

Non-destructive Fluorescence Spectroscopy as a phenotyping technique in soybeans

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This work describes the results obtained with Laser-Induced Fluorescence Spectroscopy (LIFS) and Laser-Induced Fluorescence Images (LIFI) associated with chemometrics methods, as an efficient tool for soybean cultivars characterization. Each cultivar has a specific concentration of multiple fluorophores, which alters the characteristic fluorescence spectra of the leaves in a way that can be successfully identified by this optical technique. Leaves of three different soybean cultivars, TMG1188RR, TMG4182 and M9144RR, from Parnaíba, Xingu I and Xingu II, respectively, located in Maranhão state, Northeast region of Brazil were tested in this work. Soil management, irrigation, fertilization, temperature were adequate for a correct plant growing. All leaves were collected from a region with low infestation of diseases and pests and their spectral profile are specific for the plant. Only fresh leaves were used. The portable LIFS system used in this work has an excitation wavelength at 405 nm and a high sensitivity mini-spectrometer (USB4000) with spectral range of 194–894 nm. The LIFI system is composed by a laser with excitation wavelength at 375nm and the fluorescence emission is detected by a Sony alfa 55 camera. From each image, 38 attribute per pixel were extracted. The discrimination of the soybean varieties was performed by a classifier based on the combination of classification via regression and partial least square regression using cross validation, employing the fluorescence emission spectra obtained with LIFS system and the attribute extracted from the image system for LIFS and LIFI, respectively. As result, two confusion matrices were obtained with an average accuracy for correct classification of 96.26% and 85% of instances, respectively.

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