INFLUENCE OF GENOTYPE AND COLD STORAGE ON THE CULINARY QUALITY OF ROMANIAN POTATO VARIETIES

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Abstract

Genotypic variability among potato cultivars leads to significant differences in cooking behavior, and changes in culinary quality traits of potato genotypes during extended low-temperature storage are also of significant interest. In 2024, twelve potato varieties developed at NIRDPSB Brașov were evaluated for their boiling behaviour and the variability of culinary quality characteristics after 150 days of storage at 4°C. Sensory analysis of boiled tubers allowed the classification of the varieties into culinary use types AB, B, and BC, based on their tendency to disintegrate during boiling, flesh consistency, and moisture content. Extended storage led to changes in the sensory qualities of boiled tubers, particularly by reducing their appearance, decreasing mealiness and flavor intensity, and enhancing the flesh color. Except for Darilena and Cezarina varieties, for which the culinary use type index remained unchanged, the other varieties showed slight variations after storage, generally in a decrease direction. Nonetheless, these changes resulted in a reclassification of the culinary type only for the Sarmis, Cosiana, and Azaria varieties.

Key words: potato, genotype, culinary quality, variability

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important food crops worldwide, consumed in a variety of culinary forms. Genotypic variability among cultivars leads to significant differences in cooking behavior: some varieties maintain pulp firmness and structural integrity, while others become mealy or disintegrate, affecting both culinary quality and industrial processing (Zhang et al., 2023).

Cold storage at low temperatures (≈4–6 °C) over extended periods can induce biochemical changes, including increased reducing sugars (Krochmal-Marczak et al., 2017) and starch modification, a phenomenon known as cold-induced sweetening. These changes could influence pulp texture and moisture retention during boiling and vary among genotypes, highlighting the importance of selecting cultivars suitable for long-term storage. A good potato taste is very important for breeding programs focused on quality (Wang et al., 2024). Potato texture is very important for the consumer's perception of potato quality (Arvanitoyannis et al., 2012). Studying the cooking characteristics of tubers immediately after harvest and after 5–6 months of storage is essential for identifying genotypes that combine storage resilience with superior cooking quality. Evaluating boiling performance, pulp consistency, and moisture retention provides valuable information for optimizing tuber quality for both fresh consumption and industrial processing (Jankowski, 1992). Considering

the wide range of potato varieties available on the market, examining both potato storage and culinary properties is a pertinent task (Pusik et al., 2020).

MATERIALS AND METHODS

The research was carried out on 12 potato varieties with the objective of evaluating their culinary qualities both at harvest and after the storage period, in order to assess the changes induced by storage on organoleptic and textural characteristics. The determinations were carried out in two distinct stages: at harvest, immediately after the tubers were collected, and after storage, at the end of a 150-day storage period in a refrigerated warehouse at a temperature of 4°C.

For each variety under study, peeled tubers were steamed. The boiled tubers were then subjected to qualitative sensory evaluation. An organoleptic analysis of the potato samples was performed by a trained sensory panel, including assessments of various attributes describing the culinary quality of the boiled potatoes. The evaluation of each culinary quality attribute was performed using a 0 – 10 points scale according to the culinary quality evaluation sheet for potato tubers, as follows:

• *Tuber appearance*, assessed in terms of uniformity and external visual appeal (where 0 = very unattractive and 10 = excellent);

• *Flesh color*, evaluated based on the visual perception of the assessor using colorimetric reference scales (where 0 = white and 10 = dark yellow);

• *Boiling behavior*, referring to the degree of structural integrity maintained by the tubers after boiling (where 0 = remains intact and 10 = completely disintegrates);

• *Flesh consistency*, determined by assessing the resistance of the boiled tuber to crushing (where 0 = firm and 10 = soft);

• *Moisture content* of the boiled flesh, expressing the perceived level of wateriness or dryness (where 0 = moist and 10 = dry);

• *Mealiness*, describing the degree of looseness or flouriness of the boiled tuber flesh (where 0 = not mealy and 10 = highly mealy);

• *Granulation*, referring to the internal texture and fineness of starch granules (where 0 = fine and 10 = coarse);

• *Flavor intensity*, representing the perceived strength of the characteristic potato taste (where 0 = bland and 10 = very pronounced).

The values obtained for each attribute were compiled and compared between the two assessment points: before storage (immediately after harvest) and after storage, for each of the 12 potato varieties.

To determine the culinary use type, a culinary value index was calculated as the average of three sensory-evaluated culinary attributes: boiling behavior, flesh consistency, and moisture content of the boiled tubers. Each resulting value allowed classification into culinary types (A, AB, B, BC, C, CD, and D), indicating the optimal usage of each variety (boiling, baking, frying, or starch production) (Table 1).

Table 1. Classification into types of culinary use according to the index for the type of use

Culinary type index	Culinary type	Recommended uses
0.0 – 0.9	A	Salads, steamed
1.0 – 2.9	AB	Steamed, boiling in skin
3.0 – 3.9	B	Multiple culinary uses
4.0 – 4,.9	BC	Versatile uses for baking and frying
5.0 – 5.9	C	Fried, chips, mashed or baked
6.0 – 7.9	CD	Fried, chips or mashed
8.0-10.0	D	For starch production or animal feed

RESULTS AND DISCUSSIONS

The sensory analysis revealed significant differences among the varieties, as well as changes in the main characteristics after

the storage period (Figures 1-5). In general, it was found that storage influenced both the external appearance and the internal textural characteristics of the tubers, due to physiological respiration processes and biochemical transformations of the reserve substances.

An examination of the scores obtained for the attributes not included in the calculation of the culinary type use index showed noticeable changes between the time before storage and the end of the storage period.

Regarding tuber appearance (Figure 1), scores at harvest ranged from 5.8 (Castrum) to 9.3 points (Sevastia), with the most visually appealing varieties being Sevastia, Asinaria, and Darilena.

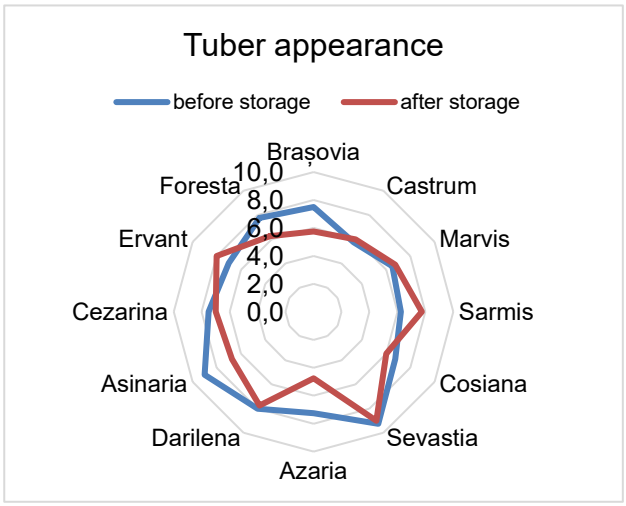

Figure 1. Tuber appearance scores of potato variety before and after storage

After storage, some varieties experienced more noticeable declines in appearance scores (Asinaria, Brasovia, and Azaria), whereas Sarmis and Ervant showed slight improvements. Notably, Sevastia and Darilena maintained their external appearance even after five months of storage.

Flesh color varied according to variety, ranging from creamy white to deep yellow (Figure 2). At harvest, the highest scores, reflecting deep yellow flesh, were recorded for Sevastia (9.0) and Foresta (9.0), while the lowest, corresponding to creamy-white flesh, were observed in Marvis (2.8) and Ervant (1.5). After storage, most varieties exhibited an intensification of flesh color, whereas Azaria showed a decrease in color intensity. Sevastia demonstrated the greatest color stability throughout the storage period.

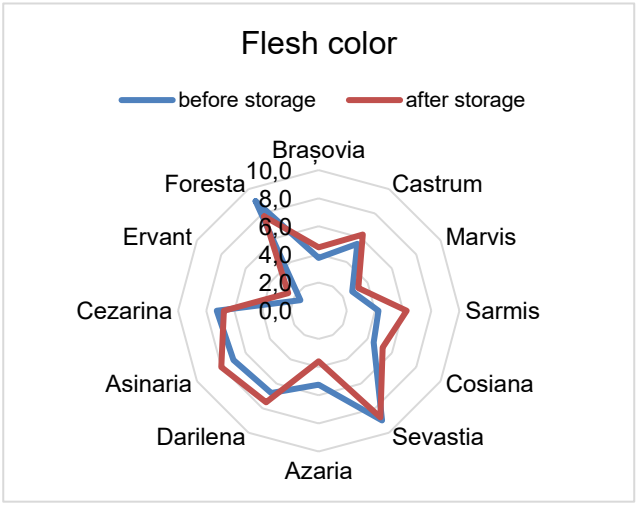

Figure 2. Flesh color scores of potato variety before and after storage

In terms of mealiness (Figure 3), the results indicate varietal differences and a slight increase after storage. Castrum, Marvis, Cosiana, Azaria, and Cezarina displayed medium to high mealiness, while Sevastia and Sarmis had less mealy flesh, making them more suitable for boiling.

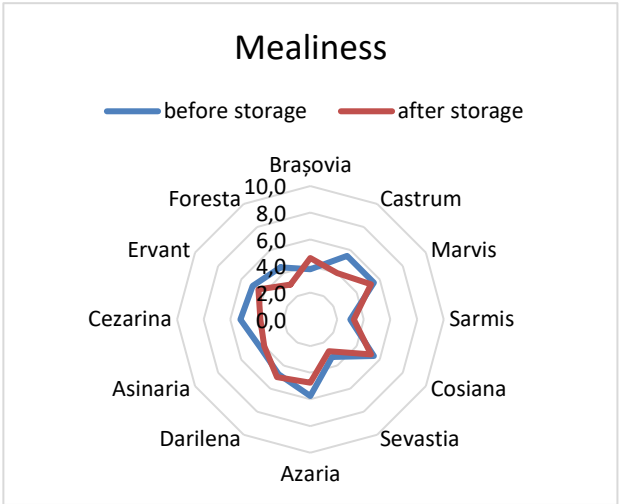

Figure 3. Mealiness scores of potato variety before and after storage

The sensory analysis of starch granules revealed more pronounced differences among varieties (Figure 4). At harvest, organoleptic evaluations yielded scores ranging from 2.3 (Sevastia) to 5.0 (Azaria), while after storage, most varieties showed a decreasing trend, indicating a finer pulp texture. The Azaria variety maintained the same rating for this characteristic (5.0).

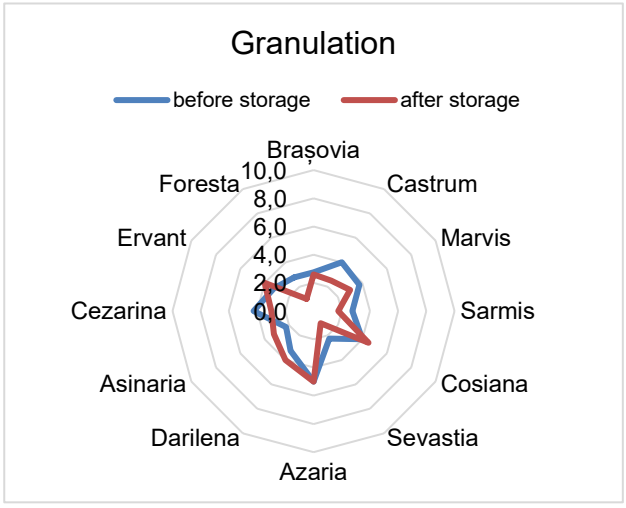

Figure 4. Sensory evaluation scores of starch granules in potato varieties

Regarding taste intensity, most varieties recorded values between 4.5 and 7.0 at harvest (Figure 5).

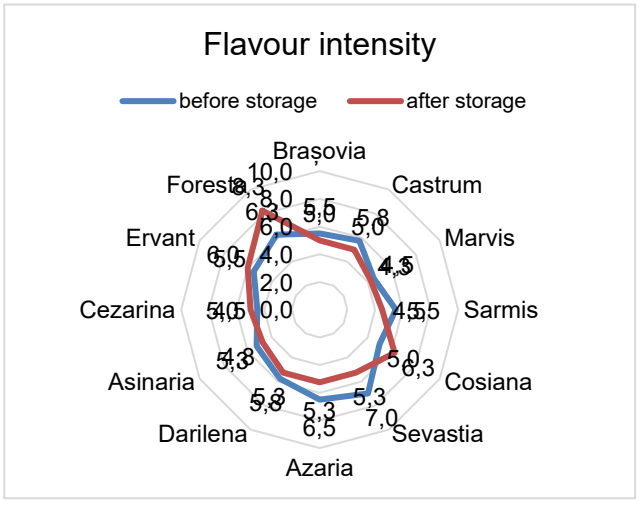

Figure 5. Flavour intensity scores of potato variety before and after storage

After storage, changes in the taste profile were observed, indicating that storage contributed to either the enhancement or reduction of taste intensity. Specifically, the Foresta and Cosiana varieties showed a significant increase in taste intensity by 2.0 and 1.3 points, respectively, whereas Sevastia, Sarmis, and Azaria experienced a decrease in taste intensity of 1.8, 1.3, and 1.0 points, respectively.

The sensory evaluation of the 12 potato varieties also included three additional culinary quality traits: boiling behavior, pulp consistency, and pulp moisture (Figure 6). The mean sensory scores obtained for these traits were used to establish the index for the culinary use type.

Regarding boiling behavior, the scores for boiled tubers before storage ranged from 0.5 (Sevastia) to 4.25 (Castrum), and after storage from 0.5 to 2.0. An improvement in boiling behavior was observed for most varieties, indicating a tendency to maintain tuber integrity due to postharvest biochemical changes. The Sevastia, Darilena, Brasovia, Azaria, and Ervant varieties recorded the lowest values, maintaining the specific characteristics of varieties suitable for boiling, while Castrum, Cezarina, Marvis, and Sarmis showed higher indices, suggesting a pulp more prone to surface disintegration. After storage, the Castrum variety exhibited a statistically significant decrease compared to the value recorded at harvest, whereas the differences observed in the other 11 varieties were not statistically significant. For pulp consistency before storage, the values ranged from 2.75 (Asinaria) to 6.0 (Foresta). After storage, most varieties showed a decrease in this parameter, except for Marvis, which maintained the same value, and Foresta, which showed a slight increase.

Regarding the moisture content of boiled tubers, values before storage ranged from 2.5 to 6.5, while after storage a slight increase in the index was observed for most varieties. The increase in values

reflects a reduction in free water content, associated with a relative concentration of dry matter. The Marvis, Darilena, Cosiana, Castrum, and Asinaria varieties were assessed as having low moisture content, whereas Foresta, Sevastia, and Sarmis were considered to have relatively moist pulp. A statistically significant decrease in tuber moisture was observed in the Darilena variety after prolonged storage, while the differences recorded for the other varieties were not statistically significant.

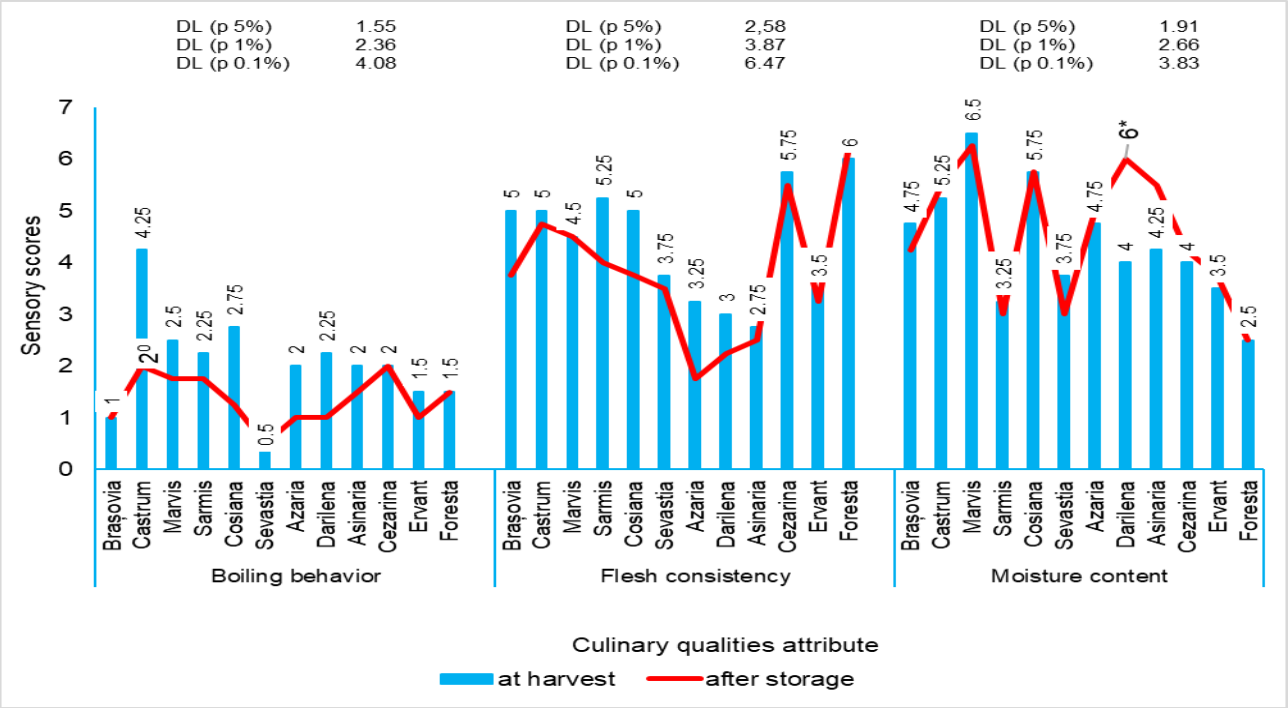

Figure 6. Boiling behavior, flesh consistency and moisture content scores of potato variety before and after storage

Analyzing the culinary use type index, calculated as the mean of the scores for boiling behavior, pulp consistency, and pulp moisture (as shown in Figure 7), it can be observed that the values before storage ranged between 2.67 and 4.83, and after storage between 2.33 and 4.83.

The highest values before storage were recorded for the Marvis (4.50), Castrum (4.83), and Cosiana (4.50) varieties, corresponding to the BC culinary type. After the storage period, Marvis (4.17) and Castrum (4.08) maintained their classification within the BC type, which recommends them for multiple uses such as baking and frying, while Cosiana was reclassified into usage type B.

The Sevastia and Ervant varieties recorded the lowest index values (2.67 and 2.83, respectively); these values slightly decreased after storage (2.33 and 2.67), but remained within the AB culinary

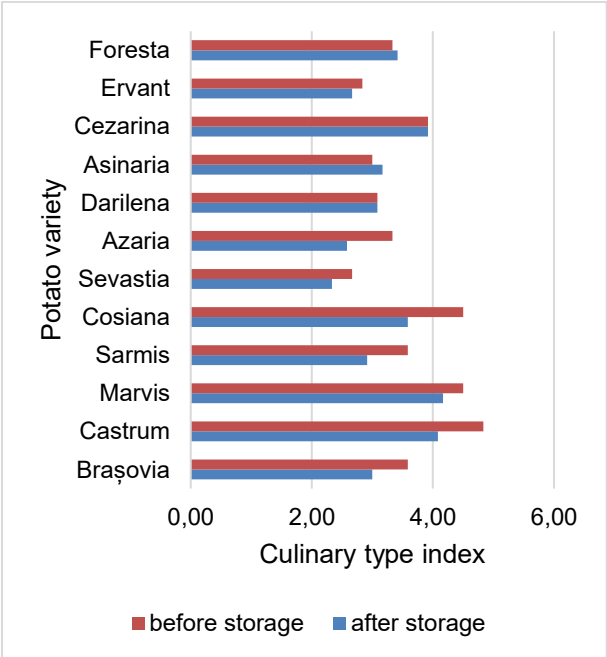

Figure 7. The potato varieties culinary use type index before and after storage

type, which makes them suitable for steaming or boiling.

The remaining varieties fall into the B culinary type, suitable for multiple culinary uses, and retained this classification after storage, except for Sarmis and Azaria variety, which shifted from B type to the AB type.

CONCLUSIONS

On average, it was observed that long-term storage at 4 °C causes a slight changes in the sensory qualities of boiled tubers, particularly by reducing their appearance, decreasing mealiness and flavor intensity, and enhancing the flesh color.

With the exception of the Darilena and Cezarina varieties, for which the culinary use type index remained unchanged, the other varieties showed slight variations after storage, generally in a decrease direction.

These changes in the culinary usage index led to a change in the culinary type only for the Sarmis, Cosiana, and Azaria varieties, while the remaining varieties retained the same culinary classification as prior to storage.

The fact that most varieties maintained their initial culinary classification before and after storage indicates their stability in terms of culinary quality traits.

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