




Wheat Program Update
Yield and Protein Determination

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Wheat and Forages Extension Specialist

Agronomy Agent Update
Northeast Area
Manhattan, KS
20 November 2017

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KSU Wheat

Current projects

- Environmental characterization for wheat production
- Historical wheat varieties comparison
- Variety by management interaction
- Intensive wheat management
- On-farm survey
- Nitrogen management for yield and protein
- Sulfur management for yield and protein
- Wheat demo-plots
- Sustainable Kansas Wheat (Field to Market)
- Late planted wheat following soybeans
- Seed treatment by seeding rate
- Variety response to planting density and N
- Dual-purpose wheat / first hollow stem
- Low quality seed
- Plant growth regulators
- Hail damage to wheat
- Probability of wheat yield gain due to drought traits
- Organic wheat – varieties and fertilization
- Fungicide management for head scab






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Environmental characterization for wheat

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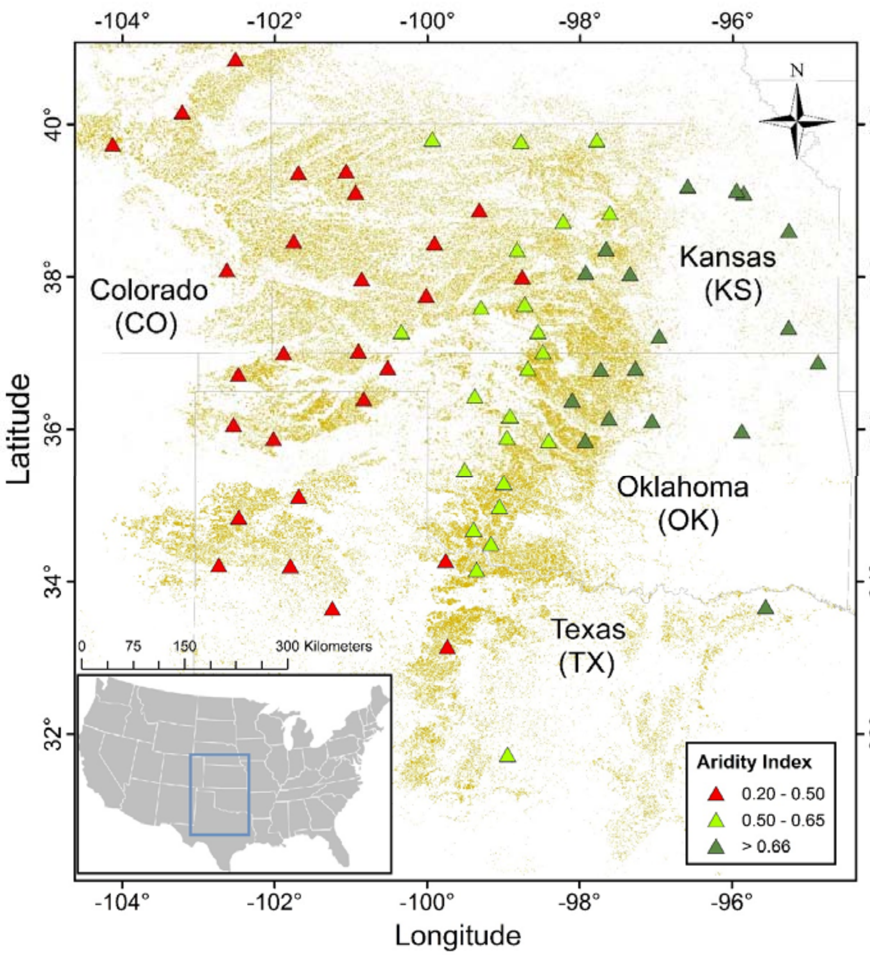
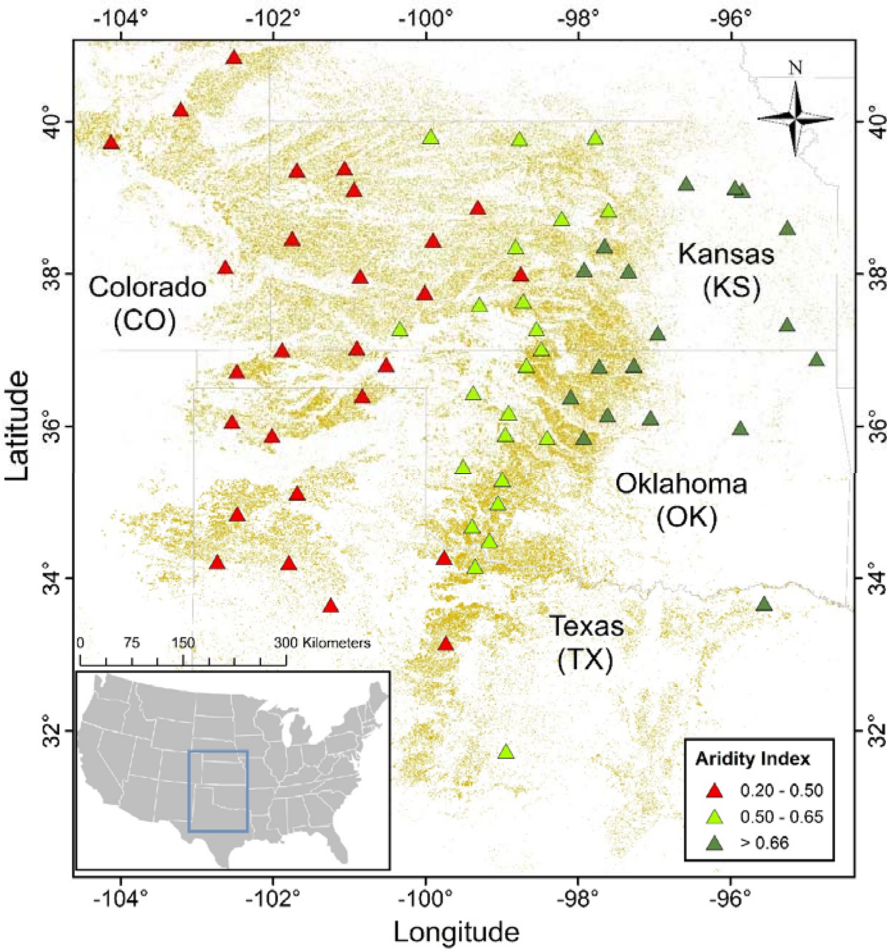
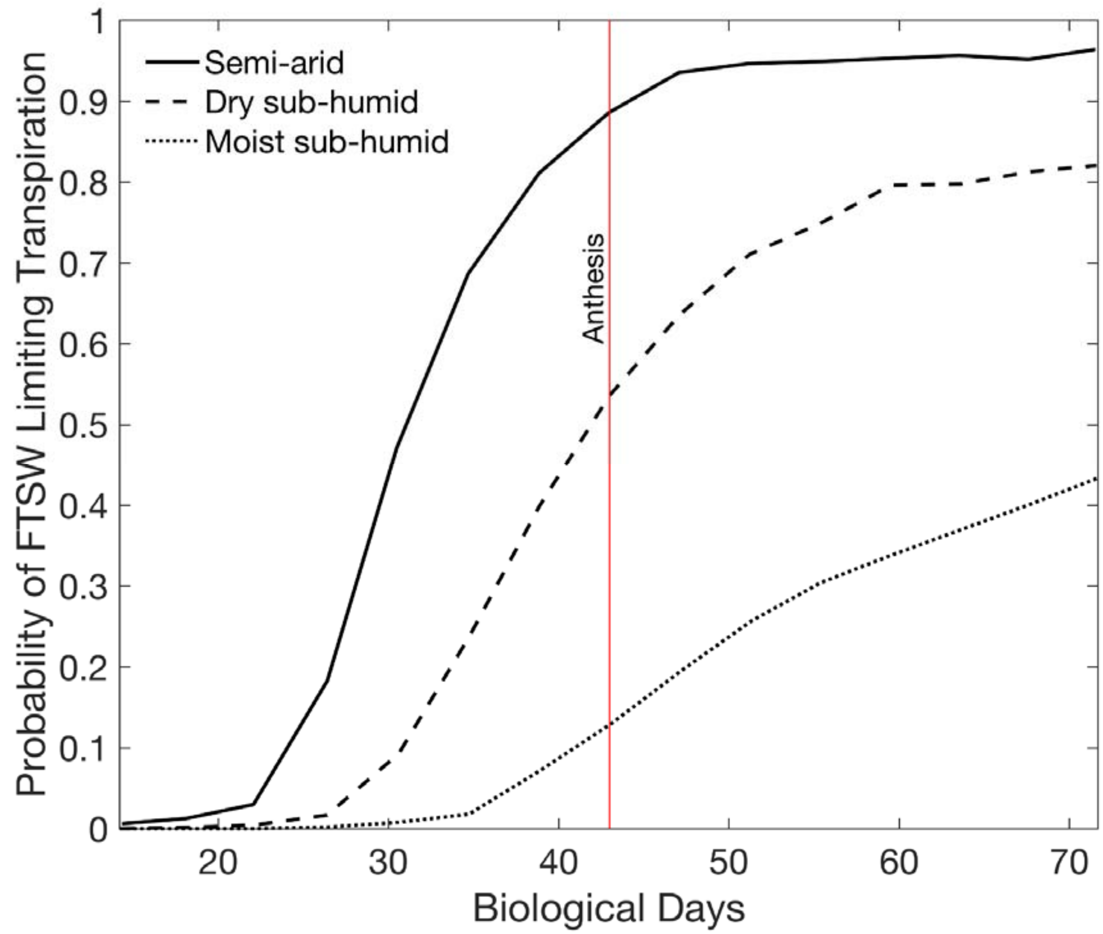


- 68 locations
- 1986 – 2016 daily weather data
- Simulation of wheat growth and development
  - Tmax
  - Tmin
  - Solar radiation
  - Precipitation
- Optimum sowing date and rate
- Predominant soil type

Environmental characterization for wheat



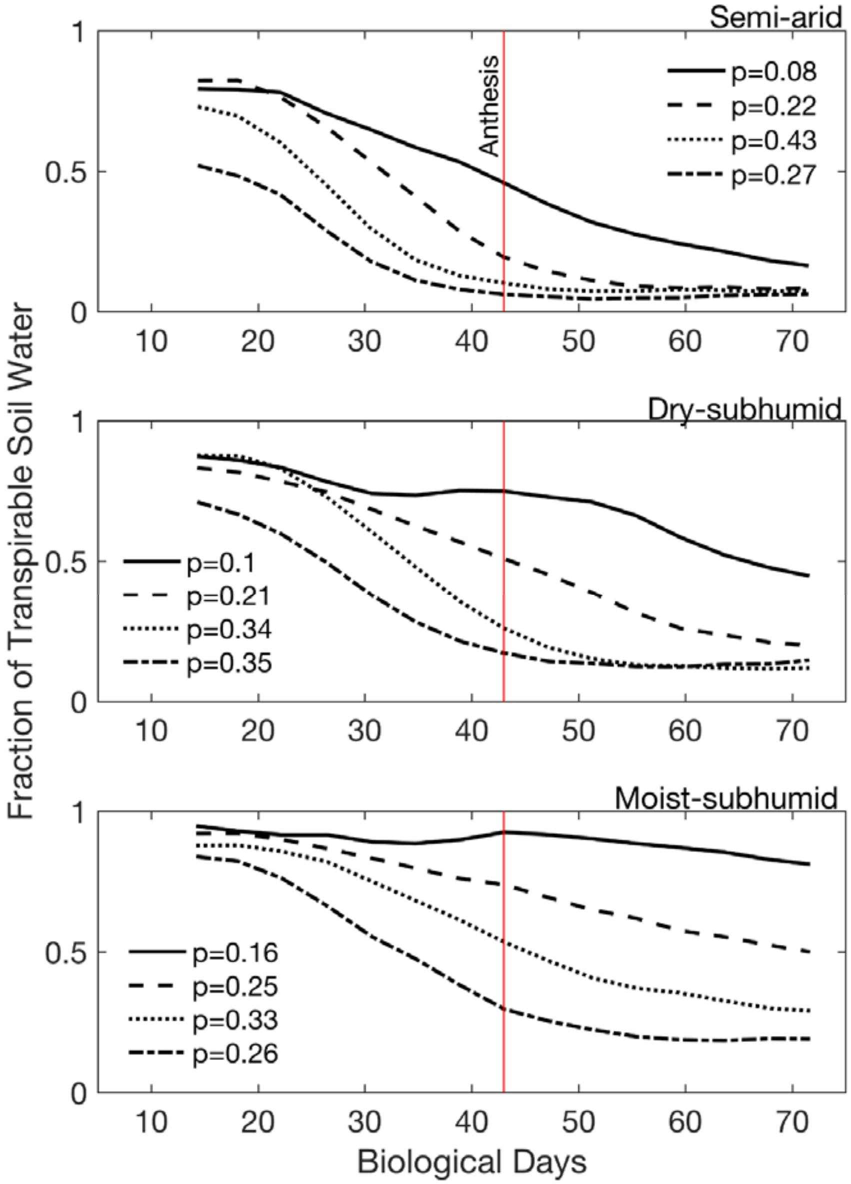


Available soil water dynamics

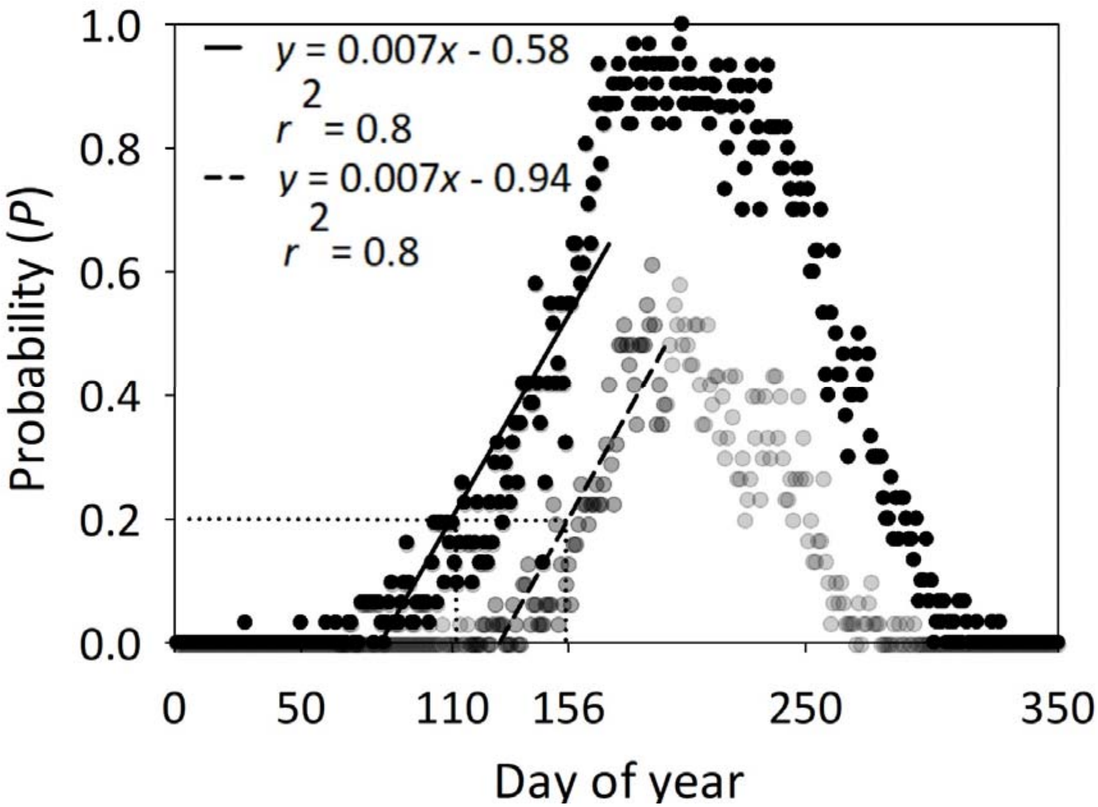
January – Maturity

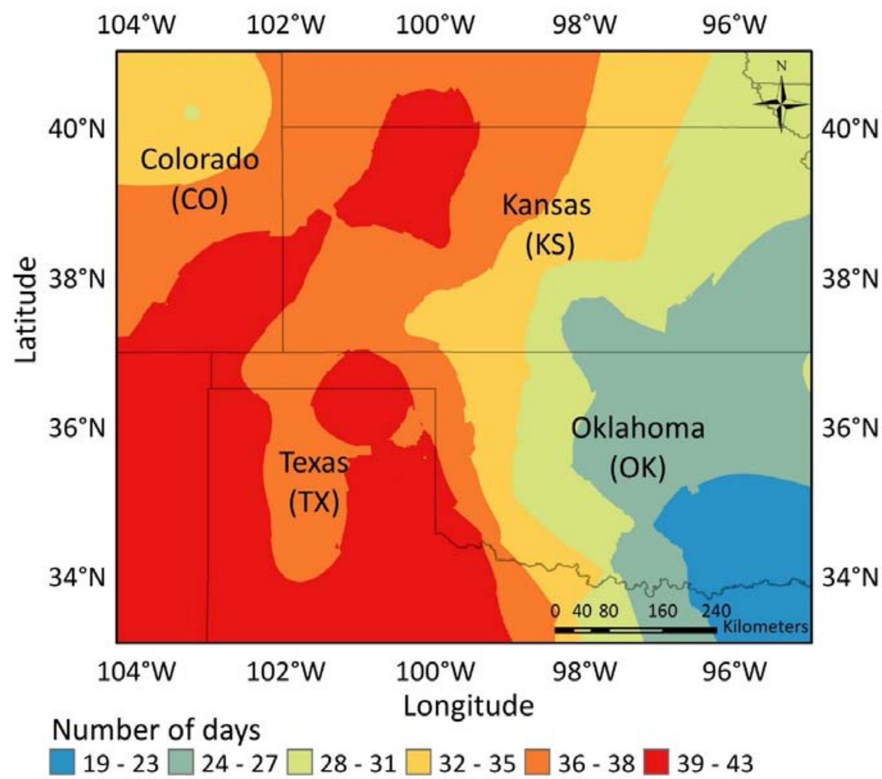
Water deficit after flowering

- Semi-arid: 92%
- Dry-subhumid: 69%
- Moist-subhumid: 59%



Probability of Tmax > 27°C flowering





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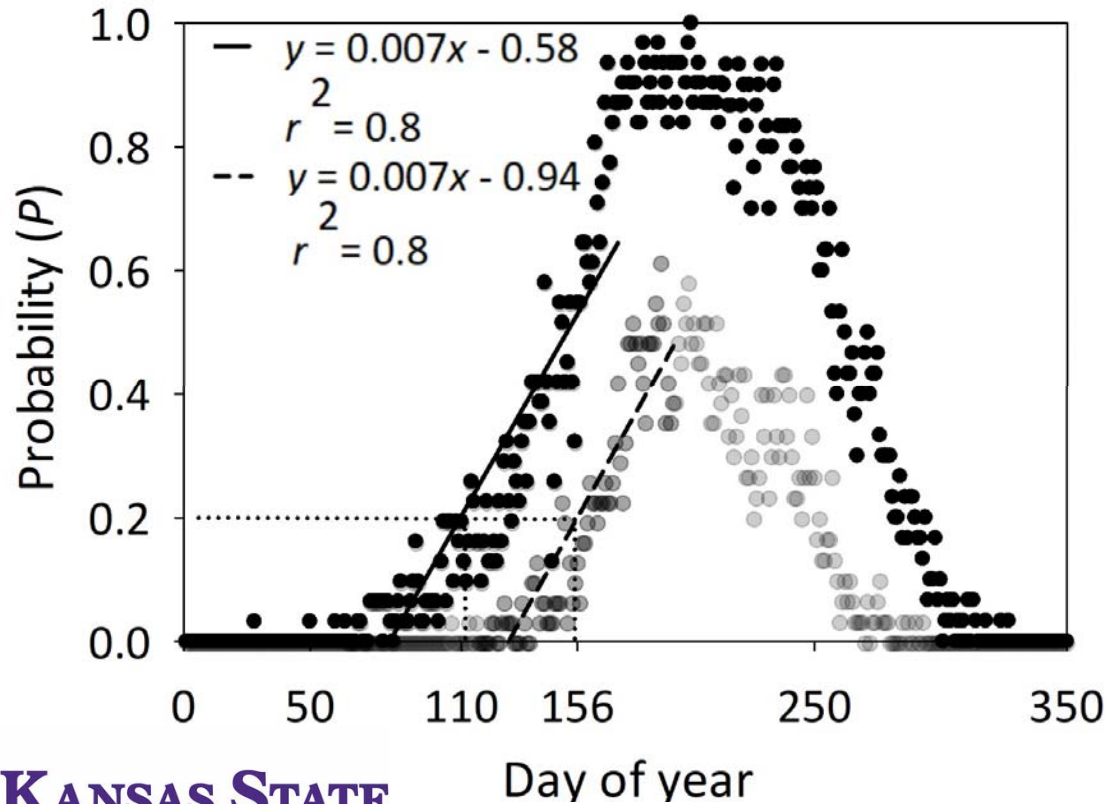
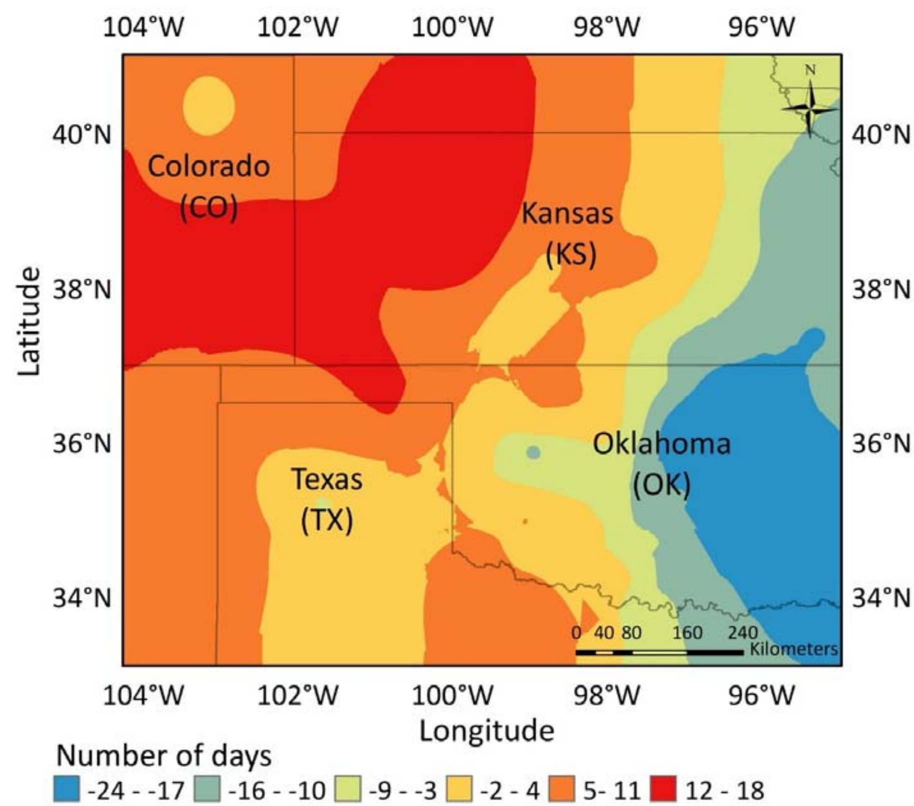
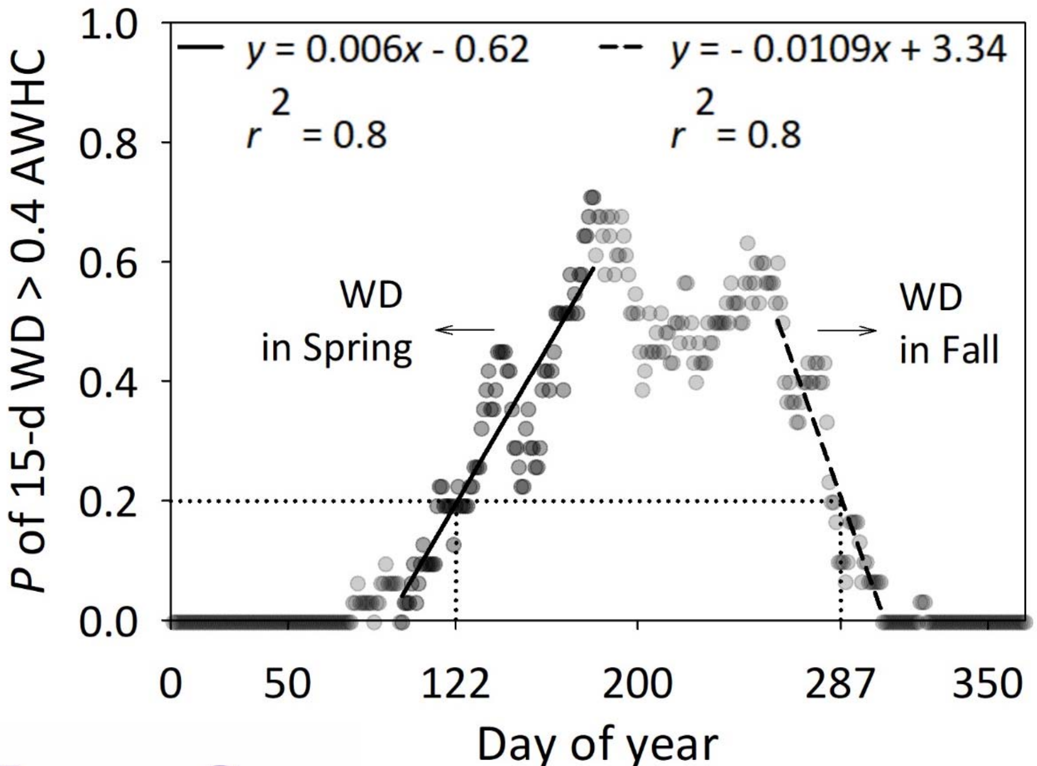
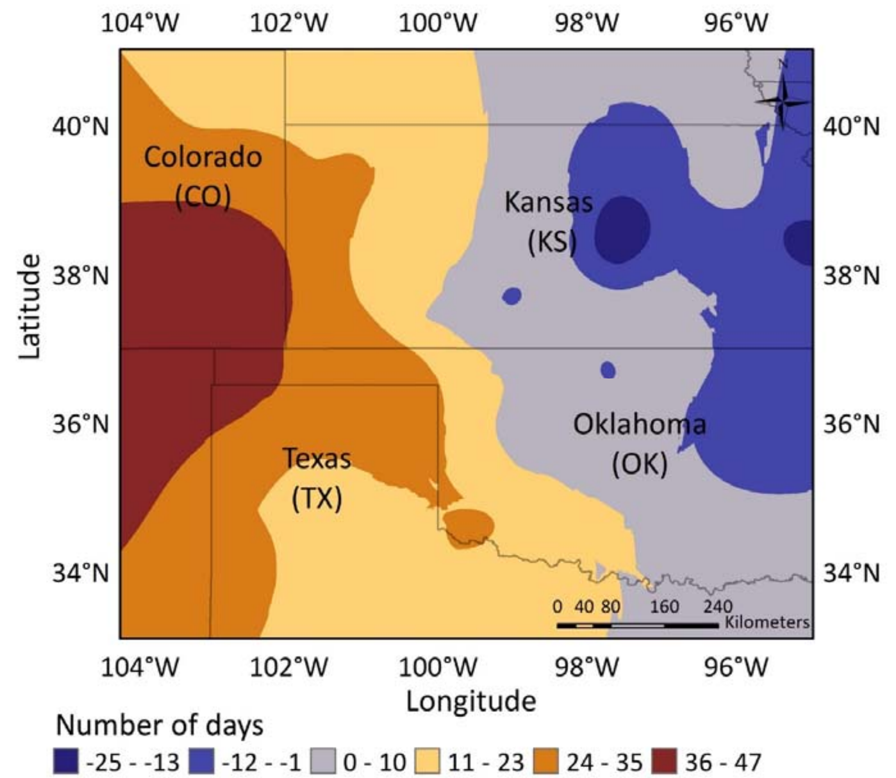
Probability of Tmax > 33°C grain fill





Probability of drought: fall





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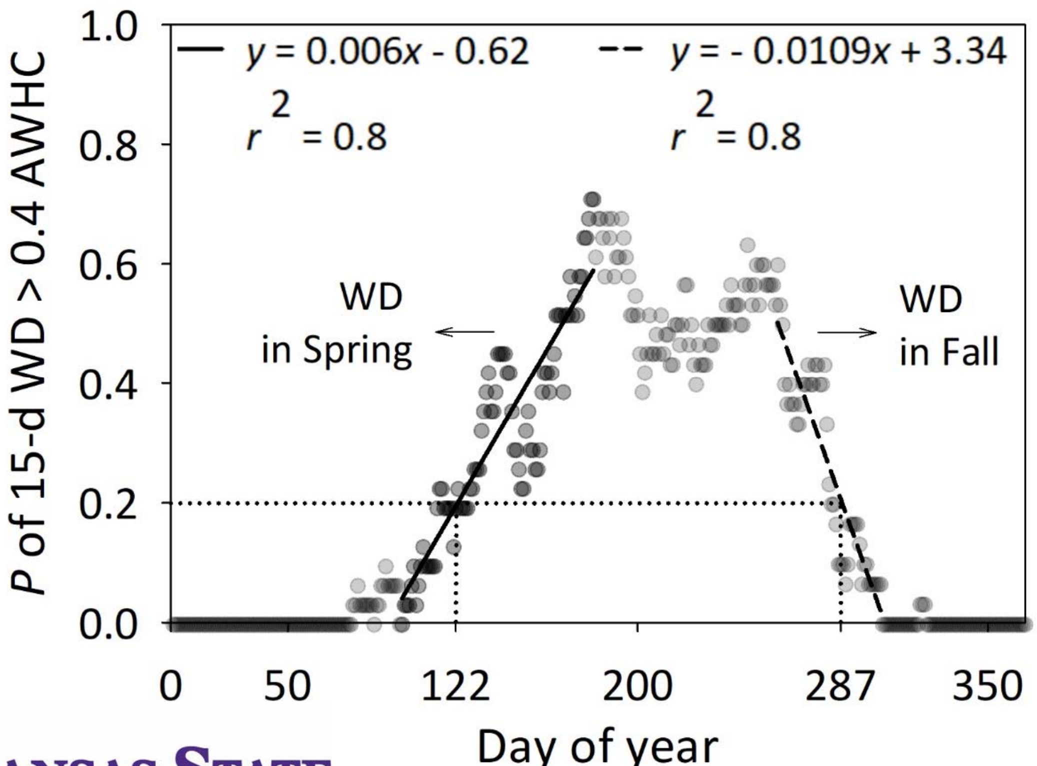
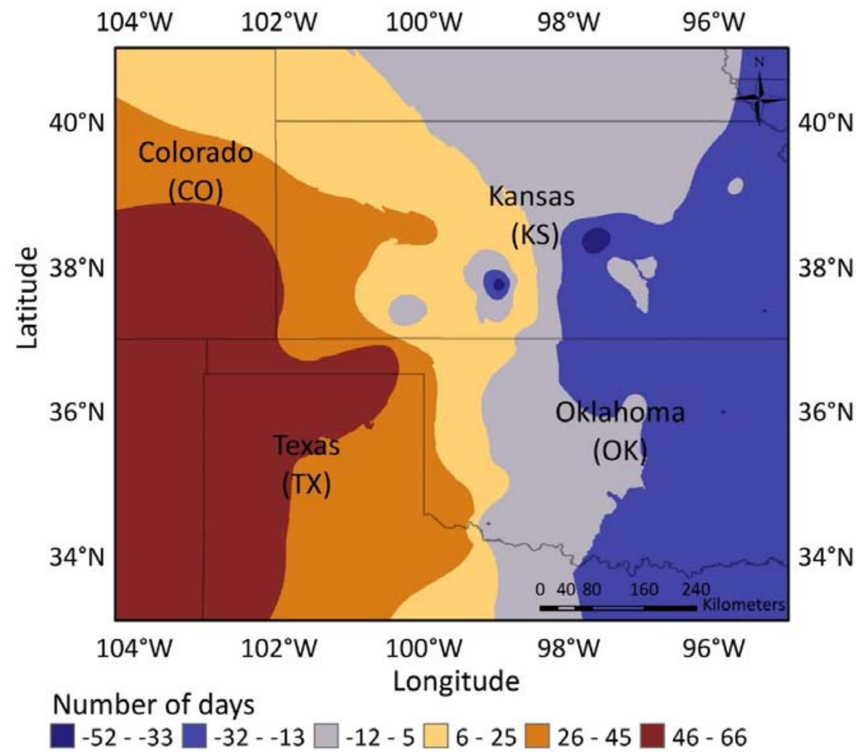
Probability of drought: spring





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Modern *versus* historical wheat varieties

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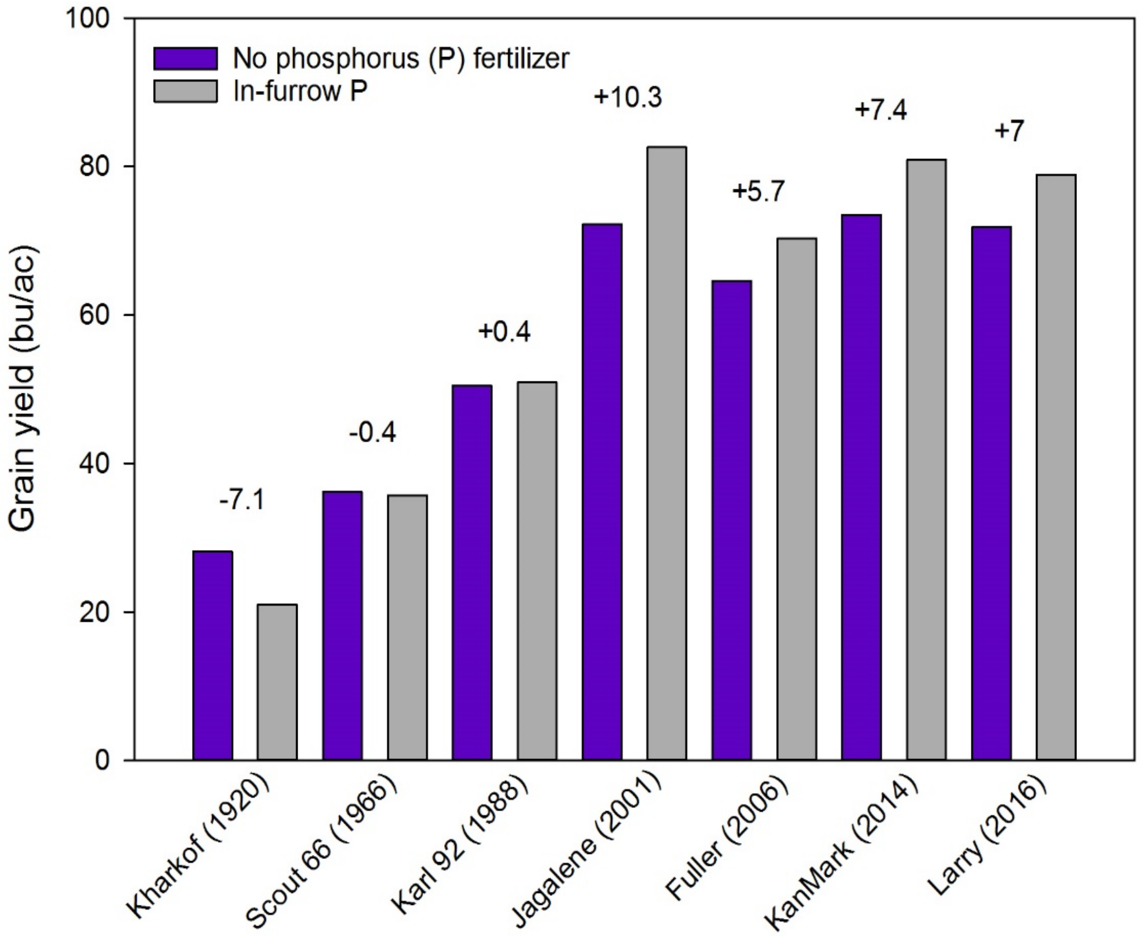
Seven wheat varieties:

- Kharkof (1920)
- Scout 66 (1966)
- Karl 92 (1988)
- Jagalene (2001)
- Fuller (2006)
- KanMark (2014)
- Larry (2016)

Two fertilizer practices:

- No in-furrow fertilizer
- 100 lbs/ac in-furrow 12-40-00-10-1 (MESZ)

Modern *versus* historical wheat varieties



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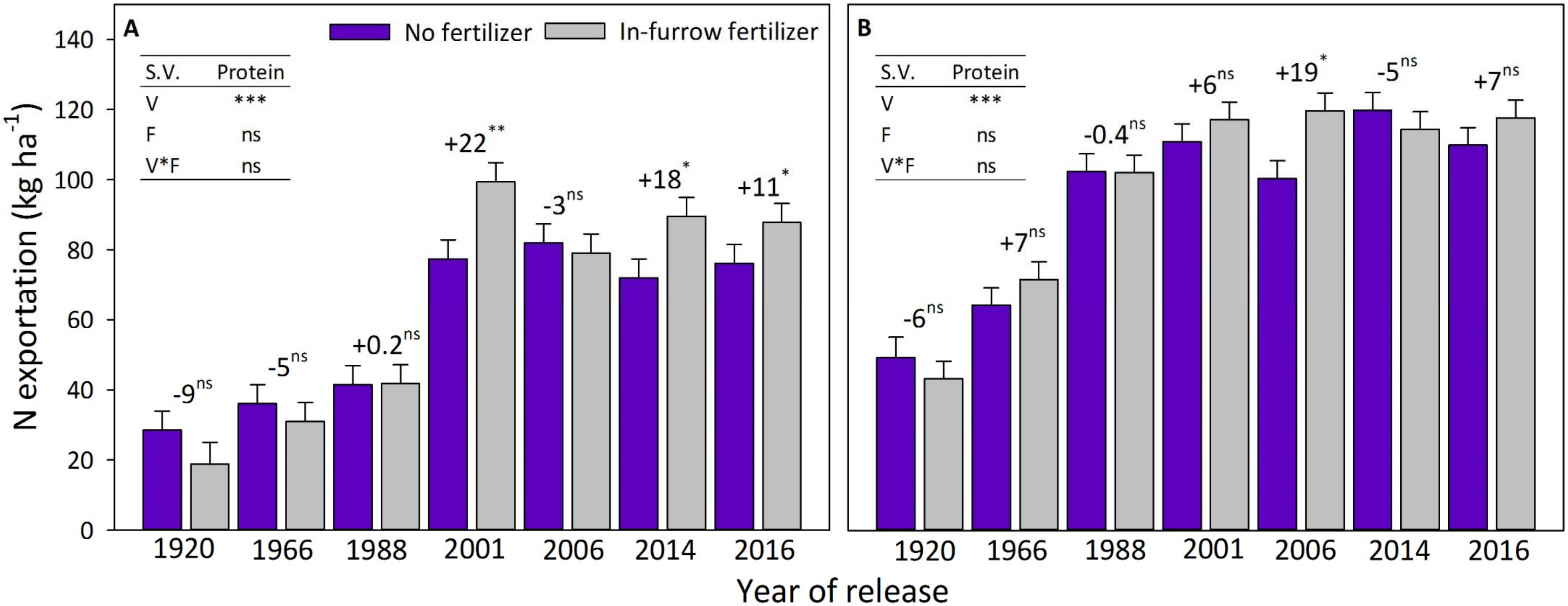

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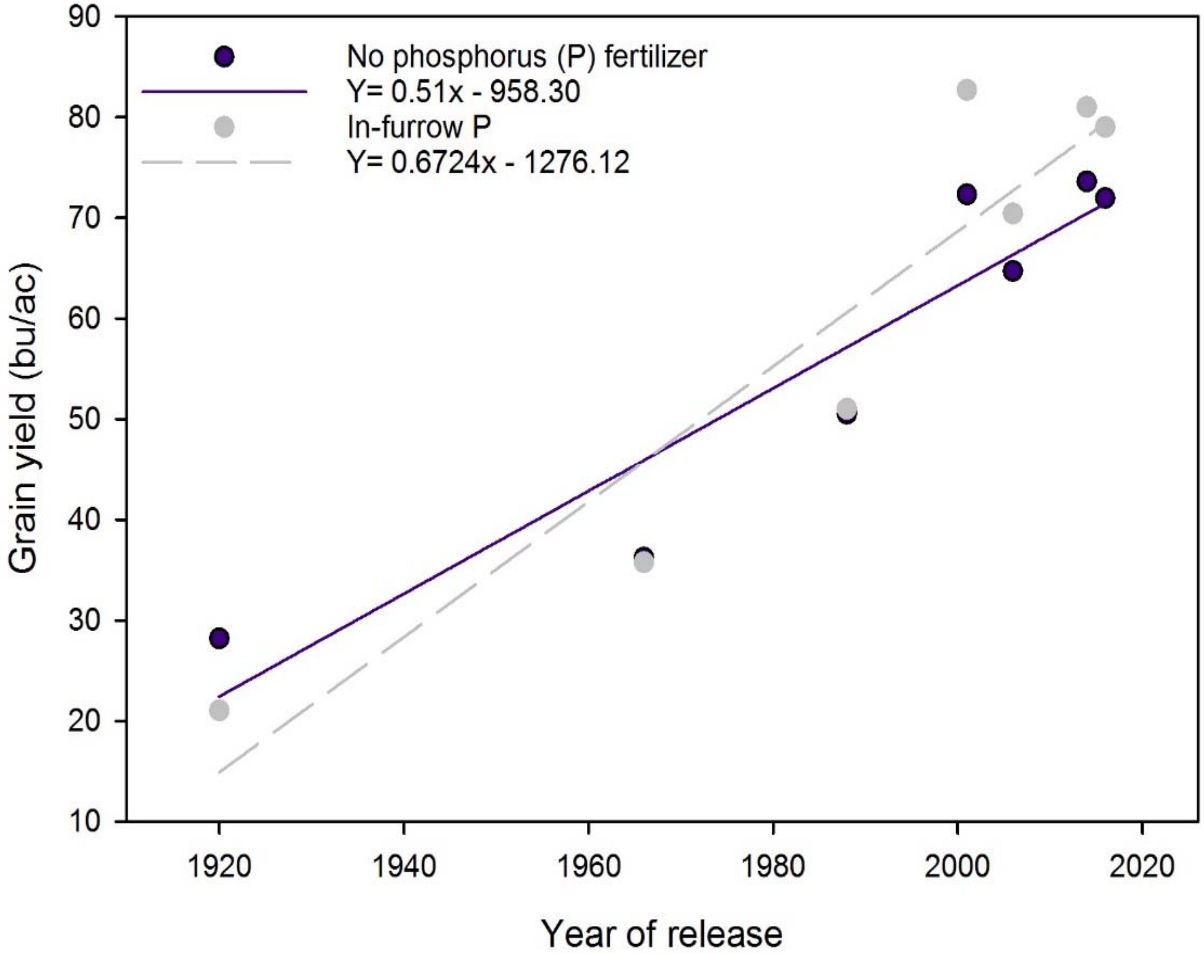
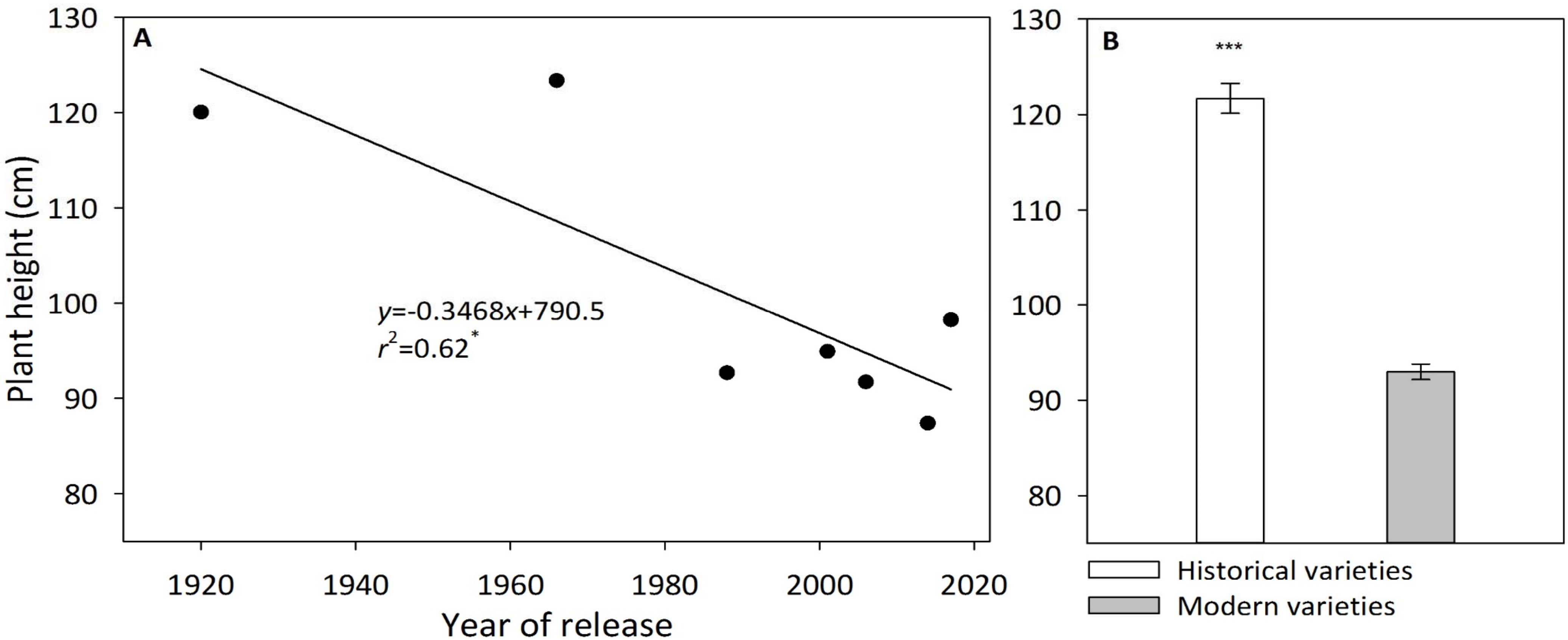
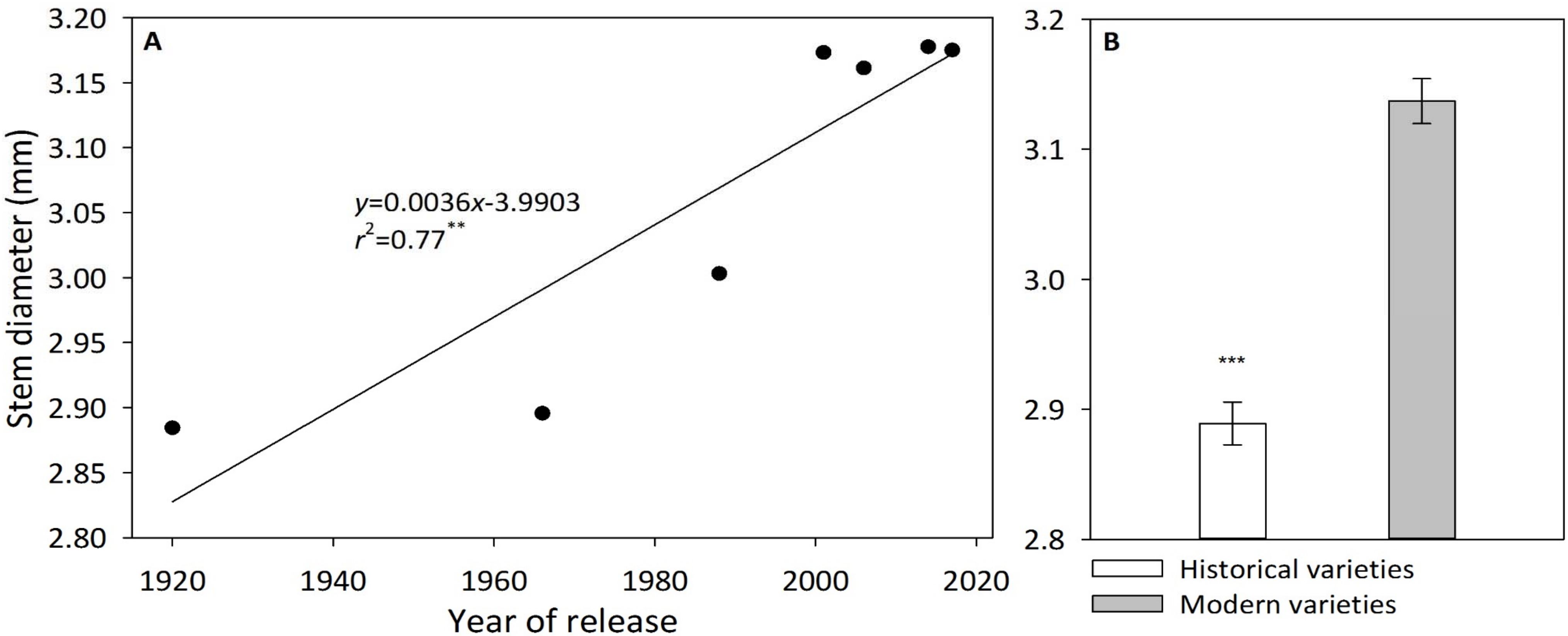


Modern *versus* historical wheat varieties



Modern *versus* historical wheat varieties



Variety-by-management

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26 to 50 varieties

3 to 4 replications

Standard
- Yield goal of 70 bu/A
- N fertilizer:
  - Soil NO3-N + 2 lbs N/bu/A
  - Applied Feekes 3 (late February)

Intensive
- same as standard plus:
  + 40 lb N/A at Feekes 5 (mid-March)
  + Jointing fungicide
  + Flag leaf/heading fungicide

2015-16
Chickasha, OK

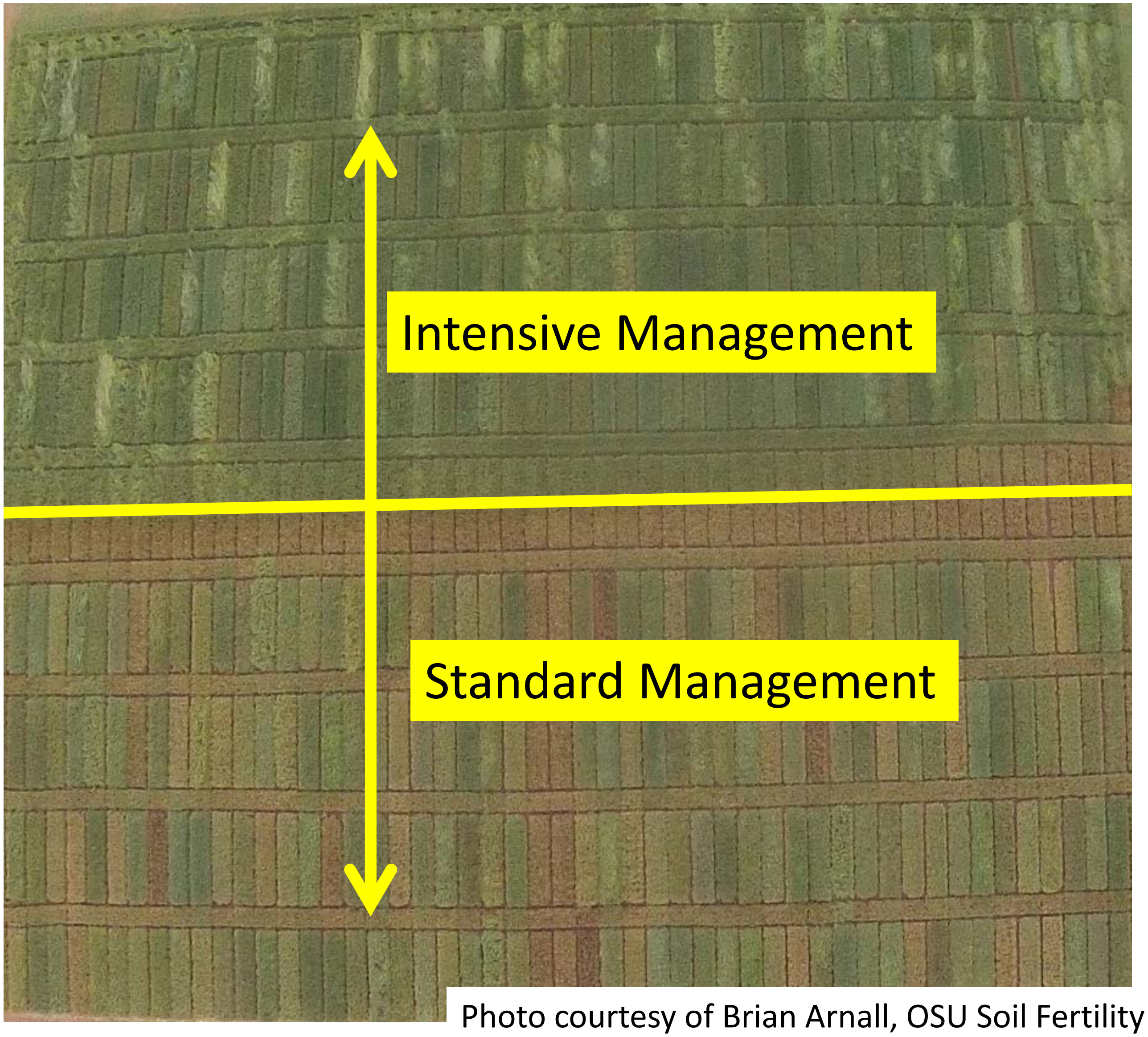
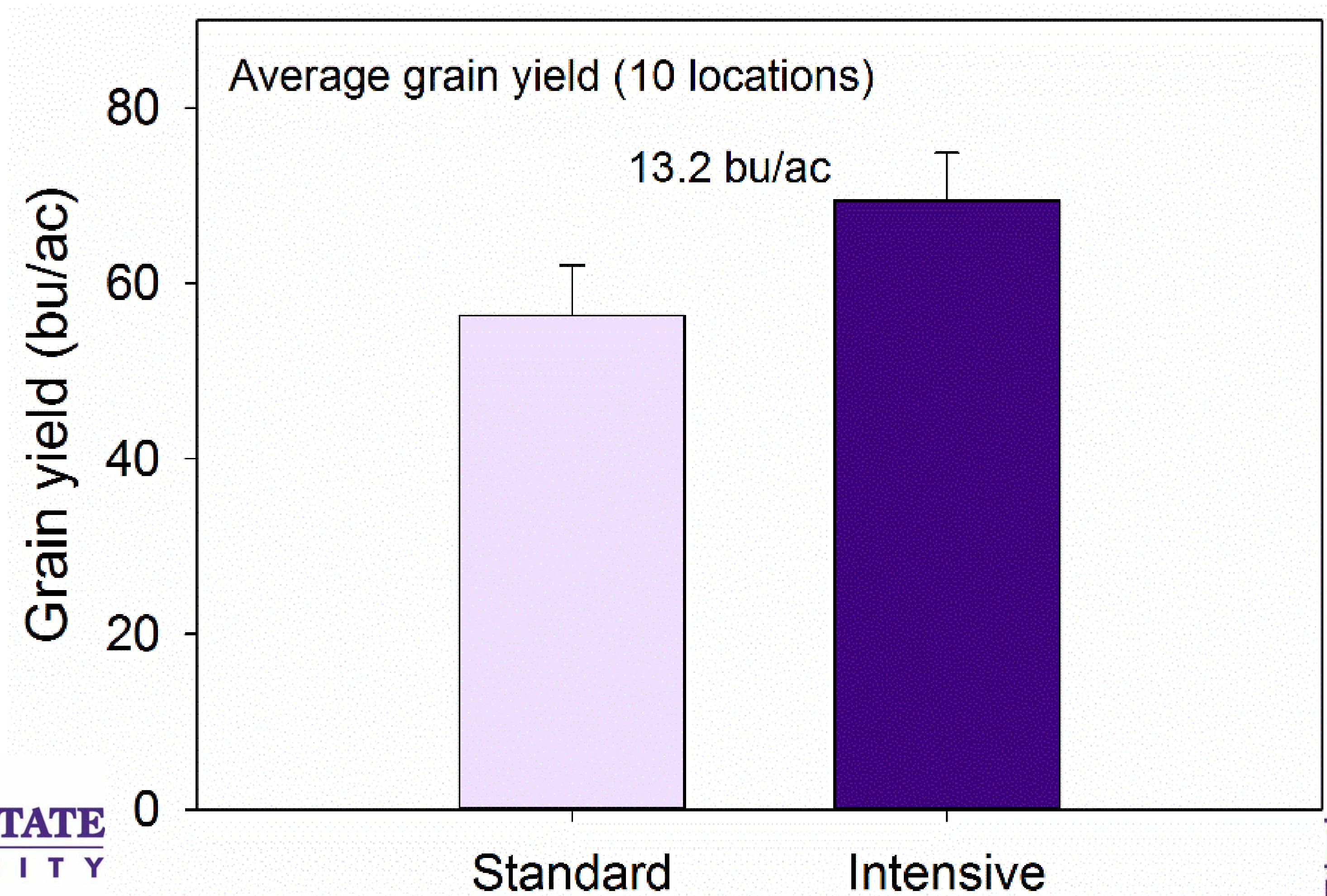


Photo courtesy of Brian Arnall, OSU Soil Fertility Extension Specialist

Grain Yield



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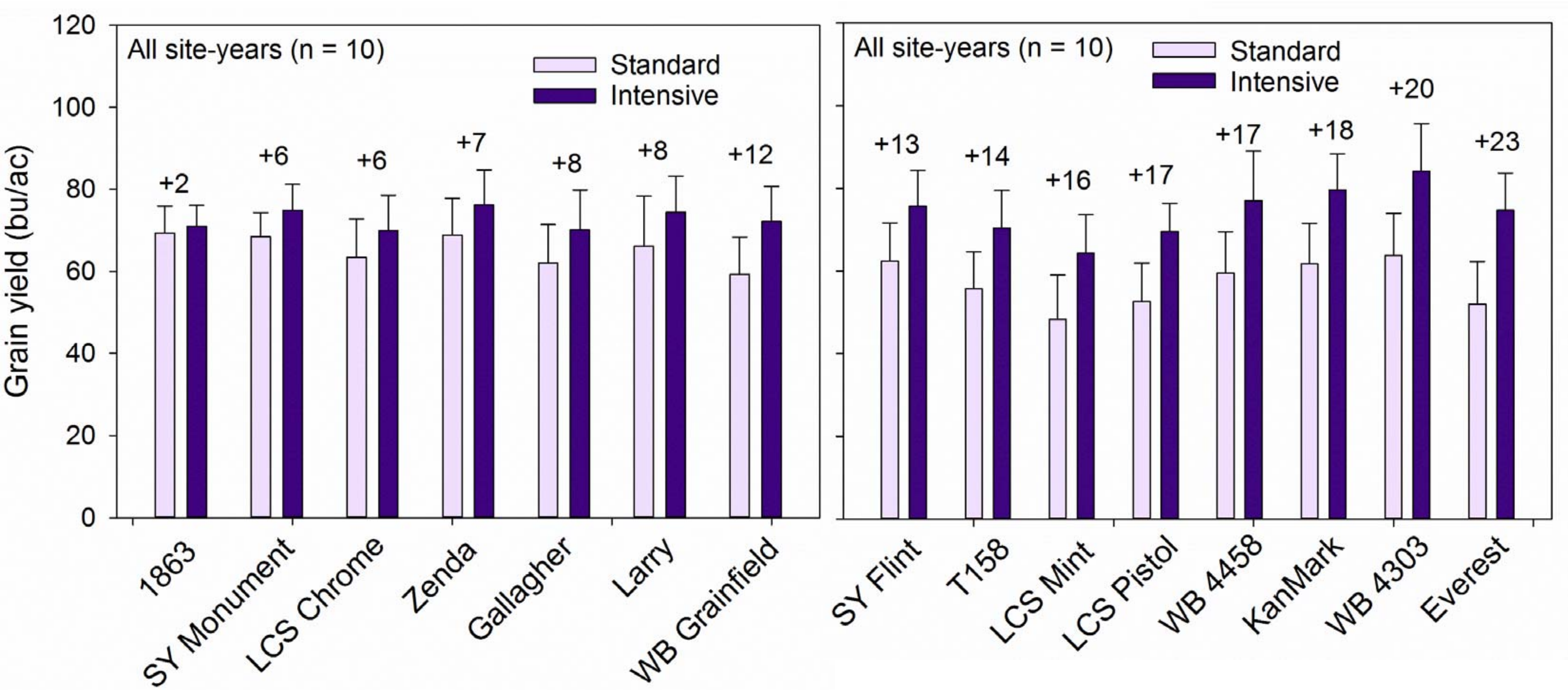
10 locations combined



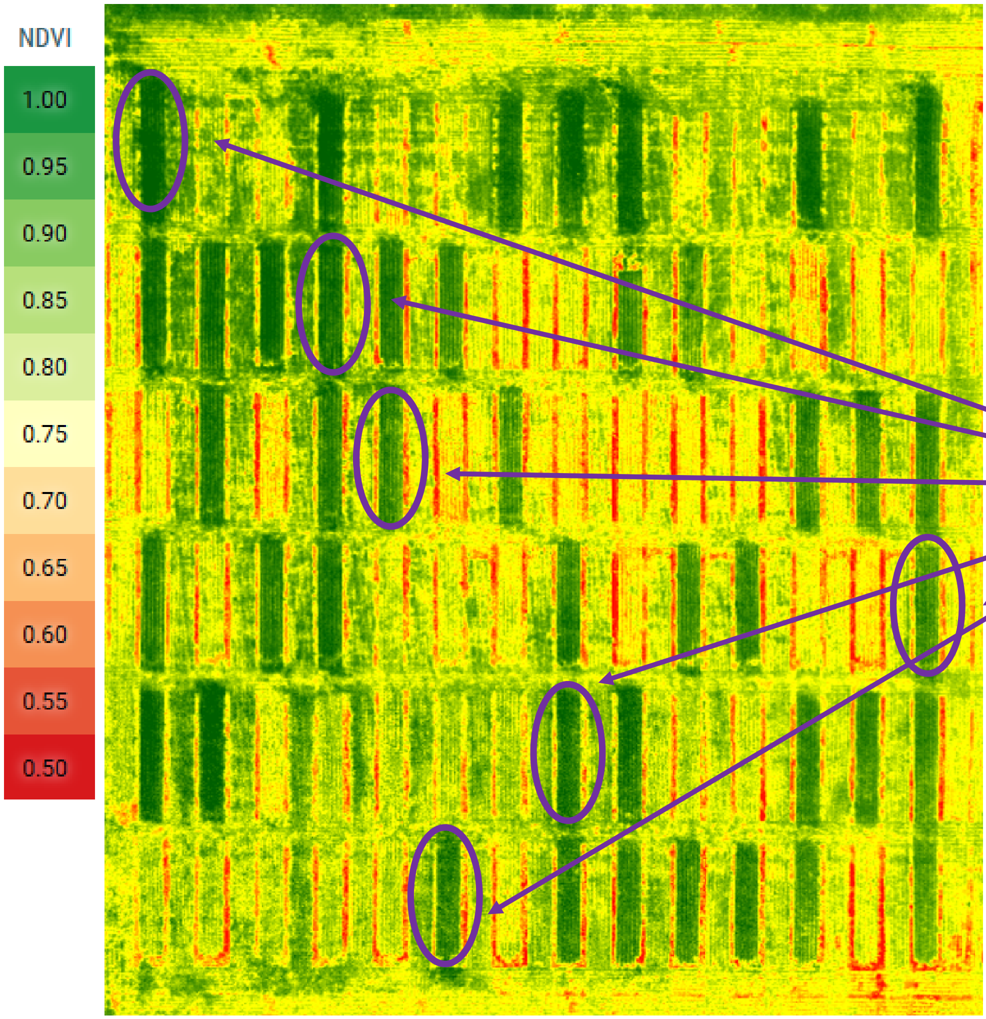
Treatment	Exception	Rate
1 - Standard	-	70 bu/ac yield goal N rate
2	+ Split-Nitrogen	+ 100 lbs N/A
3	+ Sulfur	+ 40 lbs/A
4	+ Chloride	+ 40 lbs/A
5	+ Plant Population	+ 1.6 million seeds per acre
6	+ Fungicide	+ 2 applications
7	+ Growth Regulator	+ Full rate PGR
8 - Kitchen-sink	-	All practices 2-7 combined
9	- Split-Nitrogen	- 100 lbs N/A
10	- Sulfur	- No Sulfur
11	- Chloride	- No Chloride
12	- Plant Population	- 1.2 million seeds per acre
13	- Fungicide	- No fungicide
14	- Growth Regulator	- No PGR

Approach
(jointing)

Approach Prima
(heading)

Data: Brent Jaenisch

Image: Ray Asebedo



Standard management + Fungicide

DUPONT

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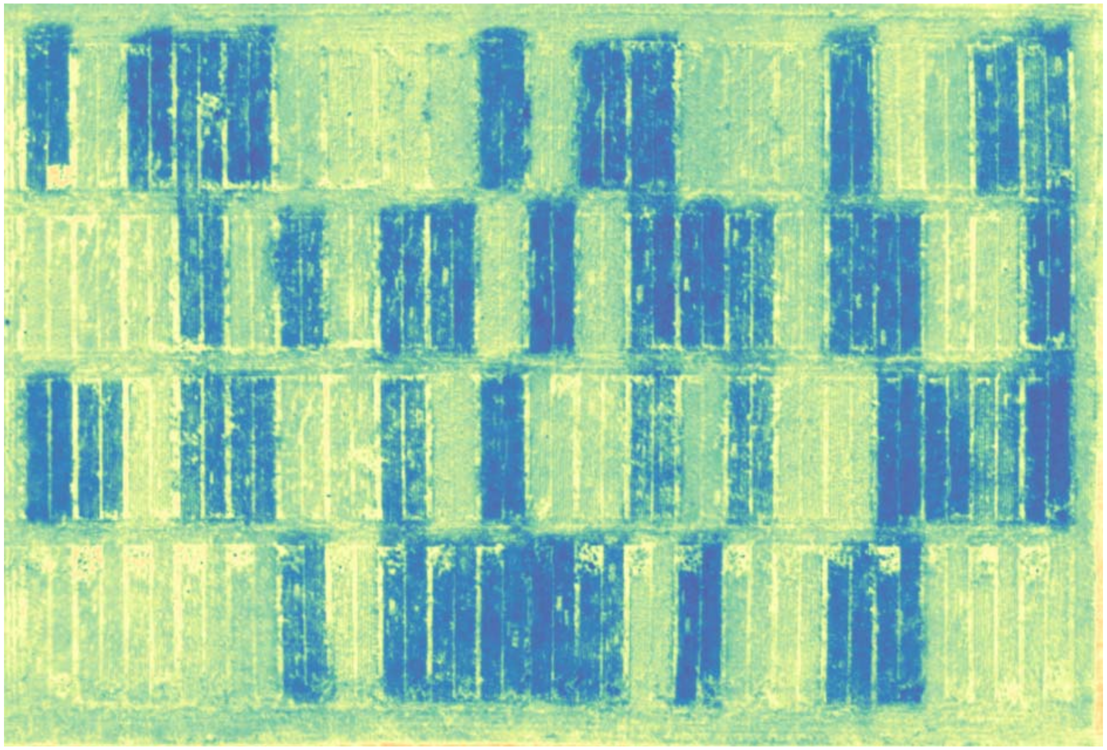
NDVI in 2016-17 (aerial)

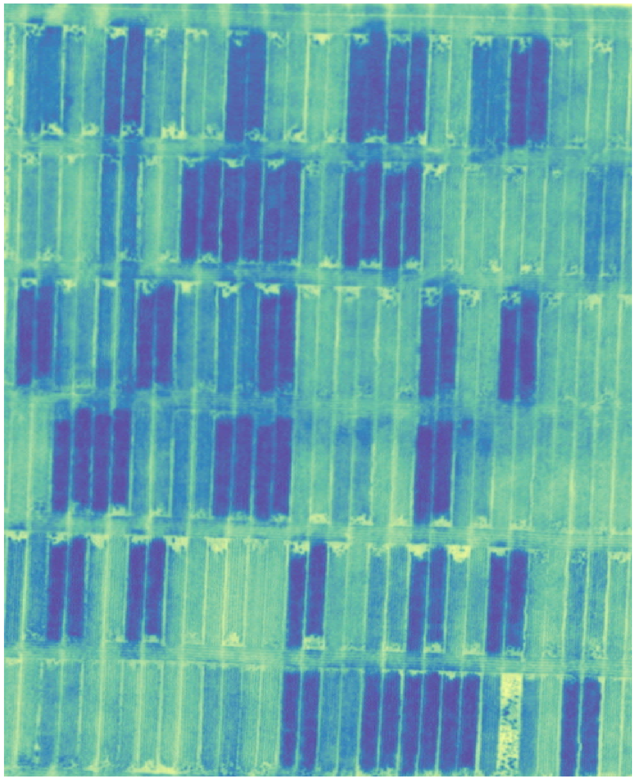
Data: Brent Jaenisch

Image: Ray Asebedo

Belleville (06-07-2017)

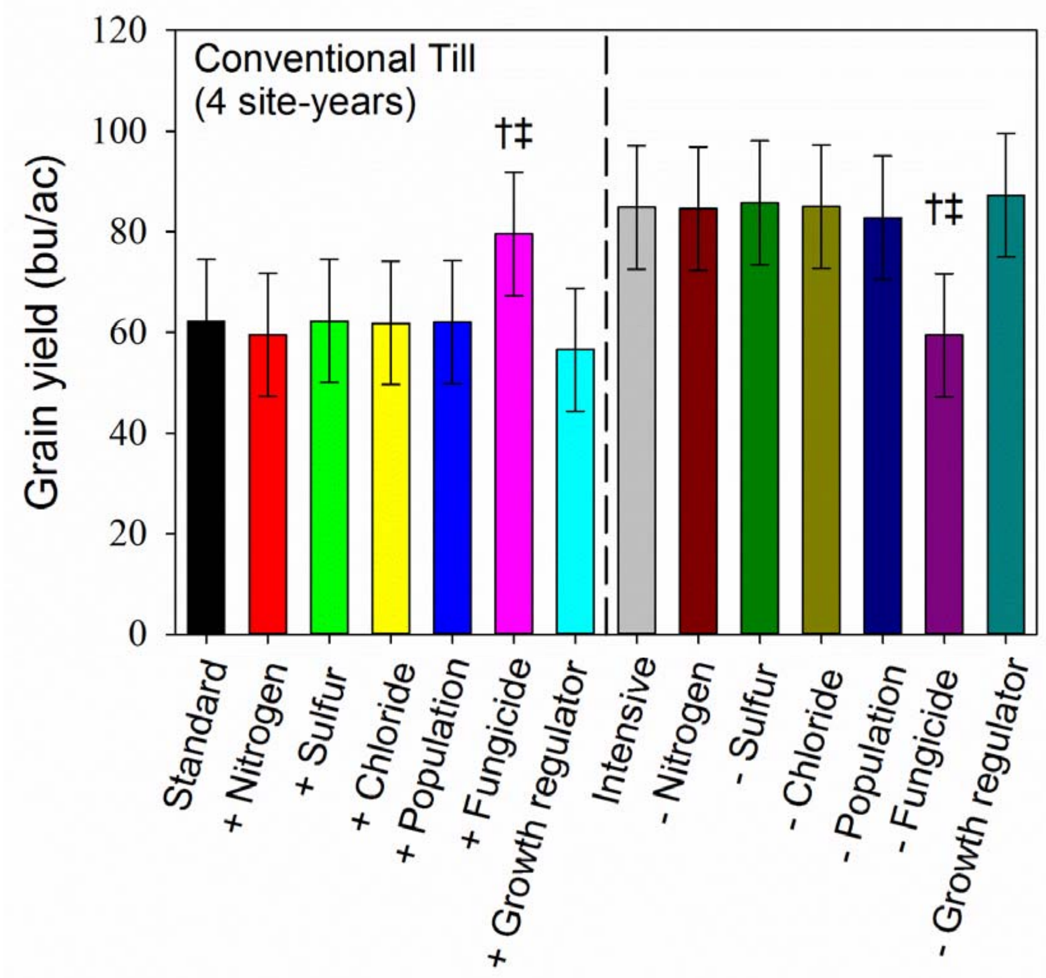


Hutchinson (05-18-2017)



Grain yield

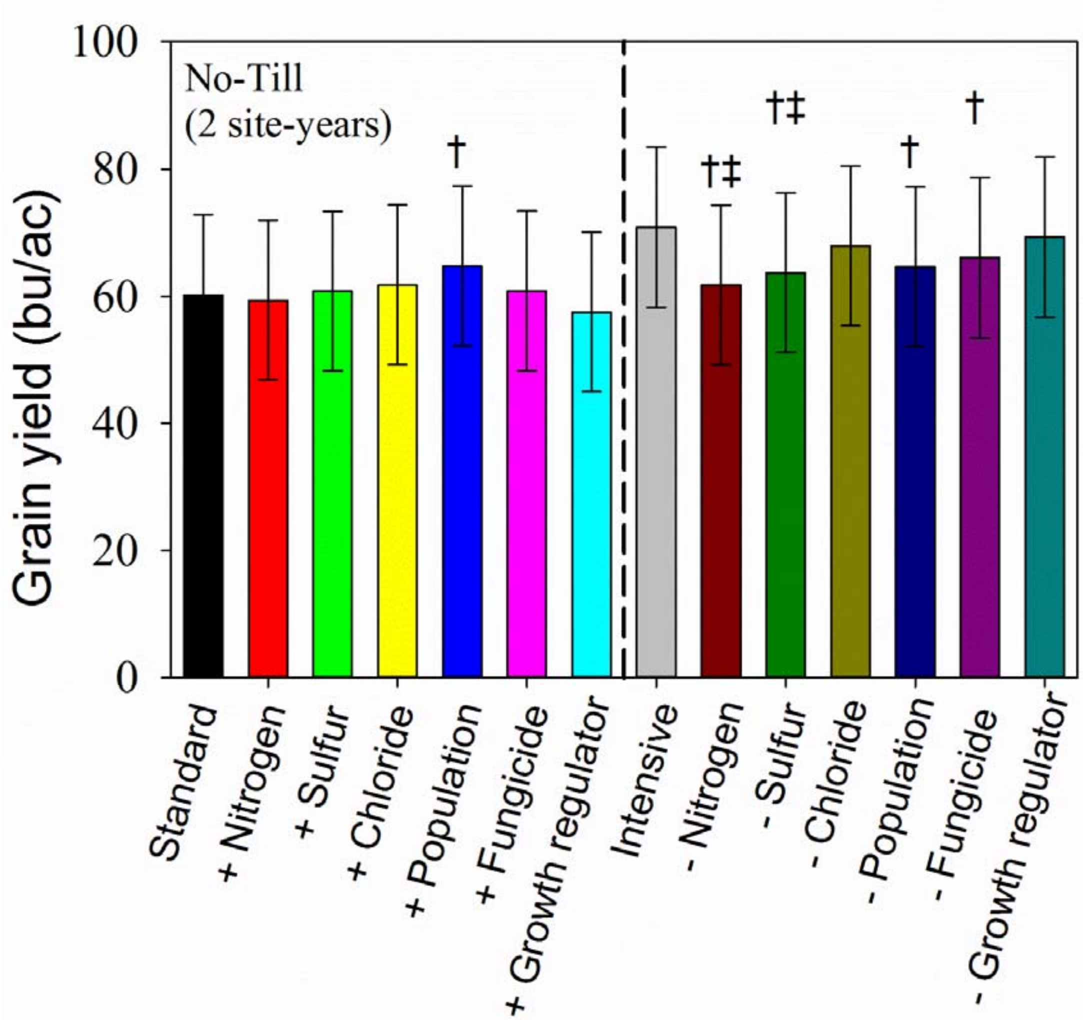
Conventional till:
Hutchinson 2016
Hutchinson 2017
Belleville 2016
Belleville 2017



Data: Brent Jaenisch

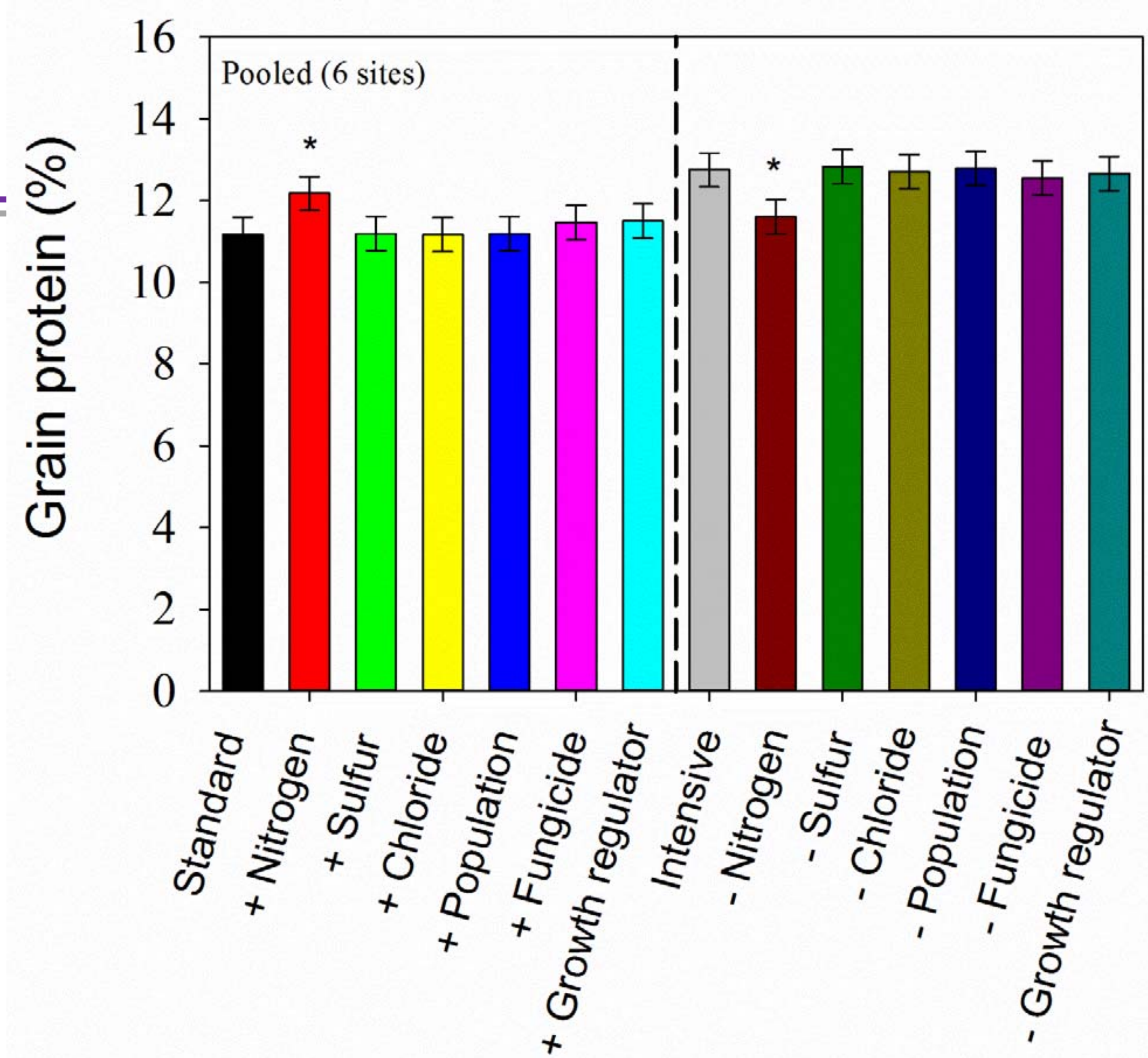
Grain yield

No till:
Manhattan 2016
Manhattan 2017



Data: Brent Jaenisch

Grain protein



Treatment	Exception	Rate
1 - Standard	-	70 bu/ac yield goal N rate
2	- Split-Nitrogen	- 100 lbs N/A
3	- Fungicide	- No Sulfur
4 - Kitchen-sink	-	All practices 2-7 combined

Varieties
1 – WB Grainfield
2 – WB4458
3 – WB4303
4 – WB4515
5 – WB4269

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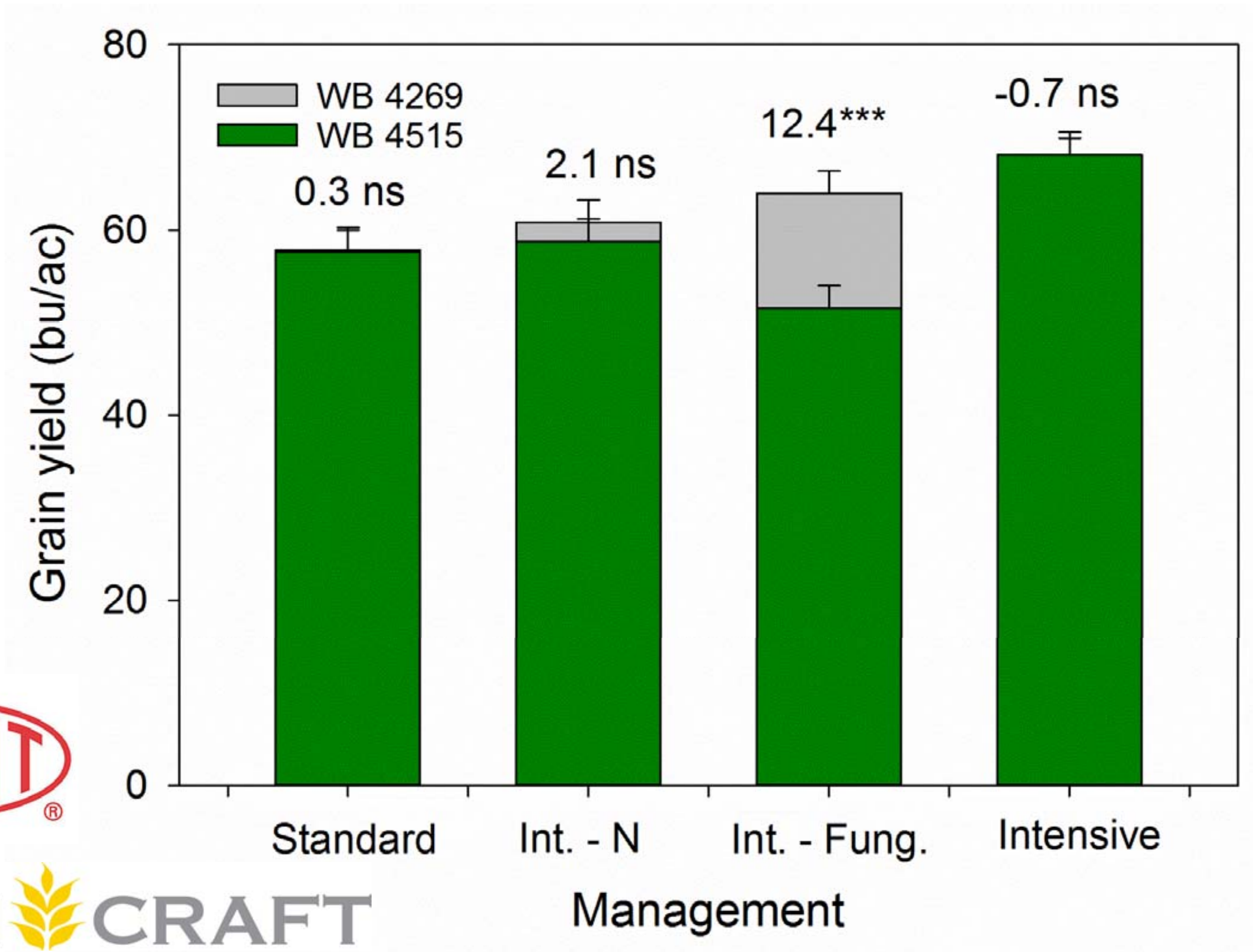
Grain Craft

DuPont

Grain yield – Hutchinson 2016-17



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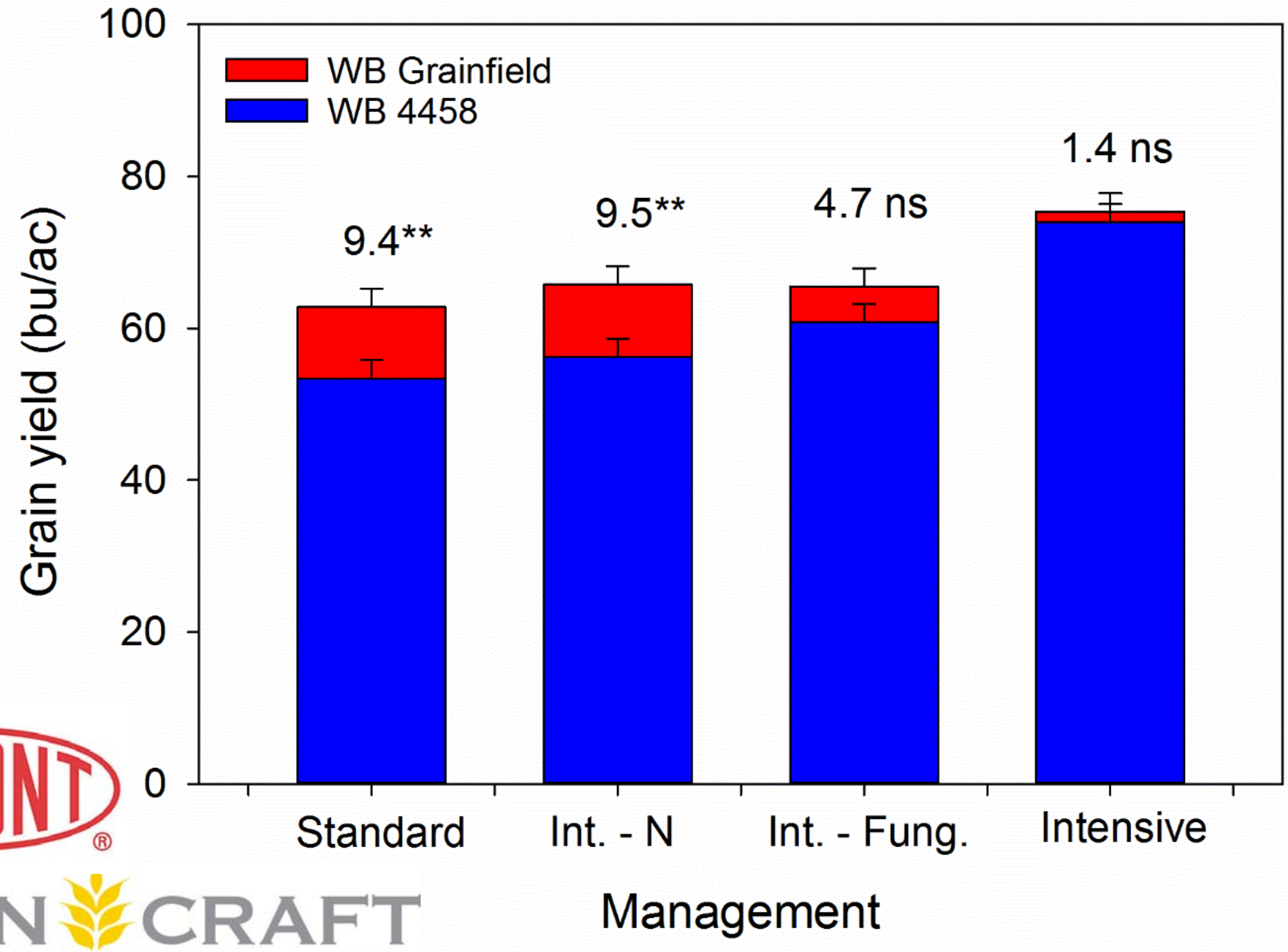

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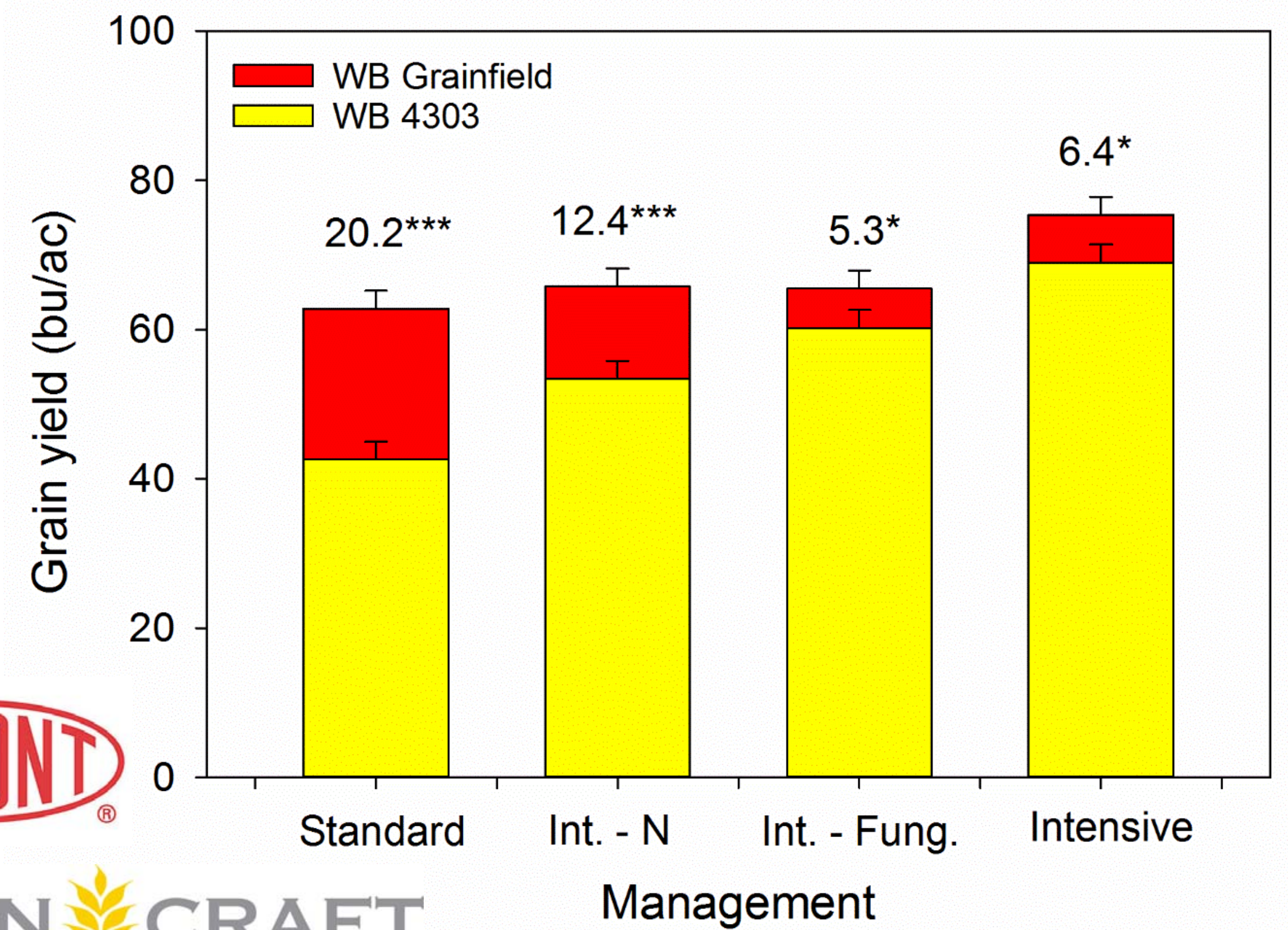
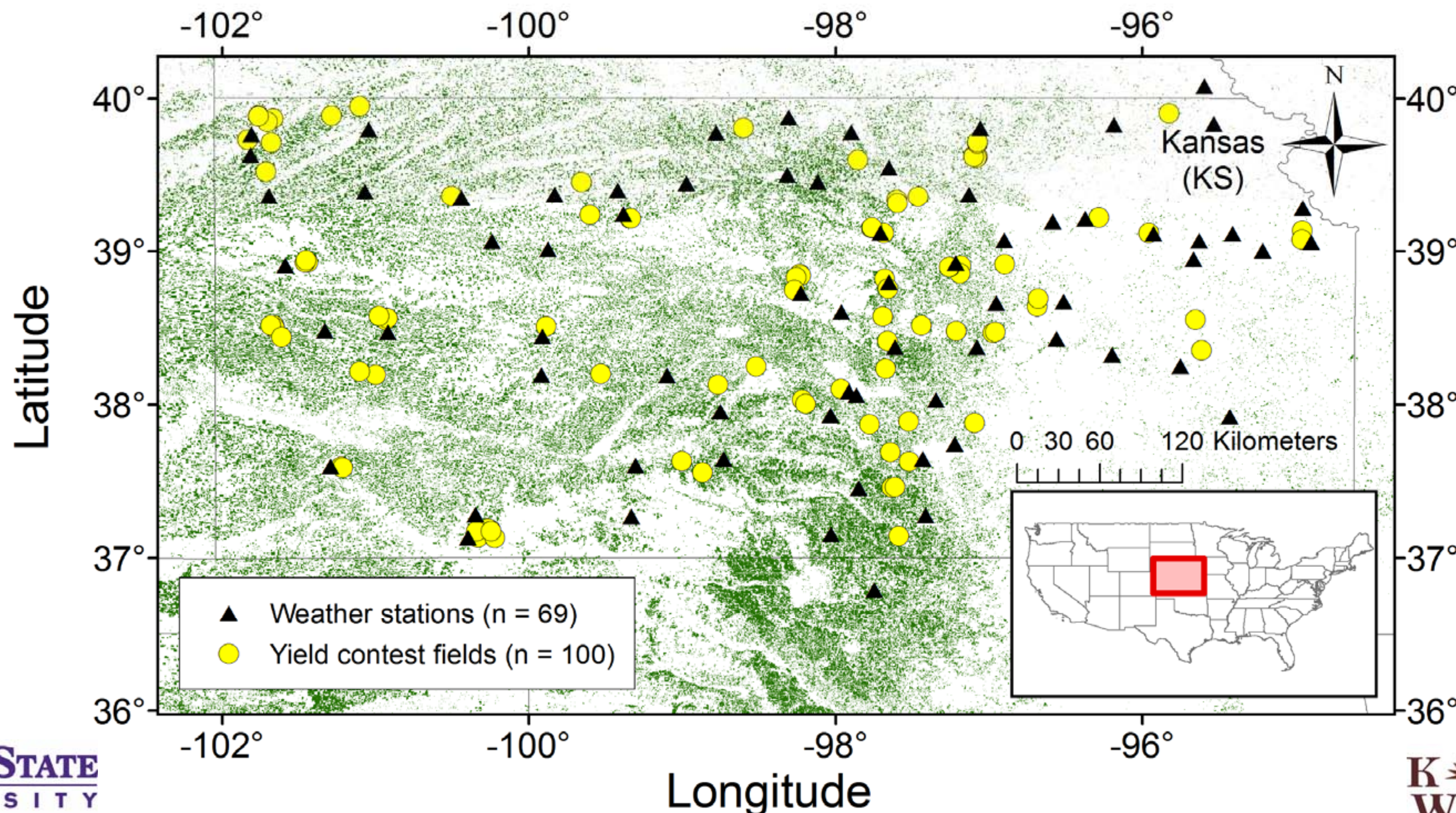


Kansas Wheat Yield Contest Fields



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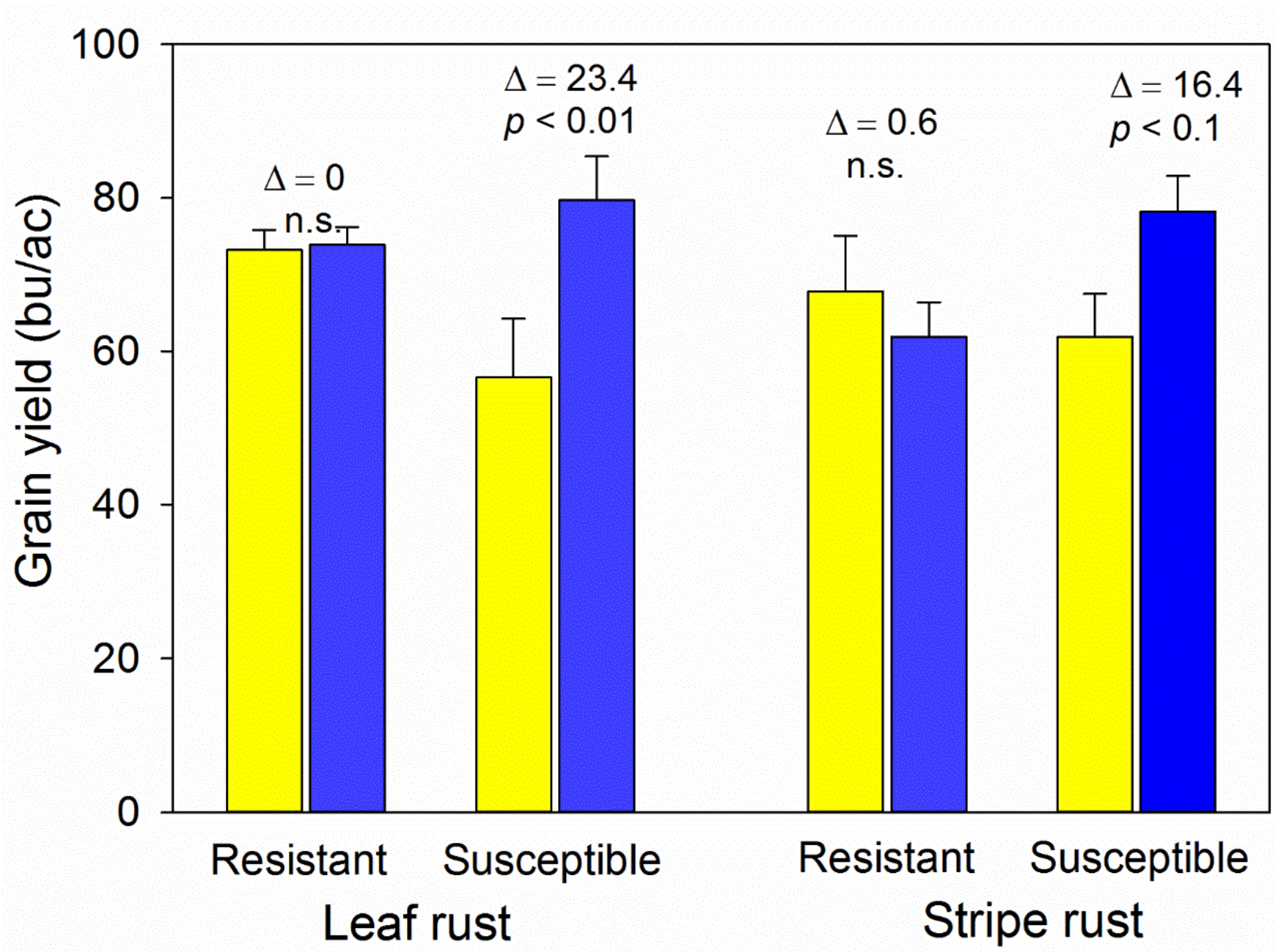
Variety resistance YR and LR x fungicide



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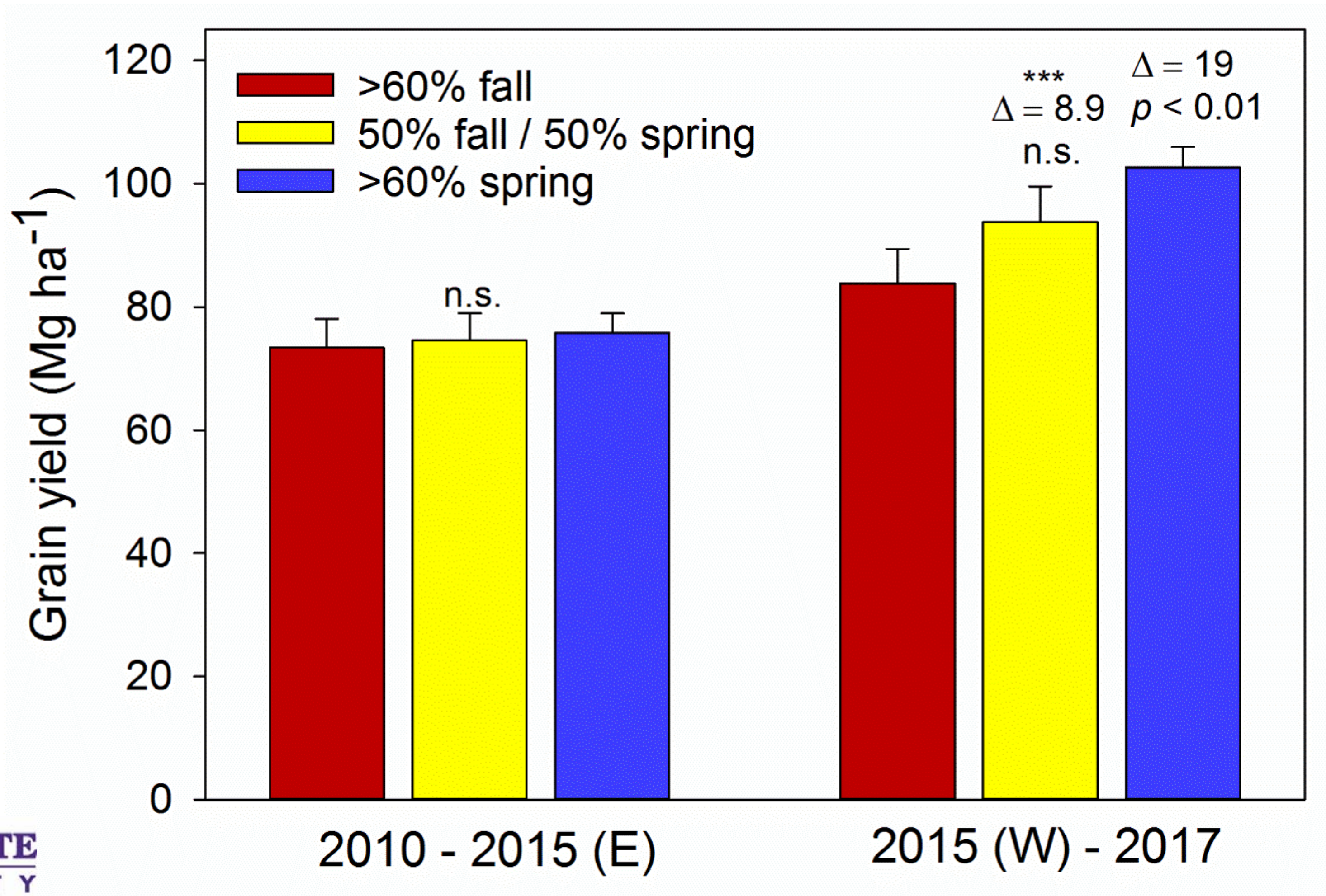
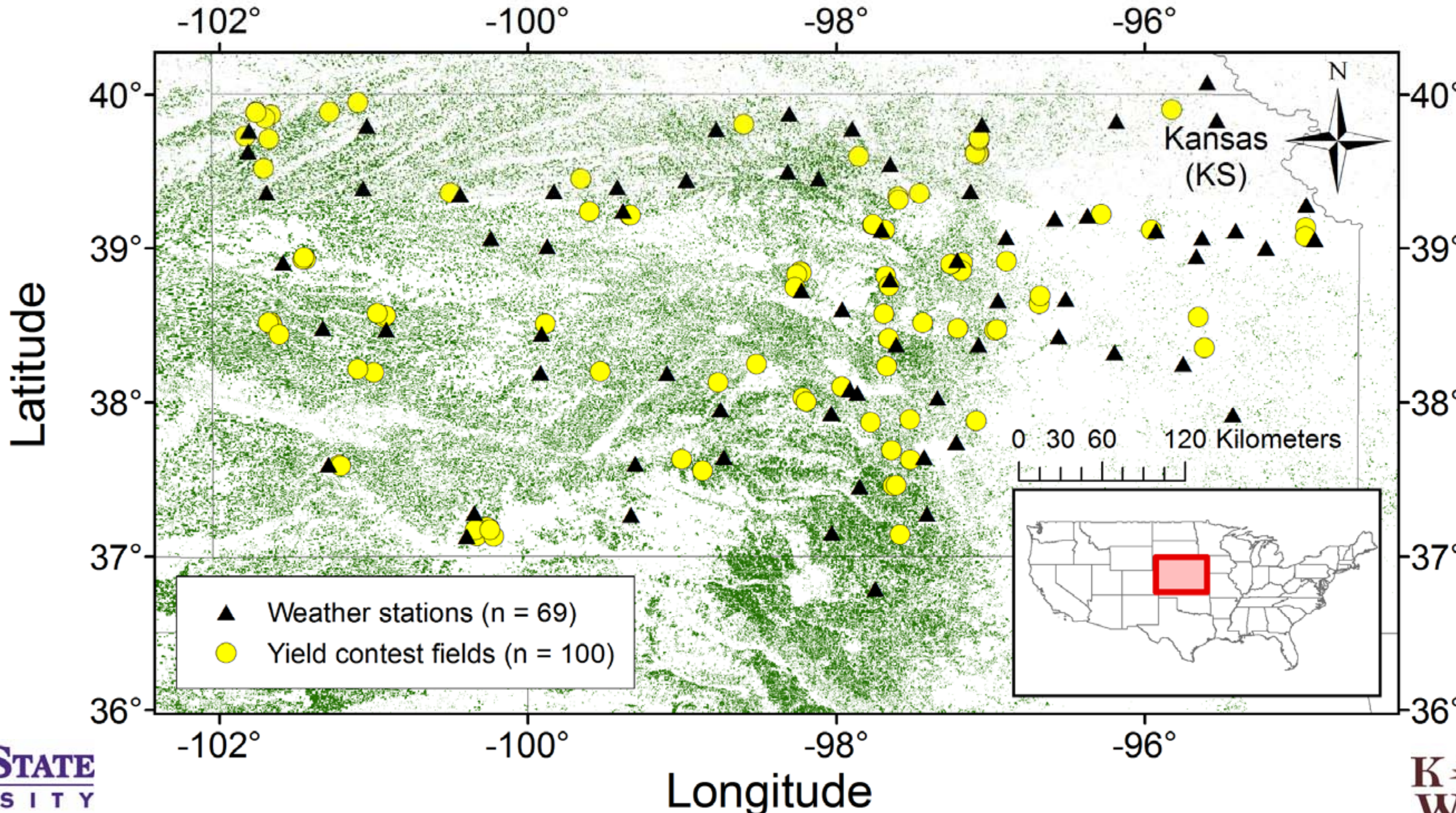
N timing



Grain yield (Mg ha-1)
0
20
40
60
80
100
120
>60% fall
50% fall / 50% spring
>60% spring
n.s.
***
Δ = 8.9
n.s.
Δ = 19
p < 0.01
2010 - 2015 (E)
2015 (W) - 2017

Kansas Wheat Management Survey



Wheat yield x protein relationships

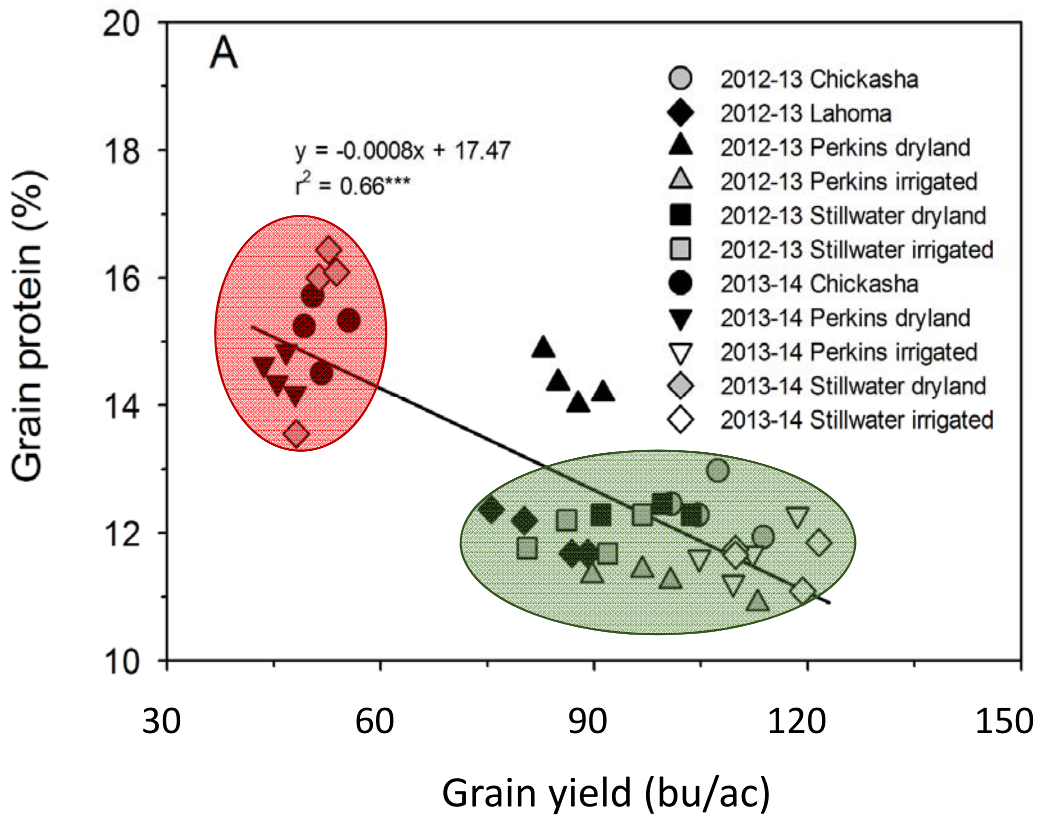
Low yielding environments

↓

Starch accumulation reduced

↓

High protein concentration



Lollato and Edwards, 2015

High yielding environments

↓

Greater starch accumulation

↓

Protein dilution if N rates are not increased

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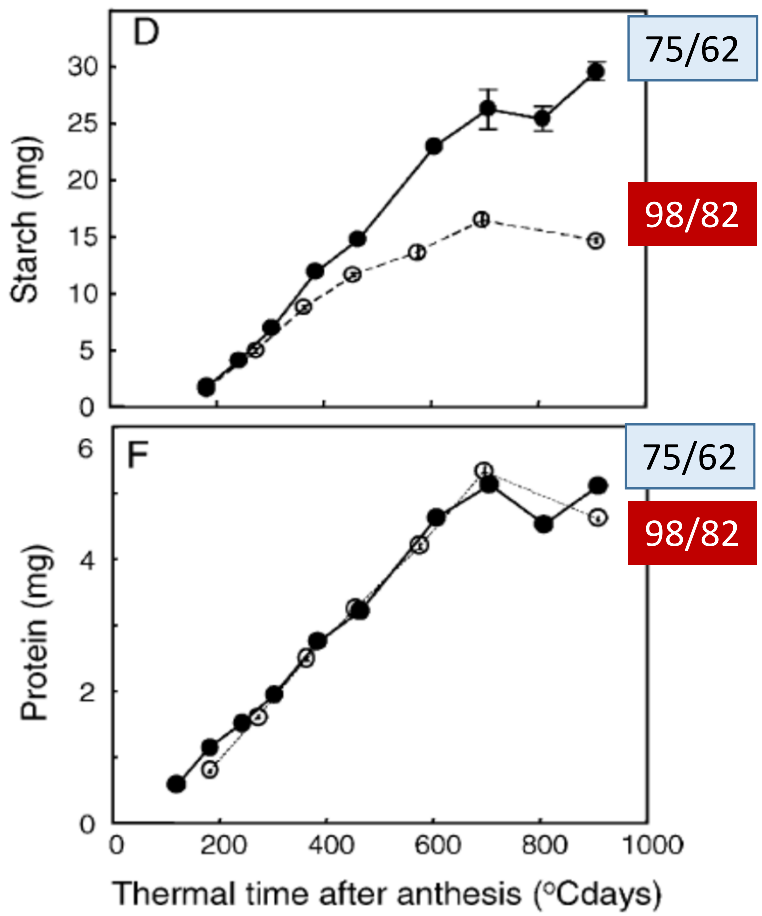
Heat and water stresses during grain fill



Decreases total starch accumulation more than protein – increases protein %

DuPont et al., 2006

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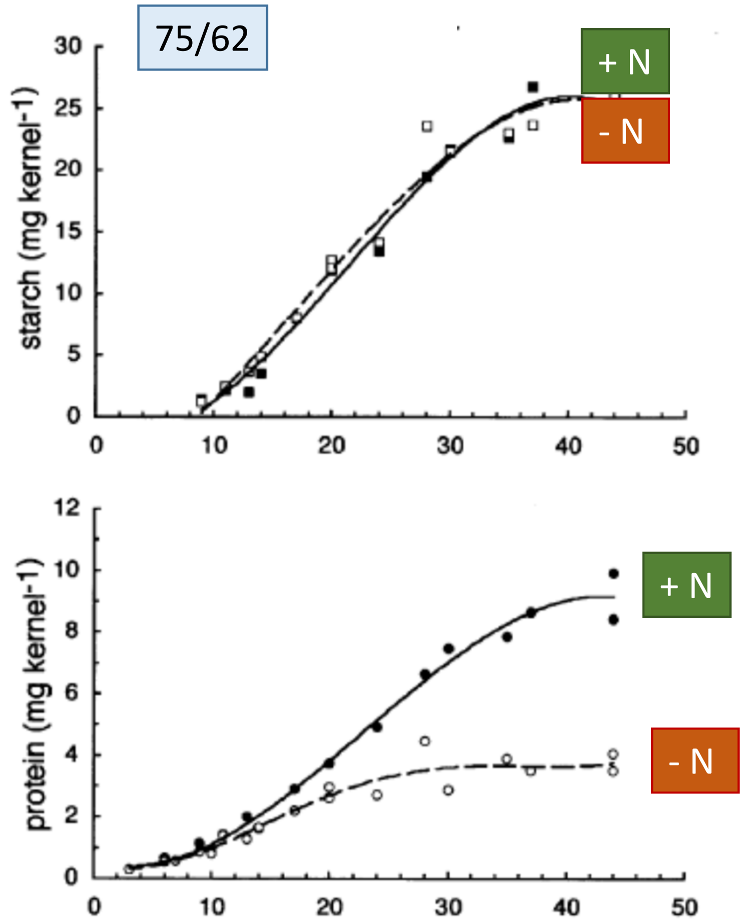
N availability affecting wheat protein and starch



Removing N fertilizer decreased protein but did not affect starch accumulation

Altenbach et al. (2003)

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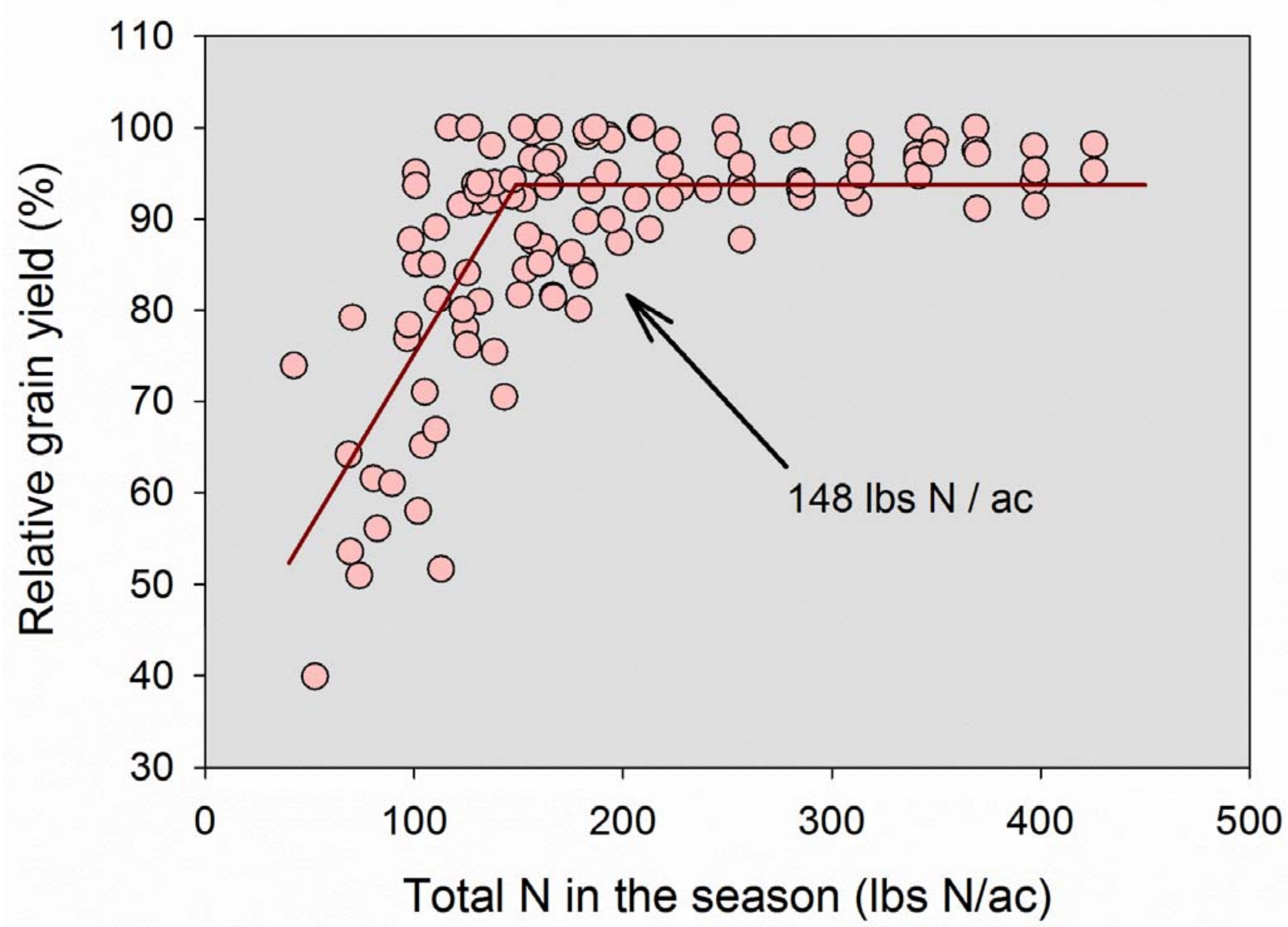
Nitrogen x Protein x Yield relationships



Data: Ashley Lorence

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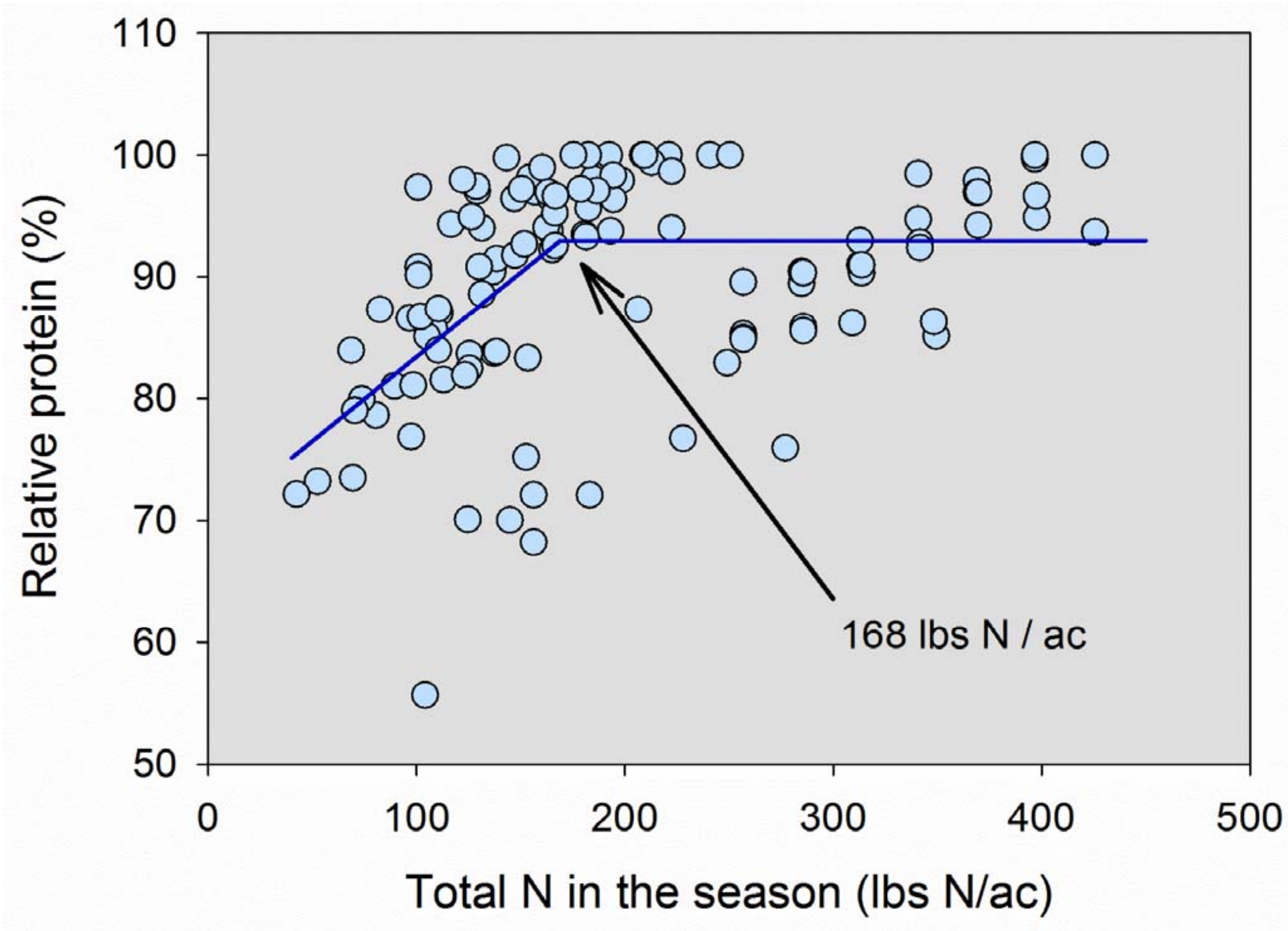
Nitrogen x Protein x Yield relationships



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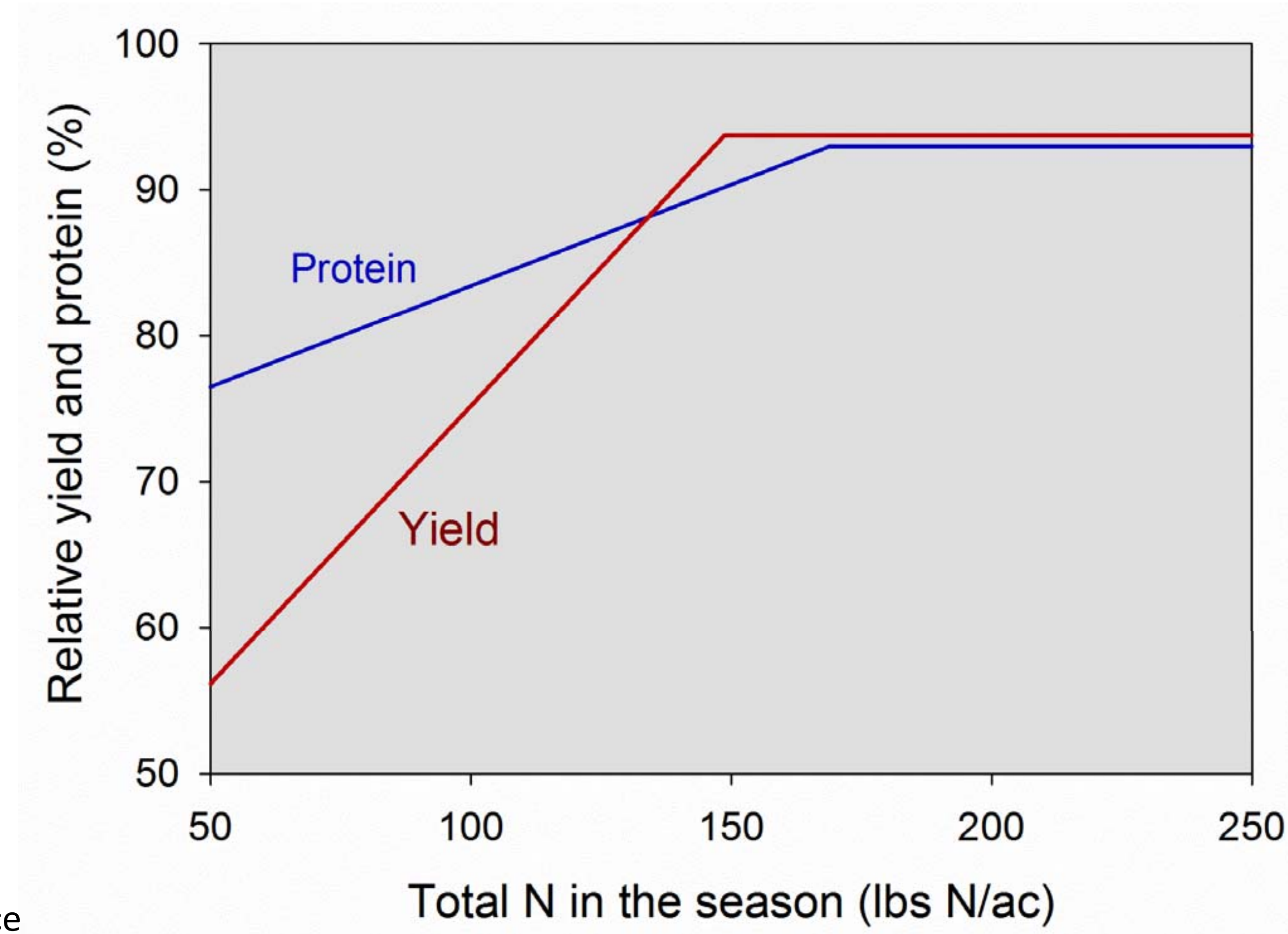

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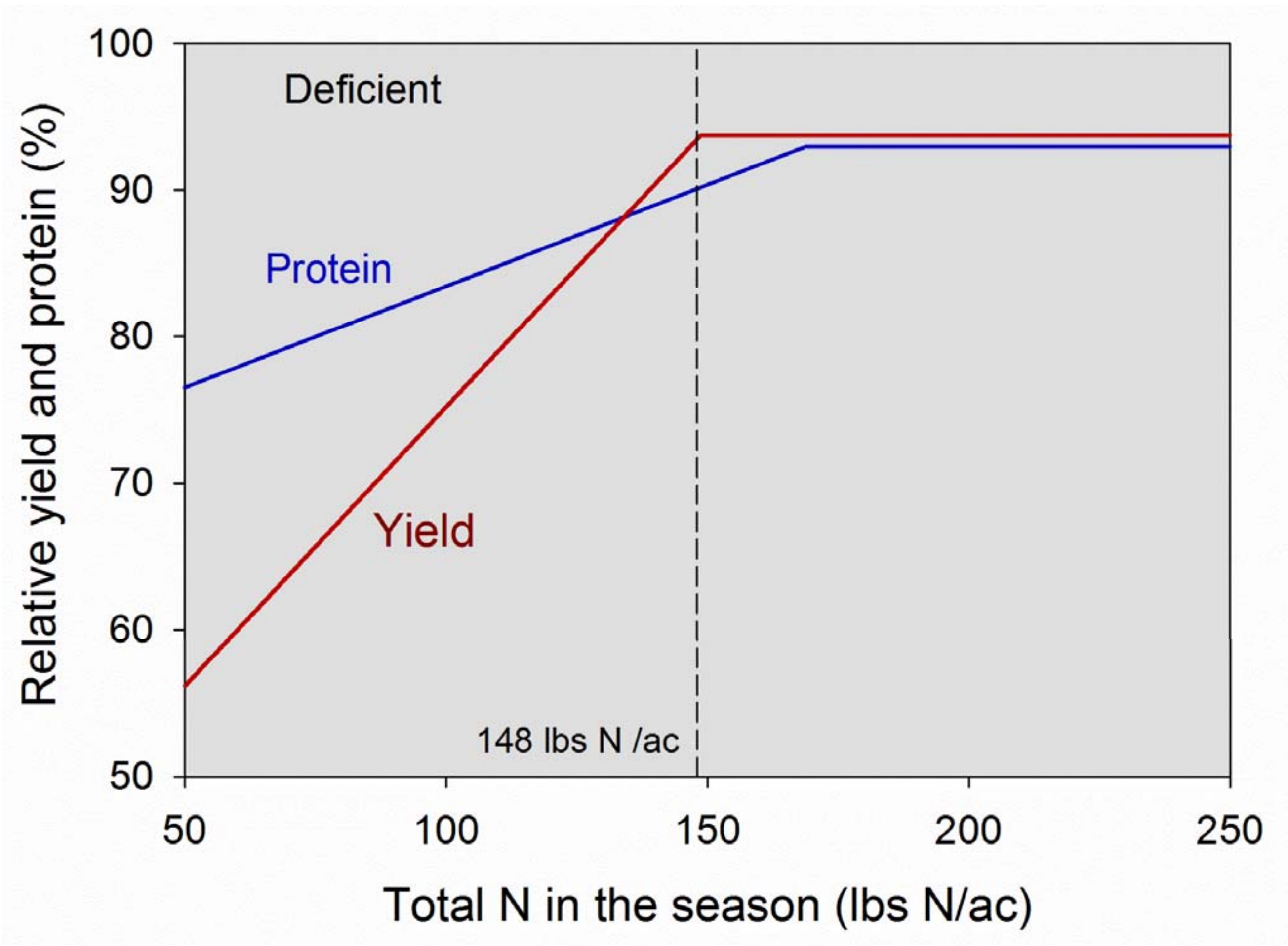

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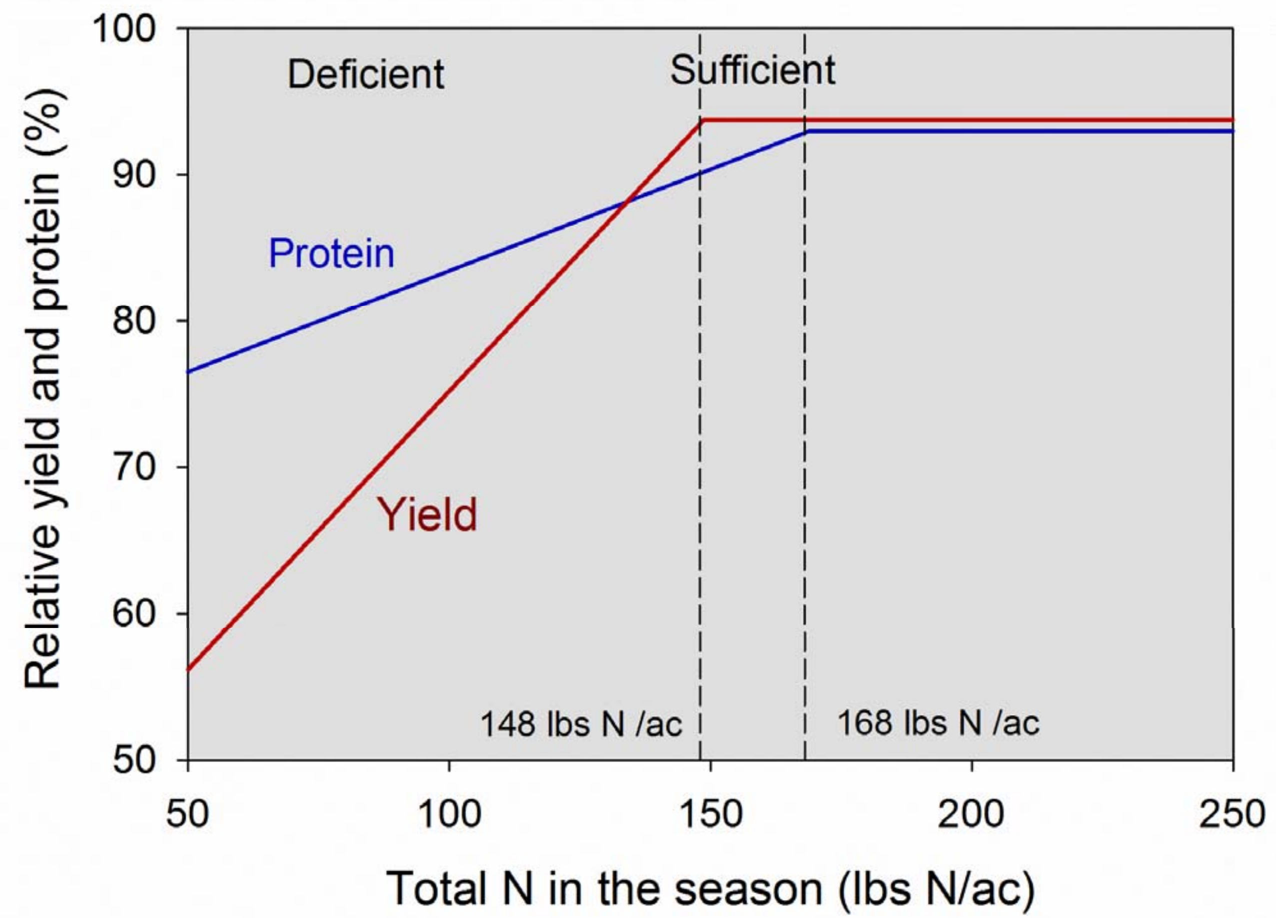

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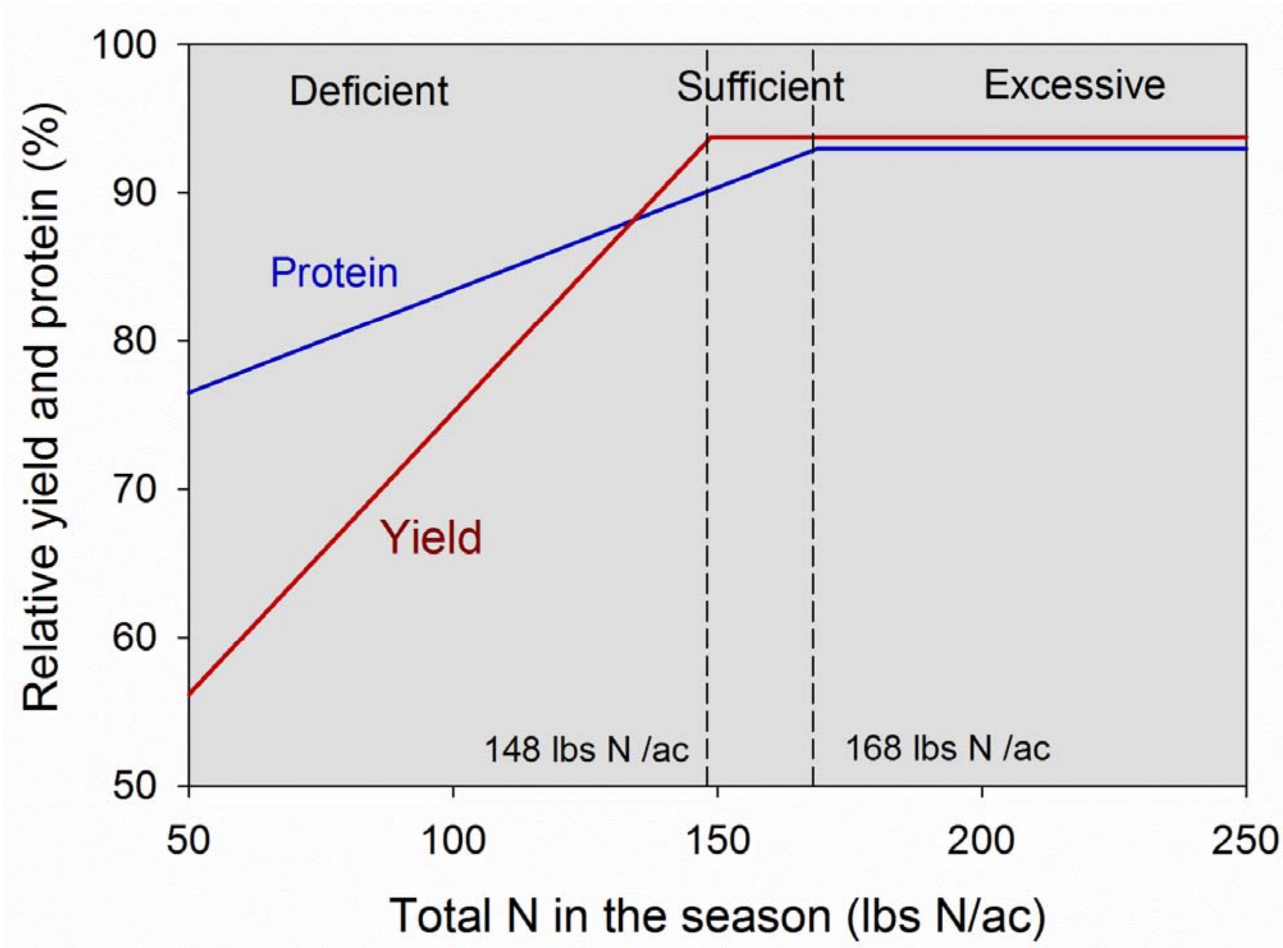

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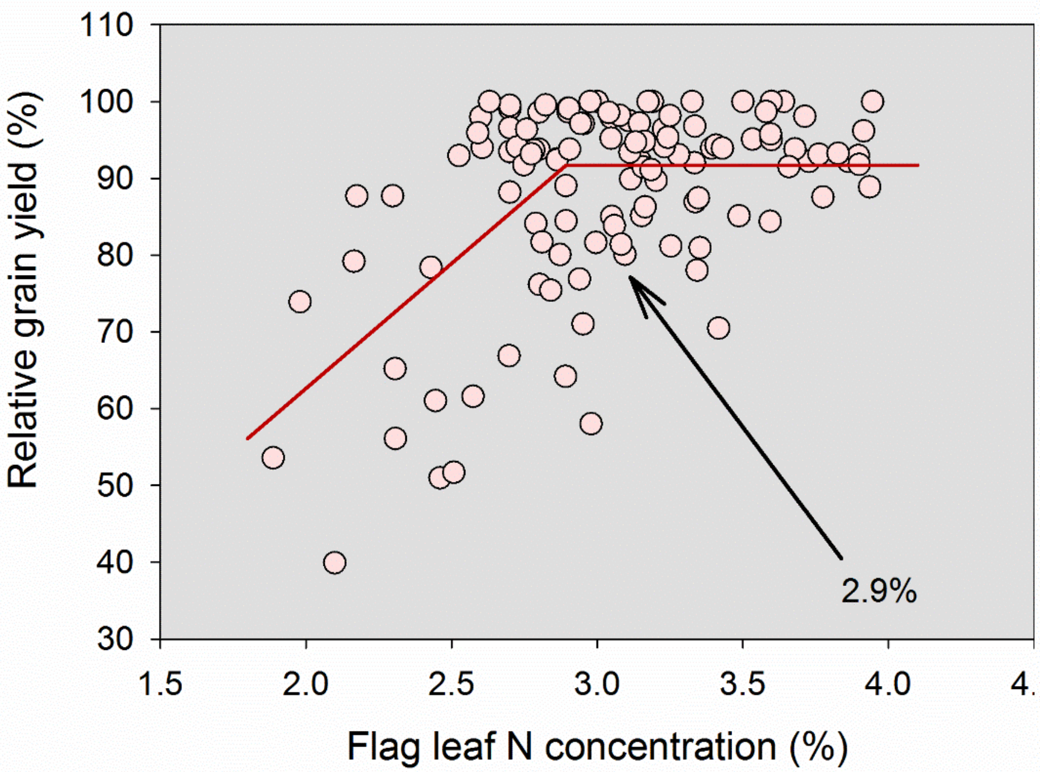
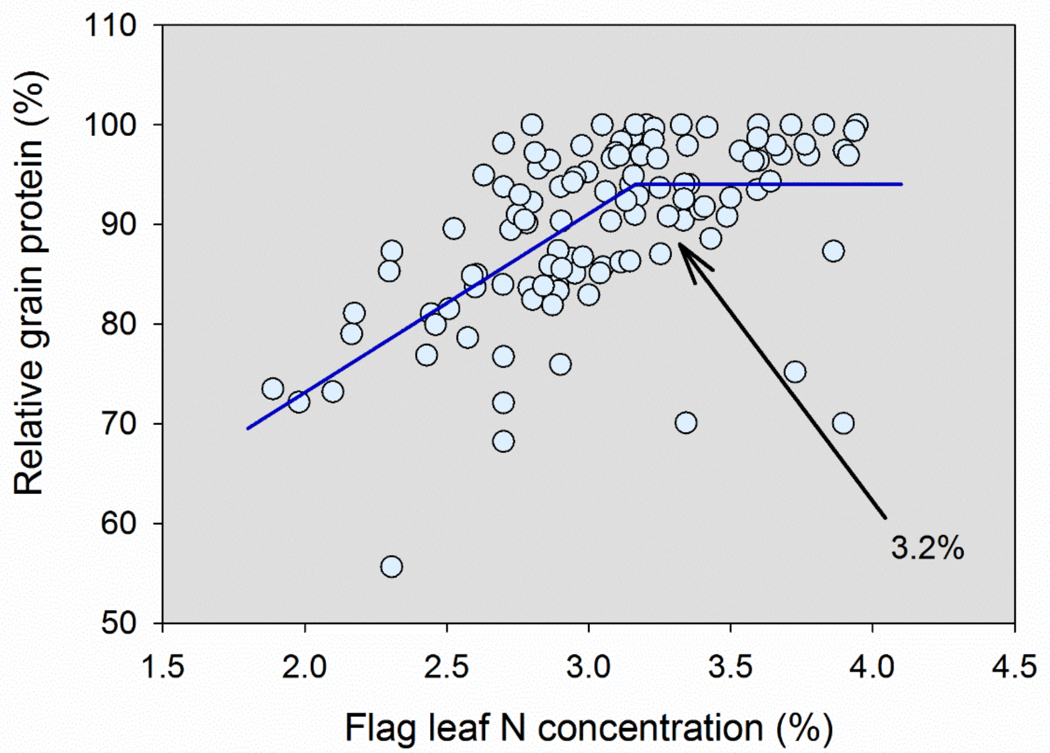
Flag leaf N as in-season indicators?





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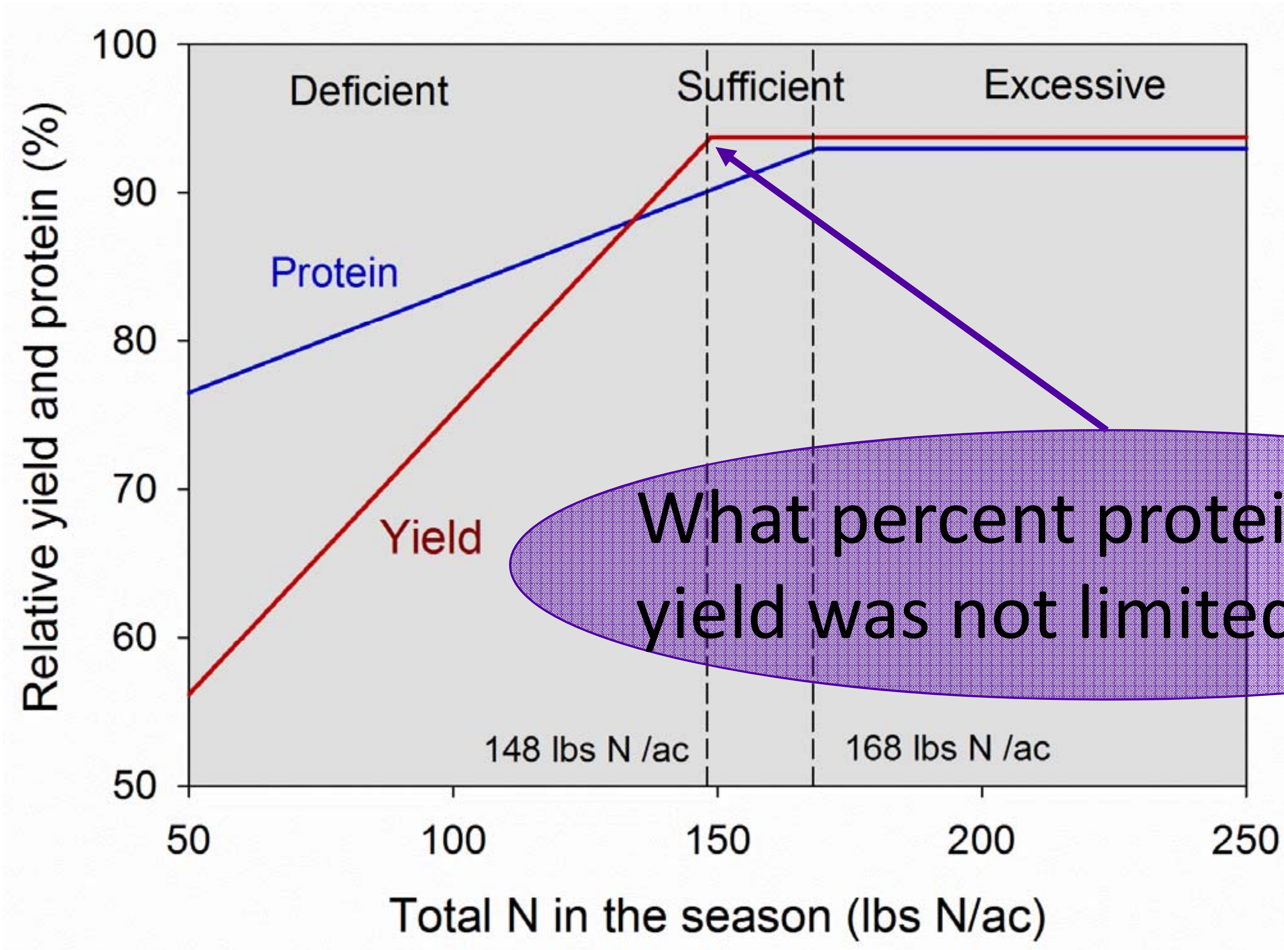
Nitrogen x Protein x Yield relationships



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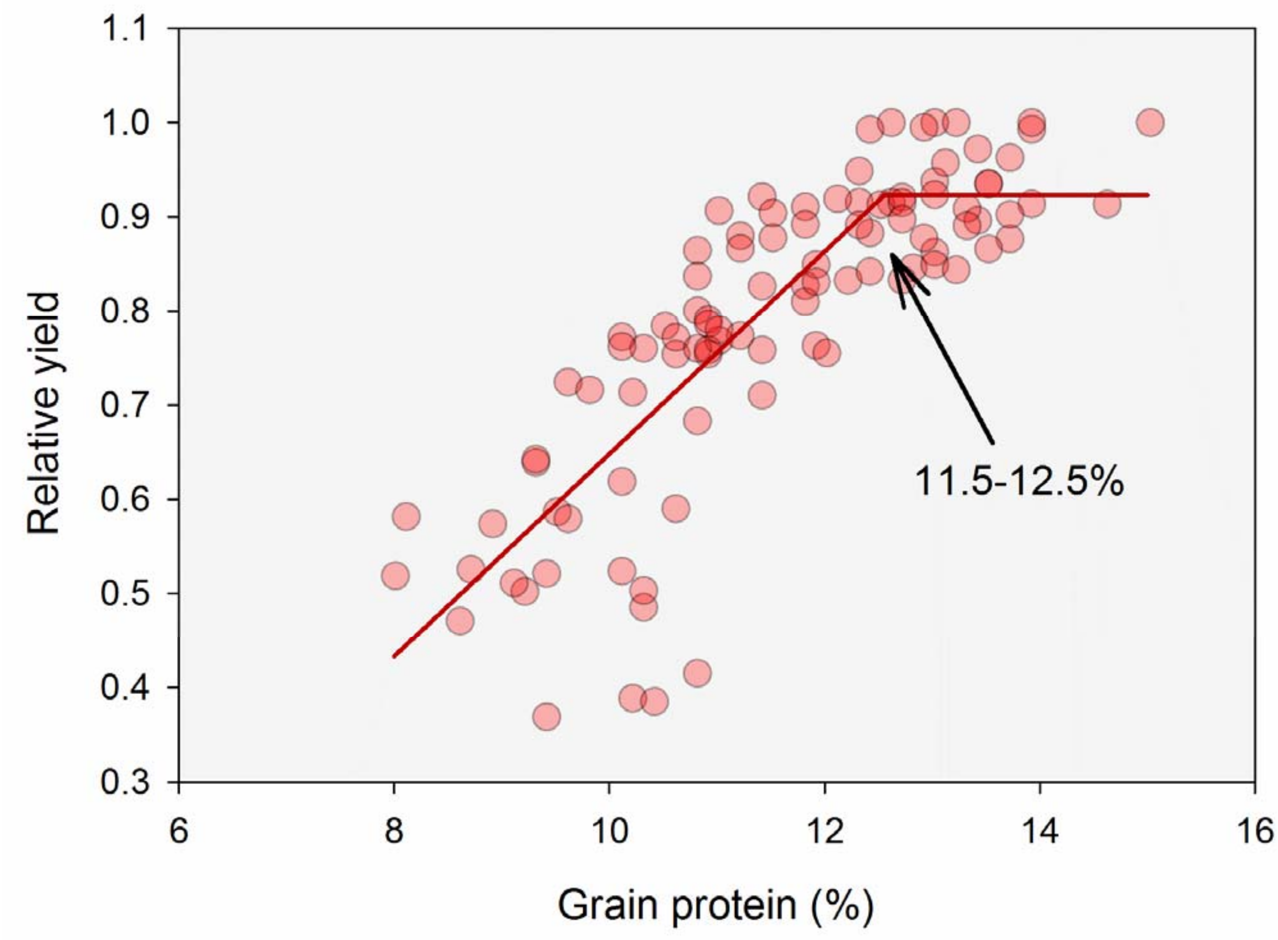
Grain protein as indicator of N sufficiency



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Questions?

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