UDC 664.8.03:635.15

# CHANGES IN THE NUTRITIVE VALUE OF THE RADISH OF DIFFERENT VARIETIES DEPENDING ON THE STORAGE METHOD

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**Abstract.** It is found that the ways of storing radish root vegetables have different effect on their nutritive properties. The data obtained show that the total mass losses during storage in containers in bulk range from 14.80% (*Bila Zymova Skvyrska*) to 19.20% (*Daikon Bile Iklo*). Storage in containers with a polyethylene liner and with a layer of damp sand on top results in total mass losses of 6.67 to 10.38% (*Chorna Zymova Skvyrska* and *Daikon Bile Iklo*, respectively); storage in containers with a polyethylene liner and open top leads to 12.30–16.65% losses in mass (*Bila Zymova Skvyrska* and *Daikon Bile Iklo*, respectively). It has been studied for different radish varieties how product losses and the dynamics of the content of dry substances, sugars, organic acids, and vitamin C depend on the method of storage. The amount of vitamin C, when radish root vegetables were stored in the traditional way in a container, decreased by 1.7–2.5 mg/100 g (the varieties *Sertse Drakona* and *Marhelanska*, respectively). The use of a polyethylene liner can reduce the loss of ascorbic acid by 40–55% of the initial content in the product. On the contrary, spreading a layer of wet sand on top contributes to an increase in vitamin C in the varieties of the radish root under study. So, its amount at the end of the storage period was 24.67 mg/100 g (*Daikon Bile Iklo*) to 35.00 mg/100 g (*Troiandova*).

It has been experimentally determined that the chemical composition of the varieties *Chorna Zymova Skvyrska*, *Bila Zymova Skvyrska*, *Marushka*, *Troiandova*, *Sertse Drakona* remains quite stable during all storage period. They are resistant to intensive sprouting, and quantitative losses do not exceed 17% even under traditional storage in containers in bulk. The varieties *Lebidka*, *Marhelanska* and *Daikon Bile Iklo* require special storage conditions which would not only provide temperature and humidity control, but, for example, the selection of gas composition or products ventilation rate, etc., as well. It has been proved that radishes are best stored in containers with a polyethylene liner, covered with a wet sand layer. This method provides high humidity, a stable temperature, and the optimum content of carbon dioxide. Besides, i allows reducing the loss in dry substances and sugars, and preventing the intensive sprouting of the root vegetables, with up to 94% of them remaining in saleable condition by the end of the storage period. The storage of root vegetables with the use of a wet sand covering layer provides an increase in vitamin C content.

**Key words:** radish root vegetables, storage, polyethylene liner, sanding, container, consumer value, commodity losses.

# ЗМІНИ СПОЖИВНОЇ ЦІННОСТІ РЕДЬКИ РІЗНИХ СОРТІВ ЗАЛЕЖНО ВІД СПОСОБУ ЗБЕРІГАННЯ

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**Анотація.** Встановлено, що способи зберігання редьки по-різному впливають на її споживні властивості під час зберігання. Досліджено товарні втрати, динаміку вмісту сухих речовин, цукрів, органічних кислот, вітаміну С у різних сортах редьки залежно від способу зберігання. Визначено, що сорти Чорна Зимова Сквирська, Біла Зимова Сквирська, Марушка, Трояндова, Серце дракона мають стабільний хімічний склад протягом всього терміну зберігання, є стійкими до інтенсивного проростання. Сорти Лебідка, Маргеланська та дайкон Біле Ікло потребують створення спеціальних умов зберігання, які забезпечують не лише контроль температури та регулювання вологості, а й, наприклад, підбір газового складу чи швидкості вентилювання продукції тощо. Доведено, що оптимальним способом зберігання редьки є зберігання в контейнерах з поліетиленовим вкладишем та з присипанням зверху шаром вологого піску, що забезпечує високу вологість, стабільну температуру та оптимальний вміст вуглекислого газу та дозволяє отримати вихід товарних коренеплодів до 94%, скоротити втрати сухих речовин і цукрів, а також перешкоджає їх інтенсивному проростанню.

**Ключові слова:** коренеплоди редьки, зберігання, поліетиленовий вкладиш, піскування, контейнер, споживна цінність, товарні втрати.



DOI: http://dx.doi.org/10.15673/fst.v12i2.942

## Introduction. Formulation of the problem

Numerous epidemiological studies show that the disease incidence is mostly due to the dietary patterns and the deficiency of biologically active substances (BAS). The consumer is undersupplied with as much as 50% of essential nutrients. This results in metabolic disorders, lower defence potential, higher risk of cardiovascular and cancer diseases. The consumption of vegetable food rich in easily digestible carbohydrates, vitamins, organic acids, dietary fibre, phytoncides, mineral and phenolic substances, reduces the risk of cardiovascular and cancer diseases and colds. This statement is now an axiom.

Comprehensive studies [1-6] show that, of all vegetables, the radish is especially valuable. It is high in BAS with phytoncidic and antioxidant properties (vitamin C, flavonoids, volatile substances, etc.), and is widely available and affordable for Ukrainian consumers. The pharmacotherapeutic effect of the radish on organs and systems of the human body ranges widely due to the rich complex of various chemical substances. Mostly, it is because of its chemical composition that includes carbohydrates, vitamins, minerals, and essential oils. All these make the radish so important in prevention and treatment of vitamin deficiency, atherosclerosis, obesity, metabolic disorders, etc. The radish is indispensable during the spring reduction of the body's protective forces because of its long shelf life.

Today, consumers generally want food products of high quality to be both tasty and highly nutritious. These concepts make especially interesting the studies of biochemical, physiological, biological, and microbiological processes in the raw material which occur after it is harvested, as well as the development and improvement of existing post-harvesting technologies.

That is why, changes in the quality of different radish varieties during their storage and finding the optimal storage conditions is a topical problem, as its solution will make it possible to minimise product losses and provide buyers with food of guaranteed consumer value.

## Analysis of recent research and publications

When radish root vegetables are stored for a long time, there are various kinds of vital activity in them: ripening, breathing, moisture evaporation, changes in the chemical composition, and growth of the microflora. All these cause 10 to 30% of spoilage of the crop [7].

Like other root vegetables, the radish is a biennial plant. Its biological feature is the ability to remain in the state of light, exogenous dormancy at low temperatures. Plants need it to complete the processes of generative development. The dormancy period allows long-term storage of radish root vegetables. However, root vegetables sprouting starts again under favourable conditions [8].

The main process in root vegetables under storage is breathing (absorption of oxygen and releasing carbon dioxide), which is accompanied by moisture evaporation and dry matter spending. The rate of evaporation depends on the storage conditions: the higher the temperature of the environment, the drier the air, the more moisture the root vegetables lose.

Alongside natural evaporation, complex physiological and biochemical processes take place in the plant tissue of the root vegetables throughout the whole storage period. As a result, the chemical composition of the products changes (the total number and the ratio of carbohydrates, vitamin C, organic acids, and essential oils decrease, decomposition of organic compounds increases), which affects the energy balance. The root vegetables become noticeably less resistant to contamination by microorganisms [9].

The preservation of root vegetables is dependent on their varietal characteristics, the degree of ripening, the content of dry matters and sugars, the time of harvesting, etc. By influencing the environmental conditions (the temperature and humidity of the air, gas composition), we can slow down or eliminate the processes that lead to the lower quality of food.

According to the results of the literary analysis, the radish is a "rough" root vegetable because of its dense skin and springy, juicy flesh. It can be stored for a long time in storage clamps or wooden bins with natural ventilation. It is also recommended to store the radish and other root vegetables in wooden or plastic boxes and containers, actively ventilated, artificially cooled, with the use of sand.

The results proved to be good with root vegetables being stored in open polyethylene bags (with the polyethylene being 100–150 microns thick) or in containers lined with a 40–60 μm thick polyethylene film. The main advantage of this method is the fact that the use of polyethylene provides high humidity and optimal carbon dioxide content, which results in high storageability of root vegetables [10].

Sanding is another effective method, as a sandy environment reduces the moisture evaporation of root vegetables, maintains a constant temperature, makes for the accumulation of carbon dioxide released by the vegetables, and has a favourable effect on their preservation. Besides, sand prevents germ diseases, for example, such dangerous ones as white, black, grey, and soft rot.

To make root vegetables' storage longer, specialists also recommend storing root vegetables in the snow. Vegetables are put in tight boxes and placed in a snow stack, with a 10-centimetre layer of snow between the boxes. The disadvantage of this method is the need to use a lot of additional materials and devices, which leads to a significant increase in storage costs and products in general [11].

A common preservation method is the treatment of root vegetables with a clay suspension, which forms a protective layer after it dries out. This layer protects vegetables from moisture evaporation and spread of diseases. The method allows root vegetables to retain their merchantable quality, but requires additional investment and significantly extends the preparatory

stage of the storage. That is why, it is impracticable for large amounts of food raw materials.

The most modern method of root vegetables storage is the use of polyethylene packaging. However, hermetic packages have appeared to be impracticable. Too high concentrations of carbon dioxide deveop inside and damage root vegetables physiology, and moisture condensation activates the sprouting processes in the raw materials.

Recently, methods of storage employing preservatives and antiseptics have become popular. But these technologies are expensive and complex, take much labour, and negatively tell on the consumers' health [12].

A non-traditional way of storage is covering the surface of root vegetables with a natural mineral, zeolite. Root vegetables undergo dry and wet treatment with zeolite, that is, the adsorbent is applied to the surface of the root vegetables in the form of a powder or a suspension, and then the vegetables are loaded into a storage place in bulk. Numerous studies have shown that, for carrots and red beet roots treated with zeolite, the natural reduction in mass and the wastage during storage are much lower than they are when these root vegetables are stored in bulk in the traditional way. With this treatment, the relative humidity in the bulk is optimum, and each root vegetable is isolated, which creates adverse conditions for pathogenic microorganisms' development. Also, it makes it possible to increase the output of standard products, maintain the positive dynamics of the biological composition, the content of micro and macroelements in the storage process. The treatment of root vegetables with zeolite does not practically change their biochemical composition and the content of heavy metals [9].

To prolong the storage period, a method has been developed of treating root vegetables with hydrodissociation and ultraviolet electromagnetic field. It is a highly effective technology which helps preserve the merchantable quality and the content of biologically active substances, and also prevents microbiological contamination of vegetables. But it requires significant investment, which is economically unprofitable [13].

The main factor of preserving the vegetable products quality is maintaining the optimal storage conditions: temperature, humidity, aeration, composition of the gas environment, and selecting the varieties of vegetable crops suitable for long-term storage. In recent years, new varieties of radishes, of domestic as well as of foreign selection, have appeared on the Ukrainian market, but in literary sources, there is only information on the traditional varieties of the radish (black and white radish). That is why, a complex research into the consumer properties of different varieties of the radish depending on the storage method is a topical and timely task of commodity science.

**The research was aimed** at determining the losses in weight and the degree of preservation of the main nutrients in radish root vegetables stored by different methods, as well as determining the optimal method for long-term storage of radish varieties.

To achieve this goal, the following **tasks** have been solved:

– determining how storage in bulk in containers affects the preservation and the consumer value of radish root vegetables;

– comparing the product losses and the consumer quality of radish root vegetables during their storage in containers with a polyethylene liner and in containers with a polyethylene liner covered with a layer of damp sand.

## Research Materials and Methods

The objects of the study were radish root vegetables of 8 economic and botanical varieties: Chorna Zymova Skvyrska, Bila Zymova Skvyrska, Marushka, Lebidka, Troiandova, Sertse Drakona, Marhelanska, Daikon Bile Iklo. To find out which radish varieties were the best for long-term storage, and to compare and assess the storage methods, the vegetables were stored for 5 months in accordance with the requirements of SSU ISO 9719–2001 at the air temperature 0 °C to +2°C and humidity 90% to 95%. The following storage methods were used: in wooden containers (1200*1000*1000) in bulk, in wooden containers with an open top polyethylene liner, and in wooden containers with a polyethylene liner and a layer of damp sand covering.

The product (natural) losses and the dynamics of nutrients content during the storage of radish root vegetables were studied during the years 2013–2016. Each month, the product losses, the number of the vegetables that had sprouted, and the dynamics of dry matters, total sugars, and vitamin C were determined.

The product losses were determined by measuring natural losses in physical terms [14]. The dry matters were calculated by drying to constant weight, the mass fraction of sugars was determined by the Bertrand method [15], the vitamin C content by the iodophenol method [15].

## Results of the research and their discussion

Studies of product (natural) losses in weight of various radish varieties depending on the storage method are presented in Table 1.

The data obtained show that the total weight losses during storage in containers in bulk vary from 14.80% (Bila Zymova Skvyrska) to 19.20% (Daikon Bile Iklo). When stored in containers with a polyethylene liner and a layer of damp sand, the total weight losses are 6.67–10.38% (the varieties Chorna Zymova Skvyrska and Daikon Bile Iklo, respectively); in containers open on top, with a polyethylene liner, the weight losses are 12.30–16.65% (Bila Zymova Skvyrska and Daikon Bile Iklo, respectively). Thus, the greatest losses are those of the radish stored in containers in bulk. It is evident from the table that the varieties Marhelanska and Daikon Bile Iklo are characterised by the greatest weight losses, and the varieties Chorna Zymova Skvyrska and Bila Zymova Skvyrska, by the smallest weight losses. This can be explained by the fact that the cover tissues of the varieties Daikon Bile Iklo and Mar-

helanska are softer and have less fibre [7], and so, they are characterised by increased air permeability, thus being more sensitive than other varieties of root vegetables to temperature fluctuations and changes in the air humidity. The denser cover tissues of Chorna Zymova Skvyrska, Bila Zymova Skvyrska, and Marushka make it possible to store these varieties for long periods.

**Table 1 – Dynamics of natural losses during radish root vegetables storage,%**

| Radish variety | Weight losses,% | | | | | |
|---|---|---|---|---|---|---|
| | November | December | January | February | March | Total weight losses,% |
| In containers in bulk | | | | | | |
| Chorna Zymova Skvyrska | 3.24 | 2.70 | 2.44 | 3.15 | 4.00 | 15.53 |
| Bila Zymova Skvyrska | 3.10 | 2.56 | 2.19 | 3.00 | 3.95 | 14.80 |
| Marushka | 3.30 | 2.71 | 2.49 | 3.20 | 4.12 | 15.82 |
| Troiandova | 3.57 | 3.00 | 2.78 | 3.45 | 4.10 | 16.90 |
| Lebidka | 3.32 | 2.89 | 2.65 | 3.34 | 4.03 | 16.23 |
| Sertse Drakona | 3.55 | 3.10 | 2.78 | 3.39 | 4.12 | 16.93 |
| Marhelanska | 3.85 | 3.50 | 3.30 | 3.82 | 4.29 | 18.76 |
| Daikon Bile Iklo | 4.00 | 3.65 | 3.29 | 3.78 | 4.48 | 19.20 |
| in containers with an open top polyethylene liner | | | | | | |
| Chorna Zymova Skvyrska | 2.86 | 2.55 | 2.20 | 2.60 | 3.06 | 13.27 |
| Bila Zymova Skvyrska | 2.74 | 2.25 | 2.01 | 2.39 | 2.91 | 12.30 |
| Marushka | 2.93 | 2.60 | 2.25 | 2.64 | 3.07 | 13.30 |
| Troiandova | 3.00 | 2.63 | 2.30 | 2.79 | 3.18 | 13.90 |
| Lebidka | 2.91 | 2.62 | 2.27 | 2.65 | 3.12 | 13.55 |
| Sertse Drakona | 2.98 | 2.60 | 2.27 | 2.74 | 3.20 | 13.79 |
| Marhelanska | 3.17 | 2.97 | 2.89 | 2.95 | 3.52 | 15.50 |
| Daikon Bile Iklo | 3.50 | 3.14 | 3.03 | 3.13 | 3.85 | 16.65 |
| in containers with a polyethylene liner and a layer of damp sand covering | | | | | | |
| Chorna Zymova Skvyrska | 1,68 | 1.30 | 0.74 | 0.86 | 2.09 | 6.67 |
| Bila Zymova Skvyrska | 1.80 | 1.50 | 0.82 | 0.91 | 2.10 | 7.13 |
| Marushka | 1.86 | 1.60 | 1.43 | 1.62 | 2.28 | 8.79 |
| Troiandova | 1.94 | 1.76 | 1.52 | 1.60 | 2.40 | 9.22 |
| Lebidka | 1.83 | 1.62 | 1.39 | 1.51 | 2.32 | 8.67 |
| Sertse Drakona | 1.84 | 1.78 | 1.46 | 1.55 | 2.34 | 8.97 |
| Marhelanska | 2.10 | 1.81 | 1.42 | 1.70 | 1.38 | 9.79 |
| Daikon Bile Iklo | 2.34 | 1.94 | 1.52 | 1.74 | 2.84 | 10.38 |

The data obtained show that the total weight losses during storage in containers in bulk vary from 14.80% (Bila Zymova Skvyrska) to 19.20% (Daikon Bile Iklo). When stored in containers with a polyethylene liner and a layer of damp sand, the total weight losses are 6.67–10.38% (the varieties Chorna Zymova Skvyrska and Daikon Bile Iklo, respectively); in containers open on top, with a polyethylene liner, the weight losses are 12.30–16.65% (Bila Zymova Skvyrska and Daikon Bile Iklo, respectively). Thus, the greatest losses are those of the radish stored in containers in bulk. It is evident from the table that the varieties Marhelanska and Daikon Bile Iklo are characterised by the greatest weight losses, and the varieties Chorna Zymova Skvyrska and Bila Zymova Skvyrska, by the smallest weight losses. This can be explained by the fact that the cover tissues of the varieties Daikon Bile Iklo and Marhelanska are softer and have less fibre [7], and so, they are characterised by increased air permeability, thus being more sensitive than other varieties of root vegetables to temperature fluctuations and changes in the air humidity. The denser cover tissues of Chorna Zymova Skvyrska, Bila Zymova Skvyrska, and Marushka make it possible to store these varieties for long periods.

It is worth noting that intensive weight losses occur during the first month of storage, due to active maturation processes accompanied by moisture evaporation. The rest period is from December to February, it is characterised by a moderate decrease in the weight of the vegetables. In the last month of storage, the natural losses of the radish begin increasing significantly and reach the maximum value. It is obviously due to the intensification of breathing and to the sprouting processes in root vegetables.

The comparison of the radish varieties for how many roots have sprouted depending on the storage methods (Fig. 1) has shown that the Marhelanska and Daikon Bile Iklo samples are the least resistant to sprouting (76.0–78.9% and 83.6–85.6%, respectively). Sprouting of the varieties Chorna Zymova Skvyrska, Bila Zymova Skvyrska, and Marushka is never more than 70%. Intensive sprouting is undesirable, as significant losses of weight, moisture, and storage substances take place, and vegetables become withered in texture. It should be noted that the method of storage has a significant effect on the number of sprouted roots at the end of the storage. Thus, the samples stored in containers with a polyethylene liner and covered with a damp sand layer, sprout up to 7% less often than those stored in containers in bulk or with a polyethylene liner.

The results of the research prove that radishes are best stored in containers with a polyethylene liner and a layer of damp sand covering. This method provides high humidity, a stable temperature, and the optimum

carbon dioxide content, which allows 90–94% output of saleable root vegetables.

It is known that storage does not only involve physical processes that cause decrease in the weight of root vegetables, but biochemical as well. The latter lead to changes in the chemical composition of raw materials (redistribution of carbohydrates, organic acids, nitrogenous and mineral substances, essential oils, vitamins, etc.). That is why, to fully assess the storage methods, it has been determined how much of the main consumer substances are preserved in the roots of different radish varieties stored in different ways.

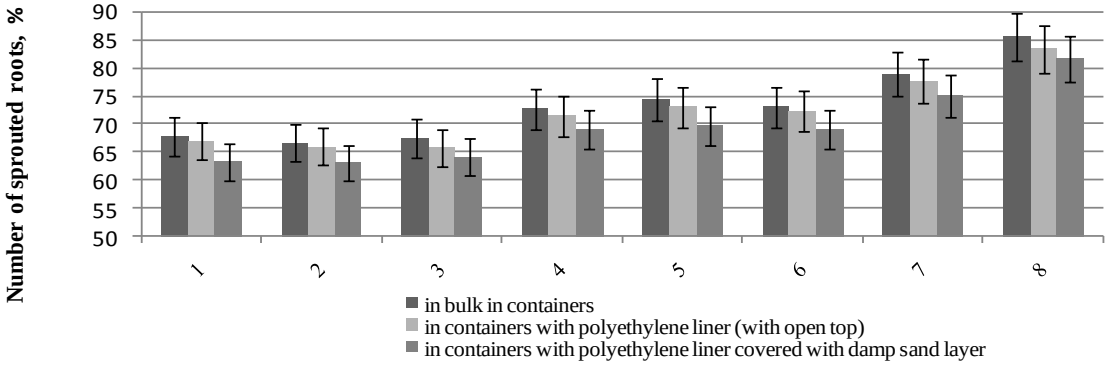


**Fig. 1. The number of sprouted radish roots depending on the method of their storage for 5 months, varieties of radish:** 1 – Chorna Zymova Skvyrska, 2 – Bila Zymova Skvyrska, 3 – Marushka, 4 – Troiandova, 5 – Lebidka , 6 – Sertse Drakona, 7 – Marhelanska, 8 – Daikon Bile Iklo

The results of studying the changes in the content of dry matters, total sugar, and vitamin C during 5 months of storage are presented in Fig. 2–4.

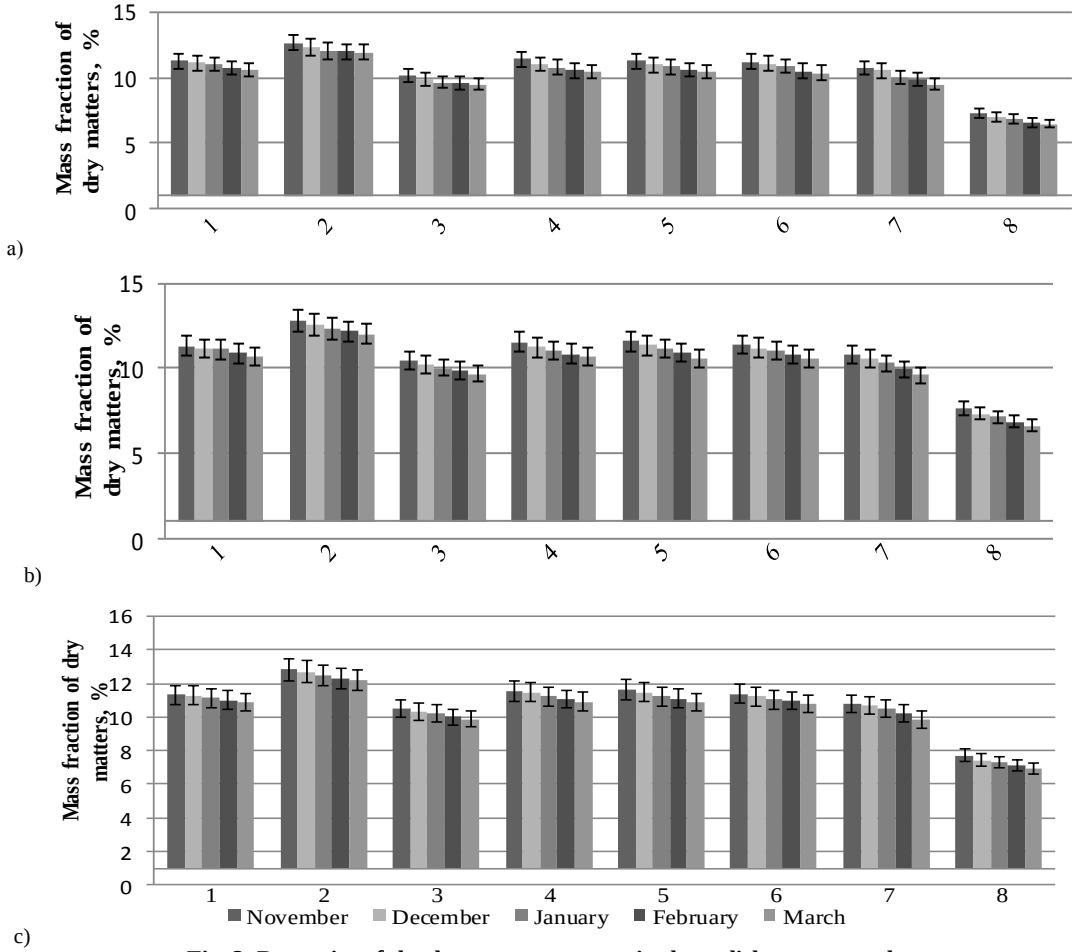


**Fig. 2. Dynamics of the dry matters content in the radish roots stored:**
a) in containers in bulk; b) in containers with an open top polyethylene liner; c) in containers with a polyethylene liner covered with a damp sand layer; varieties of radish: 1 – Chorna Zymova Skvyrska, 2 – Bila Zymova Skvyrska, 3 – Marushka, 4 – Troiandova, 5 – Lebidka , 6 – Sertse Drakona, 7 – Marhelanska, 8 – Daikon Bile Iklo

The study has shown that the dry matter losses are the least in the varieties Chorna Zymova Skvyrska, Bila Zymova Skvyrska, Marushka. The samples Lebidka, Marhelanska, and Daikon Bile Iklo, by the end of the storage period, lose as much of the initial dry matters content as: 10.69–6.92% when stored in containers in bulk, 9.32–15.12% in containers with a polyethylene liner, 7.0–11.3% in containers with a polyethylene liner covered with a damp sand layer, respectively.

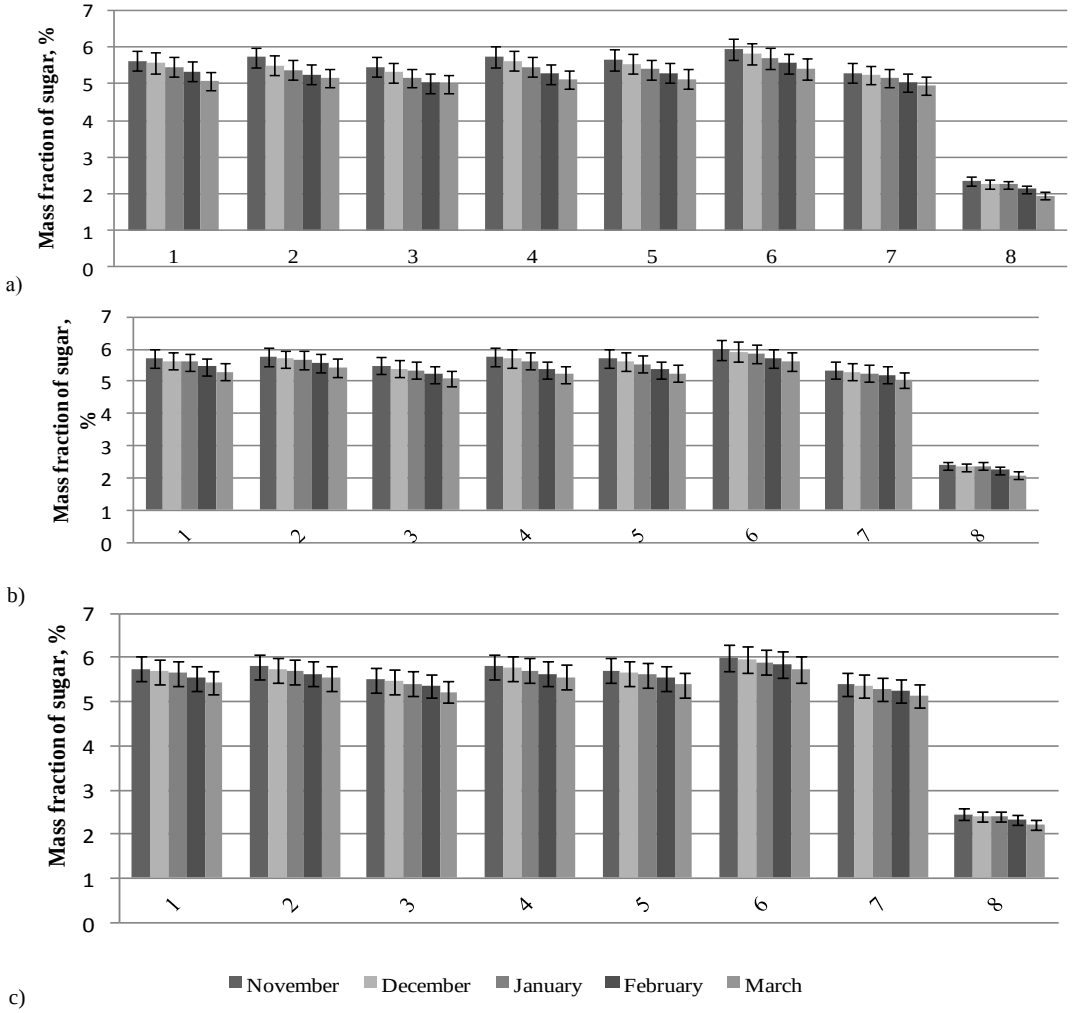


Fig. 3. **Dynamics of the content of sugars in the radish roots stored:**
a) in containers in bulk; b) in containers with an open top polyethylene liner; c) in containers with a polyethylene liner covered with a damp sand layer;
varieties of radish: 1 - Chorna Zymova Skvyrska, 2 - Bila Zymova Skvyrska, 3 - Marushka, 4 - Troiandova, 5 - Lebidka, 6 - Sertse Drakona, 7 - Marhelanska, 8 - Daikon Bile Iklo

It has been determined that, for the radish roots stored in containers in bulk, the average total sugar losses are 9.5–11.9%. When the radish roots are stored in containers with a polyethylene liner, the total sugar losses range from 6.9% (Sertse Drakona) to 10.3% (Troiandova). Storage in containers with a polyethylene liner covered with a damp sand layer reduces sugar losses by half on average.

It should be noted that Daikon Bile Iklo loses the largest amount of sugar during storage. Thus, in the first case, it loses almost 22%, in the second, 16.7%, and in the third, 12.3%.

When the radish was stored in the traditional way in a container, the mass fraction of vitamin C decreased by 1.7–2.5 mg/100 g (Sertse Drakona and Marhelanska, respectively). The use of a polyethylene liner allows reducing the ascorbic acid losses by 40–55%, compared with the storage in the traditional way (in containers in bulk). On the contrary, the use of the damp sand layer covering increases the amount of vitamin C in the radish varieties in question. Thus, its amount at the end of the storage period ranged from 24.67 mg/100 g (Daikon Bile Iklo) to 35.00 mg/100 g (Troiandova).

The study has confirmed that a storage method has a significant effect on the output and quality of the radish roots. The traditional storage in containers in bulk has been found ineffective because the root vegetables lose greatly in weight, dry matters, sugars, and vitamin C. Besides, there were a lot of sprouted roots, especially in the samples Marhelanska and Daikon Bile Iklo.

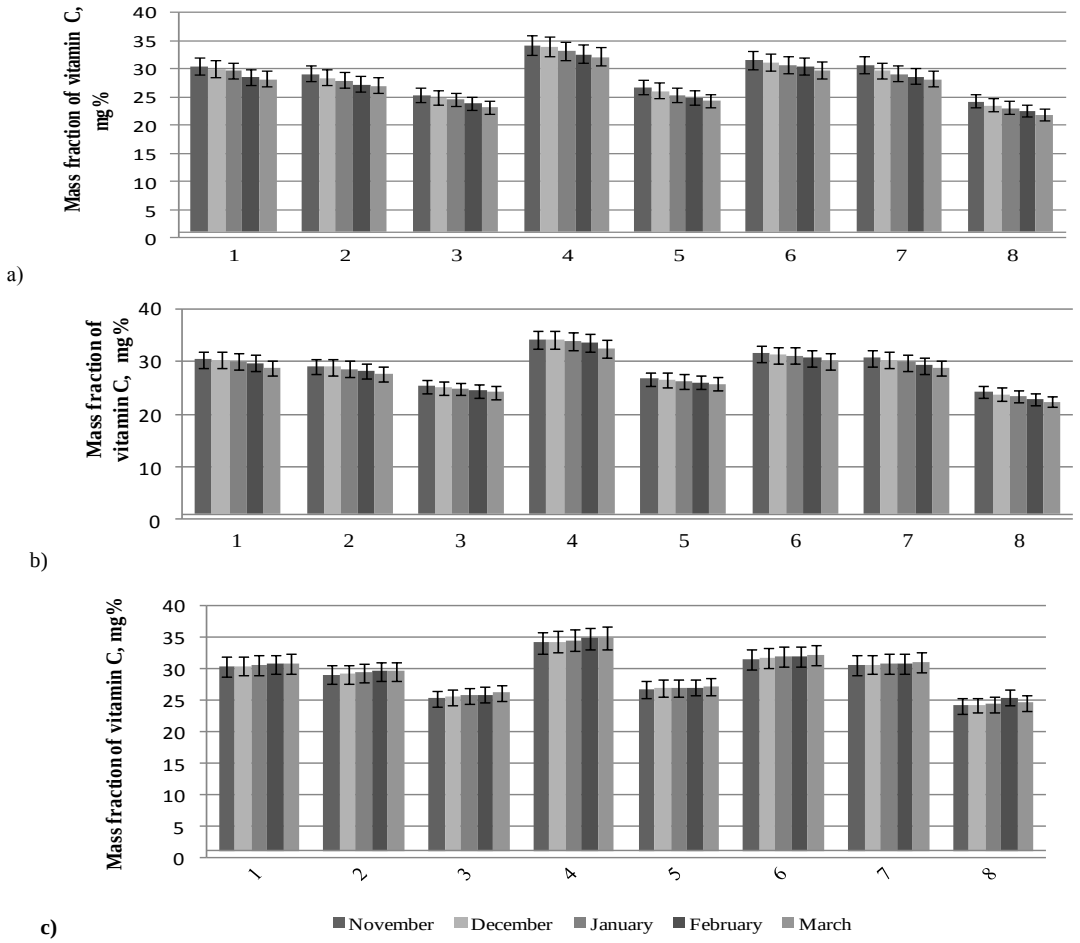


**Fig. 4. Dynamics of the vitamin C content in the radish roots during storage:**
a) in containers in bulk; b) in containers with an open top polyethylene liner; c) in containers with a polyethylene liner covered with a damp sand layer;
varieties of radish: 1 - Chorna Zymova Skvyrska, 2 - Bila Zymova Skvyrska, 3 - Marushka, 4 - Troiandova, 5 - Lebidka , 6 - Sertse Drakona, 7 - Marhelanska, 8 - Daikon Bile Iklo

Storing the radish in containers with an open top polyethylene liner and with damp sand layer covering reduces the natural losses of root vegetables' weight and the decomposition of sugars and ascorbic acid. It is explained by the fact that a gas medium with an increased carbon dioxide content is formed as a result of root vegetables breathing. Carbon dioxide is an active metabolic regulator. It affects the oxidising systems of vegetables, as it is involved in the metabolism in the tissues inhibiting it and lengthening the rest period of root vegetables [16].

The high effectiveness of storage in containers with a polyethylene liner covered with a damp sand layer is due to two factors: a high concentration of carbon dioxide, and the stabilised moisture and temperature conditions. As a result, the turgor of root vegetables is preserved, and their quantitative losses are less.

## Conclusions

It has been established that storing radish root vegetables for five months in containers with a polyethylene liner and in containers with a polyethylene liner covered with a damp sand layer can significantly reduce the weight losses and the content of dry matters and sugars in the raw materials. It can prevent intensive sprouting, too. This results in the saleable root vegetables output ranging from 85 to 94%. Besides, the latter method makes for a decrease in the vitamin C content, which is due to the formation of a gas medium with a high carbon dioxide content.

The comparative assessment of the storage qualities of radish roots has shown that the varieties Chorna Zymova Skvyrska, Bila Zymova Skvyrska, Marushka, Troiandova, Sertse Drakona are quite stable in their chemical composition throughout the storage period, are resistant to intensive sprouting, and their quantitative losses do not exceed 17% even under traditional storage in containers in bulk. For the samples of Lebidka, Marhelanska, and Daikon Bile Iklo, special storage conditions are to be created to provide not only temperature and humidity control, but also, for example, to select the proper gas composition, or the rate of products ventilation, etc.

Thus, the study has proved that storage of radishes in containers with a polyethylene liner covered with a

damp sand layer reduces moisture evaporation and metabolic processes in root vegetables to minimum values and prevents excessive sprouting.

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Отримано в редакцію 12.12.2017 Received 12.12.2017
Прийнято до друку 16.04.2018 Approved 16.04.2018

Цитування згідно ДСТУ 8302:2015

Dubinina A., Seliutina H., Letuta T., Hapontseva O., Frolova T. Changes in the nutritive value of the radish of different varieties depending on the storage method // Food science and technology. 2018. Vol. 12, Issue 2. P. 3-10. DOI: http://dx.doi.org/10.15673/fst.v12i2.942Cite as Vancuver ctyle citation

Dubinina A, Seliutina H, Letuta T, Hapontseva O, Frolova T. Changes in the nutritive value of the radish of different varieties depending on the storage method. Food science and technology.2018; 12(2): 3-10. DOI: http://dx.doi.org/10.15673/fst.v12i2.942.