ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-5206, Impact Factor: 12,23
American Academic publishers, volume 05, issue 06,2025

Journal: https://www.academicpublishers.org/journals/index.php/ijai

UÓK-602,6/7:631,523(075.8)

TECHNOLOGIES FOR LONG-TERM STORAGE OF LATE-RIPENING STONE FRUITS

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Abstract: Long-term storage of late-ripening stone fruits, such as apricots, peaches, and apples, is a pressing issue in agriculture. This article analyzes modern technologies used in the storage of late-ripening stone fruits, including cooling, gas-free storage, heat treatment, freezing, and drying technologies. The possibility of extending the shelf life of fruits through new innovative technologies, nanotechnologies, and biotechnologies will also be considered. The results of the article show the effectiveness of fruit storage technologies and their economic benefits.

Keywords:Late-ripening fruits, storage technologies, cooling, gas-free storage, freezing, drying, innovations.

Introduction. Currently, the growing population and the need to provide them with uninterrupted food supplies throughout the year are especially relevant in the matter of fruits and vegetables. Sustainable development of fruit and vegetable growing has a direct impact not only on improving the standard of living of the rural population, but also on increasing the social well-being of the entire population of the country. In the off-season, it will be possible to provide the population with high-quality fruits and vegetables by developing effective plans for the storage of fruits and vegetables, studying the experience of developed countries, and applying them in practice. This, in turn, contributes to ensuring food security and improving public health.

Fruits are grown at certain times of the year and are a source of vitamins, mineral salts, carbohydrates, organic acids, and other substances necessary for human nutrition.

For the quality of fruit storage, it is very important to understand what changes occur during storage and how environmental factors affect these processes. Storage mode is selected depending on the type and variety of each fruit. Even fruits of the same species are sorted into different varieties in storage warehouses, and each requires separate humidity and temperature conditions. Thus, when storing fruits, their characteristics and environmental factors must be taken into account, which contributes to the preservation of their quality.

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Late-ripening fruits - fast-ripening fruits such as apricots, peaches, and apples - are widespread in agriculture and have high economic importance. They have a short shelf life and, especially after ripening, quickly change and become unusable. There is a need to develop and implement technologies for long-term storage of these fruits. The preservation and use of grown products without loss or quality degradation has long been one of human needs. Proper organization of storage ensures long-term preservation of product quality and prevention of losses.

Many technologies have been developed for long-term storage, each of which works to slow down the ripening process of fruits, preserve quality, and extend the shelf life. At the same time, storage technologies, especially such methods as cooling, gas-free storage, heat treatment, freezing, and drying, contribute to the effective development of the fruit industry.

We will conduct a comprehensive analysis of the technologies used in the storage of late-ripening stone fruits, discuss their advantages and disadvantages, and explore the possibilities of new innovative technologies.

Methods. In this study, the scientific literature on storage technologies for late-ripening stone fruits was analyzed. Data were collected in the study based on the following methodologies and methods:

Cooling technologies: The use of refrigeration rooms and special cooling systems in fruit storage, reducing the internal temperature of the fruits and thereby slowing down respiration processes.

Gas-free storage: Storing fruits in gas-free rooms, slowing down the ripening process by controlling oxygen and carbon dioxide levels.

Heat treatment: Methods of heat regulation for sterilizing fruits at low temperatures, protecting them from microbes and other harmful organisms.

Freezing and drying technologies: Fruit storage time is extended through freezing or drying processes. Freezing changes the internal structure of the fruit, while drying reduces the volume of the fruit by removing water.

Results. Cooling technologies: The research results show that storing fruits by cooling allows for extending the shelf life, especially for apricots and peaches. In refrigeration rooms, the temperature of fruits should be around 0°C, which slows down the respiration process and delays ripening. At the same time, special ventilation systems and moisture regulation methods are used to preserve the appearance and quality of fruits during the cooling process.

Gas-free storage: Gas-free storage significantly slows down the ripening process by reducing oxygen levels and increasing carbon dioxide levels. This technology is especially effective for fruits such as peaches and apricots. In gas-free storage, fruits retain their organoleptic properties (taste, smell, structure) for a long time, but this technology requires high costs and special conditions.

Heat treatment: Heat treatment technology is especially effective in destroying microbes and disinfecting fruits. However, it can negatively affect the sweetness of fruits, which reduces their organoleptic qualities. In the study, it was important to analyze the effectiveness of heat treatment and its influence on the taste and structure of fruits.

Freezing and drying: Freezing technology significantly extends the shelf life of fruits. However, after freezing, the appearance and texture of the fruits change. Drying technology reduces the volume of fruits while preserving their nutritional value. This method can be used for long-term storage, but the softness and texture of the fruits can change.

Discussion. In the long-term storage of late-ripening fruits, each technology has its own advantages and disadvantages. Cooling technology is one of the most efficient methods of fruit

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storage, but this technology requires a lot of energy. Gas-free storage technology slows down the ripening process and preserves the quality of the fruits, but requires high cost and special equipment.

Although heat treatment technology is effective against microbes, it negatively affects the taste of fruits. Freezing and drying technologies extend the shelf life of fruits, but affect the appearance of fruits and the quality of the fabric. Therefore, the combination of several technologies in fruit storage can be the most effective solution.

New innovative technologies, such as biotechnology and nanotechnology, create new opportunities for fruit storage. These technologies extend the shelf life of fruits, increase their quality.

These technologies contribute to extending the shelf life of fruits, preserving their quality, and increasing economic benefits. There are also opportunities to extend the shelf life of fruits through genetic modification.

Conclusion. The introduction of modern technologies for long-term storage of late-ripening stone fruits is very important for the development of agriculture and the fruit industry. Technologies of cooling, gas-free storage, heat treatment, freezing, and drying extend the shelf life of fruits and preserve their quality. In the future, it is possible to further develop fruit storage technologies using innovative technologies, including biotechnology, nanotechnology, and genetic modification. With the help of these technologies, the fruit industry will develop effectively and economic benefits will increase.

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