

Evaluation of optimal wavelet de-noising parameters to predict nutrient content in oil palm leaves using spectroradiometer

ABSTRACT

In order to reduce excessive fertiliser application, a non-destructive method of spectral data acquisition using spectroradiometer with wavelet analysis was explored to determine the level of nutrients in the oil palm leaves. In spectral data analysis, wavelet de-noising (WD) can be applied to remove background noises and other disturbances such as scattered light that may affect the results of data. Therefore, this study aims to determine and evaluate the best combination of parameters for WD, with respect to nutrients nitrogen (N), phosphorus (P) and potassium (K). These nutrients were studied for three age groups of immature, mature, and old palms. The results were evaluated based on the highest value of coefficient of determination (R^2) and lowest root mean square error (RMSE) of partial least square regression (PLSR) analysis. The prediction of nutrient content correlation was found to have tremendous improvement using the proposed technique when compared to the original spectra, with highest prediction R^2 value of 0.99 for K of mature palms, 0.97 for N of immature palms and 0.95 for P of mature palms. The results of WD for nutrients prediction were found to be better than results from chemometric method of namely multiplicative scatter correction (MSC). It was observed that for each nutrient type and palm maturity level, there were different combination of parameters based on the highest R^2 value that best suited them. Therefore, spectroradiometer assisted with optimal wavelet de-noising parameters gives excellent relationship between spectral data and nutrients N, P, and K.

Keyword: De-noising techniques; Oil palm; Partial Least Square (PLS); Spectroradiometer; Wavelet analysis