



THE HARVEST AND STORAGE TECHNOLOGY FOR PEACHES AND NECTARINES

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The red color of a peach doesn't indicate its ripeness. Ripeness is determined by the change from the basic green color to yellow or cream-white.

Some peach cultivars can be stored for up to 5 weeks, while nectarines can be stored for up to 7 weeks.

Clingstone peach and nectarine cultivars can be stored longer than freestone cultivars.

Peaches can continue ripening after harvest, but it's crucial to accurately determine the harvest timing.

The temperature for storing peach fruits should not be higher than 1.7°C





Peaches (including **nectarines**) are among fruits that don't have a long shelf life, yet with proper timing during harvesting and suitable storage conditions, peaches can be stored for 1-5 weeks, and nectarines for 1-7 weeks. Peaches are classified as climacteric fruits, meaning they can ripen after harvest, but this occurs only when they are picked at their optimal stage of ripeness.

METHODS FOR DETERMINATION OF HARVEST TIMING

Determining the right time to harvest is vital for fruit quality and its endurance during transportation. Peach fruits designated for storage must be picked in an optimal stage of ripeness in order to be able to be stored as long as possible, but also to have a satisfactory quality after storage. If the fruits are not designated for storage or transportation, but for immediate consumption after harvesting, then we conduct the harvesting as close as possible to full maturity, because then the fruits

are the largest, tastier, and more aromatic. Hence, the longer storage is desired, the more essential it becomes to

employ these methods and if fruits get softened, indicating physiological ripeness, they should be sold promptly due to their high sensitivity to handling and storage conditions.

It's crucial to take fruit samples accurately. Optimal sampling typically involves selecting 20 fruits from various sections across the orchard, with one sample representing each cultivar. When employing a partial harvest, the sample is drawn solely from the most vividly colored fruits.

Otherwise, an average sample is taken.

1. Change of the basic skin color of the fruit.

This method is widespread and simple. Harvest begins when the basic green color of the skin starts transition into yellow (in yellow-fleshed cultivars) or white (in white-fleshed cultivars), except for cultivars that retain the green color even when fully ripe, like certain nectarines. However, this method lacks objectivity, hence color charts (codes) are used as aids, like with other fruit species. Keep in mind the over (red) color is not an indication of ripeness, as the fruit can be entirely red without being ripe, or entirely red and still unripe.

2. Fruit mesocarp firmness. To measure the firmness of peach fruit mesocarp, penetrometers are used (Figure 1), with a needle head diameter of 8 mm. Firmness is measured at two points on the widest part of the fruit, on the sunny and opposite sides, after removing a portion of the skin at the point. Other than manual penetrometers, measurement accuracy can be significantly improved using tabletop or automatic penetrometers (Figure 2). For most cultivars, the minimum fruit firmness ranges from 4.5 to 5 kg/cm² (Table 1). If the fruits are designated for longer storage, then the fruit firmness should be 5 - 6 kg/cm²

For early peach and nectarine cultivars, the harvest timing aligns with optimal sales timing, often coinciding with the appearance of the over color. So, if a customer requests delivery, harvesting can occur without taking into consideration the maturity parameters.

At the time of dispatching fruits to the market, they must also possess a minimum firmness and soluble solid content (SSC). The firmness should be a minimum of 3-4.5 kg/cm², and the SSC should be ≥9% for early cultivars, ≥11% for mid-season cultivars, and for late peach and nectarine cultivars. Failing to comply with these standards poses a significant risk of consumer dissatisfaction with the fruit quality!"

3. **Soluble solid content (SSC).** For most peach cultivars, the fruit should have a minimum of 9% soluble solids before harvesting (**Table 1**). Deviations, that is, lower content of SSC, are only permissible in early cultivars that often cannot accumulate high levels of soluble solids. Today, producers have access to both analogue and digital refractometers (Figure 3).

The listed methods for determining the harvest time should be combined for a more secure determination. The more methods we employ, the more confident we can be that the harvested fruits will be capable of longer storage.

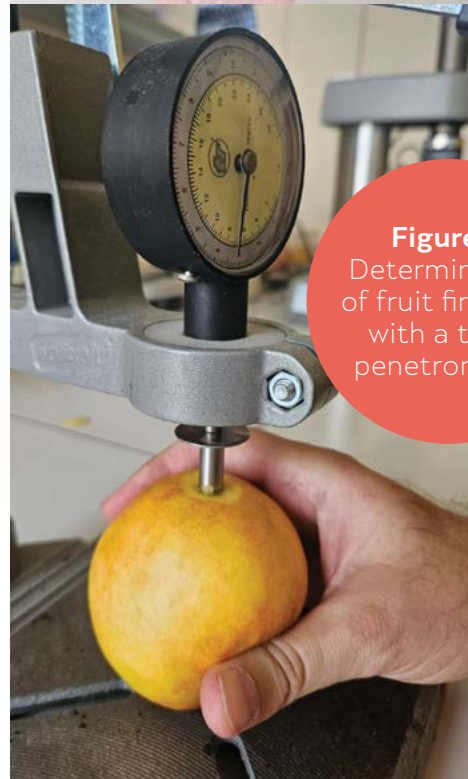


Figure 3
Digital and
analogue (manual)
refractometer

Figure 1
Determination
of fruit firmness
with a manual
penetrometer



Figure 2
Determination
of fruit firmness
with a table
penetrometer



HARVESTING

Peach fruits intended for fresh consumption are handpicked. Harvesting is carried out either directly into packaging for sale or into harvesting containers (**Figure 4**). Pickers should be trained for this task because any mechanical damage, such as bruising by fingers or harming by nails, creates conditions for disease development and fruit spoilage.

It is possible to sort the fruits in the orchard (**Figure 5**), especially if they are to be immediately sent to the market. Throughout the harvesting, picked fruits should be placed in a cool environment.



Figure 4
Harvesting of
fruits in buckets,
i.e. packaging for
harvesting



Figure 5
Sorting of fruits on
the spot

TRANSPORTATION TO THE COLD STORAGE AND SORTING

Peaches should be swiftly moved from the orchard to the warehouse and promptly cooled. Keep in mind that these fruits are harvested during high temperatures and are warmed, stressing the necessity to cool them rapidly. The transport duration from the orchard to storage or packaging should be limited to 6-8 hours. Ensuring protection from direct sunlight is imperative during transportation. While moving bumpy rural paths, the transport must maintain a moderate speed to prevent fruit damage.

If the fruits arriving at the cold storage are intended for quick sale, they can be sorted immediately. It's crucial that within the sorting line, there are no significant drops or changes in speed, as this may lead to mechanical damage to the fruits. It's preferable to use an inspection conveyor rather than an inspection table, as this prevents relative movement of the fruits. It would be beneficial for the inspection conveyor to be made of soft material to minimize mechanical damage. The heights at transfer points, where fruits move from one level to another, should be as minimal as possible.

Without a cold chain (a temperature-controlled supply chain), meaning if peach fruits are transported from the cold storage to the customer without cooling systems in the transport vehicles, then such fruits should not be cooled before the sale because as a result of the condensation on the surface of the fruits and rapid acceleration of respiration, peaches' rate of deterioration will be significant!

OPTIMAL STORAGE CONDITIONS

The peach fruits ripen quickly and then deteriorate, so it's essential to immediately cool them upon arrival at the cold storage. Cooling peach fruits before storage can be done using cold air or cold water. Cooling with cold air, particularly through a "forced air" system, is advisable if planning for longer-term storage, as water cooling might lead to increased rotting of the fruits later in the distribution chain. Pre-cooling is carried out at temperatures of 4-5°C within 8-10 hours of harvest. If the fruits are designated for quick sale, they are temporarily stored at this temperature, sometimes even at around 10°C, then packed for sale, cooled again as they warm up during packing and then transported to the market in vehicles equipped with cooling systems. If the fruits are designated for storage (**Figure 6**), their temperature is further lowered to levels optimal for long-term peach storage.



Figure 6
Peaches in the cooling chamber

Most peach cultivars can be successfully stored at temperatures between -1 to 0°C, with the chamber's relative air humidity maintained at 90-95%. The freezing point, depending on the soluble solid content, ranges from -3 to -1.5°C. Some cultivars show symptoms of a physiological disorder known as internal breakdown after storage. This condition appears in fruits stored at temperatures between 2.2 and 7.6°C. For such cultivars, it's advised to cool them to around 0°C within a maximum of 8 hours.

Peaches can be stored in controlled atmosphere (CA) cold storage facilities. The primary advantages of CA storage during peach storage or transport are maintaining fruit firmness and preserving the fruit's original skin color. It's crucial to establish the CA regime as soon as the peach fruits are placed in the chamber. Guidelines for storing peaches and nectarines are detailed in Table 2. Although earlier mentioned storage durations for peaches and nectarines can reach up to 5 or 7 weeks, a safe storage period without significantly impacting fruit quality is around 15-20 days in regular atmosphere and 25-30 days in controlled atmosphere storage.

The temperature at which we store peach fruits is crucial. Fruits that are rapidly cooled and then kept at temperatures around 0°C typically won't develop internal breakdown, whereas fruits stored at temperatures of 2-7°C will likely develop symptoms of internal breakdown for sure!

Table 2. Storage conditions for yellow-fleshed peach and nectarine in CA (source: Criof)

	Temp (°C)	Rel. humid. (%)	O ₂ %	CO ₂ %
Nectarine	-0,5 – 0,5	90 - 95	1,5 – 2,0	8,0
Peaches	-0,5 – 0,5	90 - 95	1,5 – 2,0	5,0

Apart from storage conditions, the duration of successful peach fruit storage also depends on the cultivar. Among yellow-fleshed peach cultivars, the Maria Marta variety has shown excellent quality, maintaining good fruit quality even after 35 days in storage. Next cultivar is the Symphony (20 days) and the white-fleshed cultivar Maria Marta (20 days). Among nectarine cultivars, Stark Red Gold (35 days) of yellow flesh color and Silver Giant (20 days) of white flesh color have demonstrated excellent storability. For all mentioned cultivars, evaluations were conducted after an additional 3-5 days at room temperature (source: Criof).

Properly harvested and stored fruits, later packed and distributed, in the international market, are subject to the international standards set by the Organization for Economic Co-operation and Development (OECD) for fruits and vegetables. All specific details regarding

the standards related to peaches and nectarines can be found in the brochure available at the following link: <https://www.oecd.org/agriculture/fruit-vegetables/publications/brochures/peaches-and-nectarines-9789264084926-en-fr.htm>

Table. 1. “Indicators of ripeness for individual peach cultivars that are optimal for harvesting.” **(Disciplinari di produzione integrata – norme post raccolta frutticole, 2022)**

Cultivar	Firmness, kg/cm ²	Soluble solids %
Coraline®Monco*	4,5	13,0
Royal Glory®Zaifer*	4,4	10,4
Redhaven	5,4	10,0
Vista Rich®Zainobe*	5,5	11,4
Maria Marta*	5,7	12,6
Grenat®Monafi*	5,1	13,5
Rome Star	4,5	11,2
Benedicte® Meydicte*	3,4	14,4
Suncrest	5,2	9,8
Symphonie	4-4,5	9,5-11,5
Zee Lady*	6,2	11,0
Maria Delizia*	5,2	12,1
Gladys®Zailati*	5,0	15,3

* *Freestone peach cultivars*

Table. 2. Indicators of ripeness for individual nectarine cultivars that are optimal for harvesting **(Disciplinari di produzione integrata – norme post raccolta frutticole, 2022)**

Cultivar	Firmness, kg/cm ²	Soluble solids %
Big Bang® - Maillara*	5,6	10,2
Jade Momée*	4,0	11,5
Big Top Zaitabo*	4-4,5	10,5-12,0
Alitop*	7,0	12,0
Diamond Ray*	6,5	12,8
Maria Anna*	6,7	16,4
Stark Red Gold	4-4,5	11,0-12,0
Nectaross	5,4	11,7
Alma*	6,6	14,3
Venus	4,0	11,9
Orion*	4,8	13,0
Zephir Monphir*	5,0	12,6
Morsiani 60®	5,6	13,0
Red Fair® - Zaifane	6,3	13,9
Max AM7	4,4	14,4
Alexa®	6,3	12,2

* *Freestone peach cultivars*

