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Classification of the field drainage and wetness by using aerial photographs in irrigated paddy rice and upland crop rotation field

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Information about field drainage/wetness is useful for farmers to plan field management in irrigated paddy rice and upland crop rotation field. Wet injury is a loss to farmers in upland crop farming, experience is the most common way of approaching this risk. In this study, we propose to provide efficient and objective classify and mapping method of such field drainage information using aerial photography.

Study area (500 ha) is located in Ibaraki Prefecture, Japan. In this area, we acquired multitemporalaerial photographs (ADS40) three times after the rain on winter. Digital Number (DN) of Blue, Green, Red and Near Infrared band were used to analyze. To analyze the relationship between each band DN and soil moisture, mass soil water content of 0-5cm depth was determined using the 100ml core sample at 22 sites on shooting date. And to verify our classification of the drainage and wetness, volumetric soil water content was monitored using TDR sensor (Decagon, ECH2O) at 5cm, 10cm and 20 cm depth at 16 sites.

First, optimum band was selected from correlation analysis of mass soil water content and DN. Next, optimum band DN of three aerial photographs at field area was grouped by cluster analysis (ISODATA method).

We found a good positive correlation between mass soil water content and red band DN, by selecting optimum bands. 17 groups were found from cluster analysis using three aerial photographs with different soil moisture conditions. After that, we classified them into five levels of field drainage based on red band DN values. We generated maps of drainage/wetness based on these results.

We compared volumetric soil water content at the monitoring site for the “Dry” and “Wet” points, water was drained quickly at the “Dry” site but it needed more than 1 week the volume soil water content back to revert before rain at the “Wet” site. By the result, we positively verified our classification.

We used three aerial photographs with different soil moisture conditions as proxy of top soil moisture content. It is thought to be an indication of drainage/wetness. Generally, estimating soil water content at field scale from a remote sensing data was difficult. But this method can classify the study area relatively. We think it is enough as a soil information for farmers.