Decision-Support Tool Development at the Nexus of Statistics and Programming for Better Integration of Research with Extension

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Project Timeline

Small-Plot Research
- Proof-of-concept
- Focus on stress identification
- Calibration equations

2020

Web-Tool Prototype Development
- Automate image processing
- User interface development
- Validation

Research into New Functionalities
- Mid-season N rate recommendation
- Satellite as an alternative to sUAS?

2024

Web-tool deployment
Tool Improvement
- Addition of new functionalities
- Validation of version 2.0.

Research into New Functionalities
- Economic analysis
- Resilience to climate variability

Small-Plot Research

- Yield-limiting nitrogen (N) deficiency occurs when mid-season leaf N concentration is < 3% (Espinoza and Ross, 2008)
- Pre-tassel N fertilizer application can help minimize yield loss from mid-season N deficiency (Slaton et al., 2013)
- Mid-season leaf N concentration strongly correlates to canopy greenness measured using RGB cameras mounted on SUAS and the Dark Green Color Index (DGCI) (Dos Santos et al., 2020)
- Calibration equations were created to predict yield loss from N deficiency by comparing DGCI values between normal field conditions and a high-N reference (Dos Santos et al., 2020)

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Prototype User Interface

Figure 1. Automation stages of image processing. A drone equipped with an RGB camera is flown over a field with a high N reference strip before corn tasseling (located on the right side of each image). Soil was filtered out (white pixels). The RGB image was converted into DGCI, RGY, and N status maps.

Figure 2. User interface of the corn nitrogen tool prototype. The users upload images and delineate the high-N reference. Images are processed automatically, and results are displayed in tab.

Practical Considerations

- Web tool can be used with affordable drones and without stitching
- No need to fly whole field
- Tool development is dynamic and cyclic process that occurs with research
- Limitations: no predictive capabilities because of DGCI saturation and assumes other stressors are controlled

Next Steps

- Addition of new functionalities
- Deployment/commercialization
- On-farm validation
- Development of sUAS IoT system with real-time image processing capabilities

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