PRECISION AGRICULTURE AND REMOTE SENSING: VARIANCE ANALYSIS OF WHEAT CROP BY SPECTRAL INDICES

O. BEERI*, A. PELED, S. KITAIN*****
University of Haifa, Department of Geography, Haifa, 31905 Israel
*ofer@geo.haifa.ac.il
**a.peled@uvm.haifa.ac.il
*** Ministry of Agriculture, Israel

Working Group II/2

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ABSTRACT

Precise agricultural monitoring throughout the growing season, is a key tool for obtaining optimal crop yield at lowest possible cost. The paper focuses on variance analysis of crop (wheat) yield by spectral indices. This is part of a multi-year ongoing research on precise agricultural monitoring, carried out at the department of geography, University of Haifa. This research has two main goals: (1) to test various vegetation parameters and spectral indices for monitoring wheat yields; and (2) to compare predicted remote sensing yield maps with combine-GPS yield-maps. The paper describes the data collection steps, analyses methods and the results, gained during one, particular, wheat growing season. The test field in this research effort, is located near Be'er Sheva, in the semi-arid region of southern Israel. The field was divided into 54 test plots, each given different nitrogen and water treatment. Crop was collected on three different occasions throughout the growing season, complimented with color and CIR air photography coverage. The harvesting was done in two different methods: (1) A 1.25 meters-wide combine harvested the field passing through the center of each plot. (2) In a second stage, the entire field was harvested by a "GPS-combine". The actual yield amounts were compared to the predicted-yield map, produced by processing the CIR photographs. The spectral indices, developed in this research, proved to have better correlation with the yield from each plot, than with vegetation parameters, that are used in traditional agriculture monitoring. There was not found a significant difference between the correlation of Color-Infrared indices and Visible-Light indices of the predicted yield. The crop yield map, produced by modeling the remote sensing data, correlate the combine-GPS yield-map, and has better ground resolution. Thus, it depicts better spatial variability for each plot. This variability stems from the farmer activity and may be used for better agriculture management. Three of the spectral indices manifested good correlation throughout the season, and will be applied, for crop-yield prediction, in the continued research. Using the suggested model for producing predicted crop yield maps, will enable better monitoring of wheat with greater spatial accuracy.