

KEYNOTE: NOVEL MONITORING TECHNOLOGIES, DATA PROCESSING AND MODELLING FOR QUALITY EVALUATION OF TABLE GRAPES

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ADVANCING TABLE GRAPE QUALITY ASSESSMENT WITH NON-DESTRUCTIVE TECHNOLOGIES: WHAT WE KNOW AND WHAT WE STILL NEED TO DISCOVER

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Background

Accurate assessment of table grape quality parameters is crucial for ensuring market readiness upon harvest. Compliance with minimum ripeness requirements, such as total soluble solids (TSS) and total acidity (TA), along with considerations for berry colour and size, is essential for consumer acceptance.

Introduction

Premature or delayed harvesting can result in significant economic consequences for producers, as it affects market access and product pricing. Rejection of the product by the market will also lead to substantial losses. Current standard methodologies for table grape quality evaluation are time-consuming, destructive, and prone to subjectivity, even when conducted by trained individuals. Recent studies have explored non-destructive techniques based on spectrometry (including multispectral and hyperspectral imaging) and machine learning processes for fruit and vegetable quality assessment. This review aims to evaluate existing knowledge in applying non-destructive technologies to monitor and evaluate table grape quality.

Method

A scoping review process was followed to ascertain what literature is available on non-destructive quality assessment of table grapes specifically. A search strategy was developed with targeted databases and research queries as well as inclusion/exclusion principles. The results were screened, and a final core of literature was identified. This core literature was analysed to identify techniques and protocols used, successes, and limitations/challenges.

Results

Most studies included in this review were conducted under laboratory conditions where light conditions were controlled. This factor is relevant because changes in ambient light conditions have a strong influence on spectral reflectance from fruits and is one difficulty experienced in field trials. VIS–NIR spectroscopy is the most used technique for non-destructive quality assessment of various crops, including grapes. Hyperspectral imaging (HSI) is an emerging technology which has been tested in table grapes for assessing total quality parameters such as soluble solids, flavanoids and anthocyanins. In general, the data analysis presented in the articles makes use of wavelength selection and various pre-processing steps such as multiplicative spectral correction (MSC), Savitzky-Golay smoothing and 1st and 2nd derivatives. Some new approaches also included machine learning in the data analysis process.

Conclusion

This review identifies successful applications that indicate future potential, but also less successful outcomes, which can be key to defining limitations in terms of protocol challenges. By investigating these potential challenges, this review aims to enhance our understanding of these technologies and their practical and research applications.