

Yield Assessment due to Varied Inundation in Paddy crop using UAV- based Remote Sensing

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Abstract

Inundation is increasing due to extreme weather conditions severely impacting the agricultural sector. Hence, inundation impact on crops and its monitoring is essential for policy and decision-makers to provide timely and precise reimbursement to farmers. This study attempts to estimate paddy crop (a major staple food cultivation of the world) yield under different inundations using multispectral imageries acquired by Unmanned Aerial Vehicle (UAV) in the sub-tropical region. A field experiment was carried out on paddy crop (MTU-1010) during the Kharif (monsoon) season of 2018 in the research farm of the Agricultural and Food Engineering (AgFE) Department, IIT Kharagpur, India. The experimental design consists of five different types of treatments i.e., treatment 1- 20 cm standing water level was maintained for 10 days, treatment 2- 20 cm (20 days), treatment 3- 30 cm (10 days), treatment 4- 30 cm (20 days) and treatment- 5 (control)- 5 cm standing water level maintained up to maturity stage with three replications. An in-house-quad copter Unmanned Aerial Vehicle (UAV) equipped with a multispectral camera was used to acquire the high-resolution imageries at different inundation periods. The acquired images were radiometrically calibrated and pre-processed using Pix4d-mapper software. Various spectral indices (such as NDVI, NGRDI, RVI, GRVI, NDRE, TNDVI etc.) were evaluated and compared with the different ground truth parameters (SPAD, green seeker). The yield of different treatments was also compared and correlated with the spectral indices. The yield was increased from treatment 1 to treatment 3 but decreased for treatment 4. The highest yield of 5.02 t/ha was observed for treatment 3, and treatment 1 was the lowest yield of 4.55 t/ha compared to the control treatment of 4.92 t/ha. The spectral reflectance of RVI and GRVI were observed to have similar response variations for different treatments with an increase in Days After Transplantation (DAT). The variations of yield and spatial maps generated using UAV-based multispectral imageries for the treatments will be helpful to government agencies for early estimation of yield due to flood inundation within the small farming fields.

Keywords: Inundation, Yield, Spectral indices, Unmanned Aerial Vehicle (UAV)

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