Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HTT30-06 Room:101A Time:May 25 17:45-18:00

Rice growth monitoring by radio control electric-powered Multicopter

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1. Introduction

Currently,radio control electric-powered Multicopter became miniaturization and cost reduction also the attitude control technology improves. And it became to do the proximity remote sensing at a low cost by mounting a camera or sensor as UAV (Unmanned Aerial Vehicle).

Crop production management is one of the important issues of remote sensing,the number of case studies have been accumulated.In particular,in the paddy rice is Japan's key crops,such as yield and harvest optimum time forecasting and eating quality decision is challenged, observation and prediction that target a vast field that utilizes the aircraft and satellite remote sensing has been carried out.

In this study,by using the UAV for growth monitoring of rice,it was attempted a detailed growth situation monitoring based on the image of high time-spatial resolution.In addition,we used SfM (Structure from Motion) technic to the analysis of a plurality of images taken,which can create ortho mosaic image,DSM,were utilized for growth monitoring of rice. Observation by the UAV,less limitations by clouds,such as a satellite,in addition UAV is possible to observe at any time. So if the observation costs are inexpensive and the data is the high accuracy,the advantage of using UAV is increase especially the wet area like Japan.

2. Methods

In rice Proving Ground in Chiba Prefectural Agriculture and Forestry Research Center, we observed in June 2014 from May to September.In this field is subdivided two of paddy in 48 compartments, seeding, transplanting time in each compartment,varieties and changing the amount of fertilizer,can be grown in different conditions.

To observation,electric-powered Multicopter and digital camera were subjected to aerial using.

Creation of ortho photographs and paddy fields of DSM(Digital Surface Model)was created using the SfM software PhotoScan.DSM in order to change due to the growth of rice,is subtracted the initial ground surface altitude (ground surface before planting) from DSM of each shot time,determine the average plant length of rice in each compartment.

3. Results,Discussion

1) NDVI

NDVI of rice for each partition in common,rises from transplanting time,it was lowered toward maturity around heading to the peak.

Transplant period 4 phase(4/10,4/23,5/14,6/3),appear peak earlier about what time that was transplanted early,began then descent. Due to differences in the varieties, the difference of the growth process also observed,NDVI of the same period of the previous heading slow-growth Koshihikari became lowest. In addition, even those of the same day of transplantation-breed,a higher fertilization amount became high NDVI.

Differences in growth conditions in field by growth conditions were observed in detail. (Using the NDVI)

2) DSM (the Plant length)

Results of the comparison the plant length measured from the DSM and actual measured plant length previous heading,we could observe in the error number cm level. Plant length is one of the important indicator rice to growth conditions and we could observe it from the Aerial photos.

The cause of the error, as well as DSM accuracy problems,strictly to seeking high state fallen state and wind hanging the DSM is measured "plant height". On the other hand, Actual measured values is measured by stretched straight(plant length).

3) Growth estimation using NDVI (plant length, LAI)

Based on the correlation between the measured data and NDVI of rice, I was led to the regression model for plant length ? LAI estimation in before heading using the NDVI. Each of RMSE of these models, 0.047m (plant height) 0.478m2 / m2(LAI), estimation accuracy is high, the possibility that can be applied to the growth state measurement of critical time to adjust, such as top-dressing amount has been suggested.

Keywords: UAV, SfM, NDVI, DSM, Plant length

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