Mapping of Rice Crop Height using Multispectral Imagery-based Digital Surface Model

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Abstract

Crop height especially for rice crops is an important agronomic parameter that enables calculations of biomass, yield, and plant nitrogen use, as well as the assessment of lodged areas. Traditionally, crop height has been measured with a ruler, however, this method is time-consuming, ineffective, and subject to human error. Using vegetation indices (VIs) produced from remote sensing data is an indirect approach to the estimation of crop height. VIs is not sensitive to variations in crop height during the later growth stage. Recent research has used a variety of remote sensing platforms to measure crop height. In this study, a multispectral (MS) imagery-based digital surface model (DSM) was used for crop height estimation. A field experiment was carried out in the Agricultural and Food Engineering (AgFE) Department, IIT Kharagpur. For this experiment rice crop (Variety: Super Shankar) was transplanted in 6 plots of 10m×10m size and 4 plots of 10m×10m size were kept barren. Crop height was measured at every 10 days interval and MS imageries of the same date were acquired using a quadcopter UAV. Pix4Dmapper Pro software was used for ortho-mosaicing the MS imageries and the generation of the DSM. Generated DSM was processed in ArcGIS and Extracting DSM for crop plots as well as barren plots. Ground pixels were separated from the canopy pixels by assuming the threshold values. Crop height is calculated by subtracting pixel values of the canopy from the pixel value of bare land. DSM-based crop height estimation yielded an RMSE of 6.3 cm for the crop growth period. This approach to crop height estimation may be helpful for the calculation of important agronomic and phenotypic parameters.

Keywords: Crop Height, UAV, Multispectral Imageries, Digital Surface Model (DSM)