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DEPARTMENT OF FOOD TECHNOLOGY

19FTT305-FRUIT AND VEGETABLE TECHNOLOGY

UNIT 2 – POST HARVEST PROCESSING AND STORAGE

HARVESTING OF FRUITS AND VEGETABLES

There are many different ways in which fruits and vegetables are harvested.

The harvesting method depends on the crop, how it is grown and the resources available.

For example, if it is a crop where there is machinery available to do or to help with the harvesting, those methods can only be utilized if the grower or harvesting company can afford to use that machinery to get the crops harvested.

Below, the outlined common harvesting methods of fruits and vegetables, and included examples based on the footage I have been able to gather at different harvests.

Harvesting Methods

In general, these are the three different harvesting methods that take place when harvesting fruits and vegetables:

1.Hand Harvesting

2.Harvesting with Hand Tools

3.Harvesting with Machinery

However, it is important to note that it is hard to categorize the different types of harvesting because there can be some overlap.

1. Hand Harvesting

- Hand harvesting is just that: produce is harvested by hand, without the use of any tools.
- When hand harvesting, it is typically done using a picking cart or some sort of container.
- A common example of a hand harvest with a picking cart is a strawberry harvest.
- While, an example of a hand harvest using containers is the hand harvesting carrot operation you have seen previously on the blog. (There are two different types of carrot harvest that can be done: hand harvest for the fresh market or machine harvest for carrots that go on to be processed in to baby carrots or something of that sort.)

2. Harvesting with Hand Tools

- This harvesting method is typically carried out when harvesting tree fruit, where some sort of clipper (usually specialized for the type of produce being harvested) is used to remove the fruit from the tree, and then the fruit is placed into harvesting containers.
- Once the harvesting containers are full, the harvested product is transferred to larger bins in the field, of which those are then transported to the facility.
- Some examples include the harvesting of fresh figs, peaches, and Cuties.
- Although this is very common in the harvesting of tree fruit, it does also occur for other produce items, such as onion (the non-machine harvesting operation), garlic and row crops

3.Harvesting with Machinery

- There are a lot of different harvesting types that land under this category. There are operations that perform hand harvesting and harvesting with hand tools that also use harvesting machinery (e.g., harvesting rig) to aid in the overall harvesting and packing process.
- But, there are also harvesting operations that use the harvesting rigs to perform further “semi-processing activities” or postharvest washing. Then, there are also harvesting mowing machines and combines.
- All of these harvesting types serve a specific purpose, based on the type of produce being harvested, and considering the amount of investment that goes into the machinery, it needs to make sense.

Harvesting Using a Harvesting Rig

• Commonly, the produce items are either hand harvested or harvested using tools and then passed on to the workers working on the harvesting rigs, where the product can be packed; washed and packed; trimmed, washed and packed; etc.

•The harvesting rigs serve as an aid in the packing process and then once the product is packed, or prepared for the processor, it is transported (typically via a conveyor belt) over to an adjacent trailer that is responsible for transporting the product out of the field.

• Some examples of this include the harvesting of cauliflower, cantaloupe, and romaine hearts (this is an example of semi-processing activities in the field).

- **Harvesting Using a Mower** – The mower harvests have been perfected to rely heavily on the mowers and not so much on actual workers.

- There is the mower, with a few workers on it or at least one driving it and then an adjacent trailer to capture the harvested product.

- Some examples include the harvesting of spring mix and basil. Another form of a mower that you have seen is as part of the 3-step almond harvesting process (which also includes a sweeping and shaking machine)

Chemical Changes During Fruit Ripening

Fruit ripening involves a series of biochemical and chemical processes that convert the fruit from an immature state to a mature one, making it palatable and nutritious. These changes are critical for fruit to develop its characteristic flavors, textures, colors, and aromas.

Here are the primary chemical changes during fruit ripening:

Starch to Sugars Conversion:

In many fruits, starches (complex carbohydrates) are broken down into simple sugars like glucose, fructose, and sucrose. This transformation contributes to the sweetness of ripe fruit. This process is facilitated by enzymes like amylases.

Acidity Reduction:

During ripening, organic acids such as citric acid, malic acid, and tartaric acid decrease, resulting in a less acidic taste. This reduction is due to the breakdown of acids by enzymes and the synthesis of neutral compounds.

•**Ethylene Production**:

•Ethylene is a natural plant hormone that plays a central role in fruit ripening. It accelerates many processes such as the conversion of starch to sugar, the breakdown of chlorophyll, and the softening of the fruit. Some fruits are classified as "climacteric," meaning they release large amounts of ethylene as they ripen (e.g., bananas, tomatoes), while others are "non-climacteric" (e.g., grapes, citrus fruits).

•**Chlorophyll Breakdown**:

•Chlorophyll, the green pigment in fruits, is broken down during ripening, leading to the development of yellow, red, and orange pigments (carotenoids and anthocyanins). This gives fruits like bananas, tomatoes, and apples their characteristic colors when ripe.

•**Cell Wall Softening**:

•The fruit becomes softer due to the breakdown of pectin, cellulose, and hemicellulose in the cell walls. This process is facilitated by enzymes like pectinase and cellulase. Softening is crucial for making fruits like peaches and pears enjoyable to eat.

•**Flavor Development**:

New compounds are formed, and the profile of volatile compounds changes, giving rise to the characteristic aromas and flavors of ripe fruits. These include esters, aldehydes, alcohols, and terpenes.

•**Vitamin Synthesis and Changes**:

•The concentration of vitamins, particularly Vitamin C (ascorbic acid), can change during ripening. While some fruits, like tomatoes, increase their vitamin content as they ripen, others may lose vitamin C as the fruit matures.

Natural Ripening: METHODS OF RIPENING

•**On the Plant**: Most fruits ripen naturally while still on the plant. The plant's environment, temperature, humidity, and light exposure influence the speed and uniformity of ripening.

•**Post-Harvest Ripening**: Some fruits, like bananas and avocados, are harvested when still unripe and are allowed to ripen off the plant.

Controlled Atmosphere (CA) Ripening:

•This method involves controlling the oxygen, carbon dioxide, and humidity levels in the storage environment. By reducing oxygen and increasing carbon dioxide, the respiration rate of the fruit slows down, extending its shelf life and preventing premature ripening.

Ethylene Gas Treatment:

- This method involves exposing fruits to ethylene gas, a plant hormone that accelerates ripening. This technique is commonly used for fruits like bananas, tomatoes, and avocados in commercial settings. The gas can be released naturally or artificially through ripening chambers.

Hot Water Treatment:

•Fruits like mangoes and tomatoes can be exposed to warm water (usually between 40–50°C) to accelerate ripening, especially in places with limited climate control.

Storage in Ripening Chambers:

•Commercial ripening chambers are used for controlled ripening processes. These chambers control temperature, humidity, and ethylene gas concentrations to achieve uniform ripening.

Use of Ripening Agents:

•Chemical ripening agents such as calcium carbide (often used in countries with less controlled storage environments) can be used to release acetylene gas, a compound that accelerates ripening. However, the use of carbide in ripening is controversial due to potential health hazards and regulatory issues.

Regulations Regarding Fruit Ripening

Various regulations are in place to ensure the safe and ethical ripening of fruits, particularly concerning the use of artificial ripening agents. These regulations often vary by country or region. Some common rules include:

1. **Banning the Use of Harmful Ripening Agents**:
    1. In many countries, the use of certain chemicals, like calcium carbide, is banned or strictly regulated. For example, the use of carbide for ripening is prohibited in the European Union, the United States, and many other countries due to health concerns.
2. **Ethylene Gas Standards**:
    1. Where the use of ethylene gas is allowed, there are specific guidelines on its safe application. These guidelines ensure that the exposure levels and duration of ethylene treatment are controlled to prevent fruit damage or over-ripening.

Quality Control and Inspection:

•Many countries have quality control standards for the ripening process, especially for export. Inspection systems ensure that fruits are ripened properly and meet safety and quality standards before reaching consumers.

Certification and Labeling:

•Some countries require that fruits treated with artificial ripening agents be labeled to inform consumers about the treatment. This is part of the move toward transparency and consumer rights in food safety.

Import/Export Regulations:

•Countries regulate the import and export of ripened fruits to prevent the spread of diseases and pests. For example, fruits that are artificially ripened might be subject to additional inspection or quarantine protocols.