LIDAR and Photogrammetry to Map Alfalfa Yield and Quality Using Unmanned Aircraft Systems

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In the 2017 alfalfa growing season, a UAV was flown over an alfalfa stand nearly weekly from the first cutting until the final cutting in Kentucky. Each flight was focused on 20 quadrats (1 m2) from which alfalfa was harvested to measure yield and quality. The UAV (a Phantom 4 Pro) used its built-in 4K camera to record the travel over the alfalfa at a height of about 15 m. The footage from the flights was post-process using the Pix4D photogrammetry software to generate a 3D model of the alfalfa canopy surface as a point cloud. The point cloud data was processed in Matlab which was used to apply an affine coordinate transformation (rotation, scale and translation) and isolate the point cloud within the quadrat. The distributional characteristics of the point cloud within the quadrat were then compared against the actual yield to determine the best descriptor for estimating yield.