO. Over the last 5-6 months, Til Bdr Magar has been supporting activities in the village on behalf of the NGO. The proposed facilitation of greater women's involvement in fodder cultivation by Chittra Kamari did not develop as planned (she visited only once), due to her responsibilities for a young child. It is now proposed that Til Bdr join the project team to give support and follow-up with Gajurichhap group and other groups as required. Chittra is now able to work in the village and she is

again proposed as the NGO contact and motivator. Training for women has been attempted twice, but arrangements did not work out on either occasion.

The farmers group proposed that NGO support for activities be transferred to a more local NGO in their village. They showed the team registration documents for Langali UNESCO club, to which the majority of group members apparently belong. It was agreed that they would bring along their proposal to the NGO meeting in Kathmandu on the 2nd April.

Agricultural activities at present

Vegetables, such as onion, tomato, potato, cauliflower and cabbage, are being cultivated. This is mostly on a small scale, by all households, on gharbari land that is close to a water source. Some farmers are also cultivating on a larger scale on nearby bari terraces. Yam sets were being planted on the day of our visit.

Compost is presently being transported to the bari fields and trash collected and burnt on the same fields to enhance fertility, in preparation for the maize planting.

Weather

It has not rained in the area since August 1998 and so the land is very dry. It rained more in June and July than normal, but then the rains stopped early. Usually some rain comes in November and then in January/ December, but there has been no proper rain this year. This has meant that no wheat has been grown in bari land this winter. Temperatures in this year have been similar to last years.

Research group meeting, 27th March 1999

Present

Thulo Toya Magar (HH 1)
Krishna Bdr Magar (HH 2)
Chhabi Bdr Magar (HH 3)
Chumpi Maya Magar (HH 6)
Lal Bdr Magar (HH 8)
Khum Bdr Magar (HH 9)
Dhana Bdr Magar (HH 10)

Not present:

Kul Bdr Magar (HH 5)

New women members present:

Til kumari Sujibadar
Puna Maya Magar
Renu Maya Magar (HH 7?)
Bel Maya Magar (Lok Bdr Magar's wife, HH4)

Preferred fodder species

The group explained their strong preference for Ipil in terms of both its role as a fodder and its suitability for their farming system. All livestock like the fodder and it increases the yield of milk and productivity of the animals. Within the farm it doesn't deplete the fertility of the soil and provides fuelwood and poles as well as fodder. They do not have as much experience with Khimbu, but say that cattle do not like it as a fodder in the rainy season and that it depletes adjacent bari land of fertility. The horizontally spreading roots also make it more difficult to plough on adjacent terraces.

Farmers say that they already have many slips of NB 21 in the village and therefore have not requested more as they can take slips from established clumps. They find NB 21 very good for milk production and feed mostly to milking buffalo. NB 21 they also identify as reducing the fertility of the soil, particularly in a one foot radius around each clump.

They only have a few seedlings of Flemengia in the village, but they are interested in the species because they hear that it is a legume and does not reduce soil fertility. All farmers are interested to try it this year. The leader farmer emphasised the importance of using a mixture of species.

Of the local species, farmers identified Badahar and Neemaro as the most favoured. Neemaro was identified as a very nutritious fodder that can be cut 2-3 times a year and that is used for making plates as well as a fodder. Badahar can only be cut once, but is important for providing fodder in this season when it is required for the working oxen and little else is available. Comparing their preferences with those from other sites they said that Rai Khanyo does not do well at this altitude and that they did not know about Dhudilo, that it is not available locally.

Crop thinnings

Farmers identified sowing maize more densely than that required in the final stand to offset possible poor germination and to allow for likely thinning that occurs during the first weeding. The first weeding is done by plough in this area and causes considerable disruption with in the crop. Farmers estimated sowing 50% more seed than that which would be required with good germination and no weeding damage. With good germination the crop provides a considerable amount of thinnings for fodder.

Upland rice is sown at 100% greater density than that finally required and the thinnings form an important fodder resource. These are old practices that the farmers learnt from their parents and used in the village for generations.

Communal nursery area

The communal nursery area has been rejuvenated since the last joint field visit. The protecting wall has been repaired, the beds reformed and excellent cuttings of Khimbu (2,250) are well established under good, woven mat shading. The nursery also contains 3,300 Ipil seedlings and 1,100 poly pots planted with Guazuma (yet to emerge). Neemaro is being raised in trays and will be transferred to polypots later. Thulo Toya Magar (household 1) has been instrumental in the rejuvenation of the nursery, which is located on his land. He has also supplied all the Ipil seed used this year from three year old trees on his own land. The 36 members take it in turns to water the nursery (2 member responsible in each day). The nursery should be very productive this year.

There is some problem with crickets (eating the Khimbu leaves) and an unknown, below ground insect attack associated with overwatering problem in one bed at the front of the nursery.

Further research activities

Ipil, Khimbu, Flemengia, NB 21, Budahar, Guazuma and Molasses were identified as suitable species for experimentation. The group said that they didn't know of any other species of grasses. Sunnhemp is liked by goats, but not much by other livestock and so is not preferred by farmers.

Grazing practices

Grazing is now only practised in forest areas. Villagers have controlled grazing on crop land for the last two years, since they started agroforestry activities. It is not a complete closure of crop land, just those areas where seedlings have been planted. Other areas are still grazed. They reported no conflict and unanimous agreement on the control. However, during later

visits to household nurseries, there emerged a continued grazing problem in Chapdihi tol, the lowest hamlet in Gauthale.

Farmers felt that the condition of surrounding forests was degenerating. Grazing doesn't effect the big trees, but prevents regeneration and they notice a reduction in the number of productive fodder tree species.

The practice of grazing by households is limited by labour availability. Now that a greater number of children go to school, the practice of grazing has reduced.

The number of livestock kept over the last couple of years has reduced, although farmers think that milk production has stayed the same.

Use of fodder resources

Maize tops are used as a fodder in August and maize leaves stripped from the crop in August/September for further fodder. At harvest only the maize stems are left and these are not used as fodder, as there is little edible material left. Stems may be used for bedding, or are burnt in this season to add fertility to the bari land before maize planting.

Purchase of feeds

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Concentrates are fed to kidding goats and in the September/ October period, just before Desain, to goats that are being fattened for sale.

Production objectives in livestock management

Manure production for support to farm crop production is the primary object of most farmers. Production of milk is considered of secondary importance and production of meat ranked third in importance. Manure production relies closely on feed intake and so maximum production occurs during the months of June, July and August.

Differences in farmers' management of fodders

Variable availability of fodder resources

Allocation of new species

Survival of seedlings and cuttings from 1998 planting

(Farmers not sure of exact numbers remaining, estimates given below)

HH	Name	Ipil		Bhat. M		Rai K.		Guju ma		Bad aha		NB21	
		P	S	P	S	P	S	P	S	P	S	P	S
1	Thulo Toya Magar	60	50	-	-	20	5	10	1	-	-	50	50
2	Krishna Bdr Magar	290	180	-	-	30	5	-	-	-	-	40	15
3	Chhabi Bdr Magar	150	100	-	-	30	25	-	-	-	-	50	20
4	Lok Bdr Magar	400	250	-	-	30	15	-	-	-	-	100	80
5	Kul Bdr Magar	357	250	-	-	-	-	-	-	-	-	300	250
6	Bhim Bdr Magar	350	300	-	-	30	2	-	-	-	-	60	30
7	Yam Bdr Magar	270	200	-	-	25	25	-	-	50	0	200	100
8	Lal Bdr Magar	550	300	-	-	-	-	3	2	15	0	30	15
9	Khum Bdr Magar	300	250	-	-	20	20	-	-	-	-	50	50
10	Dhan Bdr Magar	150	35	-	-	500	150	-	-	-	-	50	15
	Total	2877	1915	-	-	685	247	13	3	65	0	930	625

Seed and seedling requirement for 1999

HH	Name	Ipil	Badahar	Nimaro	Gauzuma	Kimbu	NB 21	Grass seed*
1	Thulo Toya Magar	100	5	10	4	0	0	1
2	Krishna Bdr Magar	300	20	20	0	0	0	1
3	Chhabi Bdr Magar	300	0	0	5	0	50	1
4	Lok Bdr Magar	300	0	0	0	50	100	1
5	Kul Bdr Magar	300	0	10	0	0	0	1
6	Bhim Bdr Magar							1
7	Yam Bdr Magar	250	10	20	0	0	0	1
8	Lal Bdr Magar	1000	0	100	0	0	0	1
9	Khum Bdr Magar	500	20	20	15	0	0	1
10	Dhan Bdr Magar	300	200	50	50	0	0	1
Total		3350	255	230	74	50	150	10 kg

*Grass seed includes sunnhemp, stylo, molasses and dinanath

Seedlings in farmers' nurseries in March 1999

HH	Ipil	Bhatmase	Gauzuma	Kimbu	Local pear Naspati
1	290	0	0	Community	0
2	300	0	0	Nursery	0
3	280	0	0	“	0
4	300	0	0	“	0
5	380	0	0	“	0
6	324	0	0	“	0
7	350	0	0	“	0
8	600	0	0	“	0
9	300	0	0	“	0
10	1200	300	100	1200	30
Total	4,324	300	100	3,450	30

Individual farmer's interviews

Thulo Toya Magar, HH1

Thulo has some 2 year old Ipil trees which he cut just once this year, in November. The fodder was fed to all animals, but primarily to buffalo and oxen, with just a little fed to the goats. He has not cut the trees frequently as he wants good pole production. He is thinking of reserving some for seed production this year (he was the provider of the 4 kg of Ipil seed for the community nursery this year and is responsible for seedling distribution from the nursery). He reports good survival of Ipil seedlings from last year, despite some being eaten by mice.

Nis NB 21 has survived well this year, despite the drought. This may be helped by the fact the plants are more than a year old. He cuts these grasses every 7 days in summer and every 15 days in winter. Feeding pattern similar to that for Ipil.

Thulo soaked the Ipil seeds for three days before planting and has achieved a very even germination with this technique. His Khimbu is in the communal nursery.

Lok Bdr Magar, HH 4

Particularly good growth of Ipil planted last year next to manure heap on gharbari land. Trees 2-4 metres in height, not yet cut. Other trees on bari land have been cut just once, in January. Again cutting frequency has been limited to allow good pole production. Lok bdr explained that for large pole production Ipil could usually be cut twice a year, for smaller branch production, 3-4 times a year. He cuts in June/ July and then in November/ December for production of poles approximately 1.5 metres in length and 5cm diameter. Fodder of Ipil is fed to all livestock as all like it. He plans to plant 50-60 Flemengia seedlings this year, less than Ipil because he has seen the growth in another village and it is not as good as that of Ipil. He estimates that with last years planting and the proposed planting this year that his fodder deficit will be reduced by 50%.

NB 21 did very well when there was sufficient moisture. He cut it 6-7 times during the rainy season. During the winter season only the clumps planted close to water and a source of manure were productive. He fed the majority of the grasses to the buffalo and oxen and more of the Ipil to goats.

The Khimbu he planted previously is not doing well. He thinks that it requires more space.

Lal Bdr Magar, HH 8

Good survival of Ipil planted last year. Poor survival of Guazuma. All Badahar seedlings died back after appearing to take initially. Lal Bdr thinks that this might have been due to late planting. He is not sure at present whether the NB 21 is still alive.

Lal Bdr managed both the Ipil and NB 21 for fodder for buffalo during the milking season. He cut the Ipil once and the NB 21 three times between mid June and mid October. Both types of fodder were liked by the animals and were found to increase milk production. His present nursery is situated in natural shade and looks good. He cultivates as many seedlings as he has labour to look after and plant out. At his present rate of cultivation and seedling survival he estimates that after a further 3 years of seedling raising and planting that he will have enough fodder and no remaining deficit.

Bhim Bdr Magar, HH 6

Bhim reports that the growth of Ipil planted last year has not been very good due to grazing by goats and lack of fertility in the land where they are planted.

NB 21 has been productive, cut twice a month from mid July to mid November. The grass was fed only to the Buffalo. Two year old Ipil was cut and a bhari of fodder produced that was fed mainly to the buffalo and Oxen. A small amount was also fed to the goats.

He says that uncontrolled grazing has been worse this year due to the very dry conditions and lack of alternative fodder sources.

The nursery has been constructed in an area with natural semi shade. Ipil seeds were sown 8-10 days ago.

So far he reports that planting of additional fodder species has not reduced the household's fodder deficit. If seedlings do well this year, Bhim estimates that the deficit may be reduced by 25%. He estimates that it will take 4-5 years to plant-up all available terraces on the households farm land. When this has been achieved he expects that there will be no remaining deficit. If the fodder planting is successful, he would like to increase livestock numbers and introduce improved breeds.

Dhan Bdr Magar, HH 10

Dhan Bdr lives in Chapdihi tol, the lowest hamlet in Gauthale. He says that households have larger livestock holdings here and that they regularly graze them in community forest areas. During the movement of livestock, uncontrolled grazing often takes place. This is the major

cause of poor survival of his seedlings from last year. The NB 21, however, suffered from drought conditions, rather than from grazing.

Dhan Bdr has set-up a communal nursery in Chapdihi tol with approximately 1200 Khimbu cuttings, 1200 Ipil and 300 Flemengia seedlings. The 10 local households take turns in watering. After some initial grazing problem on the Khimbu, the nursery has been well protected with fencing.

NB 21 was cut from mid June until mid October and fed exclusively to buffalo. It was found to increase milk production. Other animals are grazed at this time and did not require additional feed.

Ipil was cut once in November and fed exclusively to the goats. They were identified as the livestock type most in need of tree fodder at this time and also made use of the bark as well as green fodder. Labour was the major constraint on the number of seedlings raised this year, he is cultivating the largest amount that the nursery area and labour for watering can manage.

Krishna Bdr Magar, HH2

Ipil is cut 2-3 times a year in February/ March, May/June and sometimes in October/ November. Krishna harvests 4-5 bhari at each cut from 30 trees. All animals are fed the fodder and no special preference is given. NB 21 is harvested every two weeks in good weather and 2-3 bharis are produced from each cut. The grass NB 21 has not been cut since the start of the dry season 2-3 months ago. More is fed of the NB 21 to buffalo than other livestock.

Chhabi Bdr Magar, HH 3

Chhabi has only 2 two year old Ipil, which he cuts irregularly. Fodder is given to all animals. NB 21 is productive during the wet season (0.25 bhari per cut), but has not been cut for 2 months. He has good survival of previously planted seedlings, but growth has been poor this year.

Khum Bdr Magar, HH 9

Two year old Ipil is cut three times a year in January/February, May/June and September/October. He feeds most of the fodder to Oxen and Buffalo. NB 21 is cut every week during the summer months, but cut once every two weeks at present. He is getting approximately 0.5 bhari of fodder per cut, both now and previously in the wet season. Buffalo and Oxen are given most.

Nursery is over watered and some problem of damping-off is visible on the Ipil seedlings.

Yam Bdr Magar, HH 7

Two year old Ipil is cut three times a year in January/February, May/June and September/October. From 6 trees, 0.25 of a bhari is harvested at each cut. Milking buffalo are fed the most, then oxen, and the remainder to goats. Khimbu is cut three times a year; in January/February, March/ April and again in September/October.

NB 21 is cut once a week during the summer months when 3-4 bhari is harvested at each cut. Now it is being cut once every three weeks and 1-2 bharis harvested. It is fed to livestock in the same way as Ipil.

Last years seedlings are doing very well and Yam plans to plant this year's on another two terraces on the same bari land.