

Use of in-season response and active sensors for improved nutrient management.

BRIAN ARNALL

PRECISION NUTRIENT MANAGEMENT EXTENSION

OKLAHOMA STATE UNIVERSITY



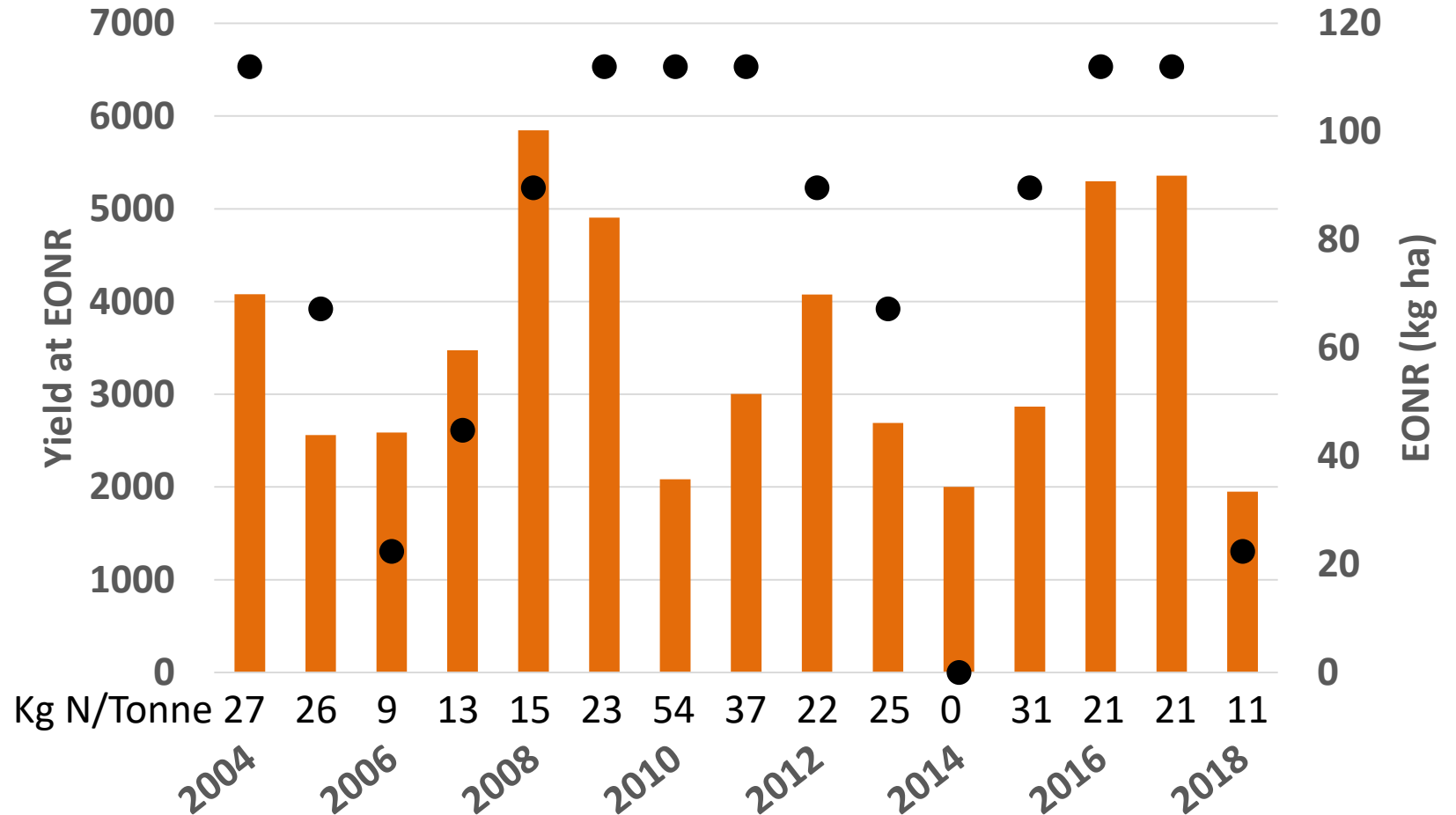
Optimizing Nitrogen Use Efficiency

Oklahoma dominated
by dryland winter
wheat production

Yields of 2-7 ton/ha

Tradition is
30 kg/tonne

22 kg/tonne Ave.



Stanford Equation

$$N_{\text{fert}} = (N_{\text{crop}} - N_{\text{soil}}) / e_{\text{fert}}$$

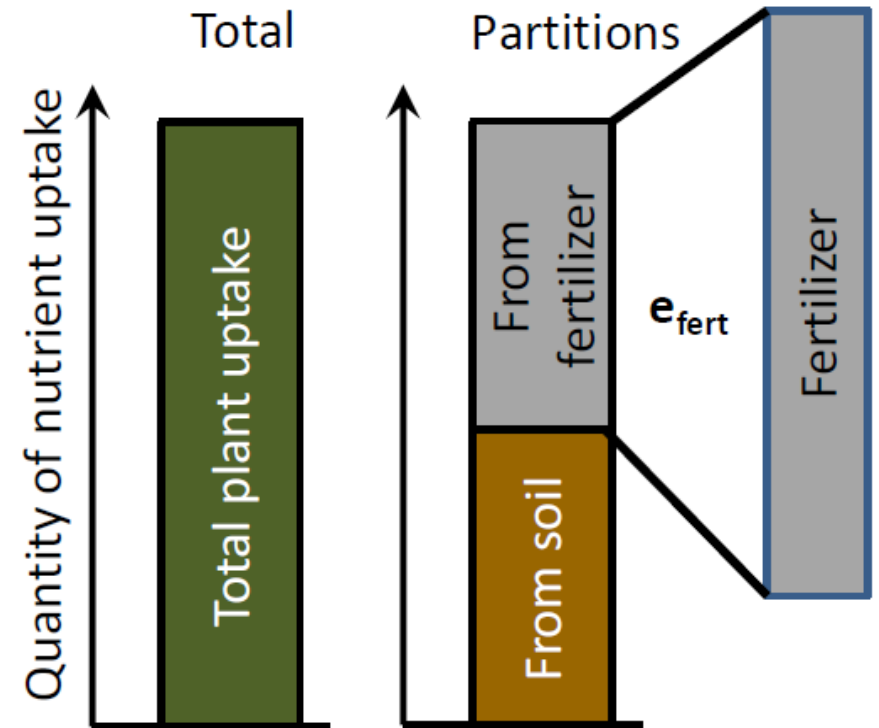
Douglas Beegle, Penn State University

Scott Murrell, International Plant Nutrition Institute

ASA Symposium

Agronomic Production Systems and Adaptive Nutrient Management Community

Strengths and Limitations of Methods, Tests, and Models for Making N Recommendations for Corn and a Framework for Improving N Recommendations



Yield is highly variable

Long term trials show annual variability in yield.

$$N_{\text{fert}} = (N_{\text{crop}} - N_{\text{soil}}) / e_{\text{fert}}$$

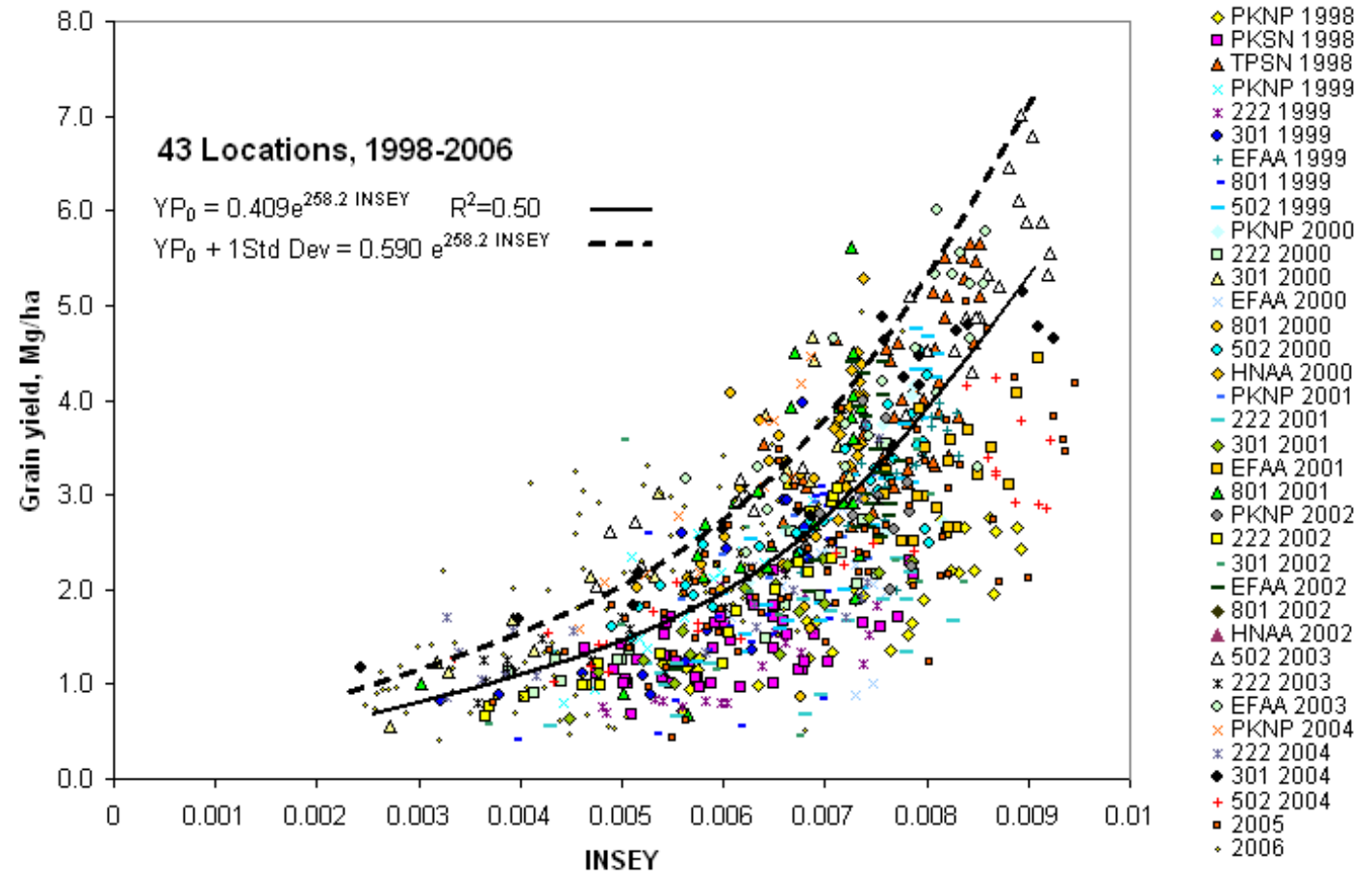
↑

Data base of yield x NDVI

Normalized by weather data.
Day's of Growth post planting.

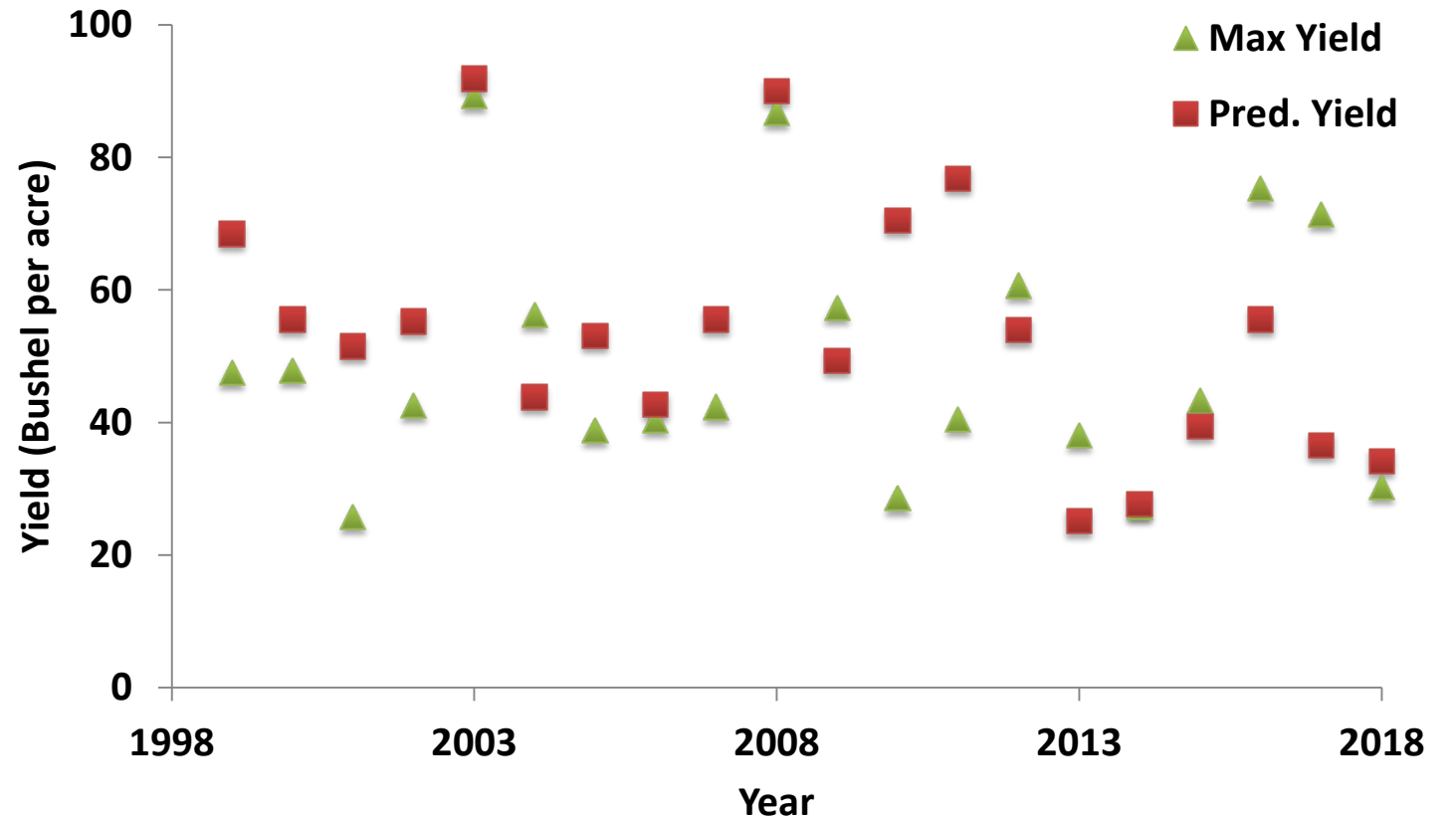
INSEY – In season Estimate of Yield

Yield Potential no Yield Prediction.

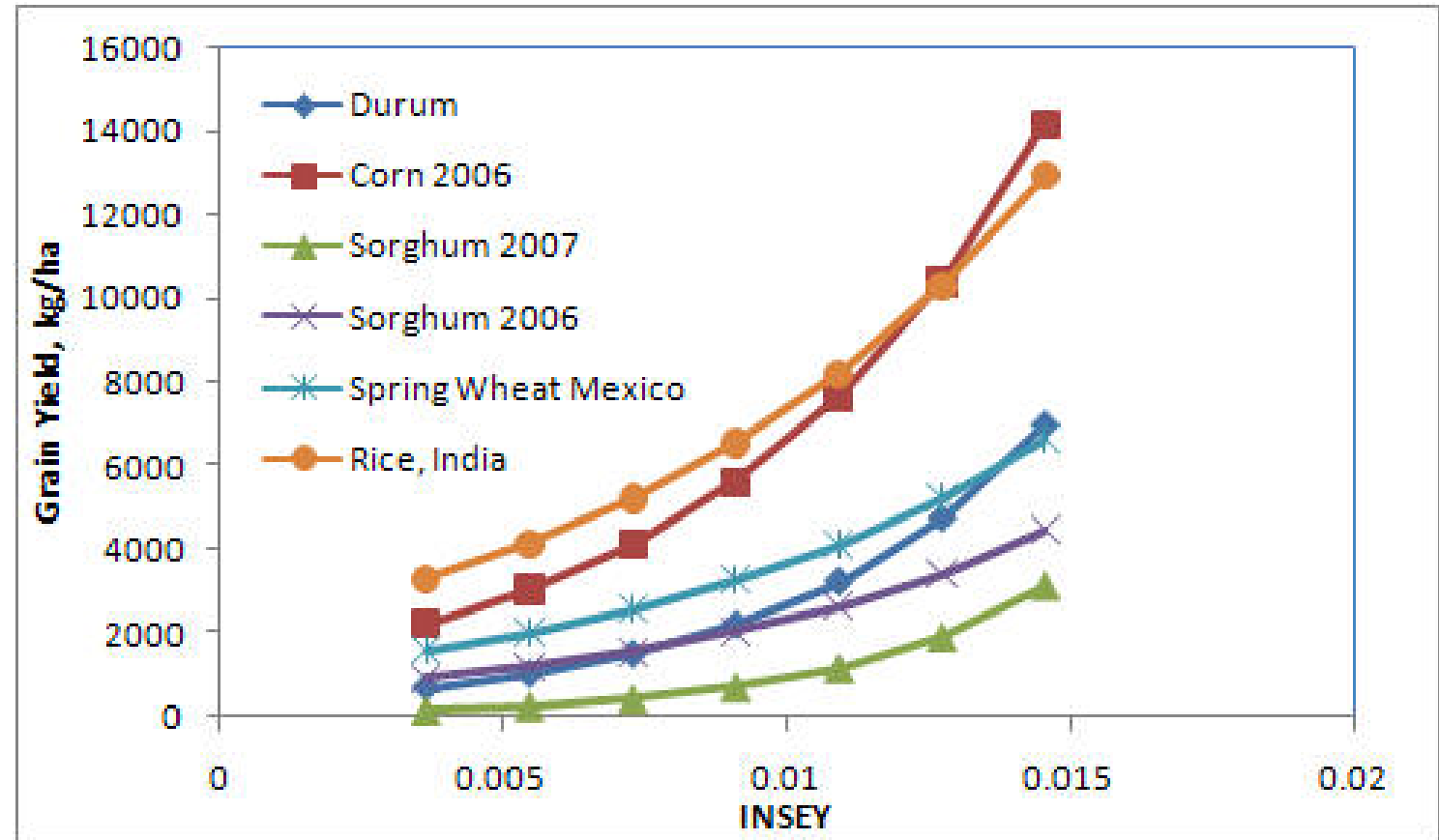


Predicting yield Potential at Feekes 5

Have done a far job of predicting potential yield in-season. Over prediction is typically preferred. This data uses a single point in time, farmers are not.



Yield Prediction Models



$$N_{\text{fert}} = (N_{\text{crop}} - N_{\text{soil}}) / e_{\text{fert}}$$

N_{soil}

Pre-plant NO_3 occurs 5 months prior to Top-dress

In-Season NO_3 time consuming and slow.

Why not let the crop tell you.

Response Index

Difference between high and low N

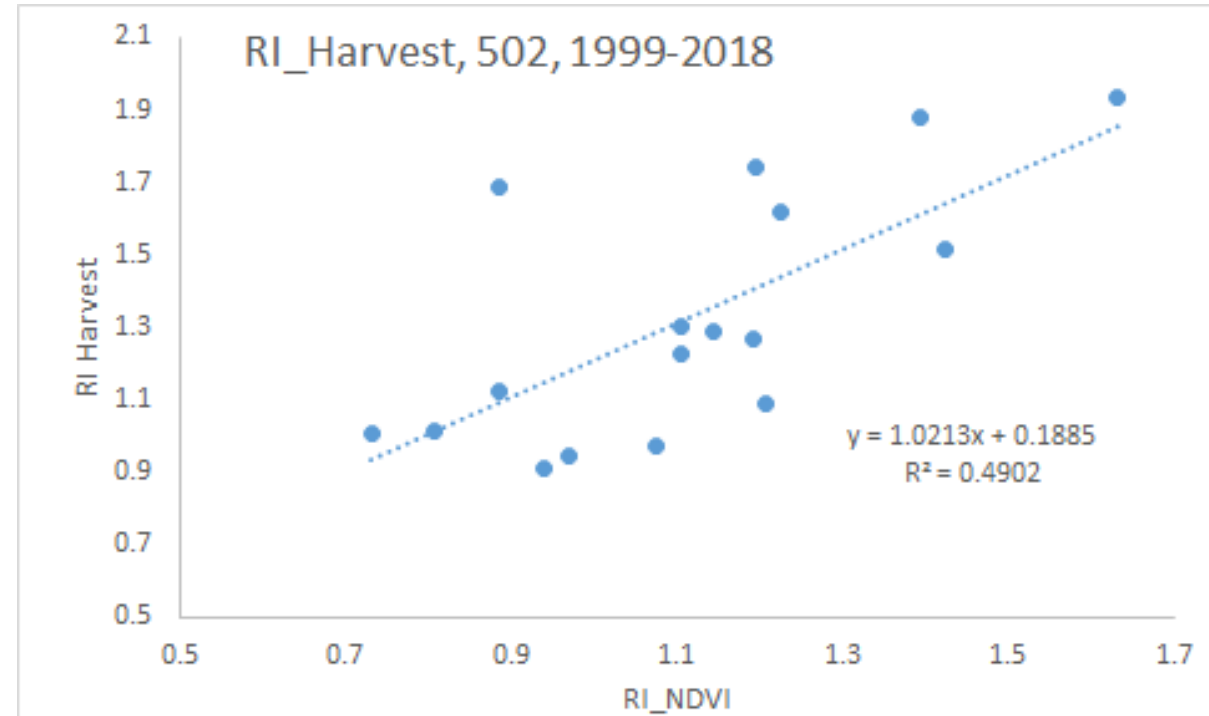


N-Rich Applicators



RI_{NDVI} and $RI_{HARVEST}$

When measured at Feekes 6
response increases until harvest



NFOA

Nitrogen Fertilization Optimization Algorithm

$$\text{N Rate} = \{(\text{YPO} * \text{RI}) - \text{YPO}\} * \%N / \text{NUE}$$

YPO = Yield potential without N

YPO*RI = YPN = Yield potential with N

%N = N concentration in grain/fiber

[Journal of Plant Nutrition](#) >

Volume 24, 2001 - Issue 6

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Views CrossRef citations to date Altmetric

Original Articles

NITROGEN FERTILIZATION OPTIMIZATION ALGORITHM BASED ON IN-SEASON ESTIMATES OF YIELD AND PLANT NITROGEN UPTAKE

E. V. Lukina, K. W. Freeman, K. J. Wynn, W. E. Thomason, R. W. Mullen, M. L. Stone, ...[show all](#)
Pages 885-898 | Published online: 14 Feb 2007

NUE.Okstate.edu

33 available Algorithms

Available at http://nue.okstate.edu/Yield_Potential.htm

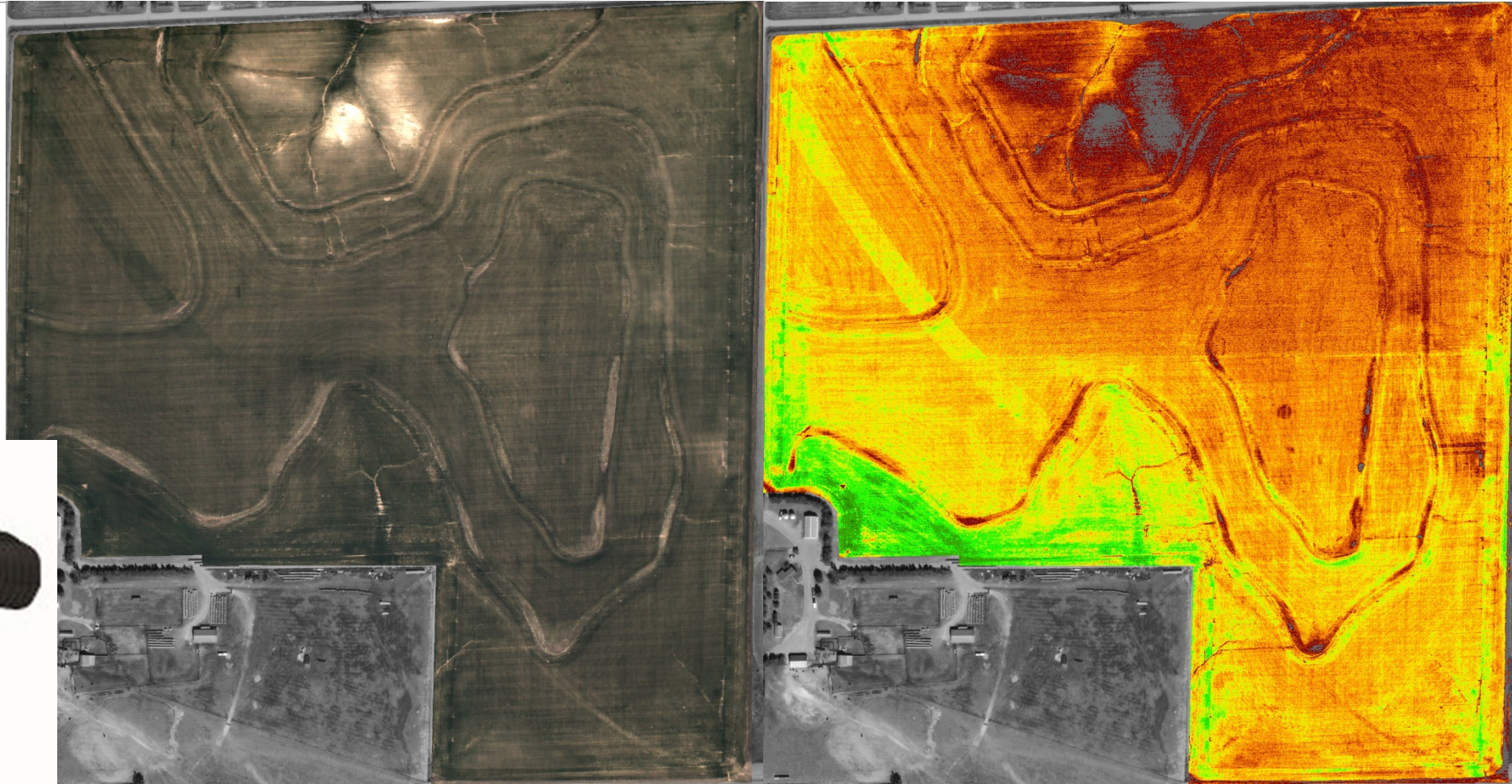
YP and NFOA “Cookbook”

http://nue.okstate.edu/Index_NFOA.htm

1. Winter Wheat, Oklahoma + US Grain Belt
2. Winter Wheat, South Central Great Plains
3. Spring Wheat-Rainfed (US, Canada, Mexico)
4. Winter Wheat Protein Optimizer
5. Spring Wheat-E.Australia R.Heath
6. Spring Wheat-India
7. Trigo Bajo-Riego (Mexico)
8. Trigo Baja California UABC-CIMMYT-Mexico
9. Trigo-Región Pampeana Central y Norte (Argentina)
10. Maiz (Bolivia)
11. Winter Wheat (China)
12. Corn-Rainfed/Irrigated (Southern US Grain Belt)
13. Maíz sin Riego (Argentina)
14. Maíz bajo Riego (Argentina)
15. Maíz bajo Riego-Siembra de Segunda (Argentina)
16. Milho no Centro-Sul do Brasil (Brazil)
17. Canola (Canada)
18. Spring Wheat (Canada)
19. Bermudagrass-Forage
20. Wheat-Forage-Pasture
21. Sorghum-Great Plains
22. Sorghum-Kansas
23. Rice-India
24. Corn-Minnesota
25. Corn-Ohio
26. Cotton North Central
27. Cotton South West Irrigated
28. Corn-Zimbabwe
29. Rice-Dominion Farms Kenya
30. Generalized Algorithm
31. Winter Wheat - Phone
32. Spring Wheat-S.Australia D. Cox
33. Maíz sin Riego Zona Cafetera (Colombia)

rogen
or
ertilizer N

Estimated use in 2019 1 million acres.



Any Scale

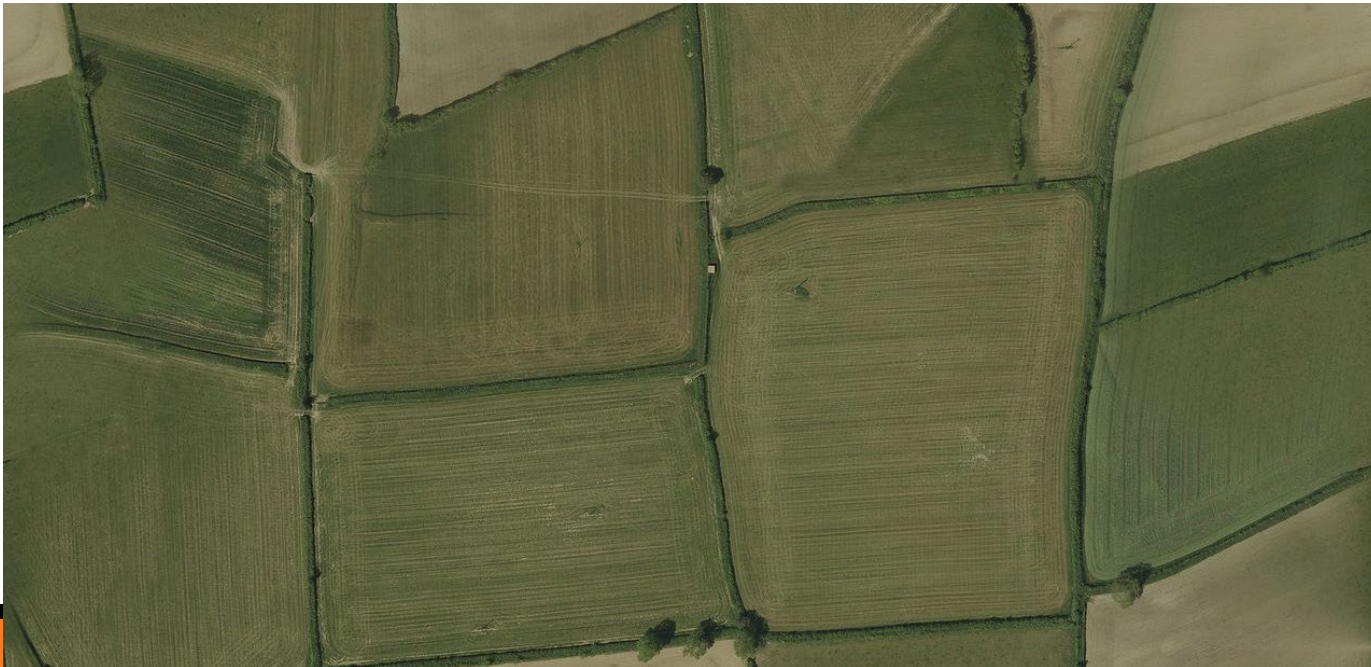


Long Term Goal

Be Truly Site Specific for all nutrients

Over extended period but near neutral for Mobile Nutrients

Targets P and K recs to soils response to addition/removal



On Farm Testing

Recommendations are built for states or regions at best.

We have highly spatially specific data.

But very little spatially specific recs.

Yield monitor and spreader.



Potential is History

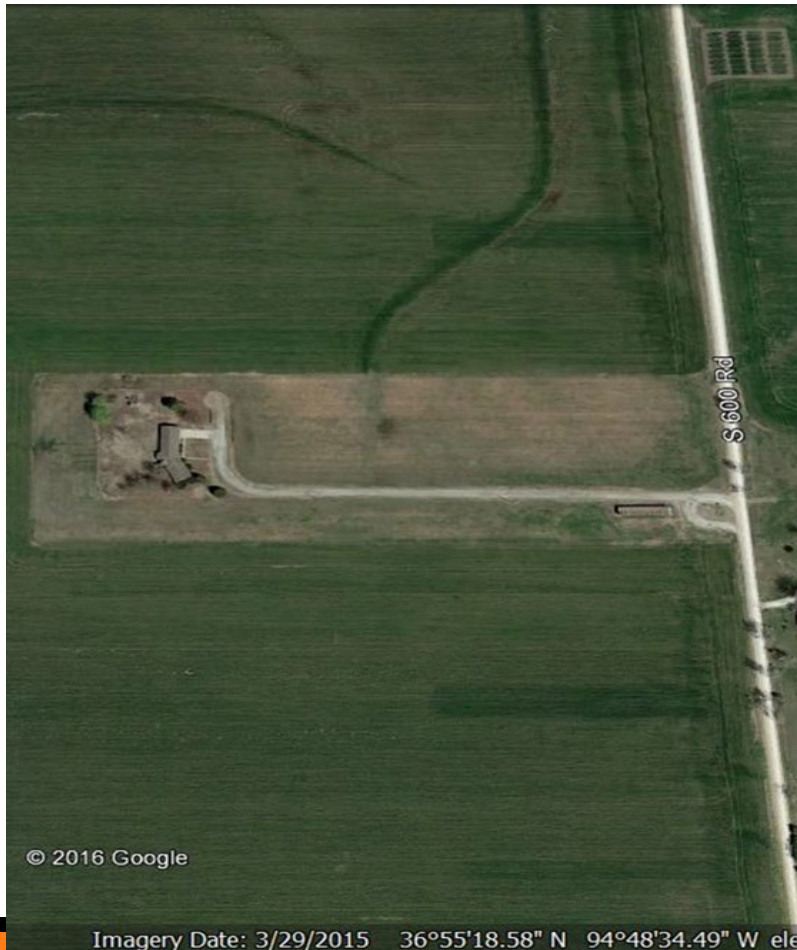
In 2001 we could fertilize ever .5 x .5 m
at 16 kmph



We have been able to fertilize every 2 ft of row since 2003



Thank you!



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www.AgLandLease.info

A website to bridge the gap between Landlords and Leases

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