Recent Corn Nitrogen Research Conducted by the LSU AgCenter

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Overview of the challenge

- Corn yields depend on optimal nitrogen rates
- Too little N costs yield
- Too much N costs money, leads to luxury consumption, and can have potential environmental impacts
- Different parts of a field require different rates of nitrogen
- Irrigated vs. non-irrigated
- Each year is different

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Environmental & Regulatory Factors

2012 EPA Lawsuit:
Gulf Restoration Network
et al v. Jackson et al.

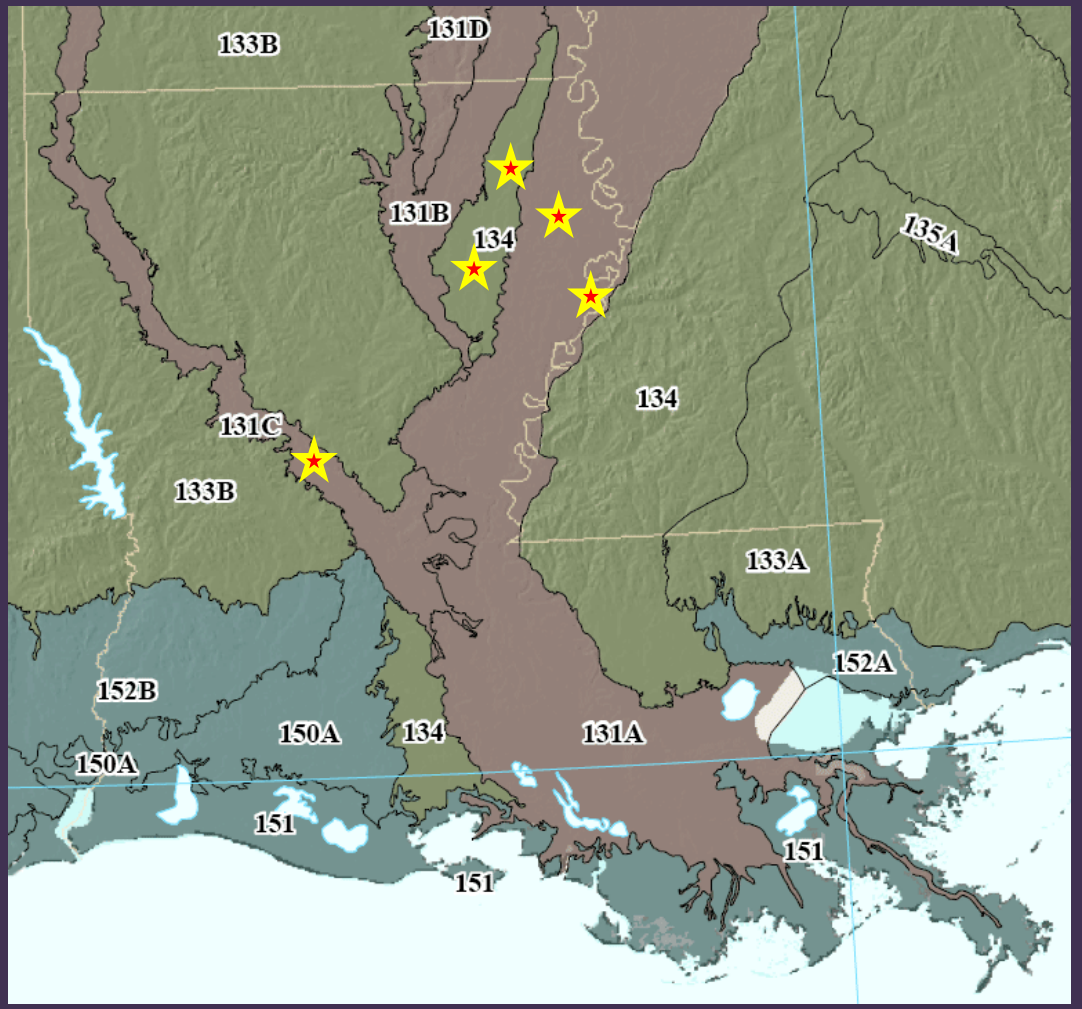
The Clean Water Act allows states to use either "narrative" or "numeric" standards as a method for determining water quality. Most states in the Mississippi River Basin use narrative standards such as "no nutrients at levels that cause a harmful imbalance of aquatic populations."
(Farm Bureau Press Release 5-10-12)

http://docs.nrdc.org/water/files/wat_12031401a.pdf

epa.gov

Research Trials

- Split applications
- Additional applications
- Sensor-based applications
- Soil test-based applications

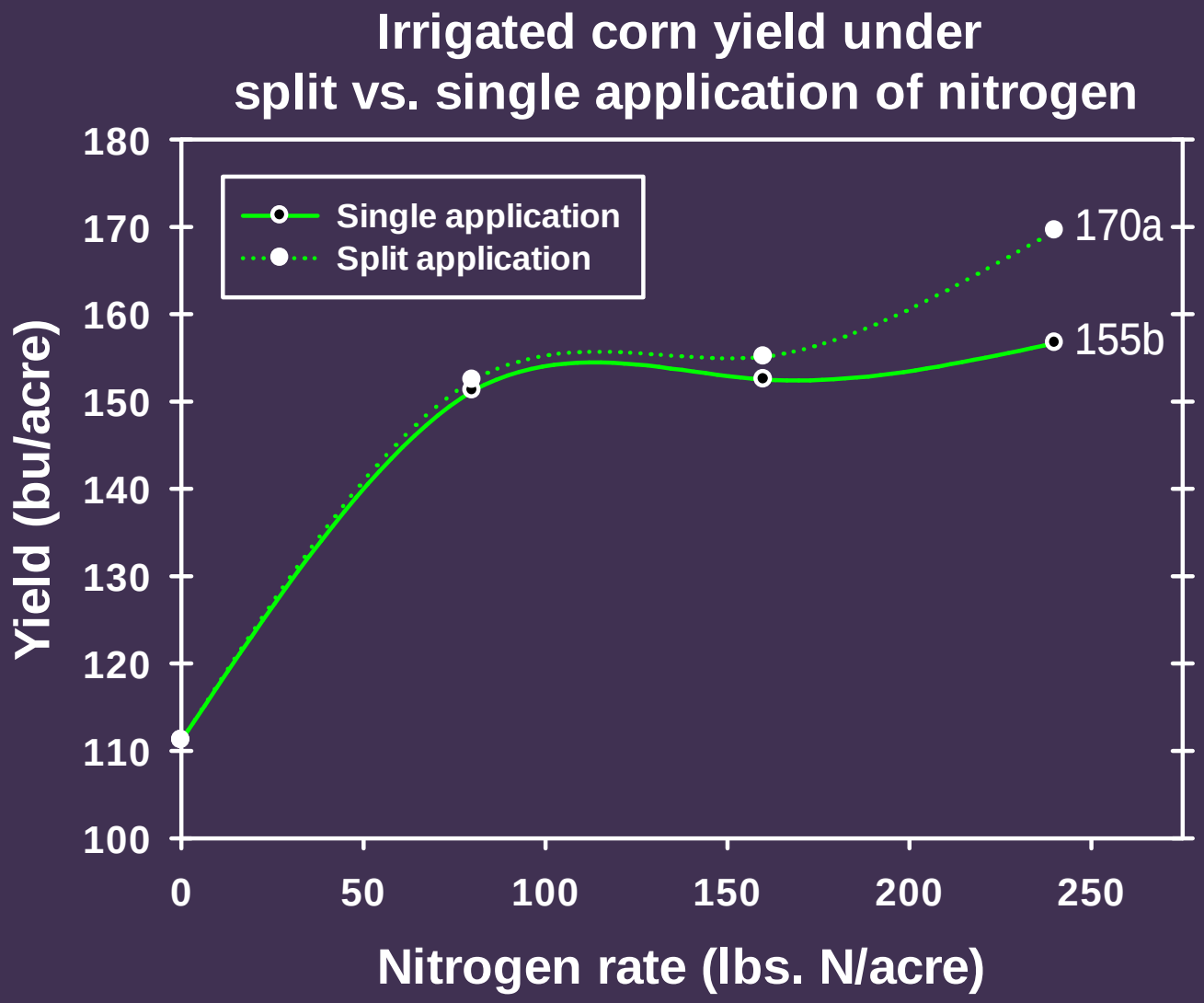


Split application – Macon Ridge

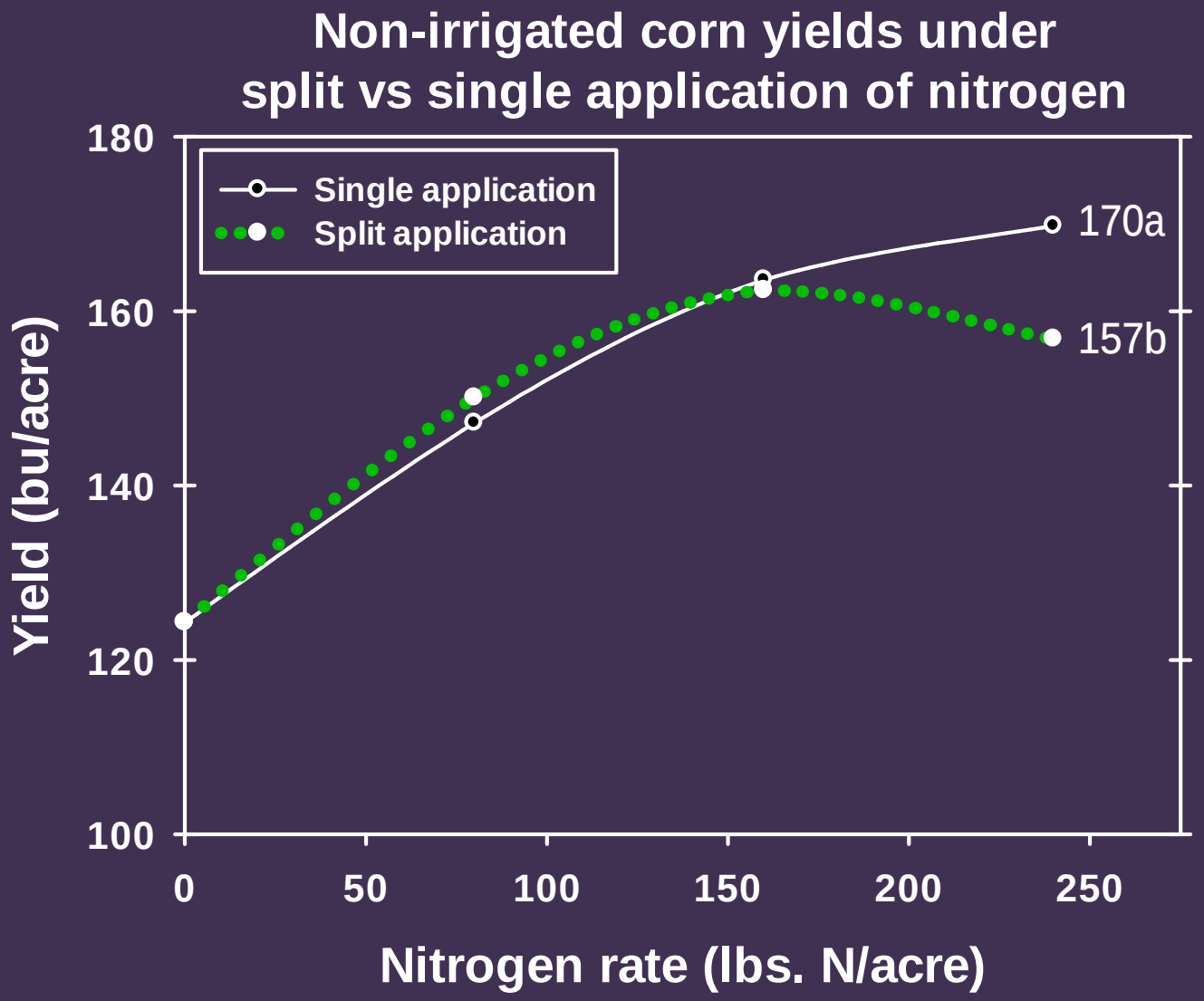
Single application

Split application

Split application – Macon Ridge



Split application – Dean Lee



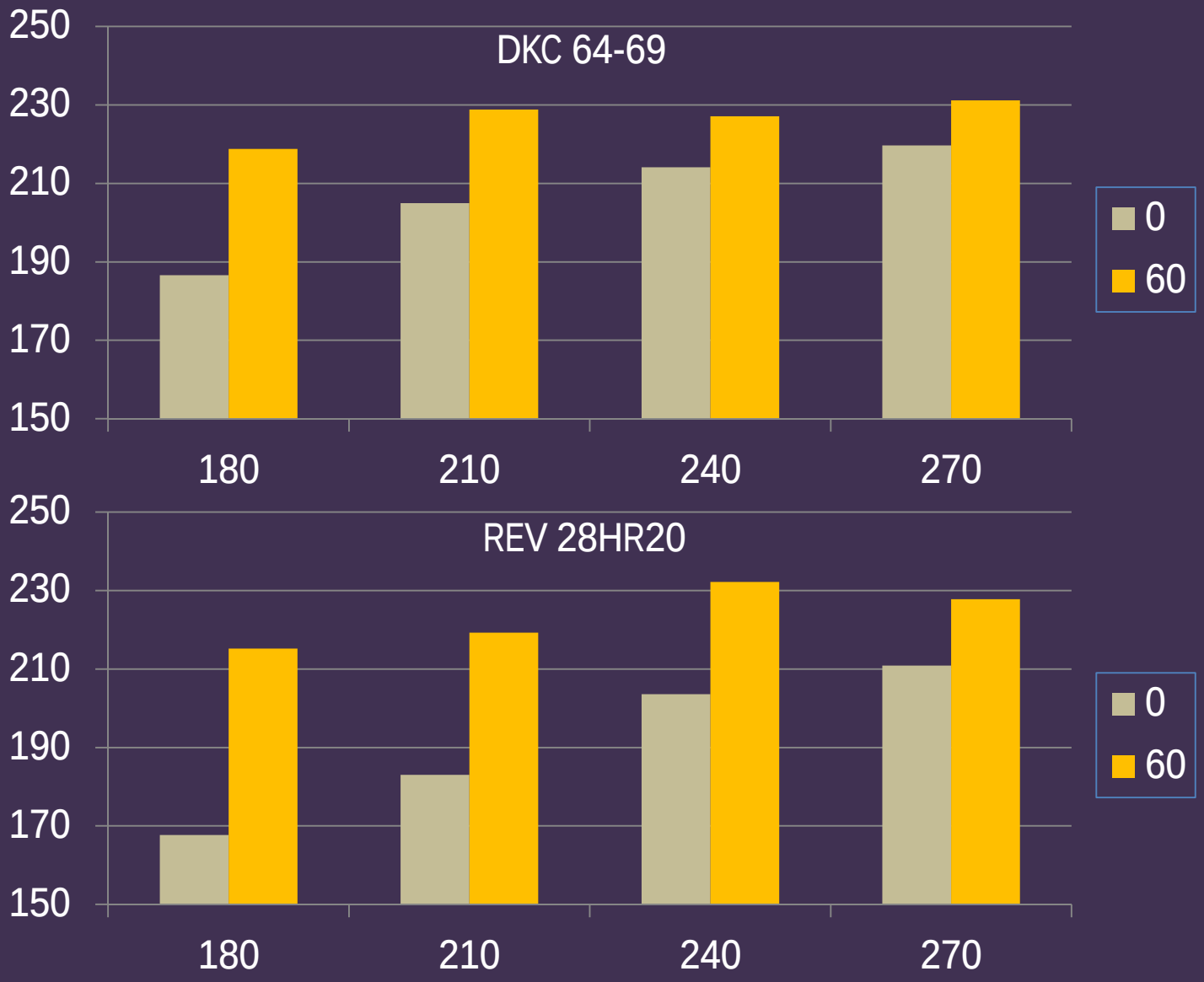
Additional applications

- NERS – St. Joseph
- Sharkey clay - irrigated
- Early season N, with and without N at tassel
- Two hybrids
- Five plant populations
- Planted April 9

Seeding rate effect (flex ear hybrids)

Seeding rate (seed/a)	Yield (bu/a)	Plants (pl/a)	Seed wt (g/100)	Kernels (no./ear)
26,400 (24,000)	213.0	28,400	37.6*	507*
26,400 (24,000-cone)	199.2	27,870	36.8	498
30,800 (28,000)	211.6	30,820	36.1	481
35,200 (32,000)	219.3*	34,970	35.3	449
39,600 (36,000)	213.6	37,600	34.7	417
44,000 (40,000)	216.6*	43,020*	33.7	375
LSD $_{(0.10)}$	5.6	700	0.7	14

Additional applications



Additional applications

Early-season N	Early silk N	Total N	AVG	Difference
---------- (lb/acre) ----------			---------- (bu/acre) ----------	
180	0	180	177.6	
	60	240	217.0	39.4
210	0	210	193.7	
	60	270	224.1	30.4
240	0	240	209.2	
	60	300	229.8	20.6
270	0	270	215.3	
	60	330	229.5	14.2
$LSD_{(0.10)}$ early N x late N				6.5
$LSD_{(0.10)}$ H x early N x late N				NS

1st-year indications

- Heavier irrigated soils – full rate + late N
- Silt loam irrigated soils – full rate + late N
- Dryland corn – full rate then check soil moisture at tassel
- Still need optimum pollination period (2012)

Nitrogen Response Trial

St. Joseph, clay, <12 lbs NO_3-N/A

Winnsboro, silt loam, 33 lbs NO_3-N/A

Samples pulled: 0-6 and 6-12 inches

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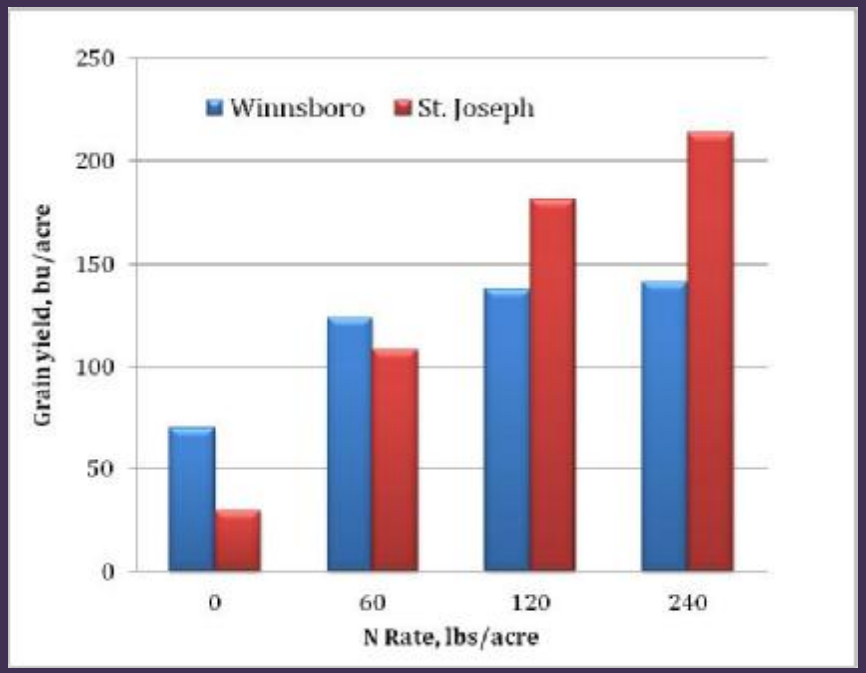
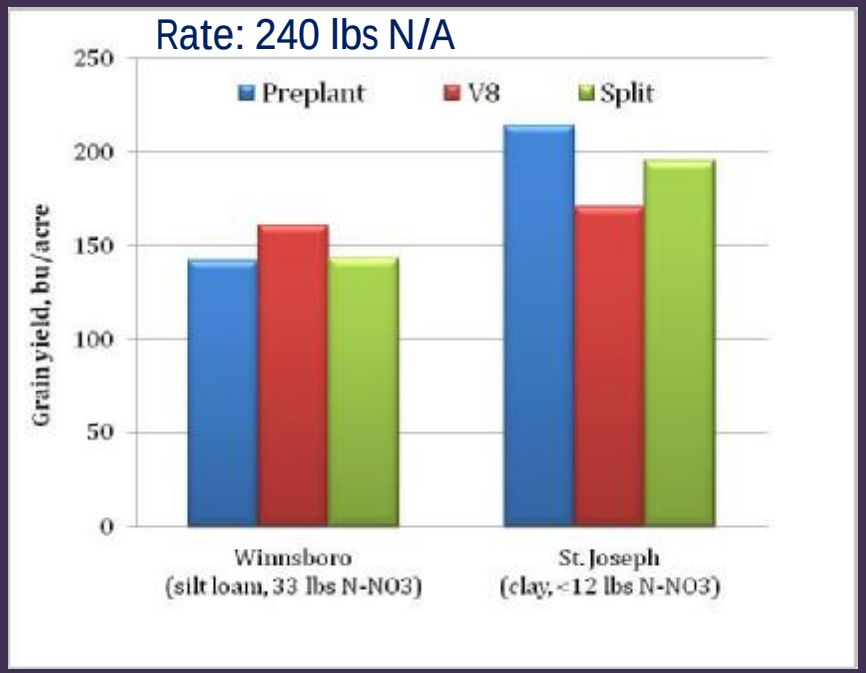
Nitrogen Response Trial



Corn in St. Joseph was more responsive to N than in Winnsboro.



Delayed N application resulted in large reduction in yield in St. Joseph but not in Winnsboro.

Soil nitrate test (at V8) was higher in Winnsboro

Evaluation of Midseason N Rate Estimation Procedures

Soil	Midseason N Rate Estimation Procedure	Total N Applied lb ac^{-1}	Yield bu ac^{-1}	N Fertilizer Use Efficiency (%)	*Net Return to N Fertilizer, $ ac^{-1}
Sharkey clay (St. Joseph)	Yield goal, PSNT	240	207	52	1138
	Sufficiency concept	127	168	76	927
	Sensor-based	175	185	62	1020
Gigger silt loam (Winnsboro)	Yield goal, PSNT	241	150	23	413
	Sufficiency concept	128	142	39	432
	Sensor-based	142	145	37	447

Recommendation: 240 lbs N/ac

Corn grain price per bushel - $7.42; N fertilizer cost (as UAN32) - $0.76/lb

* Computed as = ([$Yield_{fertilized\ plot}$ – $Yield_{check}$] X grain price) – (Total N applied X N fertilizer cost)

Sufficiency concept: (Chlorophyll reading check plot/chlorophyll reading highest N plot) < 95% then add 90

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On-Farm Demonstration

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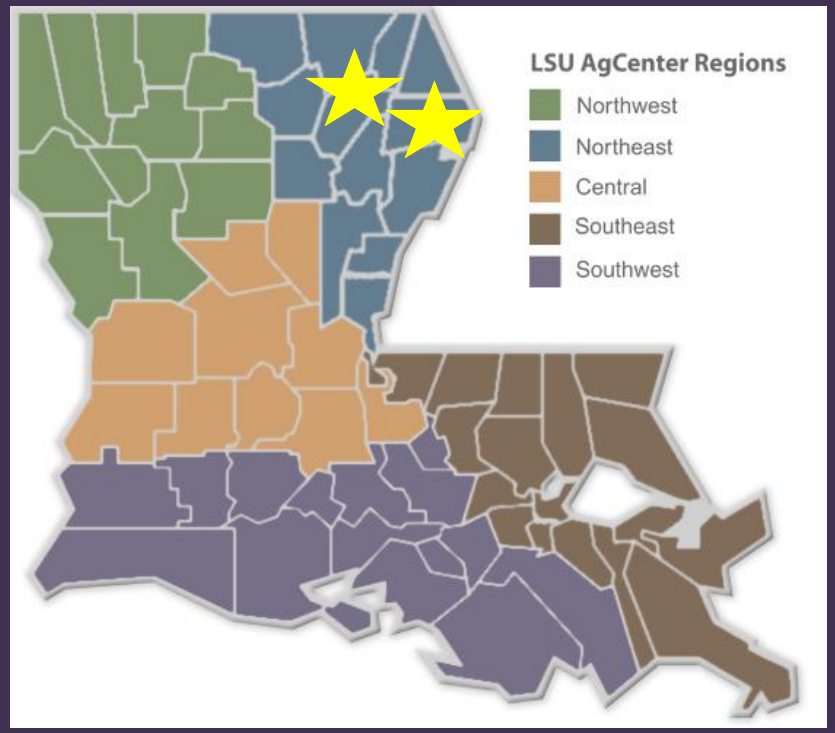
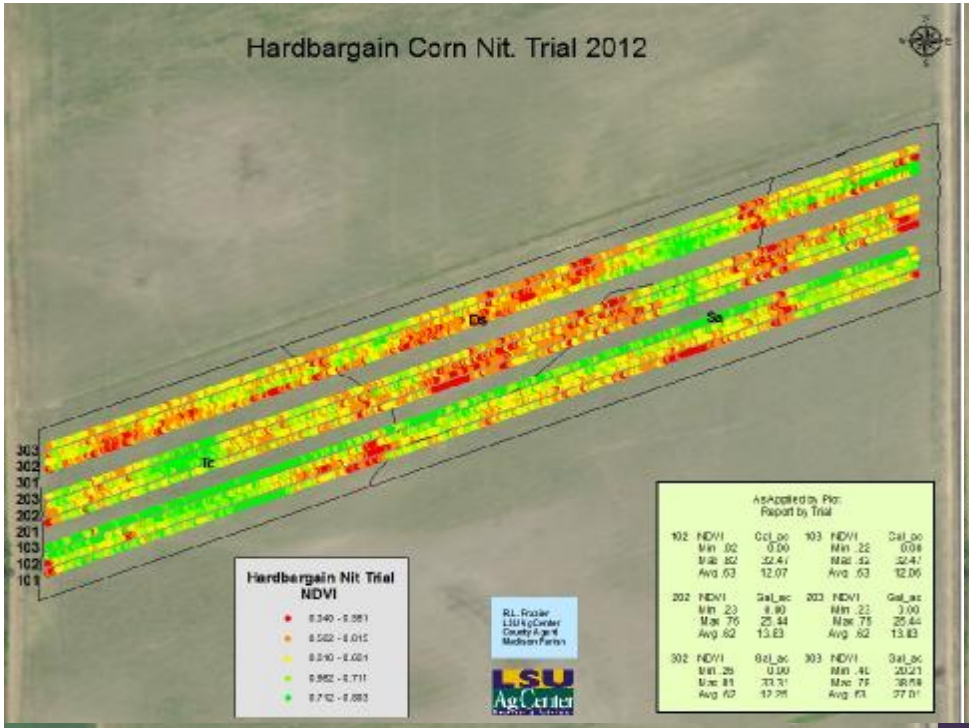
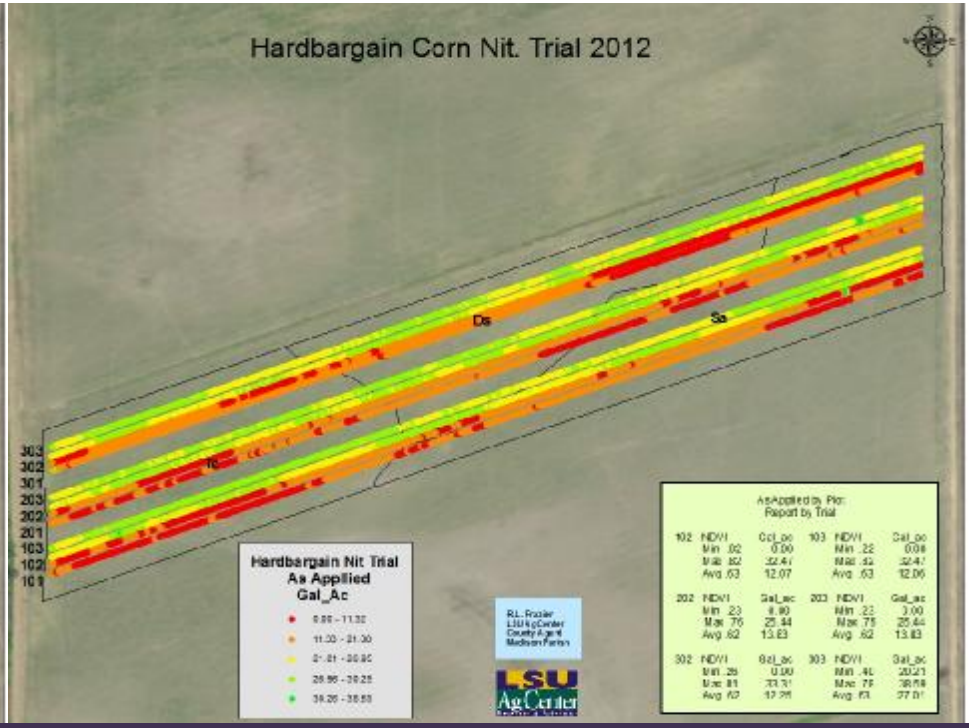
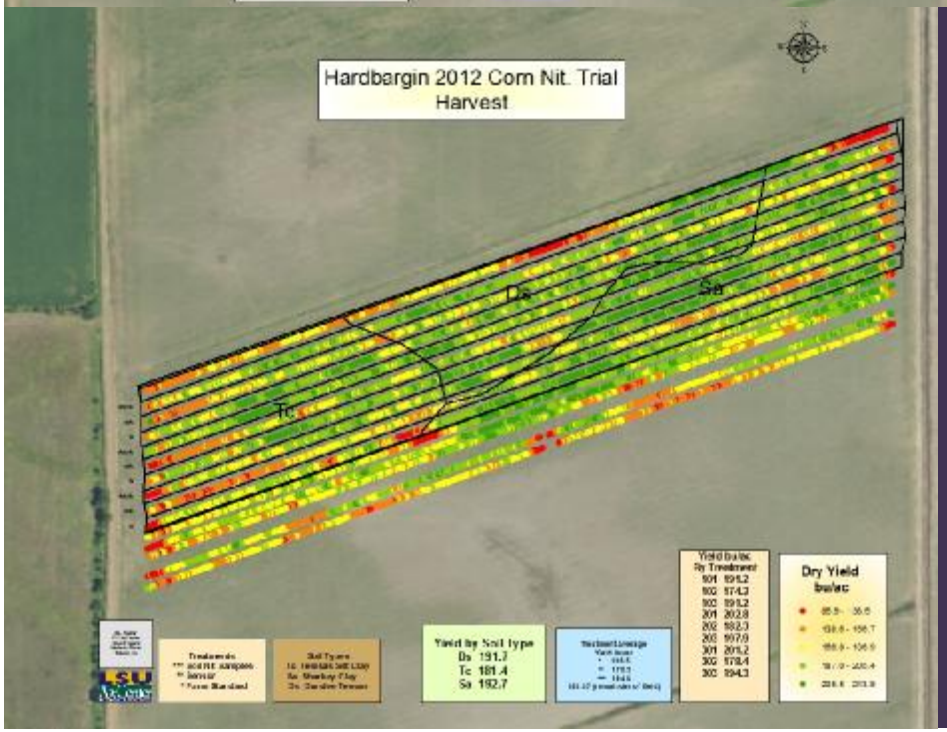
On-Farm Demonstration



- Collins – Madison Parish
- Harbargain – West Carroll Parish







The learning curve: trouble with application delivery

Plot	Total Nit/a		Yield
Grower's Standard	51 gal	180 lbs N	201 Bu/A
Sensor-Based	39 gal	138 lbs N	181 Bu/A
Yield Goal & soil NO3	52 gal	184 lbs N	198 Bu/A

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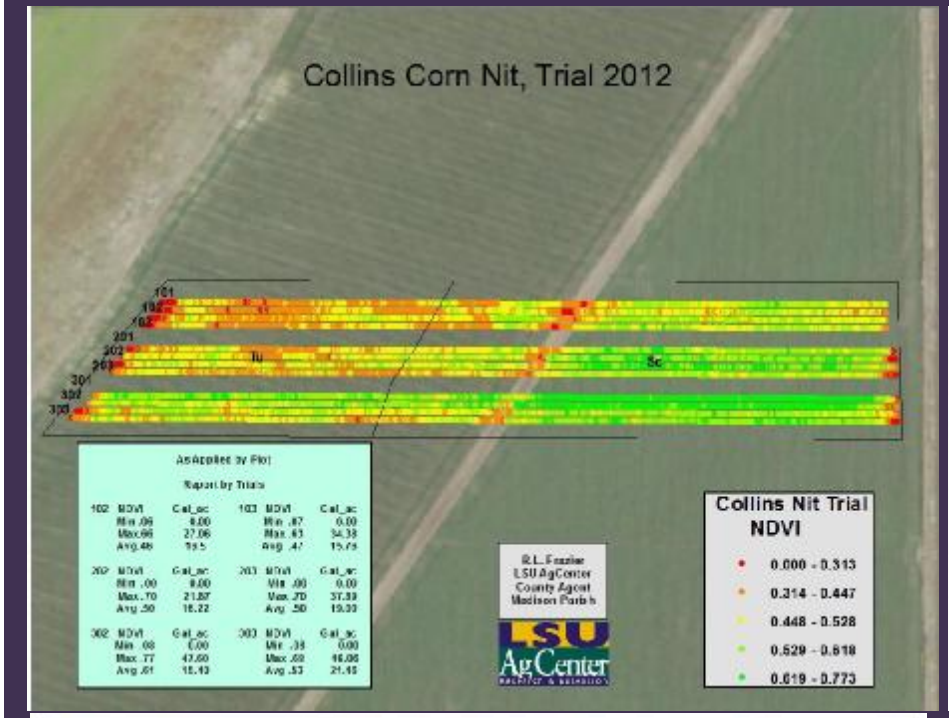

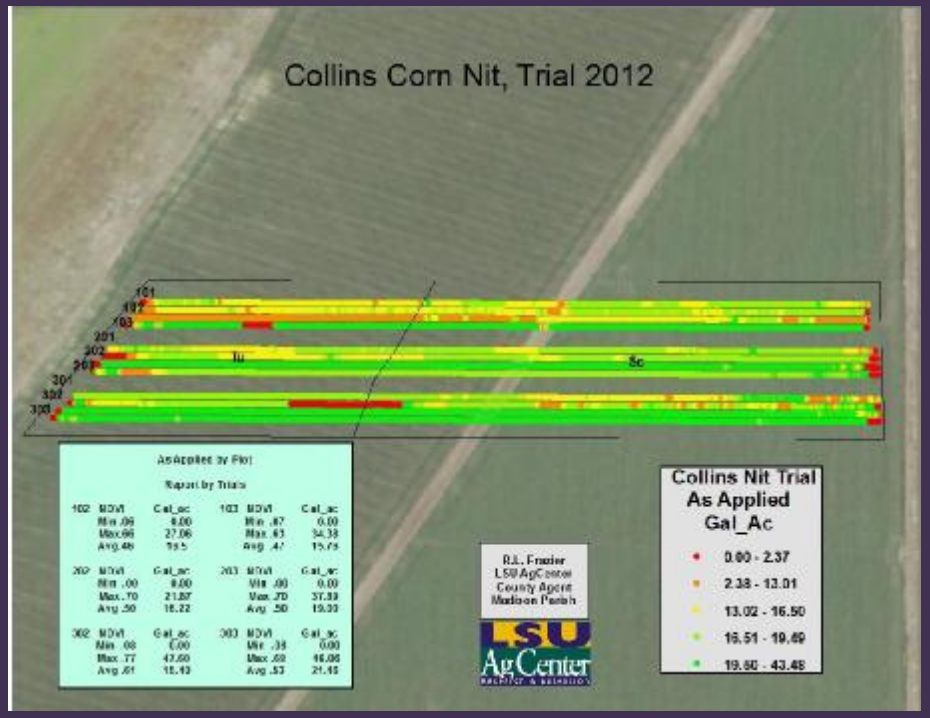

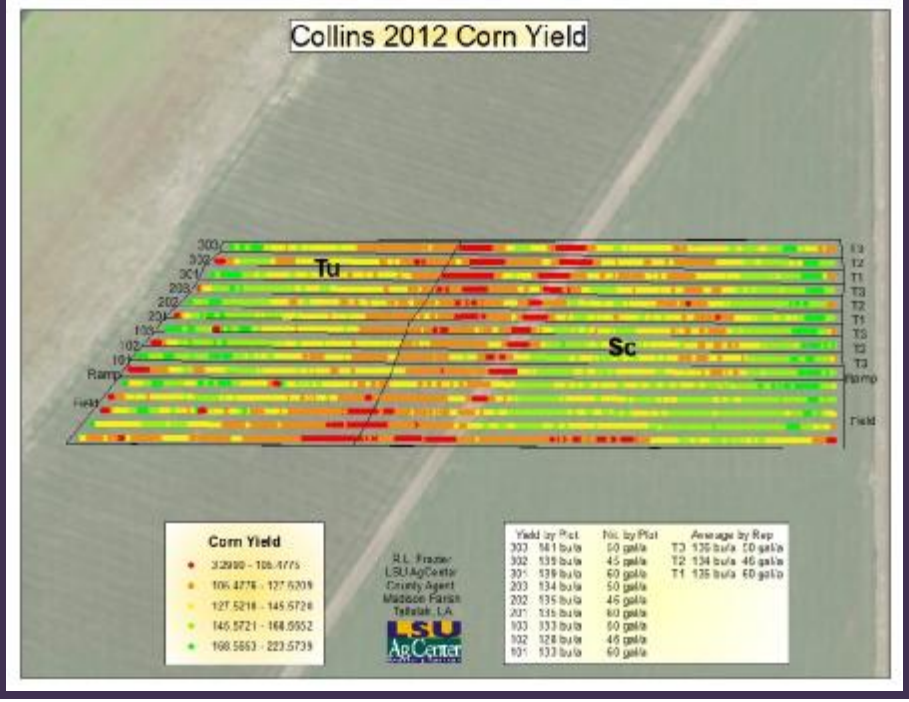

Plot	Total Nitrogen/A		Yield
Farmer's Standard	60 gal	212 Units N	135 Bu/A
Sensor-Based	46 gal	164 Units N	134 Bu/A
Yield Goal & soil NO3	50 gal	177 Units N	136 Bu/A

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Highlights

- Delayed, one-time N application may result in yield reduction if available soil N is low at planting (our study showed <12 lbs NO_3-N).
- For split-applied N, corn grown on heavy textured soil would require higher preplant N rate than corn on lighter textured soil.
  - Knowledge on soil NO3 level is valuable to make decision.

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Questions