

Fertility Research Updates



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2012 Fertility Research Trials (16)

1. **USDA Conservation Innovation Grants (3)**

2. **Fluid Fertilizer Foundation (1)**

- ✓ Cotton: Variable-rate N applications within a field

3. **The Mosaic Company (5)**

- ✓ Corn (3): P, S, Zn: MAP (11-52-0), MES (12-40-0-10S), MESZ (12-40-0-10S-1Zn), MESB (10-46-0-6S-0.4B)
- ✓ Cotton (2): K, S, Zn: DAP vs. MESZ; MOP vs. K-Mag

4. **Advanced Microbial Solutions (2)**

- ✓ Corn (1) & Soybean (1): SoilBuilder AF & Titan

5. **AgXplore International (2)**

- ✓ Corn (1): NZone, Nutrisphere, Agrotain
- ✓ Cotton (1): NZone

6. **The Nachurs Company (2)**

- ✓ Cotton: Foliar fertilizers: 6-24-6, N-Rage, 3-0-20, 13-0-13

7. **Internal Funding (1)**

- ✓ Cotton: N application timing: pre-planting, at-planting, early side dress, & late side dress under early, normal, & late planting dates

Sulfur Effects on Cotton Yields and Quality



Plant S Concentration and S Uptake

Plant Composition:

S: 0.1% – 0.5%

P: 0.3% – 0.5%

Plant Uptake:

Soil: SO_4^{2-}

Air: SO_2



Sulfur Roles in Plant

- ✓ Essential component of some amino acids (methionine, cysteine)
- ✓ Essential for production of protein
- ✓ Promotes activity and development of enzymes and vitamins
- ✓ Helps in chlorophyll formation
- ✓ Improves root growth and seed production
- ✓ Helps with vigorous plant growth and resistance to coldness

S Input to Soil and Loss from Soil

S Input to Soil

- S Fertilizers
- Animal manures and biosolids
- Plant residues
- Atmospheric deposition

S Loss from Soil

- Crop harvest
- Leaching
- Volatilization
- Runoff and erosion



Probable Causes for S Deficiency

- Low soil S: Sandy soils, low organic matter
- Excessive rainfall
- Increased use of S free fertilizers
- Declined use of S containing pesticides
- Greater S removal from soil by crops
- Less S deposition to soil from the atmosphere

Sulfur Deficiency in Plant

Symptoms:

- Yellow plants
- Slow growth
- Low vigor
- Delayed maturity
- Low yield and quality



Critical S Concentrations (U of G):

Corn: 0.13% in leaf

Cotton, soybean: 0.20 - 0.25% in leaf

Sulfur Deficiency vs. N Deficiency

S deficiency:

begins in the young, upper leaves first. A severe sulfur deficiency causes the entire plant to turn yellow.



N deficiency:

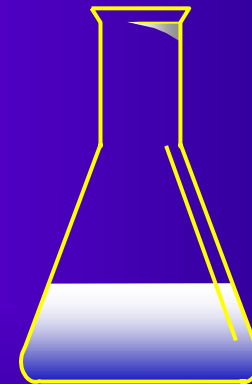
begins in the older leaves and progresses up the plant.

Soil Test and Plant Analysis

- ✓ **Soil Test of S**
Soil available S



- ✓ **Plant Tissue Analysis of S**
Total S concentration



Sulfur Fertilizers and Applications

S Fertilizers:

Ammonium sulfate (24% S)

Potassium sulfate (18% S)

Potassium-magnesium sulfate (22% S)

Magnesium sulfate (13% S)

Gypsum (19% S)

Elemental sulfur (90-100% S)

Application Rate: 15 to 25 lb S/acre

Application Timing: At planting or along with post-plant nitrogen applications

More Research on S Needed

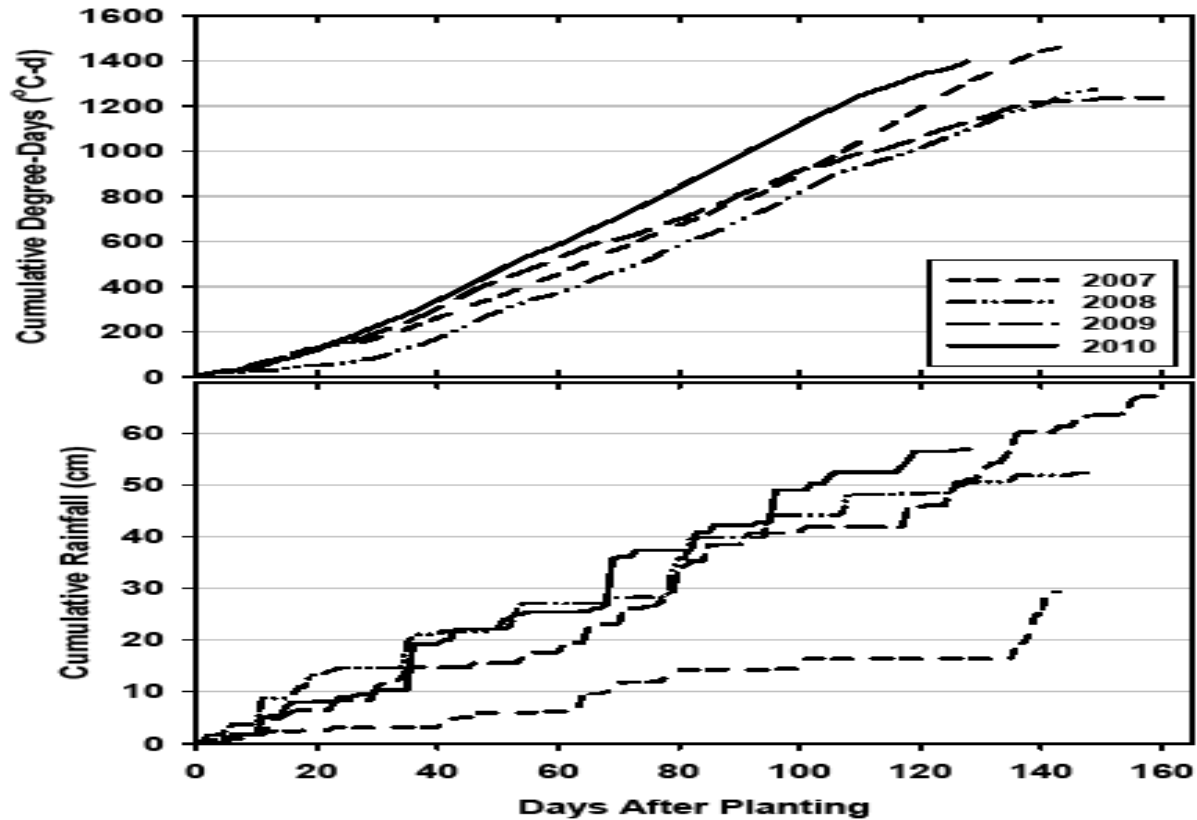
- ✓ Increased use of S free fertilizers; greater S removal from soil by crops; less S deposition to soil from the atmosphere; and less use of S-containing pesticides.
- ✓ Information about the effects of S on cotton production was limited.
- ✓ No guidelines were available in TN for correcting S deficiencies in cotton.

Field Trial

- **Location:** Jackson
- **Duration:** 2007-2010
- **Soil:** No-tilled, non-irrigated Dexter loam
- **Soil Test S:** Low (14 lb/a)
- **S Rate:** S: 0, 10, 20, & 30 lb S/a, K_2SO_4 , before planting
- **N & K Rates:** 80 lb/a N & 120 lb K_2O/a
- **Cultivar:** PHY375WRF



Weather Conditions (2007-2010)



S Deficiency Symptoms



Leaf S Responses to S Applications at Early Bloom

S Rate	2007	2008	2009	2010
(lb/a)	----- % -----			
0	0.233c	0.275d	0.309b	0.231d
10	0.291c	0.310c	0.379ab	0.314c
20	0.364b	0.348b	0.415a	0.366b
30	0.405a	0.384a	0.448a	0.401a
Sig.	***	***	*	***

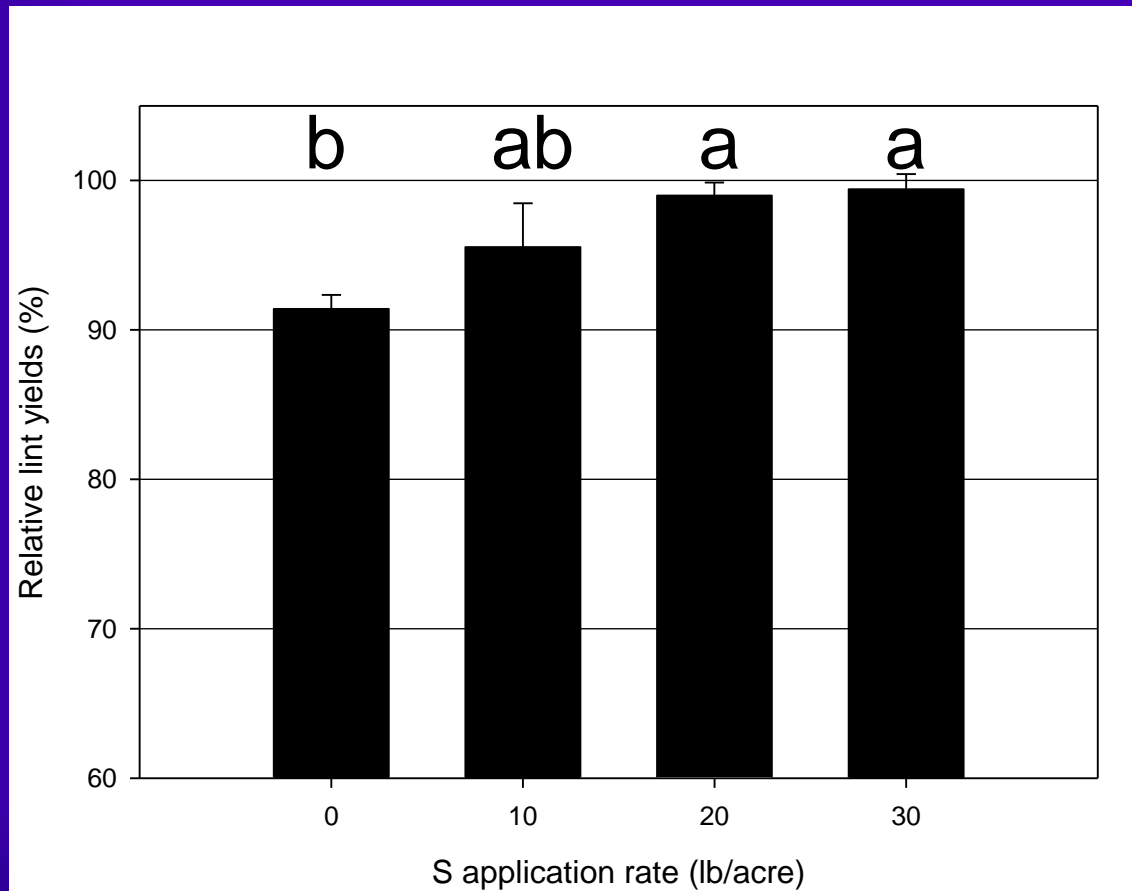
Soil S Contents at Mid-Bloom

S Rate	2007	2008	2009	2010
(lb/a)	----- lb/a -----			
0	21.3b	27.4b	20.8	36.0c
10	22.8b	25.8b	23.0	39.2bc
20	30.5b	28.0b	24.0	40.2b
30	40.2a	30.6a	27.6	44.6a
Sig.	**	*	ns	**

Lint Yield Responses to S Applications

S Rate	2007	2008	2009	2010
(lb/a)	----- lb/a -----			
0	657	2083b	1280	1463
10	716	2160ab	1307	1619
20	720	2221a	1413	1621
30	753	2253a	1388	1685
Sig.	ns	**	0.0504	ns

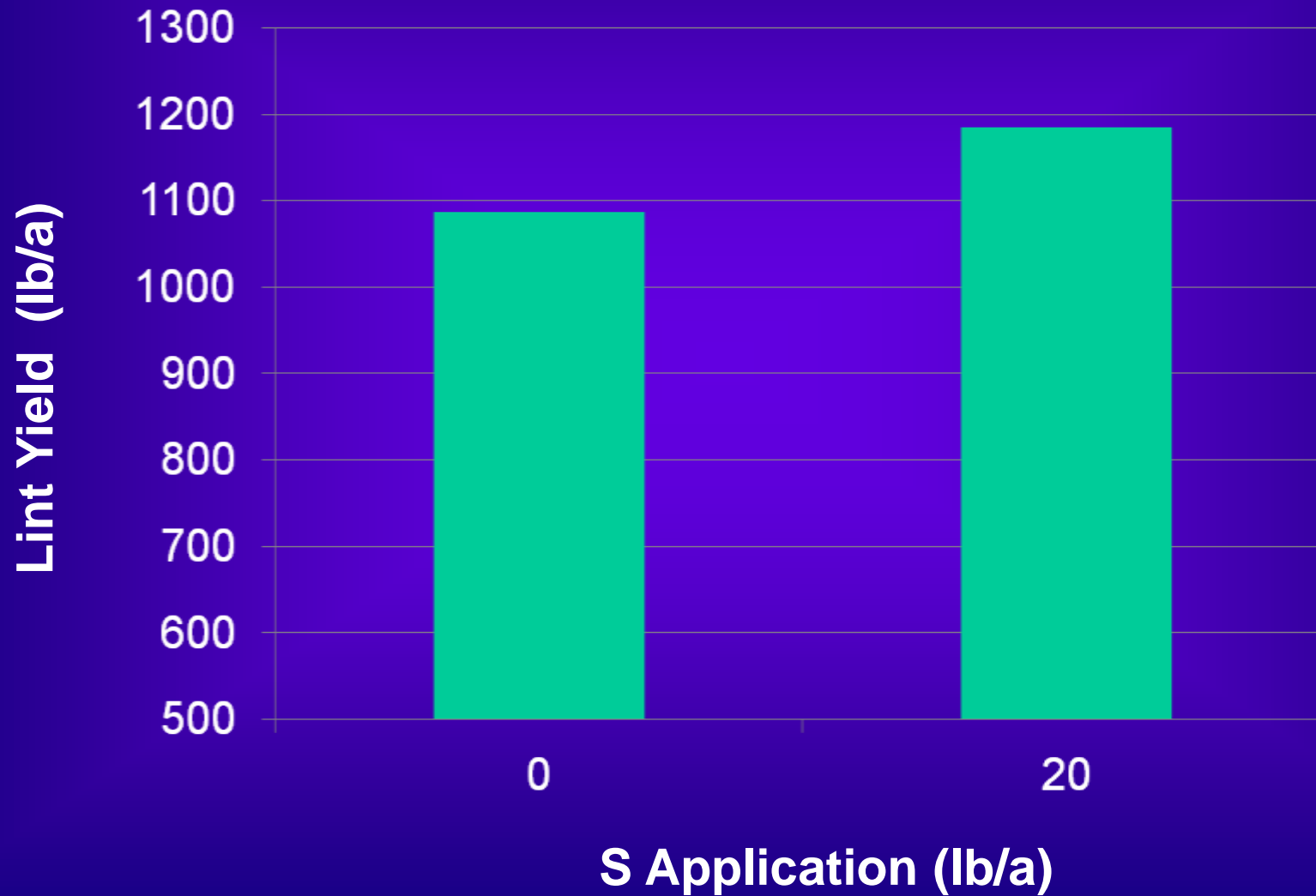
Lint Yield Responses to S on 3-Yr Averages



Fiber Quality Responses to S on 3-Yr Averages

S Rate	GTO	Fuzzy Seed Index	Mic	UHM	Uniformity	Strength	Elongation
lb/a	%	g/100		in.	%	g/tex	%
0	41.9	9.52	3.91b	1.15	82.2	27.9	5.15
10	42.2	9.55	4.05a	1.14	82.2	27.5	5.16
20	41.9	9.54	4.07a	1.13	82.1	27.4	5.19
30	42.2	9.51	4.09a	1.13	82.2	27.4	5.24
Sig.	ns	ns	**	ns	ns	ns	ns

Lint Yield Responses to S at Milan REC in 2012



Take Home

- Application of 20 lb S/a may be beneficial for cotton on soils tested low for S in TN and similar environments.
- More attention needs to be paid to S requirements of cotton in TN and similar environments where S deficiencies may become more common due to increased use of S free fertilizers, adoption of high yielding cultivars and more intensive cropping systems, and lower atmospheric S deposits.

References

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