

In-field plant monitoring as a tool for N management in small grains

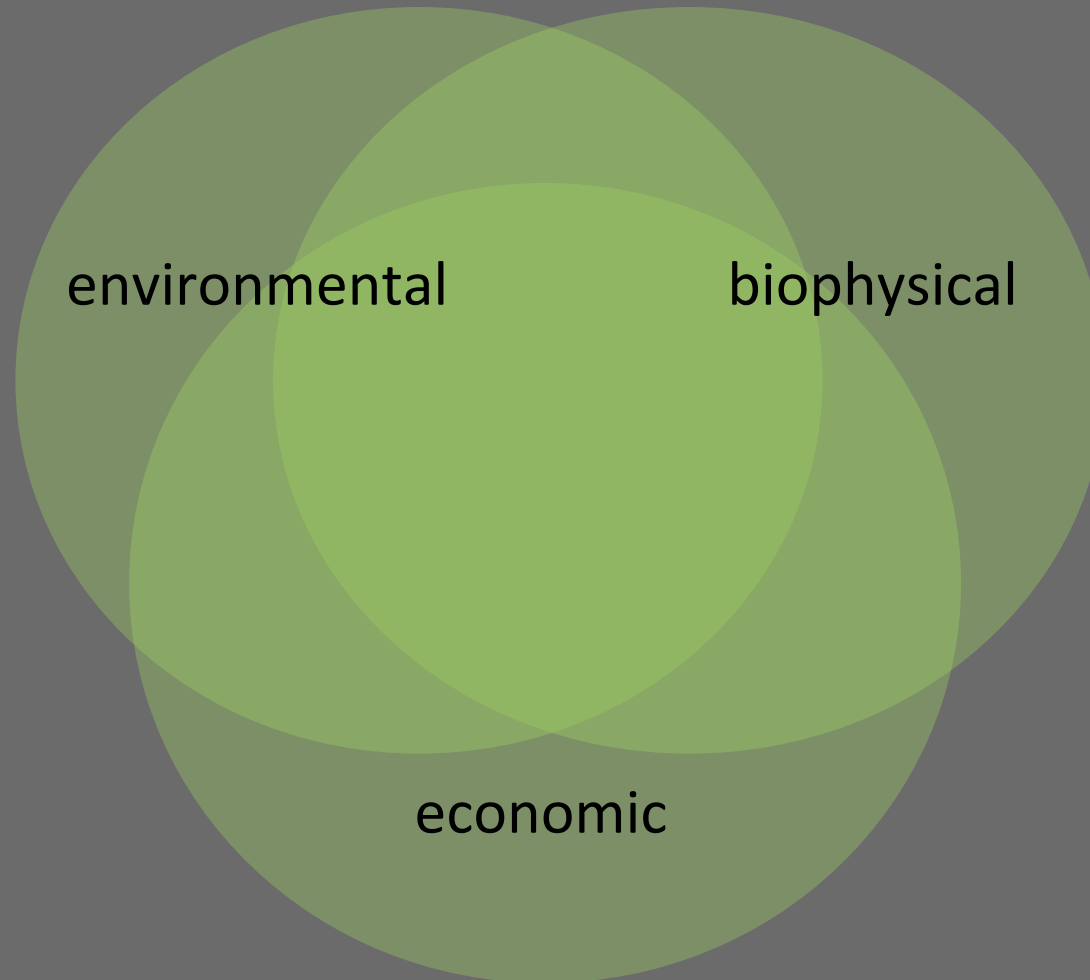


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1.

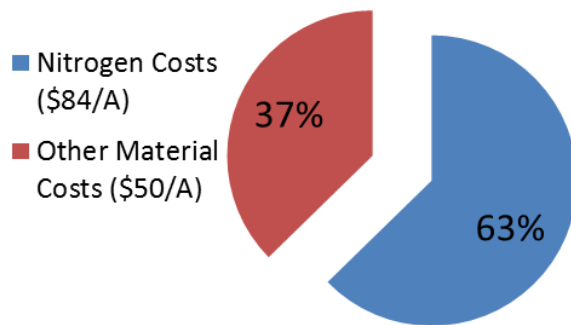
University of California
Agriculture and Natural Resources

Why should we care about site-specific N management in small grains?



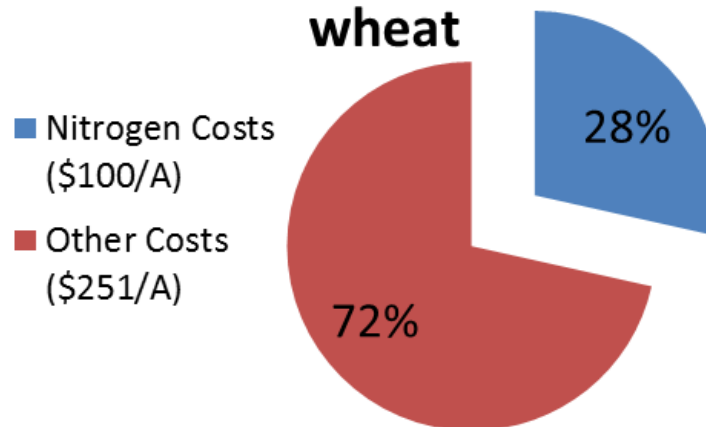
Why should we care about site-specific N management in small grains?

N costs as a proportion of material costs in wheat



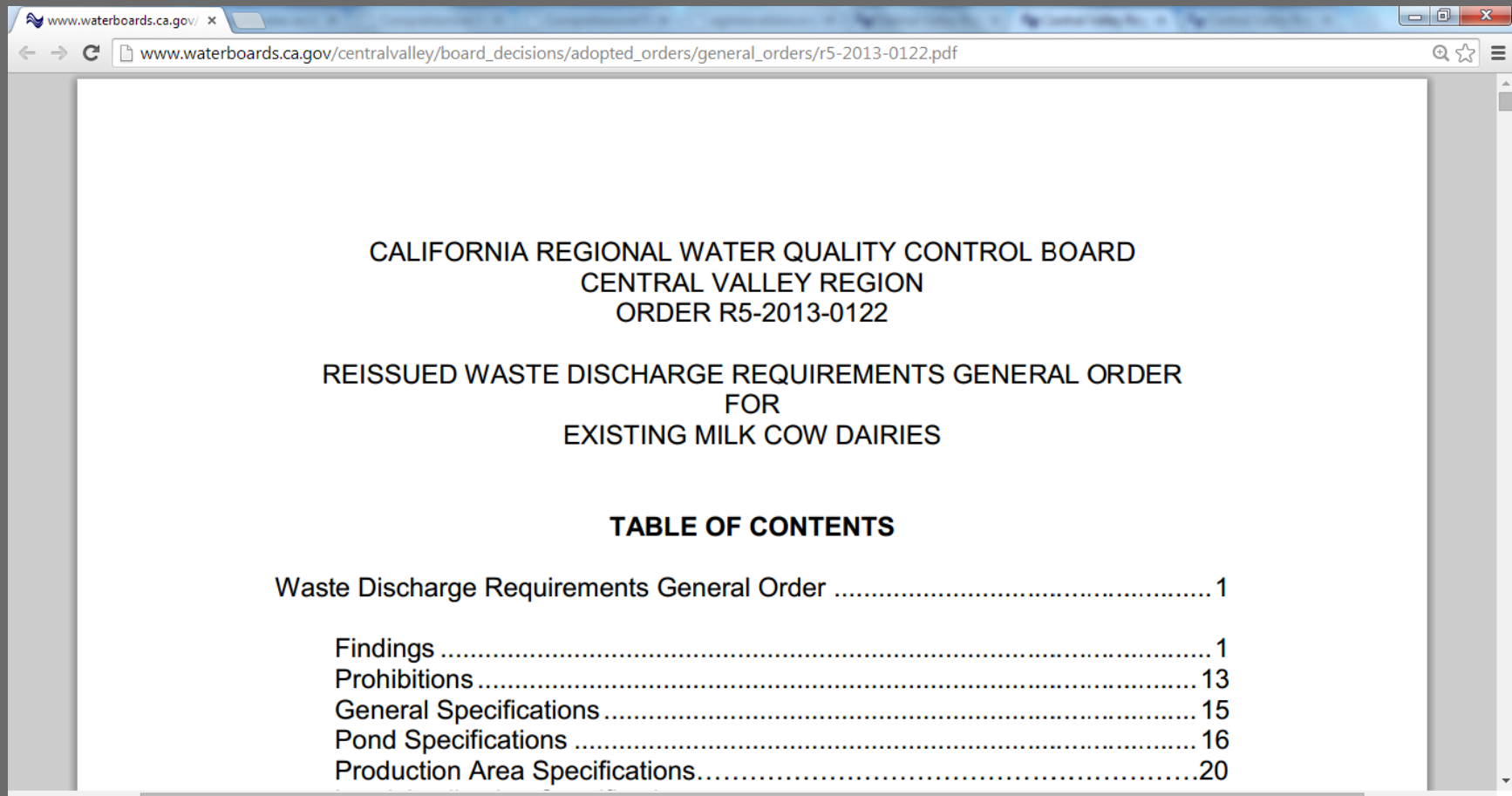
*Based on 2008 UCCE Cost Study for irrigated wheat in Sac. Valley

N costs as a proportion of total, direct operating costs in wheat



*Based on 2008 UCCE Cost Study for irrigated wheat in Sac. Valley

Why should we care about site-specific N management in small grains?



www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0122.pdf

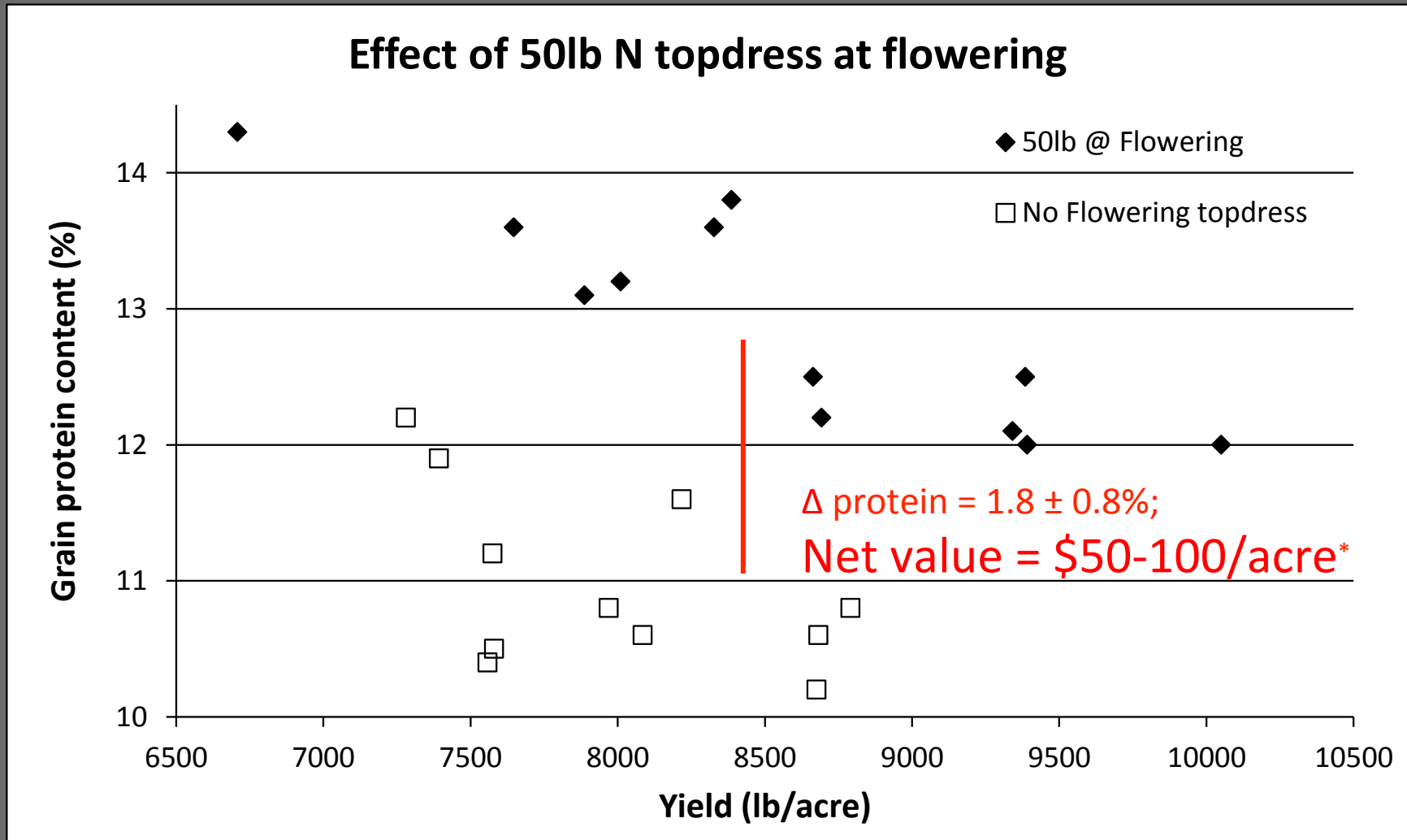
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
ORDER R5-2013-0122

REISSUED WASTE DISCHARGE REQUIREMENTS GENERAL ORDER
FOR
EXISTING MILK COW DAIRIES

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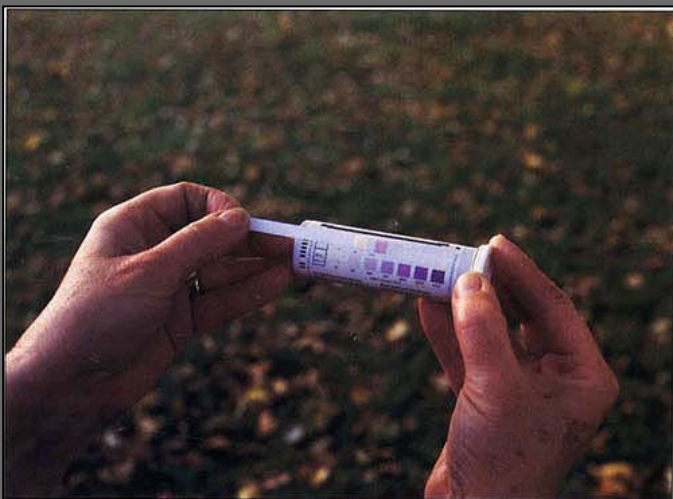
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Why should we care about site-specific N management in small grains?



*For \$7.50/bu wheat with \$0.01/ lb premium or discount / % above or below target (11%).

What tools are available to assist in real-time N management in small grains?



The Basic SOLVITA® Soil Response Color System

The patented gel-technology system indicates CO₂-respiration over a color range of 0 to 5 (see chart). In CO₂-Burst mode this corresponds to a range of 5 to 160 ppm CO₂-C. In BASAL mode it corresponds to a range of 0 - 55 ppm or 1 - 25 kg m²/year as CO₂.

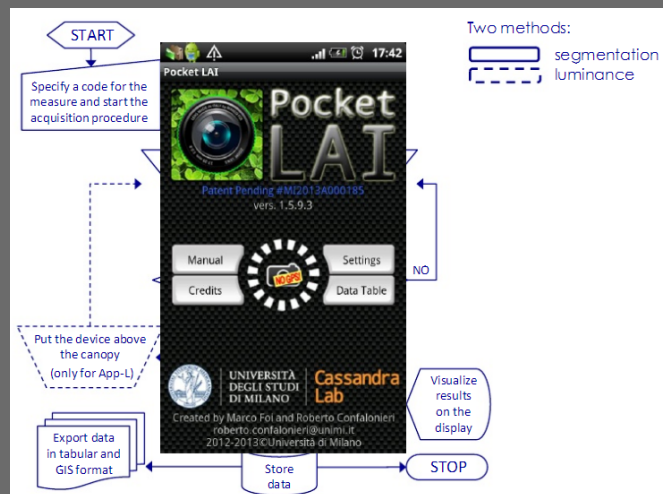
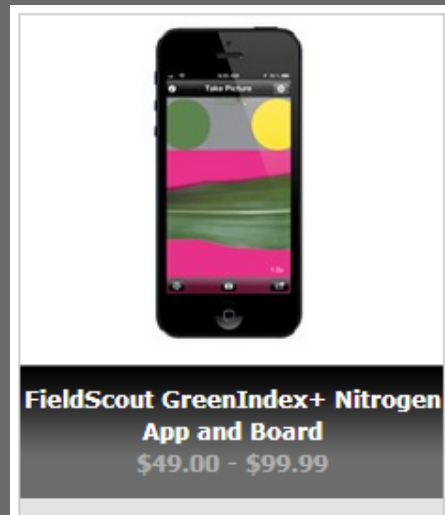
All Solvita kits work with a basic visual color system, as shown below. By using the Solvita Digital Color Reader (DCR) the soil test values can be more accurately and precisely determined.



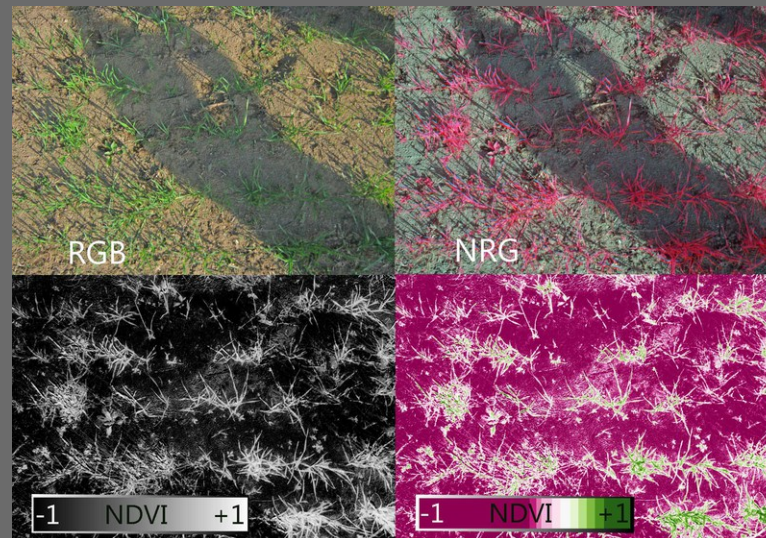
Sequence of Typical Soil Solvita Test Results:



What tools are available to assist in real-time N management in small grains?



What tools are available to assist in real-time N management in small grains?





Background: Spring wheat production in California

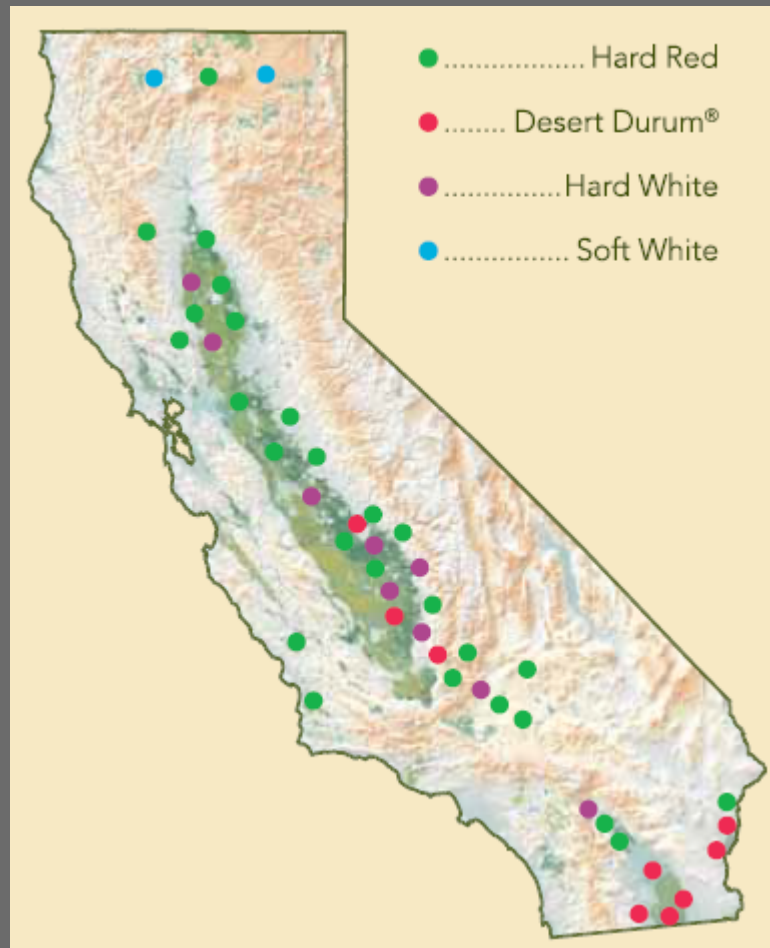
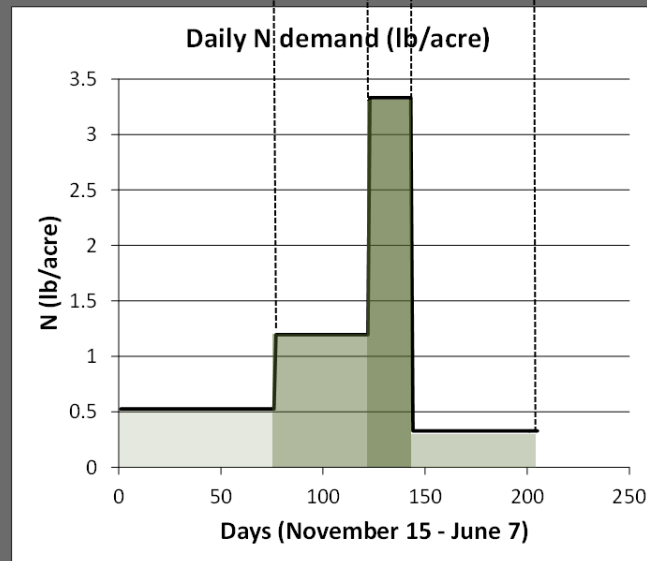
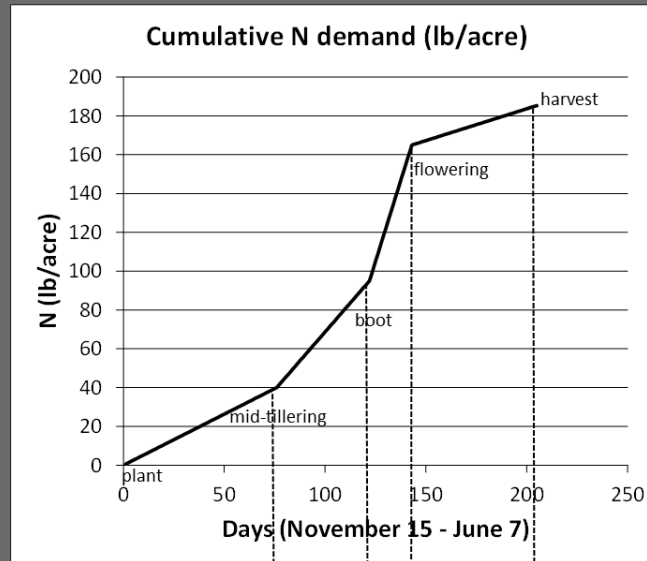


Image courtesy: California Wheat Commission

- Season (November to June) coincides with the rainfall (Mediterranean climate)
- Irrigation varies by region:
 - More opportunistic in the northern part of the state
 - More of a given in the southern part of the state
- Many growers split N applications between sowing and tillering-stem elongation
 - Total rates: 120 – 225 lb acre⁻¹

Demand for N by irrigated wheat in the Sacramento Valley (7500 lb / acre; 11.5% protein)



Fertilizer N contributions to wheat yield and protein content

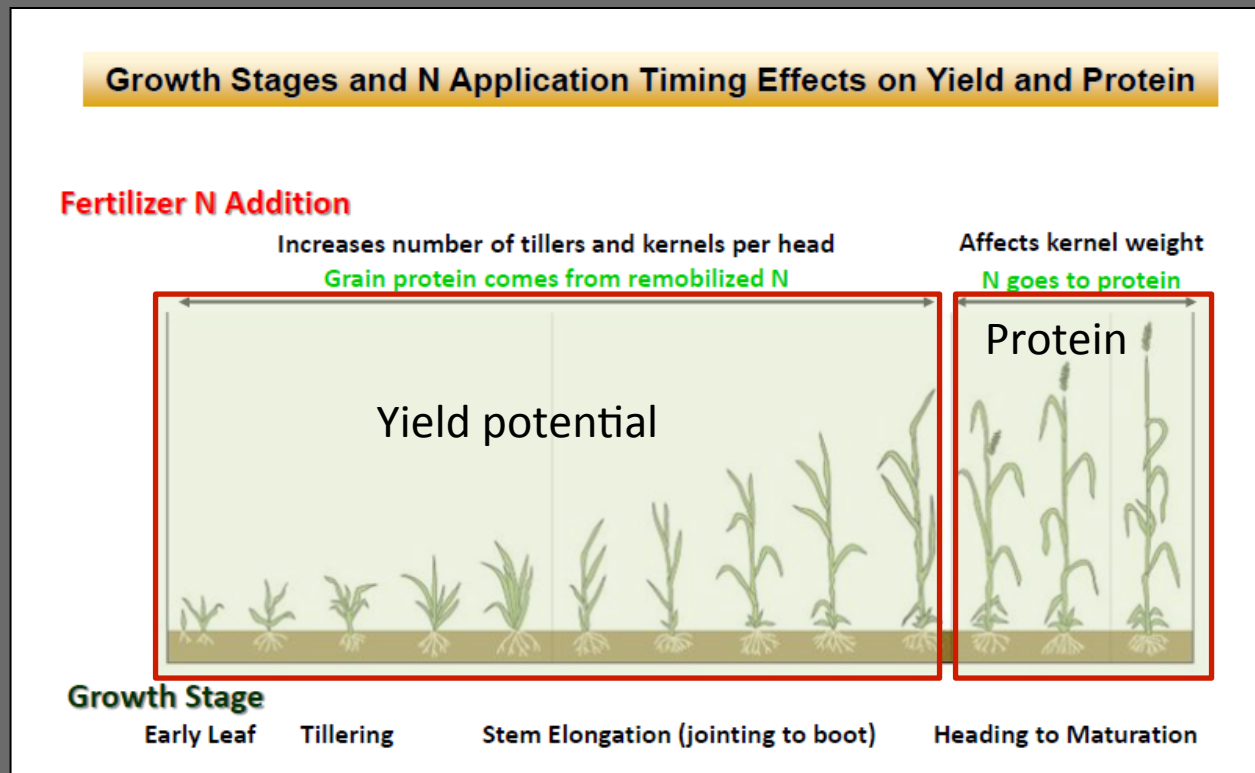


Image courtesy: S. Orloff

Proximal sensing devices



atLEAF chlorophyll meter

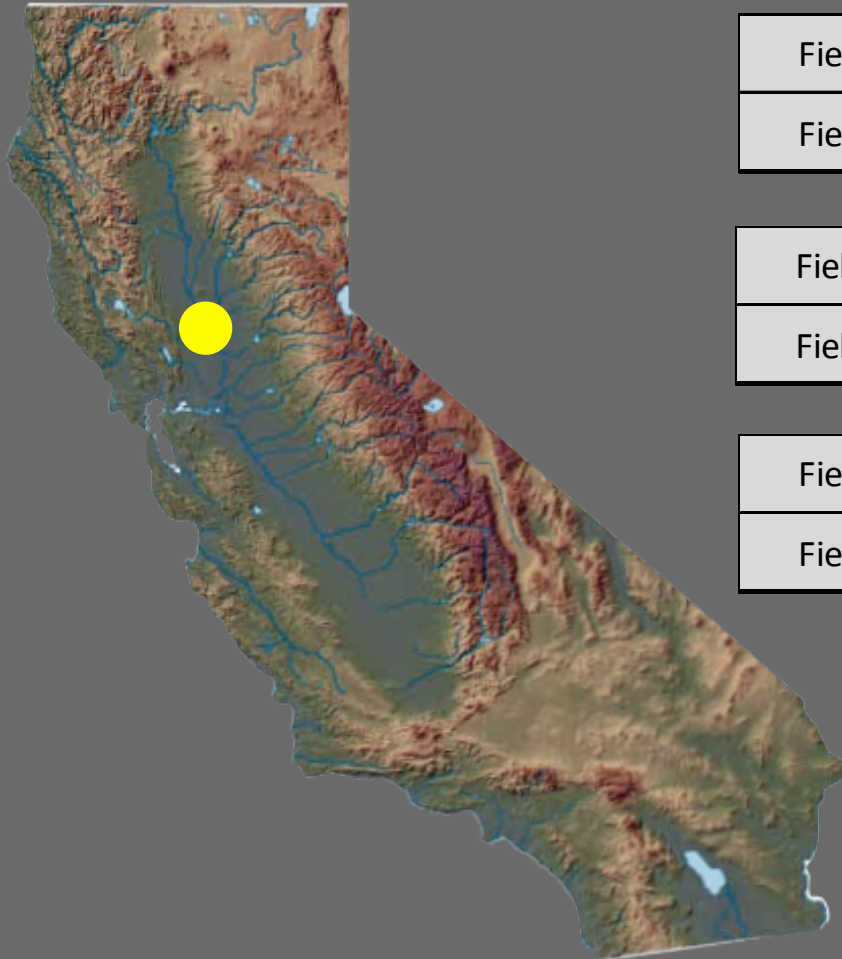
- SPAD proxy (660 and 940 nm)
- Suitable proxy for yield leaf N concentration?
- Retail: \approx \$250



Trimble Greenseeker handheld

- NDVI (660 and 770 nm)
- Suitable proxy for yield potential?
- Retail: \approx \$500

Methods: Crop environments



Fertilizer treatments	PREPLANT	TILLERING	BOOT	FLOWERING	TOTAL
	% of N fertilizer applied				kg / ha
	0 - 100%	0 - 100%	0 - 50%	0 - 20%	0 - 335 kg/ha

Field 1	fully irrigated
Field 2	not irrigated
	supplemental irrigation

Field 1	Variety: hard white
Field 2	Variety: hard red

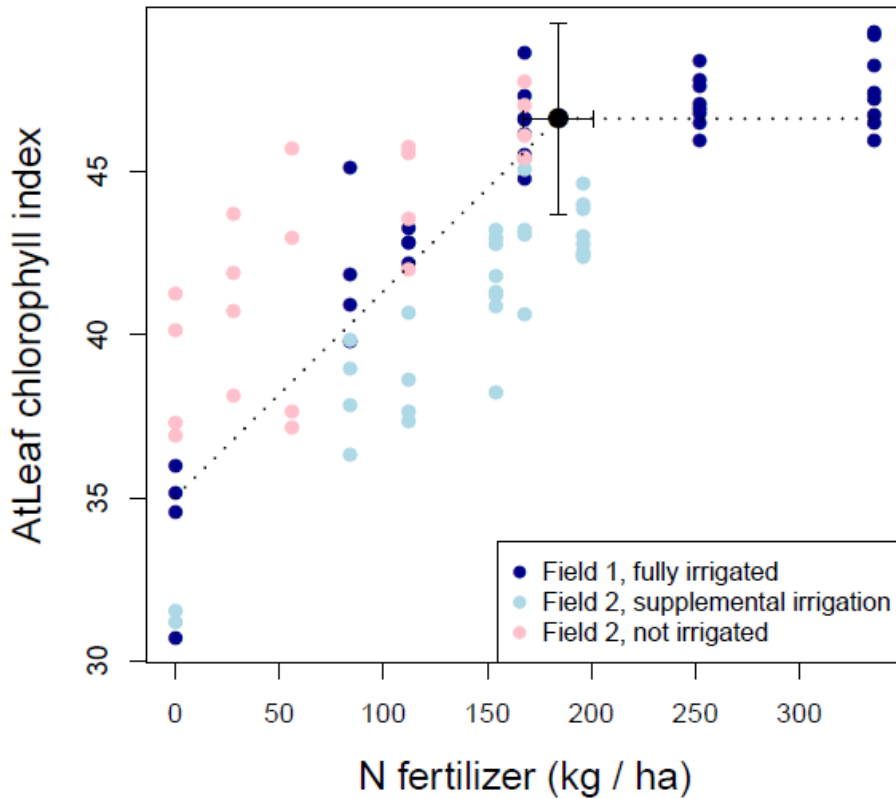
Field 1	Soil: Entisol, preplant NO ₃ -N = 1 ppm, 0 - 60 cm
Field 2	Soil: Alfisol, preplant NO ₃ -N = 10 ppm, 0 - 60 cm

Gradients (HIGH to LOW):

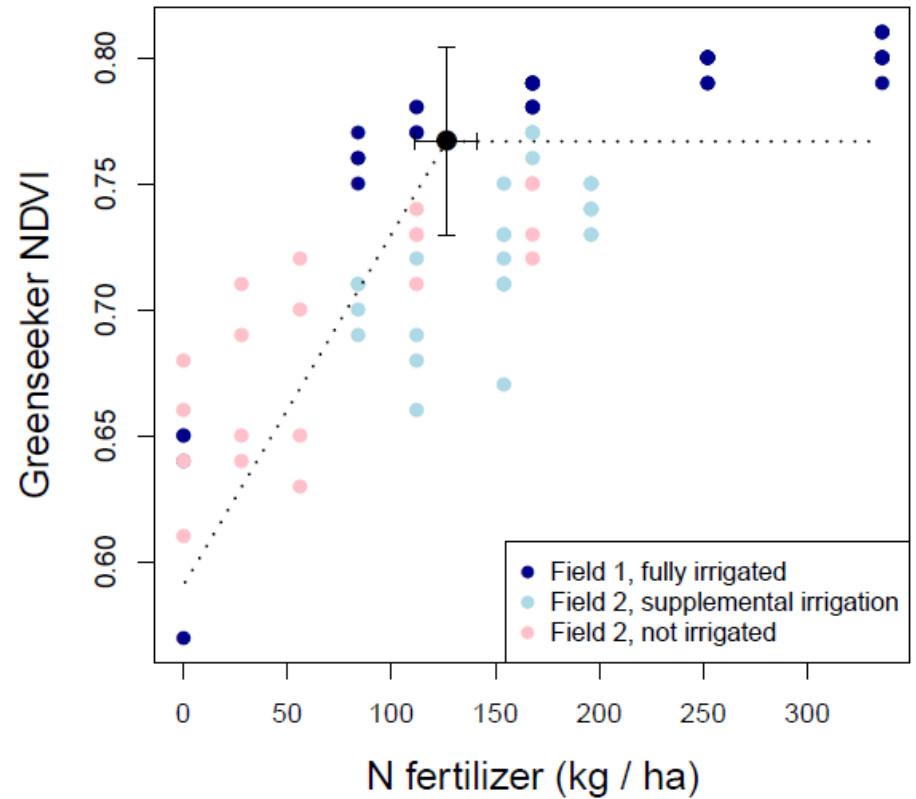
- Nitrogen availability
- Water availability

Results: Calibration

Flowering reading and N applied

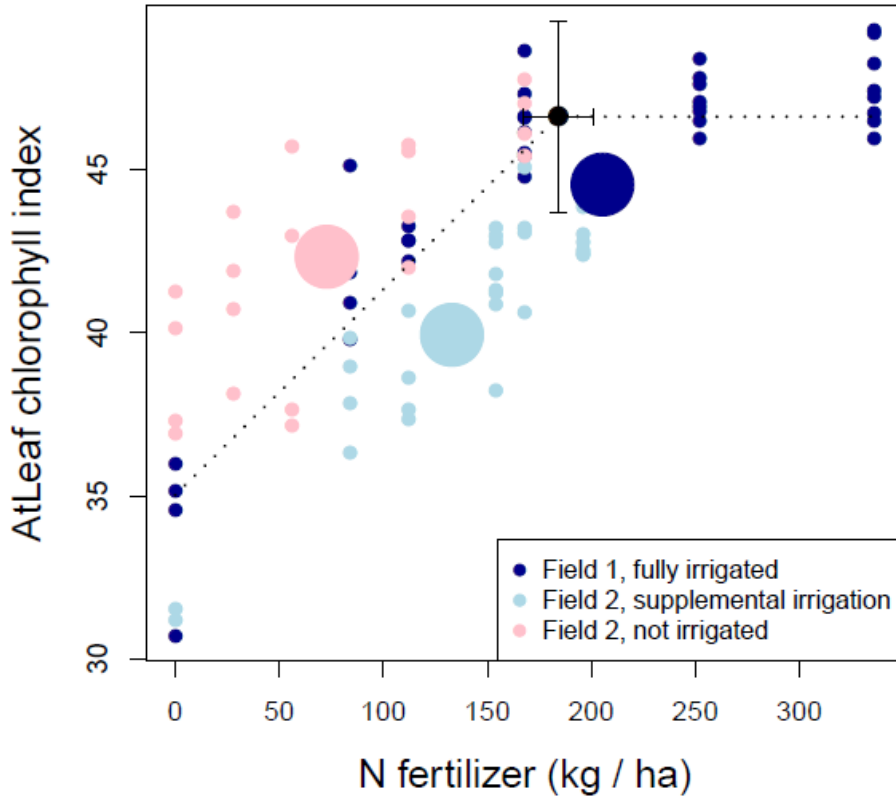


Flowering reading and N applied

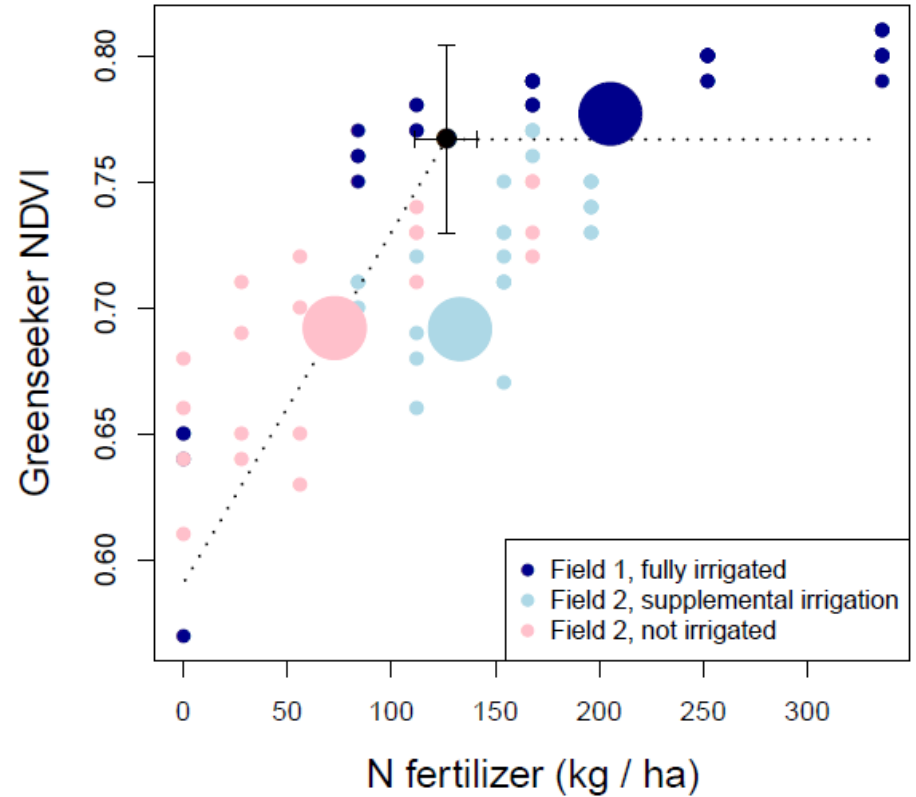


Results: Calibration

Flowering reading and N applied

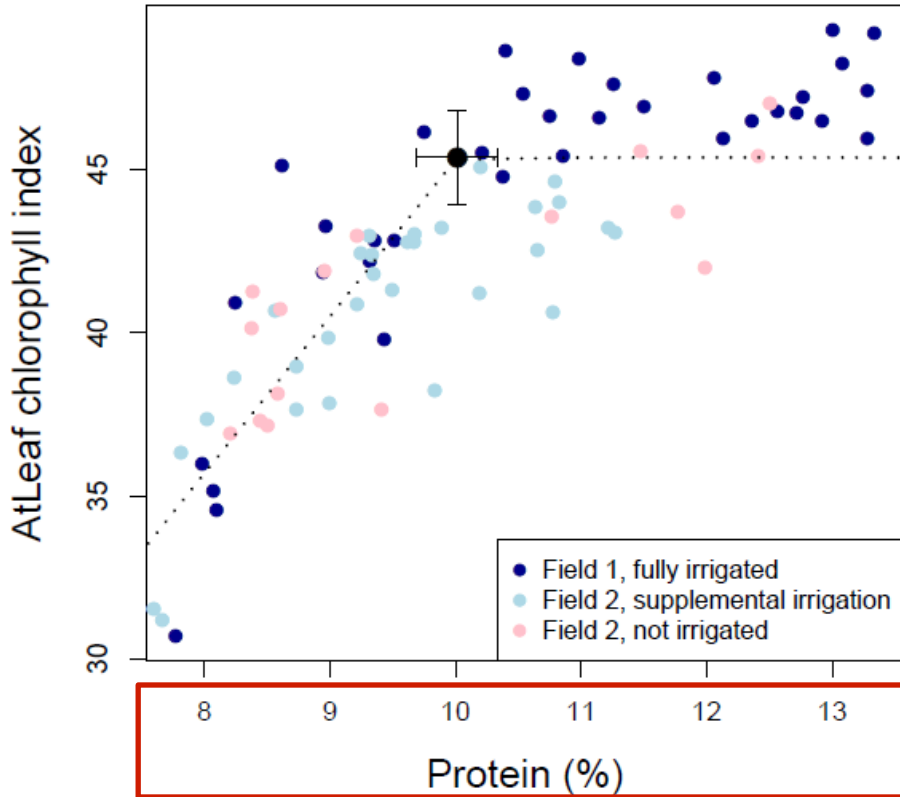


Flowering reading and N applied

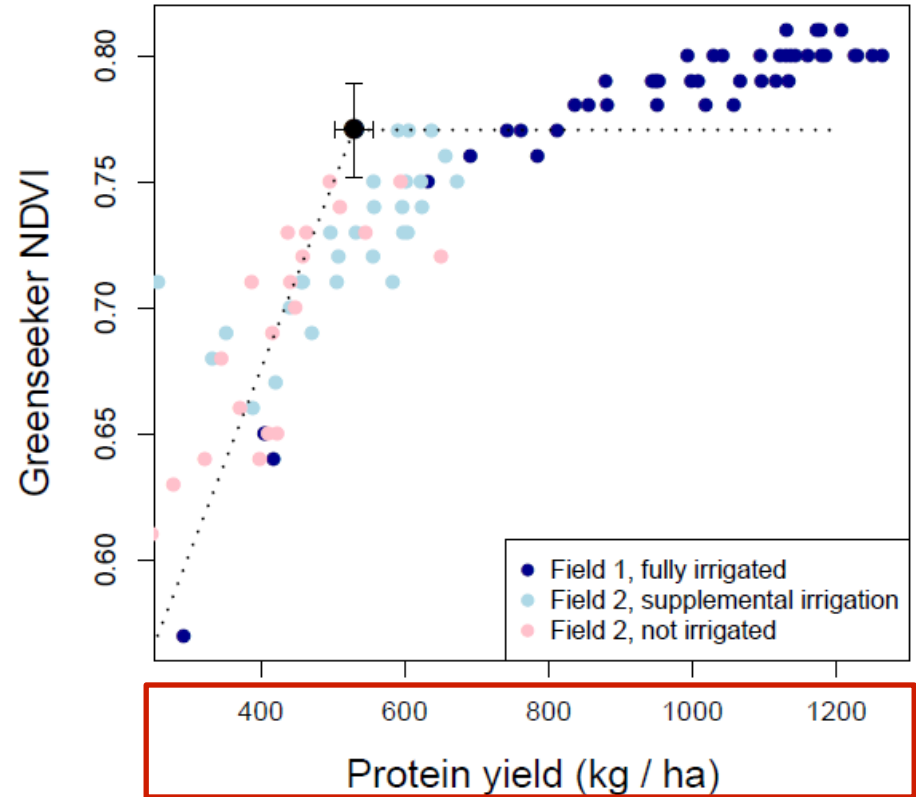


Results: Calibration

Flowering reading and protein outcome

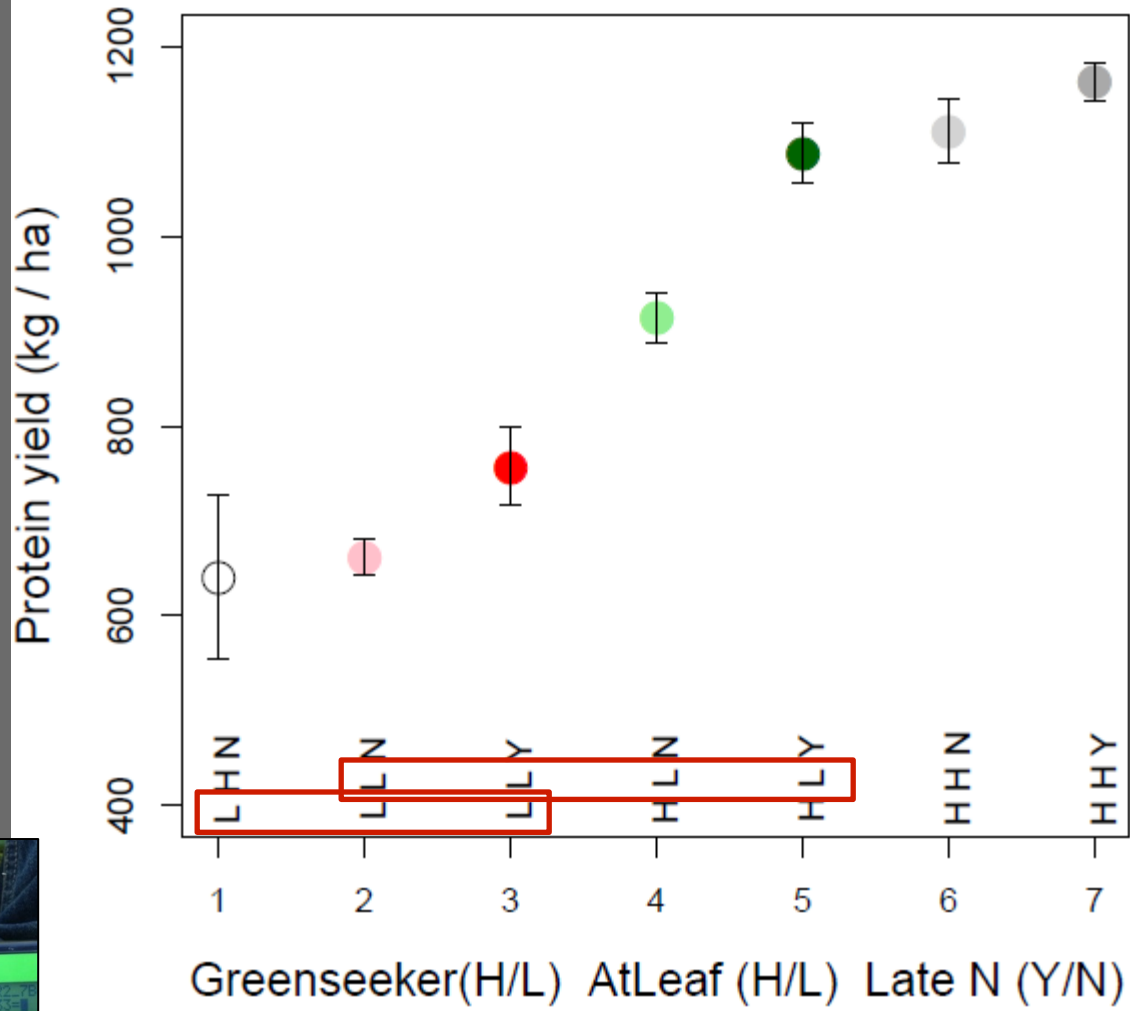


Flowering reading and protein outcome

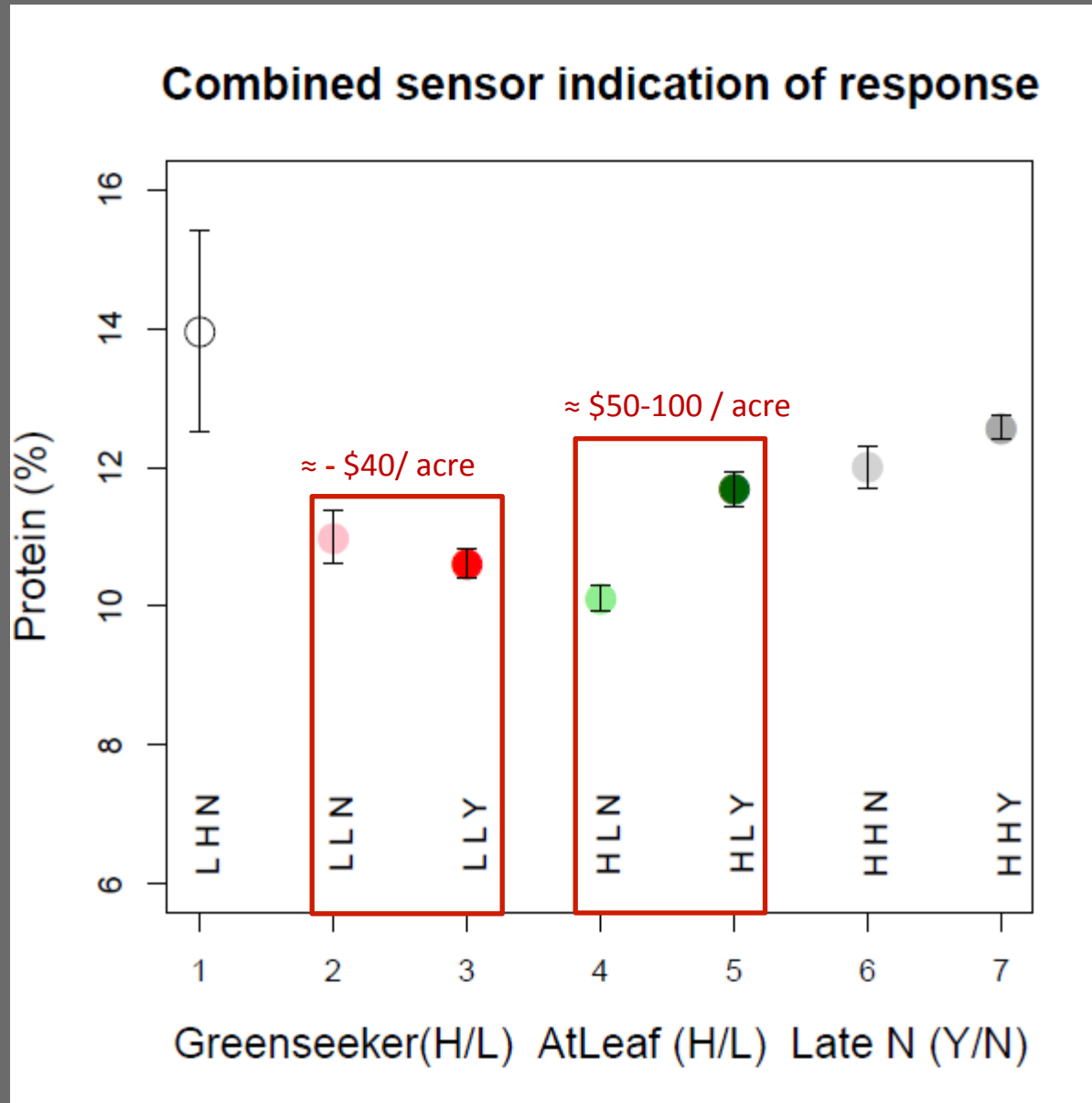


Results: Decision support

Combined sensor indication of response



Results: Decision support



Summary

1. The use of in-field sensors provided actionable, real-time information as to the protein and protein-yield outcomes of the crop.
2. Combining information from more than one sensor resulted in additive information that improved the in-season ability to predict outcome.
3. More work is needed to validate these results and explore whether other in-field measures can add valuable information.

DYI calibration?



Image courtesy: Oklahoma State University

Acknowledgments



- Jason Tschlis
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Thank you!

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