Developing diagnostic tools for nitrogen management in potatoes

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Background

- Nitrogen (N) fertilization in annual cropping is key to maximizing yield and quality.
- Optimization of N application in-season offers economic and environmental advantages and provides flexibility in management practices.
- Potatoes are high users of N.
- Petiole sampling is currently used to estimate in-season N requirements of potatoes.
- Interest is growing in the use of alternative, non-destructive, methods to examine or estimate N levels.
- Instruments which show potential are the Greenseeker, chlorophyll meter (SPAD) and Dualex (Figure 1).

Objective

- To conduct a preliminary evaluation of the use of the Greenseeker, SPAD, and Dualex meters for measuring in-season N deficiency in potatoes.

Method

- The study was superimposed on an experiment designed to examine petiole nutrient recommendations for Russet Burbank potatoes.
- There were four N levels and four replicated plots per treatment (Figure 2).
- Seven times throughout the season, and coincident to petiole sampling, Greenseeker, SPAD and Dualex meter measurements were taken.
- As readings can vary between instruments, timing of sampling and environmental conditions, the Greenseeker, SPAD and Dualex measurements were normalized to the mean value for the 280 kg ha⁻¹ treatment.

Results

- Potato canopy closure occurred between July 18th and 25th. A hailstorm on August 10th resulted in significant damage to the aboveground plant material and thus the data from August 22nd are not considered reliable (Figure 3).
- Total yield which ranged from 35 to 41 tonnes ha⁻¹ was unaffected by the differential N treatments. Throughout the sampling period, petiole N ppm was significantly lower in the 27 kg ha⁻¹ N treatment. There was no significant difference in the petiole N ppm values for 169, 224 or 280 kg ha⁻¹ experimentally applied N (Figure 4a).
- There were no differences in the Greenseeker NDVI values amongst the four N treatments, the Dualex measurement values for the lowest N rate of 27 kg ha⁻¹ were significantly higher than the other three N rates (Figure 4d).
- With the exception of June 27th and August 8th when there were no significant differences amongst the four N treatments, the Dualex values for the lowest N rate of 27 kg ha⁻¹ were significantly higher than the other three N rates (Figure 4d).

Conclusions and Future Directions

- More than one year of testing is required to confirm these results. However, the results from this preliminary study suggest the Dualex instrument has potential as an alternative tool to petiole N testing for measuring differential N levels in potatoes and aiding in management decisions.
- Studies are required to quantify the Dualex measurements in terms of N requirements for potatoes.

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