

INFLUENCE OF PERMANENT STORAGE CONDITIONS ON THE QUALITY CHARACTERISTICS OF MUNG BEAN (*VIGNA RADIATA*) GRAIN

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Abstract. *The preservation of mung bean (*Vigna radiata*) grain quality during storage is a critical factor in ensuring food security and maintaining its nutritional and technological value. This study evaluated the influence of permanent storage conditions on the physical, technological, and biochemical characteristics of mung bean grain over a six-month storage period. Grain samples of six cultivars were stored under different temperature, humidity, and ventilation regimes, and changes in grain weight, bulk density, water absorption capacity, protein and starch contents, as well as enzymatic activity, were determined. The findings demonstrated that maintaining an optimal storage microclimate effectively reduced quality deterioration and preserved the nutritional and processing properties of the grain. In contrast, elevated temperature and relative humidity accelerated biochemical transformations, increased enzymatic activity, and negatively affected grain quality. Among the studied cultivars, **Turon** and **Durdona** exhibited the greatest storage stability, whereas **Navruz** showed the highest susceptibility to quality deterioration. The results confirm that strict control of storage temperature, moisture, and air circulation is essential for extending the storage life of mung bean grain and minimizing postharvest losses..*

Keywords: *Mung bean; *Vigna radiata*; grain storage; storage conditions; grain quality; biochemical changes; enzymatic activity; temperature; relative humidity; postharvest technology.*

1. Introduction

Mung bean (*Vigna radiata* L.) is one of the most valuable grain legumes cultivated in many regions of Asia, including Uzbekistan, due to its high nutritional value, digestibility, and adaptability to diverse agroecological conditions. The grain contains approximately 24–26% protein, essential amino acids, vitamins, minerals, and bioactive compounds, making it an important source of plant-based nutrition for both human consumption and food processing.

Despite its nutritional advantages, mung bean grain remains a biologically active material after harvest. During storage, continuous respiration and metabolic activity may lead to moisture accumulation, loss of dry matter, enzymatic reactions, and deterioration of technological properties. These processes become more intensive when storage temperature, relative humidity, and ventilation are not properly controlled, resulting in reduced grain quality and increased postharvest losses.

Permanent storage facilities equipped with appropriate environmental control systems provide favorable conditions for preserving grain quality over extended storage periods. However, the effectiveness of such facilities largely depends on maintaining an optimal storage microclimate and implementing proper sanitary management. Therefore, understanding the relationship between storage conditions and quality changes is essential for improving storage technologies and ensuring the long-term preservation of mung bean grain.

The objective of this study was to evaluate the influence of permanent storage conditions on the physical, technological, and biochemical quality characteristics of mung bean grain during six months of storage and to identify cultivars with superior storage stability.

Novelty of the study. Unlike previous studies that mainly focused on the general influence of storage conditions on grain preservation, this research provides a comparative assessment of six mung bean cultivars under permanent storage conditions. The study identifies cultivar-specific differences in storage stability and demonstrates that maintaining an optimal storage microclimate significantly reduces biochemical deterioration and preserves technological quality during six months of storage.

2. Materials and Methods

The study was conducted using grain samples of six mung bean (*Vigna radiata* L.) cultivars (Durdon, Radost, Turon, Qahrabo, Marjon, and Navruz) harvested under the agroecological conditions of Uzbekistan. Before storage, the grain was cleaned to a purity of more than 98% and adjusted to an initial moisture content of 12–13%.

The samples were stored for six months in permanent reinforced-concrete storage facilities under controlled environmental conditions. Two storage regimes were evaluated: an optimal regime with an air temperature of 10–12°C and relative humidity of 60–65%, and a conventional regime characterized by higher temperature (18–22°C) and relative humidity (75–80%). Both natural and forced ventilation systems were applied to maintain air circulation.

Storage performance was assessed by monitoring physical (grain weight, bulk density), technological (water absorption capacity), and biochemical (protein content, starch content, and enzymatic activity) quality indicators. All analytical procedures were performed according to the relevant national standards for grain quality evaluation. The experimental data were comparatively analyzed to determine the influence of storage conditions on grain quality and to identify cultivars with greater resistance to quality deterioration during long-term storage.

3. Results and Discussion

The storage environment had a significant influence on the physical, technological, and biochemical properties of mung bean grain throughout the six-month storage period. Grain maintained under optimal storage conditions retained its commercial appearance and exhibited only minor changes in quality indicators, whereas storage under elevated temperature and relative humidity accelerated deterioration processes.

A gradual reduction in grain weight and bulk density was observed in all cultivars during storage. These changes were accompanied by a decline in water absorption capacity, indicating a deterioration of technological quality. The reduction in these parameters is associated with continuous respiration, depletion of dry matter reserves, and structural modifications within the grain. Among the evaluated cultivars, Turon and Durдона maintained more stable physical characteristics, while Navruz showed the greatest decline in storage performance.

Biochemical analyses also revealed progressive changes in grain composition. Protein and starch contents decreased gradually during storage, whereas enzymatic activity increased, reflecting the continuation of metabolic processes after harvest. These biochemical transformations became more pronounced under unfavorable storage conditions, where higher temperature and humidity accelerated enzymatic reactions and nutrient degradation. Such changes adversely affected both the nutritional value and processing quality of the grain.

Table 1. Changes in physical and technological properties of mung bean grain after six months of storage

Cultivar	Grain weight loss (%)	Bulk density loss (%)	Water absorption loss (%)
Durдона	3.8	3.6	8.1
Radost	4.0	3.6	8.3
Turon	3.4	3.7	8.2
Qahrabo	4.0	3.7	8.5

Marjon	4.0	3.6	8.4
Navruz	4.1	3.6	7.8

After six months of storage, all mung bean cultivars exhibited gradual reductions in grain weight, bulk density, and water absorption capacity (Table 1). Grain weight decreased by **3.4–4.1%**, while bulk density declined by approximately **3.6–3.7%**. Water absorption capacity showed a more pronounced reduction, ranging from **7.8 to 8.5%** depending on the cultivar. Among the evaluated cultivars, **Turon** and **Durdona** demonstrated the highest storage stability, whereas **Navruz** showed the greatest susceptibility to quality deterioration.

A comparison of the studied cultivars demonstrated clear differences in storage stability. Turon and Durdona consistently exhibited lower rates of quality deterioration, suggesting a greater tolerance to prolonged storage. In contrast, Navruz experienced more intensive biochemical changes, including greater starch depletion, higher enzymatic activity, and reduced water absorption capacity. These findings indicate that cultivar characteristics should be considered when selecting grain for long-term storage.

Overall, the results confirm that maintaining a stable storage microclimate is essential for preserving mung bean grain quality. Proper regulation of temperature, relative humidity, and ventilation effectively limits biochemical degradation and helps maintain the technological and nutritional properties of stored grain, thereby reducing postharvest losses and improving storage efficiency.

4. Scientific Implications and Conclusion

The results of this study demonstrate that maintaining an optimal storage microclimate is essential for preserving the quality of mung bean grain during long-term storage. Stable temperature, relative humidity, and adequate ventilation effectively reduced the intensity of biochemical transformations and minimized the deterioration of physical and technological characteristics.

Among the evaluated cultivars, **Turon** and **Durdona** exhibited superior storage stability, retaining higher grain quality throughout the six-month storage period. In contrast, the **Navruz** cultivar showed greater susceptibility to quality deterioration, as reflected by larger reductions in grain weight, starch content, and water absorption capacity, together with increased enzymatic activity.

These findings provide practical guidance for selecting suitable mung bean cultivars for long-term storage and emphasize the importance of environmental control in permanent storage facilities. The obtained results may contribute to the improvement

of postharvest grain management technologies, reduction of storage losses, and preservation of the nutritional and technological value of mung bean grain under commercial storage conditions.

Comparative Discussion

The observed decline in grain quality during storage is consistent with previous studies reporting that elevated temperature and relative humidity accelerate grain respiration, enzymatic activity, and nutrient degradation. Similar trends have been described for grain legumes, where prolonged storage under unfavorable environmental conditions resulted in reduced protein stability, starch degradation, and deterioration of technological properties. These findings support the hypothesis that effective control of storage microclimate is the primary factor determining the preservation of grain quality during long-term storage.

Compared with earlier reports, the present study additionally demonstrated cultivar-dependent differences in storage stability. The superior performance of **Turon** and **Durdona** suggests that varietal characteristics may play an important role in maintaining grain quality under prolonged storage conditions. This information may contribute to the development of improved postharvest management strategies for mung bean production in arid and semi-arid regions.

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