

Z.H. Siyum¹, T.P. Thanh¹, L.P. Nguyen¹, L. Baranyai¹

¹Department of Food Measurements and Process Control, Hungarian University of Agriculture and Life Sciences, 1118 Budapest, Hungary

INTRODUCTION

- Asparagus (*Asparagus officinalis* L.) is a healthy and a valued food due to its low-calorie content, high fiber content, and the presence of several phytochemicals, such as flavonoids and vitamins and organic acids.
- However, its quality deteriorates rapidly after harvest due to increased respiratory and metabolic activities.
- Cold storage helps maintaining the freshness and quality of asparagus for several days. However, firmness can change during storage in relation to weight loss.

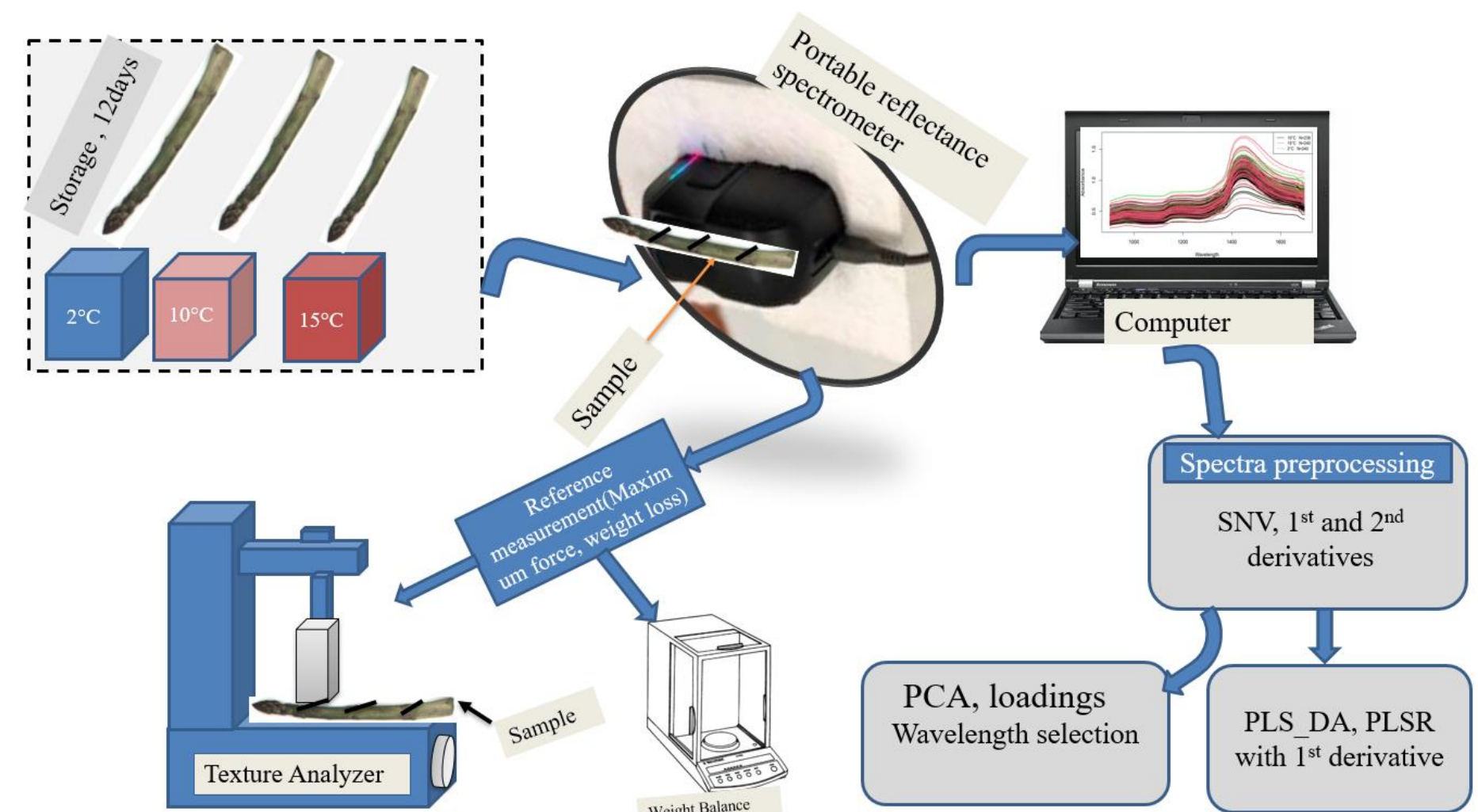
The aim of the presented study was to monitor the surface changes of asparagus under different storage conditions using near-infrared (NIR) spectroscopy.

OBJECTIVES

- Investigate the effects of storage time and temperature on the weight loss and firmness of asparagus spears using reference methods.
- Evaluate the firmness and weight loss of the asparagus using portable NIR spectrometer in a non-destructive manner.
- Perform chemometric multivariate analysis on the data obtained from portable NIR spectrometer.

MATERIALS&METHODS

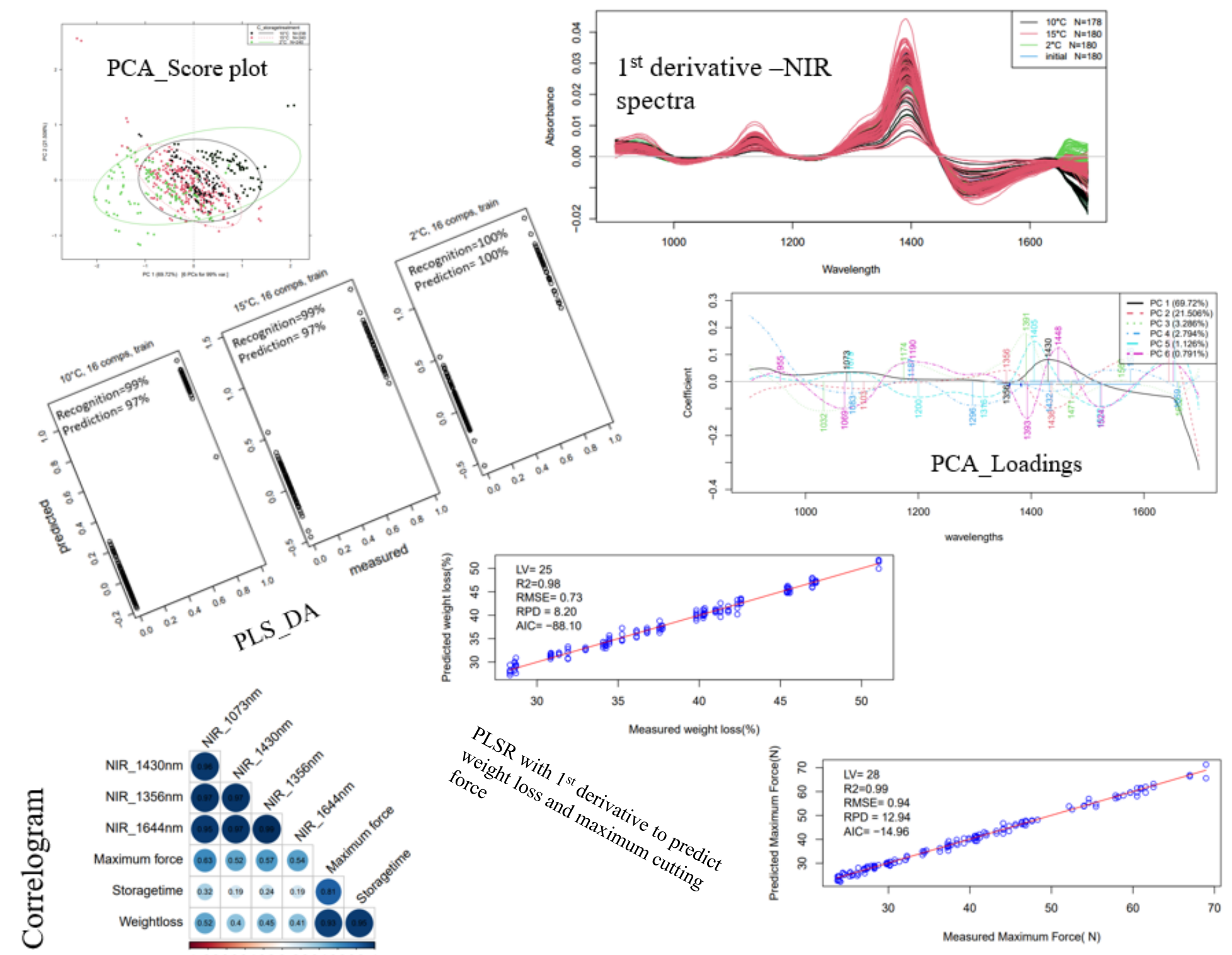
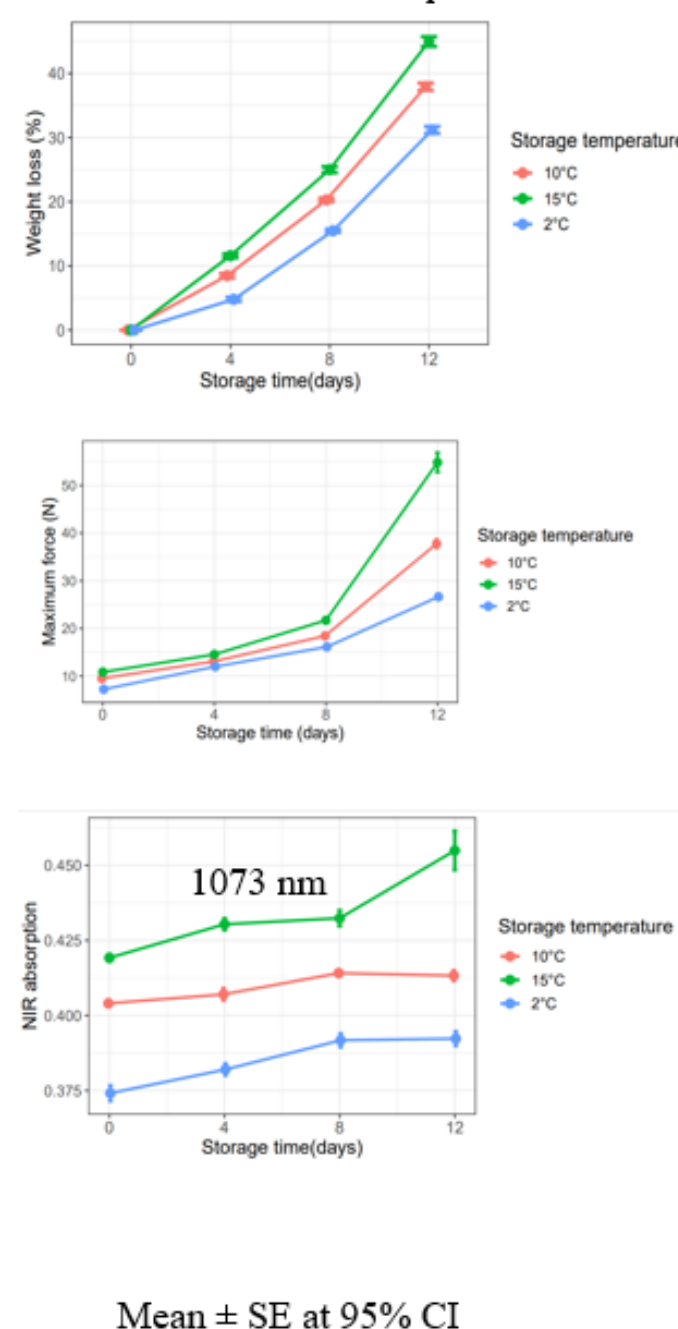
- The green asparagus spears were stored at 2, 10 and 15 °C for 12 days. Ten samples were taken from each group at 4 days measurement intervals.
- Quality parameters, such as weight loss, firmness and near-infrared absorption at range of 900-1700 nm were measured.
- Two-Way MANOVA was used to evaluate the effect of both storage time and temperature.
- Spectral preprocessing using SNV (Standard Normal Variate), first and second derivatives.
- Principal component analysis (PCA), Partial Least square discriminant analysis (PLS_DA) and Partial least square regression (PLSR) were performed.



RESULTS

- The weight loss and maximum force, which is a firmness parameter of asparagus, were significantly affected by storage time and temperature.
- NIR absorption peak at 1073, 1356, 1430 and 1644 nm also showed significant change due to storage time and temperature.
- NIR at 1073 nm positively correlated with weight loss ($r=0.52$) and maximum force ($r=0.63$).
- PLSR with 1st derivative pre-processing predicted weight loss with good performance ($R^2=0.98$, $RMSE=0.73\%$) and maximum force ($R^2=0.99$, $RMSE=0.94$ N).
- PLS_DA classified storage temperature groups at average accuracy level of 99.3% and validation of 97.2%

Changes in weight loss, maximum force and NIR absorption.



CONCLUSIONS

- NIR absorption peaks at 1073, 1356, 1430, and 1644 nm were observed due to the vibrational or stretching modes of N-H, C-H, and O-H bonds in asparagus spears. The changes in these peaks were influenced by storage time and temperature.
- The PLS_DA model also classified the NIR dataset by storage temperature with good performance.
- The weight loss and firmness of the asparagus were effectively predicted by using PLSR model along with first derivative NIR spectra processing.
- These findings confirm, that NIR spectroscopy was successful in monitoring the quality changes of asparagus during storage at different temperatures.

ACKNOWLEDGMENTS

Authors acknowledge the financial support of the Doctoral school of Food Science, MATE, and Stipendium Hungaricum scholarship.

REFERENCES

- Pegiou, E., Mumm, R., Acharya, P., De Vos, R.C.H., Hall, R.D. (2019). Green and White Asparagus (*Asparagus officinalis*): A Source of Developmental, Chemical and Urinary Intrigue. *Metabolites*, 10, 17. <https://doi.org/10.3390/metabo10010017>
- Lipton, W. J. (2011). Postharvest Biology of Fresh Asparagus. In: Janick, J. (ed.) *Horticultural Reviews*. Hoboken, NJ, USA: John Wiley & Sons, Inc., pp. 69-155. <https://onlinelibrary.wiley.com/doi/10.1002/9781118060858.ch2>
- Bhowmik, P. K., Chatterjee, A., & Nandi, A. (2002). Changes in storage quality and shelf life of green asparagus over an extended harvest season. *Postharvest Biology and Technology*, 26(3), 323-328.
- Anastasiadi, M. et al. (2022). Investigating the role of abscisic acid and its catabolites on senescence processes in green asparagus under controlled atmosphere (CA) storage regimes. *Postharvest Biology and Technology*.