Methods for comparing and improving the quality of local storage of grapes in Uzbekistan

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Abstract. In this article, several methods of storing the harvest of the grape varieties in a natural way, including storage, vine method, storage in water-filled containers (by the method of legumes) were studied. During the experiments, discrepancy between their quality indicators, advantages and disadvantages of these methods, storage periods and conditions, as well as the amount of dry matter, the amount of nitrate, the pH environment were researched and analyzed. The pertinent results showed that the sugar content of grapes was the lowest according to the characteristics of varieties in the vine method, accounted for 16.3% and the highest in the storage method, which was 21.17%, the amount of nitrate was not more than 60 mg/kg in the norm, which was also allowed in all methods. Noteworthy, the most acceptable method among them was the bottle method, however, the method needed to be improved in the future.

Keywords: grapes, storage, wooden boxes, dry matter, temperature

1. Introduction
In recent years, the president and the Cabinet of Ministers of the Republic of Uzbekistan have paid special attention to the issues of providing the population with quality food products [1, 2], that is, grape products throughout the year, improving the processes of storage of products, as well as increasing the export potential and entering to the world market with regard to the reform of agriculture in our country [3, 4]. According to the calculations, there is an opportunity to receive 7 times more income from grapes than cotton homesick grown on an area of 1 hectare [5].

According to the State Statistics Committee, over the past 10 months, in January-October 2021, the country exported 88,000 tons to Russia, 63,000 tons to Kazakhstan, 23,000 tons to Kyrgyzstan and 9,000 tons to China, Turkey - 4 thousand tons, Saudi Arabia - 3 thousand tons, Ukraine - 3 thousand tons, Belarus - 2.3 thousand tons, Azerbaijan - 1.6 thousand tons, Iraq - 1.6 thousand tons, Germany - 867 tons exported about 204,000 tons of grapes worth $ 153.2 million to foreign countries [6, 7]. However, based on the centuries-old national agricultural culture of our people, the development of grape growing as a national culture, the creation of value chains in the field through large-scale, cluster and cooperative cultivation, storage, sorting and processing of grapes [8].

Tasks such as strengthening, creating national brands of local grape varieties and expanding exports by entering new markets have not yet been fully addressed [9]. At the same time, the lack of systematic effective market mechanisms in the development of viticulture, the lack of a scientific approach do not allow to fully use the existing potential of the industry [10-12]. For example, the technologies of natural storage of grape varieties grown in different regions of the country, which are used in practice in a
resource-efficient, energy-saving and free from various other chemicals, are not scientifically substantiated and insufficiently covered, possible.

Resolution of the President of the Republic of Uzbekistan, No PR-4239 "On measures to develop agricultural cooperation in the field of fruit and vegetables" was issued on March 14, 2019 [13]. In accordance with this resolution to ensure the implementation of the Decree of the President of the Republic of Uzbekistan dated October 23, 2019 No PF-5853 “On approval of the Strategy of agricultural development of the Republic of Uzbekistan for 2020-2030”: production of high value-added products in the field of vegetables and viticulture, increase in exports, development of obsolete and dry lands, increase in the sowing of export-oriented agricultural crops on the areas reduced by cotton and grain [14].

Furthermore, the Ministry of Agriculture, Ministry of Economy and Industry, Ministry of Employment and Labor Relations of the Republic of Uzbekistan, farmers, dehkan farms and The task of the Council of Landowners was to develop proposals for the introduction of new mechanisms for the development of clusters and cooperatives in the cultivation, processing, storage and export of fruits, vegetables and grapes [1].

According to the tasks of Resolution No. PR-4239, the use of resource-saving, energy-saving value-added value in the storage of edible grape varieties and the use of quality and long-term storage methods of grapes will undoubtedly ensure the implementation of this decree and resolution [2]. The use of some local methods of storing grape fruits, for example: storage, the method of storing the vine itself, and the use of traditional methods such as cutting the grape heads with secondary perennial rust and putting them in water-filled containers, as noted above, is resource-saving, that is, leads to the minimization of energy consumption.

2. Methods

In order to scientifically study and improve the above-mentioned shortcomings and measures, this research was conducted on “Improving the technology of natural storage of grape varieties”. Farms in many parts of the country have enough experience in growing, storing and processing grapes [6, 8, 9]. At the same time, Oltiariq district of Fergana province (Uzbekistan) is one of the leading regions for the preservation of local varieties of grapes, and our research is carried out on farms specializing in viticulture in this area.

Clearly, several technologies of natural storage of grapes in Oltiariq district of Fergana province (Uzbekistan), their physicochemical and quality indicators, advantages and disadvantages were studied and analyzed. Several methods were used to determine the physicochemical and quality characteristics of grapes stored in different ways [3-7, 14]. These include: the overall size of the grapes stored in different ways: the geometric dimensions of the grape grain, such as the length of the grain, the width, the length of the grape head, and the distance from the stalk to the grape seed, were measured using a commonly accepted (electronic caliper) method. The hardness of the crop grain of grape varieties carried out in the method of penetrometric measurement. The amount of dry substances contained in grape juice was adopted by the council” requirements for testing laboratories and certification bodies of the international system of measurement and certification ISO 2113-2013 State standard [8, 12, 13] was determined in the refractometric method. The dry amount of dissolved substances detected was listed in percentages. The measurement of the post-storage temperature of grape products was carried out according to the international standard 30204-95 State standard.

The amount of nitrates in grapes "Determination of nitrates in fruits and vegetables and processed products" 29270-95. According to State standard, it was carried out in several ways, such as ionometry. In fact, edible grapes have been preserved in our homes by our ancestors since ancient times, but the data on these methods are not sufficiently scientifically based [4, 11]. These methods are as follows:

1. A method popularly known as "Storage". This method is one of the earliest methods of storing grapes. One of the oldest methods of preserving the harvest of edible grapes in the traditional, local state is the dry method. In this method, the grape heads are cut and carefully placed in pre-prepared containers
and placed in a room set aside for storage. Grapes stored in this way can be stored from April to May, if the rules of storage are followed correctly.

There were many advantages and disadvantages of the storage method. The disadvantage was that the bunches of stored grapes dried out and lost their color. Given the market demand, the marketability of the product was very low (Figure 1).

![Husain variety of grapes stored by storage methods.](image)

**Figure 1.** Husain variety of grapes stored by storage methods.

In addition, the shedding of the grape head was very high, and the grapes had a tendency to soften. However, this method had its advantages. For example, the sugar content of grape grains was found to be higher than in other methods. It was also found that the grain hardness level was also significantly higher than the current method.

2. The method of storing grapes in the vine. In this case, the heads of grapes are left in the current without interruption. The upper part of the vine is covered with polyethylene material, and the upper part of the vine heads is wrapped in paper to prevent direct sunlight from falling, birds, rain (Figure 2). Grapes of this method can also be stored from February to March, provided that the rules of storage are followed. However, this method also has many advantages and disadvantages [3, 7, 13]. For example, a large amount of polyethylene is used to cover a large area of vines, as the vines are not disconnected from the vines, they absorb the vines and reduce the turbidity for the next year, and leads to a small size of the grape grains, and there are cases of softening due to the prolonged hanging of the grape grains on the vine.
3. Today, as a result of the research of our practitioners, in contrast to the above methods, another method is being used in practice, and this method is one of the last local methods [5, 6, 9]. This method is the method of storing grapes in containers filled with water. In this method, the head of grapes was cut along with the harvest rust and placed in pre-prepared packaging containers, water was poured into a special small container, and the grape rust is immersed and placed in the storage room (Figure 3).

This method also has many advantages and disadvantages. The advantages of this method were: during long-term storage, the bunch and the grain retain their naturalness without losing color in accordance with its varietal characteristics, the product had a significantly higher marketability than other methods, simple to the container drinking water was poured, and the hardness and shedding resistance of grape grains were found to be higher than the remaining methods (Table 1). However, this method also had some drawbacks. For example, cutting off productive node of grape will result in a 15-20% reduction in yield for the next year. During the storage of grapes, the placement of special small containers filled with water in the packaging leads to a small amount of product in the packaging, resulting in a decrease in the utilization rate of the general storage. If storage rules are not followed properly, water in the container can cause pests and microorganisms to develop.
Figure 3. Husain grape stored in water-filled containers (in bottle method).

3. Results and Discussions

Above, several types of technologies of storage of grape fruits in a natural way, their differences from each other, as well as several advantages and disadvantages, were studied. The need for further improvement of these technologies was manifested, taking into account the presented shortcomings. Of course, in order to improve these technologies, first of all, the technological scheme of existing methods, their sequence, the degree of sugar content of grapes, the ripening period of grape heads, the external air and internal temperature of grapes, relative humidity, nitrate content, pH indicators should be determined (Table 1).

Table 1. The results of determining the quality of the harvest of edible grape varieties stored locally in Oltiariq district, Fergana province (Uzbekistan)

| #  | Technical specifications | Dry matter content, % (average) | Nitrate content, kg/mg |
|----|--------------------------|---------------------------------|------------------------|
| 1  | Dry matter content, %    | Enormous 16.3, Husain 20.3, Bride’s finger 24.3, Husain 22, Husain 18 | Norm, Norm, Norm, Norm |
| 2  | Nitrate content, kg/mg    | Norm, Norm, Norm, Norm          | Norm, Norm, Norm, Norm |
The table above shows the results of the comparison of the quality indicators of edible grape varieties stored by natural methods and the differences between them. In general, the sugar content of grapes was the lowest according to the characteristics of varieties in the vine method, accounted for 16.3% and the highest in the storage method, which was 21.17%, the amount of nitrate was not more than 60 mg/kg in the norm, which was also allowed in all methods. The degree of acidity of the PH medium was practically not changed in all methods, such indicators were presented as the degree of hardness, which was different in all methods.

4. Conclusions

1. It was found that in storage methods, drying and discoloration of stored grapes were observed, followed by the product had a very low marketability, very high shedding of grape heads, and softening of grape grains.

2. In vine-method, grape heads absorbed vines strength as they were kept uninterrupted and reduce the productivity for the next year and led to small grape size, it was soften due to long-term hanging of grapes on the vine.

3. Bottle method: cutting off productive node of the vine led to a 15-20% reduction in yield for the next year, the placement of watering cans in boxes during the storage of grapes was to minimize use of the box and room size. Importantly, the most acceptable method among them was the bottle method, however, the method needed to be improved in the future. In this research it has proposed the practical application and scientific substantiation of a Japanese made polymer container called a Japanese capsule in order to improve the technology of natural storage of edible grapes.

Acknowledgement. We as the research team are very grateful to Gofuor Hasanboy Abdullayevich, head of “Gafurov H. Oltiariq maple tag” in Oltiariq district of Fergana province (Uzbekistan), for his practical assistance in the development of scientific experiments on “Improvement of technologies for natural storage of edible grape varieties”.

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