【別紙２】

論文名： **NON-DESTRUCTIVE ANALYSIS OF JAPANESE TABLE GRAPE QUALITIES USING NEAR-INFRARED SPECTROSCOPY AND IMAGING TECHNIQUE**
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（以下要約を記入する）

Non-Destructive Analysis of Japanese Table Grape Qualities using Near-Infrared Spectroscopy and Imaging Technique

Abstract

Near-infrared (NIR) spectroscopy is a useful technique for the non-destructive analysis of fruit quality. The key quality parameters of table grapes (*Vitis vinifera*) that affect consumer preference are the soluble solids content (SSC), pH, firmness, and seedlessness. This research focused on using NIR spectroscopy to assess the quality of 'Kyoho' table grapes, as a non-destructive analysis under laboratory and field conditions. NIR spectra for each sample were acquired in the wavelength range of 400–1,000 nm, using a visible/NIR spectrometer with fiber optics in the interactance mode. Partial least-square regression was used to calibrate the NIR spectral data with all the measured properties of table grapes. The best prediction model for firmness was the Savitzky-Golay first derivative (SGD1) with a coefficient of determination ($R^2_{prediction}$) of 0.7427 in the laboratory, and 0.7804 in the field. The $R^2_{prediction}$ values for pH in the laboratory and the field were 0.6276 using multiplicative scatter correction (MSC), and 0.7676 using SGD1, respectively. These values were similar to the $R^2_{prediction}$ values of SSC, which were 0.6926 using MSC, and 0.8052 using the Savitzky-Golay second derivative, respectively. In both analyses the R^2 of the calibration model was between 0.6944 and 0.8877. The partial least-square discriminant analysis was used to classify the percentage of seedlessness, which was 93.10% in the laboratory using SGD1 or MSC, and 79.31% in the field using MSC. Therefore, NIR spectroscopy is an efficient non-destructive technique for rapidly analysing Japanese table grape qualities in laboratory and field settings.

Imaging and spectroscopy are non-destructive techniques with potential for determining fruit quality. The qualities of table grapes (*Vitis vinifera*) such as soluble solids content (SSC), pH, firmness and seedlessness are key parameters for consumer decisions. This research was focused on comparison between imaging and spectroscopy techniques in both the laboratory and field for non-destructive determination of table grape quality parameters. Sample spectra were

acquired by spectrometer in transmittance mode for imaging and interactance mode for spectroscopy with a fibre optic probe, in same wavelength range of 620–720 nm. To develop the calibration model, the relationship between spectral data and all measured parameters of table grapes was studied using partial least squares regression (PLSR). The results showed that the best prediction model in firmness for spectroscopy in the laboratory was the Savitzky–Golay first derivative (SGD1) with a coefficient of determination (R^2) for prediction (R^2_{pred}) of 0.6925; for spectroscopy in the field, the best model was multiplicative scatter correction (MSC) with R^2_{pred} of 0.5737, and for imaging it was SGD1 with R^2_{pred} of 0.6216. Standard error of prediction (SEP) of 1.7481, 2.0695, and 1.8983 N, (respectively). The best R^2_{pred} for pH for spectroscopy in the laboratory was 0.6820 using the Savitzky–Golay second derivative (SGD2), for spectroscopy in the field, the best R^2_{pred} was 0.7101 and for imaging it was 0.6494, both using MSC (SEP = 0.0637, 0.0607 and 0.0621, respectively). The best R^2_{pred} for SSC for spectroscopy in the laboratory was 0.8085 using MSC; for spectroscopy in the field, the best R^2_{pred} was 0.8169 using SGD2, and for imaging it was 0.7994 using SGD1 (SEP = 0.6394%, 0.6263% and 0.6611%, respectively). Partial least squares discriminant analysis (PLS-DA) was used to analyse the successful percentage of seedlessness classification: 89.66%, 93.10% and 81.25% for spectroscopy in the laboratory, spectroscopy in the field and imaging, respectively. Therefore, the spectroscopy technique had a bit more effective than imaging technique both in the laboratory and field. By the way, we can be used both techniques as efficiency non-destructive analysis techniques for determining these key parameters of table grape quality.