Multispectral Canopy Reflectance Measurements & Digital Imaging to Determine Soybean Maturity

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Introduction

- Soybean is an important commercial crop in the USA, 84.8 million acres in 2014
- To optimize growth and yield, producers need better tools to identify developmental stages
- Remote sensing tools have been used to assess phenotypic qualities such as height, LAI, chlorophyll content, and yield
- Spectral reflectance measurements with vegetation indexes (VI's) may provide a means to quantitatively identify developmental stages

Research Objectives

- Use off-the-shelf spectral reflectance sensor and digital camera to identify physiological stages in soybean
- Investigate the effectiveness of vegetation indexes such as normalized difference vegetation index (NDVI), normalized difference red edge index (NDRE), and dark green color index (DGCI) to quantify physiological stages

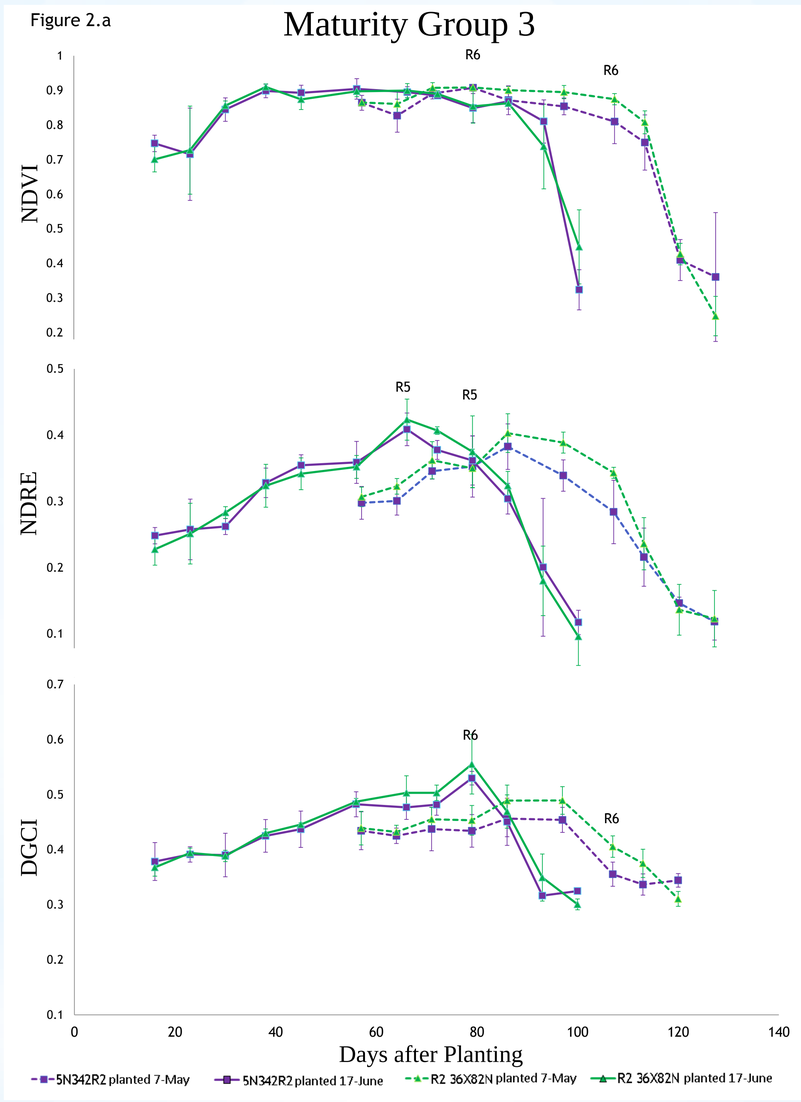
Figure 1. Demonstrating use of the Holland Scientific RapinScan CS-45

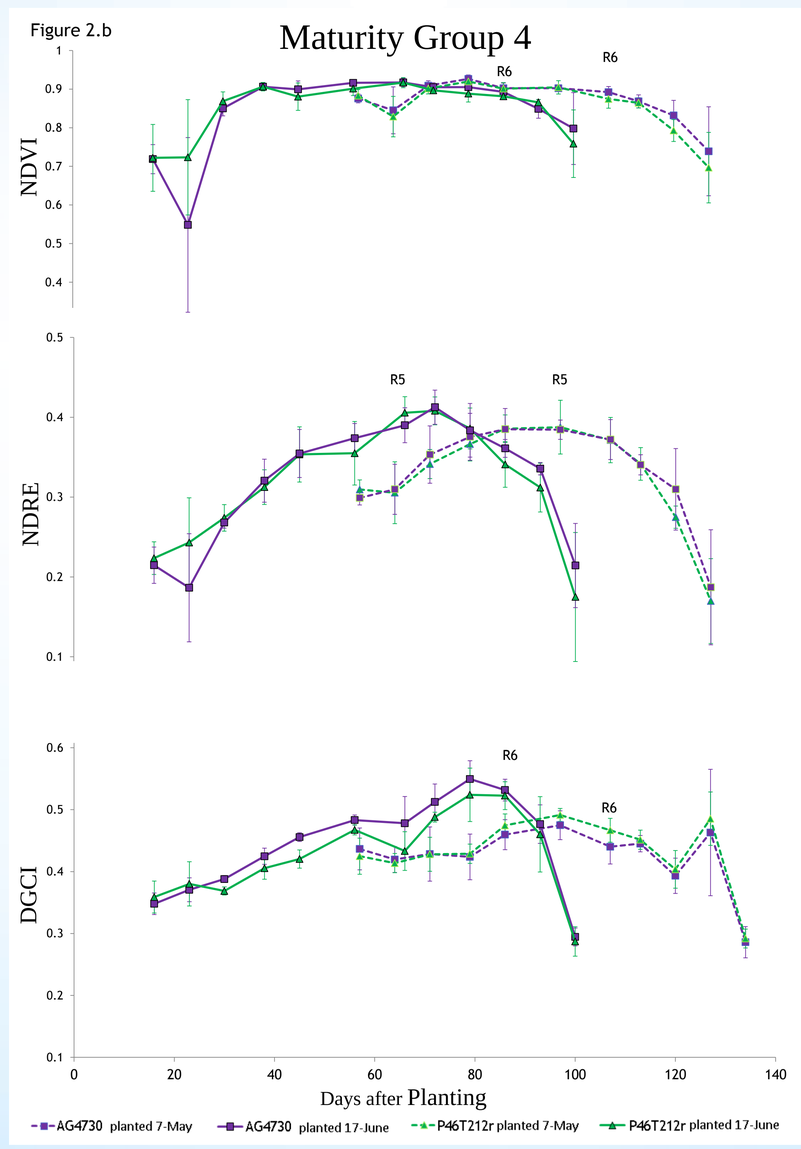
Materials & Methods

- Experiments conducted at MU Fisher Delta Research Center
- 6 commercial soybean cultivars from MG 3, 4, and 5 planted on 76cm rows
- 2 planting dates (7 May and 17 June)
- NDVI and NDRE measured using a Holland Scientific RapidSCAN CS-45
- DGCI derived with a digital camera on auto and Sigma scan software
- Cultivars staged and measured weekly from R2 through R7

Results

NDVI: Increased to ~0.9; decreased at Full seed (R6)
NDRE: Increased to ~0.4 at Beginning seed (R5) then decreased
DGCI: Increased to ~0.5 at Full seed (R6) then decreased





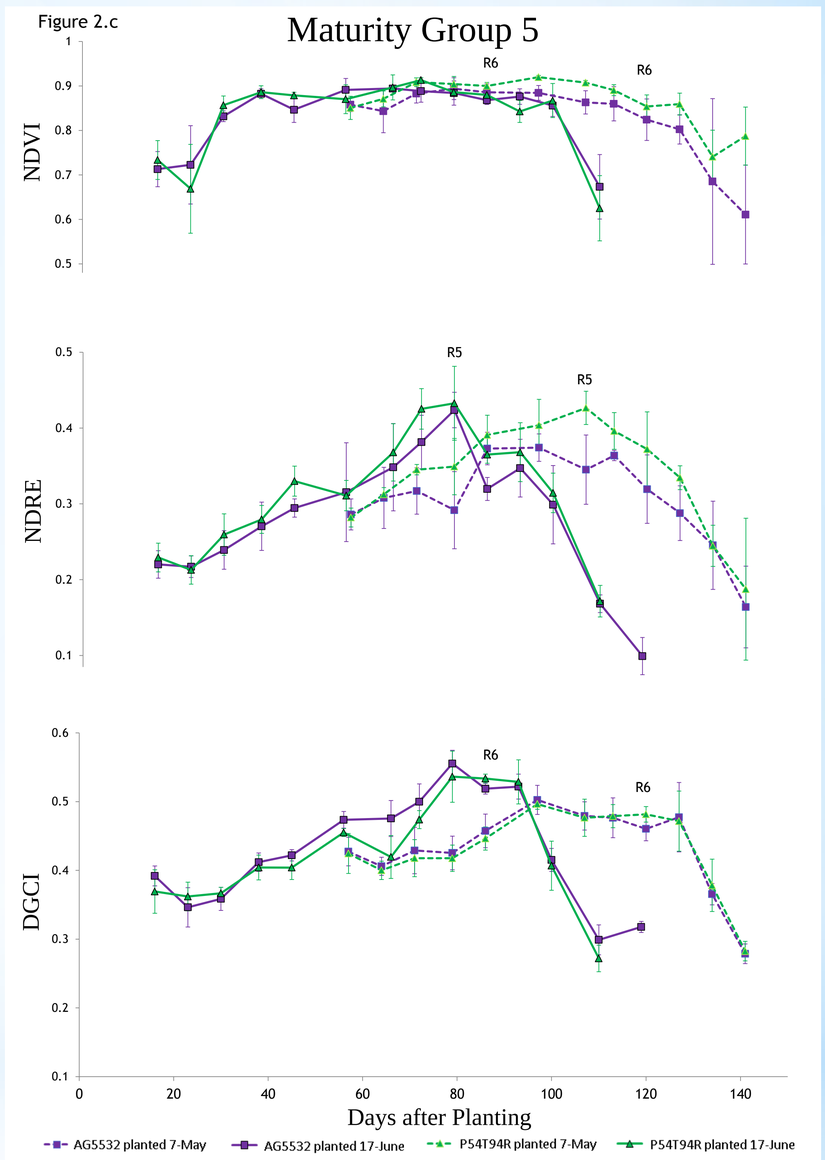


Figure 2. NDVI, NDRE, and DGCI versus days after planting at MU Fisher Delta Research Center in 2014 for two cultivars each from a) MG 3, b) MG 4, and c) MG 5.

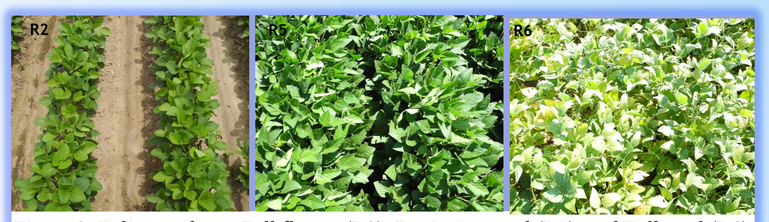


Figure 3. Foliage color at Full flower (R2), Beginning seed (R5), and Full seed (R6)

Conclusion

- NDVI, NDRE, and DGCI each show measurable changes during the growing season
- Beginning seed (R5) and seed fill (R6) coincide with the fluctuations in VI measurements
- Spectral Reflectance and digital imagery shows promise for identifying soybean growth stages

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