

Abstract

Golden Delicious apples are well-known for their appealing yellow skin color, crisp texture, and sweet flavor. The popularity of Golden Delicious apples is due to their nutritional content. They are rich in antioxidants, vitamin C, and fiber. They have been associated with several benefits, including improved immune health, digestive health, and a lower risk of chronic diseases like heart disease and cancer. The shelf life and quality of apples can be significantly affected by various internal and external factors, with the temperature being one of the most critical factors. In this study, we looked at how storage at typical room temperature (20-25°C) affected the color and weight of Golden Delicious apples.

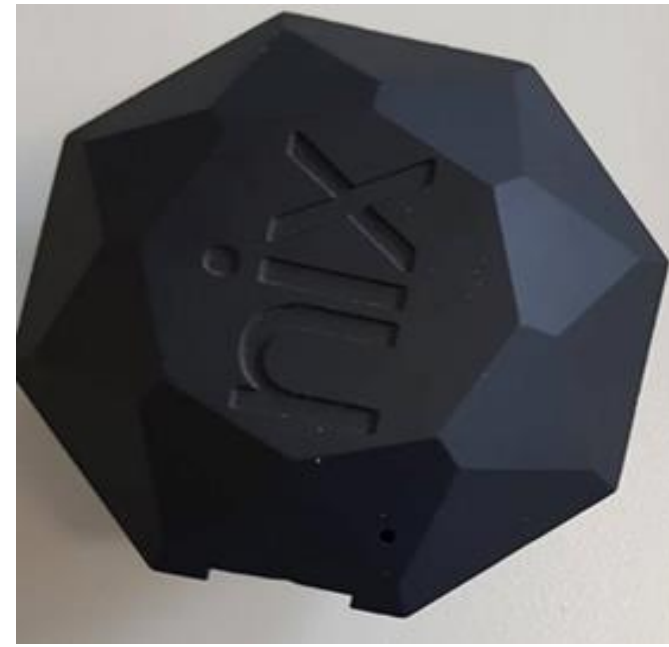
Apples were stored for six weeks, and the color parameters, including L* (lightness), a* (redness), and b* (yellowness), were measured using a Nix Pro wireless color sensor. The weight of the apples was measured using a digital scale.

The results revealed that storing Golden Delicious apples at room temperature had a detrimental impact on their color and weight. Appropriate post-harvest storage procedures, such as refrigeration or controlled environment storage, can help retain the quality and beauty of Golden Delicious apples. These data can be used to design storage methods and post-harvest handling practices for Golden Delicious apples to retain their quality and marketability.

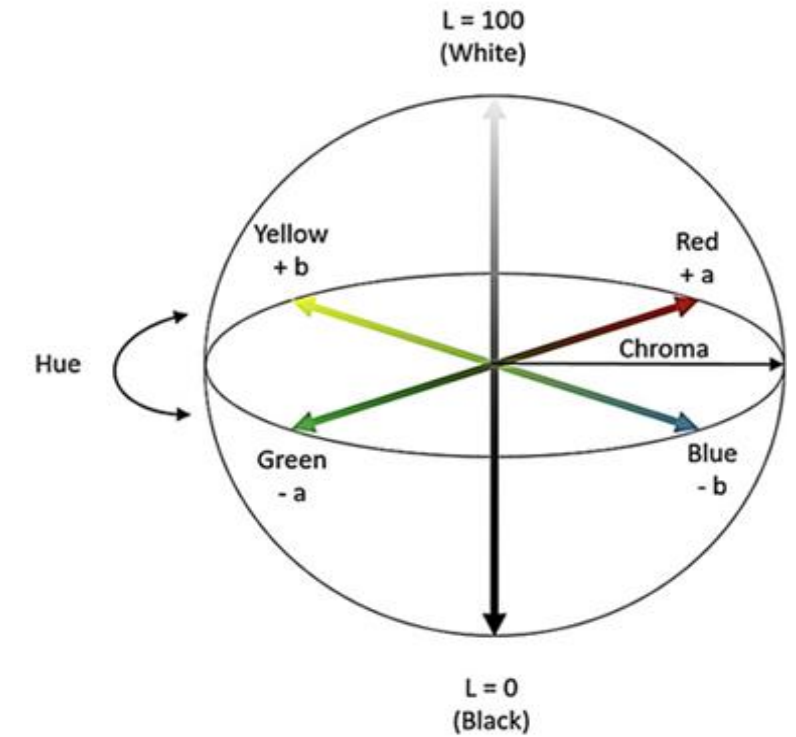
Keywords: Golden Delicious Apples, storage, colour, weight, ambient temperature storage

Methods

Apple fruit Golden Delicious were collected from "Kecskemét" in Hungary. The average weight was 150±12 g stored at ambient storage conditions (24±1°C), relative humidity (RH 60%) for six weeks. Weight loss Δm (%) was calculated using the following equation: $\Delta m = \frac{m_0 - m}{m_0} \cdot 100$ [%]. Color parameters were measured using a Nix Pro wireless color sensor. Three replicates of each apple were used for each storage time. The color was recorded using a CIE L* a* b* uniform color space (Lab). L* indicates lightness, a* indicates chromaticity on a green (-) to red (+) axis, and b* chromaticity on a blue (-) to yellow (+) axis. The experiments were carried out in the Food Technology Laboratory at the Hungarian University of Agriculture and Life Sciences, Gödöllő. Once a week for six weeks.



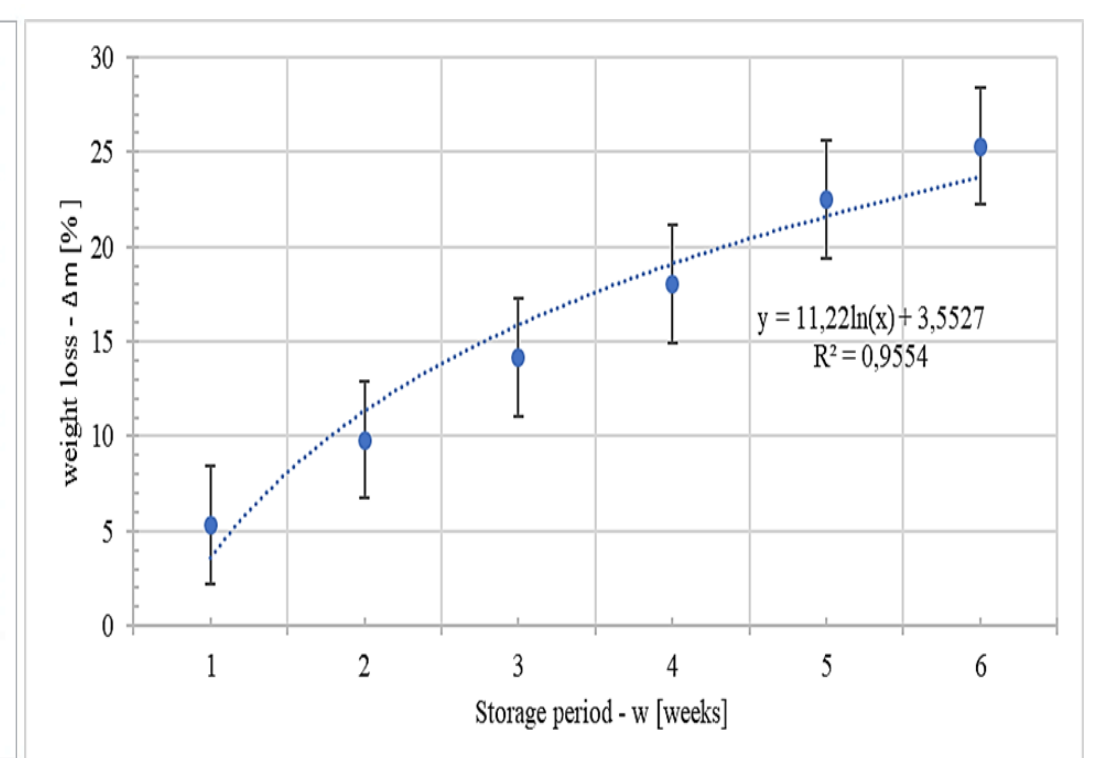
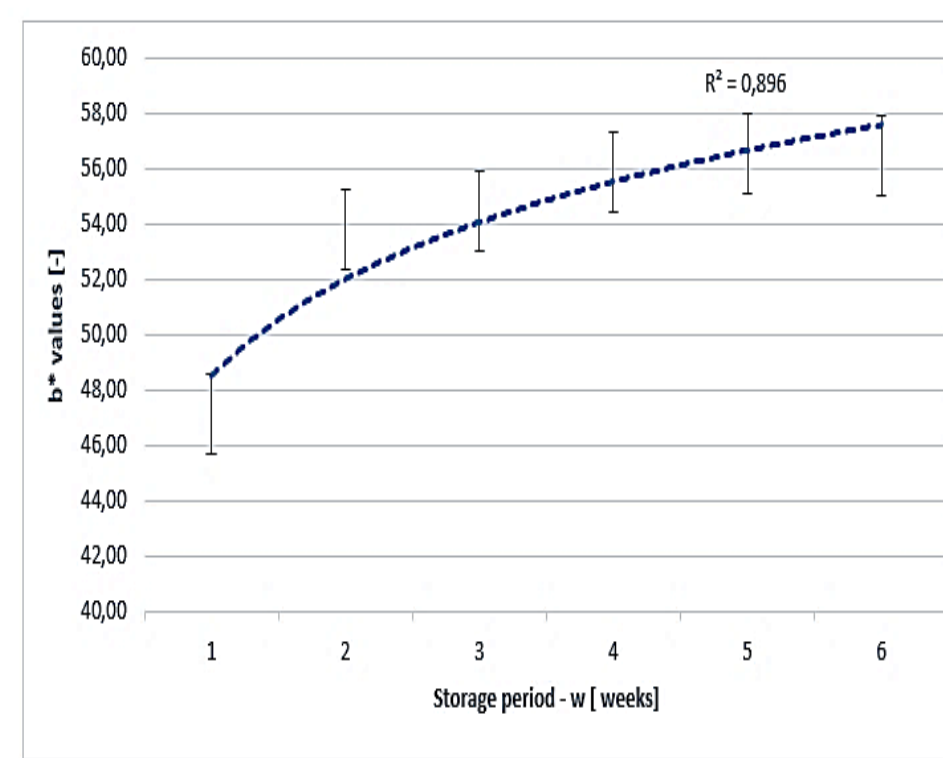
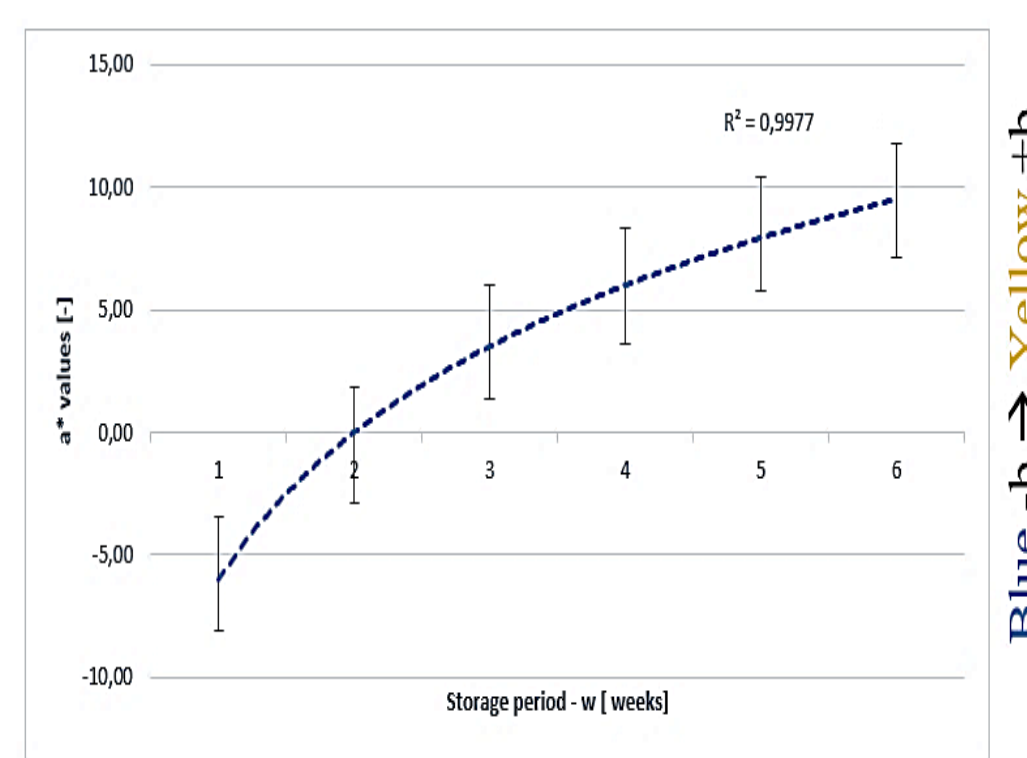
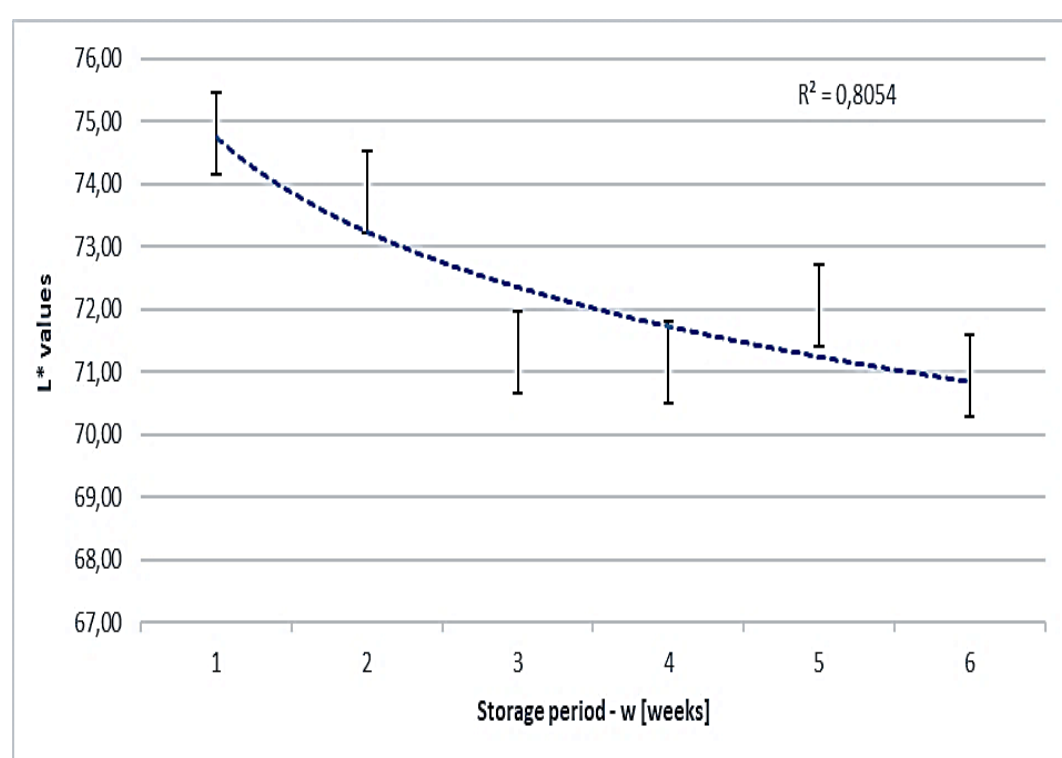
NIX PRO WIRELESS COLOUR SENSOR



THE CIELAB COLOUR SPACE DIAGRAM

Results

- The L* value indicates the lightness of the skin, whereas a* and b* values indicate the red and yellow colour of the fruit's skin.
- The L* value decreases from week 1 to week 6. This results might be related to the oxidation: Apples undergo a natural process of oxidation when exposed to air. This can cause enzymatic browning, where the apple's flesh turns brown due to the reaction between oxygen and certain enzymes present in the fruit. As browning occurs, the overall lightness of the apple decreases, leading to a lower L value..
- a* and b* values increase while apples stored at room temperature. These variations are caused by the ripening: One aspect of ripening is the breakdown of chlorophyll. As the chlorophyll degrades, the apple's color shifts from green towards the red end of the spectrum, leading to an increase in the "a" value. Additionally, the breakdown of pigments like carotenoids can result in a more yellow coloration, increasing the "b" value.
- The increase in weight loss can occur due to moisture evaporation, the respiration: Apples are living organisms that continue to respire even after they are harvested. Respiration involves the breakdown of stored sugars and release of carbon dioxide. As a result of respiration, apples can lose weight as carbon dioxide is released into the surrounding environment.



Discussion and conclusion

- Colour is a critical quality parameter that directly affects appearance and consumer acceptability.
- There was a significant colour change in the storage process, going from smooth green to apple with yellow and brown spots.
- Colour changes are associated with changes in apples' metabolism during ripening, accompanied by changes in the chlorophyll content.
- Overall, the ambient temperature had a significant ($p < 0.05$) effect on colour parameters during the storage. During the storage period, apples appeared dull, more yellowish, and less acceptable with time.
- The skin background colour is relevant in fruit maturity assessment. In fact, at the onset of fruit maturation, the chlorophyll in the skin and flesh starts to decrease, the green colour begins to pale, and yellow pigments appear.
- Water loss causes the product's weight to drop, causing the quality of the fruit to deteriorate. The weight loss percentage grew dramatically with each additional week of storage. Some apple fruits' shrivelling and perishing were observed after 4 weeks of storage. Factors such as enzymatic activity, microbial growth, and the breakdown of cell structures can contribute to the degradation of the apple's tissues, causing weight loss.

Acknowledgments

We would like to thank the University of Agriculture and Life Sciences MATE, Gödöllő, Hungary for this opportunity to work on this project in the lab of the university. Extreme gratitude to Stipendium Hungaricum scholarship program for providing me the resources for my future career in research.