NEAR-INFRARED SPECTROSCOPY ON FRESH PLANT MATERIAL FOR REAL TIME IN-FIELD NUTRIENT ANALYSIS

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JOURNEY TO A SOLUTION

Started with customer feedback

- Wanted to know what is happening in their crops in real time
- Didn't want to be overwhelmed with information
- Needed to make decisions quickly

Objectives:

- Actionable insights in real-time
- Help growers achieve their crops' economic potential

Investigated range of technologies and landed on near-infrared (NIR) spectroscopy

PRESENTATION OUTLINE

- Why Spectroscopy
- Solution and its components
- Results
- Next steps
- Summary

WHY SPECTROSCOPY?

Desirable characteristics

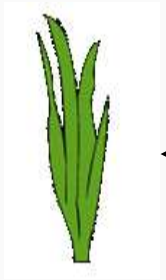
- Immediate result while in the field correlated to N
- Doesn’t require sample processing
- Compute time is minimal
- Minimise the need for consumables and maintenance
- Potential for multiple analyses from a single scan - priority is N in cereals
- Reliable and robust for in-field use

Implications

- Plant specific – need for “representative” sampling
- Requires going into the paddock

SOLUTION COMPONENTS

User captures scan with spectrometer, submits data and receives report via smartphone application



Device

Bluetooth connection

Smart phone app

User submits data for analysis

User receives nutrient analysis status

Cloud Models

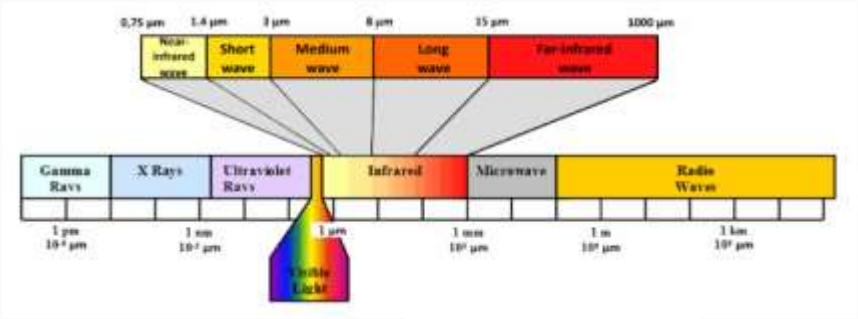
Chemometric model provides nutrient estimate

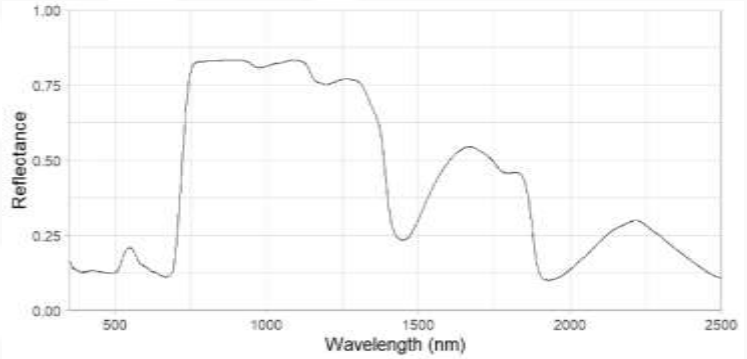
Nutrient status model

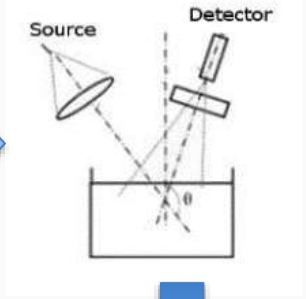
Example reporting commentary:

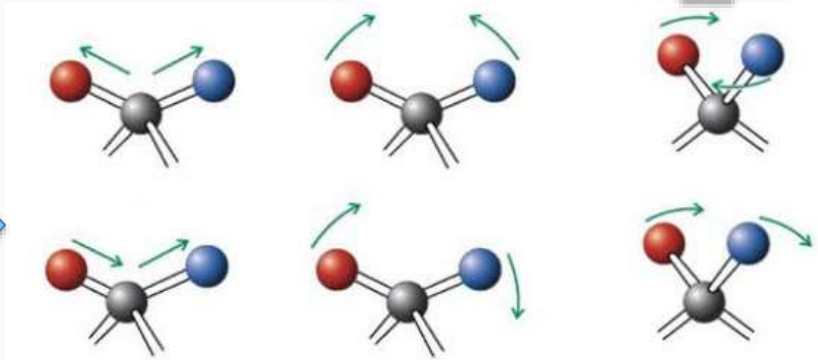
Nutrient	Estimate	Status
Nitrogen	2.0 - 2.5%	Deficient

SPECTROSCOPY









NIR HARDWARE

Expensive:

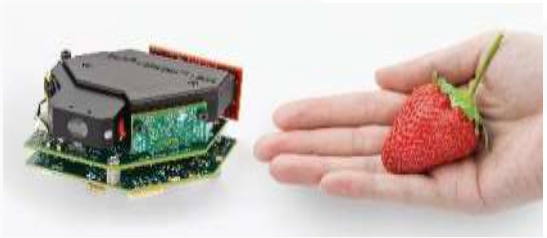
- Range: 350 – 2500nm
- High resolution: 1nm

Cheap:

- Range: 900 – 1100nm
- Resolution: 30nm

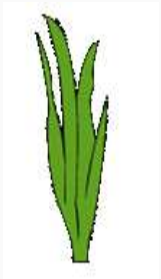
Selected device

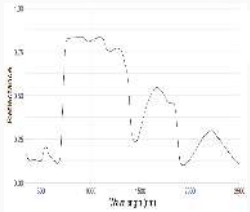
- Range: 900-1700
- Resolution: 3.5nm

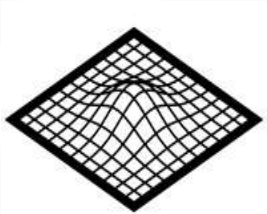


CHEMOMETRIC MODELLING

Scan leaves of a plant → Send plant to lab → Match scans to Total N → Chemometric modelling process → Deploy chemometric model







CHEMOMETRIC MODELLING

Final dataset

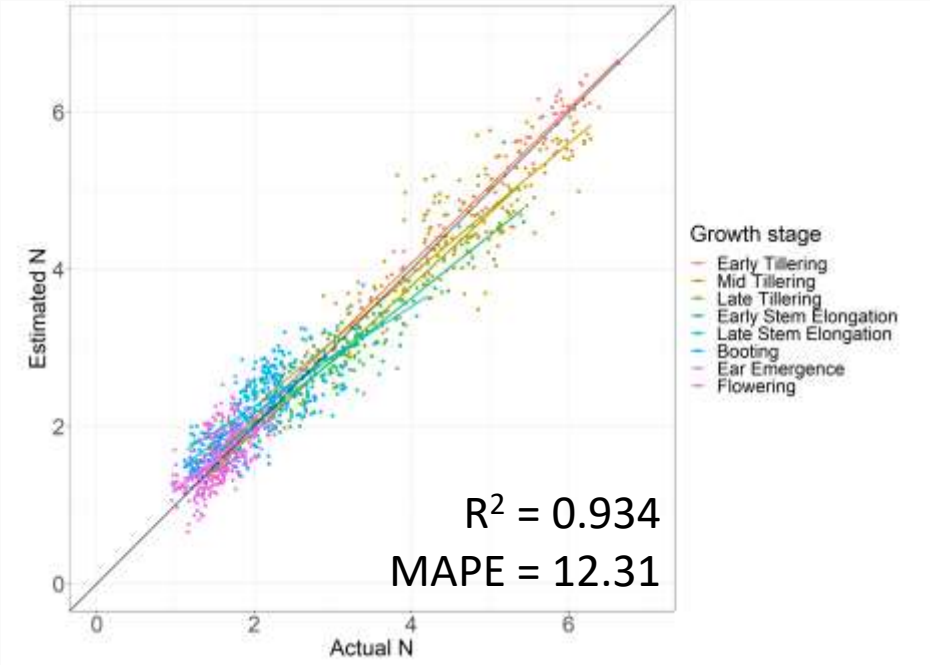
- > 10 000 plant samples collected
- Scanned multiple leaves of each plant
- Wheat and barley
- Across 2017, 2018, 2019
- WA, SA, VIC, NSW
- Tillering through to flowering
- Paddock and field trials sites

Tested the model across:

- Growth stages
- Geographies
- Climatic conditions
- Soil types
- Fertility levels

MODEL PERFORMANCE RESULTS

Actual Testing Scenario



	Average R^2	Average MAPE
Nitrogen	90.30%	12.70%

WHAT DOES THIS MEAN FOR A GROWER

- Extensive field testing across WA and East Coast already being conducted
- N-Status outputs derived from CSBP's history of trial data and expertise in soil and plant nutrition - means we don't need grower data to build this solution
- Reduces uncertainty of nitrogen applications
- Have more confidence in their decision to apply N, or not

NEXT STEPS

Pilot launch of the solution in 2020

- Assess modelling performance in upcoming season
- Continue to seek out feedback and integrate into the solution
- Investigation of other crops types and other nutrients
- Continuous evaluation of model performance

SUMMARY

- Understood the problem
- Assessed the options
- Assembled the components of the solution
- Sought grower feedback and will continue refine the solution
- Pilot launch this coming season

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