Nitrogen Rates for Wheat across Fall Tillage Treatments

Kip Balkcom and Charles Burmester

USDA-ARS and Auburn University

Background

- ✓ Alabama growers were modifying typical management practices to maximize wheat yields.
- ✓ These changes include planting into existing crop residue with higher seeding rates and higher nitrogen rates.
- ✓ We need to determine optimal N rates and timing across tillage systems to maximize wheat yields in the most

Started in 2007.

Wheat prices were going up, more farmers interested in growing wheat.

Also interested in maximizing profits through reducing trips through conservation tillage systems, optimizing nitrogen applications.

Tillage and Nitrogen Study for Wheat
12 site-years (2008 – 2011)

TVS
Decatur silt loam

EVS
Compass loamy sand

WGS
Dothan fine sandy loam

GCS
Marlboro very fine sandy loam

Several sites throughout Alabama.

This presentation will focus on the three central/southern sites on coastal plains soils.

Experimental Design

Split Plot Design

Main plot

Two tillage systems

Conventional and Non-inversion

Subplot

Nitrogen rates and timing

12 different combinations

4 replications

About 32 seeds/square foot.

Conventional tillage: Usually chisel plow and field cultivation to smooth out the field.

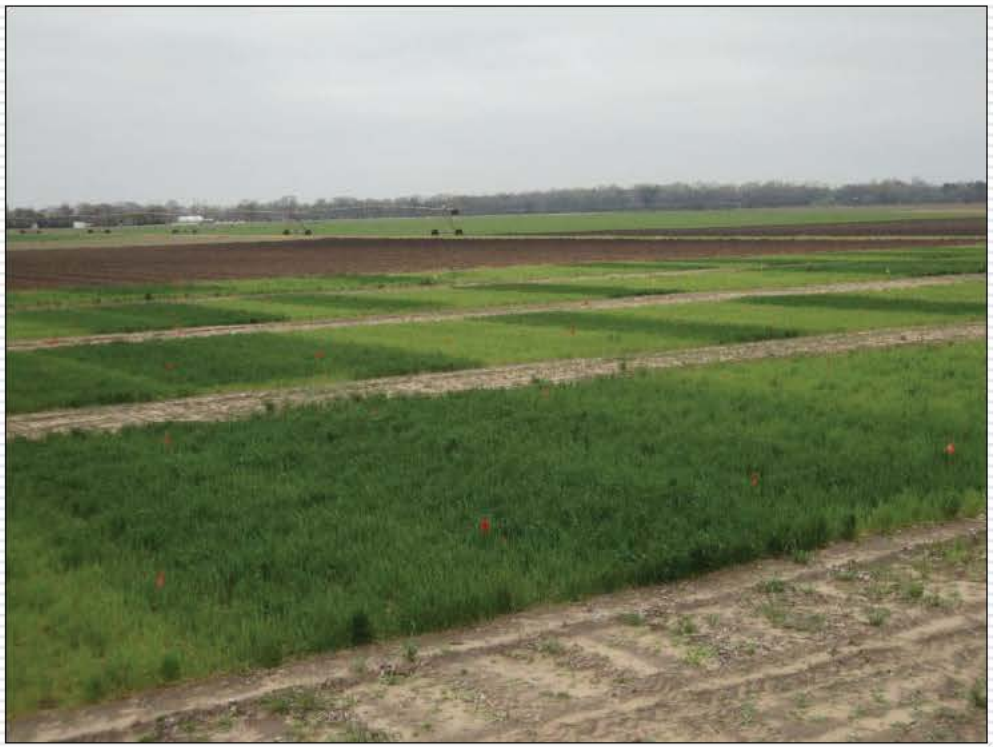
Non-inversion tillage: KMC subsoiler/leveler to eliminate any hardpan and leave residue on soil surface.

Fertilizer Treatments

Treatment #	Fall applied	Feekes 4	Feekes 6
	----------lb N ac^{-1}----------		
1	0		60
2	0		90
3	0		120
4	0	30	30
5	0	45	45
6	0	60	60
7	20	40	
8	20	70	
9	20	100	
10	20		40
11	20		70
12	20		100

Used variations of traditional rates of 60, 90, and 120 lb N/acre.

Previous Wheat N Recommendations



Fall Application

20 lb N ac^{-1}

Spring Application

60 – 100 lb N ac^{-1} by Feeke's GS6

Varied applications between fall and two spring growth stages.

Photo above (Headland, AL) shows effects of different nitrogen applications.

Tiller Counts - GS4

	Tiller Counts, no./ft^2					
	Tillage			Fall N		
Location	Conventional	Non-inversion	P ≤ 0.10	0	20 lb/A	P ≤ 0.10
TVS-08	110	125		118	117	
TVS-09	94	76		87	83	
TVS-10	57	60		54	64	x
TVS-11	104	105		106	103	
EVS-09	80	102	x	85	96	x
EVS-10	48	56		48	55	x
EVS-11	89	95		86	98	x
GCS-09	84	84		80	88	x
GCS-11	150	135	x	137	147	x
WGS-09	63	75	x	60	78	x
WGS-10	39	49	x	42	46	x
WGS-11	60	75		59	76	x

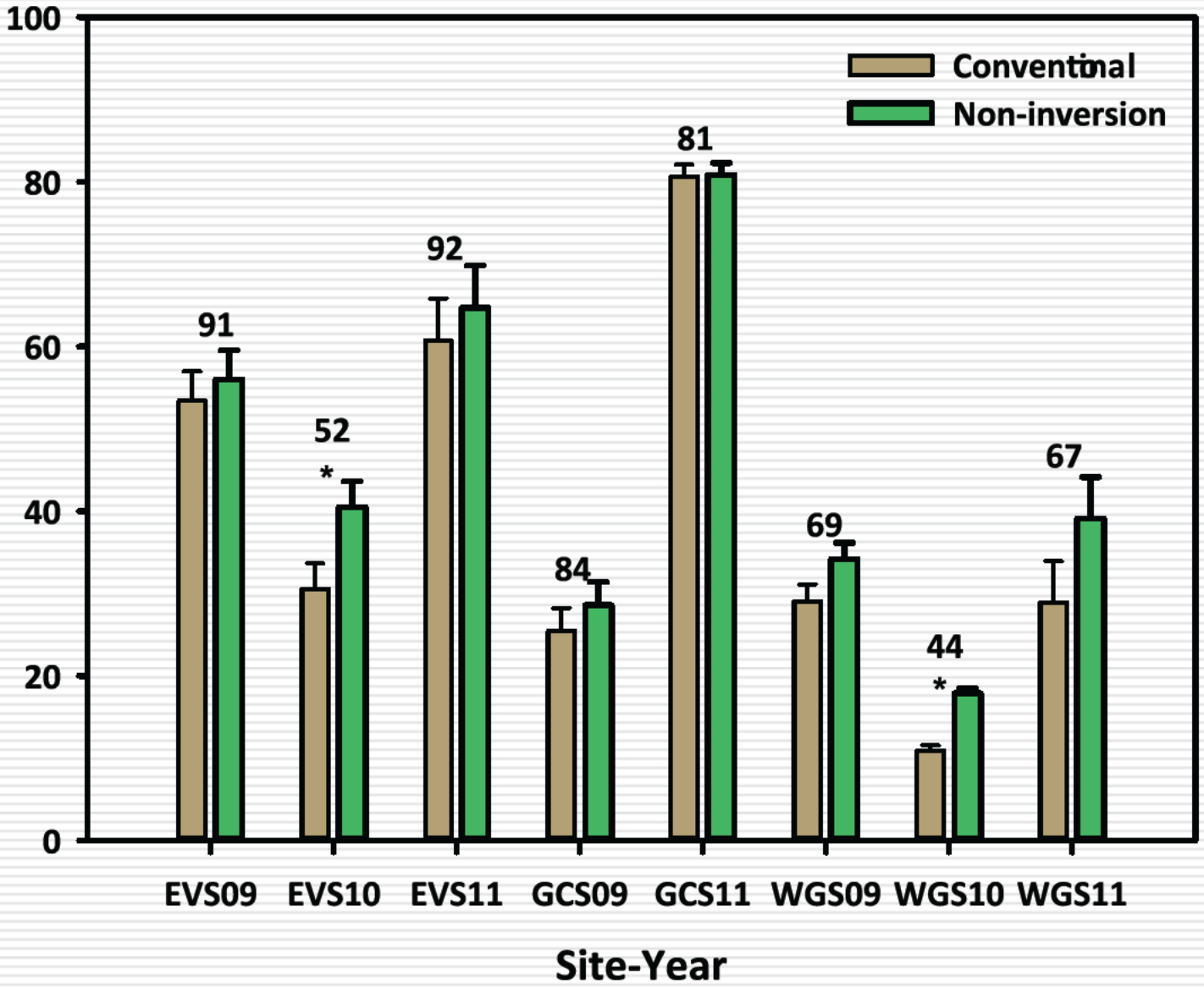
Tiller counts measured at Growth Stage 4.

TVS = Tennesee Valley (Belle Mina, AL); EVS = E.V. Smith (Shorter, AL); GCS = Gulf Coast (Fairhope, AL); WGS = Wiregrass (Headland, AL)

Only four site-years had significant tillage effects on tiller numbers (in 3 of the 4, non-inversion had greater number of tillers).

All site-years in central or south Alabama, with sandy, coastal plains soils, responded to fall applications of nitrogen.

Tillage Means - Yield



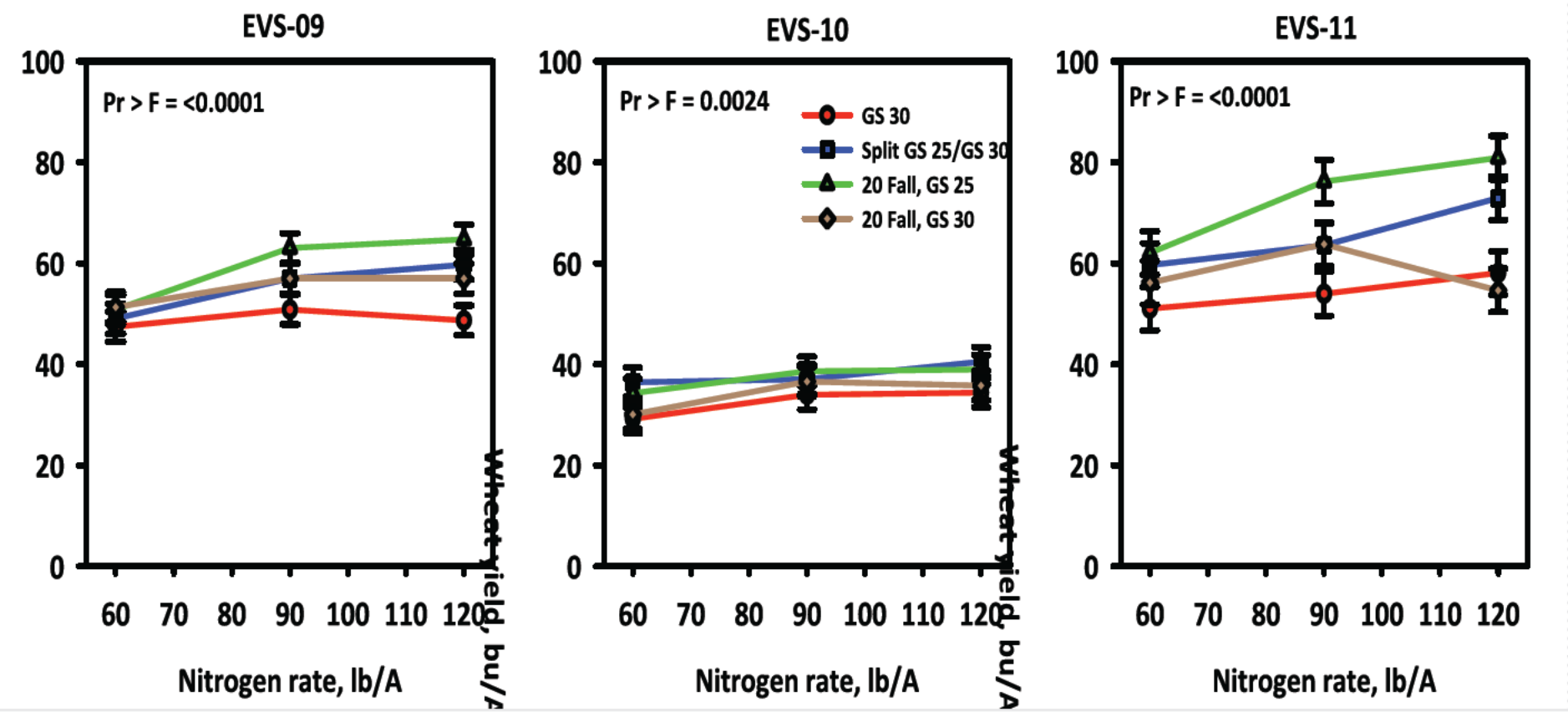
Lots of variability in yields.

Numbers above bars is the number of tillers at GS 4.

Only two site-years had a significant yield response to tillage (EVS10 and WGS10). In both cases, non-inversion tillage had greater yields.

Non-inversion tillage works!

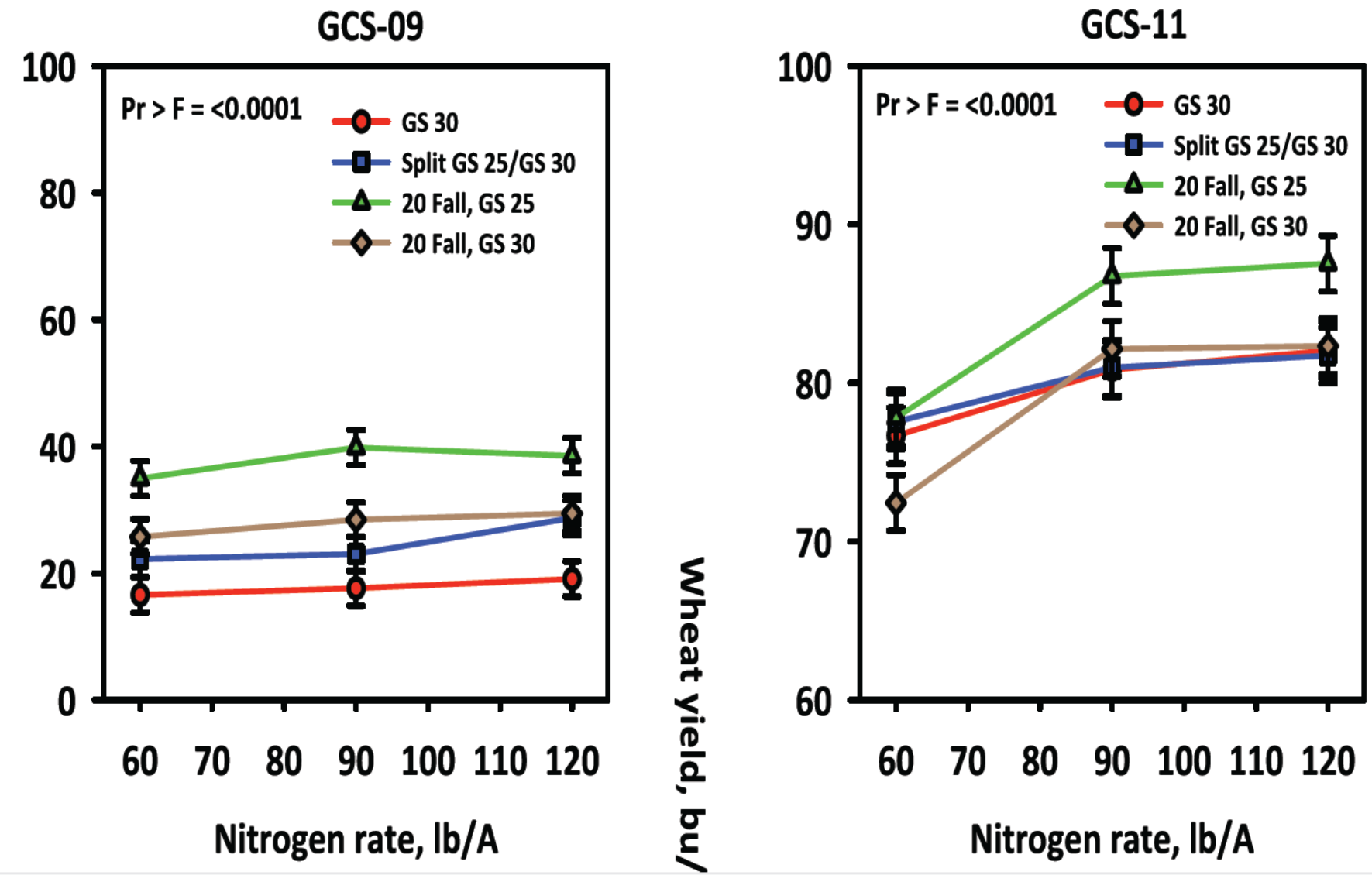
EVS Wheat Yields



Wheat yields at E.V. Smith.

20 lbs N in the fall, 70 lbs N at Feekes 4 had best yields overall. Adding more nitrogen in the spring (120 lb N total) didn't help much.

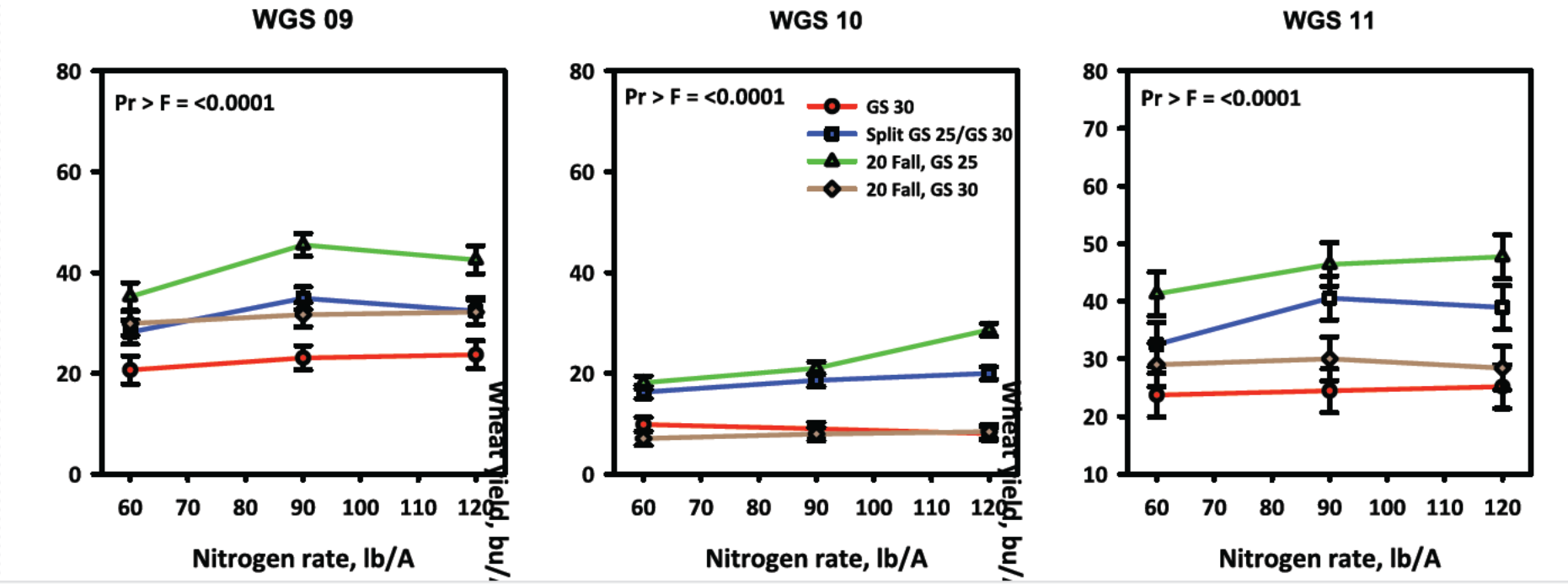
GCS Wheat Yields



Gulf Coast yields.

20 lbs in fall, 70 lbs in spring had best yields.

WGS Wheat Yields



Wiregrass yields.

Again, 20 lbs N in fall, 70 lbs N in spring had greatest yields.

Conclusions

- ✓ Non-inversion tillage produced comparable yields to conventional tillage.
- ✓ Fall-applied N was necessary for Coastal Plain soils.
- ✓ Nitrogen applied at Feekes 4 is necessary for Coastal Plain soils.

Tillage and Nitrogen Study for Wheat
3 site-years (2012)

EVS
Compass loamy sand

WGS
Dothan fine sandy loam

GCS
Marlboro very fine sandy loam

Follow-up study begun in 2012. Three locations in southern Alabama (E.V. Smith, Wiregrass, Gulf Coast).

Experimental Design

Split Plot Design

Main plot

Two tillage systems

No-tillage and Non-inversion

Subplot

Nitrogen rates and timing

6 different combinations

4 replications

If non-inversion tillage works, would no-tillage also work?

Can fall-applied N rates be increased to encourage even more tillering?

Fertilizer Treatments

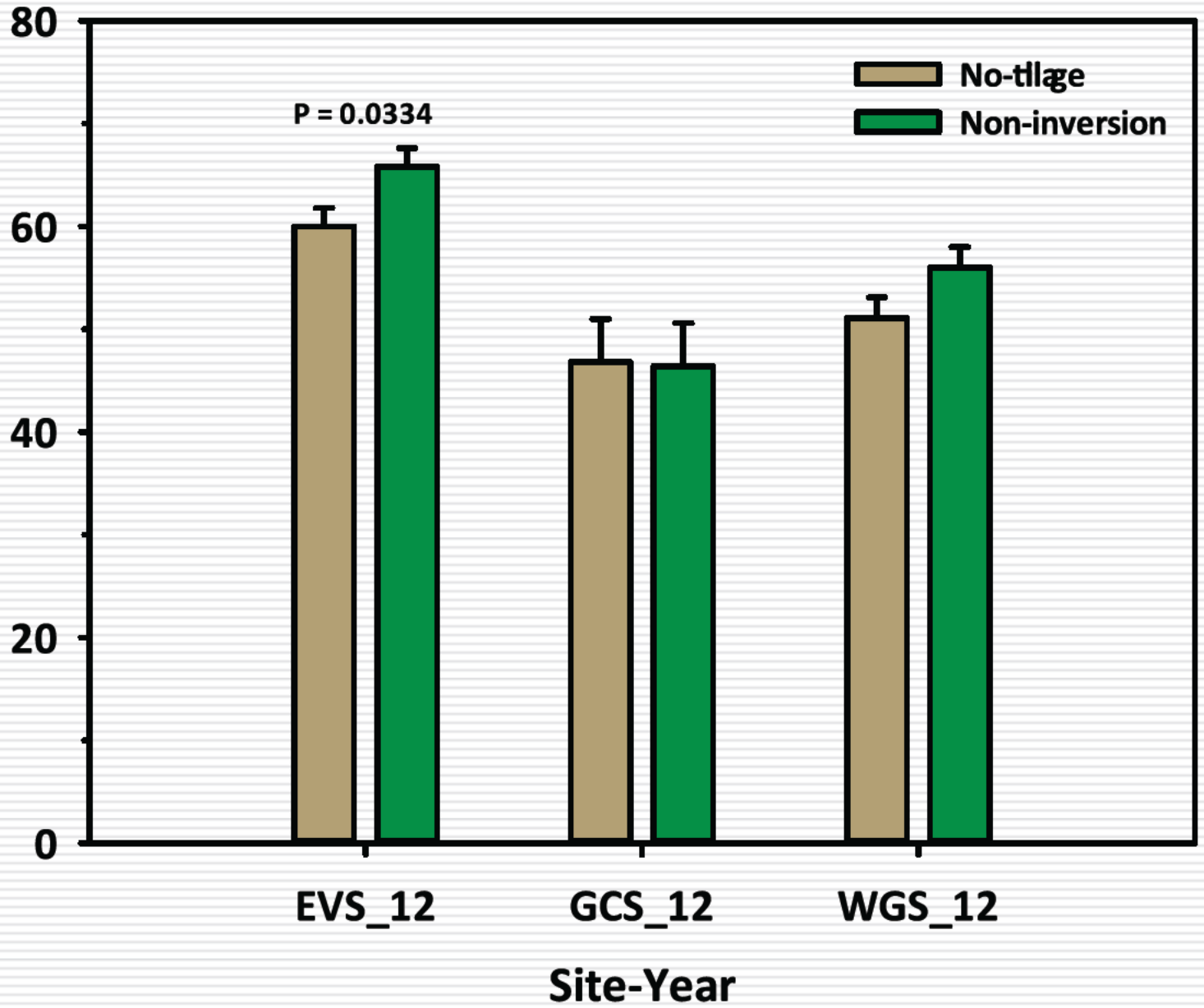
Tillage	Fall applied	Feekes 4	Total N
	----------lb N ac^{-1}----------		
No-tillage	20	40	60
No-tillage	20	70	90
No-tillage	20	100	120
No-tillage	30	30	60
No-tillage	30	60	90
No-tillage	30	90	120
Non-inversion	20	40	60
Non-inversion	20	70	90
Non-inversion	20	100	120
Non-inversion	30	30	60
Non-inversion	30	60	90
Non-inversion	30	90	120

20 and 30 lbs N/acre applied in fall.

Total N rates were 60, 90, and 120 lb N/acre.

The highlighted treatment (in red) was the most successful one in the earlier study.

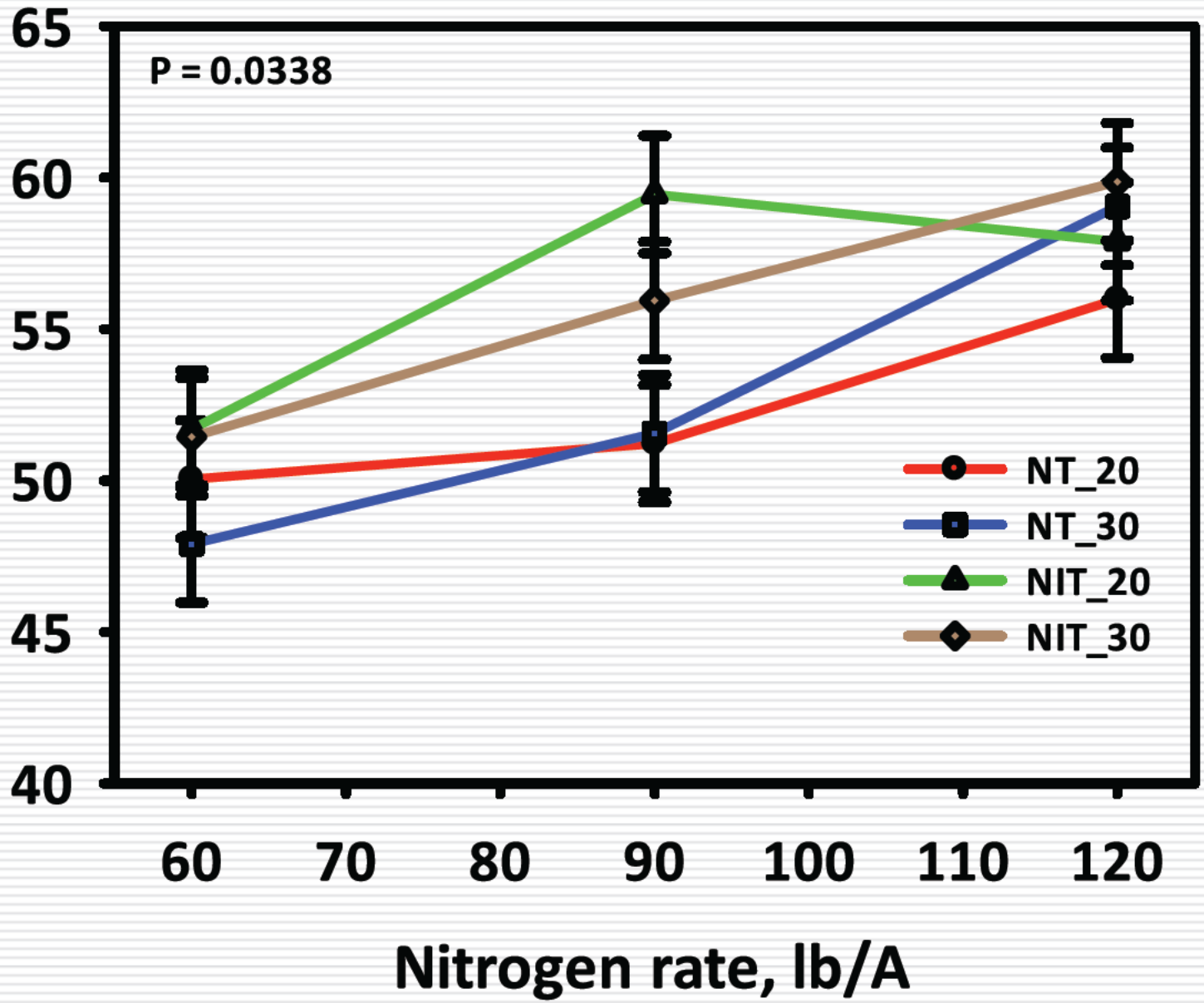
2012 Tillage Means - Yield



Only one site-year had a significant response. (EVS_12).

Non-inversion had better yield.

2012 Wheat Yields



Average response from three sites.

Best average yield came from 20 lb N fall, 70 lb N in spring (Feekes 4).

The two non-inversion tillage treatments (green and brown) had greatest yields at 90 lb N rate.

Thank you!

Financial support provided by:

- Alabama Wheat and Feed Grain Commission
- International Plant Nutrition Institute