THE EFFECTS OF ALTITUDE ON CROP FARMING AND CASH CROP USE IN ILAM DISTRICT: SOME IMPLICATIONS FOR AGRICULTURAL POLICY

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Introduction

The implementation of the First Five-Year Plan in 1956 marked the beginning of planned development in Nepal. Despite the passing of almost fifty years and the completion of the Ninth Plan in 2002, Nepal still remains one of the poorest and least developed countries in the world. While the mountainous nature of the country makes it difficult and expensive to implement development programmes and extend essential services in an effective manner, the inability of the past Plans to reach their targeted goals, particularly in the agricultural sector, has been a troublesome trend.

For the most part, the Plans have attempted to increase the production of food in order to meet the demands of the growing population. Although some successes have been had in terms of increasing total production, declining productivity and environmental degradation have made it difficult for the agricultural system to sustain itself. Since the start of the Eighth Plan in 1992, the promotion of cash crops has been a strategy that has been taken to try to improve the situation of farmers particularly in the hill region. The main objective of this strategy is to not only diversify the subsistence agricultural system, but to also commercialize agricultural production which can in turn help to stimulate growth in employment opportunities.

In light of the present focus on cash crop production, this paper is an initial attempt at trying to understand how farmers living in a cash crop growing region are utilizing cash crops in order to meet their yearly food needs. The first part of this paper provides a brief overview of the changes

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that have been made in strategies taken to try to develop the agricultural sector. Then, village-level data concerning crop farming in Ilam District is analyzed according to altitudinal zones to see what kind of crop farming activities farmers are engaged in at various altitudes. The findings of this study show that there are distinct differences in the types of crops grown and the food sufficiency of farmers according to altitude and this in turn affects the ability of cash crops to help secure their food needs. It is hoped that the insights gained from this study can contribute towards resolving some of the problems that still need to be overcome if the present strategy is to see success in developing farming in the hill region of Nepal.

Agricultural Planning in Nepal

The planning of agricultural development in Nepal has gone through a variety of phases in order to try to increase the production of food. During the implementation of the first three Plans between 1956 and 1970, the basic objectives were to improve production through the dissemination of improved seeds and extension services. The First Plan (1956-1961) initiated adaptive research suited to the varied climatic conditions found in the country in different fields of agriculture and attempted to disseminate results of research that was found appropriate for adoption through agricultural extension programmes (NPC 1975: 32). A land reform programme was initiated during the Second Plan (1962-1965) and it was only during the Third Plan that production targets and agricultural development programmes became fixed at the national level.

Despite these efforts, the 1960s were characterized by stagnant growth[1] in the production of food, while the population continued to grow. The failure to meet national production and input use targets set for various crops has generally been blamed on the inadequate coordination and organization of the administrative structure, e.g., lack of coordination between various departments and the inability of inputs and extension services to reach those living in the village, etc. The failure of the country to grow enough food was leading Nepal towards and economic crisis, the centre of which was a crisis in food production (Seddon 1987: 44).

By the end of the Third Plan, the food-deficit situation of the mountain and hill regions was particularly acute, triggering a migration of people to the food-surplus terai region. While the malaria eradication programme conducted in the terai during the 1950s enabled people to clear and settle land

in this region, it was realized that such a migration trend was not sustainable and needed to be stemmed. At the same time, the eradication of malaria was eroding north-south linkages. Traditionally, trade was conducted with Tibet during the summer months when mountain passes became snow-free. During the winter, when malaria was less of a problem, trade would be conducted with India. The eradication of malaria, however, was enabling trade to be conducted with India year-round. Given the high costs of transporting goods to the hills, food surpluses tended to go to India resulting in an exacerbation of the food-deficit situation in the hill region (Gurung 1969: 3-5).

On top of all these problems, development efforts carried out in the first three Plans were being concentrated in the Kathmandu Valley and eastern terai region[2], further deepening the regional disparities within the country. It was therefore felt that a more balanced approach and greater equalization of development was necessary. Thus, from the start of the Fourth Plan (1970-1975), a regional approach centered along four north-south growth axes[3] was thought to offer "the greatest prospects for the integration and coordination of the different development programmes in that they present both the east-west and north-south territorial dimensions of the country" (Gurung 1969: 12). This Plan tried to broadly exploit the comparative advantages of each of the ecological regions; livestock in the mountains, horticulture in the hills, and cereal and cash crop production in the terai. A fundamental problem with this Plan and that of the Fifth Plan (1975-1980) was the fact that even within one ecological zone, there were variations in the climates and types of crops that can be grown in them (Basnyat 1995: 33).

Therefore, the attainment of food self-sufficiency in the hill region became a major objective of agricultural policy during the Sixth Plan (1980-1985). While this had the effect of increasing the area of land under cereal crop cultivation in the hill region, the yield of crops tended to decline due to the marginal land that was being cleared for their cultivation. At the same time, the clearing of this land was further damaging the fragile mountain environment increasing the likelihood of landslides and decreasing watershed areas. The Seventh Plan (1985-1990) tried to address these environmental issues, but the clearing of land for cereal crop cultivation continued unabated in the hill region.

Given the unsustainable nature of increasing cereal production in the hill region, the focus of Government policy since the Eighth Plan in 1992 has been the promotion of cash crop production. The main goal of this cash crop promotion is to try to transform the subsistence agricultural system to a more

commercialized one, which can in turn help to increase employment opportunities. The Agriculture Perspective Plan (APP), formulated during the Eighth Plan, outlines a twenty year strategy to develop the agricultural sector in Nepal. The strategy calls for a greater reliance on the private sector to foster the commercialization of agriculture and relegate the role of the government to complement the activities of the private sector by reducing barriers and making investments in irrigation schemes, rural roads and electrification, chemical fertilizers, and agricultural technology[4].

The APP takes a regional approach to development with different growth strategies for the terai and hill/mountain region. The development of the terai is for the most part "technology driven" and the main aim is to drastically increase the production of basic food staples. The strategy in the hills and mountains, however, is "demand driven". Through the increased income that people earn from the rise in production in the terai, it is envisioned that this will create a demand for high-value commodities that grow well in the various agro-ecological zones found in the mountains and hills. In particular, the APP calls for special attention to be paid on the development of livestock (specifically milk), citrus, apples, vegetable and vegetable seeds, and products of apiculture and sericulture (APROSC and JMA 1996: xix-xx).

Having gained a general understanding of the changes in agricultural policies, the next section takes a look at the crop farming situation in a region that is well-known for cash crop production in Nepal. With the current policy of trying to take advantage of the various agro-climatic zones in the hill and mountain regions, a particular focus is placed on the differences that are found in different altitudinal zones. By examining the differences according to altitude, it is hoped that a better understanding can be reached about farming in the hill region and help to shed light on some of the issues that need to be taken into consideration when trying to integrate cash crops into the subsistence farming system predominantly practiced in the hills.

Altitudinal Classifications Utilized in Nepal

One of the unique features of farming in mountainous regions lies in the existence of a wide variety of climates within a relatively small area due to altitudinal differences. Those living near river valleys, for example, tend to farm in a more tropical climate while areas near the mountain peaks have a more temperate type. Such differences in climate will tend to affect the types of crops that can be grown and also affect the yield of crops, thereby

affecting the food sufficiency of farmers. Despite the fact that village-level studies conducted up until this point in time recognize that differences exist in the type of crops and farming that can be conducted at various altitudes, the overall analysis has tended to focus on the village as a whole and the differences found between land types, upland-lowland areas[5], landholding size, caste/ethnic groups, etc. (Adhikari 1996; Adhikari and Bohle 1999; Blaikie et al. 2000).

Various researchers have attempted to classify the climatic zones found in Nepal according to altitude, but as can be seen from Figure 1, they all tend to differ slightly from one another. When conducting research on farming, the altitudinal zonation proposed by Manandhar and Shakya (1996) seems to be the best suited given the fact that their study deals strictly with farming, while the other authors solely deal with the natural fauna found in each of the zones. From the classification given by Manandhar and Shakya, Figure 2 shows the different types of cropping patterns being practiced in each of the climate zones. As can be seen from the figure, those living below 1000m can grow between two to three crops in one calendar year, while those farming in the cool temperate to alpine climate zones typically grow only one crop.

For the purposes of this study, however, a horticultural zone classification also defined in the same study by Manandhar and Shakya will be utilised. The reasons for taking this horticulture zone classification are two-fold. Firstly, the APP has made the cultivation of crops such as citrus fruits and apples a priority and it is therefore useful to analyze the farming situation according to horticultural zones. Secondly, while the climate zone classification of Manandhar and Shakya does provide a generalized picture, observations from the field found that the horticulture zone classification was better suited to the actual situation of the study area.

Figure 3 shows the basic characteristics of the Manandhar and Shakya horticulture zone classification. As can be seen from the figure, they differ slightly from the more commonly used climatic zones. Nepal is home to various kinds of horticulture zones from tropical below 1000m to arctic conditions in mountain areas above 4500m. In terms of farming, rice can only be cultivated up to an altitude of 2000m and the double cropping of rice can only be conducted in areas below 1000m. Maize can be successfully grown up to an altitude of 2500m and the farming of crops on the South side of the Himalayas ends at around 3000m. Above the 3000m mark, the only crops that can be grown are potato, naked barley or wheat.

In order to better understand the differences in farming among these horticultural zones and the ability of cash crops to secure the food needs of farmers, Ilam District was chosen for empirical study because of the pioneering role that farmers in this region are playing in integrating cash crops into their subsistence farming system. Two Village Development Committees (VDCs) located next to Ilam Municipality were selected for detailed analysis due to their relative proximity to the commercial centre of the District and their differences in altitude (Figure 4). Namsaling VDC ranges in altitude from approximately 550m to 2000m, with the large majority of the village lying above 1000m. Soyak, on the other hand, ranges in altitude from about 350m to 1300m and thus is a much more low-lying village with the majority of the village falling under 1000m.

Despite the fact that it is necessary to examine both the crop farming and livestock activities in order to gain a fuller appreciation of the altitudinal differences of hill farming, this paper is an initial attempt at making altitudinal differentiations and will therefore focus solely on crop farming activities. In doing so, this study has concentrated its analysis on areas below 2000m as this is the main area in which rice cultivation is possible. The examination of crop farming in a district such as Ilam that is undergoing a transformation in the subsistence farming system is an important step in trying to gain a better understanding of how the current agricultural strategy can help improve the economic situation of farmers in the hill region.

Crop Farming in Three Altitudinal Zones

Landholding in Three Altitudinal Zones: The first thing that one needs to examine when conducting a study on crop farming is to gain a clearer picture of the farming environment. When breaking down the land types and landholding characteristics according to altitude some interesting differences can be found. Looking at Table 1, which shows the landholding of households in each of the altitudinal zones, there are some small differences that can be seen. Firstly, there tends to be a slightly greater proportion of landless without livestock in the 1000-1500m zone. The presence of the bazaar area in the upper part of this zone may help to account for this difference. There are also a slightly smaller proportion of small farms and a larger proportion of medium farms in the 1500m-2000m zone. The analysis in this chapter will show that this zone faces greater difficulties in

comparison to those living below 1500m and this may necessitate the need for more land in order to survive.

The differences in land become much clearer when looking at the distribution of the various types of land. Table 2 shows the area of the different types of land found in each of the altitudinal zones. The area below 1000m has the best land when one considers the fact that 43.2% of all the land is irrigated *khet*, while those living between 1500m and 2000m have very little *khet* land available for cultivation. Instead, the people living above 1500m are much more reliant upon irrigated *pākhā* land for their crop cultivation. While the proportion of non-irrigated *pākhā* land is similar for all three zones, the 1500m-2000m zone has almost double the amount of agro-forest land which is conducive for the growth of high earning crops such as cardamom.

Looking at the proportion of households holding different types of land and the average holding size in Table 3, some interesting differences are also seen. In particular, the importance of *pākhā* land for those living in the 1500m-2000m zone is quite clear with a large proportion of households in this zone having access to irrigated *pākhā*. While access to non-irrigated pakha tends to decline as altitude increases, the average holding size tends to be bigger at higher altitudes. The importance of agro-forest land for those living in the 1500m-2000m zone is also evident; the average holding size and proportion of farmers holding agro-forest land being much larger in this zone.

Types of Crops Grown: In order to see what kind of differences can be found in the climate and crop farming practiced in the altitudinal zones defined above, Figure 5 shows the cropping calendar and farming operations of the main crops found in the two study villages according to the altitudinal zone where farmers live. Among those farming below 1000m and between 1000m and 1500m, there were very few differences that could be seen in terms of the months in which the various farming activities are conducted. The biggest difference was found in the between 1500m and 2000m, whereby the growing season for crops tends to be about one month longer in comparison to farmers living below 1500m. The presence of a cooler climate can be considered to be the major factor influencing this phenomenon.

Given the different environments that farmers are faced with in each of the altitudinal zones, the yield of crops will also differ. Table 4 shows the average area and yield of various crops according to altitudinal zone. For the most part, the yield of crops tends to decrease as altitude increases. The main

exception to this rule can be seen in wheat, with the yield of wheat increasing as altitude increases.

The characteristics of farming in the various altitudinal zones can also be illustrated by examining the type of crops that farmers cultivate and sell in each of the altitudinal zones (Table 5). In terms of cereal crops, the production of paddy and maize can be seen as being very important for farmers living below 1000m with the large majority of farmers cultivating these two crops. The average production below 1000m is also much higher in comparison to those living between 1000m-1500m. The importance of maize, however, tends to increase as altitude increases with average production being the greatest between 1500m-2000m. Millet and wheat are cultivated in all three altitudinal zones and while average production levels are relatively high below 1000m, these two crops tend to be more important for farmers living above 1000m with a greater proportion of farmers cultivating them.

In terms of non-cereal crops, there are also slight differences in the types of crops grown due to climatic conditions. Looking at the proportion of households growing non-cereal crops and their average production, fruits are for the most part grown below 1000m, while cardamom, which requires a cooler environment, is more commonly found between 1500m and 2000m. The remaining crops can theoretically be grown in all of the regions but there are a few differences noticed in the zones that some of the crops are produced in. For example, while the production of garlic is similar for all three zones, a greater proportion of farmers living below 1500m grow red chillies. Pulses also show a marked difference in areas that they are grown with dal/beans being more popular above 1000m, while average soybean production being much higher below 1000m. Ginger is grown by a large majority of farmers below 1500m but the average production in the between 1500m and 2000m is highest. Potato is also a popular crop whose average production tends to increase as altitude increases. Finally, farmers living below 1500m tend to produce greater amounts of mustard and green vegetables in comparison to those living above the 1500m mark.

The differences mentioned above can in part be explained by looking at the production that is put up for sale on the market and the average income earned from each of these crops. In terms of meeting the subsistence food needs from farming, it can be said that those living above 1500m have greater difficulties with lower average production of paddy and cooler climates which translates into a longer growing season for crops. In order to cope with this problem, farmers in this zone sell a variety of cash crops. Cardamom is

the highest earning crop in all of the three zones (Table 6). This crop, however, requires a cool, shady and moist climate to grow properly and thus can only be cultivated in areas of a village that have an environment conducive to its growth. Given the existence of such land in the upper part of Namsaling, it can be seen from Table 5, that farmers living between 1500m and 2000m rely heavily on cardamom as a source of income with a large proportion of farmers cultivating this crop. Although average production levels are higher between 1000m and 1500m, only 18% of farmers grow this crop mainly due to the lack of suitable land in this region of the village.

Ginger earns the second highest average income from sale above 1500m. Although a larger proportion of farmers living below 1500m grow ginger to earn cash income, the average production levels of ginger between 1500m and 2000m is much higher, making the income earned from ginger similar to that of what farmers living below 1500m earn from the sale of paddy.

Dal/beans are the third highest earning crop and the table shows that the average production levels and average sold production of dal/beans is much higher between 1500m and 2000m. From this finding, it can be said that dal/beans play an important role as a cash crop for farmers in this region. The reason for choosing dal/beans can be attributed to the higher price that it receives on the market in comparison to soybeans. In fact, the selling of dal/beans earns more income on average than that of maize between 1000m and 1500m and ginger below the 1000m mark.

Looking at the figures for potato, the proportion of farmers growing potato and selling potato and the average produced and sold amounts is highest between 1500m and 2000m (Table 5). As altitude increase, potato becomes more and more important as it is the one crop that can be grown at higher altitudes. Although potato does not earn as much money as ginger between 1000m and 1500m, it earns almost double that of maize grown below 1000m.

Finally, maize is also an important source of income. Although the average production of maize is highest between 1500m and 2000m, the amount of maize sold on the market is less than farmers living between 1000m and 1500m. A reason for this may be that given the poorer ability to grow paddy above 1500m, there is a need for farmers to consume a much larger proportion of their maize production.

Factors Affecting Adoption of Cash Crops: There are a number of factors that need to be taken into consideration when examining the ability of farmers to

integrate cash crops into their subsistence farming system. Firstly, as has been mentioned in previous sections, the types of crops that farmers can grow will be influenced by climate. Crops such as mango, citrus, peach and apple, for example, have unique climatic requirements and the ideal altitudinal zones in which they can be grown have been outlined in Figure 3.

Secondly, the food sufficiency of farmers can also influence their ability to adopt crops, especially those that compete for land with cereal crops and/or require a long gestation period. Those who have low levels of food sufficiency, for example, are less able to deal with the risks if investment in cash crops fails. Crops which have long gestation periods can also be difficult for a farmer to adopt due to the time that has to pass before income can be earned from their investment. In a food consumption survey conducted from the sample households, farmers were asked to estimate the total amount of different cereal and non-cereal food items they consume and the respective amounts that they purchased in the past year. From the data collected, the overall food sufficiency levels of households were calculated according to altitude, the results of which can be found in Table 7. As can be seen from Table 7, food sufficiency tends to be highest below 1000m and decrease as altitude increases. The warmer climate, greater presence of irrigated khet, and higher yield of crops at lower altitudes can all be seen as major factors influencing this trend. In the same survey, farmers were also asked how much money they spent to purchase each of the food items. From this data, the average prices for each of the food items were calculated in order to determine the approximate Rupee amount of food each household consumed and purchased in one year. As can be seen from the figures in Table 7, reliance on cash income to meet food needs tends to increase as altitude increases.

If incomes earned from cash crops are to be used to meet these yearly food expenses, those living between 1500m-2000m will have greater difficulties in doing so with a need to earn over three times more money than farmers living below 1000m. Cardamom was found to be a popular crop in this zone given the high price it receives on the market, low labour requirements, and the fact that it is grown on wasteland not suitable for the cultivation of cereal crops.

Thirdly, the investments that farmers make in labour, land and capital have to yield benefits and be of a reasonable scale in order for farmers to be willing to adopt crops. In terms of labour, farmers will be willing to invest their time and effort if their returns to labour are sufficient enough to justify

the effort. Table 8 shows the amount of labour used per ropani of land for various crops and the monetary returns to labour. As a general trend, the amount of labour used for the growing of non-cereal crops tends to be higher than that of cereal crops. Although there are higher labour requirements, non-cereal crops yield much higher monetary returns to labour.

Maize is one of the traditional cash crops in the region and this can in part be explained by the fact that in comparison to other cereal crops, relatively less labour is utilized to cultivate maize making the monetary returns to labour from this crop high. In terms of non-cereal crops, dal/beans and potato show relatively high returns to labour below 1000m. While further study of broomgrass and cardamom is still required, ginger is a crop that has high returns to labour in the 1000m-1500m and 1500m-2000m zones.

In order to examine the usefulness of cash crops in helping farmers meet their yearly food needs, the production costs[6] and profitability[7] of some of the major crops grown in the two study villages were calculated according to altitudinal zones. From these calculations, Table 9 has calculated the investment in terms of land and money that farmers need to provide in order to earn the average purchased food consumption shown in Table 7. This was done to gain an understanding of the scale of investment that one has to make in order to earn enough money to cover purchased food expenses for a year in each of the altitudinal zones.

Given the fact that many farmers do not have the ability to invest large amounts of money, the loan amounts given out by microfinancial institutions can be considered to be a good guide as to what can be considered to be a small amount of money. In the two study villages, saving and credit groups typically lent between NRs. 2500 to NRs. 5000. The SFDP office located in Namsaling would typically lend up to NRs. 15000. With this in mind, when looking at the figures for those living below 1000m, it is quite evident that small microfinancial loans can be invested in any crop and earn enough money to cover purchased food expenses. The main problem is that cereal crops need a much larger area of land investment in order to earn enough income in comparison to non-cereal crops needs.

For farmers living between 1000m and 2000m, it is quite evident that the investment of microfinancial funds for cereal crops is not feasible and the large area of land that needs to be used is simply unrealistic. Thus investments in non-cereal crops are the only viable alternative. From the data available in the 1000m-1500m altitudinal zone, investment in cardamom is rather difficult, especially for poorer farmers, given the large initial

investment (NRs. 25,319) required to purchase seedlings. Although the area of land needed is small, at 3.6 ropani, the environment needed to grow this crop is very specific and thus can only be grown in certain areas. Ginger would seem to be the best alternative in this zone, given the relatively small amount of money (NRs. 5,539) needed for investment to meet purchased food needs. The figures for broomgrass are a little misleading simply because it is a crop that is typically grown in areas where other crops cannot. Further study is required to see what the costs and profits of this crop would be when it is farmed in a more intensive manner.

The figures in the 1500m-2000m altitudinal zone show that farmers need to invest over NRs. 30,000 in farming in order to be able to make enough money to cover their purchased food needs. The greater reliance on purchased food and the lower profitability of crop production in this zone can be considered to be the major reasons for this. Finally, the figures for all the altitudinal zones covered in this study show that the monetary investments for paddy, maize, wheat, ginger, potato and dal/beans[8] are small enough for the loan amounts disbursed by saving and credit groups. The land requirements, however, for cereal crops are not realistic and thus investment in the production of non-cereal crops would seem to be the best option.

Problems Facing Farmers in Ilam District: Despite the potential benefits that cash crop farming can have in improving the lives of farmers, any newly adapted activity will undoubtedly face its share of problems. Sample farmers were surveyed to gain an understanding of the problems that they are facing not only in cash crop farming but in farming in general as well. Overall, diseases and pests were cited as being the most common problem, especially for those living in the warm climate found below 1000m (Table 10). While problems of irrigation were common, the need for technical knowledge on farming techniques and how to grow crops in a more productive manner were seen as the second biggest problem by farmers.

The severity of the problems listed in Table 10, however, only provide a partial understanding. Given the differences found in the ability of farmers to produce enough food for their sustenance in the various altitudinal zones, Tables 11 to 13 examine the problems that farmers are facing according to the type of crop that they produce, i.e., cereal crops, cash crops, and vegetables.

In terms of cereal crop farming, lack of irrigation facilities, need for technical knowledge and improved seeds were the most common problems cited by farmers, respectively (Table 11). While irrigation was cited as being

the most common problem for those living below 1000m, diseases and pests were also seen as being a major headache affecting production levels. Farmers living between 1000m and 2000m faced fewer problems in terms of disease and pests but felt a much greater need for technical knowledge on how to grow crops in an effective manner. The high number of responses citing the lack of improved seeds, fertilizers and irrigation facilities reflects the desire for farmers to increase their production levels through the use of more modern technologies. In the cooler climate of the 1500m-2000m zone, the need for improved seeds was the most common problem. Given the lower yields and profitability of farming, it is understandable that farmers would want to have better seeds that could help to boost production levels.

In terms of vegetable farming, problems of diseases and pests were overwhelmingly seen as being the most problematic, especially for those living below 1000m (Table 12). While the need for technical knowledge on how to grow vegetable crops effectively was considered to be important, those living in the 1500m to 2000m again felt a strong need for improved seeds.

When it comes to cash crops, however, the importance of marketing problems come to the fore (Table 13). Difficulties in transporting goods to the market due to poor road networks can be cited as being a major factor. In the 1500m-2000m zone, problems of disease and pests received the most responses among farmers. In recent years, diseases called jurjure and pahele by the local people have affected the cardamom and ginger crops respectively. Such diseases can drastically reduce the production levels of these crops and are very troublesome for farmers in this zone especially when one considers the importance of these crops as a source of income. Attempts were made during the field visit to try to find out the nature of these diseases but the lack of pathological testing facilities in the district made it difficult to do so.

In order to overcome such problems, the provision of quality extension services that are relevant to the situation of farmers is important. The Department of Agricultural Development (DOAD) which is responsible for the provision of extension services, however, has had difficulties in providing these services in an effective manner. Basnyat (1995: 36) has criticized the fact that the extension services up until now have been unsuccessful in properly educating farmers due to their preoccupation with "meeting certain preordained quantitative targets such as number of trials, demonstrations,

tours, trips, and training sessions without regard to their impact on agriculture production."

The APP also recognizes that the DOAD has had difficulty in providing proper extension services.

> At the District level, functional linkages among the DOAD and other related agencies have remained weak, with the result that coordination is poor between research and extension, irrigation and extension, extension and credit, and extension and fertilizer....Past efforts to improve interagency coordination have not produced positive results (APROSC and JMA 1996: 285).

In the study area, sample farmers who had participated in extension programmes were asked about their opinion concerning the usefulness of the extension services provided. Out of the 118 households sampled, it was found that only 20 households had any experience in dealing with extension services. Those who had participated, however, tended to partake in a variety of different programmes. On a scale of one to five, one being not useful and five being very useful, farmers were asked to rank their satisfaction level with different programmes and the results are shown in Table 14. It was found, however, that the lowest score that farmers gave was a score of three, i.e., indifferent. Thus a satisfaction level of three should be considered as being poor.

Overall, farmers found the various extension programmes that they had participated in rather useful. In particular, satisfaction was particularly high for result demonstrations and animal fairs. Programmes dealing with the teaching of farming methods, however, did tend to receive lower scores, i.e., method demonstration, Kishan Brahman[9], training. These technical training programmes therefore need to be improved if more productive methods of farming are to be disseminated to the village level.

Implications for Agricultural Policy

The analysis of crop farming has shown that there are distinct differences between altitudinal zones. These characteristics need to be taken into consideration when trying to resolve problems, set priorities, and implement agricultural policy initiatives. In the study, it was also found that the

problems that farmers are facing differed according to altitude and these difficulties have plagued Nepal since the inception of the First Plan. Some of the initiatives outlined in the APP, however, might help to resolve or at least improve upon a number of the past problems.

The poorly developed road infrastructure in the hill region has been problematic given the difficulties and costs associated with the transport of goods to and from villages and market centres. In Ilam District, the proliferation of cash crop farming roughly coincides with the paving of the main road linking Ilam Municipality to Jhapa in the late 1980s. The creation of a new Department of Agricultural Roads to oversee the construction of new roads will therefore play an important role to the success of the APP strategy. The commitment to building up a road network is an investment that will be very beneficial not only for the transport and marketing of cash crops, but also reduce the costs of transporting inputs that can vastly improve the productivity of agriculture.

The focus on greater privatization may also have a positive impact on the availability of various inputs. In order to overcome the problems related to the lack of inputs, the Government has started on a course to remove subsidies on these goods. A major problem affecting the distribution of inputs has been due to the budgetary constraints of the government; they have been unable to provide enough of these inputs with the subsidies that they have been providing. By limiting the role of the government, through the removal of subsidies, and leaving the development of input markets to the private sector, it is hoped that the allocation of resources can be achieved in a much more efficient and effective manner. In particular, the Government is placing a high priority on the distribution of chemical fertilizers and aims to support the activities of the private sector in the following manner:

> Under this arrangement, there is no need to acquire import license, and foreign currency will be made available easily on the basis of a letter of credit from the bank. Importers are allowed to fix retail price. From this arrangement, timely availability of chemical fertilizer at competitive price on a regular basis is ensured for the farmer (NPC 1998: 387).

The development of irrigation is also seen as being important, with an emphasis on the development of shallow tube wells in the terai and surface water schemes in the hills and mountains. Past Plans, however, have

generally not been able to meet projected targets in terms of area coverage. The main difference that can be seen between the current strategy and past Plans is that there is a greater focus on decentralized planning and implementation. The District Development Committee (DDC) is given greater responsibility for determining the priorities of their respective Districts while the VDCs are to play an important role in helping the DDC identify where and what kind of activities should be promoted as well as monitor and provide feedback of activities (APROSC and JMA 1996: 280). This greater participation from the local level bodies is hoped to be able to facilitate the organizational aspects of increasing irrigation areas.

The biggest challenges that can be foreseen in the success of APP strategy lies in the decisions that the DDC has to make in terms of where resources should be invested, the crops that should be given priority, and the implementation of effective extension services to support the development of priority crops. The APP emphasizes the need to be selective and suggests that "demand is best led by a single "lead" crop and a single "lead" livestock commodity per ecological planning unit in both the hills and mountains. This is done to take advantage of significant scale economies in research, input purchase, extension, production, processing, commercialization, and export promotion" (APROSC and JMA 1996: 214). While this does not rule out the growing of other high value crops by farmers, the APP calls for the Government to focus solely on the lead commodities.[10]

In the Eastern Hills, the APP has recommended that for crop farming, citrus fruits are best suited as the lead commodity while tea, cardamom, and off-season vegetables have a good potential as subsidiary commodities. In terms of livestock farming, dairy is seen as being the lead commodity while goats, pig and angora rabbits are potential subsidiaries (APROSC and JMA 1996: 216). The adoption of crops such as citrus, tea, and cardamom, however, can be difficult for farmers given the gestation periods needed before these crops can earn income. Thus the APP has recommended that the changes in cropping patterns should undergo a four stage process outlined in Table 15.

The following of such a sequence, or something similar to it, is thought to be essential so that those living in the hill region do not lose confidence in their ability to invest in cash crops. At the same time, it is noted that "this sequence is consistent with the APP agricultural expansion timing. Some crops can be produced on small farms without diseconomies; for other

commodities, farming with agribusiness firms may be necessary" (APROSC and JMA: 217).

The APP has also set certain targets for the area coverage of high-value crops[11] according to land type. By the end of the twenty-year plan period in 2015, the following percentages of land are expected to be devoted to high-value commodities in the hill region: 5% of irrigated valleys, 8% of monsoon irrigated valleys, 13% of unirrigated slopes, 33% of irrigated slope-land, and 43% of monsoon irrigated slope-land (APROSC and JMA: 217). Separate targets have also been set for mountain areas and it is estimated that if all of the land coverage targets are met, the per capita GDP and share in GDP will meet the calculated projections.

The altitudinal analysis of crop farming has found, however, that the food sufficiency of farmers tends to differ according to altitudinal zone. Given the risk-adverse nature of subsistence farmers, the need and willingness to adopt the lead and/or subsidiary crops will also tend to differ according to altitude. The findings from this study have also shown that those living below 1000m can earn enough income to meet their yearly food needs from the sale of crops such as dal/beans, ginger, and potato with relatively small investments in land and capital. Those living in the 1000m-1500m altitudinal zone, which has an ideal climate for the growing of citrus fruits (see figure 3), have a relatively more difficult time to meet their food needs. Although their yearly purchased food expenses can be met through the sale of crops such as ginger, the long gestation period of citrus fruits can make it difficult for farmers to adopt this crop.

One of the key factors in ensuring the success of the APP strategy lies in the bolstering of food production through increased use of fertilizers and irrigation, which will better enable farmers to adopt lead commodities. Despite the failure of past Plans to achieve similar goals, the focus on liberalization of the economy and decentralization of decision-making is hoped to bring about better results. Regardless of how successful the government is in achieving production targets, the findings from the study have shown that those living below 1000m have higher levels of food sufficiency and will therefore be better positioned to adopt crops such as citrus fruits compared to farmers living in the 1000m-1500m zone. In fact, Table 5 has shown that citrus fruits were more popularly grown below 1000m.

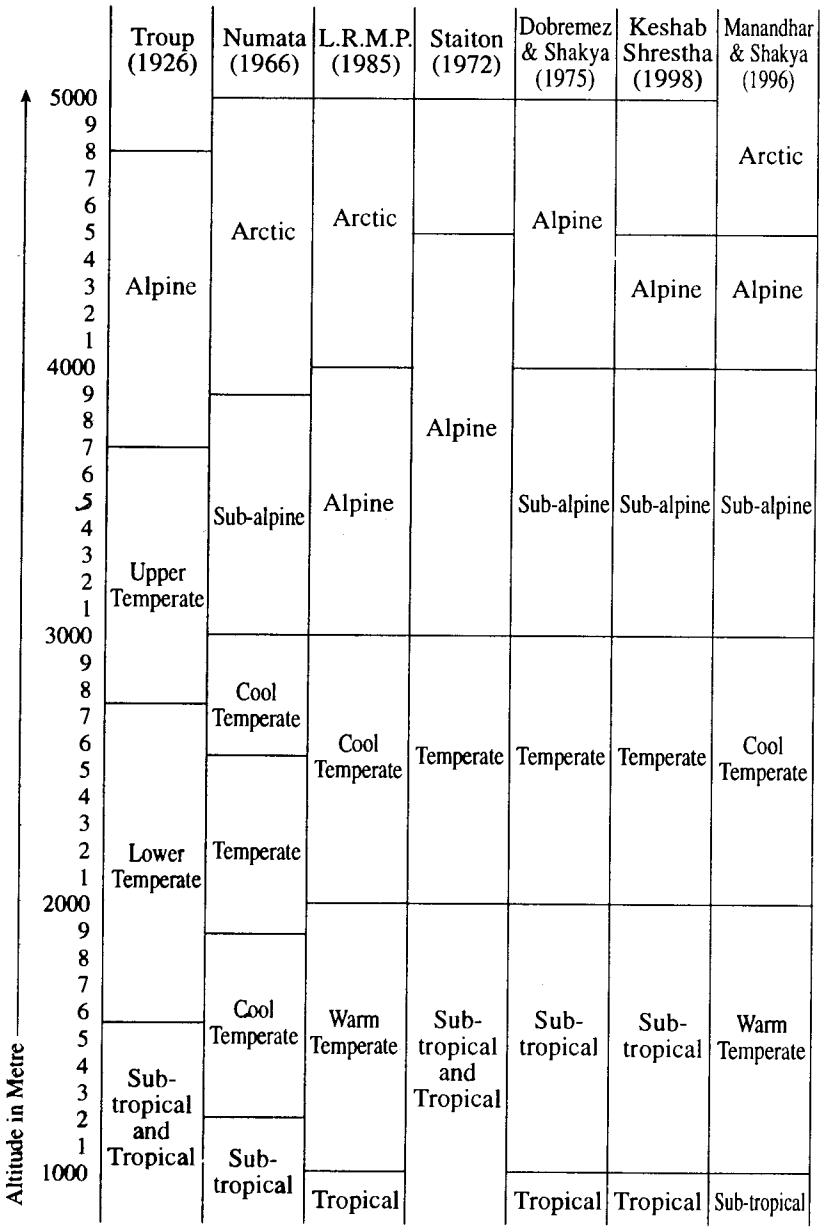
This study has also found that the farmers living in the 1500m-2000m zone have the hardest time meeting their food needs from crop farming alone.

While further study needs to be done concerning the contribution of livestock to agricultural income, high-value commodities that compete with cereal crops for land will be much more difficult to adopt in this zone. Cardamom, however, is a crop that grows on moist and shady wasteland that is not suitable for the cultivation cereal crops. This crop is extremely popular for those who are able to adopt it given the low labour requirements once the seedling is planted. The major obstacles to the adoption of cardamom lies in the availability of suitable land, the costs associated with purchasing cardamom seedlings, the ability of a farmer to absorb the costs associated with the gestation period that is needed before income can be earned, and the problems associated with disease that had greatly reduced the productivity of cardamom. Policies that can help farmers overcome such obstacles will be very important for those living in this zone.

The success of the APP will dependent upon the ability of the government to meet the targets set for its four main policies: roads, irrigation, chemical fertilizers, and agricultural technology. While the poor performance of the past Plans can make one cynical of the ability of the current strategy to achieve targeted goals, the APP states that the past Plans had spread efforts out too thinly so that nothing was able to work properly. The very tight priorities that have been established in the APP is hoped to bring about better results (APROSC and JMA 1996: xxix).

While the focus on a single lead crop can help to take advantage of scale economies in the various aspects of its cultivation and has the potential to bring about positive results in the long-run, this study has shown that in a region where farmers are integrating cash crop into their subsistence farming system, the needs and ability of farmers to adopt high-value crops differs according to the altitudinal zones. It will be important for the government to remain flexible and not ignore the way farmers are adapting to the new policy environment.

Figure 1: Bioclimatic (altidinal) zonation proposed by various authors



Source: Shrestha, T.B. (1989); Shrestha, Keshab (1998), Manandhar and Shakya (1996)

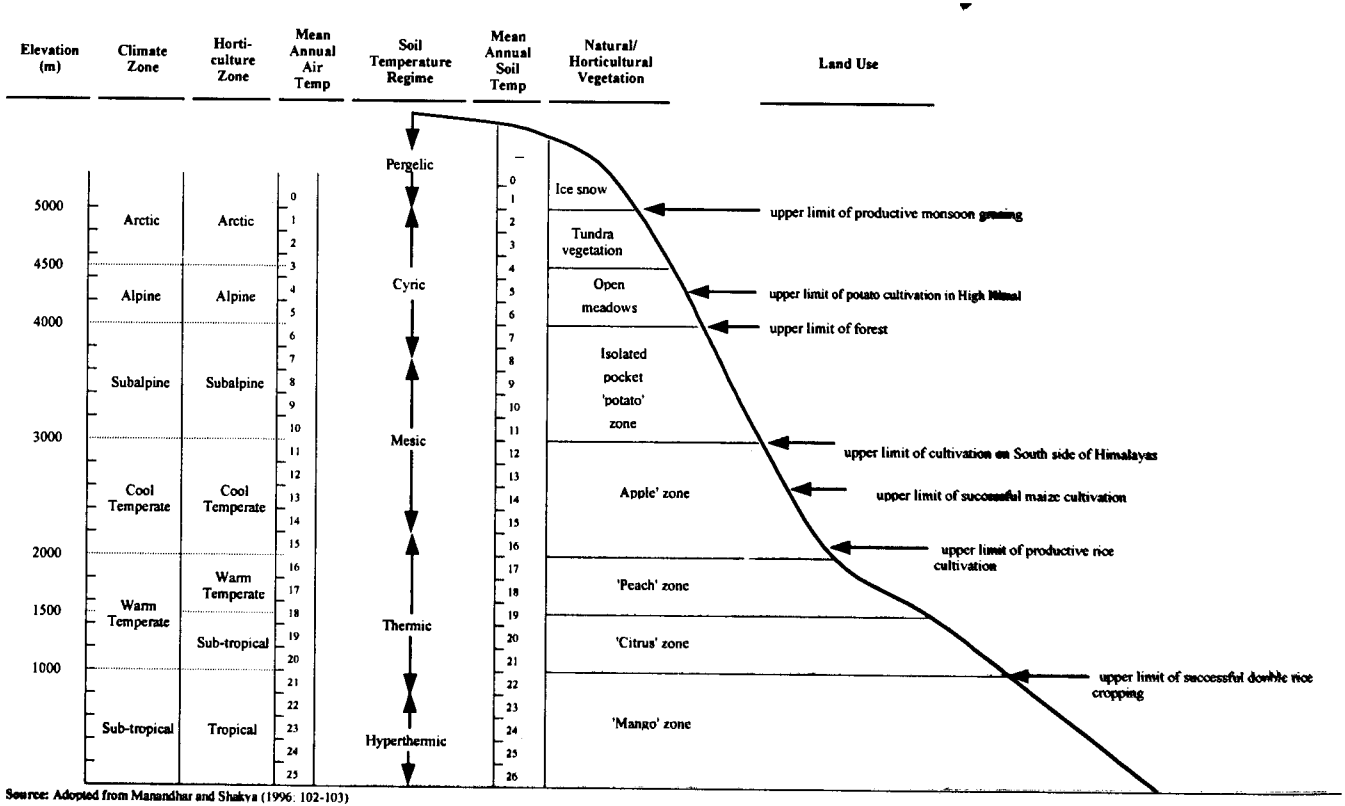
Figure 2: Cropping Patterns in Different Agro-ecological Zones

Sub-tropical (<1000 m asl)	Rainfed	Maize-Mustard-Fallow	Rice-Fallow
		Rice-Wheat-Fallow	Rice-Mustard-Chickpea
		Rice-Mustard-Lentil	Maize-Chickpea or Lentil
		Cotton+Pigeon Pea	Fingermillet-Lathyrus
		Jute-Mustard-Fallow	Jute-Wheat-Fallow
	Irrigated	Rice-Wheat-Fallow	Rice-Rice-Wheat
		Rice-Rice/Lentil	Rice-Wheat-Mungbean
		Rice-Wheat-Dhaincha	Rice-Potato-Dhaincha
		Rice-Fieldpea	Rice-Rice-Maize
		Rice+Pigeon pea (in rice bund)-Wheat	
Warm Temperate (1000m-2000m asl)	Rainfed	Maize/Fingermillet-Wheat	Maize/Fingermiller-Fallow
		Maize+Soybean-Mustard/Fallow	Maize-Barley
		Maize+Upland Rice-Fallow	Maize+Rice-Wheat
	Irrigated	Rice+Blackgram in bund-Wheat	Blackgram-Wheat-Fallow
		Rice-Wheat-Fallow	Rice-Wheat-Maize
		Rice-Rice-Wheat	Rice-Barley
Cool Temperate to Alpine (2000m-3000m+)[1]	Rainfed	Maize-Fallow	Potato-Fallow
		Maize-Wheat	Naked barley-Fallow
		Wheat-Fingermillet (2 years pattern)	
		Maize-Naked Barley-Fingermillet (2 years pattern)	
		Maize-Wheat-Fingermillet (2 years pattern)	
	Irrigated	Rice-Naked Barley	Buckwheat-Naked Barley
		Rice-Wheat	Potato-Naked Barley-Fallow (2 yrs Pattern)

Note: [1]One crop is usually grown at lower altitudes and as additional second crop is only possible in a few areas. In higher altitudes, three crops are generally grown in a two year time span. Above 3000m, only one crop of potato, naked barley or wheat.

Source: Manandhar & Shakya (1996: 18).

Figure 3: Relationship between Elevation, Climatic and Horticulture Zone, Mean Annual Air and Soil Temperature, Vegetation, and Land Use Limits



Source: Adopted from Manandhar and Shakya (1996: 102-103)

Figure 4: Map of Village Development Committees in Ilam District

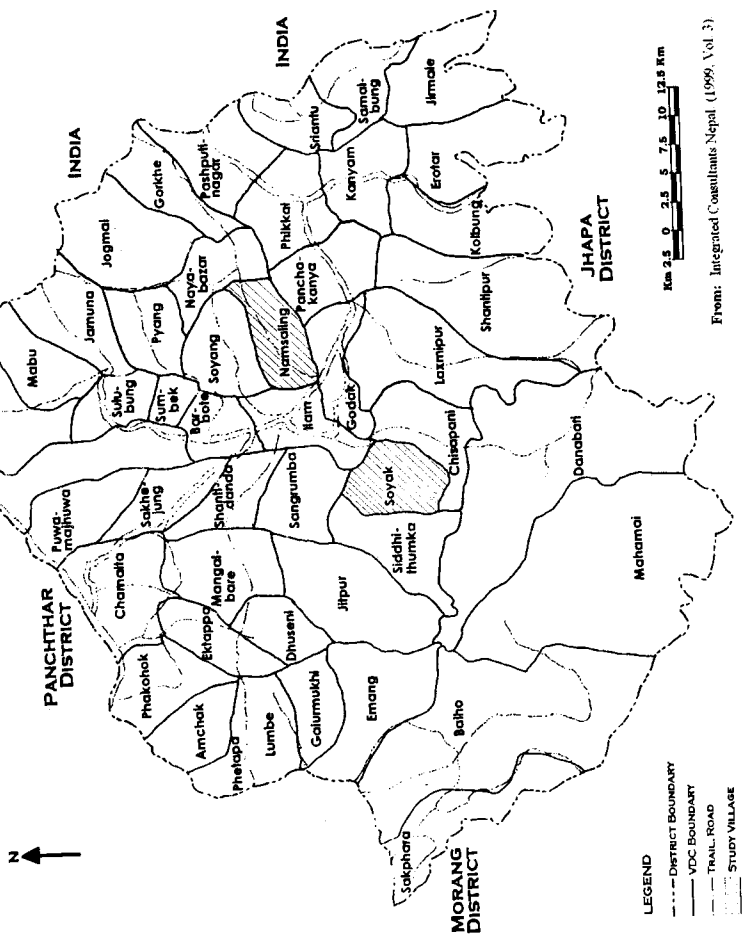
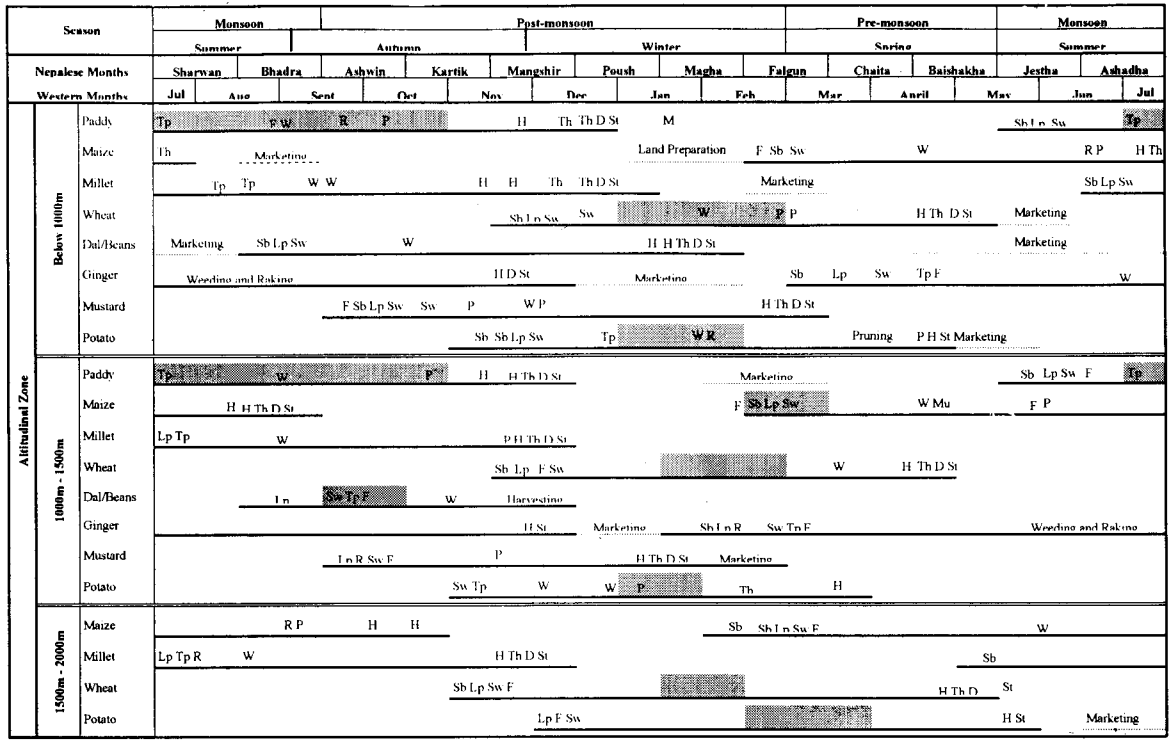


Figure 5: Cropping Calendar and Farming Operations for Selected Crops in Study Area According to Altitudinal Zone



Source: Field Survey 1999, 2001

Note: Sb = Seed bed making, Lp = Land preparation, Sw = Sowing, Tp = Transplantation, F = Fertilizing, W = Weeding and Raking, Mu = Mulching, R = Ridging and Furrowing, P = Pruning, H = Harvesting, Th = Threshing and Winnowing, D = Drying, St = Storing; Shaded areas indicate irrigation period

Table 1: Landholding According to Altitudinal Zone in Study Area

Altitudinal Zone / Landholding Category	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	No	%	No	%	No	%	No	%
Landless without livestock	8	1.4	27	3.9	2	1.3	37	2.6
Landless with livestock	10	1.7	8	1.2	1	0.6	19	1.3
Small	143	24.7	178	26.0	31	20.0	352	24.8
Medium	335	58.0	354	51.8	99	63.9	788	55.6
Large	82	14.2	117	17.1	22	14.2	221	15.6
Total	**578**	**100.0**	**684**	**100.0**	**155**	**100.0**	**1417**	**100.0**

Note:

1) "Landless with livestock" are holdings having area under crops less than 0.01272 ha (4 Aanas), but raising at least two productive animals (i.e. two cows, buffalo, ox, horse, mule or five goat, pig, sheep) or twenty poultry birds. The "landless without livestock" has been added because it is a category that it overlooked by the Agricultural Census.
2) Small = 0.01272 ha to under 0.5 ha; Medium = 0.5 ha to under 2ha; Large = 2 ha and over
3) The landholdings of households are calculated according to the method utilised in the Agriculture Census of Nepal and is the sum of all land types operated by farmers inlucding khet, pakha, homestead, agroforest, pasture, and forest land.

Source: Field Survey 1999, 2001

Table 2: Area of Different Land Types According to Altitudinal Zone (Ha)

Land Type \ Altitudinal Zone		Below 1000m		1000m-1500m		1500m-2000m		All Zones	
		Area	%	Area	%	Area	%	Area	%
Khet	Irrigated	293.8	43.2	247.0	31.9	8.5	4.5	549.3	33.4
	Non Irrigated	17.7	2.6	16.7	2.2	0.5	0.2	34.8	2.1
Pakha	Irrigated	22.6	3.3	94.5	12.2	54.3	28.8	171.4	10.4
	Non Irrigated	217.9	32.0	264.9	34.2	60.7	32.2	543.5	33.1
Homestead		56.4	8.3	55.1	7.1	24.6	13.1	136.1	8.3
Agro-forest		71.1	10.4	95.5	12.3	39.8	21.1	206.4	12.6
Pasture		9.6	1.4	30.0	3.9	2.2	1.2	41.8	2.5
Forest		1.0	0.1	0.4	0.05			1.4	0.1
Total		**680.5**	**100.0**	**774.1**	**100.0**	**188.4**	**100.0**	**1643.0**	**100.0**

Source: Field Survey 1999, 2001

Table 3: Proportion of Households Holding Different Land Types and their Average Holding Size According to Altitudinal Zone

	Below 1000m			1000m-1500m			1500m-2000m					
	No	%	Avg. Size (Ha)	No	%	Avg. Size (Ha)	No	%	Avg. Size (Ha)	No		
	451	78.0	0.65	459	67.1	0.54	13	8.4	0.65	923		0.60
	38	6.6	0.47	45	6.6	0.37	1	0.6	0.46	84	5.9	0.41
	49	8.5	0.46	154	22.5	0.61	122	78.7	0.45	325	22.9	0.53
	416	72.0	0.52	448	65.5	0.59	75	48.4	0.81	939	66.3	0.58
	578	100.0	0.10	684	100.0	0.08	155	100.0	0.16	1417	100.0	0.10
	150	26.0	0.47	261	38.2	0.37	76	49.0	0.52	487	34.4	0.42
	32	5.5	0.30	89	13.0	0.34	8	5.2	0.27	129	9.1	0.32
	4	0.7	0.25	2	0.3	0.18		0.0		6	0.4	0.23
	578	**100.0**	**1.18**	**684**	**100.0**	**1.13**	**155**	**100.0**	**1.22**	**1417**	**100.0**	**1.16**

Survey 1999, 2001

Table 4: Average Area and Yield of Various Crops According to Altitudinal Zone

Crop	Below 1000m (n=66)		1000m-1500m (n=44)		1500m-2000m (n=6)		All Zones (n=116)	
	Avg. Area (Rop)	Avg. Yield (Kg/Rop)	Avg. Area (Rop)	Avg. Yield (Kg/Rop)	Avg. Area (Rop)	Avg. Yield (Kg/Rop)	Avg. Area (Rop)	Avg. Yield (Kg/Rop)
Paddy	21.9	112	15.6	76.5	17.3	42.3	19.8	99.1
Maize	15.6	67.6	15.1	40.1	19.5	37.4	15.6	55.9
Millet	10.9	45.2	8.6	45.4	4.9	36.8	9.1	44.1
Wheat	8.3	54.3	6.2	69.1	2.5	70.1	7.5	58.7
Broomgrass			9.8	19.1			9.8	19.7
Cardamom			2	51.3			2	51.3
Dal/Beans	0.5	105.2					0.5	105.2
Ginger	4.3	344.3	8.5	224	9	124.4	7.1	261.1
Potato	10.9	303.3	1.8	110.4	4.3	143.6	6.6	207.2
Total	**14.8**	**93.8**	**12.1**	**71**	**13.6**	**83.4**	**13.6**	**83.4**

Source: Field Survey 1999

Table 5: Production and Sale of Various Crops According to Altitudinal Zone

Altitudinal zone			Below 1000m (n=66)					1000m - 1500m (n=44)					1500m - 2000m (n=6)				
			Production		Sale			Production		Sale			Production		Sale		
Crop		Avg. Market Price (NRs./Kg)[1]	% of Sample HH	Avg. Prod. (Kg)	% of Sample HH	Avg. Sold Prod. (Kg)	Avg. Income from Sale[2]	% of Sample HH	Avg. Prod. (Kg)	% of Sample HH	Avg. Prod. (Kg)	Avg. Income from Sale	% of Sample HH	Avg. Prod. (Kg)	% of Sample HH	Avg. Prod. (Kg)	Avg. Income from Sale
Cereal crops	Paddy	10	92.4	1,794	24.2	991	9,911	84.1	1,117	9.1	1,024	10,238	50.0	552			
	Maize	11.56	98.5	509	16.7	216	2,497	97.7	539	9.1	537	6,210	100.0	763	16.7	373	4,315
	Millet	11.5	59.1	284	10.6	182	2,090	81.8	207	31.8	217	2,493	66.7	138	33.3	55	633
	Wheat	10.5	57.6	208	21.2	179	1,875	63.6	141	6.8	169	1,772	66.7	219	33.3	149	1,568
	Other Cereals		3.0	113				2.3	3								
Fruits	Banana[3]	1	53.0	316	16.7	336	336	25.0	157	2.3	50	50					
	Citrus Fruits		27.3	124	13.6	198		4.5	10								
Low-weight spices	Cardamom	267.92	18.2	56	15.2	67	17,875	18.2	302	18.2	302	80,848	83.3	276	83.3	261	69,999
	Garlic	35.88	24.2	5	6.1	5	188	34.1	12	4.5	15	538	33.3	8			
	Red chilli	94.44	69.7	9	10.6	12	1,106	54.5	8	4.5	8	708	33.3	8			
Pulses	Dal/beans	31.2	34.8	26	1.5	18	547	59.1	56	20.5	68	2,114	66.7	121	33.3	201	6,259
	Soybeans	18.85	19.7	104	6.1	197	3,718	9.1	14				50.0	10			
Other major crops	Ginger	13.1	83.3	527	81.8	415	5,441	81.8	426	61.4	438	5,732	33.3	746	33.3	741	9,713
	Potato	7.89	78.8	159	9.1	159	1,252	65.9	290	13.6	373	2,945	66.7	1,026	66.7	607	4,785
	Mustard	27.5	42.4	46				50.0	48	2.3	44	1,212	50.0	21			
	Green veg.		71.2	552	4.5	90		45.5	122	2.3	37		66.7	49			
Other Crops	Roots/tubers		15.2	140				9.1	233								
	Others[4]		60.6	41	12.1	77		11.4	29	6.8	26		50.0	13	33.2	20	

Note:

1 Average market prices are for 1997/98 in Ilam District, with the exception of banana and cardamom which are prices that farmers receive at harvest time.

2 Average income is derived by multiplying average sold production by the average market price.
3 Average Production for bananas is not in kilograms but in pieces. For example, the average self production for banana in the tropical zone is not 336 kg but 336 bananas.
4 Others includes herbal medicine, honey, jute/tobacco, kandamul, leechi, onion, other fruits, peanuts, silk, sugarcane, tea/coffee

Source: Field Survey 1999; Marketing and Development Division (1998: 12); Manandhar and Shakya (1996)

Table 6: Ranking of Crops According to Average Income Earned from Sale in Three Altitudinal Zones

Altitudinal Zone	Below 1000m		1000m-1500m		1500m-2000m	
Rank	Crop	Avg. Income from sale	Crop	Avg. Income from sale	Crop	Avg. Income from sale
1	Cardamom	17,875	Cardamom	80,848	Cardamom	69,[illegible]
2	Paddy	9,911	Paddy	10,238	Ginger	9,713
3	Ginger	5,441	Maize	6,210	Dal/Beans	6,259
4	Soybeans	3,718	Ginger	5,732	Potato	4,785
5	Maize	2,497	Potato	2,945	Maize	4,315
6	Millet	2,090	Millet	2,493	Wheat	1,568
7	Wheat	1,875	Dal/Beans	2,114	Millet	633
8	Potato	1,252	Wheat	1,772		
9	Red chili	1,106	Mustard	1,212		
10	Dal/Beans	547	Red chili	708		

Source: Field Survey 1999; Manandhar and Shakya (1996); Marketing Development Division (1998).

Table 7: Food Sufficiency and Rupee Value of Food Consumption According to Altitudinal Zone

Altitudinal Zone	No of HH	Food sufficiency (%)	Total Food Consumption		Purchased Food	
			Average per HH (NRs.)	Average per person (NRs.)	Average per HH (NRs.)	Average per person (NRs.)
Below 1000m	65	74.8	51,935	8,796	11,954	2,257
1000m-1500m	44	57.4	71,022	11,261	23,964	3,797
1500m-2000m	6	45.3	62,673	9,854	39,977	6,500
Total	**115**	**66.6**	**59,599**	**9,832**	**17,906**	**3,107**

Source: Field Survey 1999

Labour Use and Monetary Returns to Labour for Various Crops According to Altitudinal Zones

Below 1000m		1000m-1500m		1500m-2000m		All Zones	
Mandays/ Ropani	NRs./ Manday	Mandays/ Ropani	NRs./ Manday	Mandays/ Ropani	NRs./ Manday	Mandays/ Ropani	NRs./ Manday
27.9	40.5	29.2	25.5	29.6	14.6	28.3	36.1
8.2	93.4	15.7	29.3	17.1	25.3	11.5	55.5
18.0	28.9	46.1	10.6	47.6	8.9	30.8	16.3
13.6	41.2	36.8	19.8	37.6	19.6	18.6	32.0
		0.4	1300.8			0.4	1300.8
		35.9	383.2			35.9	383.2
32.5	104.4					32.5	104.4
79.6	57.6	32.9	89.3	32.9	49.6	42.8	74.8
27.1	17.9	48.0	2.1			46.2	2.9
35.6	67.2	39.8	21.9	39.8	28.4	36.7	56.0
		12.5	14.9			12.5	14.9
19.3	**50.0**	**25.3**	**29.5**	**25.5**	**21.0**	**21.6**	**40.4**

day = 8 hours of adult labour; For survey year 1999, $1US = NRs. 68.25

Survey 1999; Marketing Development Division (1998)

Table 9: Area of Land and Investment Required to Meet Purchased Food Expenses

Crop	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	Area (Ropani)	Required Investment (NRs.)	Area (Ropani)	Required Investment (NRs.)	Area (Ropani)	Required Investment (NRs.)	Area (Ropani)	Required Investment (NRs.)
Paddy	12.1	1,786	58.9	19,784	499.7	176,399	21.8	4,318
Maize	16.7	887	79.1	12,496	167.3	32,283	33.3	3,334
Millet	26.7	1,948	103.7	26,661	309.9	91,110	52.2	8,300
Wheat	23.7	1,305	61.6	21,007	99.2	33,132	37.4	4,374
Broomgrass			64.4	10,243			48.1	7,653
Cardamom			3.6	25,319			2.7	18,918
Dal/Beans	3.5	0					5.3	0
Ginger	3.1	2,417	10.1	5,539	46.5	35,793	6.9	4,229
Potato	5.4	1,007			1998.9	2,224,720	11.1	4,811
Total	**13.9**	**1,477**	**49.5**	**13,071**	**185.1**	**59,225**	**25.1**	**4,288**

Note: Purchased food expenses are as follows: Below 1000m = NRs. 11,954, 1000m-1500m = NRs: 23,964, 1500m-2000m = NRs. 39,977, All Zones = NRs. 17,906.

Source: Field Survey 1999

Table 10: Problems Facing Crop, Cash Crop and Vegetable Farming According to Altitudinal Zone

Crop Farming Problems	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	No of Responses	%	No of Responses	%	No of Responses	%	No of Responses	%
Disease and Pests	74	34.7	20	12.0	4	17.4	98	24.3
Technical Knowledge	31	14.6	39	23.4	6	26.1	76	18.9
Irrigation	37	17.4	26	15.6	3	13.0	66	16.4
Lack of Improved Seeds	20	9.4	36	21.6	8	34.8	64	15.9
Lack of Fertilizer	19	8.9	22	13.2	1	4.3	42	10.4
Lack of Pesticides	6	2.8	14	8.4	1	4.3	21	5.2
Marketing	23	10.8	10	6.0			33	8.2
Other	3	1.4					3	0.7
Total	**213**	**100.0**	**167**	**100.0**	**23**	**100.0**	**403**	**100.0**

Note: Disease and pests includes knowledge of diseases, insect, viral infection, monkey.
Technical Knowledge includes need for training, farming techniques, etc.
Irrigation includes need for irrigation, lack of water.
Lack of fertilizer includes manure and chemical fertilizer.
Marketing includes access to markets, transportation problems.
Other includes lack of land, low yield.

Source: Field Survey 1999

Table 11: Problems Facing Cereal Crop Farming According to Altitudinal Zone

Cereal Crop production	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	No of Responses	%	No of Responses	%	No of Responses	%	No of Responses	%
Disease and Pests	17	21.5	4	4.6	1	12.5	22	12.6
Technical Knowledge	13	16.5	22	25.3	1	12.5	36	20.7
Irrigation	25	31.6	18	20.7	2	25.0	45	25.9
Lack of Improved Seeds	9	11.4	20	23.0	4	50.0	33	19.0
Lack of Fertilizer	7	8.9	16	18.4			23	13.2
Lack of Pesticides	2	2.5	5	5.7			7	4.0
Marketing	3	3.8	2	2.3			5	2.9
Other	3	3.8					3	1.7
Total	**79**	**100.0**	**87**	**100.0**	**8**	**100.0**	**174**	**100.0**

Source: Field Survey 1999

Table 12: Problems Facing Vegetable Farming According to Altitudinal Zone

Vegetable production	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	No of Responses	%	No of Responses	%	No of Responses	%	No of Responses	%
Disease and Pests	47	51.1	13	24.5			60	39.2
Technical Knowledge	12	13.0	12	22.6	3	37.5	27	17.6
Irrigation	2	2.2	4	7.5			6	3.9
Lack of Improved Seeds	9	9.8	13	24.5	4	50.0	26	17.0
Lack of Fertilizer	9	9.8	3	5.7	1	12.5	13	8.5
Lack of Pesticides	3	3.3	6	11.3			9	5.9
Marketing	10	10.9	2	3.8			12	7.8
Total	**92**	**100.0**	**53**	**100.0**	**8**	**100.0**	**153**	**100.0**

Source: Field Survey 1999

Table 13: Problems Facing Cash Crop Farming According to Altitudinal Zone

Cash crop Production	Below 1000m		1000m-1500m		1500m-2000m		All Zones	
	No of Responses	%	No of Responses	%	No of Responses	%	No of Responses	%
Disease and Pests	9	22.0	3	11.1	3	42.9	15	20.0
Technical Knowledge	6	14.6	5	18.5	2	28.6	13	17.3
Irrigation	10	24.4	4	14.8	1	14.3	15	20.0
Lack of Improved Seeds	2	4.9	3	11.1			5	6.7
Lack of Fertilizer	3	7.3	3	11.1			6	8.0
Lack of Pesticides	1	2.4	3	11.1	1	14.3	5	6.7
Marketing	10	24.4	6	22.2			16	21.3
Total	**41**	**100.0**	**27**	**100.0**	**7**	**100.0**	**75**	**100.0**

Source: Field Survey 1999

Table 14: Satisfaction Ranking of Farmers with Extension Programmes

Extension Programme	No of Responses	Avg. Satisfaction Rank
Result demonstration	9	4.8
Method demonstration	9	3.9
Production demonstration	9	4
Farmer's day	13	4.1
Animal fair	8	4.6
Kishan Bhraman	9	3.8
Training	7	3.7
Goods fair	1	4
Total	**65**	**4.1**

Note: The scores used for this survey are as follows: 1=Useless, 2=Less Useful, 3=Indifferent, 4=Useful, 5=Very Useful .

Source: Field Survey 1999

Table 15: Four Stages of Transition in Cropping Patterns Envisioned in APP

Stage	Major Activity
Year 1-5	Technological catch-up in the grain crops (through enhanced infrastructure and research). Farmers become confident that they have sufficient food security to extend to cash-crop production.
Year 6-10	Fodder and dairy improvement. Improve diets, productivity, incomes of hill populations.
Year 11-15	Citrus trees planted in preceding stages come into full production.
Year 16-20	Apple production could come into its own.

Source: APROSC and JMA (1996: 217)

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Notes

1. With the exception of wheat, the yield of most agricultural crops during the 1960s was on a downward trend. Any increases in overall production have been attributed to "traditional factors of increased labour force, additional land (brought under cultivation), changes in weather conditions and so on, and not due to any qualitative improvement or any sizeable increase in the magnitude of factors of production (Pant 1973: 173)" (Seddon 1987: 43).
2. During the first four Plans, Nepal was divided into three administrative regions: Eastern, Central, and Western. This was increased to four regions during the Fifth Plan and eventually to the present-day five development region classification utilized today during the Sixth Plan.
3. The four growth axes included the Kosi Growth Axis (Biratnagar to Hedanga), Gandaki Growth Axis (Bairawa to Jomosom), Karnali Growth Axis (Nepalgunj to Jumla), Kathmandu Growth Axis (Birgunj to Dhunche/Barbise). Although there is a fifth growth axis from Dhangari

to Dandeldhura envisioned in the original regional development planning concept, the Fourth Plan focussed upon the four axes mentioned above due to the existence or undergoing construction of roads in the area.

4. This agricultural technology includes a technology system of research and extension.
5. In Nepal, khet (i.e., irrigated or rain-fed rice fields) and pakho (i.e., land where crops other than rice are grown) are the two most commonly cultivated land types. Adhikari (1996) also equates upland with pakho and lowland with khet.
6. Production costs include all cash costs associated with crop production and excludes self supplied inputs and labour. Cash costs include money spent on the purchase of seeds, manure, chemical fertilizers, pesticides, hired labour as well as money used for irrigation, machinery, and storage.
7. Profit = Production value – Production costs. Production value was calculated by multiplying total production by the average yearly market prices for the respective crops.
8. The sample farmers growing dal/beans did not purchase any seeds making the production costs for this crop NRs. 0. If one were to purchase all of the seeds, it would cost approximately NRs. 58 per ropani of land when utilizing an average seedling rate of 1.8kg/ropani. Most farmers, however, produce dal/beans for their own consumption as it is one of the staple foods of the Nepalese diet.
9. Kishan Brahman is a programme which brings farmers to show the types of farming being conducted in other regions.
10. In the Himalchal Pradesh, a particular focus was placed on the growing of apples. The success that this region has had in commercializing agriculture is the underlying reason for following a single lead commodity strategy.
11. These crops include citrus, apples, vegetable and vegetable seeds, cardamom, ginger, tea, coffee, and sericulture.

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