A NARROW BAND COMBINATION MODEL TO DETERMINE LEAF NITROGEN AND WATER CONTENT IN RICE

Shalei Song, PingXiang Li, Wei Gong, Liangpei Zhang
State Key Laboratory Information Engineering in Surveying, Mapping and Remote Sensing, Wuhan University
Wuhan, Hubei 430079, China
songshalei@gmail.com
Phone Number: (+86)-(13476082677)

ABSTRACT:

Using remote sensing technologies to supervise the growth and nutrition status of crops is the primary research content of precision agricultural management. Leaf nitrogen content is central to understanding plant and whole agricultural ecosystem function, but so are other leaf properties, especially water content, pigments such as chlorophylls. Numerous leaf-level precision agricultural research have focused on the prediction of crop physiological status through the extraction of leaf biochemical parameters, such as the concentration of nitrogen, chlorophyll a, and water using hyperspectral vegetation indices. However, for large scale application, it should be more interesting to extract leaf biochemical parameters, and as such crop physiological status directly from canopy reflectance measurements, the simultaneous interaction of nitrogen and chlorophyll on the vegetation spectrum hampers this action. Leaf water is another important factor regulating canopy temperature and moisture stress, both of which are particularly acute in rice canopies. Therefore, it can be concluded that there is certainly a need for an efficient and accurate extraction of nitrogen and water. This paper aims at investigating the capability of narrow bands combination for accurately estimating nitrogen and water content of rice by applying the index on simulated and in in-situ measured canopy spectral datasets.

In this paper, the hyperspectral data of rice leaf under different levels of nitrogen and water was used to study the nutritional status of rice. The hyperspectral experiment of leaf observation in rice was conducted with four nitrogen application levels of 0，6，12，18kg/ hm2, and three water application levels 4cm，4-9cm and exceed 9cm in the rice field. There are several characteristic variables of hyperspectra, such as the green peak or red valley of reflectivity, the red edge position, the blue edge area and the vegetation indices. So we established several narrow band models and compare the inverse effects with each other in order to confirm the most effective narrow bands combination model.

The methodologies employed used partial least squares (PLS) analysis method and spectral bands inter-correlation method (ICM), on the basis of an experiment using reflectance spectra of rice leaves and the concentration of three foliar biochemicals: nitrogen, chlorophyll-a and water. The PLS methodology is implemented on a spectra/biochemical concentration data set from two growing season and tested on a similar data set from late in the growing season. We use the two methodologies (PLS and ICM) to select the narrow bands which are sensitive to the nitrogen and water content of rice leaves, and then these narrow bands are combined in several PLS models. A particular comparison of the models will be done to confirm the most appropriate narrow band combination which is spectral final result for rice observation. This narrow band combination is recommended that its utility is investigated for the estimation of rice biochemical concentration from field, airborne or even spaceborne spectra.

KEY WORD: hyperspectral data, narrow band, rice