



Food and Agriculture Organization  
of the United Nations

# POST-HARVEST MANAGEMENT OF LETTUCE TO ENSURE QUALITY AND SAFETY

A photograph showing a person's hands holding a large, fresh head of lettuce in a field. The lettuce is vibrant green and appears to be freshly harvested. The background is a blurred field of similar lettuce plants. A yellow rectangular overlay is positioned on the right side of the image, containing the text 'GUIDANCE FOR STAKEHOLDERS IN THE HORTICULTURAL SUPPLY CHAIN'.

GUIDANCE  
FOR STAKEHOLDERS  
IN THE HORTICULTURAL  
SUPPLY CHAIN



# POST- HARVEST MANAGEMENT OF LETTUCE TO ENSURE QUALITY AND SAFETY

GUIDANCE  
FOR STAKEHOLDERS  
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SUPPLY CHAIN

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## Acronyms

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FAO	Food and Agriculture Organization of the United Nations
GMS	Greater Mekong Subregion
PHTRC	Postharvest Horticulture Training and Research Center (the Philippines)
PDR	People's Democratic Republic
RAP	Regional Office for Asia and the Pacific (FAO)
RAS	Rural Advisory Services
SAARC	South Asian Association for Regional Cooperation
TCP	Technical Cooperation Programme
UPLB	University of the Philippines Los Baños

## Introduction

Lettuce (*Lactuca sativa* L.) is a leafy vegetable that is popularly consumed in the Lao People's Democratic Republic (PDR). Lettuce is widely used as an ingredient in salads. Aside from its economic value, lettuce provides a good source of vitamin A and potassium. It also provides some dietary fibre, carbohydrate and protein. With the exception of iceberg lettuce, most varieties also provide a source of vitamin C, calcium, iron, copper, with vitamins and minerals largely found in the leaf.



**Photo 1.** Fully mature lettuce showing desirable quality attributes

## Importance of post-harvest handling

Good post-harvest handling practice is important in maintaining the freshness of lettuce and in assuring its safety as it moves along the marketing chain.

Lettuce is highly susceptible to damage and losses between harvest and consumption. Losses in lettuce result from over-maturity, yellowing of leaves, mechanical damage (torn leaves) and decay (Photo 2). Losses result largely from poor harvesting and rough handling. These losses must be minimised if farmers are to benefit from the production of lettuce for sale.

Attention must be paid to good post-harvesting handling practice to ensure the safety and quality of lettuce for consumers (Photo 1).



**Photo 2.** Lettuce with wilting and yellowing leaves

## Harvest management practices



**Photo 3.** Harvesting lettuce late in the afternoon

It is important to consider the maturity of lettuce, how it is harvested and the time of harvesting to ensure that good quality is maintained during harvesting.

### Harvest maturity

Lettuce is generally harvested when it has attained the desirable size for the market. Farmers use the number of days after transplanting as an objective index of harvest maturity. Based on their experience, leaf lettuce is harvested at 30 to 35 days after transplanting, while head lettuce is harvested 45 days after transplanting.

### Time of harvesting

Lettuce must be harvested at the coolest time of day, either early in the morning or late in the afternoon to minimise wilting and the build-up of field heat (Photo 3). Lettuce should not be harvested very early in the morning when covered with dew or when wet, since the brittle, crisp leaves will break during handling. Decay is also likely to occur under high moisture conditions. If there is a delay when packing, harvested lettuce should be kept under shade.

### Harvesting method

Lettuce must be cut at the base with a harvesting knife (Photo 4). Soil conditions at harvest should be relatively dry to allow the soil to be readily removed from the roots. Old and senescing (yellow) leaves must be trimmed, following which the harvested lettuce must be placed in field containers.

Round plastic baskets (Photo 5a) are not suitable as field containers, since they cannot be properly stacked during transportation, resulting in damage to the lettuce. Similarly, bamboo baskets will damage the leaves, especially when they are over-packed (Photo 5b).



**Photo 4.** Manual harvesting of lettuce



**Photo 5.** Semi-rigid round plastic basket (a) and bamboo baskets (b) used as field containers

## Harvest management practices

Plastic crates are the most suitable field containers (Photo 6) for transportation of harvested lettuce, since they are rigid and can be stacked several layers high without causing any damage to the produce.

Harvesters should observe good personal hygiene during harvesting to avoid contamination of the lettuce.

**Photo 6.**  
*Plastic crates as field containers for lettuce*

GOOD  
PRACTICE



## Post-harvest handling operations



**Photo 7.** A simple packinghouse for lettuce



**Photo 8.** Good quality lettuce



**Photo 9.** Trimming lettuce using a knife (a) and gloves being worn during trimming (b)

Post-harvest operations refer to activities undertaken when lettuce is prepared for the market. Post-harvest operations can take place in the field, at collection centres or in a packinghouse (Photo 7). Post-harvest operations should be carried out in an area that is adequately protected from direct sunlight and rain, and must be kept clean at all times. Animals must be kept out of the packing area. All workers should maintain a high degree of personal hygiene and, where appropriate, should wear suitable protective clothing and a head covering.

### Sorting/grading

Sorting is a necessary operation for the selection of good quality lettuce. The lettuce can be sorted right after harvest or before packing. Good quality lettuce must have fresh, fairly tender, well-trimmed leaves, and must be free from decay, discolouration, foreign material, insects, and damage caused by coarse stalks or other mechanical means (Photo 8).

Sorters should practice good hygiene such as washing their hands before sorting. The sorting table should be properly cleaned and disinfected before and after use to prevent cross-contamination.

### Trimming

Trimming refers to the removal of unwanted parts of the lettuce, and those that are likely to be rejected by consumers. These include unwanted wrapper leaves. Leaves that are starting to turn yellow must be trimmed to increase the marketability of the produce (Photo 9a). A clean knife must be used for trimming.

Likewise, workers should practice good hygiene such as washing their hands before trimming. When trimming it is best to use gloves (Photo 9b) to prevent risk of the lettuce being contaminated.

## Post-harvest handling operations

### Cleaning and washing

Lettuce must be cleaned to remove any dirt and to render the commodity more saleable. Lettuce must be washed in tap water (Photo 10), preferably with a disinfectant added to the wash water such as sodium hypochlorite (bleach). Tap water alone may not eliminate organisms that cause decay, for example bacterial soft rot, and those that cause food spoilage. It is also recommended that the wash water be changed frequently so as to prevent the accumulation of organisms that cause decay.

It is bad practice to wash lettuce in dirty water such as canals or rivers (Photo 11), as this will not meet the objective of cleaning the produce. In fact, washing in dirty water will contribute to contaminating the lettuce and increasing decay. Lettuce contaminated by poor quality water could pose a health risk to the consumer.

### Drying after washing

Drying eliminates excess water from the leaves, which may increase decay. A common practice is to dry the washed lettuce overnight on the ground or cemented floor with or without a plastic sheet underlay. However, this is not a good practice as the washed lettuce will be exposed to contamination. Cemented floors, even with a plastic underlay, can be a source of contamination.

In packinghouses that supply lettuce to institutional markets such as supermarkets, washed lettuce is dried on top of stainless steel tables (Photo 12). For small-scale operations, lettuce can be dried on top of drying racks made of wire mesh. The drying area must be cleaned before and after each use.



**Photo 10.** Clean water is used to wash the lettuce



**Photo 11.** Washing lettuce in dirty water causes decay and microbial contamination



**Photo 12.** Drying and trimming of washed lettuce destined for high-end markets

## Packaging



**Photo 13.** Stackable plastic crates for lettuce



**Photo 14.** Semi-rigid plastic baskets (a and b) and bamboo baskets (c) will not provide adequate protection to the lettuce

Good packaging is essential so as to maintain the quality of the produce during transport and subsequent handling. The basic functions of bulk packaging are to provide adequate protection, contain convenient quantities of produce, and facilitate transportation, handling and distribution.

### Bulk packaging containers

Rigid containers such as plastic crates are highly recommended for the bulk packaging of lettuce since they provide adequate protection against compression damage (Photo 13). Plastic crates have a smooth interior finish and can be easily cleaned. They are also stackable, reusable and returnable. Although more expensive than traditional packaging containers, plastic crates can be used over an extended period of 5 to 6 years. The packaging cost per kilogram of produce is, therefore, relatively less expensive.

Semi-rigid plastic baskets do not provide adequate protection to the produce (Photo 14a and b). Similarly, packing lettuce in bamboo baskets (Photo 14c), or round plastic baskets (Photo 14b) may damage the leaves, especially if over-packed.

## Packaging

### Good practice when using plastic crates

- ✓ **Hygiene** – plastic crates must be thoroughly cleaned with soap/detergent after use (Photo 15). Sanitizers such as sodium hypochlorite reduce the microbial load in a plastic crate.
- ✓ **Handling** – plastic crates must be handled with care during loading, stacking and unloading. They must be used only for their intended purpose and not be used as seats when sorting (Photo 16).
- ✓ **Storage** – plastic crates must be stored in a clean area that will prevent them from becoming infested by insects and rodents. They must be stored separately from chemicals and farm machinery to prevent contamination.
- ✓ Plastic crates for the bulk packaging of fruits and vegetables must not be used as storage containers for chemicals (fertilizers and pesticides).



**Photo 15.** Dirty plastic containers are a source of contamination (a); clean plastic crates after use (b)



**Photo 16.** Bad practice – Using a plastic crate as a seat

## Transport



**Photo 17.** *Wooden horizontal divider in the vehicle*



**Photo 18.** *Wet cloth covering packed lettuce to minimise water loss*

- The main objectives to be met during transportation are to ensure that the lettuce is not damaged or subjected to water loss. Lettuce often undergoes three transport stages, prior to reaching the market: (a) farm to collection centre or packing shed; (b) packing shed to wholesale market; and (c) wholesale market to retail market. Good practice must be followed at each of these stages.
- ✓ Containers filled with lettuce containers must be handled gently; they should not be dropped or thrown onto each other.
- ✓ Horizontal dividers must be installed in the vehicle when using containers such as round plastic baskets or bamboo baskets (Photo 17) to avoid compression damage.
- ✓ Good temperature management is important, especially during hot and dry weather. Water loss that leads to wilting and loss of marketable weight can be prevented by covering the crates of lettuce with a wet cloth when they are transported (Photo 18).
- ✓ Provide space between stacks or piles of produce to allow air to circulate. If a canvas cover is used, provide space for the air to pass through at the bottom and top of the stack; use light coloured material as a cover as this will reflect the heat.
- ✓ Delays can be minimised. Produce can be transferred from one part of the market to another, using four-wheeled hand trolleys (Photo 19) to minimise damage during unloading and transfer of produce packed into plastic crates.

## Transport

✓The transport vehicle must be maintained in a clean and sanitary condition.

Produce safety is compromised when:

- there are decaying remains of produce from the previous shipment;
- insects and rodents are nesting in the vehicles;
- the vehicle is used to store farm implements when not in use.



**Photo 19.** Four-wheeled trolley facilitates transfer of crates of lettuce



## Handling at wholesale and retail markets



**Photo 20.** Lettuce on display in a retail market where poor hygiene and sanitation leads to contamination of the produce



**Photo 21.** Retail display of lettuce without packaging (a) and in retail packs (b)

Wholesale and retail markets serve as outlets for lettuce farmers, collectors and other traders. The following basic rules should be observed:

- Containers from the transport vehicle must be off-loaded under cover or shade and should be handled carefully to minimise mechanical damage.
- The retail area where lettuce is sold must be clean in order to prevent contamination (Photo 20).

Frequent handling of unpackaged lettuce by consumers can result in contamination (Photo 21a). The use of retail packaging, for display and sale, helps prevent contamination and damage to the lettuce that is caused by frequent handling (Photo 21b).

- When retailing in open-air markets and roadside stalls, lettuce should be displayed under shade and must be protected from exposure to sun and rain.

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