Comparing the FieldScout GreenIndex+ Chlorophyll Sensing App to the Minolta SPAD Meter

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Abstract
With the improvement of mobile computing, the company Spectrum Technologies, Inc. has developed a precision Ag App which adapts an iPod, iPad, or iPhone camera to select for specific wavelengths of light from a corn leaf (Zea mays L.) in comparison to accompanying board for light/color comparison. The App computes a Dark Green Color Index (DGCI), indicating leaf greenness, which relates to the amount of chlorophyll and thus, indirectly, leaf nitrogen (N) content. The question posed for this study is: How accurate and convenient is the App compared to a proven technology, the Minolta 502 Soil-Plant Analysis Development (SPAD) meter; do they provide the same information?

Keywords
leaf nitrogen content, Soil-Plant Analysis Development (SPAD) meter, Dark Green Color Index, Ag App, Science with Practice (SWP)

Disciplines
Agronomy and Crop Sciences | Software Engineering

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Materials & Methods
- From two Ames and two Kanawha, Iowa sites with varying rates of fertilizer, five random plants were chosen from the center two rows of each of the 134 total plots and measured with both the SPAD meter and App.
- This was done over three growth stages; once during the mid-vegetative stages, once during tasseling, and once during a mid-reproductive stage.
- The data was then recorded in Excel. Upon plant maturity, six random plants from each center plot were taken for total plant biomass analysis, grain yield combine harvested, and completed results will be compared for N stress detection and measurement efficacy when full yield data is available.

Results
Complete analysis of results will not be possible until the grain yield and biomass samples has been finalized. However, in my own user experience with the App, I have found it to be adequate as an alternative to the SPAD meter in several ways:
- The 5-plant average can be easily saved on an electronic log.
- The App displays both DGCI and Normalized Difference Vegetation Index (NDVI), an estimate of the photosynthetically absorbed radiation over the surface from green vegetation.
- The SPAD meter can cost $2,100.00+, while the App, board, and device all together are ~$325.00, or 15% of the price.

Conclusions
Overall, the App readings were consistently lower than the readings taken by the SPAD meter, as shown on the first three graphs at left. The scatter plot depicts DGCI given from the App to that given by the SPAD from the same plants. There was variation between App and SPAD values at different N rates, and across all readings. Without further data from the yields, it is difficult to postulate concretely on comparative accuracy, but as the SPAD meter has been reliable in the past, results suggest the App may require some adjustment. Overall, the App shows promise as a viable, cheaper, and convenient alternative to the SPAD meter in both a production and research setting.

Impacts and Benefits of SWP
This project has been the most involved, challenging, and enlightening experience I have had at ISU. The opportunity for hands-on experience with the myriad of field and office work required in an ongoing study is invaluable to my personal professional development in Agronomy. Realizing that trial, error, and patience are essential parts of the scientific method are key lessons that have struck strong with me.

The Science With Practice lectures and assignments were a useful compliment to my project experiences and provided both material and practical life skills that could be used in this poster, as well as in any career or educational future I might pursue.

SWP Objectives
- Gain practical experience in how a formal research study is conducted from start to finish.
- Understand how data gathered from the iPod relates to data gathered by routine sensors and yield results.
- Become familiar with software & hardware operation.
- Determine whether the App would be suitable for research and/or production agriculture settings.
- Communicate with the manufacturer about product strengths, weaknesses, experiences, and suggestions.

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