# Chapter 8

# Apple Farming and Pollination Issues in Jumla Valley, Nepal

## Apple Farming in Nepal

Nepal is located on the southern flank of the Central Himalayan range. It covers an area of 147,181 km$^2$. It is bordered by India along the eastern, southern, and western frontiers, and by China to the north. Altitudes range from 75 masl in the Terai and inner Terai zone to over 8,000m in the greater Himalayan region.

According to official statistics, apple trees have been planted in 55 of Nepal's 75 Districts, but in most of these areas the plantations are young. Only 3,200 of the total 4,970 ha of orchards contain mature productive trees; these produce about 30,464 tonnes of apples annually. The average annual return from this crop is about US$4 million (Ministry of Agriculture 1999). The district wise distribution is highly variable, from as little as 3.3 ha in Parbat to 388 ha in Solukhumbu (Agricultural Statistical Report 1999).

This study was launched to collect information on apple productivity issues in Nepal, particularly those related to pollination. Jumla was selected as a representative area. The field surveys were conducted among 60 farmers in ten village development committee areas (VDCs). The details are given in Chapter 3 (Table 3.5).

### Apple farming in Jumla

Jumla is one of the three major apple-producing districts of Nepal. It ranks third after Solukhumbu and Mustang in terms of apple-growing area, and second in terms of production. The revenue records show 382 ha of apple plantations in Jumla, of which 274 ha have mature trees, producing about 2690 tonnes of apples annually (Agricultural Statistics Report 1998/99). Recent records (2001) of the Agriculture Development Office in Jumla show an increase to 461 ha with a production of 4600 tonnes in 2001. This may still be an underestimate, under reporting occurs as a result of land tenureship problems and related to tax and revenue returns. Local farmers reported unofficial estimates of about 1,000 ha of apple plantations in 2001.

Apples were introduced to Jumla about 30 years ago, but most plantations are only 10-15 years old. Apples have only recently become an important cash crop for farmers in this area. Jumla is a

remote mountain district and the only way to transport apples to the nearest market town in Nepalgunj is to airlift the produce. The airfare is high and not affordable by poor farmers. Often the cost of airlifting makes the price of apples produced in Jumla more expensive than those imported from India or China. Thus most farmers do not try to sell apples outside the valley. The situation is changing, however. In 1999 the DoA started to help the apple farmers of Jumla District to sell their fruit. The Department provides special support in the form of subsidies towards the cost of cardboard boxes (28%) and airlifting the apples to the nearest lowland market in Nepalgunj (58%). As a result contractors from market towns have started approaching apple farmers in Jumla and some farmers now sell their apples through these contractors. Jumla apples are now available in Nepalgunj, Butwal, Surkhet, and Kathmandu, the local price has also risen, and farmers' incomes have increased.

Farmers started to become interested in using honeybees to manage apple pollination when the DoA started to help them sell their fruit. In 1999, a local NGO called Surya Social Service Society (4S) interacted widely with apple farmers and explained the importance of managing pollination in apples. Later, in collaboration with the DoA and financial support from ICIMOD, 4S organised an awareness-cum-training course for leading apple farmers in the district. As a result, since April 2000, a few farmers in Kholikot and Mahatgaon have started keeping honeybee colonies in their orchards for the first time.

## Survey Findings

### Climate change and its impact on apple productivity

Records from the meteorological station in Chhinalagna, Jumla show that on average the temperature in the valley varies from –12 to 10°C in winter, from 15 to 22°C in spring, and from 25 to 30°C in the summer. It snows between November and February and sometimes in March.

The great majority of farmers (93%) reported experiencing a marked change in climate during the past decade. About 50% of farmers said that it had become warmer and the same number reported less snowfall, one farmer thought the snowfall period had shifted to late winter. Thirteen per cent of farmers said that rainfall had also decreased, and 8% reported unpredictable and untimely rains accompanied by hailstorms.

All except three farmers (95%) considered that the change in climate had had an adverse impact on farming, particularly on apple farming. Two-thirds felt that climate change was contributing to a decline in yield and quality (size, colour, and taste) of apples. The early rise in temperature during the winter months was leading to early flowering of the apple crops, but then the weather suddenly became cold during spring accompanied by an increase in the frequency of hailstorms, which damage both the flowers and the fruits. Moreover, as a result of the increase in temperature the incidence of various diseases and pests was also increasing. Nearly a quarter of the farmers (22%) also considered that the change in climate was having an adverse impact on apple pollination because of more rain during flowering which washed away pollen grains leading to poor pollination of apple flowers.

## Landholdings and land use

The landholding size among the surveyed farmers ranged from 0.1 to 15 ha, but 82% of the farmers had marginal holdings of less than 1 ha and only one farmer owned more than 10 ha (Figure 8.1). The average size of landholding per household was 1.1 ha, of this on average 0.6 ha (55%) was used for basic food crops, 0.1 ha (9%) for cash crops other than apples, and 0.4 ha (36%) for apple farming (Figure 8.2). Apples are an important cash crop for many households in Jumla. All the farmers had apple trees. The main food crops included rice, wheat, maize, barley, buckwheat, and millets such as finger millet and foxtail millet. Cash crops other than apples included potatoes, beans, mustard, and soybeans; and fresh vegetables such as cauliflower, cabbages, tomatoes, onions, garlic, and chillies. One farmer had started growing saffron and another walnuts and peaches (Table 8.1).

## Apple farming

Most of the orchards were small, the average size was 0.4 ha and only 7% of the farmers had apple orchards bigger than 1 ha. In Nepal, apples have not assumed the same importance as a cash crop as in some other countries in the Hindu Kush-Himalayan (HKH) region. This is mainly

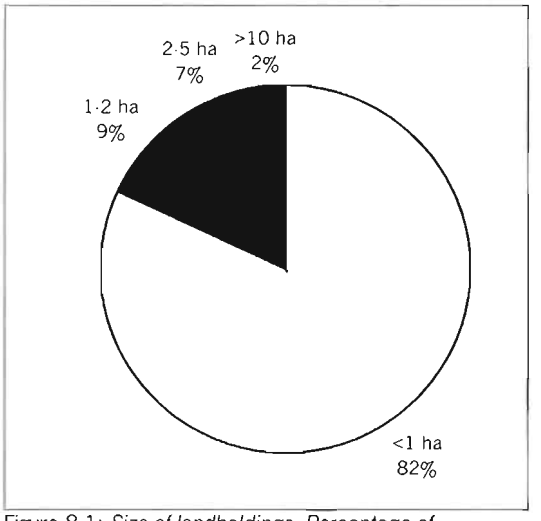


Figure 8.1: *Size of landholdings. Percentage of surveyed farmers owning different amounts of land*

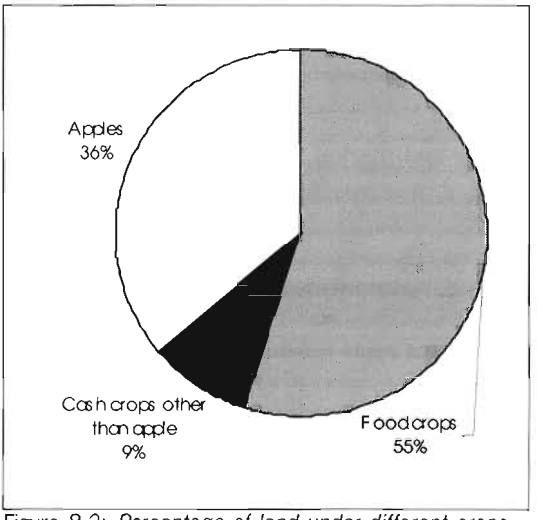


Figure 8.2: *Percentage of land under different crops (surveyed households)*

Table 8.1: **Crops Grown in Jumla Valley**

| Crop | Percentage of responses* |
|---|---|
| **Apples** | 100 |
| **Cash crops other than apples** | |
| Potatoes | 72 |
| Beans | 63 |
| Mustard | 30 |
| Soybeans | 27 |
| Fresh vegetables | 35 |
| **Basic food crops** | |
| Rice, wheat, maize, and barley | 79 |
| Buckwheat | 52 |
| Millets (including finger millet, foxtail millet) | 82 |

*Farmers grew more than one crop

because the best apple growing areas are in remote mountain regions with no road access. Among the farmers interviewed, almost equal numbers reported apples being their main cash crop (38%), one among a number of cash crops (27%), and not very significant as a cash crop (35%). This last group comprised those whose orchards were far away from Jumla Bazaar, for whom the cost of transportation was more than the income earned from selling the apples.

All the farmers had planted Delicious varieties of apples including Royal Delicious, Red Delicious, and Golden Delicious. A few farmers had planted other varieties like Jonathan, Chocolate, Kashmiri, and Mashadi. Most farmers had planted a mixture of varieties in their orchards but only a very few farmers knew about pollinizer varieties and none were clear about the proportion of pollinizers in their orchards. Five farmers (8%) had only one variety in their orchards, and thus no pollinizers, clearly indicating a lack of knowledge about the importance of pollinizers.

## Apple production and sale

Nearly half of the farmers had no clear idea of their total annual apple production; of those who did know, nearly two-thirds were producing between one and five tonnes, only five farmers produced 10 tonnes or more (Table 8.2).

Slightly more than half the interviewed farmers sold their apples in Jumla Bazaar and about a quarter sold them locally in villages. The remainder transported the apples to outside markets including Nepalgunj, Surkhet, and Kathmandu (Table 8.2). The price of apples depended on fruit quality and market place; it was highest in markets outside Jumla and lowest in local villages (Table 8.2). Sometimes in remote villages apples were sold at a piece rate rather than by weight,

Table 8.2: **Apple production and sale (surveyed farmers, percentage of responses)**

| | No. of farmers (%) | Remarks |
|---|---|---|
| **Household apple production** (tonnes) | | |
| <1 | 18 | One farmer produced 20 tonnes, one 12 tonnes, and three others 10 tonnes of apples each |
| 1–2 | 20 | |
| 2–5 | 10 | |
| >5 | 8 | |
| Range | 0.1-20 | |
| No response | 44 | |
| **Markets** | | |
| Outside Jumla (Nepalgunj, Surkhet, and Kathmandu) | 18 | Only farmers producing more than five tonnes, transported and sold apples outside Jumla |
| Jumla Bazaar | 55 | |
| Villages | 27 | |
| **Price** (US$ per kg) | | |
| Outside Jumla District | 0.27 - 0.4 (depending on fruit quality) | Farmers in villages more than six hours' walk from Jumla Bazaar sold their apples in local villages and/or converted them to other products. Farmers kept some apples for home consumption |
| Jumla Bazaar | 0.11 – 0.20 | |
| Local villages | 0.05 – 0.13 | |
| **Home consumption** | | |
| **Trends in apple cultivation** | | |
| Increasing | 100 | Both farmers and government agencies realise the potential for and are promoting apple farming in Jumla Valley. |

221-294 fruits per US$1 depending upon the size of the fruit, and a few farmers also bartered their apples for food grain and beans (barter rate 20 apples for about 4 kg of beans). Three farmers had contracted their standing apple crop at a rate of US$ 0.13 per kg for the estimated total production.

In the remote villages the farmers were unable to sell sizeable quantities of their apple production. Much of the fruit was wasted. Some farmers dried the apples, particularly Delicious varieties, and sold them to trekkers and/or in Jumla Bazaar at a rate of US $6.7 per kg, or in a few cases exported them to other parts of Nepal. Some made apple jam, and others an alcoholic drink called syau ko rakshi (apple brandy), particularly from the sour varieties of apple, which sold at about US$ 0.33 per litre.

Information from a key informant indicated that more than 50% of the total annual apple production in Jumla (some 2,600 tonnes out of 4,600 tonnes) is sold within Jumla District and the remainder sent to lowland markets in Nepal.

## Farmers' understanding of apple pollination

Just over half the surveyed farmers had some awareness about pollination, although no technical knowledge (Table 8.3). They knew that pollination was necessary for the production of fruits and

Table 8.3: **Farmers' awareness about apple pollination and pollinating insects (surveyed farmers, percentage of responses)**

| | Farmers' response (%) | Remarks |
|---|---|---|
| **Farmers aware about pollination** | 55 | Farmers were aware of the need for pollination but had no technical knowledge of how to manage it |
| **Insects observed in orchards** | 75 | About 12% of farmers said they had seen insects in their orchards, but apart from honeybees and bumblebees they were all pests |
| **Types of insects seen on apple flowers*** | | |
| Honeybees | 75 | There is a low use of pesticides in the valley and still large natural populations of insects |
| Bumblebees | 22 | |
| Syrphids | 22 | |
| Butterflies | 25 | |
| Other insects | 30 | |
| **Natural insect pollinators sufficient for apple pollination?** | | |
| Yes | 15 | |
| No | 13 | |
| Don't know | 72 | |
| **Natural insect populations declining?** | | |
| Yes | 35 | |
| No | 10 | |
| Don't know | 55 | |
| **Pollination in own orchard adequate?** | | |
| Yes | 20 | |
| No | 15 | |
| Don't know | 65 | |
| **Factors responsible for inadequate pollination** | | |
| Lack of pollinating insects | 12 | |
| Lack of pollinizer trees | 3 | |
| Don't know | 85 | |

*Individual farmers saw more than one kind of insect on apple flowers

seeds but did not know whether it could be improved or managed. The farmers had learnt about pollination from government extension services, from reading pollination-related literature, from when they were studying in school, from beekeepers, and from Radio Nepal programmes on horticultural crops (Figure 8.3).

Three-quarters of farmers had seen different types of insect pollinators on apple flowers in their orchards including honeybees, bumblebees, syrphid flies, and butterflies. Some had also seen harmful insects (pests). Of those who reported seeing insects, most had seen honeybees and around a quarter each bumblebees, butterflies, flies, and other insects (Table 8.3). Pesticide use is very limited in this remote valley and there is a great diversity and abundance of natural insect pollinators. However, three-quarters of the farmers didn't know whether the populations of natural insects were sufficient for apple pollination, and only 15% thought they were. One-third of farmers thought that the populations of natural insect pollinators were declining, and 55% didn't know (Table 8.3). Most thought pesticides were responsible for the decline (although pesticide use is very limited in Jumla), followed by change in climate, and increasing area under cultivation (Figure 8.4).

Nearly two-thirds of farmers didn't know whether pollination in their orchards was adequate, and only 20% thought it was (Table 8.3). Another 15% thought their crop was not being adequately pollinated because they had noticed a drop in productivity. The great majority had no idea of the reasons for inadequate pollination, a few identified lack of pollinators, and two farmers lack of pollinizers (Table 8.3).

## Beekeeping

Beekeeping in Jumla is a small-scale, income-generating activity where individual farmers keep a few colonies of the indigenous Himalayan hive honeybee (*Apis cerana*) in traditional log hives with minimum management. About 35% of the farmers in the survey kept from 1 to 13 colonies of *Apis cerana* in traditional log hives, but only one kept the bees in his apple orchards at the time of flowering. There are no commercial beekeepers in Jumla; the climate, lack of motorable roads, and overall poor farming, limit the potential for commercial beekeeping in this district.

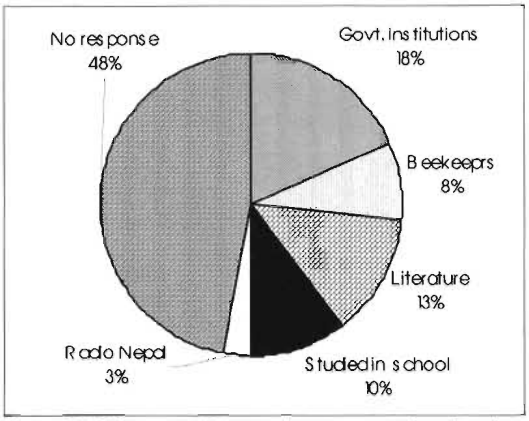


Figure 8.3: *Sources of farmers' awareness about apple pollination (percentage of responses)*

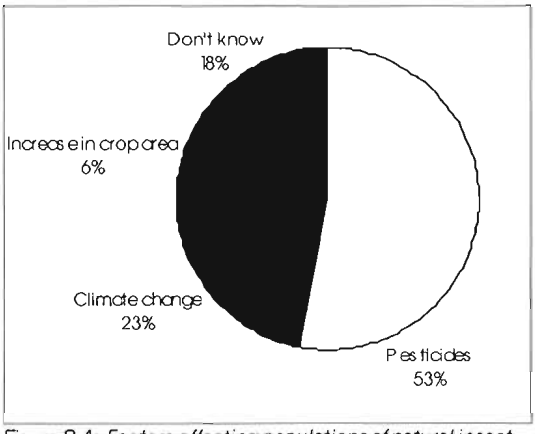


Figure 8.4: *Factors affecting populations of natural insect pollinators (percentage of responses)*

## Pesticide use and its impact on natural insect pollinators

The use of pesticides is summarised in Table 8.4. Only one-third of the farmers used any pesticides in their orchards, in other words most of the apples were produced 'organically'. The commonly used pesticides include metacid, melathion, thiodan, sumithion, and Bordeaux mixture, they were obtained from government stores. The farmers only sprayed once or twice a year and never when the apples were in flower. Only 7% of the farmers sprayed twice, and only one farmer three times. Around half of the farmers thought that pesticides killed natural insects, but mainly harmful insects, and the remainder didn't know.

## Institutional support desired

All except one farmer said they would like to have some form of institutional support towards increasing awareness and training in apple farming (Table 8.5); around a quarter reported that they had already received some form of awareness or training support from NGOs or government agencies. Most wanted training in orchard management, and improved methods of beekeeping, and about half wanted to have support towards increasing awareness and technical knowledge about pollination and the use of honeybees. About 40% of farmers wanted financial support to buy orchard equipment and honeybees and/or for study tours to China, India, and countries in Europe where apples are a main cash crop. Farmers also wanted government agencies and non-government organisations (NGOs) to provide colonies of honeybees for apple pollination. A few farmers wanted horticultural scientists to conduct studies on apple pollination-related issues in Jumla Valley, and some wanted government help to build cold stores to help prevent fruit rotting before it can be transported.

Table 8.4: **Use of pesticides in apple orchards (surveyed farmers, percentage of responses)**

| Parameter | Responses (%) | Remarks |
|---|---|---|
| **Pesticides used in orchards** | | |
| Yes | 33 | |
| No | 67 | |
| **Types of pesticide** | | |
| Metacid | 46 | |
| Melathion, thiodan, or sumithion | 24 | |
| Bordeaux mixture | 30 | |
| **Number of sprays** | 1–2 | Usually once at the beginning of the season and occasionally after fruit set |
| **Source of pesticides** | | Government stores |
| **Do pesticides kill insects?** | | |
| Yes | 52 | Farmers don't spray during flowering |
| Don't know | 48 | |

Table 8.5: **Desired institutional support (percentage of responses)**

| Type of support | Responses (%) | Remarks |
|---|---|---|
| Training in orchard management and beekeeping | 80 | Training in orchard management, improved methods of beekeeping, and pollination management using honeybees |
| Financial support | 40 | Support for study tours to horticulturally advanced countries, to buy farm equipment, and for planting materials |
| Increasing awareness | 65 | Support towards increasing awareness of technical aspects of pollination, including honeybee pollination and the impact of pesticides |

## Summary of Issues

Around half of the farmers in Jumla had almost no knowledge of pollination; many farmers had not even heard the word 'pollination' before 1999. At the same time farmers perceived little need for intervention. Although apple productivity has been lower than expected, farmers have not been particularly concerned because the inaccessibility of the area by road means that there is only a small market for the fruit anyway. Even today many of the apples produced in the villages rot and go to waste due to a lack of proper post-harvest handling and selling, although some produce is dried and much is used for making brandy. Thus increasing productivity has not been a priority concern. For the past two to three years the situation has been changing. In order to promote apples as a cash crop, the government is now providing different kinds of support to apple farmers and trying to encourage farmers to plant more apples. Awareness campaigns by NGOs and improved selling facilities are creating a wider understanding among farmers about the value of apples as a cash crop.

Pollination is probably also less of an issue in Jumla than in other areas of the HKH region. Beekeeping with *Apis cerana* is a common tradition; farmers keep the bees in traditional log hives for honey production. Although the bees are not managed explicitly to pollinate apples, some pollination always takes place because many colonies are kept near apple orchards. Similarly the low levels of pesticide use mean that there are extensive populations of natural insect pollinators. Furthermore, because apple production is less commercially focused, farmers haven't been tempted into planting extensive areas of a single variety. The orchards contained a mixture of trees, and unwittingly most probably have a reasonable number of pollinizers.

Because of the facilities provided by the government, apples are gaining in importance as a cash crop. Slowly farmers are feeling the need to improve productivity, produce more apples, and earn more money. This is the ideal time to promote beekeeping for apple pollination and train more farmers.

### How to promote beekeeping for apple pollination

Beekeeping with *Apis cerana* is a common income-generating tradition in Jumla. Already over 50% of farmers in the district keep colonies of the native bee, *Apis cerana* in traditional log hives for honey production. The need now is to promote the wider use of beekeeping for pollination by raising awareness about its value in apple production, and in particular to promote beekeeping in movable-frame hives so that these hives can be transferred to orchards at the time of apple flowering. This can be done through on-farm research and demonstrations on the effect of honeybee pollination on apple yield and quality. Farmers may also need some training in managing honeybees in improved hives if they are to be used for pollination.