**Potential application of hyperspectral imaging and FT-NIR spectroscopy for discrimination of soilless tomato according to cultural practices**

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**Abstract.** This study was aimed to evaluate the suitability of hyperspectral imaging (HSI) and Fourier Transform (FT)-NIR spectroscopy for classifying sustainable-produced tomatoes according to applied cultural practices. Three different cultivation management strategies for water and fertilizer use were applied: i) free drain open cycle cultivation (OPEN); ii) open cycle cultivation with on-demand sensor-based fertigation (SMART); iii) closed cycle cultivation (CLOSED), across two cultivation cycles for two varieties (cv Carminio, for the autumn-winter cycle and cv Mose for the spring-summer cycle). Reflectance spectra were acquired using two HSI spectrographs in Visible-Near Infrared (Vis-NIR) and NIR ranges, and a FT-NIR spectrometer, for about 300 fully ripe tomatoes per variety. For each cycle and variety, a partial least squares discriminant analysis (PLS-DA) was first aimed to discriminate for the management cultivation system and then for water and fertilizers use efficiency (WUE and FUE), having only 2 levels for cycle. The final objective was to propose a general model for discrimination of 3 levels of WUE and FUE, merging the data of the 2 varieties, which was further optimized for the number of variables. Model performance were higher when using FT-NIR and HIS in the Vis-NIR range, but the last one was preferred in term of number of latent variable used. Good performance on external prediction sets were obtained for discriminating tomatoes from three cultural practices (Accuracy = 81%; Specificity = 86%) for each variety. In addition, an excellent performance was reached by classifying tomatoes in two different levels of WUE and FUE with accuracy, specificity and sensitivity higher than 95%. Finally for the general models, based on 3 WUE levels, over the 2 experiments, only 20 significant wavelengths were selected using Vis-NIR spectra using IPLS variable selection method and a repeated double cross validation (rDCV) technique yielding accuracy and specificity of 89.8% and 91.7%, respectively. Results of this study indicate promising potential of these techniques for the authentication of agricultural crop grown with low inputs, which need further validation across different production environments and years.