Characterization of a multispectral camera for abiotic and biotic stress detection in greenhouse

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**Abstract.** The national and international environmental regulation forces the agricultural industry to achieve a more sustainable production system. Nowadays, multispectral sensors and cameras are quite widespread in arable and fruit tree crops, while they are not commonly used in protected crops. This latter point is mainly due to structural features (i.e. columns, pallets), radiance characteristics of the greenhouse covering, which modify the incident light and the presence of an artificial light source. This study describes the application of a multispectral camera for greenhouse applications. The paper investigated the influence of different light conditions and the protocol for the detection of abiotic and abiotic stress in three on-farm trials by using an RGB-NIr multispectral camera. Different light conditions were evaluated for their influence on the vegetation index calculation. Images were acquired on white and black calibrated target with natural light, sodium lamps, and in a darkroom equipped with RGB-NIr light-emitting diodes (LEDs), considered a reference. The suitability of the system to identify abiotic stress and vegetation growth were evaluated on a randomized block (5x5) trial of Geranium (Pelargonium spp). Puncture, cut, loss of a cutting and double irrigation damages were simulated on 250 plants and then were monitored for 30 days. LAI and VARI indexes showed to be suitable to highlight the different growth stages of Geranium plants. Finally, biotic stresses were evaluated by acquiring images on Mandevilla and Euphorbia pulcherrima infested by Bemisia tabaci. Significant differences between infested and non-infested plants were found by using EVI and VARI indexes. According to these results, multispectral cameras can be profitably used in the greenhouse environment by I) correcting the incident light, II) combining pixel classification with spectral analysis and, III) identifying suitable indexes for each biotic and abiotic symptoms.