APPLICATION OF UAV MULTI-SPECTRAL CAMERA FOR ESTIMATING BANANAS DISEASE INFESTATIONS IN COMPLEX FARMING IN PHITSANULOK PROVIMCE

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Phitsanulok Province located in the lower north, Thailand. The famous souvenir of Phitsanulok is dried bananas. The yield from bananas farm is essential as it is used as a raw material for production. The application of Remote Sensing methods to asses crop vigor and yields has had limited applications in Phitsanulok Province due largely to limitations associated with satellite images. The increasing use of Unmanned Aerial Vehicles (UAV) in recent times opens up new possibilities for remotely seeing crop status and yields even on complex smallholder farms.

This study demonstrates the applicability of a vegetation index derived from UAV multi-spectral cameras imagery to assess bananas crop vigor and yields at various stages of crop growth. The study employs a quadcopter flown at 80 m over farm and equipped with 6 bands cameras, RGB, Blue, Green, Red, Red Edge and Near Infrared. The Normalized Difference Vegetation Index (NDVI), Enhance normalized Difference Vegetation Index (ENDVI) and red-edge chlorophyll index (CIRE) were compared. To Estimating bananas vigor and yields, we found that ENDVI and CIRE is better indicator of crop vigor and a better estimator of yields than NDVI.

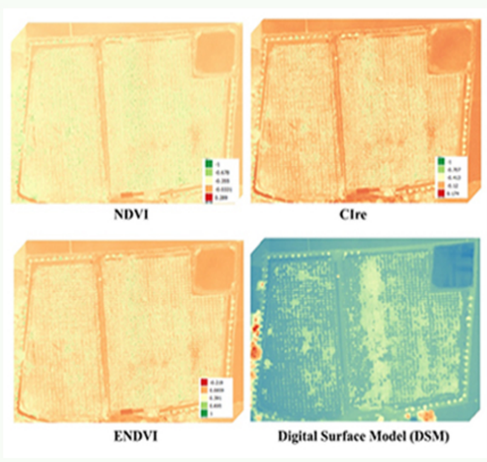
STEP 01 INTRODUCTION

"Kluai Nam Wa Mali Ong" is considered an important alternative economic crop in the current situation. In the past few years, it has been affected by drought as well as the impact of deadly disease and banana borer. Make the banana price drop. Phitsanulok have a large demand for banana cultivars for planting. Instead, they pay more attention to the prevention of mortality before planting, and will see the importance when the bananas show symptomsof disease, which is not timely and difficult to fix.

The objectives of this study were to (i) develop an identification method for the dead zone of banana using UAV-based multispectral imagery, (ii) determine the optimal VI for establishing an optimal identification model, and (iii) assess the effect of different image resolution on the identification accuracy of dead banana from disease to provide a reference for large-scale applications of satellite-based data.

STEP 03 RESULE

We analyzed the differences in the VI values between the healthy and diseased samples obtained from the experiment area, and conducted independent t-test analyses for each sample. The results showed that there were significant differences in the values of NDVI, GNDVI and CIRE between the healthy and diseased samples.



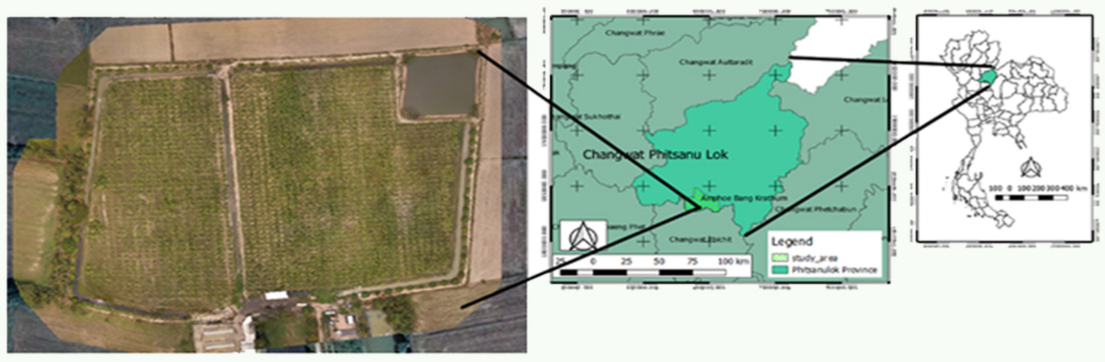
STEP 04 DISCUSSION AND CONCLUSION

The results of this study indicate that the CIRE was the optimal red-edge VI and the NDVI, ENDVI were the optimal non-red-edge VI for developing identification models for banana disease infestations. This is attributed to the fact that as the infection of disease progresses, the chlorophyll content decreases significantly, and the CIRE values are sensitive to small variations in the chlorophyll content.

STEP 02 METHEOLOGY

STUDY AREA

The experiments were conducted at Bangkrathum district



UAV MULTI-SPECTRAL CAMERA AND RTK ACQUISITION

This UAV was equipped with a five-band multispectral camera which has five narrow bands: Blue (465–485 nm), green (550–570 nm), red (653–673 nm), red edge (712–722 nm), near-infrared (800–880 nm) and one RGB (visible) band. The flight at the site was conducted between 14:00 p.m.–14:30 p.m. and covered an area of 21 ha. The flight at Hainan site was conducted between 11:00 a.m.–12:00 p.m. on 11 December 2018 and covered an area of 60,500 square meter. The flight plans were developed to ensure greater than 80% cross-track and along-track overlap rates. The multispectral imagery was acquired from a flying height of 100 m above the ground with a ground sample distance of 0.08 m. The multi-spectral imagery is 125 images

DATA ANALYSIS

In this study, different VIs were used to identify the infestation status of banana plants. These resolutions were selected because they were similar to those of several mainstream and easily accessible satellite imagery products (i.e., WorldView series with a resolution of 0.5 m, GF-2 with a resolution of 1 m, GF-1 and GF-6 with a resolution of 2 m, RapidEye with a resolution of 5 m, and Sentinel-2 with a resolution of 10 m) for agricultural applications.

Vegetation Index	Equation	Reference
Normalized Difference Vegetation Index (NDVI)	$NDVI = \frac{NIR - RED}{NIR + RED}$	Rouse et al., 1974
Enhance normalized Difference Vegetation Index (ENDVI)	$ENDVI = \frac{((NIR + Green) - (2 * Blue))}{((NIR + Green) + (2 * Blue))}$	Gitelson et al. 1996
red-edge chlorophyll index (CI_{RE})	$CIre = \frac{NIR}{(RE - 1)}$	Gitelson et al. 1996

List of vegetation indices developed for remote sensing applications.

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