Prediction of Crop Nitrogen Status of Banana Using UAV-Based Multispectral Imagery

Perera P.R.K., Vitharana U.W.A.,[*] and Haputhantri T.[1]
Department of Soil Science,
Faculty of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka

Banana (*Musa spp.*) is the fourth most consuming food and it provides several nutritional benefits. Nitrogen is essential for banana plant for the growth and development. Application of nitrogen fertilizer on the basis of blanket recommendations may cause over application or under application due to variations in soil properties. Objectives of this study were to evaluate the potential of using unmanned aerial vehicle (UAV) based multispectral imagery to predict nitrogen status of banana crop and study relationship between leaf total nitrogen content and soil properties. Multispectral images were acquired using an agricultural UAV, preprocessed, mosaicked and soil reflections were removed by image classification using iso-cluster unsupervised classification. Multispectral images were used to calculate different vegetative indices and the images of Normalized Difference Vegetation Index (NDVI) was used for further analysis. Jenks natural breaks classification method was used to classify the NDVI values into five classes. Sample points for leaf and soil sampling were identified randomly representing five NDVI classes. Then a leaf sample was taken from banana plant at each sampling locations and SPAD meter reading of the same leaf were recorded at five randomly selected places. Moreover, surface soil sample (0-30 cm) was taken near to the selected banana plant, total nitrogen concentration of leaf sample, pH, Electrical conductivity (EC) and organic matter percentage of soil sample were analyzed. Strong linear regression relationships were observed between NDVI and SPAD meter reading ($R^2 = 0.57$) and leaf total nitrogen ($R^2 = 0.79$). However, leaf total nitrogen did not show strong relationship with soil pH ($R^2 = 0.03$), EC ($R^2 = 0.06$), and organic matter content ($R^2 = 0.25$). A strong relationship between NDVI and leaf total N showed multispectral imagery can be used to predict nitrogen status, thus allowing site-specific N fertilizer management in banana.

Keywords: NDVI, Total Nitrogen Content, Unmanned Aerial vehicle

[1] Dole Lanka (Pvt) Ltd., Colombo, Sri Lanka

[*] uvithara@agri.pdn.ac.lk