Monitoring maize N status with airborne and ground level sensors

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Background and aims

Remote sensing might improve fertilization by monitoring crop nitrogen (N) status using non-invasive methods. The main goal of this experiment was to test the ability of proximal and airborne sensors to identify the nutritional N status of maize.

Methods

We compared various indexes and combination of indexes to select those that provided the best estimation. As airborne images were acquired from different sensors and platforms (drone and aircraft) we compared the effect of spatial resolution on the indexes calculated. The study was conducted in a field maize experiment in Aranjuez (Madrid, Spain) during 2015. The experiment consisted in a complete randomized design with five fertilizer rates ranging from 0 to 220 kg N ha^{-1} and six replications. Readings at ground level were taken with proximal sensors (SPAD® and Dualex®), and airborne data were acquired by flying a hyperspectral sensor 330 m and a multispectral camera 80 m over the experimental site. The aerial imagery was used to calculate N status indexes for each plot.

Results

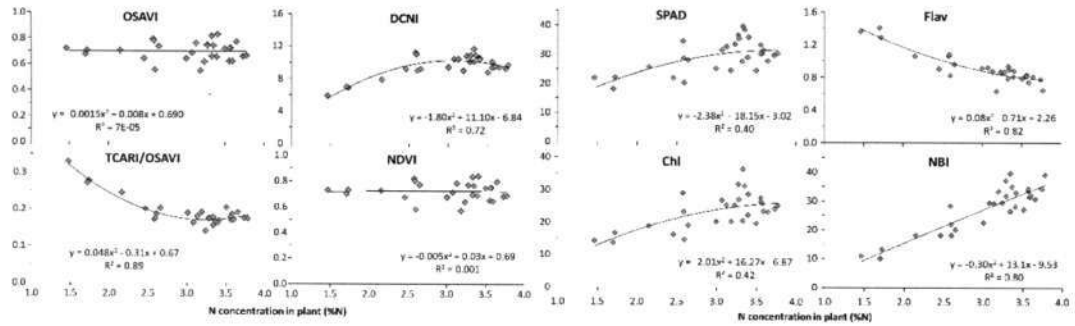

Fig1. Polynomial correlations between airborne/leaf clip indexes and N concentration (%N) observed.

Conclusions

Proximal and airborne sensors provided useful information for the assessment of maize N nutritional status. Higher accuracy was obtained with indexes combining chlorophyll estimation with canopy structure or with polyphenol indexes. Combined indexes improved the estimation compared to an individual index and mitigated the index saturation at high N concentration values. Plant N concentration was strongly related with TCARI/OSAVI obtained from airborne imagery but not with NDVI. The spatial resolution did not affect the performance of structural indexes whereas highly influenced the pigment indexes.

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