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Organizing the Storage of Grape Products

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Annotation: This article discusses one of the most important fruits for your Republic today, not only in the domestic market, but also in the export sector. The main task in preserving grapes is to preserve their physical and chemical composition, that is, their appearance, texture, taste, and nutritional value. The article presents a detailed study of the biological and physiological processes involved in preserving grapes and information on the factors affecting product quality indicators.

Keywords: Grape varieties, hardness, dimensions, biological and physiological, storage, shelf life, processes, quality indicators, harvesting.

Introduction. Increasing the efficiency of the agro-industrial complex of Uzbekistan, dramatically improving the provision of the population with high-quality and safe food products, and creating opportunities for its sustainability are the most important issues of our time. In particular, it is necessary to pay special attention to the storage and processing of agricultural products to ensure the year-round supply of food to the population. As is known, agricultural products are grown in a certain season of the year, therefore, the issue of providing the population with various products throughout the year cannot be solved without organizing their long-term storage and processing. As agricultural production increases, their storage and processing are also being improved, and new modern warehouses are being built. Grapes are grown at a certain time of the year and are the main source of a number of substances necessary for human nutrition - vitamins, mineral salts, carbohydrates, organic acids, etc. The main task in storing grapes is to preserve their physical and chemical composition, that is, their appearance, color, taste, nutritional value and other properties.

Therefore, the correct and scientific organization of grape storage and processing can solve the problem of providing the population with these products throughout the year. A deep study of the biological and physiological processes that occur during grape storage and a clear understanding of this issue are of great importance in preserving high-quality products.

For high-quality preservation of grapes, it is necessary to know what physiological and biochemical processes occur in them during storage and what environmental factors affect the course of these processes. A natural decrease in the weight of grapes during storage, reducing their weight by just one percent, leads to an increase in production by tens of thousands of tons. Therefore, we need to pay more attention to the preservation of grapes and deeply study all the issues related to this. The ability of grapes to be stored for a certain period of time without deterioration of quality and with minimal weight loss determines their storage stability. The ability of grapes to resist damage by microorganisms is called their immunity. These two characteristics are closely related, and products that are not resistant to storage are usually quickly damaged by microorganisms. The resistance of products to storage is determined by the period of their storage under favorable conditions. The manifestation of the resistance of grapes to storage in a certain zone and season, as well as in agrotechnical and technological regime, is called preservation. Storage stability is usually determined by the percentage of weight loss of products during storage. In general, the storage stability of grapes is their natural property. Therefore, the same variety can be stored differently under different conditions. The storage stability of grapes depends on many factors. If the size, density, skin thickness, shape and integrity of the skin, color, and other characteristics of the fruits within a single variety are typical for a particular variety, such products will store well.

Research methods and materials. The experiments were conducted in a modern refrigerator belonging to the Department of Storage and Processing of Agricultural Products of Tashkent State Agrarian University and in a refrigerator for storing fruits and vegetables at "OLMOS-MCHJ" with a capacity of 1,000 tons, located in the Parkent district of the Tashkent region.

The sugar content of grape juice was determined using the "Areometric" and "Refractometric" methods, the dry matter content was determined according to ISO 2113-2013 GOST adopted by the "International Council for Metrology and Certification", the active acid content was determined according to GOST 26188-2016, the nitrate content in grapes was determined according to GOST 34570-2019, and the content of mono- and disaccharides, organic acids, and pectin substances in grapes before and after storage was determined using the carbazole method.

Grapes are divided into three groups according to their main characteristics that determine their resistance to storage according to their biological properties after harvesting: these are early, medium and late ripening varieties. Physiological rest period of products is an adaptation to unfavorable conditions of the season and is a genetically reinforced property in the process of phylogenesis. It depends on the grape variety, growing conditions, and storage conditions, and lasts for several months. The mechanism of physiological dormancy is due to specific changes in cells and metabolism. During physiological dormancy, natural losses of products are very low, and their quality is almost unchanged.

The storage stability of grapes depends on the duration of their post-harvest ripening period. Post-harvest ripening is the period of complete formation of the seeds and pulp of grapes as a result of physiological and biochemical processes that occur in them after they are harvested. The length of the ripening period after harvest determines the shelf life of the product. The longer the ripening period, the longer the shelf life of the grapes. The ripening period varies not only between different types of grapes, but also between different varieties.

Research results and their discussion. Based on the above. The objects of research were black raisins with low shelf life and Andijan black, Husayni muscat variety in modern refrigerated warehouses, equipment for studying the mechanical composition of grape varieties was selected. The experiments were conducted in vineyards and modern cold storage facilities where grape

varieties were grown. In addition, the research was conducted in two stages: first, grapes were picked manually according to established requirements and placed in cold storage facilities, and in the second stage, after two months of storage, the composition of the grapes was examined and comparison processes were carried out. Changes after the end of the ripening period significantly reduce the quality of the products and their shelf life. In order to manage the maturation period, it is necessary to know what processes are going on in them and what factors of the external environment affect the progress of these processes. Morning When grapes are stored, they do not retain valuable nutrients and flavoring substances, on the contrary, they decompose. Evening and winter After the grapes are harvested, the above-mentioned substances accumulate for a certain period of time, and then decomposition begins. As the grapes mature, the amount of sugar in them increases, and the acid and flavoring substances decrease. In addition, the accumulation of aromatic substances increases. Sugar increases mainly due to the hydrolysis of starch in fruits, the breakdown of glucoside, pectin and hemicelluloses.

Table 1. The content of organic substances in grape varieties

(in %) (before saving 18 October 2024)

Grape varieties	Water quantity	Dry matter	Sugar	Organic acid	Pectin
Andijan black	80,7	19,3	17,7	0,5	0,6
Husseini's musk	80,3	19,6	18,1	0,4	0,6
Black raisins	80,1	20,6	21,1	0,3	0,5

The table shows that the amount of dry matter, sugar and pectin in the Kara Kishmish variety is higher than in the Khusaini Muscat and Andijan Kara varieties, and the ratio of sucrose to monosaccharides changes during the ripening period. During the storage period, the amount of fructose increases, and the amount of glucose and sucrose decreases. As the fruit ripens, the sugar content decreases due to their respiration. The sweetness of grape fruits is determined by the amount of fructose, although the amount of sucrose and glucose is higher than that of fructose, the fruit is not very sweet.

During the storage of grapes, the acids contained in them break down faster than sugar, so the ratio of sugar and acids changes. By the end of the storage period, the fruits are quite sweet, and then they become tasteless due to the loss of acids. During storage, pectin breaks down into soluble pectins, which causes the fruit to soften. The softening of the fruit progresses from the center to the periphery (outer part). As a result of the breakdown of pectin substances, methyl alcohol is formed, which darkens the fruit. Generally, pectin substances accumulate when grapes wither. During the storage period of grapes, flavoring substances decrease, and aromatic substances turn into other substances (oxidized) under the influence of enzymes.

Table 2. The content of organic substances in grape varieties (in %)

(after storage October 18, 2024 - February 15, 2025)

Grape varieties	Water quantity	Dry matter	Sugar	Ascorbic acid	Pectin
Andijan black	82,7	17,2	18,4	2,1	0,96
Husseini's musk	81,3	18,6	21,3	1,9	1,8
Black raisins	80,0	18,6	19,1	1,8	0,9

The most important physiological process in grape storage is respiration. As a result of respiration, carbohydrates, acids, fats, and sugars in the product are oxidized, which are broken down into the final products - water and carbon dioxide, and a certain amount of energy is released in this process. As a result of the decomposition of 180 g of carbohydrates during the respiration of

grapes, 2824 kD of heat is released. During grape storage, it is necessary to create all the conditions that slow down the biochemical changes in the composition, minimize weight loss and prevent the occurrence of various diseases.

In order for grape products to maintain their quality indicators better, the necessary temperature, humidity and exchange of air in warehouses are among the first conditions. In addition, for each variety, several of the above-mentioned mode factors should be created to a certain extent. If one of the factors mentioned above is violated, it will have a negative effect on the storage of grape products.

Special attention should be paid to storing grapes after they are picked. Grapes to be stored should be placed in a cool place as soon as possible after they are picked. In such conditions, they should be kept in a cool place away from sunlight for up to 24 hours. Before placing grapes in their permanent storage location, they are first stored in a cooling compartment at a temperature of 5-8 ^{0}C for 8-10 hours. Otherwise, if grapes are placed directly in the storage compartment, the air temperature in the compartment will rise, resulting in rapid spoilage of other products stored in the compartment.

Conclusion. The relative humidity of the air is around 85-90%. If it is less than 80%, the band of Grapes starts to wilt. Air temperature should not be below 2^{0}C. Otherwise, the fruits may freeze and the metabolic process may be disrupted. Grapes do not restore their properties when frozen. To prevent grapes from freezing near cooling batteries, the batteries are covered with polyethylene film or burlap. Grapes with a high shelf life should be placed in the inner part of the refrigerators. In order to regularly check the condition of the stored grapes, their width should not exceed the width of four rows of boxes. A corridor should be placed between each row. The boxes should be stacked 10-12 times, 50-60 cm from cooling and lighting devices, and 30-40 cm from the walls. Various antiseptic agents are used to store grapes. Sulfur and potassium metabisulfite are used in this. Storing grapes in bags made of polyethylene film also works well. Small quantities of grapes can be stored in cellars where artificial cooling is not used.

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