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# VARIABILITY OF REFLECTANCE MEASUREMENTS DUE TO THE INTERACTION OF ROW AZIMUTH AND SOLAR ILLUMINATION ANGLE

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Pronounced effects on the reflective response of a crop canopy due to changes in solar azimuth and row azimuth angle have been noted on soybeans planted in wide rows. Understanding the interaction between row azimuth and illumination direction on the crop canopy spectral response is necessary in order to utilize effectively the spectral data collected on row crops.

The objective of this experiment was to determine the effects of rows and row direction on the reflective response of a soybean canopy as a function of solar azimuth and zenith angles. Data were acquired over eleven plots in 1979. One plot was planted in east-west and north-south rows 25 cm wide to obtain, at later growth stages, a canopy with negligible row effects. A bare soil plot was included in order to monitor the sunlit soil background reflectance of the soybean plots. The remaining nine plots were planted in soybeans with 76 cm wide rows with the following azimuthal directions: 90-270, 105-285, 120-300, 135-315, 150-330, 165-345, 180-360, 210-030, and 240-060 degrees. The row directions were selected to favor the data collections during the morning hours when cloud free conditions are more likely. Reflectance data were acquired with a Landsat band radiometer (Exotech 100) at 15 minute intervals throughout the day on three days, representing three canopy growth stages with 65, 75 and 95 percent soil cover for those plots with 76 cm wide rows.

Analysis of the data has shown minor effects on reflectance due to solar zenith angle. (Significant effects may be observed at lower latitudes whose wider diurnal variations of solar zenith angle are observed.) The two visible bands (0.5-0.6  $\mu\text{m}$ ) and (0.6-0.7  $\mu\text{m}$ ) were significantly affected by the interaction of solar and row azimuth angles. Reflectances of canopies with rows parallel to the

solar azimuth illumination angle were more than double the reflectance of canopies with rows perpendicular to the illumination angle.

Mathematical models relating the spectral response of a soybean canopy changing in size and shape to the projected solar angle ( $\theta_{sp}$ ) will be discussed. ( $\theta_{sp} = \tan^{-1}(\tan\theta_s \sin\phi_s)$  where  $\theta_s$  = solar zenith angle;  $\phi_s$  = solar azimuth - row azimuth angle)

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