

Postharvest horticulture in Nepal

Introduction

Nepal is a mountainous, small and landlocked country located in the South Asian Region situated in between India and China. Altitude varies from 60m above mean sea level to the highest peak of the world, Mount Everest 8848 meter (amsl). Agricultural cultivated land is 3091000 ha. Out of which approximately 8 percent is under horticultural crops. The country is divided into three physiogeographic zones namely terai an elevation of 60-300 masl; the hills with an elevation of 301-5000 amsl and mountains with an elevation above 5000 amsl, comprising 23 percent, 42 percent and 35 percent of the total land areas respectively. The horticultural crops like mango, banana, papaya, litchi, guava, pineapple, tomato, radish, brinjal, okra, chilli, cauliflower, cabbage, cucurbits, taro, coconut and arecanut are grown successfully in the terai and mid-hills. Altitude from 600 to 1800 amsl are suitable for growing citrus, pear, peach, plum, persimmon, tomato, potato, beans, sweet pepper, carrot, cabbage, cauliflower, radish, turnip, leafy vegetables, coffee and tea. Similarly, apples, walnut, almond, carrot, cauliflower, cabbage, beans and potato are main horticultural crops of the high hills of Nepal. Much progress has been made in the production of fruits and vegetables. Conversely, postharvest losses of these commodities are very high as a result of inappropriate harvesting and handling practices. In Nepal, different studies have shown the postharvest losses of fruits and vegetables are 20-50% (Gautam and Bhattarai, 2012). Perishable natures of most horticultural commodities demand good postharvest technologies and knowledge. Proper postharvest handling is an additional or complementary method of solving food needs. We can feed more people without bringing an additional land under production.

Various studies have conducted to determine the postharvest loss of fruits and vegetables. Postharvest losses have been estimated from 20 to 30% for fresh fruits and vegetables and could exceed 50% under adverse conditions. Losses were reported to vary between 20 and 30% for apple, between 15 and 20% for citrus, between 10 and 15% for tomatoes and between 10 and 15% cauliflower.¹ Losses in vegetables result from harvesting at an improper stage of maturity, direct packing and shipping without the removal of field heat, improper packaging and insufficient grading and sorting, poor transportation and handling and poor storage facilities. Losses in fruits also result from harvesting at an improper stage of maturity, improper methods of harvesting, packaging, transportation and storage. Fruits are generally harvested by shaking trees or by hitting with a stick. The fruit consequently drop with the peduncle and leaves. The majority of losses occur during transportation from the farm yard to the collection centre and thereafter to the wholesale market and retail outlets. Transportation loss of different fruits and vegetables from the border of Nepal to different Indian markets ranged from 15-36% depending on commodity (Table 1).²

Available postharvest handling technologies

Postharvest handling techniques such as harvesting index, harvesting time, method, grading standards and packaging materials have been developed for mandarin, sweet orange, apple and tomato. A number of studies have accomplished on postharvest management of tomato.^{3,4} Manual grading equipment has been developed for mandarin and sweet orange. Crop specific sizes of corrugated

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Dhruba Raj Bhattarai

Horticulture Research Division, Nepal Agricultural Research Council, India

Correspondence: Dhruba Raj Bhattarai, Horticulture Research Division, Nepal Agricultural Research Council, Khumaltar, Lalitpur, Nepal, India, Email raj01dhruba@gmail.com

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cardboard boxes (for apple and mandarin) and plastic trays/crates (for tomato, mandarin) suitable to local conditions are standardized and locally available wrapping/cushion materials are recommended. Government provides 25% subsidy on the price of such materials. However, traditional forms of packaging such as bamboo baskets, wooden boxes and gunny sacks are still widely use.⁵ Various models of solar dryers have been developed by Nepal Agricultural Research Council that are suitable for drying fruits and vegetables in remote and inaccessible area. The dryers are especially useful for the farmers of such areas to make dried apple slices.⁶ Farmers of remote mountain areas cannot sell fresh apple fruits in the market but high value low volume dried slices can be easily transported and fetch better market price. The solar dryers are either plastic or glass covered and available in different sizes. Government and nongovernment organizations like Practical Action are promoting the technology in remote districts of Nepal in subsidized rate.⁷

Table 1 Losses of horticultural products at different stages

Name	Loading, unloading and transportation (%)	Storage (%)	Wholesale & retail market (%)	Total (%)
Fruits	15-Oct	-	20-Oct	20-35
Vegetables	10-May	-	20-Oct	15-30
Potatoes	5	10-May	10-May	15-20

Source: Gautam and Bhattarai, 2012

Fresh vegetables and fruits are stored in zero-energy storage structures. These are constructed using local materials such as brick and sand. The structure is doubled walled with a 4" (10 cm) space between two walls which enclose a central storage space having dimensions of 75 cm x 50 cm x 75 cm. ⁸The sand is kept moist by sprinkling water regularly in order to reduce temperature (7 to 10 °C) and increase humidity. It is covered by a jute matrix which is also kept moist. The cellar store is a warehouse constructed from locally available construction materials such as stone, mud and sand. The temperature within a cellar can be maintained between 4 and 12 °C depending upon season and altitude, while the humidity is maintained between 75 and 90%. Cellars are generally used for the storage of apples and citrus fruits. The techniques of fruit storing in cellar store are standardized for mandarin and apple. Mandarin can be stored for about 3 months and apple for about 6 months in such stores above 1000 m asl. Most of the villages in hills and mountain lack storage facilities which needs external power for storing fruits. For such areas, cellar storage can be a profitable option due to supply season extension by storing the produce in glut season. Due to price

differentials between harvest time and marketing time these ventures are quite profitable and smoothens supply of farm products in local market. Cellar store is based on principles of natural cold storage and do not require electrical energy. A number of technologies have been developed to satisfy demands of the processing sector. These include: dehydration technologies for the production of apple rings and cubes; juicing technologies for the production of concentrates from apples, sweet orange, mango, pineapple, lime, lemon, bael, banana and other fruits; cider and brandy production technology in apple, apricot; pickle, jam, jelly, nectar, candy, sauces production technologies for small and medium scale fruit and vegetable processing enterprises. These technologies are disseminated through trainings and are being widely used by small scale enterprises especially the women groups and cooperatives.⁹

Major problems

Since the country is facing problem of food security, national agendas are concentrated on increasing in productivity. Despite having importance of postharvest loss minimization for increasing food availability, this has not got much attention. The postharvest losses are more in commercial vegetable and fruit production than that of subsistence. Since commercial vegetable production is relatively new enterprise in Nepal, the sector has many existing and emerging challenges as listed below.^{10,11}

- I. Little knowledge of harvesting index to growers and field level technicians
- II. Traditional harvesting techniques adopted from subsistence farming system
- III. Improper handling practices of the products (not consider as live stuff)
- IV. Very little grading and sorting practices
- V. Use of improper packages during transportation
- VI. Rough handling during loading and unloading
- VII. Inappropriate means of transportation
- VIII. Virtually no storage facilities in collection and market centres
- IX. Domination of fair weather road for fruit and vegetable transport.
- X. Unpredictable road blockade and highway traffic interruption

Horticulture marketing in Nepal

In Nepal, the well organized marketing channels did not exist. Marketing of fruits and vegetables are carried out either farmers individually (*Doke*), or through cooperative and selling to the middleman and directly selling to the retailers.

The following three channels are in use for fruits and vegetables supply:

Farmer----->Consumer

Farmer----->Retailer----->Consumer

Farmer----->cooperative/collection centre----->Wholesaler----->Retailer----->Consumer

Farm-gate selling

This is not a prominent market practice. However some farmers

sell their fruits and vegetables to the buyers at the farm-gate. In this mode of marketing buying and selling of fruits and vegetables may be on an individual basis at the farm gate. Buyers go to the farm, usually at the fixed time given by producers or any time without any notice.¹¹

Direct Selling

Some farmers preferably go to sell their products after harvesting by themselves and primary grading assuming that they will get good price for their produce. In this case after harvesting farmers do general grading and bring their produces in bamboo basket (*Doko*) or plastic sacks in the nearby market on foot. In some cases they have permanent buyer in the bazaar (local market) and sometime they visit house to house carrying fresh fruits and vegetables in *Doko*. Farmers travel from door to door to sell their produce, called *Doko* (bamboo basket designed to carry in the back of man/women). This can be time consuming and exhausting. Nowadays some farmers have improved it by using bi-cycle and motorcycle.¹²

Selling to middleman

Direct selling is being abandoned as the volume of produce increased. Farmers also found it time consuming and exhausting. Selling to a middleman is an often adopted strategy by rural and small producers in developing countries including in Nepal. Door-to-door selling also makes price setting difficult because farmers have little information regarding prices being charged by other sellers. In such a case they sell their products to a middleman who is willing to collect products from different producers and sell them to retailer to consumers. This provides employment and income to both producers and the middle person. Irrespective of volume a middleman collects products from producers and after getting considerable volumes he/she sells the collection by bringing it to the retailer's shop at market place. Price is generally negotiated between producers and a middleman. Selling to a middleman is also very common. A middleman collects products from farms far away from peri-urban areas and brings them to the market where demand is high. Most of the fruits and vegetables producers in adopt this strategy to sell their products.

Collective marketing

In other cases the sales are through marketing groups or cooperatives. The farmers in this case bring their produce in the collection center which is managed by farmers marketing management groups or wait for the trader at collection centers (Table 2).

Table 2 Problems/Challenges smallholder farmers faced

Type	Problems/challenges
Market access	Low volume of production and inferior quality
	Inadequate market information and pricing mechanism
	Lack of organized market
Technology & product development	Inadequacy of quality seed and other inputs at production pockets
	Poor access to production and postharvest handling technology at farmers and trader level
	Poor access to processing industry/units
Management & Organization	Low knowledge on management practice, record keeping/ accounting, business planning

Table Continued...

Type	Problems/challenges
	Un organized marketing channels and marketing practices
Access to finance	Groups poor performance due to lack of knowledge and expertise
Infrastructure	Basic infrastructures (postharvest lab and electricity) poorly available Lack of cold storage
Input supply	Lack of quality and quantity inputs at proper time and place
Governance for empowerment	Still women farmers are deprived of income generation activities like fruits & vegetable marketing Poor service delivery from stakeholders

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Conflicts of interest

The author declares there is no conflict of interest.

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