

# Packhouse and Cold-Chain: An Approach for Horticulture Commercialization

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## Abstract

Efforts have been made by the government and other organizations for commercial production of horticultural crop in Nepal. Production of fruits and vegetables has been increased to some extent but the production is not enough to meet the domestic market demand. Despite of great potentiality, farmers are reluctant to establish larger farms as marketing is the problem. There is great potentiality to produce different kinds of fruits and off-season vegetables in hills and mountains. Nepal can become self-sufficient in vegetables and can export fruits and off-season vegetables to neighboring countries. For effective marketing fruits and vegetables should be pre-cooled, sorted, graded and properly packed. Packhouse is necessary to perform all these operations. Packhouse is also an assembling point for small and scattered productions. Packhouse can be small (manually operated) to large (mechanically operated). For fruits, large packhouse are needed. Cold storage is necessary to assemble large quantities, to lower down and maintain low temperature, hold temporarily for bulk marketing and storage. Shelf-life of fruits and vegetables can be prolonged and loss can be minimized at lower temperature. Pre-cooled commodities can be effectively transported in refrigerated vehicle to long distance market. Various packing house operations and a model marketing approach are described in this paper. Until and unless commercial production is linked with market it will not get success. A holistic approach with packhouse and cold-chain facility is the utmost need of nation.

**Keywords:** *Sorting, Grading, Packaging, Curing, Cold chain, Marketing.*

## INTRODUCTION

Various efforts have been made by the government and different INGO's and NGO's to promote horticulture production. Despite of great efforts little progress has been made on production of fruits and vegetables. Production of fruits and vegetables has increased from 575,095 to 1,018,308 M ton and 2,298,689 to 3,749,802 M tons respectively during the year 2006/7-2016/17 (SINA, 2018). Still the large

quantities of fruits and vegetables are imported from India and abroad. Nepal is facing a great challenge to increase production to substitute import and promote export of fruits and vegetables. There is great potentiality to export some fruits and vegetables to China, India and other neighboring countries. Thousands of vegetable collection centers have been established in production areas, but at present situation these collection center are not used by the farmers to assemble their produce. Middle

men and venders reach to the farms and collect produce for market and get margin. In most of the cases the production programs supported by the government and other organizations continue until there is support. Farmers in remote area are reluctant to continue production as because it is difficult for marketing. Most of the fruits and vegetables producers are small and scattered. It is very difficult for them to market their produce. Fruits and vegetables are living, perishable produce for which marketing is very difficult. In appropriate harvesting, packaging, transportation, handling and storage causes postharvest loss in fruits and vegetables. In ordinary transportation weight loss, desiccation, drying and fermentation are common problem. Producers usually sell their produce without trimming, sorting, grading and pre-cooling. Transportation of unnecessary parts of vegetable increase the cost in transportation and ultimately the price of product will be high. Ungraded fruits and vegetables get lower price in the market. It is known fact that hills and mountain is potential for production of fruits and off-season vegetables. How to reach its produce to distance domestic and international market is a big question. Pre-cooling sorting, grading, cold storage and cold chain management are very important for effective marketing. A model packhouse with cold chain has been established by Agro Manag which is an example for effective marketing of apple.

This technology must be replicated in different production pocket for assembled marketing of fruits and vegetables. Various packing house operations and a model marketing approach are described in this paper. Until and unless commercial production is linked with market it will not get success. A holistic approach with packhouse and cold-chain facility is the utmost need of nation.

### Marketing System:

In the existing marketing system there is involvement of middle men. Most of the fruit growers sell their fruits to the middlemen in the tree it-self. Middlemen harvest the fruit and collect in big piles and after that they transport put in crate for marketing. Piling of large quantities results internal damage to the fruits but the middlemen do not care about it. Middlemen took large margins as a result there is great different in farmers price and consumers price. In case of vegetables, middlemen reach to the farmer's field and collet their produce and sell to the market. It is difficult for small producers to get their produce to the market. Establishment of packhouse in production center with pre-cooling and cold storage facility facilitates assembled marketing. Large quantities of quality product can be transported to distance market and involvement of middlemen for assembling produce and be eliminated (Fig 1).

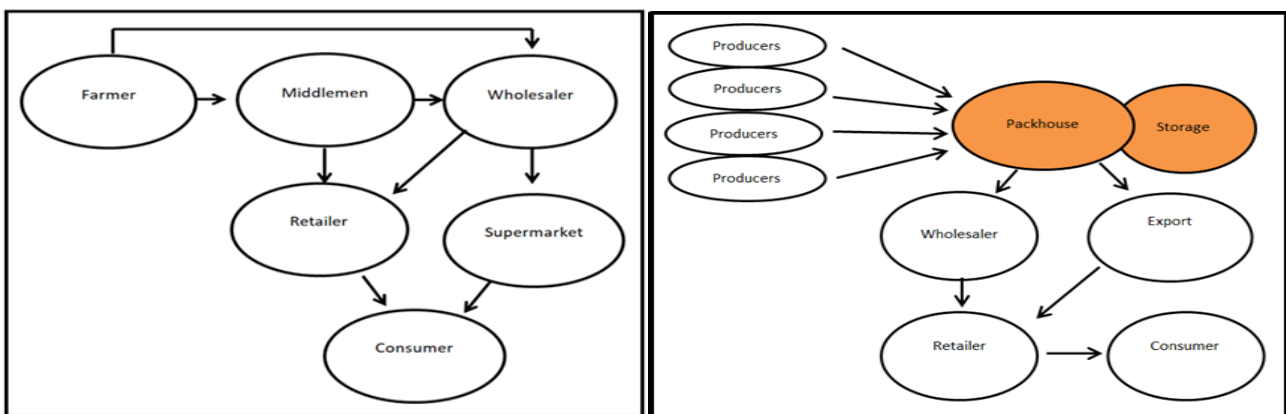


Fig 1. Conventional marketing system (left) and proposed marketing system with the establishment of packhouse (right).

## Packhouse and packhouse operations:

Pack house is a place where different operations are carried out in before storage and transport (Acedo et., al. 2018). Commonly used packhouse operations are washing, cleaning, trimming, sorting, grading, waxing, chemical treatment, pre-cooling, packaging etc. Different kinds of fruits and vegetables require different packhouse operations. Some may require washing and sanitization treatments. A packhouse is necessary for assembling and efficient marketing and it should coordinate with farm and markets. A packhouse should consist, washing and cleaning area, sorting and grading area, sorting, grading and packing table, pre-cooling chamber and cold storage. For local short distance domestic market pre-cooling and cold storage may not be important but for export and distant markets they are necessary. For commercial production of fruits and vegetables packhouse and cold storage facility is very important for effective marketing. Packhouse can be small manually operated to large mechanically operated. For fruits usually large packhouse are required. Vegetable packhouse can be a small simply facilitated with weighing machine, sorting and packing table and space for assembling vegetables.

Various important packhouse operations are described herewith in this paper. Some of the packhouse operations should be done right on the farmer's condition immediately after harvest. Some of the time requiring activities like curing should be done by the producers and not feasible in pack house. Following are the major packhouse operations.

**Trimming:** Trimming is the process of removing undesirable portion. Trimming is necessary in radish and carrots to remove top leaves and small roots. Carrots, radish and turnips are usually marketed for their roots. Foliage portion

utilizes reserve material of root for respiration, enhance water loss and reduces shelf-life and quality. Shelf-life, storability can be increased while transportation and storage cost can be reduced. Similar is the case is with cabbage and cauliflowers. Often cauliflowers and cabbage in Nepal are transported with leaves. A study carried out revealed 30% extra materials in cauliflowers which contributed about 30% high cost for transportation. The costs of transporting unnecessary materials certainly increase the price of transported commodities.

**Sorting and Grading:** Sorting is a practice to remove off size, diseased, damaged and undesired vegetables from the mass whereas grading is a practice to categorize fruits and vegetables in different groups based on size, shape, color, maturity stage, defects and other uniformity. If grading is done on the basis of size, it is called sizing. Different grades can be defined for different vegetables based on market demand. For example potatoes and onions can be graded to large medium and small. Fresh fruits and vegetables can be graded as Grade 1, Grade 2 and ungraded etc.

**Curing:** Curing is the natural process of thickening of periderm layer, healing of wounds in potatoes, sweet potatoes and drying and tightening of outer scale leaves and neck in onion and garlcs. In potatoes curing process starts during maturity and continue after harvest. In immature potato tuber peel is thin and delicate while it is tough, hard and leathery in matured potatoes. Immature potatoes harvested early in the season fetch higher price in the market but they are delicate and cannot be stored longer. Tubers harvested late in the season upon natural drying of haulms have thick skin, partially cured and have better shelf-life. Curing process continues in the harvested potatoes at ambient temperature. High temperature and high humidity is favorable for curing. If potatoes are to be stored in cold storage they should be properly cured before storage otherwise serious

rotting may occur upon removal from storage. It is advised to spread potatoes for about 15-20 days for curing. Onions and garlicks are partially cured in the field by bending their neck (top fall) a week before harvest. It is practiced by using a long bamboo pole or stick. After harvest, spread onions in sun for a day. Remove upper portion by a scissors about 2-2.5 cm above the bulb. Long roots can be trimmed to 1-2 cm. Curing should be done by spreading on the floor for 7-10 days. Cured onions have hard brittle outer skin and tight neck.

**Packaging:** Packaging plays crucial role in marketing of vegetables. Different vegetables are packed in different ways. Plastic crates are the suitable containers for packing tomatoes. Potatoes are packed in jute sacks, onions are packed in netted nylon sacs. Potatoes should be always packed in opaque container to avoid exposure to light. Potato tubers if exposed to light develop greening. Greening of tuber is due to solanine formation. Solanine is harmful to human health. Developing vegetables are metabolically very active and need holes in package for exchange of gases. Anaerobic condition in side package causes fermentation and rotting. Package should protect the commodity and easy for handling. Depending on nature of commodity different size of containers are used. For highly perishable commodities small package should be used. About 20 kg capacity crates are the most useful size. For big size commodities like cauliflowers and cabbage 40 kg capacity crates may be appropriate. Plastic lined perforated CFB boxes are best packaging materials for transportation of fresh fruit vegetables.

**Pre-cooling:** Pre-cooling is a process of cooling produce before transportation/shipment or storage. It is necessary to remove field heat and lower down the temperature. Fruits and vegetables at harvest have higher temperature close to the ambient condition. If vegetables transported or stored without pre-cooling

temperature rises and cause faster deterioration. Principally for every 5.6 °C decrease in temperature of the commodity storage life can be doubled. As early as the temperature of produce is lowered close to the storage temperature shelf-life can be prolonged significantly. Various methods of cooling can be used to lower down the temperature. In the hills and mountains just keeping in open space in shade lowers the temperature. It is slow and takes long time. This method can be practiced for local transportation of vegetables. Mechanized pre-cooling chambers should be used to cool fruits and vegetables before storage and refrigerated transport to long distance markets. Pre-cooling can be done by hydro cooling, vacuum cooling, forced air cooling, icing etc. Rapid cooling is necessary for more perishable commodities.

**Storage:** Storage of fruits and vegetable is important to regulate market supply and refrigerated transport. Long term storage of fresh vegetables in Nepal is not necessary as they can be produced through-out the year within the country. Short term storage is necessary for refrigerated transport and market supply. Fruits and vegetables are perishable commodities and cannot be stored for long duration. Storages should be utilized to assemble these commodities in large quantities to make bulk for transportation. Cold storage is the most common method for fruit and vegetable storage. Modified atmosphere packages can be used further to prolong shelf-life. Different types of fruits and vegetables require different temperature for storage. Temperature requirement of some important fruits and vegetables and possible storage duration is given in the annex.

## **Cold Chain:**

Cold chain is an approach to handle harvested fresh produce at lower temperature. At lower temperature all physiological activities are at lowest rate and commodity remains safe.

After harvest fruits and vegetables should be cooled, stored, transported and again stored in cold condition. At present cold chain does not exist in Nepal but needed in future for effective marketing of fruits vegetables.

Transportation in low temperature is an important operation to maintain the quality of the fresh produce. In conventional practices fruits and vegetables are transported loosely, in trucks and small vehicles without staking. Losses due to pressure and vibration are very high in this system. In modern practice vegetable should be transported by proper staking in side carriers. For long distance transportation vegetables should be pre-cooled and properly stalked in carriers. Refrigerated vehicles are the most appropriate carriers for transporting fresh fruits and vegetables to long distance market. Losses can be minimized and shelf-life prolongs as a result of low temperature.

## CONCLUSION/WAY FORWARD:

Establishment of packhouse, cold storage in commercial fruits and vegetable production centers along with cold chain management is the utmost need to assemble and transport fruits and vegetables.

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