CHAPTER I

1. INTRODUCTION

1.1 Statement of the Problems

The livelihood of the hill farmers in Nepal is traditionally sustained by two major components of the mixed farming systems: crops and livestock. However, since recently their livelihood in the hill terrain is threatened by the vulnerability of these two sectors as a result of increasing population pressure and deterioration of natural resource base.

The lack of remunerative alternative income and employment opportunities in the hills have forced farmers to over exploit existing land and expand cultivation to steep slopes and marginal areas. Deteriorating soil fertility and increasing erosion from cultivated land have resulted low and declining return from traditional annual (cereal) crop based production systems.

Furthermore, the livestock raising which has been traditionally a major source of cash income for the hill farmers has become no more remunerative during recent years as a result of deforestation and subsequent feed scarcity (APROSC, 1989). Increased emphasis on livestock development in the hills without proper management would further increase deforestation

and soil erosion from grazing land (Kaini, 1993a). The nature of hill topography, marginality and fragile resource base also impede the possibilities of further improvement in hill economy through wide sclae agricultural intensification which is commonly found in low land (Terai).

Despite the above problems, the region is still least prioritized in terms of both developmental and conservation initiatives. Past agricultural developmental policies of government were also too broad and was mostly emphasized for cereal (grain) production. There was a lack of recognition of mountain characteristics during the formulation of periodic plans and programs (Shrestha and Yadav, 1992). This has adversely affected the environmental conditions in the hills as fragile slopy areas are brought under cultivation (Yadav, 1991).

Therefore, the economic conditions of hill farmers have worsened over time and the region is facing alarming situation of food scarcity, malnutrition and out migration. The absence of appropriate institutional mechanism thus, seems to be the weakest factor in the failure to bring about the basic transformation of hill agriculture in Nepal (ICIMOD, 1989).

1.2 Rationale

1.2.1 Fruit tree Integration as an Alternative Strategy

In the deteriorating economic and environmental situation of Nepalese hill region, the best strategy for farm improvement would be the integration of high value perennial crops such as fruit trees that can improve the viability and capability of existing farming systems. This is because the middle hill region of Nepal provides a `niche' for growing specific high value activities like fruits (Jodha, 1990).

Considering the geoclimatic conditions, it is obvious (Table 1) that increased emphasis on fruit tree production in the hills offers substantial improvement in farm income (Calkins and Sisler, 1978; Calkins, 1982; Anonymous, 1987; Kaini, 1993a). Fruit based farming system can play unique role for improving income status of small farmers because the productivity and return from fruit trees are higher and more stable than the traditional field crops in the hills (APROSC, 1989; Kaini, 1993a).

Integration of fruit trees with slight but meaningful modification of farming systems can be adopted by the farmers wherever transportation and market facilities are developing. Considering the small size of holding, resource poor and capital starved situation of hill farmers this could be a better strategy than present government's policy of promoting cereal crops and monoculture of fruit trees. Integrating market oriented

fruit production without completely sacrificing subsistence autonomy will protect small farm households from extreme vulnerability to the vagaries of market economy and natural environment.

Table 1: Comparative costs and returns of selected fruit trees and Cereal crops production in the hills of Nepal.

Crop	Average Cost of Production (Rs/Ha)	Average Yield (kg/ha)	Gross income (Rs/ha)	Net Benefit (Rs/ha)
Maize	5,164	1,500	7,875	2,711
Wheat	5,252	1,200	7,128	1,876
Citrus*	5,302	10,000	8,849	3,547
Apple	2,979	10,000	7,433	4,454

Citrus* : It includes mainly mandarin and sweet orange (Junar).

Note: Cost of Production and benefits are present value of cost and benefit stream discounted at the rate of 15% per annum divided by the number of years of economic life. Hence, the net benefits are largely understated for fruit trees.

Source: East Consultant, 1990

1.2.2 Prospects for Citrus fruit Integration

The agroclimatic conditions of mid- hill region provides diverse environment for growing various type of fruit trees. Among fruit trees, citrus species, especially oranges (mandarin and sweet) are the major type of fruits grown in the middle hills at 1000 - 1500 m altitude which occupies about 16.2 per cent of area under fruits in Nepal. These fruits can be also cultivated in the marginal lands where

the returns are declining and are not suitable for present annual crops (APROSC, 1987). Hence, as Table 2 shows, there exists an obvious comparative advantages of increased domestic production of citrus fruits, especially oranges in Nepal that are being imported from India to meet growing demand.

Table 2: Analysis of comparative advantage of selected fruit tree production in Nepal (Economic, Rs/mt).

Fruits	In-country Cost of Production	Packing & Handling	porterage	Net Economic Price of In-country production	Farm gate Econ.Price of Import
Apple	1,763	882	2,500	5,145	10,960
citrus	2,417	1,209	1,250	4,876	11,600
Banana	2,581	1,291	625	4,660	4,600
Mango	3,264	816	625	4,705	9,560

Note: Unit cost of production for fruit trees is based on the total costs and benefits discounted at 15% per annum over the economic life.

Citrus: It includes mandarin and sweet oranges.

Source: East Consultant, 1990

Cultivation of citrus (orange fruits) in the existing hill farming systems is more profitable to dry land anuual crops like maize and wheat and also its promotion is imperative for the import substitution, export promotion (particularly in the market of Northern India) and arresting deteriorating hill economy and natural environment (Anonymous, 1987; APROSC, 1989; East Consultant, 1990). Nepal has a current deficit demand of 12,000 tons of fruits (about 85% of total demand) for local consumption

every year. In value term, Nepal imported about 138 million rupees of fresh fruits and about 4.3 million rupees of processed fruit from different countries in 1989-90. It is reported that if present production of fruit remains constant, the gap in demand would increase to 400,000 tons by the year 2005 (Anonymous, 1987). This gap will widen more in the future as the demand for fruits and fruit products is projected to rise with the growth of population and market induced demand (APROSC, 1989).

Initiation of citrus development project in some mid hill districts of Nepal reflects the present government's favorable policy in the promotion of the citrus fruits. Furthermore, it is also preferred fruit as farmers' in the hills have traditionally been growing citrus fruits near homesteads in association with some annual food crops.

1.2.3 Need of Optimum Farm Planning

From the above information it is obvious that citrus fruits are regarded as the important source of farm income for the small farmers in the hill region. Despite this, no detailed and scientific micro-level study as to the actual and potential contribution of citrus integration in existing hill farming systems has been previously been undertaken. Therefore, there exist not much reliable information on the potentiality of integrating this enterprise in improving farm income and welfare of the rural people (EAD, 1992).

Alternative farm plans are imperative in the hills to uplift the present low level of income (Maharjan, 1984). Information on long term farm planning is desirable as presently farmers have not integrated citrus in their existing farming systems with better planning and management. Despite the potential contribution of citrus to farm income, farmers' have not been able to integrate citrus into existing farm systems due to lack of information on the long term benefit of fruit trees, their future market prospects and better technological and information support.

Farm size is assumed to be the major determinant in the hills in integrating citrus in the existing farming systems and consequently the optimum farm plan. The perennial nature of citrus also itself lends appropriate planning since it requires investment for longer period whose returns are obtained only after few years and are spread for throughout their life period.

1.3 Objectives

The main objective of this proposed research is to study existing hill farming systems and analyze the optimum farm plan for integrating citrus, particularly mandarin orange. The specific objectives are outlined below :

1.3.1. To study existing farming systems and identify the major resource availability and their utilization in the study sites.

1.3.2. To analyze the optimal farm plan for the hill farming systems in order to maximize the present value of future income subject to resource constraints and consumption demand.

1.3.3. To examine the economic potentiality of integrating citrus (mandarin orange) when economic environment changed.

1.3.4. To assess the major constraints to integrating citrus fruit in the present hill farming systems.

1.4. Usefulness of the Study

This study will give understanding of existing farming systems and help to identify main constraints and opportunities in improving hill farming systems through optimal multiperiod farm planning. The results of the study will provide the direction for the farmers to improve the efficiency of their limited resource utilization and household income through the use of citrus fruits.

The shadow prices of the resources obtained from this study and sensitivity analysis of the optimal plan will give valuable insights into the relative importance of various resource constraints and about the benefits to be gained by relaxing limiting factors. This study also will highlight impact of policy changes under different alternative economic environments which will be useful for policy makers and planners in

formulating policies and guidelines for planning and improving the sustainability of hill farming systems. This research and study approach could possibly be useful for planning and evaluation of similar tree based farming or agroforestry systems which are prevalent in the hills of Nepal.

1.5 Literature Review

Most of the previous studies on the planning and economic analysis in Nepal are biased towards cereal food crops. There are limited scientific and systematic studies dealing with economics of perennial fruit crops and tree based farming systems in the hills of Nepal. Apart from this, there are also limited cases of use of linear programming in farm planning in Nepal, though considering the presence of small farmers and their limited resource endowments, these tools and technique can be successfully used in Nepal for micro level planning and policy analysis (FAO, 1989).

Nair (1984) reported that fruit trees have both distinct socioeconomic value (cash income, nutrition and employment) and environmental merits (soil conservation and ecosystem stability). They are socio-economically more acceptable in comparison with other trees because of their contribution to the cash economy of small farmers (Amyot, 1987; Khaleque, 1987).

Fonzen and Oberholzer (1984) reported that the main improvement strategy for Nepalese hill farms lies in the use of fruit and other multipurpose trees as they are one of the important components of the existing integrated small holder hill farming systems.

APROSC(1989) has conducted feasibility study reports for the viability of the citrus farming projects in the mid-hills of Nepal. It has reported the profitability of the project with economic internal rate of return of 29.36 % . Results of sensitivity tests showed that the citrus farming is economically viable even under adverse situation of (a) cost over run (by 10%) (b) benefit shortfall (by 10 %) (c) a combination of (a) and (b) and (d) delayed project benefits. The financial rate of return for commercial orchard comes to about 29 %.

Gupta and George (1974) used profitability indices for the orange plant whose production life was more than 23 years. The internal rate of return of 29.3 and 45.9% and benefit cost ratio of 1.85 to 2.64 was obtained for orange fruit depending on the size of orange grove .

Eder (1981) also reports from Philippines that peasants experienced a five fold increase in returns to land and about 3.8 times higher returns per unit of labor when they made switch from rice to permanent tree crop like citrus, coconut etc. for the local market.

Due to high return from orange crops more than one third of the

sample farmers in the villages of Thanhxuan and Dongphuoc in Mekong Delta of Vietnam converted their part of their paddy fields to orange cultivation (Dung, 1994).

Betters (1988) reported that economic performance measures like Present Net Value, Benefit-Cost Ratio,and Internal Rate of Return can be used to determine the best joint production level for a particular tree - food or agroforestry practice. Once these best combinations have been defined linear programming can be applied using this " best" production combinations as decision variables along with considering wide range of additional constraints.

Linear programming provides effective method for dealing with the allocation of limited resources among the competing activities in determining the farm plan (Heady and Candler, 1958). Mathematical programming (MP) techniques are suitable to consider farming systems in technical, biological and economical sense and to optimize certain aspects. This technique is specially useful to consider the implications of erosion and conservation in whole farming systems and to judge its profitability (Stroosnijder, 1988).

Linear programming for permanent agriculture can become more realistic by incorporating time dimension in the model. Dynamic linear programming (DLP) is a model which can overcome many of the limitations

of the stationary equilibrium approach of modeling investment decision (Hazell and Norton, 1986).

Loftsgard and Heady (1959), applied DLP model to solve optimum plans for eight series of years where productivity of resources in the farm business were related to expenditure needs of farm family in Iowa.

Similarly, the DLP was also employed by Dean and Benedicts (1964) to derive normative development plans through time for small land reform farms in the newly irrigated Metaponto Plain Southern Italy. The analysis indicated great potential for internal saving and investment by farm families and therefore rapid development possibilities for intensive fruit (oranges, peaches and grapes) and vegetable cultivation.

Dynamic modeling of farmer's decision making was employed by Rosegrant and Herdt (1980) in order to simulate the impacts of credit policy and fertilizer subsidy in Central Luzon, Philippines. The model incorporates stochastic production relationship and dual credit market situation. Three policies were evaluated in the model solution which showed that credit and fertilizer policies could increase yield by 21-30%.

The use of multiperiod programming can increase the scope and accuracy of farm management and planning analysis; it can provide a more accurate representation of the time related production coonditions that are characteristics of agriculture in most of the developing countries of the world (Crawford *et al.*, 1977).

Shaky and Leuschner (1990) developed a multiple objective linear programming (MOLP) model which could generate technically efficient land use plans by using data from Phewa Tal Catchment, Pokhara, Nepal. The farms in this area practised integrated agricultural system embodying crops livestock and forestry. A five year planning period and 25 year planning horizon were chosen.

Yaha, Wiboonpongse and Sriboonchitta (1991) used multiperiod linear programming model for Planning Conservation Farming Systems for the Highlands of Chiangmai Province. The results showed that off-farm income is important for expanding permanent farming systems in the Highlands.