GreenariA
Go Green, Learn Green
An Agricultural Monthly e-Magazine
Volume 02, Issue 05, 2024
e- ISSN: 2584-153X
Article ID: G-24-0513

FRUITS RESPIRATION

Asmiya R [1*] and C Venkatesh [2]

[1]B.Sc. (Hons.) Agriculture, III Year, J. K. K. Munirajah College of Agricultural Science,

[2]Assistant Professor, Department of Horticulture, J. K. K. Munirajah College of Agricultural Science, T. N. Palayam, Gobi, Erode-638 506

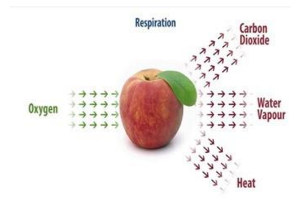
***e-mail:** asmiyarajayan@gmail.com

INTRODUCTION

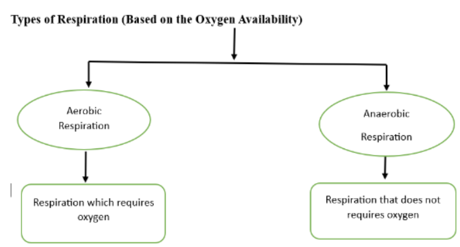
Respiration is the primary mechanism that regulates the shelf life of fruits. Fruit quality is determined by respiration. Postharvest handling of fruits has gained attention due to the unfavorable conditions leading to significant annual fruit loss. Fruits are still alive after harvest and continue to breathe. Respiration, a physiological function, affects postharvest behavior, shelf life, and quality. Even after harvesting, fruits continue to breathe, which causes a variety of biochemical alterations that impact their flavor, texture, scent, and nutritional value. Fruit respiration is crucial in the food industry's postharvest handling, storage, transportation, and marketing plans. When the vapor encounters unripe fruits, it can affect their respiration rate and, in turn, their quality.

RESPIRATION

A constant source of energy is necessary for all living things. Biochemical processes require energy to function. Through a chemical reaction involving the transfer of electrons, respiration is the process by which cells release energy to make ATP from organic substances. The ATP molecules serve as an energy source for the cell. Fruits maintain their life by an internal process called respiration. Reduced respiration lowers ATP synthesis, which in turn leaves less energy available for the biochemical ripening process. It is believed that breathing is both an anabolic and a catabolic activity. Cellular respiration is a necessary process for the production of energy. Within the cell's mitochondrion, respiration takes place. In aerobic respiration, the last acceptor is oxygen (O2).



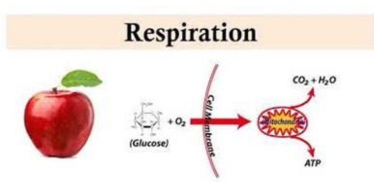
TYPES OF RESPIRATION (BASED ON THE OXYGEN AVAILABILITY)



Aerobic respiration

Aerobic respiration is required for the ripening process and the growth of excellent fruit. Fruits use aerobic respiration, in which oxygen (O2) is used to break down most of the substrates into carbon dioxide (CO2), water (H2O), and energy. In aerobic respiration, substrates such as lipids, carbohydrates, and organic acids are utilized. Glucose is the preferred component for respiration. After being transformed into glucose, the other substrates are still utilized for respiration. It involves the oxidation of several organic substances (maleic acid, glucose). We refer to the oxidized molecules as respiratory substrates. The three phases of aerobic respiration are the Electron Transport Chain, the Kerbs or Tri-carboxylic Acid Cycle, and Glycolysis or EMP (Embden-Meyerhoff-Parnas) pathway.

The six-carbon sugar glucose is oxidized to produce two molecules of three-carbon pyruvate during glycolysis. Pyruvate is oxidized in the Kerbs cycle to yield reduced electron carriers and carbon dioxide (CO2). Water (H2O) is produced in the Electron Transport Chain when the proton (H+) stimulates the synthesis of additional ATP and transfers electrons to oxygen (O2). Since 60% of energy is lost as heat during respiration, it is an exothermic process. The fruit's temperature rises due to the heat of respiration, which is caused by post-harvest dissipation of heat loss and decreased ATP synthesis. This is the main factor to be taken into account when planning the storage of horticultural crops.



Anaerobic respiration

Fruits undergo fermentation, commonly referred to as anaerobic respiration, when oxygen (O2) is absent. Anaerobic respiration generates less energy. The same substrates—carbohydrates, lipids, and organic acids—are utilized, but the process yields ethanol, which is the precursor to carbon dioxide (CO2). Increased fermentation leads to physiological diseases such as necrosis, discolored tissues, off-colors, off-flavors, etc. The term "extinction point" refers to the oxygen (O2) concentration at which anaerobic respiration begins.

Change in the Quality of Fruit Due to Respiration

It is critical for fruit ripening and development, as well as fruit quality. It maintains the physiological process that causes softening, fragrance development, and astringent loss. The color, taste, perfume, and ripening of fruits are all determined by their continual aerobic respiration. High respiration causes the loss of sugar and other components, which reduces the weight and quality of the fruit.

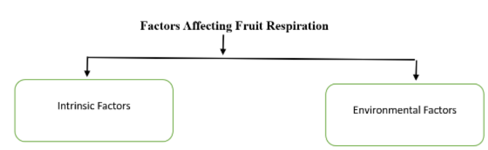
Measuring Fruit Respiration

Fruit respiration is determined by evaluating the oxygen and carbon dioxide levels in the environment of the storage room, storage container, or MAP (Modified Atmospheric Packaging) packaging. The Felix instrument is used to determine gas precision for non-destructive, real-time oxygen and carbon dioxide measurements. The gas analyzer measures O2 using electrochemical sensors and CO2 with pyroelectric and infrared sensors.

Factors Affecting Fruit Respiration

The components must be managed to maintain the optimal rate of fruit respiration. The elements are internal and environmental.

Factors Affecting Fruit Respiration



1. **Fruit Type:** Commodity type and cultivars influence preharvest and postharvest respiration rate.

2. **Maturity Stage:** Respiration increases as the fruit matures. More mature fruits show higher respiration rate.
3. **Size:** Small sized fruit have higher respiration rate than the medium or larger fruits.
4. **Age/ Storage Time:** When the age of fruit increases the fruit begins to ripe and the respiration rate also increases.
5. **Microbial Infection:** Both climacteric and non-climacteric fruit experiences higher respiration rate during long term storage due to microbial infection.
6. **Wounding:** Any wound or any damage to the fruit during harvest or storage or transport causes fruit stress and triggers the ethylene formation that increases the respiration rate.

Environmental Factors

1. **Temperature:** In high temperature the enzymes involved in respiration break down. The temperature is low due to the physiological injury.
2. **Oxygen Levels:** If the oxygen level decreases the respiration slows down. Respiration rate below zero (0) is not recommended.
3. **Carbon dioxide level:** High rate of CO_2 is not desirable.

CONCLUSION

The process of respiration includes the breakdown of the complex substrate to produce energy and a usable carbon skeleton. A good measure of metallic activity is respiration rate. Any fruit's main goal is to prolong its shelf life and preserve it. Both internal and external variables influence respiration. The rate of respiration varies due to the phase of development. In the postharvest stages, excessive fruit respiration is detrimental. One of the main factors that affects fruit shelf life and quality is fruit respiration. Organic molecules must be broken throughout respiration.