The Technology of Storage Chinese Cabbage (*Brassica Rapal*)

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Abstract: The scientific article analyzes the fundamental factors affecting the long-term preservation of cabbage heads during the storage of Beijing cabbage. It identifies that the air temperature in the warehouse is influenced by the relative humidity, and the processes involved in knocking down cabbage heads impact their readiness for storage and the continuation of sorting processes. Additionally, the study examines the effect of various packaging materials on the quality preservation of the product, emphasizing the importance of long-lasting storage of cabbage heads in refrigerated warehouses.

1 INTRODUCTION

In the conditions of Tashkent region, Chinese cabbage (*Brassica Rapa L*). is cultivated as a repeated crop. This fact is based on the geographical location of the region, as well as the availability of fertile soil. Vegetables are the main type of food consumed fresh by the population. This is since these vegetables contain all the vitamins, minerals, pectin substances, etc. necessary for human health. However, there are many problems associated with the use of these types of products in the food industry. One of them is the problem of long-term storage of vegetables. Since most of the vegetable products in the republic are grown mainly in a certain period of the year, i.e. season, then the use of modern high-quality long-term storage technologies will simply be necessary to supply food industry enterprises with this type of raw material throughout the year (GOST 28373-94, 1996), (Meshkov and Terekhova, 2005), (Rusanov, 2000), (Shirokov, 1998).

In the food industry, storage of vegetable raw materials is divided into two types, namely temporary and long-term. At the same time, long-term storage in the food industry can be considered a period of time when vegetables cannot maintain basic quality indicators without the use of any special storage tools.

2 MATERIALS AND METHODS

The amount of dry matter in Chinese cabbage (*Brassica Rapa L*). according to ISO 2113-2013 GOST adopted by the International Board of metrology and certification, the amount of active acid is according to GOST 26188-2016, the determination of the amount of nitrate in pear fruit is according to GOST 34570-2019, before and after storage of Chinese cabbage (*Brassica Rapa L*). containing organic acids, pectin substances - by the carbazole method; vitamin C - by titration with KNO_3 solution; physical, chemical and organoleptic quality indicators of Chinese cabbage (*Brassica Rapa L*). before and after storage were carried out according to the method of E.P. Shirokov.

"Khibinskaya" was included in the state register of agricultural crops recommended for planting in the territory of the Republic of Uzbekistan in 1988, and the varieties "Billur", "Zangori", "Mezon" included in this register in 2022 were selected as research objects.

3 RESULTS AND DISCUSSION

It is known to us that during the storage of cabbage heads, there is a decrease in the content of antioxidant activity and phenolic compounds in their raw

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materials, as well as a short-term violation of products as a result. The preservation of Chinese cabbage (*Brassica Rapa L*)., among other types of vegetables, is directly influenced by the conditions of their cultivation. The reason is the geographical location of the region in which the plant was grown during storage, and the processes that take place in the plants, also have their effect during storage. The basis of the vital activity of any living organism is breathing, which produces the energy contained in organic matter and necessary for the implementation of all other vital processes.

In different varieties of Chinese cabbage (Brassica Rapa L)., the process of respiration and the physiological processes that take place in them occur differently. During the storage of Chinese cabbage (*Brassica Rapa L*)., the breathing process also occurs differently in individual tissues of cabbage heads. Some tissues have different breathing coefficients. The breathing duration of Chinese cabbage (*Brassica Rapa L*).is accelerated in the first days after harvest. This effect is caused by their reaction to separation from the plant, that is, from the stem of cabbage. At the time when the heads of cabbage come out of the dormant state, there is an increase in nutrient consumption as a result of increased breathing. During the storage of Chinese cabbage (*Brassica Rapa L*)., moisture evaporates from the products, so the normal course of metabolic processes in them is disrupted. As a result, the initial leaf tissue in the head of cabbage begins to dry out, and the process of decomposition of organic matter is accelerated, there is a sharp violation of energy metabolism. After that, the resistance of cabbage heads to pathogens decreases. The quality of the stored product is greatly influenced by the temperature in the storage tank, and when it increases, the intensity of biochemical processes increases, that is, the breakdown of complex organic matter, the exchange of breathing gases and anaerobic respiration of cabbage heads occurs.

During the storage of cabbage heads, the mass of raw material is partially reduced mainly due to evaporation of moisture and consumption of organic matter by respiration. This leads to an increase in the relative amount of dry matter in cabbage heads. To protect cabbage heads from wilting, it is important to maintain a sufficiently high humidity in the storage warehouse (Figure 1).

Experiments have shown that Chinese cabbage (*Brassica Rapa L*). has a positive result when stored in wooden and cardboard boxes.

During the storage of Chinese cabbage (*Brassica Rapa L*)., products are more susceptible to pathogenic microorganisms. It was observed in our experiments that this process accelerates, especially if the product is slightly mechanically damaged. Despite the sharp reduction in the vital activity of microorganisms when the temperature is close to 0 °C during product storage, it was observed that the resistance of the stored product to natural losses is significantly weakened. In addition, in some cases it is necessary to store products at slightly higher temperatures. It was found during our experiments that this is due to the fact that different levels of cabbage heads use different organic substances for respiration (Misirov et al., 2023).

During the storage of Chinese cabbage (*Brassica Rapa L*)., it was observed that the natural reductions and spoilage of products happened differently in different varieties. Experiments were carried out focusing on the preservation of Chinese cabbage (*Brassica Rapa L*). varieties grown in one period and in one region (Hakimov, 2024), (Musirmonov et al., 2023), (Alimova et al., 2022), (Hakimov, 2024).

Figure 1: The process of preparing Chinese cabbage (*Brassica Rapa L*). for storage in cold storage.

It should be said that although the weight and size of the heads of cabbage do not differ sharply from each other, it was found in our experiments that the levels of natural reduction during their storage were different. In the experiment, 100 kg of products of each variety were stored in wooden boxes for storage.

In our experiments, products were stored at different temperatures during the season. In our initial

experiment, the temperature of the air in the storage warehouse was set to +3 ^{0}C and the relative humidity was set to 95%. Observations were conducted 4 times every 10 days. When the total natural reduction indicators of cabbage heads stored for 40 days were analyzed, it was found that the varieties were similar. In this case, the level of natural decrease in products was determined in the "Khibinskaya" variety, 10% in the "Billur" variety, 10% in the "Zangori" variety, and up to 9% in the "Mezon" variety (Table 1).

Table 1: Effects of storage temperature and relative humidity on the natural shrinkage of the product during the storage of Chinese cabbage (*Brassica Rapa L*). varieties.

Varieties of Chinese cabbage	The rate of natural lost (%)				Average result
	+3 ^{0}C	+2 ^{0}C	+1 ^{0}C	0 ^{0}C	+1,5 ^{0}C
	95 %	96 %	97 %	98 %	96,5 %
"Khibinskaya" (control)	11	10	9	9	9,75
"Billur"	10	10	8	7	8.75
"Zangori"	10	10	8	7	8,75
"Mezon"	9	9	7	5	7,5
Sx	0,08	0,07	0,05	0,04	0,06
LSD_{05}	0,3	0,3	0,4	0,5	0,3

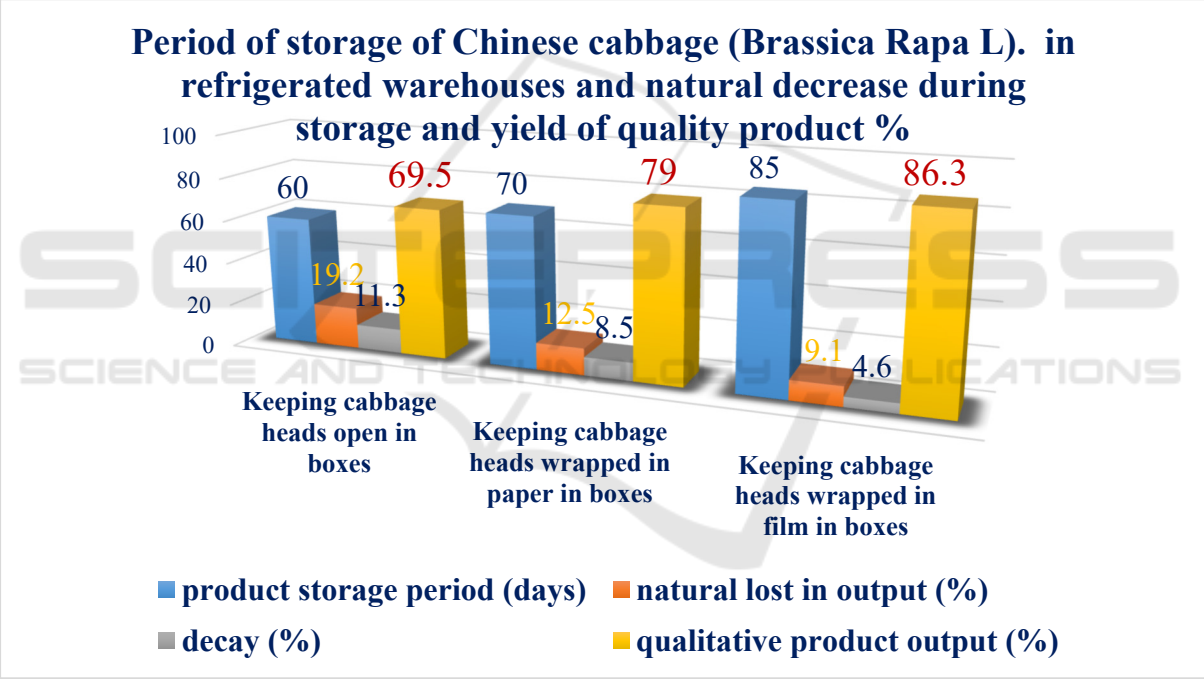

Figure 2: Chinese cabbage (Brassica Rapa L). storage period in refrigerated warehouses and natural reduction during storage and quality product yield were analyzed in (%).

From the data in the table, we can see that when the temperature of the air in the storage warehouse is +2 ^{0}C and the relative humidity of the air is 96%, the indicators of natural reduction of the products were observed up to 10% in the "Khbinskaya" variety, 10% in the "Billur" variety, 10% in the "Zangori" variety, and 9% in the "Mezon" variety.

During the storage of products, when the temperature of the air in the warehouse is +1 ^{0}C and the relative humidity of the air is 97%, natural reduction indicators of the "Khibinskaya" variety, 9% in the "Billur" variety, 8% in the "Zangori" variety, and 7% in the "Mezon" variety were determined.

During storage, when the temperature of the air in the warehouse was 0 ^{0}C and the relative humidity of the air was 98%, the natural decrease in the products was determined up to 9% in the "Khibinskaya" variety, 7% in the "Billur" variety, 7% in the "Zangori" variety, and 5% in the "Mezon" variety.

It should be said that the relatively low temperature of the air in the storage warehouse and the relative humidity of the air not less than 97% lead

to a sharp decrease in the level of natural reduction in the products. In addition, a sharp decrease in the effect of certain harmful microorganisms in stored products was determined during these experiments.

When comparing the most resistant varieties to storage, it was found that the “Mezon” variety of Chinese cabbage (*Brassica Rapa L*). showed a relatively high result compared to other varieties studied in our experiment.

In our research, when storing Chinese cabbage, when cabbage heads were wrapped in a film, their storage time was slightly longer compared to the usual method. It is not recommended to store Chinese cabbage (*Brassica Rapa L*). together with other types of fruits and vegetables. Otherwise, it affects the quality indicators of cabbage heads.

In addition to the refrigerator, Chinese cabbage (*Brassica Rapa L*). can also be stored in ordinary warehouses. In this case, it is necessary to ensure that the storage area does not get direct sunlight and maximum darkness and cool temperature. Chinese cabbage (*Brassica Rapa L*). can be stored in ordinary cellars.

In our experiments, we analyzed the changes in the duration of storage of different types of Chinese cabbage (*Brassica Rapa L*). during storage in refrigerated warehouses in cardboard boxes in an open state and in polyethylene bags or wrapped in food film. In this process, there is no need to remove the leaves from the upper layer of cabbage heads, and this situation makes it possible to store cabbage heads for a long time in some processes. Air humidity exceeding 100% during storage causes cabbage heads to spoil very quickly.

In our experiments, studies were conducted on storing Chinese cabbage in a refrigerated warehouse in an open state in cardboard boxes, wrapped in paper and wrapped in film. In this case, the air temperature in the cold room was set at $+2^0$C, and the relative air humidity was set at 95%. In this process, it was found that the shelf life of cabbage heads, natural reductions, rotting and yield of quality products were different (Fig. 2).

Studies have shown that when we store Chinese cabbage (Brassica Rapa L). heads in different packaging materials, i.e., when cabbage heads are stored in cardboard boxes with the top open, the shelf life of the product is 60 days, the rate of natural cane is 19.2%, the rate of decay is 11.3%, and the rate of quality product output is 79.0%. was observed during our experiments.

When the products were stored in cardboard boxes wrapped in paper, it was found that the product's shelf life was 70 days, natural reed rate was 12.5%, decay rate was 8.5%, and quality product output rate was 69.5%.

During our research, it was found that when Chinese cabbage (Brassica Rapa L). heads are stored in cardboard boxes wrapped in plastic, the shelf life of the product is 85 days, the rate of natural cane is 9.1%, the rate of decay is 4.6%, and the rate of quality product output is 86.3%. It should be said that despite the microclimate in the storage warehouse being the same in our experiment, the storage of carm heads in different packaging materials showed different differences.

It was found that when the heads of cabbage were stored in a cardboard box wrapped in a film, the duration of storage, the degree of natural cane, rotting and quality product yield had a high effect.

4 CONCLUSIONS

It was found that Chinese cabbage (*Brassica Rapa L*). varieties “Mezon” showed the best results when the temperature and relative humidity of the air in the warehouse was set to 1.5% ^{0}C and the relative humidity of the air was 96.5% during their storage. At the same time, the efficiency of Chinese cabbage (*Brassica Rapa L*). storage in refrigerated warehouses increases if cabbage heads are kept wrapped in film in cardboard boxes. Quality storage and long-term storage of cabbage heads is ensured.

REFERENCES

GOST 28373-94. Fresh cabbage. Storage guide. Date of introduction 01.01.1996.

Meshkov A.V., Terekhova V.N. Technology of production of Peking cabbage for products and seeds in the Central Chernozem region of the Russian Federation: methodological recommendations [Text]/ A.V.Meshkov, -M.: "Agropromizdat", 2005. - 35 p.

Rusanov B.G. Cabbage: Varieties, cultivation, storage, application: scientific and practical. the manual/ B.G. Rusanov. - St. Petersburg: St. Petersburg: LLC "Diamant", LLC "Golden Age Publishing House", "Agropromizdat", 2000. - 192 p.

Shirokov E.P. Technology of fruit storage and processing with the basics of standardization: a textbook./ E.P. Shirokov — M.: "Agropromizdat", 1998. - 319 p.

Kadam D.M., Samuel. The effect of pretreatment and packaging material on the physico-chemical properties and shelf life of cauliflower after solar drying. (India) = Impact of processing treatment and packaging material on some properties of stored dehydrated cauliflower.

Misirov Sh., Sharipov S. Methods of storing broccoli in different periods /E3S Web of Conferences 389, 03065 (2023) UESF-2023. https://doi.org/10.1051/e3sconf/202338903065

Hakimov R. Beijing cabbage cultivation and storage/ modern transformation of Education. Set 7 No. 2024. – B. 190-193. www.tadqiqotlar.uz.

Musirmonov, J., Gafurova, L., Ergasheva, O., & Saidova, M. (2023). Wastewater treatment in Central Asia: a review of papers from the Scopus database published in English of 2000−2020. E3S Web of Conferences, 386. https://doi.org/10.1051/e3sconf/202338602005

Alimova, F. A., Primkulov, B. Sh., Saidova, M. T., & Boboniyozov, E. A. (2022). Combined aggregate for strip tillage and simultaneous sowing of re-crops. IOP Conference Series: Earth and Environmental Science, 1112(1).https://doi.org/10.1088/1755-1315/1112/1/012021

Hakimov R. Factors affecting the process of storage of Beijing cabbage /modern transformation of Education. Set 7 No. 2024. – p. 194-197. www.tadqiqotlar.uz