Proximal and Remote Sensing of Dry Beans infected with the rust pathogen (*Uromyces appendiculatus*)

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Introduction

- Rust is an important disease that affects dry beans in Eastern CO and Western NE

- Rust development is favored by cool to moderate temperatures (70-85°F) with moist conditions that result in prolonged periods of water (more than 10 hours) on the leaf surface

- Recent yield losses have exceeded 50% in some areas

Objectives

- 1) Determine if spectral data, both field-acquired and airborne, can be used to detect rust in dry beans

- 2) Assess differences between Pinto and Great Northern Dry Beans with regard to spectral detection of rust

- (3) Determine whether spectral reflectance from infected plants / leaves is statistically significantly different than from healthy leaves

Results (Proximal)

- Infected Pinto beans at later growth stages are statistically significantly different from healthy plants

- Infection usually occurs during the later stages of growth in Nebraska

- Best time to scan is when the plants are at later growth stages and when the infection has progressed to where it is affecting the leaf surface, thereby influencing the vegetative fraction

Results (Remote)

$$((\_NIR / \_Green) - 1)$$

Rust

Infected

Area

11 August 2004

22 August 2004

Conclusions

- Based on the initial leaf-level results, there is a statistically significant difference between the healthy and rust infected leaves at later growth stages

- Correlation between Vegetative Fraction and NDVI and VARI yielded R^2 values of 0.86 and 0.83 for GN beans

- Correlation between Vegetative Fraction and ((_ NIR/_ Red Edge) -1) and ((_ NIR/_ Green) -1) yielded R^2 values of 0.93 and 0.87 for GN beans

- The imagery from the two aerial missions have not been thoroughly examined, but preliminary results are not encouraging

Future Work

- Greenhouse experiment
  - Scan reproductive stage
    - Scan more frequently after initial infection
    - This would show when the pathogen is statistically spectrally different from healthy plants

- Remote Sensing
  - Coincide with the field experiment

- Field Experiment
  - Scan at higher level of infection
  - Scan more than one time

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