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DETERMINATION OF CHANGES IN PHYSICAL AND TECHNOLOGICAL CHARACTERISTICS OF SOME POTATO (*Solanum tuberosum* L.) VARIETIES GROWN IN KONYA UNDER LONG STORAGE CONDITIONS

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Abstract: In this study conducted in 2022 year under the ecological conditions of Konya, five registered potato varieties (Innovator, Russet Burbank, Metro, Brooke, Lady Olympia) were cultivated, and certain physical and technological characteristics were examined before and after a six-month long storage period at conditions of 4-6 °C and 90-98% humidity. These characteristics, including dry matter content, chips yield, French fries yield, and the color values of chips after frying (L*, a*, b*) were assessed both before and after storage, and weight losses at the end of storage were also recorded. At the end of the storage period, there were variations in the physical and technological characteristics of the tubers. According to the overall average of the potato varieties, by the end of storage compared to pre-storage, the dry matter content of potato tubers increased by 2.72%, chip yield by 0.48%, French fries yield by 5.09%, and the a* value by 55.37%. On the other hand, the L* value decreased by 8.39%, the b* value by 28.17%, and the weight loss during storage showed a decrease of 4.61%. In terms of industrial type, based on dry matter content, Brooke and Innovator varieties had the highest values. Excluding the Melody variety, all other varieties showed high yields in chips and French fries production. The variety with the least weight loss detected was the Innovator.

Keywords: Physical characteristics, Potato, Storage, Technological characteristics, Variety

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1. Introduction

Potatoes, even after being harvested, continue to exhibit metabolic activities, making them living organisms. This characteristic elevates the significance of proper storage conditions to preserve their quality and extend shelf life. During storage, potato tubers undergo quality changes negatively influenced by moisture loss, decay, and physiological deteriorations. The alteration in physical, technological, and quality characteristics depends on the duration of storage, the temperature and humidity level, the presence of air, and gas components of the storage location. The desired outcomes post-storage are minimized weight loss, reduced changes in tuber quality, and the least amount of observed diseases in the tubers (Eltawil et al., 2006). To minimize storage losses, delay physiological aging, and achieve positive results in chip quality at the end of storage, pre-harvest applications of natural and synthetic sprout growth inhibitors have been conducted in many studies, yielding successful outcomes (Baydar et al., 2009; Şanlı and Karadoğan, 2013; Ok and Şanlı, 2021). On the other hand, factors such as storage types, storage temperature, the differences in storage structures, storage duration, and understanding how pre-harvest conditions affect tuber quality and its relationship with tuber dormancy are among the factors that directly influence the changes in the tuber before and after storage (Öztürk, 2010; Kibar, 2012; Yurtlu et al., 2012; Öztürk et al., 2016; Alamar et al., 2017; Şanlı et al., 2019). The purpose of storage is crucial in determining the storage temperature. Generally, after the harvested tubers are placed in storage, the storage temperature is gradually reduced by 1 °C every 1-2 days. Additionally, it is documented in the literature that tubers intended for seed use should be kept at 2-4 °C to prevent dormancy for a longer period, those intended for culinary use should be kept at 3-5 °C to preserve cooking properties, and industrial tubers should be kept at 7-10 °C to maintain the increase in reducing sugars at a certain level (Karadoğan and Şanlı, 2019). Depending on storage conditions, potato tubers lose water through transpiration, which will manifest as weight loss and shriveling of the tubers. Additionally, metabolic processes such as respiration in potato tubers require energy, utilizing a portion of the dry matter, particularly starch, resulting in a reduction in tuber weight due to dry matter loss. Storage diseases and pests can further exacerbate these losses. Consequently, there will be changes in the chemical composition of the tubers during the storage period (Wustman and Struik, 2007). Differences in pre-harvest care practices, such as the amount of water provided and nitrogen fertilization, also lead to changes in quality parameters such as the protein content of the tuber (Çalışkan and Akkamış, 2023). On the other hand, climate changes are also expected to adversely affect the storage of potatoes, tuber sprouting, and storage diseases (Zhang et al., 2024). After long-term storage, the loss of apical dominance occurs, and the resulting bud sprouting and branching directly affect the number of stems in the plant during the growing season. Since the number of main stems determines the tuber size distribution, it is crucial to bring the seed potatoes to the growing season with minimal storage weight loss (Eshel, 2015). After the end of dormancy, the cumulative temperature during storage directly affects physiological aging. Additionally, light conditions and genotypic characteristics are among the factors that influence physiological aging (Struik, 2007).

In potato breeding and cultivation, determining post-storage quality and physical changes is as important as yield. This study aims to identify the physical and technological changes of some registered potato varieties under long-term storage conditions (6 months).

2. Materials and Methods

The experiment was conducted at the Prof. Dr. Abdülkadir Akçin trial field of the Faculty of Agriculture, Selçuk University, during the 2022 growing season (May-September). Before planting, soil samples were taken from various points in the trial field at a depth of 0-30 cm. According to the soil analysis results, the texture class was identified as loamy, with an organic matter content of 1.37%, inorganic nitrogen at 8.6 mg kg^{-1}, phosphorus at 5.0 mg kg^{-1}, potassium at 48 mg kg^{-1}, and a pH of 7.81. According to climate data obtained from the Konya Meteorology Regional Directorate, the average temperature and relative humidity values during the study period in 2022 were found to be close to the long-term averages (1980-2021). The average temperature for the months of May to September was recorded as 20.6 °C over the long term, while it was 21 °C in 2022. The average relative humidity values were 46.3% over the long term and 45.1% in 2022. The total precipitation in June was significantly higher in the long-term average (26.1 mm) compared to 2022 (10.4 mm), whereas the total precipitation amounts for the other months were found to be similar.

The experiment was conducted using a "Randomized Complete Block Design" and the storage data were analyzed using the same design with factorial. Five registered potato varieties (Innovator, Russet Burbank, Metro, Brooke, and Lady Olympia) were used as materials in the study. The characteristics of the varieties used in the research are provided in Table 1. In the experimental field, tubers were hand-planted into rows marked with markers, with each plot measuring 70x30 cm. Each plot consisted of 4 rows, and the plot length was set to 5 meters. The experiment was set up with 3 replications. Tubers harvested from each plot were placed into 5 kg mesh potato bags and stored in a storage facility with a temperature of 4-6 °C and humidity adjusted to 90-98%. In addition to the 5 kg of tubers placed in mesh potato bags from each plot, additional randomly selected tubers were taken their pre-storage technological properties were measured. At the end of the storage period (September-March, "6 months"), the technological properties of randomly selected tubers from each mesh potato bags were determined as post-storage properties. Additionally, at the end of the storage period, the weights of the tubers in the mesh potato bags were measured, and the weight loss percentage was calculated by comparing it to the pre-storage weight (Öztürk et al., 2016). The technological properties calculated both pre and post storage included dry matter content (%) (Kacar, 1994), chips yield (%) (Anonymous, 2001), French fries yield (%) (Şenol, 1973), and post-frying color values measured using a Minolta Chromo Meter CR 200b device, with lightness (L*), red/greenness (a*), and yellow/blueness (b*) values recorded respectively (Torrico et al., 2019).

The data obtained as a result of the study were subjected to analysis of variance using JMP 11 software (JMP Version 11, SAS Institute Inc. Cary, NC, 1989–2021) and the differences between the averages were grouped by “LSD Multiple Comparison Test” with the computer statistic program MSTAT-C (Michigan State University, v. 2.10).

Table 1. Characteristics of the varieties used in the experiment

Varieties	Maturity Group	Usage Area
Brooke	Mid-Late	Table and Industrial
Innovator	Mid-Late	Chips and French Fries
Lady Olympia	Mid	Chips and Industrial
Metro	Mid-Early	Table and Industrial
Russet Burbank	Late	French Fries

3. Results

3.1. Dry Matter Content (%)

Before storage, the dry matter content of the varieties showed that the highest value was found in the Brooke variety (22.46%), followed by Russet Burbank (22.24%), Innovator (21.51%), Lady Olympia (21.17%), and Metro (19.26%). The changes in dry matter content post-storage varied among the varieties. The overall average increased from 21.33% to 21.91%. The varieties that showed a decrease in dry matter content after storage were Brooke (1.47% decrease) and Russet Burbank (6.97% decrease). It was determined that the dry matter content of the other varieties increased after storage (Table 2).

3.2. Chip Yield (%)

Pre- and post-storage chip yields of varieties were found to be higher in varieties bred for chipping and French fry production, while the table variety Metro exhibited the lowest values (37.18%-31.49%). Excluding the Metro variety, all other types were categorized in group (a), and numerical comparisons revealed the highest yield of 46.46% with the Lady Olympia, followed by 45.63% with Brooke, 44.79% with Innovator, and 43.03% with Russet Burbank variety. Post-storage chip yield values paralleled the increase in dry matter content, showing a 0.48% rise, thus recording an experimental average of 43.63%. At the end of storage, chip yields of Innovator, Lady Olympia, and Russet Burbank varieties showed increases, whereas Brooke and Metro varieties displayed decreases (Table 2).

3.3. French Fry Yield (%)

The changes in French fry yields from post-harvest to post-storage were parallel to the chip yield values. The lowest French fry yield was observed in the Metro variety at 33.40%. Post-storage, this value increased to 38.15%. The Russet Burbank and Innovator varieties exhibited increases from 44.22% to 44.57% and from 42.37% to 43.00%, respectively.

Table 2. Mean values and statistical groupings of dry matter content and chips yield of cultivars

Cultivars \ Traits	Pre-storage	Post-storage	Pre-storage	Post-storage
	Dry matter content (%)		Chips yield (%)	
Brooke	22.46^{a}	22.13^{b}	45.63^{a}	44.17^{a}
Innovator	21.51^{bc}	23.61^{a}	44.79^{a}	48.55^{a}
Lady Olimpia	21.17^{c}	22.81^{ab}	46.46^{a}	48.83^{a}
Metro	19.26^{d}	20.30^{c}	37.18^{b}	31.49^{b}
Russet Burbank	22.24^{ab}	20.69^{c}	43.03^{a}	45.14^{a}
Mean	21.33	21.91	43.42	43.63^{a}
LSD(%)	0.27**	1.31**	4.60**	4.75**

a,b= The differences between the means shown with the same letters and the same column in the same group are insignificant (*: P<0.05, **: P<0.01, NS: non-significant).

Table 3. Mean values and statistical groupings of French-fry yield and storage weight loss of cultivars

Cultivars \ Traits	Pre-storage	Post-storage	Storage weight loss (%)
	French-Fry Yield (%)		
Brooke	45.53^{a}	42.60^{b}	5.34
Innovator	42.37^{a}	43.00^{b}	3.52
Lady Olimpia	41.85^{a}	49.58^{a}	5.47
Metro	33.40^{b}	38.15^{c}	3.87
Russet Burbank	44.22^{a}	44.57^{b}	4.88
Mean	41.47	43.58	4.61
LSD(%)	7.00*	3.68**	NS

a,b= The differences between the means shown with the same letters and the same column in the same group are insignificant (*: P<0.05, **: P<0.01, NS: non-significant).

Table 4. Mean values and statistical groupings of a and b of cultivars

Traits / Cultivars	Pre-storage	Post-storage	Pre-storage	Post-storage	Pre-storage	Post-storage
	Chips of L* value		Chips of a* value		Chips of b* value	
Brooke	41.76	41.76	-4.18a	-1.82	21.43	14.07
Innovator	45.65	45.65	-3.23a	-1.10	20.29	16.55
Lady Olimpia	38.30	38.30	-2.28ab	-1.68	19.70	15.35
Metro	39.18	39.18	-1.51bc	-0.46	18.59	13.85
Russet Burbank	35.38	35.38	-0.91c	-0.33	15.83	9.06
Mean	40.05	40.05	-2.42	-1.08	19.17	13.77
LSD	NS	NS	1.72*	NS	NS	NS

A decrease in French fry yields was noted in other varieties post-storage. The trial average showed a proportional increase from 41.47% to 43.58%, amounting to a 5.09% rise (Table 3).

3.4. Storage Weight Loss (%)

The weight loss rates of the varieties before and after storage did not exhibit statistical significance. However, when comparing the numerical data of weight losses among the varieties, the highest weight loss was recorded in the Lady Olympia variety at 5.47%, followed by 5.34% in Brooke, 4.88% in Russet Burbank, 3.87% in Metro, and 3.52% in Innovator (Table 3).

3.5. *L Value of Chips**

The L* values of chips before and after storage did not show statistical significance after frying. Numerically compared, the highest L* value was measured in the Innovator variety both pre-storage (45.65) and post-storage (39.92), while the lowest value was recorded in the Russet Burbank variety before storage (35.38) and in the Metro variety after storage (32.26). A decrease in the trial average from 40.05 to 36.69 was observed (Table 4).

3.6. a* Value of Chips

The pre-storage a* values of the varieties were found to be statistically significant at the 5% level. The highest values were observed in the Russet Burbank (-0.91) and Metro (-1.51) varieties, while the lowest value was recorded for the Brooke variety (-4.18). No statistically significant differences were found among the a* values of the varieties after storage. Numerically, as before storage, the highest value was again determined in the Russet Burbank variety (-0.33), followed by the Metro variety (-0.46). According to trial averages, the a* value increased from -2.42 before storage to -1.08 after storage (Table 4).

3.7. b* Value of Chips

According to trial averages, the b* values were 19.17 before storage and decreased to 13.77 after storage. No statistical differences were identified between the two periods, and a decrease was observed in all varieties post-storage. Numerically, the highest pre-storage b* value was 21.43 in the Brooke variety, while post-storage, the highest was 16.55 in the Innovator variety. The lowest b* value was recorded in the Russet Burbank variety, with 15.83 before storage and 9.06 after storage (Table 4).

4. Discussion

4.1. Dry Matter Content

As reported by Pinhero et al. (2009), the dry matter content varies according to cultivation conditions and genotype. During storage, tubers undergo respiration, reducing starch to sugar within the tuber, which indirectly leads to a decrease in dry matter. Additionally, the physiological age of the tuber, maturity group, storage temperature, and duration directly affect the dry matter content (Mazza, 1983a; 1983b). In a study conducted over two years, the dry matter content of tubers showed variability among varieties, with a trial average decrease of 1.46%. By variety, Marfona showed a decrease of 4.32% in dry matter content after storage, Toscana 3.91%, Binella 2.43%, Granola 9.96%, and Natascha 6.64%, while Banba and Slaney exhibited increases of 4.24% and 5.72%, respectively (Ozturk and Polat, 2016). In a research conducted by Baijal and Van Vliet (1966), a reduction in the dry matter contents of tubers was observed by the end of storage. The dry matter content consists of 70% starch, and fluctuations in dry matter content also impact the starch level. A study designed to investigate changes in tubers over various storage durations explained that the reduction in starch content at the end of storage was due to the decomposition of starch necessary for the respiration of the tubers. Additionally, it was noted that as the storage duration increased, the development of shoots in the tubers led to greater moisture loss from these shoots, potentially causing a proportional increase in dry matter contents (Özcan et al., 2019). The study observed variability in dry matter contents among different varieties; decreases were noted in Brooke and Russet Burbank varieties, while increases were detected in other varieties. The findings of the researchers aligned with the dry matter values recorded in the study, demonstrating that the lowest dry matter content found in the Metro variety, a culinary type, was consistent with its characteristics.

4.2. Chip Yield

The chemical composition of a tuber determines whether a potato is suitable for industrial use. Industrial-type potato varieties are desired for their high dry matter content, high chip yield, and low oil absorption during frying. Specific gravity directly affects chip yield, with varieties having a higher specific gravity typically showing higher yields. As specific gravity correlates positively with dry matter content, varieties with high dry matter levels are expected to also have high chip yields. Additionally, it is preferred that chips do not darken excessively during frying. Besides these criteria, the physiological age of the tuber is also significant (Sowokinos, 1978; Lulai and Orr, 1979; 1980). Research findings have varied by varieties. A study conducted by Karadoğan (1994) under Erzurum conditions reported that chip yields for 15 potato varieties ranged between 27.56% and 48.21%, with a positive correlation noted between chip yields and dry matter contents. Kara (1996) found an increase in chip yields corresponding to a decrease in tuber weight loss during storage. A study initiated by Kita (2002) reported that chip texture underwent various changes during storage, linked to alterations in the water content within the chip texture. Another study conducted under storage conditions found that post-storage chip yields ranged between -8.40% and 3.85%. Some varieties showed an increase in chip yield values, while others showed a decrease (Ozturk and Polat; 2016). The variations in chip yield values in this study are consistent with existing literature.

4.3. French Fry Yield

In a study conducted by Özcan et al. (2019), it was found that as storage duration increased, the yields of French fries decreased. The highest French fry yield was observed in the Russet Burbank variety, with a pre-storage value of 35.4% decreasing to 30.9% post-storage. The researchers have explained this by relating it to the dry matter content, noting that an increase in dry matter content proportionally enhances French fry yields. It has also been stated that a reduction in moisture loss in tubers increases their specific gravity and indirectly their dry matter content, which in turn improves French fry yields over the course of storage according to their specific gravity and dry matter content (Şenol, 1970; Şanlı, 2012). The findings related to French fry values in the study are consistent with the researchers' observations.

4.4. Storage Weight Loss

There is a close relationship between the dormancy periods of potato tubers and post-storage weight losses. It has been observed that breaking dormancy leads to an increase in weight losses after storage (Özcan et al., 2019). In this field, the findings of some researchers have varied. Accordingly, weight changes identified as storage weight losses, such as those reported by Ozturk and Polat (2016) (2.03%), were found to be above the range of data obtained in this study, while those reported by Okur (2008) (7.2-9.5%) and Özcan et al. (2019) (5.78-13.49%) were closer to the lower end of the observed range. The differences in weight losses among genotypes are influenced by factors such as respiration, transpiration, and sprout formation (Kolbe and Stephan-Beckmann, 1997).

4.5. Color Values of Chips after Frying (L*, a*, b*)

One of the most significant challenges in the potato chip industry is maintaining the color of chips and ensuring consumer appeal. The key factors affecting chip color include variety, storage conditions, storage duration, maturity of the variety, specific gravity and, indirectly, the dry matter content of the variety, as well as cultivation practices (Hill, 1974). When potato tubers are stored at 9-10 °C, tubers exhibit high reducing sugar content, known as low-temperature sweetening (LTS). Tubers stored at this temperature result in chips and French fries that appear dark brown during frying (Maillard browning reaction), which is undesirable to consumers. To prevent this, storage temperatures should be lowered. Storing tubers at lower temperatures offers several advantages: reduced respiration rates leading to lower storage weight losses, natural control of sprouting, control of bacterial and fungal pathogens, avoidance of chemical sprouting inhibitors, and benefits to human health and environmental protection (Pinhero et al., 2012).

Studies on various accessions of the *Solanum* genus have concluded that flesh color is related to carotenoids. The primary carotenoids are zeaxanthin, lutein, violaxanthin, and β-carotene (Burgos et al., 2009). Carotenoids vary with flesh color, with lutein being predominant in yellow-fleshed varieties and zeaxanthin in orange-fleshed varieties (Sulli et al., 2017). Studies have shown a significant relationship between dry matter content, reducing sugar and sucrose levels, and chip color in tubers, directly affecting chip color (cited from Mazza, 1983a;b in Pinhero et al., 2009). Except for the a* value before storage, L* and b* values were not statistically significant in post-frying chip color values, and no dark color appearances were observed during the studies. The frying colors were found to have the brightness and yellowness desired by consumers.

5. Conclusion

Long-term storage has been observed to cause changes in the physical and technological aspects of potato tubers. These changes vary depending on the characteristics of the variety. The Innovator variety exhibited the lowest numerical weight loss, indicating its high resistance to storage conditions. The varieties Brooke, Innovator, Lady Olympia, and Russet Burbank were found to have desirable values for industrial use. Dry matter content is the most critical industrial criterion and can vary according to variety, storage duration and conditions, and the differences in cultural practices during cultivation. Values of this study are significant for increasing researches on storage, one of the most crucial aspects of potato breeding, and for comparing the potential of breeding materials with standard varieties. Further studies should incorporate different storage types and conditions and include additional varieties to enhance the quality and scope of the research.

Author Contributions

The percentage of the author(s) contributions is presented below. The author reviewed and approved the final version of the manuscript.

	N.Ç.K.
C	100
D	100
S	100
DCP	100
DAI	100
L	100
W	100
CR	100
SR	100
PM	100
FA	100

C=Concept, D= design, S= supervision, DCP= data collection and/or processing, DAI= data analysis and/or interpretation, L= literature search, W= writing, CR= critical review, SR= submission and revision, PM= project management, FA= funding acquisition.

Conflict of Interest

The author declared that there is no conflict of interest.

Ethical Consideration

Ethics committee approval was not required for this study because of there was no study on animals or humans.

References

Alamar MC, Tosetti R, Landahl S, Bermejo A, Terry LA. 2017. Assuring potato tuber quality during storage: A future perspective. Front Plant Sci, 8: 283308.

Anonymous. 2001. Technical guidelines for measuring agricultural values. Republic of Türkiye Ministry of Agriculture and Rural Affairs, Seed Registration and Certification Center Directorate. URL: https://www.tarimorman.gov.tr/BUGEM/TTSM/Belgeler/Tescil/Teknik%20Talimatlar/Endüstri%20Bitkileri/pates.pdf (accessed date: May 02, 2024).

Baijal BD, Van Vliet WF. 1966. The chemical composition in different parts of the potato tuber during storage. Eur Potato J, 9: 179-192.

Baydar H, Altındal D, Karadoğan T. 2009. Effects of volatile oils on sprout growth in potato. SDU J Nat Appl Sci, 13(2): 137-141.

Burgos G, Salas E, Amoros W, Auqui M, Munoa L, Kimura M, Bonierbale M. 2009. Total and individual carotenoid profiles in Solanum phureja of cultivated potatoes: I. Concentrations and relationships as determined by spectrophotometry and HPLC. J Food Compos Anal, 22(6): 503-508.

Çalışkan S, Akkamış M. 2023. Change in protein content of potato tubers grown under different irrigation and nitrogen fertilization conditions during storage. Mustafa Kemal Univ J Agric Sci, 29(1): 96-107.

Eltawil MA, Samuel DK, Singhal OP. 2006. Potato storage technology and store design aspects. Agric Eng Int: CIGR J, 2006: 1-18.

Eshel D. 2015. Bridging dormancy release and apical dominance in potato tuber. Adv Plant Dormancy, 2015: 187-196.

Hill LD. 1974. Factors affecting chip color. In: Potato chip quality and processing. McGraw-Hill, New York, US.

Kacar B. 1994. Chemical analysis of plant and soil. Ankara Univ Fac Agric Educ Res Dev Found, Abnkara, Türkiye.

Kara K. 1996. An investigation on some characteristics of certain potato varieties stored for different periods. Gıda, 21(3): 215-225.

Karadoğan T, Şanlı A. 2019. Recent developments in potato production. 4th International Anatolian Agriculture, Food, Environment and Biology Congress, April 20-22, Afyonkarahisar, Türkiye, pp: 9-14.

Karadoğan T. 1994. A study on the quality of chips and french fries of some potato varieties. Atatürk Univ J Fac Agric, 25(1): 1-10.

Kibar H. 2012. Design and management of postharvest potato (*Solanum tuberosum* L.) storage structures. Ordu Univ J Sci Tech, 2(1): 23-48.

Kita A. 2002. Factors affecting potato chips texture during storage. Acta Agrophys, 2002: 77.

Kolbe H, Stephan-Beckmann S. 1997. Development, growth and chemical composition of the potato crop (*Solanum tuberosum* L.). II. Tuber and whole plant. Potato Res, 40(2): 135-153.

Lulai EC, Orr PH. 1979. Influence of potato specific gravity on yield and oil content of chips. Amer Potato J, 56: 379-390.

Lulai EC, Orr PH. 1980. Quality-testing facilities for grower use at the Potato Research Laboratory. Amer Potato J, 57(12): 622-628.

Mazza G. 1983a. Processing/Nutritional quality changes in potato tubers during growth and long term storage. Can Inst Food Sci Technol J, 16(1): 39–44.

Mazza G. 1983b. Correlations between quality parameters of potatoes during growth and long-term storage. Am Potato J, 60: 145-159.

Ok FZ, Şanlı A. 2021. Effects of pre-harvest application with natural and synthetic sprout inhibitors on yield and storage quality of potato (*Solanum tuberosum* L.). J Inst Sci Technol, 11(Special Issue): 3546-3558.

Okur H. 2008. Effects of haulm killing on yield quality and storage properties in potato (*Solanum tuberosum* L.) cultivars. MSc Thesis, Gaziosmanpaşa University, Institute of Science, Tokat, Türkiye, pp: 70.

Özcan S, Şanlı A, Ok FZ. 2019. Determination of storage responses and quality changes of some potato (*Solanum tuberosum* L.) cultivars during storage. Turk J Agric Food Sci Technol, 7(Special Issue 2): 59-66.

Öztürk E, Polat T, Tarakçı S. 2016. Effect of storage on the physical properties of the some potato (*Solanum tuberosum* L.) cultivars. Atatürk Univ J Agric Fac, 47(2): 89-94.

Ozturk E, Polat T. 2016. The effect of long term storage on physical and chemical properties of potato. Turk J Field Crops, 21(2): 218-223.

Öztürk T. 2010. The potato storage in the volcanic tuff storages in Turkey. J Agric Fac Gaziosmanpaşa Univ, 27(2): 113-120.

Pinhero R, Pazhekattu R, Whitfield K, Marangoni AG, Liu Q, Yada RY. 2012. Effect of genetic modification and storage on the physico-chemical properties of potato dry matter and acrylamide content of potato chips. Food Res Int, 49(1): 7-14.

Pinhero RG, Coffin R, Yada RY. 2009. Post-harvest storage of potatoes. In: Advances in potato chemistry and technology. Academic Press, Cambridge, UK, pp: 339-370.

Şanlı A. 2012. Effects of volatile oils containing carvone on sprouting of potato (*Solanum tuberosum* L.) tubers at storage conditions. PhD Thesis, Süleyman Demirel University, Institute of Science, Isparta, Türkiye, pp: 197.

Şanlı A, Karadoğan T. 2013. Effects of chemical and natural sprout inhibitors and storage temperature on potato (*Solanum tuberosum* L.) chips quality. Yuzuncu Yıl Univ J Agri Sci, 23(2): 172-184.

Şanlı A, Cirit Y, Tosun B. 2019. Effects of Essential Oil Applications on Sprout and Root Development Seed Potato (*Solanum tuberosum* L.) Tubers. Turkish J Agri Food Sci Technol, 7(3): 50-57.

Şenol S. 1970. The effect of plant density and seed weight on yield and some other characteristics of potatoes under Erzurum conditions. MSc Thesis, Gaziosmanpaşa University, Institute of Science, Tokat, Türkiye, pp: 70.

Şenol S. 1973. The effect of temperature, duration, tuber specific gravity, and variety characteristics on sugar, dry matter, and chip quality in potato storage. Atatürk Univ Publ No: 159, Fac Agric Publ No: 76, Baylan Print. House, Ankara, Türkiye.

Sowokinos JR. 1978. Relationship of harvest sucrose content to processing maturity and storage life of potatoes. Amer Potato J, 55: 333-344.

Struik PC. 2007. The canon of potato science: 40. Physiological age of seed tubers. Potato Res, 50(3): 375-377.

Sulli M, Mandolino G, Sturaro M, Onofri C, Diretto G, Parisi B, Giuliano G. 2017. Molecular and biochemical characterization of a potato collection with contrasting tuber carotenoid content. PLoS One, 12(9): e0184143.

Torrico DD, Nguyen PT, Li T, Mena B, Viejo CG, Fuentes S, Dunshea FR. 2019. Sensory acceptability, quality and purchase intent of potato chips with reduced salt (NaCl) concentrations. LWT, 102: 347-355.

Wustman R, Struik PC. 2007. The canon of potato science: 35. Seed and ware potato storage. Potato Res, 50: 351-355.

Yurtlu YB, Vursavuş KK, Arslanoğlu F, Yeşiloğlu E. 2012. Physico-mechanical properties of early grown potato tubers during different storage conditions. Soil Water J, 1(2): 61-70.

Zhang S, Wang X, Kinay P, Dau Q. 2024. Climate change impacts on potato storage. Foods, 13(7): 1119.