Weed-crop competition and the effect on spectral reflectance and physiological processes as demonstrated in maize

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Weed-crop competition is a problem affecting food production leading to significant yield losses in various crops. The use of remote sensing technologies in agriculture enables rapid, non-destructive measurements that can be used for research and agronomical management. Previous research has been conducted characterizing the spectral response of crops to the stress caused by weeds but not much progress has been achieved nor has this been fully connected to physiological processes. Understanding the spectral characteristics of this type of stress is a basic step in advancing precision agricultural technologies for managing weeds in the field. This research focuses on corn (Zea mays) with variable densities of redroot pigweed (Amaranthus retroflexus), a common weed that is known to reduce corn yields. The primary research goal is to characterize the physiological changes that occur in the corn during early growth stages in the presence of weeds of different densities. A secondary goal, is to examine the ability to detect those changes by means of proximal and remote sensing.

During June to August 2019, a field experiment was conducted in Sede – Boker, Israel. Hyperspectral reflectance measurements using an ASD spectrometer, IR images acquired with a thermal camera and multispectral VIS-NIR images from a mounted UAV were taken. We combined the spectral measurements with physiological measurements (photosynthesis, stomatal conductance and transpiration). The data and results were integrated and analyzed to determine whether physiological differences between variable treatments can be detected by the sensing methods. Results show that these can be observed, detected and we will provide new explanations associating the competition, spectral response and physiological processes.
