

ESTIMATION OF FORAGE NUTRITIVE VALUES USING UNMANNED AERIAL VEHICLE (UAV)-BASED OPTICAL SENSORS

C. N. Vong¹, J. Zhou¹, J. A. Tooley², H. D. Naumann² and J. A. Lory²

Precision livestock farming is an opportunity to improve forage use efficiency through the timely acquisition of site-specific information. Remote sensing has the potential to estimate forage biomass and nutritive value in real time on pastures. This study evaluated the feasibility of quantifying forage dry matter (DM) and nutritive value using an unmanned aerial vehicle (UAV)-based remote sensing system consisting of a visible and two multispectral cameras. On 28th September 2017, aerial images were taken and plant samples were analyzed for % DM, crude protein (CP), hemicellulose (hemi), acid detergent fiber (ADF), neutral detergent fiber (NDF), NDF digestibility (NDFD), digestible NDF (dNDF), indigestible NDF (iNDF), and in vitro true digestibility (IVTD) using conventional drying and chemical analysis method. Image features such as red (R), green (G), blue (B), hue (H), saturation (S), value (V), red-edge (VIR), normalized difference vegetation index (NDVI), and soil-adjusted vegetation index (SAVI) were extracted as features from the images and used to estimate the DM and nutritive value using statistical models. The results indicated that % DM and CP could be estimated with a coefficient of determination (R^2) of 0.34 and 0.42, respectively. The correlation of image features and other plant quality indicators was low (less than 0.1). There may be potential to improve results using more advanced sensors, such as a hyperspectral camera, which will be tested for future work.

¹Graduate Student, Division of Food Systems and Bioengineering, University of Missouri (cv6d6@mail.missouri.edu); Assistant Professor, Division of Food Systems and Bioengineering, University of Missouri (zhoujianf@missouri.edu). ²Graduate Student, Division of Plant Science, University of Missouri (jatc65@mail.missouri.edu); Assistant Professor, Division of Plant Science, University of Missouri (naumannhd@missouri.edu); Professor, Division of Plant Science, University of Missouri (loryj@missouri.edu)