

CHAPTER II

RESEARCH METHODS

2.1 Scope of the Study

This study mainly deals with the trees, whose leaves and green tender branches are fed to ruminants. The general purpose of the study was to identify factors associated with adoption of fodder trees in the farming system, extent of adoption, and farmers' perception about the program implemented by GOs or NGOs.

Since this is the developmental policy, the introduction of such type of technology deals with the people in a region, country as a whole, concerned mostly with adoption, rather than the depth of technology itself. Additionally, this study confined on some internal socio-economic factors that farmers had some control like land holding size, livestock number. External factors were limited only to a few which include proximity to market, to nurseries and to forest.

The choice and adoption of fodder tree species vary from one ecological region to another in relation to their availability and feed value. Therefore, the outcomes of such studies, mainly in terms of species preference could not be disseminated to other areas. A separate study is required.

In the context of hill of Nepal, fodder tree are grown in terrace wall or bund raisers of land without proper spacing. Measuring of accurate area for each tree is not possible and tedious task.

2.2 Conceptual Framework

Several concepts had been used in the literature to describe the adoption of new technologies (Yaron, 1992). However, adoption here is defined as the plantation of fodder tree species that were brought either from nurseries and/or transplanted, regenerated by farmers either from outside or own farm land, which differed from the species that were grown naturally. The adoption mentioned above was considered as a dependent variable and was influenced by number of factors. As a more comprehensive way, the following concepts were sought.

1) Adoption Performance

In order to understand the performance (outcomes) from the adoption of farm practices (fodder trees), extent of adoption as well as effect of adoption were assessed. The former referred to the "degree of use" of farm practice as a quantitative measure and was assessed from number of adopters and fodder trees to the total number of farmers and ruminants respectively. The later part was examined through the impact in the farming system. Because adoption probably have some effect to the crop, livestock

and to the farmer as well in terms of milk production, crop yield, time of fodder collection, change in system of rearing etc. which could provide some opportunity to off farm income.

2) Adoption Factors

The adoption of fodder trees could be correlated to a number of independent variables. However, reviewing the literature on past research, scrutinizing the relevance of the findings in rural areas and also socio-cultural environment in Nepal, concentration was made mainly to some of the factors in socio-economic aspects, which were considered pertinent to explain the behavior of the fodder trees growing farmers of Kavre district. The following Figure 2, represents the conceptual frame work for adoption:

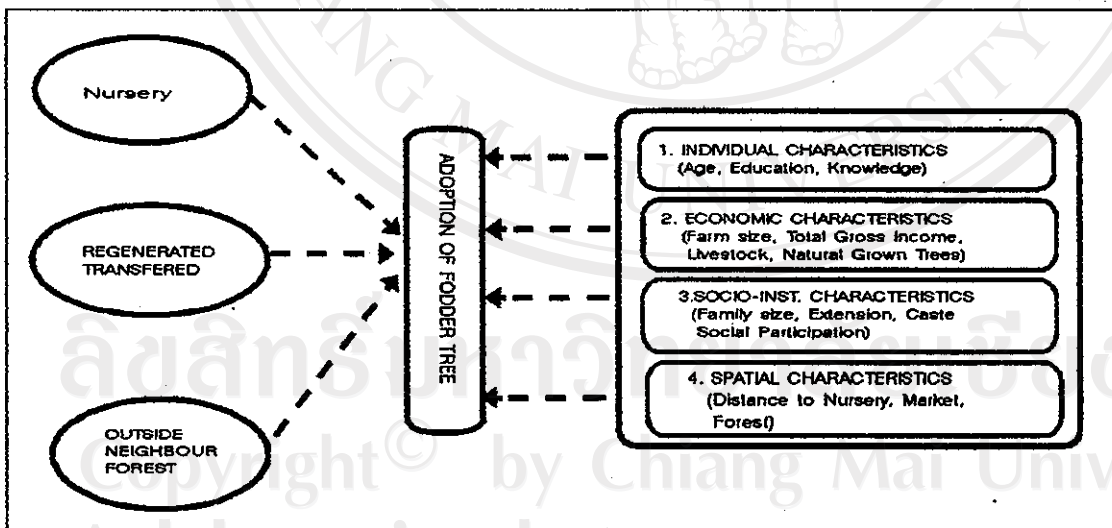


Figure 2 Conceptual Frame work of Fodder Tree Adoption

2.3 Data Collection

A combination of methods was applied, in order to gather necessary and relevant information, which is as follows:

1) Secondary Data

For initial understanding of the existing situation of fodder trees in Nepal, review of available information was carried out. This not only permitted to select specific area for the study vis a vis provided a guideline for designing and preparing a formal survey questionnaire. Secondary information like bio-physical, infrastructure, climate, topography, soil, altitude, cropping pattern, population, ethnic groups were collected from the concerned sectors such as; Department of Livestock; Forestry, PLBP (GTZ), CBS, DFAMS, Planning Division and NGOs like: Winrock International; ICIMOD; Australian Forestry. Specifically, the available village profile Mold (1993) supported more for describing the farming system of the study sites.

2) Participatory Method

Since the study is mainly about fodder tree adoption, a "matrix ranking and scoring" (Paliniswamy, 1992) was employed for understanding farmers' preference of fodder trees from their own choices, criteria and priorities.

3) Primary Data

Both informal and formal survey were conducted for different aspects. The former was used to select the area of study. Consultation was done with number of persons belong to the Kavre district who are acquainted with the problems in the field level. Special help was taken from extension staff (JT and or JTAS) of the district who has good rapport in the village. Other persons like village head men, village leaders and also respectful persons of village were selected as key informants.

While the later formal survey was carried out by preparing and pretesting questionnaire. Questions including mainly socio-economic related profile; adoption related and farm production and income on the concerned subject matter were asked to the sampled households. The questionnaires were prepared with the discussion of subject matter experts to overcome the unnecessary collection as well as to get only the required information. Preparation was done in English for ease to analyze and to save time. The local unit used for gathering the data, was transformed into standard unit in analyses. Skilled experienced persons of the relevant field were hired as enumerators for reliability.

2.4 Information Collected

The following data were gathered from the survey:

1) **Farming Systems**

- Land holding and land use
- Different crops, yield, cropping patterns
- Livestock population, feed information, income and expenses
- Existing tree species, production and management

2) **Socio-Economic**

- Farmers' identity (age, caste, education)
- Population and family size
- Income sources
- Knowledge and Social participation
- Infrastructure development

3) **Adoption Related**

- Farmers' knowledge and understanding
- Decision making
- Perception about the fodder tree distribution
- Farmers' preference and opinion of the fodder trees

2.5 **Sampling Technique**

Commensurate with the objectives, a sample size of 216 households with equal number (54) from each of the 4 village development committees (VDCs) were selected. A multistage purposive sampling procedure was used as follows:

| STAGES | AREA | CRITERIA |
|-------------------|---------------------|--|
| First (Region) | Mid hill | * High density of livestock population * Potential for livestock development* |
| Second | Kavre (District) | * Accessible and familiar to researcher * Availability of secondary information * Can be generalized |
| Third | (VDC) | * Availability (non) of nursery and market |
| Fourth | (Household) | * Domestication of ruminants and land holder (Random selection) Fig.3. |

Note* NPC (1984).

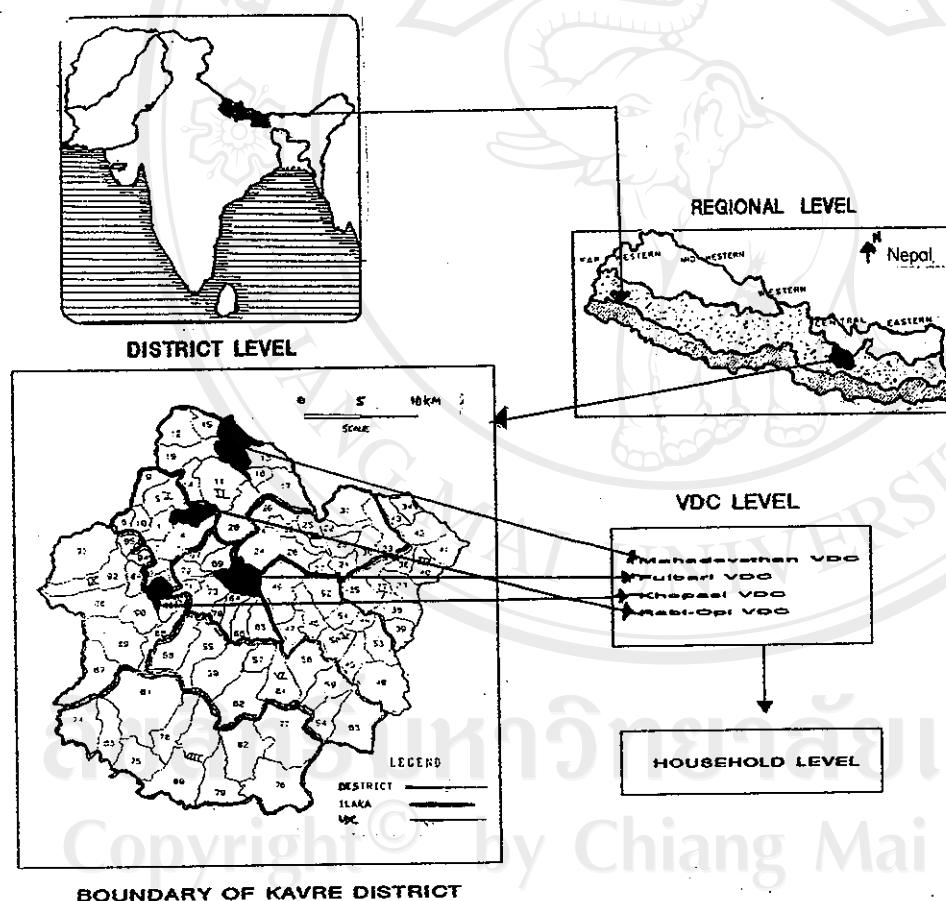


Figure 3 Multistage Sampling Technique

2.6 Analysis of Data

Both descriptive and empirical analyses were employed for different aspects in order to meet the objectives.

1) Describing the Farming Systems and Socio-Economic Condition

Percentage, rank, score, mean, range and standard deviation were applied for analysis of farming system components and socio-economic status. Contingency tables and diagrams were used to represent the inter relationship among the various components.

2) Adoption Measurement

It was based on the combination of two aspects.

i) The Degree (Extent) of Adoption Analogous with Casley and Lury formula (1984) and (Ashadi, 1992), it was assessed in index form and measured in percentage. The formula is presented as:

$$a) \quad \text{Farm Adoption Index} = \Sigma(100A/T) \dots \dots \dots (1)$$

$$b) \quad \text{Activity Adoption Index} = \Sigma(100N/R) \dots \dots \dots (2)$$

Where T is the total number the sampled household, A is the actual number of adopters, N is the actual number of planted fodder trees and R is the required number of fodder trees for the total number of

ruminants reared in the household.

ii) **Effect of Adoption** The performance of adoption in terms of effect was assessed through the changes that had brought in livestock subsystem (number/unit of holding), types (breed, ruminants/ non ruminants, milk production, fodder proportion in feed, rearing system), crop subsystem (production), human subsystem (fodder collection time). Percentage, mean and a simple statistical tool were employed to show the effect of fodder tree adoption on the whole system.

3) **Factors Influencing Adoption**

To identify the key variables and analyze the relationship between adoption of fodder trees and the selected variables, a logit or probit model is the appropriate form as recommended by various econometricians, for example, Maddala (1983), Pindyck and Rubinfeld (1981) and Wiboonpongse (1994). However, in terms of approximation, logit provides better result than the probit (Judge *et al.*, 1980). Therefore, logit is selected for this study, which was estimated using maximum-likelihood non linear technique. The equation of the model is given as:

$$P_i = 1/[1+e^{-\beta'X_i}]$$

where, P_i = Probability of farmers adopt fodder trees

$$\log \frac{P_i}{(1-P_i)} = \beta'X_i \quad \text{where,} \quad \log \frac{P_i}{(1-P_i)} = Y$$

Hence, $Y = \beta'X_i = \beta_0 + \beta_1.Knds + \beta_2.Age + \beta_3.Edu + \beta_4.Hedu + \beta_5.Tpland + \beta_6.Tgrinc + \beta_7.Lru + \beta_8.Ngft + \beta_9.Famsize + 10.Caste + \beta_{11}.Socpat + \beta_{12}.Ext + \beta_{13}.Nur + \beta_{14}.Mark + \beta_{15}.Fore$

Here, P_i is unobservable but for each observations we have information on whether farmer adopt or not. Thus, the measured dependent variable $Y = f(X_i)$, where $Y_i = 1$ if number of farmers (n1) adopt, otherwise $1-Y_i = 0$ if they (n2) do not. The $n1+n2 = N$, is the total number of sampled population. $\beta_0 + \dots + \beta_{15} =$ Parameters and $X_i =$ Variables ($X_1 \dots X_{15}$) respectively. The maximum likelihood estimation used the second derivatives of log likelihood and iterates until the function converges.

The log likelihood formula is $\beta_1 = \beta_0 + [I(\beta_0)]'S(\beta_0)$ where β_0 is the initial value of β 's i.e. initial stage of iteration. While $I(\beta)$ and $S(\beta)$ are first and second choice respectively which are divided by N , the total observation to obtain $\hat{\beta}$ or optimum estimation. The $\hat{\beta}$ is used to find estimated $P_i^{\hat{}}$, which is given by Maddala (1983: 25) as:

$$P_i^{\hat{}} = \frac{e^{\beta'X_i}}{1+e^{\beta'X_i}}$$

The computation was done by software computer program LIMDEP (Limited Dependent Variable in Econometrics)¹. Employing this estimation

¹Greene, W.H (1986): LIMDEP[®] Users' Manual, New York.

procedure, all parameters estimators give consistent and efficient asymptotically especially for large samples. Further, significance of entire model or subset of the coefficients can test by using the chi-square that replaces the "F" test. To test the goodness of fit McFadden R^2 was used, which is given as:

$$R^2 = 1 - \log L_{max} / \log L_0$$

where, L_0 is the initial value when all parameters (except constant) are set equal to zero and L_{max} is the value of likelihood at maximum (Pindyck and Rubinfeld, 1981).

Based on research findings, all the variables included were hypothesized to have a great influence on the farmers' rational decision making in fodder trees adoption.

Knowledge (Knds) is one of the important factor in any technology (farm practice) adoption, deals about awareness of the problems and understanding of the technique. The awareness of fodder shortage, understanding on its cause and consequences, the techniques and purpose of the systems would create farmers' perception, valuation and attitude to adopt or not. In this case, proxy variables (rating or scoring) based on farmers' knowledge was applied.

Thus, the knowledge mentioned here consists of 4 major parts with

list of statements in each part. Purpose regarding the importance of the use of fodder trees. Skills includes identification, spacing, harvesting time and management, third part deals with farmers' opinion towards tree fodder in terms of feed and finally farmers' awareness about price of input and output of livestock, sources, agencies involved in fodder sapling distribution program.

For the measurement of this variable, the total score was standardized into 100 units, which was equally divided into 4 major parts (25 units). Further, each part total score (25 score) was divided by the number of statements listed in it. Finally, all the score obtained was summed up to individual knowledge score. The Table with list of statements of knowledge and score is given in Appendix 1.

Age of a farmer was measured in years. Young farmer was supposed to be more radical, progressive, and interested in new technology of farming than the older one.

Education (Edu) attainment of the farmer was considered as one of the factor for adoption. Because low rate of literacy is one of the major hurdles in the diffusion of recommended farm technologies in countries like Nepal. The education level is measured by the number of years of schooling attained. Here, **Highest education** attainment (Hedu) from the family members was also considered as a proxy of accelerator for adoption, and educated individual might have great role in decision making

in the house hold activities.

Farm Size (Tpland) is one of the most important factor that needs to be considered while identifying the factors of adoption. Many empirical studies also suggested that use of new technology (HYVs and inputs) tends to lag behind on smaller farms, because smallness of farm is often believed to be a reason that refrains farmers from trying a new practice. The farm size referred here "own" farm indicated, the cultivated land area owned by the respondent which differs from "total" farm size refers total area of land under the cultivation of a respondent irrespective of its sources of occupancy (Private+Lease). The farm size is measured as hectare of operational holdings.

Gross Income (Tgrinc) was the other economic variables chosen for the study of the farm household. This was defined as the total earnings of a respondent and the members of his family from any farm (crop+livestock) including consumption and non farm activities during the year prior to interview. The farm income was calculated by adding up the market value of harvested-time crop and income from livestock, where as non-farm income was income of farmers in terms of Rupees.

Livestock (Ruminants) Number (Lru) is the one that is essential to consider while determining the factors for adoption of fodder trees. Because in general fodder trees are mainly grown for the fodder, which is used as feed supplement to ruminant livestock. It could be measured in

heads or livestock unit² (lu) on the farm.

Natural Grown Fodder Trees (Ngft) also contribute fodder for feeding of ruminants. Therefore, it was assumed that if farmers had such types of existing fodder trees, they might be reluctant to plant the fodder trees on their land.

Family Size (Famsize) was defined as the total number of people in the household. Family serves as one of the social institutes which perform several function. The household size was measured by adding up the number of dependents actually living with the respondent in his household at the time of investigation.

Caste (Caste) is the categorization of farmers' in different groups on the basis of traditional socio-cultural factors. This also affects in adoption as believe or attitude towards the social norms is predominant in rural Nepal. This was grouped in 4 classes on the basis of prevalent occupational group and the analysis was carried out by running dummy variables for these groups.

Social Participation (Socpat) was defined as the degree to which an individual participates voluntarily in different organizations in the community and also involved in both formal and informal activities.

²Livestock Unit (lu): Adopted from Devendra, C. (1989): where, 1Cattle=0.8 lu, 1Buffalo=1 lu, 1Goat=0.1 lu
Adopted from Rajbhandari and Shah (1981): 1Swine=0.12 lu
Adopted from PLBP (GTZ), 1991: 1Chicken = 0.00237 lu

Adoption rates were supposed to vary with the extent of social and institutional exposure of farmers. The extent of participation was measured by summing up involvement of respondent in each activity with scoring 1.

Extension Agent Contact (Ext) was regarded as the single most important factor for influencing day to day behavior of other farmers in the community. It psychologically influences farmers to adopt the system. This was calculated by the frequency of contact, regularly, occasionally, rarely, only calling and never by using scores 12 to 0.

Farmers' Access to Nursery (Nur) was the one that might have effect in adoption of fodder trees. Since, nursery serves as one of the source for the availability of seedlings, a farmer who had easy access to nursery might tend to adopt than the farmer who did not.

Market Availability (Mark) was the other factor consider as determinant of decision to adopt. Rearing of livestock is determined by the availability of market. Because market is essential for the flow of inputs (feeds, medicines) and outputs especially milk, which is perishable in nature.

Access to Forest Resource (Fore) might refrain adoption behavior since forest is also one of the resource for fodder and fuel wood, even though it is legally prohibited. It was measured in distance from the

respondent house.

2.7 Farmers' Perception about Distribution Program

To understand the farmers' opinion about the fodder tree distribution program that has been carried out by number of agencies both government and private, 3 questions were asked. Such as; preferred agencies and usefulness of the program and reasons, consequence of increase of fodder trees in future. The first two were evaluated through the mean and percentage form, where as latter one was measured in rank and performance score.

2.8 Assessment of Constraints and Improvement

Constraints might be different for different areas, therefore VDC wise problems encountered were examined. A farmer who adopted once might have stopped or slow down due to some reasons. It is essential to understand the problems of fodder scarcity to overcome and improvement in future implications. This was assessed through the preference of fodder tree species as well as farmers' readiness to adopt. Percentage, ranking, and scoring were employed to evaluate this objective.

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