UAS-Derived Crop Height and NDVI Measure of Sorghum Yield

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A small, fixed-wing unmanned aircraft system (UAS) was used to survey crop fields being used for an experiment on economic spray thresholds for sugarcane aphids (a type of insect). Equipped with a near-infrared camera, the UAS was flown on a recurring basis over the summer 2015 growing season. The raw imagery was processed to generate Normalized Difference Vegetation Index (NDVI) maps of the fields. NDVI is commonly used to identify crop stress with higher values being associated with healthier plants due to a stronger near-infrared response. The focus of the data analysis and hypothesis was that higher NDVI values obtained mid-season would correlate with higher grain yield; similarly, lower NDVI values would indicate lower yielding crops. Data collected was also used to generate 3D point clouds of the crops. By differencing the canopy height from point clouds to a point cloud generated from a bare ground aerial survey of the area, plant height (a maximum height and a mean height per plot) was estimated.

NDVI values were averaged on a per plot basis for three separate flights, two flown mid-season and a third flown close to harvest. Two varieties of sorghum, one aphid-resistant and one aphid-susceptible, were used for statistical analysis. NDVI values for each flight were compared to per-plot yield at 14% moisture. Regression models confirmed that a statistically significant positive correlation exists between mid-season NDVI values. Strong correlations were also found between plant height and NDVI, as well as between plant height and yield. These correlations suggest UAS-derived NDVI and crop height measures serve as useful measures for identifying stressed areas and improving crop yield.