



# GUIDE TO **POST-HARVEST ACTIVITIES** FOR **PEPPERS**

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# GUIDE TO **POST-HARVEST ACTIVITIES** FOR **PEPPERS**

Harvest occurs  
when the fruit  
has reached  
**80-90%**  
of its colour

Within **1 hour** of  
harvesting, peppers  
should be removed  
from sunlight and  
warm environment

Peppers are  
best stored at a  
temperature of  
**7°C**;  
lower storage  
temperatures can  
cause damage.



*Pepper is a unique crop because it is harvested and consumed at different stages of maturity. The presence of a large number of different varieties for different purposes also plays a role in the accurate selection and application of postharvest measures, that will reduce losses and maintain the quality of the pepper.*

*This guide is intended for all producers, buyers, traders, and other entities involved in the placement and commerce of sweet peppers intended for fresh consumption.*

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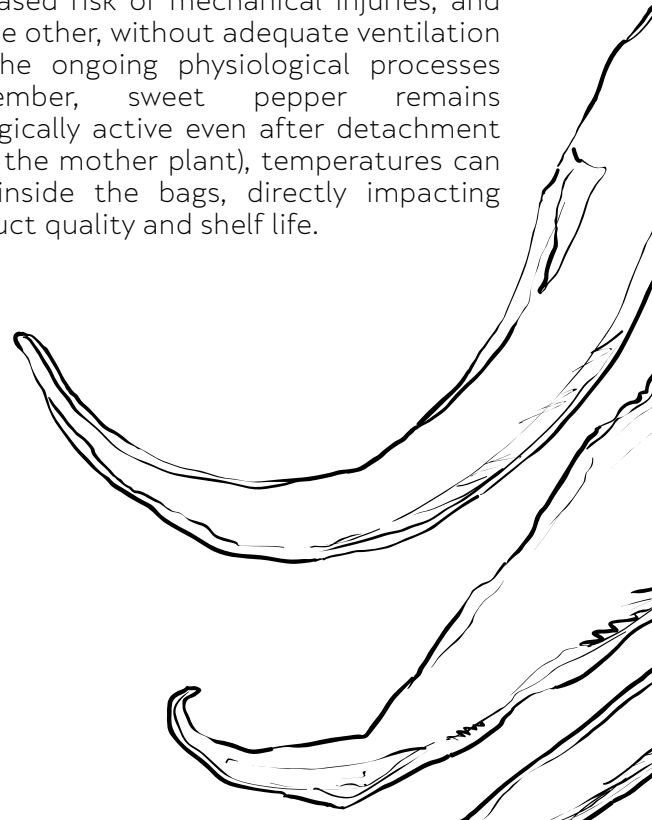
# HARVESTING

The harvesting of sweet peppers is performed manually, by snapping the fruits off together with the the pedicel. The method of harvesting directly affects the quality and shelf life of the sweet peppers. There is a risk of stem breakage and cracking of the pedicel, which, along with possible injuries to the fruit, represents entry points for pathogenic diseases. To avoid damage to the plants and the fruits, it is recommended to use a sharp knife or scissors for harvesting, especially for large fruited varieties. Attention should be paid to the hygiene of the workers, ensuring that they wear gloves. Harvesting tools should be sterilized once a day.

Sweet peppers are harvested in the morning, avoid early harvesting (before dew) when turgor is at its peak, making the fruits prone to easy cracking and damaging if handled carelessly. Harvesting in conditions with high humidity also reduces the storage period. On the other hand, when harvesting in warmer weather, it's crucial to shade the fruits and limit sun exposure to no more than an hour after harvesting. The highest losses at this stage, occur due to harvesting in hot conditions, when the fruit surface is heated, and the workers are rushing and overlook proper fruit handling. Avoid overfilling boxes or crates during transportation to prevent

fruit bruising and cracking.

The use of reusable plastic crates is recommended (**Figure 1**). Simultaneously, thorough cleaning and disinfection of these crates from previous use are essential, allowing for efficient cooling of the harvested fruits. Although employing plastic bags previously used for other products is a common practice, this method carries more risk for the quality of sweet pepper (**Figure 2**). On one hand, there's an increased risk of mechanical injuries, and on the other, without adequate ventilation for the ongoing physiological processes (remember, sweet pepper remains biologically active even after detachment from the mother plant), temperatures can rise inside the bags, directly impacting product quality and shelf life.



Harvest packaging:  
the use of plastic  
crates - suitable  
**(Figure 1)** and the use of  
plastic bags from other  
products - unsuitable  
**(Figure 2)**





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## HARVESTING TIME

Sweet pepper belongs to non-climacteric vegetables, unlike tomatoes, and does not ripen after harvesting. This means that when stored at 12-20°C, the fruits may change colour, but will not reach the required intensity that they would have when harvested at the optimal stage of maturity. Therefore, determining the time of harvest in pepper is essential for successful market placement.

The ripening of the sweet pepper occurs in three stages. The first stage is the immature green (**Figure 3**) when the fruit reaches optimal size for the variety. At this stage, the pericarp is thinner compared to the following stages, and the content of dry matter and aromatic substances is low, resulting in harvested sweet peppers of poor quality and a short shelf life. The next stage is the mature green stage (technological maturity), when the fruits display a green colour (the hue varies by variety), with a smooth and shiny surface (**Figure 3** and **Figure 4**). Then, the colour of the sweet peppers begins to change toward the final phase of ripeness for consumption, turning red with varying intensity and hue depending on the variety (**Figure 3** and **Figure 4**). Colour, as

a maturity criterion, is one of the most important indicators to determine the harvesting time. To achieve and maintain the best quality in the post-harvest period, sweet peppers should be harvested when the fruit has reached 80-90% of its final colour.

Sweet pepper fruits in different stages of ripeness (**Figure 3** – on the plant and **Figure 4** – after harvest)



## DISINFECTION

After harvesting, peppers are cleaned of plant residues, while fruits with mechanical damage, as well as damage caused by pathogenic diseases are removed. In terms of washing, a short-term brushing under a jet of water is used, in which a disinfectant can be applied. Cleaning with prolonged soaking in water is not recommended, as rotting may occur due to excess moisture that can penetrate through small cracks. After washing, the peppers should be dried immediately and not left wet.

**Figure5.**

Sweet  
pepper storage  
with regulated  
temperature  
and relative  
humidity



## STORAGE

The optimal conditions for sweet pepper storage are temperature of 7°C and a relative air humidity of 90-95%, during which the quality is safely maintained for 3-5 weeks (**Figure 5**). Regulating the relative humidity is almost as crucial as controlling the temperature for the length of storage. Decreasing the relative humidity shortens the storage period, resulting in fruit weight loss due to dehydration (Table 1).

**Table 1.** Percentage of daily mass losses of sweet peppers stored under different conditions

| Relative humidity | Temperature |     |      |      |
|-------------------|-------------|-----|------|------|
|                   | 2°C         | 5°C | 10°C | 20°C |
| 60%               | 0,5         | 0,7 | 0,9  | 0,5  |
| 80%               | 0,3         | 0,4 | 0,5  | 0,3  |
| 90%               | 0,2         | 0,2 | 0,3  | 0,2  |
| 100%              | 0           | 0   | 0,1  | 0,2  |

On the other hand, low storage temperatures (< 5°C) can cause freezing injuries and shorten the shelf life. Injuries from exposure to low temperatures manifest as fruit rot occurring over a much shorter period after returning to normal temperatures. Sweet peppers harvested at green (technological) maturity are more susceptible to this type of damage compared to those harvested at full (red) maturity. Storing at higher temperatures accelerates overripening and the appearance of fungal diseases. Another important note is to avoid transporting and storing sweet peppers together with other fruits that emit ethylene, such as melons, pears, and apples.

Regarding transportation, particularly from the field to the processing and storage area, it's advisable to shield the sweet peppers from direct sunlight. Table 2 outlines the losses incurred through various transportation methods.

**Table 2.** Percentage of losses under different transport conditions in sweet peppers

| Distance from the market (km) | 150 | 300 | 450 | 600 | 900 |
|-------------------------------|-----|-----|-----|-----|-----|
| Regular trucks                | 0,5 | 1   | 2   | 3   | 4   |
| Refrigerated trucks           | -   | -   | 0,5 | 1   |     |

## SORTING

The initial sorting starts in the field, immediately after the harvest. When sorting and packing can occur near the production sites, substantial reductions in losses can be achieved. If there are conditions for sorting and packing to be carried out close to the production plots, losses can be significantly reduced. In this process, damaged fruits are removed, and healthy ones are classified according to colour and size (**Figure 6** a and **Figure 7**). Sweet peppers that meet the UNECE standards can be placed on the international markets.

It is important to emphasize that the UNECE standard FFV-28 refers to sweet peppers of the species *Capsicum annuum* L. var. *annuum* intended for fresh consumption, which according to the shape can be elongated, square and flat. <https://unece.org/info/Trade/pub/2431>

The UNECE standard FFV-61 applies to chili peppers from the species *Capsicum annuum*, *C. baccatum*, *C. chinense*, *C. frutescens*, and *C. pubescens* with a minimum pungency level of 900 units on the SHU scale and are strictly intended for fresh consumption. [https://unece.org/sites/default/files/2021-04/ChilliPeppers\\_HighResolution\\_Eng.pdf](https://unece.org/sites/default/files/2021-04/ChilliPeppers_HighResolution_Eng.pdf)

Peppers for processing of the kapiya type, which play a significant role in the production and trade within the region, are not covered by the UNECE standards. Sorting and assessment are commonly carried out by buyers and processors (**Figure 7**).



**Figure 6.**  
Typical sorting  
for green market  
placement



**Figure 7.**  
Sorting  
preparations  
after harvest

To support the production of this type of peppers, the following guidelines taken from the Macedonian rulebook of minimum standards for fruits and vegetables intended for processing may be useful. There, based on quality, peppers for processing are classified into 4 classes: extra, I, II and III combined from I and II.

Pepper for processing of extra class must exhibit excellent quality and originate from the same high-quality variety. The fruits must be well developed, displaying typical varietal characteristics, smooth surface, fleshy, uniform in shape, size, colour, and taste (sweet). They must not have any damage, have a pedicel, be free from impurities and packed in cardboard boxes.

Peppers for processing in Class I must have uniform quality, while the provisions regarding the size are outlined in Table 3.

**Table 3.** Provisions for the size of fruits for processing by class

|                                | Extra | I    | II    | III   |
|--------------------------------|-------|------|-------|-------|
| Number of fruits in kg package | 6     | 10   | 10-15 | 15-20 |
| Fruit size (cm)                | > 12  | > 12 | 10-12 | 8-10  |



**Figure 8.**  
Sorted peppers  
ready for  
processing

Pepper for processing of class II must have well developed fruits, typical of the variety, uniform in both shape and size and without significant defects. Up to 5% of peppers are allowed to have minor mechanical damage or cracks that do not reduce the use value of the product.

Peppers for processing of class III must be with good quality, well-developed fruits, and without defects. This class allows for slight variations in fruit uniformity concerning size and shape, as well as presence of minor mechanical damages. In a unit package, up to 10% of the peppers are allowed to have minor damage.

Peppers for processing can be purchased as a mixed class I and II, with a requirement that a minimum of 50% of the delivered peppers must be Class I.

