



GUIDE TO **POST-HARVEST ACTIVITIES** FOR **TOMATOES**

Author:
Rsch. Assoc. Biljana
Drvoshanova, PhD



Anna Kucherova/Shutterstock.com



GUIDE TO **POST-HARVEST ACTIVITIES** FOR **TOMATOES**

For tomato harvesting, gloves are worn, and the fruits are handled carefully.

The fruits continue to ripen after harvest but harvested immature green fruits do not ripen properly.

Optimal and long-term storage is ensured at a temperature of **10-15°C**.

Tomatoes should not be stored with fruits that produce ethylene (such as apples, melons, bananas, kiwis, etc.) as it significantly shortens the storage period.



This Guide is intended for all producers, buyers, traders and other stakeholders involved in the placement and trade of tomatoes meant for fresh consumption.

The goal is to demonstrate straightforward methods and steps that ought to be applied to minimize losses during the post-harvest period, all the while preserving the freshness and quality of the product from harvest until it is consumed as food.

Author: Rsch. Assoc. Biljana Drvoshanova, PhD

HARVESTING

Harvesting tomatoes should occur in the cooler period of the day (after dew or late afternoon). Care should be taken not to cause unnecessary damage to the plants or harvested fruits. The fruits are picked by gently twisting the stems, which, based on their classification, can be removed later. First-class tomatoes must have a stem; break them at the node. When harvesting large-fruited varieties and trusses of tomatoes, scissors are used. It's required to wear gloves because the fruit has thin skin that is prone to cracking and surface damage (**Figure 1**).

Handle tomatoes with care by avoiding throwing them and instead, arranging them gently in the containers used for harvesting. Any compression (bruising) caused during this phase will result in faster deterioration and spoilage of the fruits, which although not immediately visible, later during storage can adversely affect the healthy fruits they come into contact with. Generally, it is advisable to harvest tomatoes in shallow plastic crates, limiting the arrangement to no more than 3-4 rows to prevent crushing and physical damage (**Figure 2**). The packaging used for harvesting should be robust enough to support stacking crates without causing damage to the tomatoes. During harvesting, conduct regular checks to eliminate damaged fruits, plant remnants, and other debris.



Figure 1. Proper hygienic and sanitary practices during harvesting-



Figure 2.
Harvesting
containers for
greenhouse
tomatoes

When you are done harvesting, it is very important to recognize that open wounds are left on the plant – where each tomato is torn, providing potential entry points for various diseases. Therefore, it is crucial to pay attention to the hygiene of the workers and to sterilize the harvesting equipment if possible. Maintaining hygiene is equally important during other phases like packaging, transportation, and storage.

HARVESTING

Tomato fruits continue to ripen even after harvest. Therefore, determining the moment of harvest is a critical point for maintaining quality in the post-harvest period. It depends on several factors such as market requirements, and the available conditions for transport and storage, that is, the distance to the final destination where the product would be placed.

Tomatoes can be collected at different maturity stages to ensure they reach consumers at full ripeness while maintaining quality and sensory attributes. The literature acknowledges six maturity stages, each influencing subsequent handling and storage methods before sale (**Figure 3**).

1. Stage I - (mature green) when the fruits have reached the size and firmness characteristic of the variety, and in terms of colour, they are green (the shades may vary depending on the variety from light to dark green);
2. Stage II - (breaker) occurs when the green hue gives way to a yellowish tone, and a pink or red tint starts appearing at the fruit's base, covering no more than 10% of its surface;
3. Stage III (turning) – when 10% - 30% of the fruit's surface undergoes a distinct shift from green to yellow, pink, red, or a blend of these hues;
4. Stage IV (pink) – when 30 - 60% of the surface showcases a pink-red or red coloration;
5. Stage V (light red) –when 60 - 90% of the fruit's surface displays a pinkish-red or red tone;
6. Stage VI (ripe red) – signifies fruits with a solid texture and over 90% of the surface exhibiting a red colour.



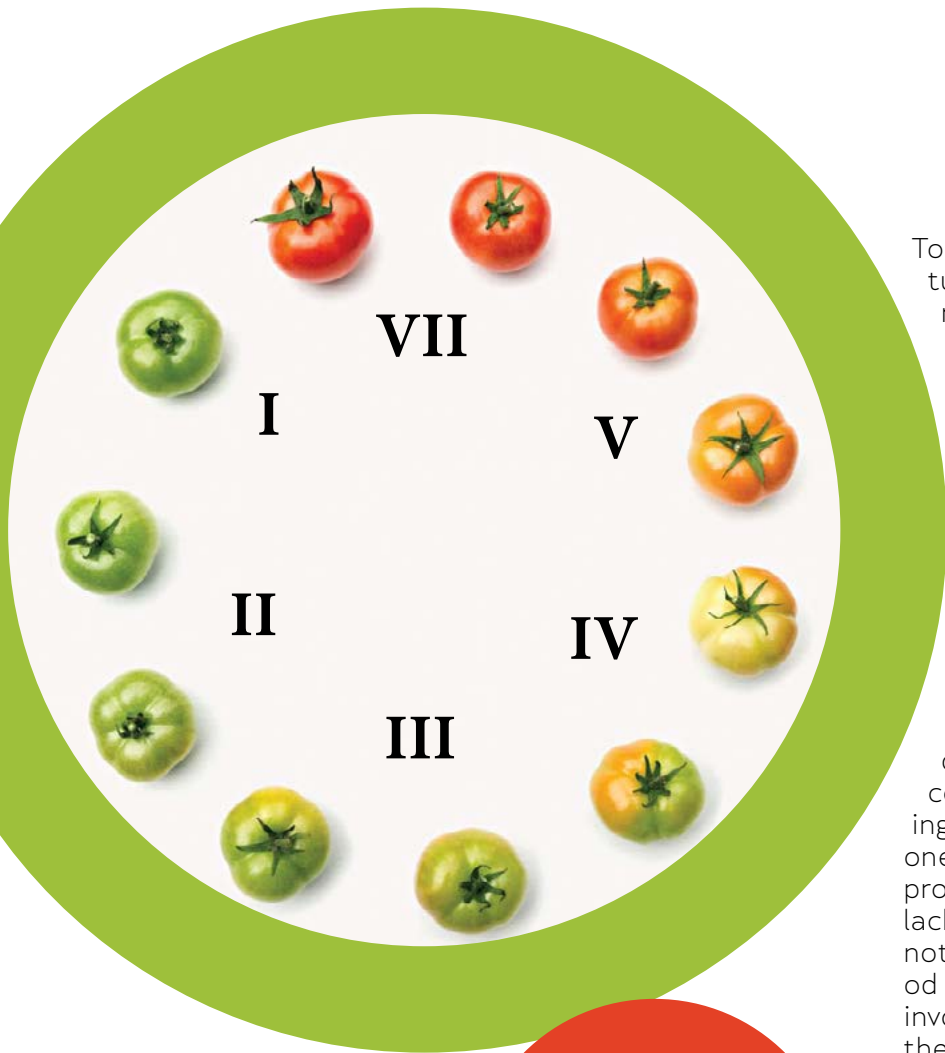


Figure 3.
Color
transitions
throughout all
ripening stages of
tomato

Tomatoes harvested at the mature green stage are meant for markets located further from the production area. The ideal temperature for ripening ranges between 18°C and 21°C, and a relative air humidity of 90-95%. The ripening process can be safely prolonged at a lower temperature (5-16°C), but only at this specific stage of maturity. Ethylene use is permissible, yet it's crucial to avoid its application in later maturity stages. Rather than introducing additional ethylene, a common practice involves placing ripe tomatoes among green ones to stimulate natural ethylene production. Immature green fruits lack proper ripening and should not be harvested. A reliable method for assessing green ripeness involves slicing the fruit in half: if the seeds are white, incompletely formed, without gelatinous substance or internal coloration, the fruit is not ready for harvest. Best quality is maintained when tomatoes are picked at the initial maturity phase. For local markets, tomatoes are harvested at the light red maturity phase.

CLEANING AND DISINFECTION

Maintaining proper hygiene throughout the post-harvest stages is essential to preserve the quality and safety of tomatoes for consumers. In developing countries, the lack of tomato disinfection practices after harvesting significantly contributes to losses during this period. Tomatoes are prone to post-harvest fungal or bacterial diseases that can easily penetrate through minor scratches or cracks in the fruit (**Figure 4**). Consequently, any affected fruits should be promptly removed, while healthy ones should undergo washing and disinfection. Disinfection can be combined with the pre-cooling process after harvest. Hydrocooling serves to lower the fruit's temperature post-after harvest, slowing down respiration and ripening processes.



Figure 4.
Occurrence and
spread of rotting
during storage

To effectively
disinfect tomatoes
post-harvest, merely
using clean water isn't
sufficient. A straightforward
recommendation is to utilize
sodium hypochlorite (5.25%
NaOCl) in a quantity of
300 ml per 100 L of
water.



SORTING

The act of sorting holds significant importance in the packaging and marketing of fresh vegetables. A check-up and elimination of fruits displaying visible surface injuries is done during the sorting. Healthy tomatoes are sorted by size and colour. Meeting UN/ECE standards is imperative for international trade, which is well illustrated in the tomato brochure in cooperation with the OECD (https://read.oecd-ilibrary.org/agriculture-and-food/tomatoes_941fdd50-en-fr). The stipulated standards contain provisions regarding the quality of tomatoes by class (extra, I, and II), sorting by size, tolerances, provisions concerning appearance in terms of uniformity and packaging, as well as labelling requirements.



Figure 5.
Sorted
tomatoes by size
and colour



Methods of
packaging based
on placement:
cardboard packaging
(**Figure 6**) and plastic
packaging (**Figure 7**)



PACKAGING

Tomatoes are packed fresh and clean, without residues of plant protection products, or moisture, and should not be rotten or damaged. Packaging should be executed to prevent any damage or contamination of the tomatoes, but also to protect tomatoes from biological and chemical contaminants. In practice, diverse packaging materials are utilized, and the technique employed in packaging is vital as it can extend the shelf-life after storage. Larger operators may employ techniques like modified atmosphere packaging, smart packaging, etc., where the regulation of conditions is at a higher level.



STORAGE

The tomato has a high moisture content and is therefore difficult to store in ambient conditions for a long period (up to maximum 1 week). Storage temperature is kept lower than the ripening temperature. For long-term storage at a temperature of 10-15°C and a relative humidity of 85-95%, losses are minimal. Storage at a temperature below 10°C is not recommended because it shortens the shelf life and can compromise the quality (resulting in decreased content of dry matter and negative impact on the taste and aroma). Tomatoes at the pink stage can be stored at 10°C for a week, while at the ripe red stage, the temperature can be reduced below 10°C. Ripe tomatoes tolerate lower temperatures, but the storage time is reduced as well as the shelf life after removing from the refrigerator, and such tomatoes should be used quickly.



Figure8.
Tomatoes
stored in
crates

TRANSPORTATION

According to some estimates, approximately 20% of losses during the post-harvest period occur during transport. The reason for that could be the poor road infrastructure. However, what can be paid attention to is a proper stacking of the crates in the vehicles and immobilization of the cargo to reduce the intensity of vibration and movement in the cargo area of the vehicles. Regardless of the length of the transport duration, it is important that the vehicles have good shock absorbers to mitigate shocks during movement. Table 1 shows the losses under various transport conditions.

Table 1. Percentage of losses under different transport conditions in tomatoes.

Distance from the market (km)	150	300	450	600	900
Regular trucks	1	1,5	2	2,6	3,1
Refrigerated trucks	-	0.5	1	1,5	

