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# A greenhouse experiment for the identification of spectral indices for crop water and nitrogen status assessment

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Improvements in crop production depend on the correct adoption of agronomic and irrigation management strategies. The use of high spatial and temporal resolution monitoring methods may be used in precision agriculture to improve the efficiency in water and nutrient input management, guaranteeing the environmental sustainability of agricultural productions. In the last decades, many indices for the monitoring of water or nitrogen status of crops were developed by using multispectral images and, more recently, hyperspectral and thermal images acquired by satellite of airborne platforms. To date, however, comprehensive studies aimed at identifying indices as independent as possible for the management of the two types of stress are still scarce in the literature. Moreover, the chemometric approach for the statistical analysis of the acquired images is not yet widely experienced in this research area.

In this context, this work presents the set-up of a greenhouse experiment that will start in February 2015 in Milan (Northern Italy), which aims to the objectives described above. The experiment will be carried out on two crops with a different canopy geometry (rice and spinach) subjected to four nitrogen treatments, for a total of 96 pots. Hyperspectral scanner and thermal images will be acquired at four phenological stages. At each phenological phase, acquisitions will be conducted on one-fourth of the pots, in the first instance in good water conditions and, subsequently, at different time steps after the cessation of irrigation. During the acquisitions, measurements of leaf area index and biomass, chlorophyll and nitrogen content in the plants, soil water content, stomatal conductance and leaf water potential will be performed. Moreover, on leaf samples, destructive biochemical analysis will be conducted to evaluate the physiological stress status of crops in the light of different irrigation and nutrient levels. Multivariate regression analysis between the acquired spectra and the chemical-physical properties of the crop determined with standard methods will be used to identify suitable models for the estimation of crop water and nitrogen status. The most significant wavelengths for the detection of water and nitrogen stress could be the subject of a future experimentation in open field conditions using multispectral systems.