Kirkuk University Journal for Agricultural Sciences
ISSN:2958-6585
https://kujas.uokirkuk.edu.iq

REVIEW ARTICLE
https://doi.org. 10.58928/ku26.17310

Postharvest Management of Onions: Storage Strategies and Handling Techniques – A Review

Maha A. Hussein
Department of Horticulture and Landscape Engineering , College of Agricultural Engineering Sciences , University of Baghdad
*Corresponding Author: maha.a@coagri.uobaghdad.edu.iq

Received:15/10/2025 **Revised: 16/11/2025** **Accepted: 20/08/2026** **Published: 06/09/2026**

ABSTRACT

As a strategic crop, onion holds significant economic importance in trade due to its nutritional value, processing applications, and therapeutic benefits. Postharvest handling and storage aim to preserve the physiological and physical quality of onion bulbs from harvest to fresh consumption or seed use. Grading, sorting, and packaging are crucial for ensuring storage efficiency and marketing success. Onions are susceptible to postharvest losses of 30–40% during storage, transport, and marketing, primarily due to moisture loss, decay, and sprouting, which compromise product quality. Cultivars and hybrids vary in their tolerance to cold storage, particularly regarding firmness, total soluble solids, outer skin thickness, and moisture retention. Storage success depends on temperature, relative humidity, gas composition, and the storage system employed. To mitigate these losses**,** Smart Cold Storage Systems (SCSS) utilize microcontrollers and advanced sensors (e.g., DHT11 for temperature/humidity, MQ-6 for gases, and LDR for light) connected to mobile applications, enabling real-time monitoring and automated responses, such as ventilation or fan activation. These systems enhance product quality, profitability for farmers and marketers, rural economic development, and sustainable agriculture
by reducing food waste and ensuring year-round availability of strategic crops. Additionally, the selection of appropriate packaging materials, timely harvesting, and sustainable preharvest management are critical for extending storage life and improving the marketability of onions, whether for direct consumption or use as seed in subsequent seasons.

***Keywords*:** Smart storage, pungency, bulb sprouting, curing treatment, cold storage facilities.

INTRODUCTION

Onion [*Allium cepa* L.] holds a strategic economic position in global trade as an agricultural commodity with significant nutritional, industrial, and medicinal value. Global demand for onions are projected to increase over the next five years [1]. Over the past two decades, global onion production has risen by 25%, positioning it as the second most important horticultural commodity, largely due to its high nutritional and industrial processing value. Their waste, especially red onion peels, can support the food industry and improve its quality [2].

Onions are consumed in various forms: fresh [green], dried, powdered [as a flavor enhancer], or as frozen rings in fast food. Their widespread daily use in the human diet stems from their diverse nutritional content, including sulfur, protein, flavonoids [quercetin], phenolics, niacin, riboflavin, and thiamine. These compounds elevate onions' therapeutic and preventive value, positioning them as a potent antioxidant and detoxifier in cells damaged by free radical accumulation, particularly in the liver, by scavenging free radicals and boosting protein biosynthesis [3]. Despite its importance, onion producers face significant challenges during postharvest handling, marketing, and shipping, resulting in losses of up to 30–40% due to poor pre- and postharvest practices. These include improper temperature and humidity control in storage facilities and transport trucks, as well as insufficient ventilation [4, 5].

1.2 Post-Harvest Losses

These economic losses are primarily caused by weight loss, sprouting, rotting, and decay, which make the bulbs more susceptible to various diseases and shorten their storage life. Such deterioration is often due to the use of unsuitable storage technologies, inadequate packaging, and the lack of essential field and postharvest treatments, such as the application of growth regulators and fungicides. High storage costs also contribute to the problem [5, 6]. Losses can be minimized by harvesting at the appropriate time, properly curing the harvested bulbs, and storing them under optimal temperature and humidity conditions specific to the chosen storage system. Adequate ventilation is also crucial. Furthermore, proper packaging plays a key role in preserving both the physical (e.g., firmness) and physiological qualities of onions. Preharvest treatments—such as the use of fungicides and biological control agents—can significantly reduce the risk of head rot during storage. Sprouting near the end of the storage period is usually due to poor bulb quality, thick necks, and exposure to suboptimal storage and marketing conditions. Generally, red onion cultivars are more susceptible to sprouting than white cultivars [7].

1.3 Physiology of Onion Storage

Onion, classified as a slow-perishable crop, can typically be stored for 4 to 6 months, and under optimal conditions, even longer. Approximately 50–90% of storage-related damage in onions is influenced by genetic factors—such as species, varieties, and cultivars—as well as by storage conditions. The primary physiological disorders during storage include weight loss (mainly due to moisture loss, accounting for 30–40%), rotting (20–30%), and sprouting (20–40%), as reported by Bellincontro and Mejia [8].

The primary goal of postharvest handling and storage is to preserve the physiological and physical quality of onion bulbs from harvest through to fresh consumption or use as seed stock. Subsequent operations—grading, sorting, and packaging—play a crucial role in determining the overall effectiveness of storage and marketing success. The storage pathway of onions is predominantly governed by temperature and relative humidity. A temperature of 0°C combined with 65–70% relative humidity is considered ideal, allowing storage durations of over 8 months. Deviations from these conditions can lead to increased water loss (manifested as shrinkage), stimulation of sprouting, higher disease incidence, and reduced market value. To counteract sprouting and sprouting-related deterioration, some storage treatments such as gamma irradiation (rays used to sterilize and prevent pest and bacteria infestation) or chemical applications—most notably Maleic Hydrazide (MH) a synthetic plant growth regulator and ethylene gas—are employed. While these treatments can effectively suppress sprouting, they are often economically impractical and raise consumer safety concerns due to potential residual effects and long-term health implications [9)].

Adopting sustainable pre-harvest agricultural practices—including balanced fertilization programs and integrated pest and disease management—can significantly improve postharvest performance and extend the storage life of onions. Being a non-climacteric crop, onions do not exhibit a post-harvest respiratory surge and are not dependent on ethylene for ripening. However, the accumulation of internally produced ethylene in storage environments can still accelerate physiological changes. Ethylene, a natural plant hormone in gaseous form, promotes premature tissue senescence, reduces firmness, and increases softness—even in non-climacteric tissues. These conditions create a favorable environment for microbial growth and fungal proliferation, ultimately leading to microbial decay and rot [10, 11]

Market quality in onions is significantly affected by postharvest moisture loss, a factor that has drawn considerable research attention—particularly during the curing and storage phases. Substantial biomass loss occurs due to ongoing metabolic activities such as respiration, transpiration, and evaporation [12)]. Additionally, enzymatic activity tends to decline with prolonged storage duration, particularly that of key enzymes such as peroxidase, polyphenol oxidase, and phenylalanine ammonia-lyase. This reduction is associated with increased spoilage and sprouting incidence. Likewise, the concentrations of pyruvic acid and ascorbic acid gradually decrease as storage duration increases. The decline in ascorbic acid (vitamin C) is primarily due to its enzymatic oxidation to dehydroascorbic acid, catalyzed by ascorbinase. In contrast, sulfur compound levels tend to increase over time, especially under conditions of poor ventilation. This accumulation contributes to stronger pungency and may influence both sensory quality and storability [13, 14)].

2.Quality of Stored Onion Bulbs

The quality of onion bulbs during storage is primarily assessed through several key traits, including firmness, pungency, aroma, color and blemishes, bulb shape and size (true to hybrid or cultivar), and the integrity and texture of the bulb scales and outer skin [15]. Among these, market-preferred traits such as bulb color and size are largely governed by the genetic composition of the cultivar and are also influenced by postharvest storage conditions, especially temperature and ventilation ([16]. It is worth noting that bulbs with diameters between 5–7 cm are considered most suitable for storage [17].

Generally, onion quality does not improve after harvest. However, maintaining optimal postharvest handling and storage conditions is essential to preserve bulb quality for the longest possible duration. Preharvest factors—such as environmental conditions, integrated pest and disease management, and nutrient availability—also strongly influence postharvest storability and marketability [18].

Storage conditions, especially temperature and the use of drying or freezing methods, can lead to changes in bulb chemical composition, negatively affecting quality. Therefore, choosing the most suitable storage technology is vital to minimize visual degradation and nutritional loss at the consumer level [19]. Cultivars and hybrids differ in their performance under cold storage, particularly in terms of firmness, total soluble solids, outer skin thickness, and moisture loss [20].

3. Maturation and Harvest

Green onions typically require 45-90 days from planting to harvest and can be harvested and marketed at any time as long as the green part of the plant is still fresh. Dry onions take 90-150 days from planting to maturity, depending on the genetic variety. Signs of maturity include yellowing, drying, and toppling of the leaves, as well as the wilting of the onion's neck tissue. When pulled, the outer scales are dry and have the characteristic color of the harvested variety. The timing of harvest is influenced by market supply and demand, high prices, and fluctuating weather conditions, and the intended use of the bulbs [21].

Harvest timing is crucial for determining the storage behavior of the bulbs. Harvesting before maturity can accelerate sprouting because the bulbs have not yet entered their dormancy phase. This leads to the continued growth of inner leaves after being pulled, a decrease in product quality, and significant weight loss, as the bulbs require a longer curing period. This makes them more susceptible to microbial infection, which can harm consumer health and render the crop unmarketable [22].

4. Curing and Drying

Curing removes excess moisture from the outer leaves of onion bulbs, preparing them for storage. This preventive measure creates a dry outer skin that reduces water loss and microbial infections, facilitating subsequent transportation and export processes. It also helps maintain the consumable portion of the bulb in high quality and fresh condition, reducing shrinkage and sprouting during handling, and enhancing the bulbs' readiness for long-term storage consumption.

A moisture loss of 3–5% in cured bulbs indicates complete drying of the bulb necks and outer scales. Curing is performed immediately after harvest and takes 3–14 days, depending on ambient temperatures, in a shaded, well-ventilated area. Bulbs are gathered in heaps or rows to facilitate covering with available materials like straw, plant debris, or soil. Once dried, the leaves are trimmed manually or mechanically, leaving 1.5–2.5 cm of the neck to ensure tight closure. Bulbs treated this way have a high dry matter content and are ready for sorting, grading, and packaging [21]. The curing process significantly determines the shelf life and market suitability of the bulbs.

5. Sorting, Grading, and Packaging

During postharvest handling, damaged, diseased, mechanically injured, deformed, double bulbs, and those with thick necks or visible sprouting are discarded. The remaining bulbs are then graded based on diameter. Large bulbs measure 6.5–7 cm, medium bulbs range from **4.5–6 cm**, and small bulbs are categorized between 3.5–4.5 cm. Onions intended for pickling typically have diameters less than 3.5 cm. After grading, the bulbs are packed in 25-kg Raschel mesh bags, although smaller consumer-sized packages of 1–5 kg may also be used [23].

Optimal packaging for storage should offer mechanical strength, durability, and the ability to maintain appropriate humidity levels during handling, transport, and storage. Packaging should also be cost-effective for small-scale farmers. To promote sustainability in agricultural commodity preservation, environmentally friendly packaging materials such as recycled paper sacks and boxes are recommended [24].

6. Bulb Dormancy and Sprouting

Onion bulbs undergo three main physiological phases:

6.1 Rest Phase: Post-harvest, onion bulbs enter a rest phase lasting 4–6 weeks, during which they show no response to environmental changes. Biological activities cease, with reduced endogenous hormone activity and metabolic compounds like glucose, fructose, and sucrose, alongside an increase in inhibitors such as abscisic acid [ABA] and ethylene. The bulbs then transition to the dormancy phase, which may occur during uprooting or immediately after harvest [25].

6.2. Natural Dormancy: In this phase, bulbs exhibit minimal response to environmental changes, with responsiveness gradually increasing toward the end of dormancy. Hormonal regulation, bulb type, and hybrid characteristics play significant roles in this phase, which may last weeks or months. Despite dormancy, some metabolic activities occur at low, often imperceptible levels [8].

Dormancy is prolonged by the presence and increased production of ethylene, a key inhibitor of cell division [26].

Ethylene counteracts responsive factors [RFS], inhibits gibberellin formation, and reduces levels of expansins, proteins that regulate cell wall expansion [27]. This extends dormancy, suppresses sprouting vigor, and delays sprouting. Controlling ethylene levels in refrigerated storage regulates physiological activities and restricts them. Additionally, levels of ABA and its metabolic derivative, phaseic acid (PA), increase with prolonged dormancy due to modifications in genes responsible for this phenomenon, particularly those involved in ABA biosynthesis (e.g., NCED) and cytokinin biosynthesis (e.g., LOG and CKX) [28]. Cools et al. [29] noted that gene expression in dormant bulbs responds to internally produced ethylene and the application of anti-sprouting agents like 1-methylcyclopropene (1-MCP). Regulation of genes responsible for inhibiting sprouting, such as EIN3, aligns with the production of gaseous ethylene. RNA sequencing can be used to study genetic and hormonal changes during dormancy and the resumption of sprouting [30].

7. Sprouting

Sprouting occurs immediately after the bulbs break dormancy and is a major issue for stored onions. Scientific studies attribute sprouting, which begins with rooting and then the emergence of shoots, to levels of inhibitors and the prevailing temperatures in the storage environment. This process is accompanied by several physiological, chemical, and metabolic changes, most notably an increase in the concentration of reducing sugars, as well as an increase in respiration and transpiration, in addition to hormonal changes. Sprouting resumes with the redistribution of water, metabolic compounds, and plant nutrients responsible for the formation and elongation of new cells. During this process, high activity is recorded in meristematic tissues compared to the low activity during the dormancy stage [31].

Rooted bulbs sprout earlier than non-rooted bulbs under cold storage conditions. Cytokinins (CKs) play an active role in the sprouting process by encouraging cell division, and removing the primary roots reduces the accumulation of cytokinins and inhibits sprouting. The elongation of leaf shoots and the resumption of sprouting are primarily under genetic control, with multiple genes regulating this phase. For example, the FI genes and the ACFT1 genes stimulate bulbs to sprout, while the ACFT2 genes inhibit sprouting and prolong dormancy [Khokhar, 2020]. Generally, plant hormones have less control than genes in this regard. The change in the levels of various hormones signals the transition of the bulbs from the rest and dormancy phases to the development and growth of the neck area and the beginning of sprouting. This is accomplished by activating CKs and GAs, which is accompanied by extensive polymerization. Changes in the metabolism of sprouted onions are closely linked to the presence of primary and secondary metabolic compounds, particularly sulfur and carbohydrates, which constitute 80% of the dry weight of the bulbs [31]].

The length of the dormancy period determines when the bulbs begin to sprout, which in turn reduces their shelf life and marketable quality and increases water loss. This also makes them more susceptible to common storage diseases, such as black mold, which is prevalent in onions during this phase. The genetic makeup of the onion plays a vital role in this matter. A study by Nane et al. [32] on 12 genetic varieties of this crop showed varied behavior after 60 and 90 days of cold storage, with differing rates of weight loss, sprouting, and black mold infection. The AKNO-3 variety had the lowest rates for these indicators.

8. Importance of Onion Storage and Techniques

The application of onion storage techniques aims to extend the market availability of the crop, particularly outside the production season, ensuring year-round availability of this strategic commodity while maintaining the highest quality standards and minimizing physiological losses and microbial infections [33]. Bulbs selected for storage should have thick, closed, firm necks free from microbial infections, particularly *Aspergillus niger*, which often develop during production and proliferate in storage under favorable conditions. Failure to meet these criteria results in a short shelf life [4].

Storage behavior and success depend on temperature, relative humidity, gas composition, and the chosen storage system. One of the most prominent systems is low-temperature storage, which relies on low humidity levels (70–75%) and temperatures as low as 0°C, requiring good ventilation. This system can extend onion storage up to 200 days. Maintaining these conditions depends on high air velocity during the first week of storage to remove moisture from outer leaves and dry mechanically damaged areas, reducing rooting and rot, particularly *Botrytis* rots. Occasionally, lowering the temperature to -3°C is recommended for safe storage, but 0°C is preferred to prevent chilling injuries and subsequent disease infections. This system is suitable for green onion storage with humidity increased to 95% [34].

In tropical and hot climate regions, high-temperature storage is commonly employed, where onion bulbs are stored at temperatures above 25°C and relative humidity of 75–85%. This method helps reduce moisture loss and more effectively suppresses root development and sprouting compared to low-temperature storage. However, exceeding the recommended temperature range can lead to excessive weight loss, bulb dehydration, and increased decay, making this system economically unsustainable over time and negatively affecting marketing outcomes [10, 20]. In contrast, Modified or Controlled Atmosphere (MA/CA) storage extends the shelf life and improves and market quality by limiting gas exchange and metabolic activity, particularly in the neck region, thereby reducing fungal decay—especially black mold (*Aspergillus niger*)—and significantly lowering sprouting rates, which reduces reliance on chemical sprout inhibitors [35]. This technique typically maintains oxygen levels at around 3%, carbon dioxide at 5%, and temperatures between 4–10°C, under very dry conditions, preserving freshness for an additional 2–3 months, delaying senescence and color loss, and minimizing microbial infections. MA/CA can be integrated with cold storage, but onions should not be stored alongside high-moisture crops like potatoes to avoid humidity and gas imbalances, while CO_2 levels must be carefully managed to prevent tissue damage. Optimal relative humidity is 65–70% for dry onions and 90–95% for green onions [33, 36].

To further enhance efficiency, Smart Cold Storage Systems (SCSS) utilize advanced electronic technologies, including microcontrollers, sensors (e.g., DHT11 for temperature/humidity, MQ-3 for ethylene, MQ-6 for general gases, and LDR for light), and Wi-Fi connectivity to enable real-time monitoring via mobile applications. This allows remote tracking of storage conditions and automated responses—such as activating fans or adjusting ventilation—ensuring precise control and improved sustainability [1, 37]. SCSS can be combined with MA/CA systems and operates on the same fundamental principle of slowing metabolic and microbial activity through environmental control, but with added automation and responsiveness [38]. Key benefits include remote monitoring, automatic regulation of cooling and ventilation, and integrated ethylene removal, all of which delay sprouting and extend storage life. By minimizing postharvest losses and improving product quality, SCSS enhances profitability for farmers and marketers, supports rural economic development, and promotes sustainable agriculture by reducing food waste and ensuring year-round availability of strategic crops [39, 40]. Given its effectiveness, recent studies strongly recommend adopting SCSS in postharvest operations and advocate for affordable access to this technology, especially for small-scale farmers, through subsidized equipment and accessible digital tools to ensure long-term sustainability in agricultural production and supply chains [36].

Conclusion

Some sustainable field practices on the fertilization system and Integrated Pest Management (IPM) could help to reduce the economic losses during handling, storage and marketing of onions besides extending their storage life. Safe and eco-friendly packaging materials, for example, the recycled paper bags and boxes should be considered if we want to keep this strategic commodity sustained. Indeed, smart electronic devices such as the smart controlled storage system (SCSS) for refrigerated storage are able to constantly control temperature, air humidity or gas concentration levels thanks to sensor signals. These systems are used to retard deterioration, decrease physiological and microbial infestations, and reduce postharvest losses. Thus, intelligent storage systems are the complement complementary to conventional methods of preservation, which provides a solution to problems that confront farmers and marketers for agricultural crops in general and strategic agricultural commodities such as onions

References

[1].Patidar, A., A. Nerma, Y. Sharma, and N. Yadav.)2025(. Optimization of onion storage system through smart sensing and automation. International Research Journal of Modernization in Engineering Technology and Science 7 (3): 2829–2833.

[2].Al-Bandary, N. A.)2023(. Phenolic compounds content, antioxidant, antibacterial and antifungal activities of red onion skin. Iraqi Journal of Agricultural Sciences 54 (4): 1050–1057.

[3].Dorrigiv, M., A. Zareiyan, and H. Hosseinzadeh.)2021(. Onion (Allium cepa) and its main constituents as antidotes or protective agents against natural or chemical toxicities: A comprehensive review. Iranian Journal of Pharmaceutical Research 20 (1): 3–26. https://doi.org/10.22037ijpr.202011277313940.

[4].Lanzotti, V., A. Romano, S. Lanzuise, G. Bonanomi, and F. Scala.)2012(. Antifungal saponins from bulbs of white onion (Allium cepa L.). Phytochemistry 74: 133–139.

[5].Shabina, S., G. Sharma, and M. A. Irfan.)2020(. A review: Allium cepa aggregatum, characteristics and properties. Gyan Vihar 6 (1): 1–6.

[6].Anbukkarasi, V., P. Paramaguru, L. Pugalendhi, and P. Jayakumar.)2020(. Effect of packing and storage methods on quality and shelf life of onion (Allium cepa L.) var. aggregatum Don. International Journal of Current Microbiology and Applied Sciences 9 (11).

[7].Bhardwaj, S. 2020. Onion storage. International Journal of Current Advanced Research 9 (8): 22882–22884.

[8].Belincontro, A., and D. J. Mejia.)2004(. Technical guide for Eritrean growers on harvesting, curing and storage of onions (Allium cepa L.). Rome: FAO, 1–8.

[9].Jadav, U. B., and Y. Viradiya.)2025(. Processing and storage of onion. The Agriculture Magazine 4 (9).

[10]. Bamba, B. S. B., A. C. A. Komenan, K. K. P. Kouassi, and D. Soro.)2020(. Effect of onion bulb processing conditions on drying characteristics, physio-chemical and functional properties profile of onion (Allium cepa L.) powder. Journal of Food Science 85 (10): 3345–3354.
[11]. Forney, C. F., K. Cue, and S. Fillmore.)2022(. Ethylene inhibits sprouting of onion bulbs during long-term storage. HortScience 57 (6): 686–691.
[12]. Islam, N., O. Körner, J. S. Pedersen, J. N. Sørensen, and M. Edelenbos.)2019(. Analyzing quality and modelling mass loss of onions during drying and storage. Computers and Electronics in Agriculture 164: 104865.
[13]. Corzo-M., M., N. Carzo, and M. Villamiel.)2007(. Biological properties of onions and garlic. Trends in Food Science and Technology 18 (2): 609–625.
[14]. Anbukkarasi, V., P. Paramaguru, L. Pugalendhi, and P. Jayakumar.)2020(. Effect of packing and storage methods on quality and shelf life of onion (Allium cepa L.) var. aggregatum Don. International Journal of Current Microbiology and Applied Sciences 9 (11).
[15]. Resemann, J., G. Bufler, H. P. Liebig, and R. Carle.)2004(. Factors affecting quality traits of onion bulbs for the production of onion juice concentrate and onion oil. European Journal of Horticultural Science 69 (2): 45–52. https://doi.org/10.17660/EJHS.2004/20158.
[16]. Olanipekun, C. I.)2018(. Increasing production and reducing postharvest losses of onion in Nigeria. World Vegetable Center. https://avrdc.org/increasing–production–and–reducing–postharvest–losses–of–onion–in–nigeria.
[17]. Anikoh, P. O., Z. O. Osivave, H. Ogbaje, C. T. Metiboba, and M. M. Egbunu.)2023(. Effects of bulb size, depth of storage and bulb orientation on storage loss of onion (Allium cepa L.). FUDMA Journal of Agriculture and Agricultural Technology 9 (1): 41–49.
[18]. Rodrigues, G. S. O., I. C. Grangeiro, M. Z. Negreros, A. C. Silva, and J. I. Novo.)2015(. Qualidade de cebola em função de doses de nitrogênio e épocas de plantio. Revista Caatinga 28 (3): 239–247.
[19]. Ren, F., Y. Nian, and C. A. Perussello.)2020(. Effect of storage, food processing and novel extraction technologies on onion flavonoid content: A review. Food Research International 132 (3): 108953. https://doi.org/10.1016/j.foodres.2019.108953.
[20]. Modolo, A., L. Dotto, T. Vargas, M. S. Garbossa, and A. Bilck.)2022(. Postharvest quality of onion bulbs in controlled environment. https://doi.org/10.1590/fst.83222.
[21]. Jadav, U. B., and Viradiya, Y. (2025). Processing and storage of onion. The Agriculture Magazine, 4(9).
[22]. Borole, S. T., and Patii, S. (2013). Evaluation and analysis of low-cost onion storage structure. International Journal of Architecture, 1(1), 21–30. http://www.iaeme.com/IJA.asp
[23]. Adamicki, F. (2005). Effect of pre-harvest treatments and storage conditions on quality and shelf-life of onions. Acta Horticulturae (ISHS), 688, 229–238.
[24]. Bhardwaj, S. (2020). Onion storage. International Journal of Current Advanced Research, 9(8), 22882–22884.
[25]. Khokhar, K. M. (2020). A short review on onion bulb dormancy metabolism. Advances in Biotechnology and Microbiology, 15(3). https://doi.org/10.19080/ AIBM.202015.555915
[26]. Ohanenye, I. C., Alamar, M. C., Thompson, A. J., and Terry, L. A. (2019). Fructans redistribution prior to sprouting in stored onion bulbs is a potential marker for dormancy break. Postharvest Biology and Technology, 149, 221–234. https://doi.org/10.1016/j.postharvbio.2018.12.002
[27]. Dubois, M., Van den Broeck, V., and Inzé, D. (2018). The pivotal role of ethylene in plant growth. Trends in Plant Science, 23(4), 311–323. https://doi.org/10.1016/ j.tplants.2018.01.003
[28]. Alamar, M. G., Anastasiadi, M., Lopez-Cobollo, R., Bennett, M. H., Thompson, A. J., Turnbull, C. G. N., Mohareb, F., and Teery, L. A. (2020). Transcriptome and phytohormone changes associated with ethylene-induced onion bulb dormancy. Postharvest Biology and Technology, 168, 111267. https://doi.org/10.1016/j.postharvbio.2020.111267
[29]. Cools, K., Chope, G. A., Hammond, J. P., Thompson, A. J., and Terry, L. A. (2011). Ethylene and 1-methylcyclopropene differentially regulate gene expression during onion sprout suppression. Plant Physiology, 156, 1639–1652. https://doi.org/10.1104/pp.111.174979
[30]. Galsurker, O., Kelly, G., Doron-Faigenboim, A., Aruchamya, K., Salama, B. B., Teper-Bamnolkera, P., Lers, A., and Eshel, D. (2020). Endogenous sugar level is associated with differential heat tolerance in onion bulb scales. Postharvest Biology and Technology, 163, 111145. https://doi.org/10.1016/j.postharvbio.2020.111145
[31]. Chope, G. A., Cools, K., Hammond, J. P., Thompson, A. J., and Terry, L. A. (2012). Physiological, biochemical and transcriptional analysis of onion bulbs during storage. Annals of Botany, 109(4), 819–831.
[32]. Nane, N. V., Kale, V. S., Karande, P. J., Umbarkar, S. P., Nare, P. K., and Sonkamble, A. M. (2020). Storage studies in onion (Allium cepa L.) varieties and genotypes. Journal of Pharmacognosy and Phytochemistry, 9(6), 1359–1360.

[33]. FAO. (2003). Onions: Post-harvest operation. Food and Agriculture Organization of the United Nations, Rome, Italy.
[34]. Istan N., Körner, O., Pedersen, J. S., Sørensen, J. N., & Edelenbos, M. (2019). Analyzing quality and modelling mass loss of onions during drying and storage. Computers and Electronics in Agriculture, 164, 104865. https://doi.org/10.1016/j.compag.2019.104865
[35]. Benkeblia, N., and Varoquaux, P. (2001). Modified atmosphere package of onion bulbs (Allium cepa L.). Sciences des Aliments, 21, 297–302.
[36]. Kumari, S., Adarsh, A., Kumari, A., and Choudhary, H. (2022). Comparative study of different improved low-cost storage structure of onion. Environment and Ecology, 40(1), 195–200.
[37]. Srivatsa, S. G., Bharadwaj, K. R. M., Alamuri, S. L., Shanif, M. M. C., and Shreenidhi, H. S. (2021). Smart cold storage and inventory monitoring system. International Conference on Recent Trends in Electronics, Information, Communication and Technology. https://doi.org/10.1109/RTEICT52294.2021.9573939
[38]. Patil, V., Patil, R., Magdum, K., Patil, S., and Suryawanshi, D. A. (2023). Iota-based smart cold storage system. International Research Journal of Modernization in Engineering Technology and Science, 5(4), 60–64.
[39]. Alshdadi, A., Kamel, S., Alsolami, E., and Boubaker, S. (2024). An IoT smart system for cold supply chain storage and trans-coration management. Engineering Technology and Applied Science Research, 14(2), 13167–13171.
[40]. Sher, A., Khan, U., Rafique, M. N., Ikram, M. A., and Mazhar, A. R. (2024). Smart monitoring system for cold storage of vegetables. MATEC Web of Conferences, 398, 01027. https://doi.org/10.1051/matecconf/202439801027

ادارة البصل ما بعد الحصاد : استراتيجيات التخزين وتقنيات التداول – مقالة بحثية

مها علي حسين

قسم البستنة وهندسة الحدائق ، كلية علوم الهندسة الزراعية ، جامعة بغداد ، العراق

الخلاصة

لكونه محصولا استراتيجيا فان البصل يشغل اهمية اقتصادية كبيرة في التجارة لقيمته التغذوية ، استعمالاته التصنيعية وفوائده العلاجية . يهدف التداول والتخزين ما بعد الحصاد للحفاظ على الصفات الشكلية والفسيولوجية للابصال من الحصاد حتى الاستهلاك الطازج او استعمالها كتقاوي . يعد التدريج ، الفرز والتعبئة بالغ الاهمية لضمان كفاءة التخزين ونجاح التسويق . تتعرض الابصال للفقدان بالحاصل بنسبة 30-40% اثناء التخزين، النقل والتسويق جراء الفقد الرطوبي ، التفسخ والتنبيت مما يؤثر في حودة المنتج . تختلف الاصناف والهجن في تحملها للتخزين المبرد لاسيما بما يتعلق بالصلابة ، المواد الصلبة الذائبة الكلية ، سمك القشرة الخارجية والاحتفاظ بالرطوبة . يعتمد نجاح التخزين على درجة الحرارة ، الرطوبة النسبية ، نسب الغازات ونظام التخزين المتبع ، وللتقليل من هذه الخسائر يمكن استخدام انظمة التخزين المبرد الذكية ***(SCSS)*** المتضمنة متحكمات دقيقة ومستشعرات متقدمة على سبيل المثال ***DHT11*** للحرارة \الرطوبة ، ***MQ-6*** للغازات و***LDR*** للاضاءة مرتبطة بتطبيقات في الهاتف النقال تتيح المراقبة على مدار الوقت والاستجابة الاوتوماتيكية كالتهوية وتشغيل المراوح . تحسن هذه الانظمة جودة المنتج ، ربحية المزارعين والمسوقين ، تعزز الاقتصاد الريفي واستدامة الزراعة بوساطة خفض هدر الغذاء وضمان توفر المحاصيل الاستراتيجية على مدار العام ، اضافة الى ان اختيار مواد التعبئة المناسبة ، الحصاد بالموعد الملائم والادارة المستدامة لما قبل الحصاد تكون بالغة الاهمية لاطالة العمر المخزني والقابلية التسويقية للبصل سواء للاستهلاكه المباشر او استعماله كتقاوي لمواسم الزراعة اللاحقة

الكلمات المفتاحية: الخزن الذكي ، حرافة ، تنبيت الابصال ،العلاج التجفيفي ، المستودعات المبردة.