SAMPLING SIZE STUDY FOR CANOPY SPECTRAL REFLECTANCE MEASUREMENTS

Kiran Pavuluri, W.E. Thomason

Dept of Crop Soil and Environmental Science
Virginia Tech
Blacksburg, Virginia

ABSTRACT

Reliable data pertaining to canopy biophysical status can be obtained by collecting canopy spectral reflectance measurements. Heterogeneity in the experimental plots is an inherent problem for obtaining quality data. Sampling size, frequency and time parameters can be adjusted for reducing the heterogeneity in the experimental plot. A clear understanding about the influence of those parameters of sampling pattern will help in the development of protocols for collecting canopy spectral reflectance (CSR) measurements. An experiment was conducted by using randomized complete block design with five regionally established genotypes as blocks and 16 sub sampling patterns as treatments. Canopy spectral reflectance measurements are being collected from each experimental unit by using Ocean optic's JAZ spectrophotometer and different vegetative indices will be calculated. Appropriate subsampling design will be determined by using statistical data of standard deviations and coefficient of variations of various indices for all the treatments.

Keywords: Canopy spectral reflectance, sampling frequency, size, time.

INTRODUCTION

The development of sensors to measure crop reflectance created opportunities to evaluate agronomic parameters and thus to improved crop management practices(Hatfield et al., 2008). Vegetative indices enhance the signal for the target feature while minimizing the non-target signal strength such as solar irradiance and soil background effects. Vegetative indices are therefore calculated from the reflectance data in order to relate it with canopy characteristics. Potential of using CSR measurements as a selection tool for grain yield in winter wheat breeding programs was assessed in various studies (Babar et al., 2006a; Babar et al., 2006b; Prasad et al., 2007). In these studies, four spectral measurements per experimental plot were collected by using sensor with a 25^{o} field of view at vertical position at a height of 50 cm above the plant canopy. Recent developments in scripting languages at the University of California Davis have allowed users to collect data rapidly across different points and thus reducing the heterogeneity in the experimental plots. However, studies standardizing this sampling protocol are limited and further investigations on these aspects are thus warranted.

MATERIALS AND METHODS

A field experiment was conducted in 2010-11 growing season by using a randomized complete block design with 5 soft red winter wheat *(Triticum aestivum, L.*) genotypes as blocks and 16 sampling patterns as treatments. Eight treatments were sensed at a height of 50 cm and the other eight at 100 cm above the canopy level per plot. At each level of height, four measurements were taken by using point scan method at four different places and the other four measurements were taken by using continuous scan method at different places (100, 200, 300 and 400). Spectral readings are being collected by using an Ocean Optic's Jaz spectrometer (Ocean Optics, Dunedin, FL) in 10nm bandwidths from 400-900 nm at Zadoks growth stage (GS) 35, 45, 55, and 75 (Zadoks J.C, 1974). According to the treatments, reflectance measurements are being collected with a 25^{o} field of view at vertical position. The incident spectrum is being taken from the light reflected from a white reference plate and the reflectance is calculated from the ratio of reflected light from the crop canopy against the total radiance reflectance from the white reference plate. Seeding rates, dates and agronomy followed was according to the intensively managed, high-yielding small grain production (Brann et al., 2000). Appropriate treatments will be selected by analyzing standard deviation and coefficient of variation values.

REFERENCES

Babar M., van Ginkel M., Klatt A., Prasad B., Reynolds M. (2006a) The Potential of Using Spectral Reflectance Indices to Estimate Yield in Wheat Grown Under Reduced Irrigation. Euphytica 150:155-172. DOI: 10.1007/s10681-006-9104-9.

Babar M.A., Reynolds M.P., van Ginkel M., Klatt A.R., Raun W.R., Stone M.L. (2006b) Spectral Reflectance Indices as a Potential Indirect Selection Criteria for Wheat Yield under Irrigation. Crop Sci. 46:578-588. DOI: 10.2135/cropsci2005.0059.

Brann D.E., Holshouser D.L., Mullins G.L. (2000) Agronomy handbook. Pub. No. 424-100, Virginia Coop. Ext. Blacksburg, VA.

Hatfield J.L., Gitelson A.A., Schepers J.S., Walthall C.L. (2008) Application of Spectral Remote Sensing for Agronomic Decisions. Agron. J. 100:S-117-S-131. DOI: 10.2134/agronj2006.0370c.

Prasad B., Carver B.F., Stone M.L., Babar M.A., Raun W.R., Klatt A.R. (2007) Potential Use of Spectral Reflectance Indices as a Selection Tool for Grain Yield in Winter Wheat under Great Plains Conditions. Crop Sci. 47:1426-1440. DOI: 10.2135/cropsci2006.07.0492.

Zadoks J.C C.T.T.A.K.C.F. (1974) A decimal code for the growth stages of cereals. Weed Research 14:415-421.