

FLUID NITROGEN/SULFUR FORMULATIONS TO MITIGATE SULFUR DEFICIENCIES AND MAXIMIZE COTTON YIELDS IN THE UPPER SOUTHEAST COASTAL PLAIN

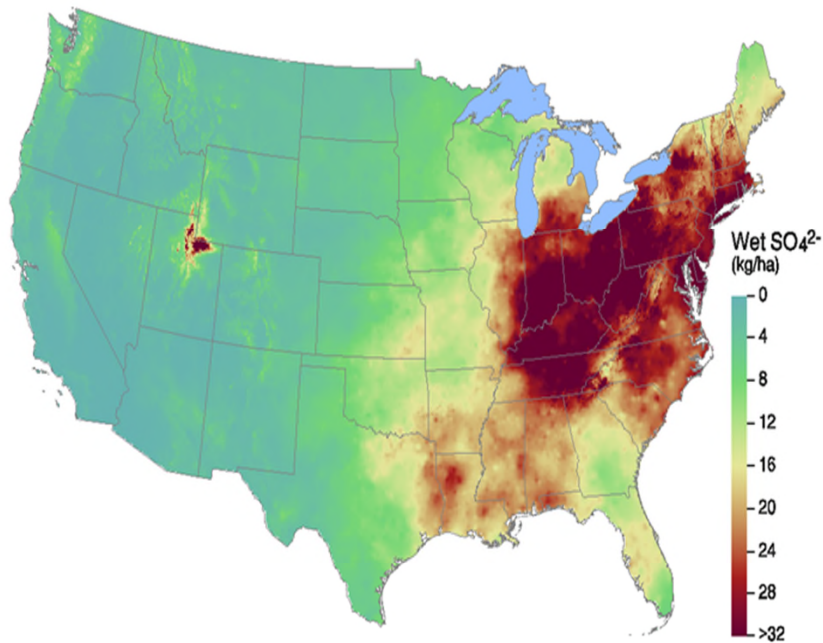
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2017 Fluid Fertilizer Forum
Scottsdale, AZ

JUSTIFICATION

- Sulfur is an essential plant nutrient, though required in smaller quantities than N, P and K.
 - Used to create proteins which regulated photosynthesis and N metabolism.
- Sulfur is mobile in soil systems and is taken up by plants as sulfate, SO_4^{2-} , thus making it prone to leaching like nitrate (NO_3^-).
- Sulfur is immobile in plants, therefore remobilization of S will not occur and deficiencies will be observed in the upper portion of the canopy
- The Clean Air Act has resulted in cleaner air with lower S deposition and more common S deficiencies occurring in cotton

WET SULFATE DEPOSITION

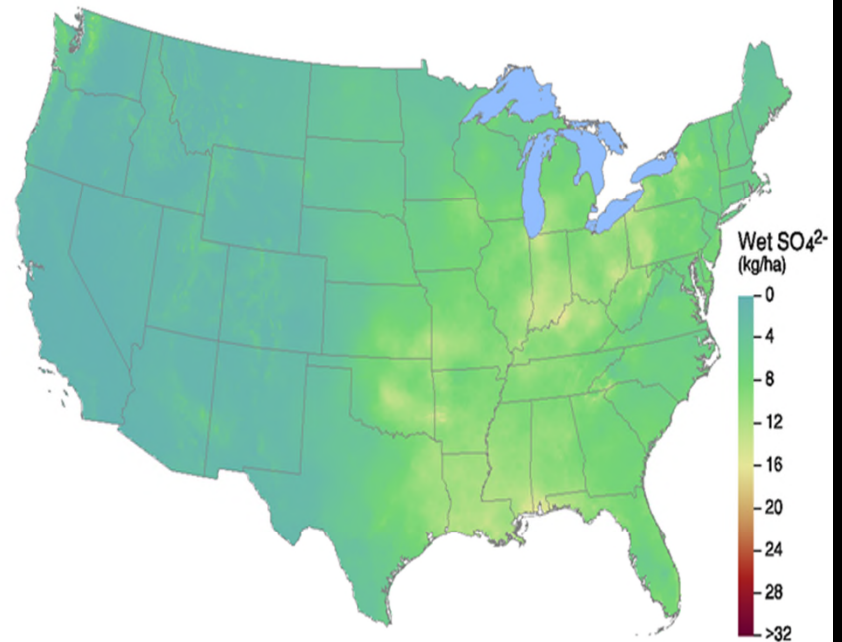


Source: NADP/NTN & PRISM

USEPA/CAMD 05/17/11

[/data/arc/ryson/gis/050901/out_4-0909](#)

1989



Source: NADP/NTN & PRISM

USEPA/CAMD 10/09/14

[/data/arc/ryson/gis/2013/out_4-2013](#)

2013



1519 lbs of lint per acre



1863 lbs of lint per acre



OBJECTIVES

- Evaluate granular and fluid N sources with varying S application rates on in-season NDVI measurements, petiole and leaf S status during the first week of bloom, and lint yield of cotton in the upper southeast coastal plain.
- Determine the effect of high N:S ratios in side-dress fluid N sources at varying N application rates on NDVI, petiole and leaf N:S ratios, and lint yield in the upper southeast coastal plain.

MATERIALS AND METHODS

- Three locations during 2016
- Randomized complete block design with 17 treatments and 4 replications
- Compared granular and fluid side-dress sources
 - Urea + ammonium sulfate (AMS)
 - UAN32 + ammonium thiosulfate (12-0-0-26S)
 - 24-0-0-3S
 - 24-0-0-6S
 - 24-0-0-9S
- NDVI measured from a week after fertilizer application for five weeks (data not shown)
- Petiole and leaf tissue samples were collected from each plot during the first week of bloom
- Yield was measured from the center two rows of the four row plot
- PROC GLIMMIX was used for ANOVA with an $\alpha = 0.05$.
 - Treatment design was
 - 2 S Sources x 4 S rates
 - 4 Fluid Formulations x 3 N rates



NITROGEN AND SULFUR TREATMENTS

| Trt | N-S Formulations | Total N | Side-dress N | Sulfur | Total N:S | Fluid Fertilizer N:S |
|-----|---------------------------|------------------------------------|--------------|--------|-----------|----------------------|
| | | ----- lbs acre ⁻¹ ----- | | | | |
| 1 | No Applied N or S Control | - | - | - | - | - |
| 2‡ | Urea | 100 | 80 | 0 | 100:0 | - |
| 3‡ | Urea + AMS† | 100 | 80 | 10 | 10:1 | - |
| 4‡ | Urea + AMS | 100 | 80 | 20 | 5:1 | - |
| 5‡ | Urea + AMS | 100 | 80 | 30 | 3:1 | - |
| 6 | 32-0-0 | 60 | 40 | 0 | 60:0 | 32:0 |
| 7‡ | 32-0-0 | 100 | 80 | 0 | 100:0 | 32:0 |
| 8 | 32-0-0 | 140 | 120 | 0 | 140:0 | 32:0 |
| 9 | 24-0-0-3S | 60 | 40 | 5 | 12:1 | 8:1 |
| 10‡ | 24-0-0-3S | 100 | 80 | 10 | 10:1 | 8:1 |
| 11 | 24-0-0-3S | 140 | 120 | 15 | 9.33:1 | 8:1 |
| 12 | 24-0-0-6S | 60 | 40 | 10 | 6:1 | 4:1 |
| 13‡ | 24-0-0-6S | 100 | 80 | 20 | 5:1 | 4:1 |
| 14 | 24-0-0-6S | 140 | 120 | 30 | 4.67:1 | 4:1 |
| 15 | 24-0-0-9S | 60 | 40 | 15 | 4:1 | 2.66:1 |
| 16‡ | 24-0-0-9S | 100 | 80 | 30 | 3:1 | 2.66:1 |
| 17 | 24-0-0-9S | 140 | 120 | 45 | 3.11:1 | 2.66:1 |

†AMS = granular ammonium sulfate (21-0-0-24S)

‡ Treatments to be compared to evaluate sulfur application rates and granular vs fluid N-S sources.

PLANTING AND TREATMENT APPLICATION DATES

| Location | Planting Date | Side-dress N/S Application Date |
|-----------------------|---------------|---------------------------------|
| Suffolk, VA | 4/26/2016 | 6/27/2016 |
| Southampton, VA (SHC) | 5/10/2016 | 7/5/2016 |
| Lewiston, NC (LEW) | 5/19/2016 | 7/7/2016 |



PRE-PLANT SOIL AMMONIUM AND NITRATE-N

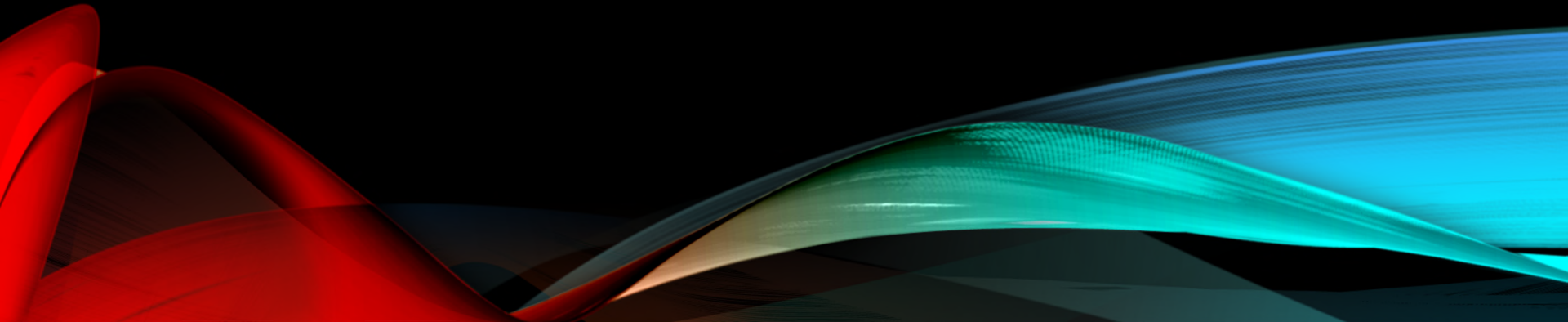
| Sampling Depth | | TAREC | | Southampton | | Lewiston | |
|----------------|--|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|
| in. | | NH ₄ ⁺ -N | NO ₃ ⁻ -N | NH ₄ ⁺ -N | NO ₃ ⁻ -N | NH ₄ ⁺ -N | NO ₃ ⁻ -N |
| | | ppm | | | | | |
| 0-6 | | 2.03 | 2.55 | 1.15 | 1.81 | 0.79 | 1.26 |
| 6-12 | | 1.85 | 0.99 | 0.96 | 1.59 | 0.83 | 1.13 |
| 12-24 | | 2.11 | 1.14 | 1.08 | 1.16 | 0.60 | 1.93 |
| 24-36 | | 2.65 | 2.25 | 5.31 | 1.08 | 1.37 | 2.21 |
| | | | | | | | |
| Total | | 8.63 | 6.93 | 8.50 | 5.63 | 3.59 | 6.52 |

RESULTS

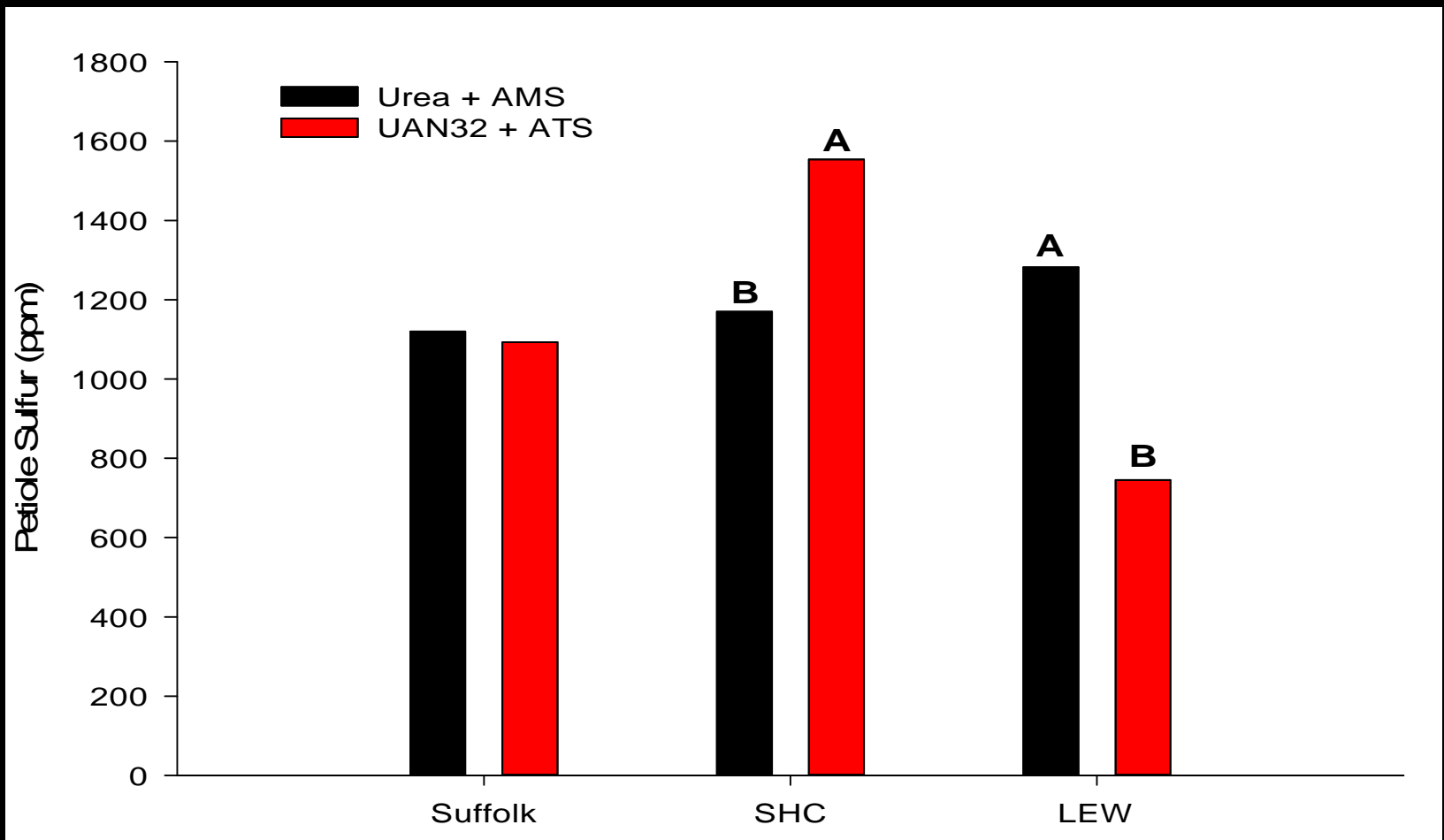
GRANULAR N/S FORMULATIONS

VERSUS

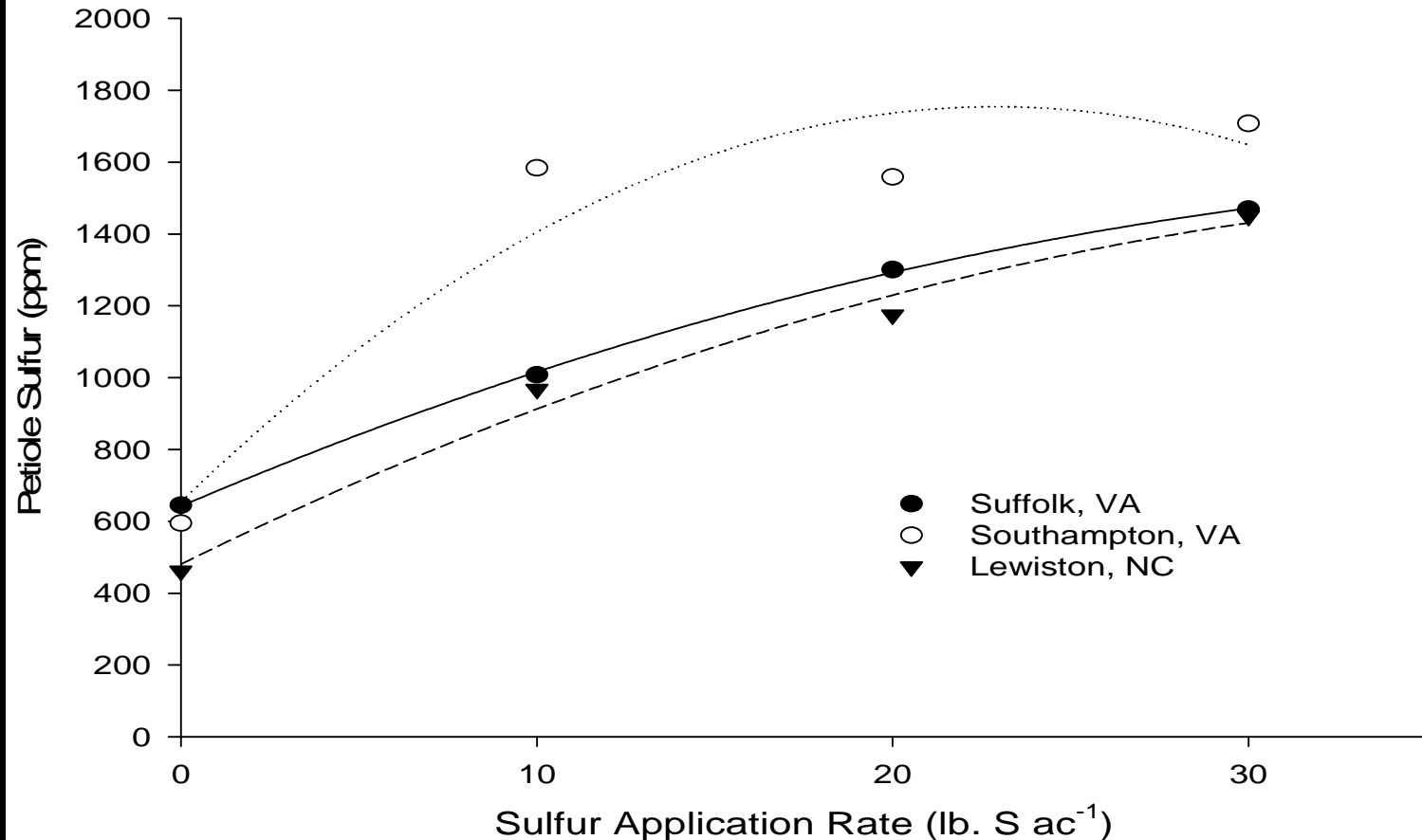
FLUID N/S FORMULATIONS



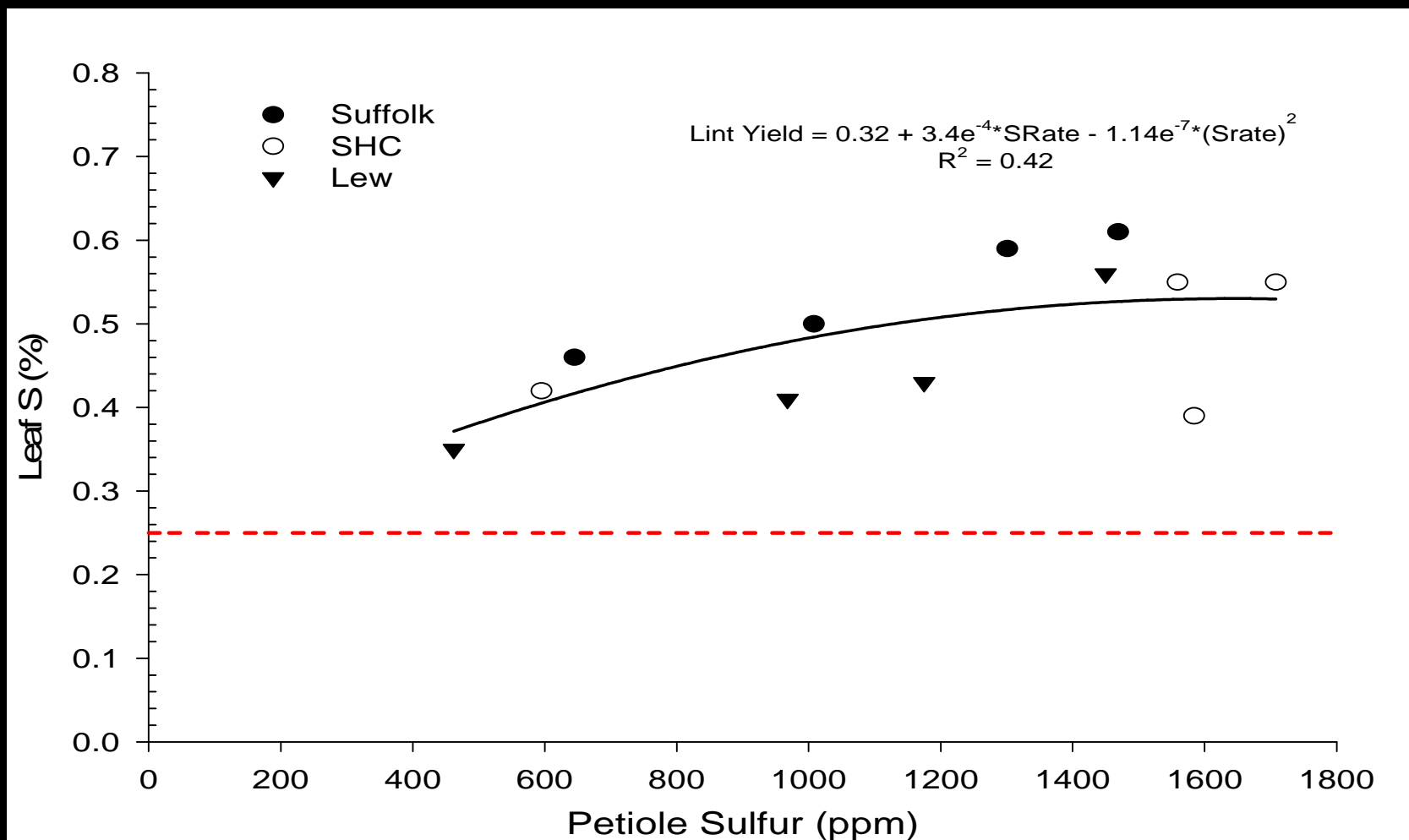
PETIOLE S CONCENTRATION AND FERTILIZER SOURCE



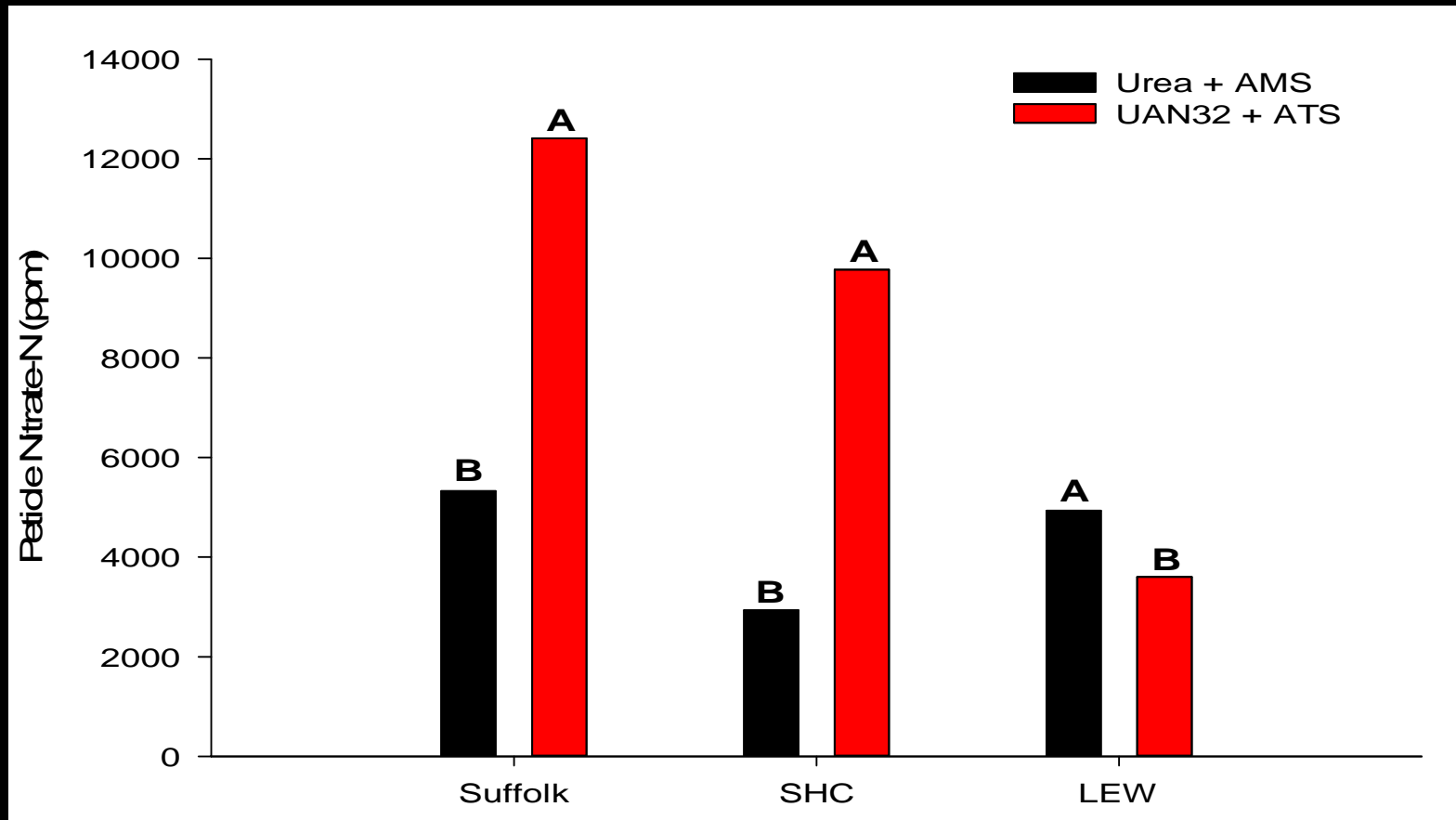
PETIOLE SULFUR DURING 1ST WEEK OF BLOOM



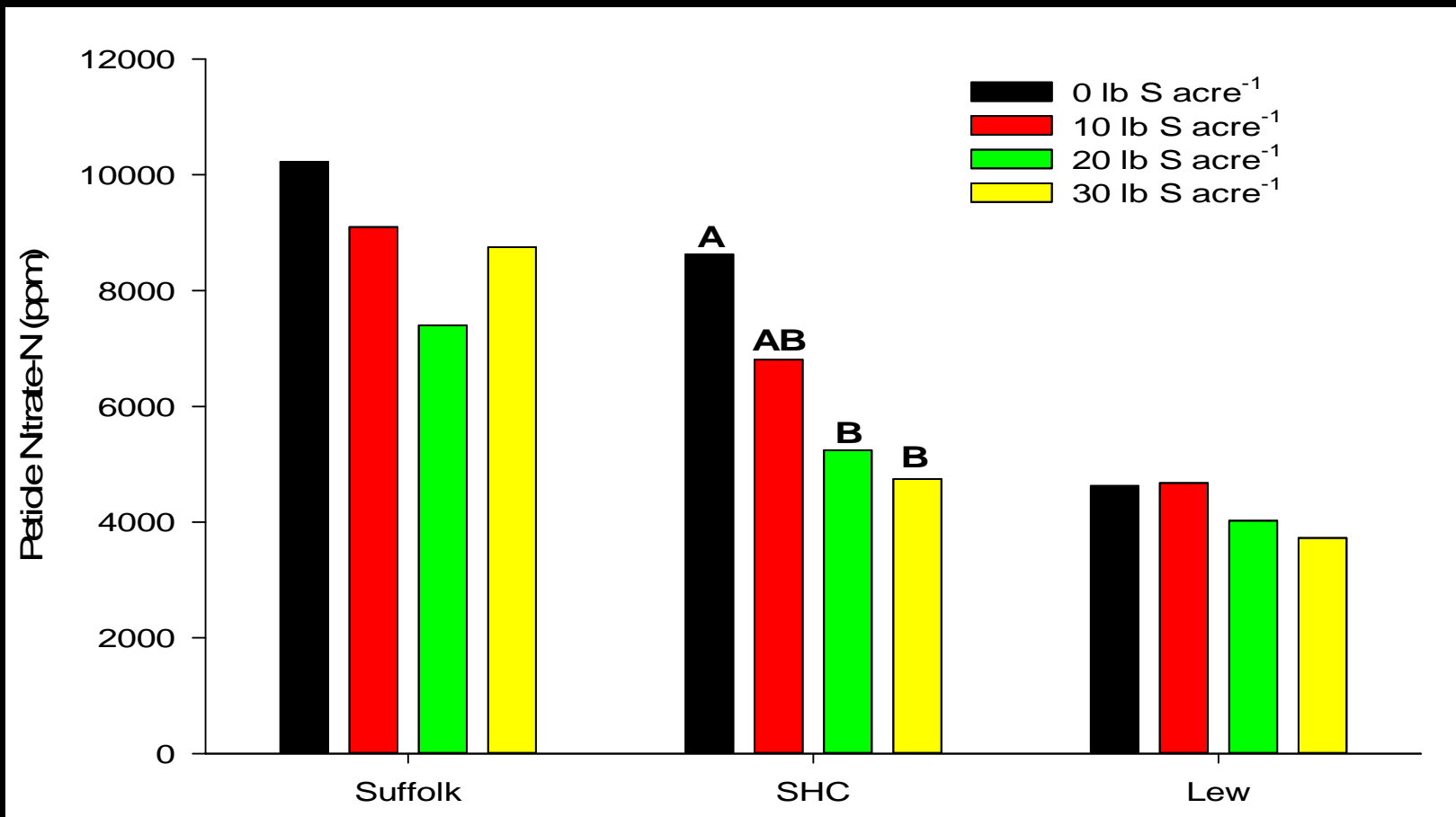
PETIOLE SULFUR AND LEAF SULFUR CONTENT



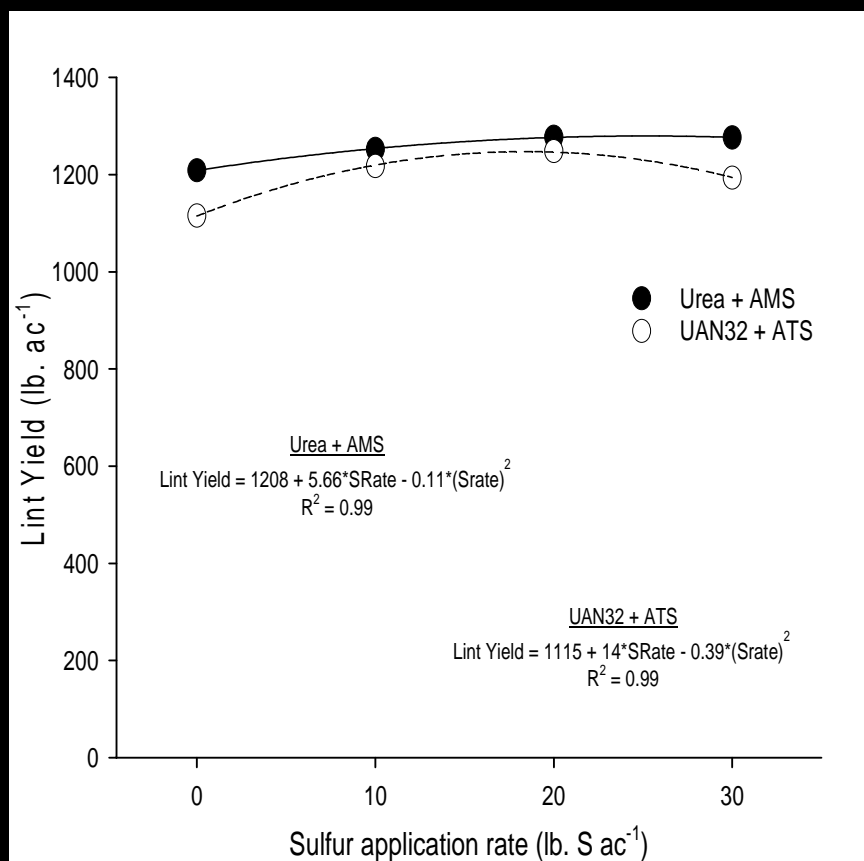
FERTILIZER SOURCE AND PETIOLE NITRATE-N AT 100 LB N ACRE⁻¹



PETIOLE NITRATE-N AND SULFUR RATE DURING THE 1ST WEEK OF BLOOM

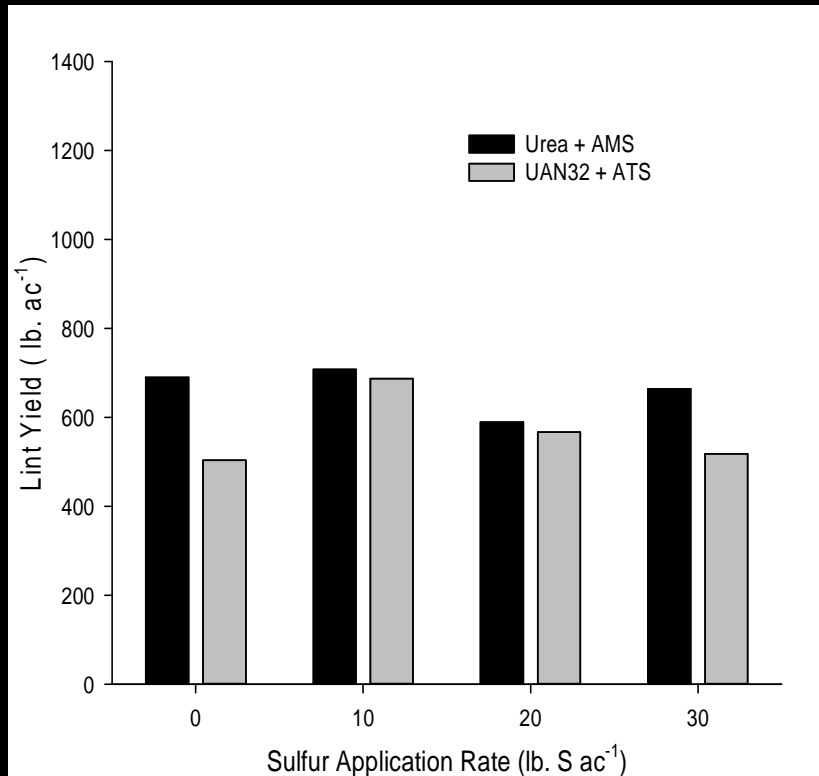


LINT YIELD AND N/S SOURCE SUFFOLK, VA

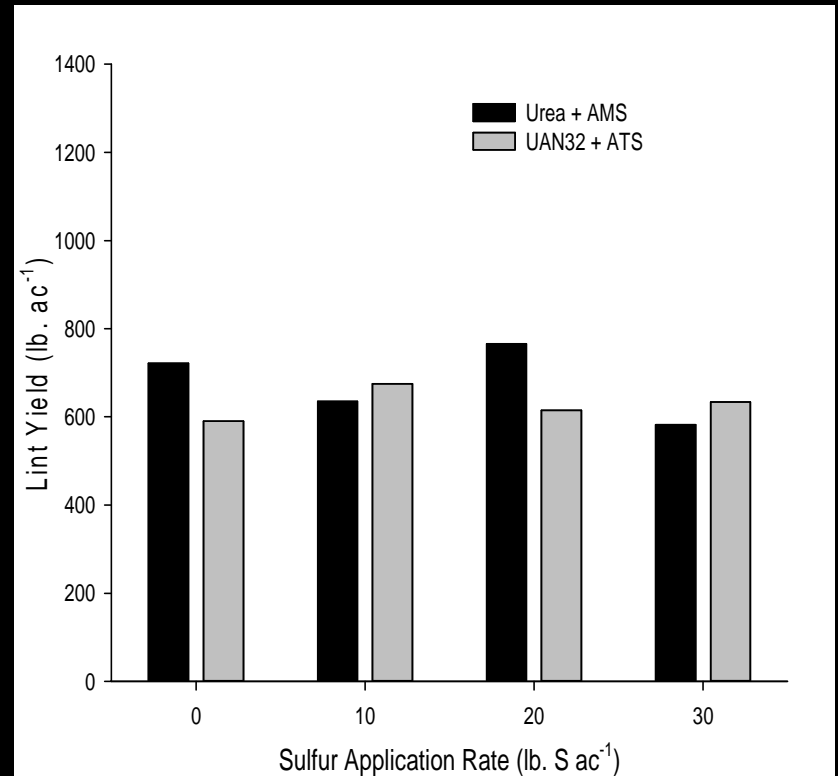


LINT YIELD AND N/S SOURCE

Southampton, VA

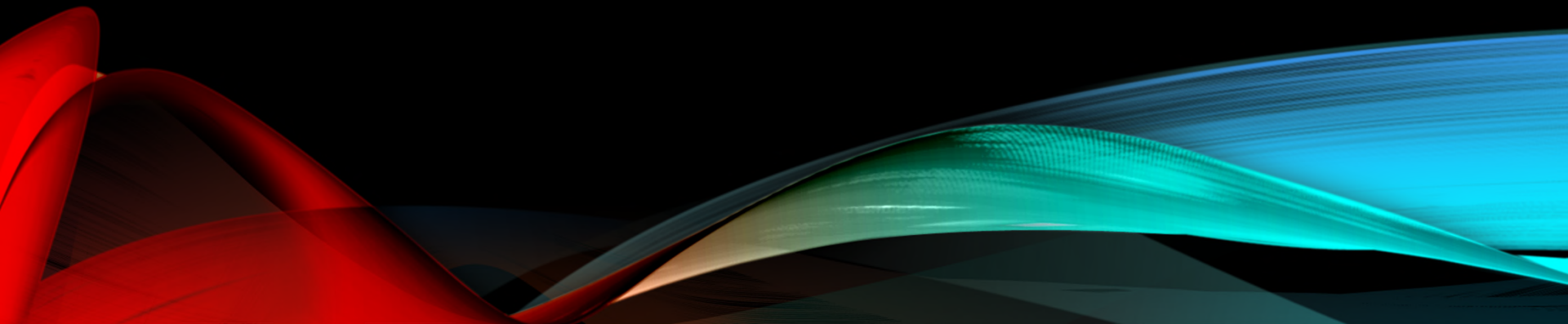


Lewiston, NC

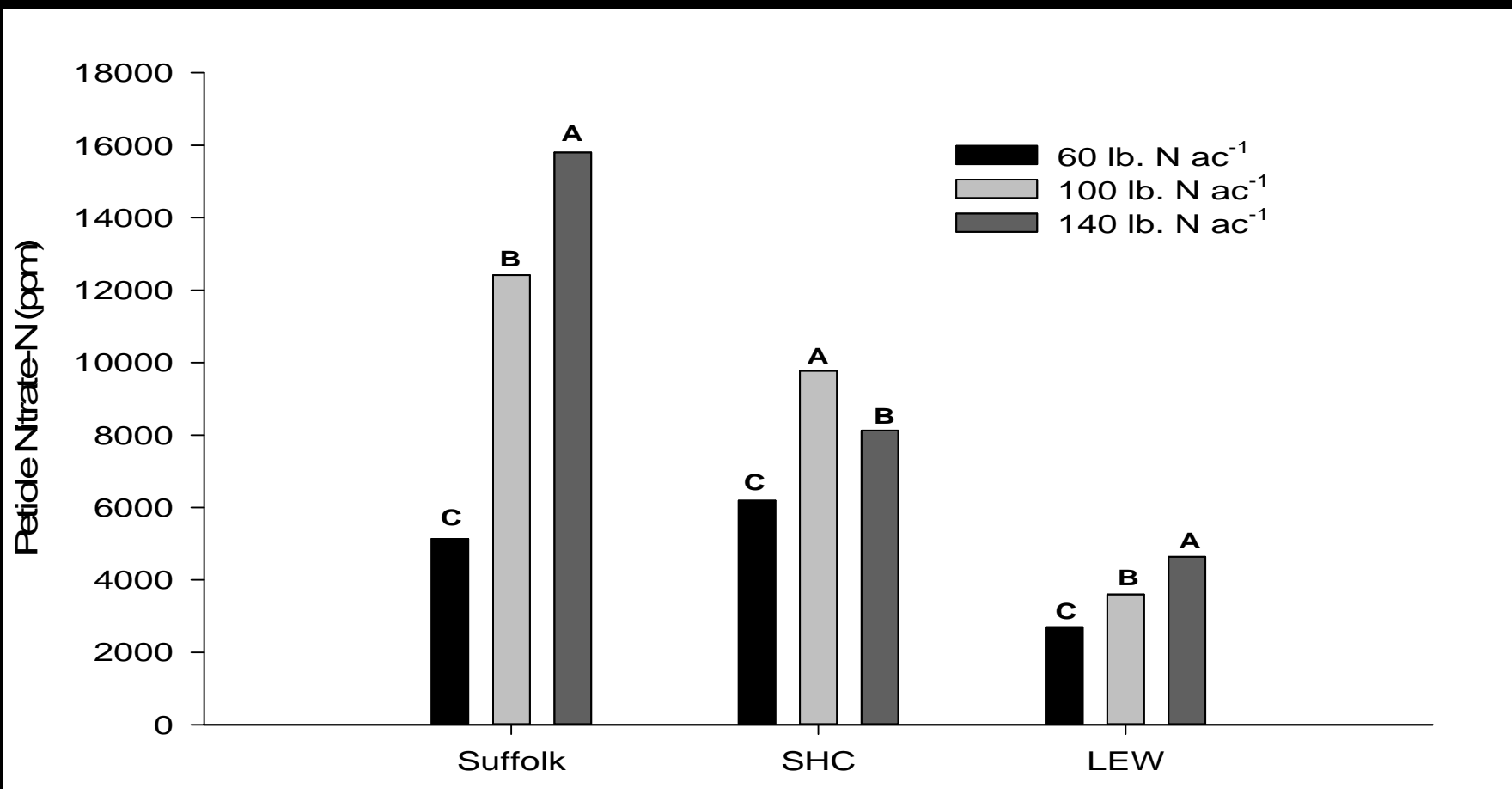


RESULTS

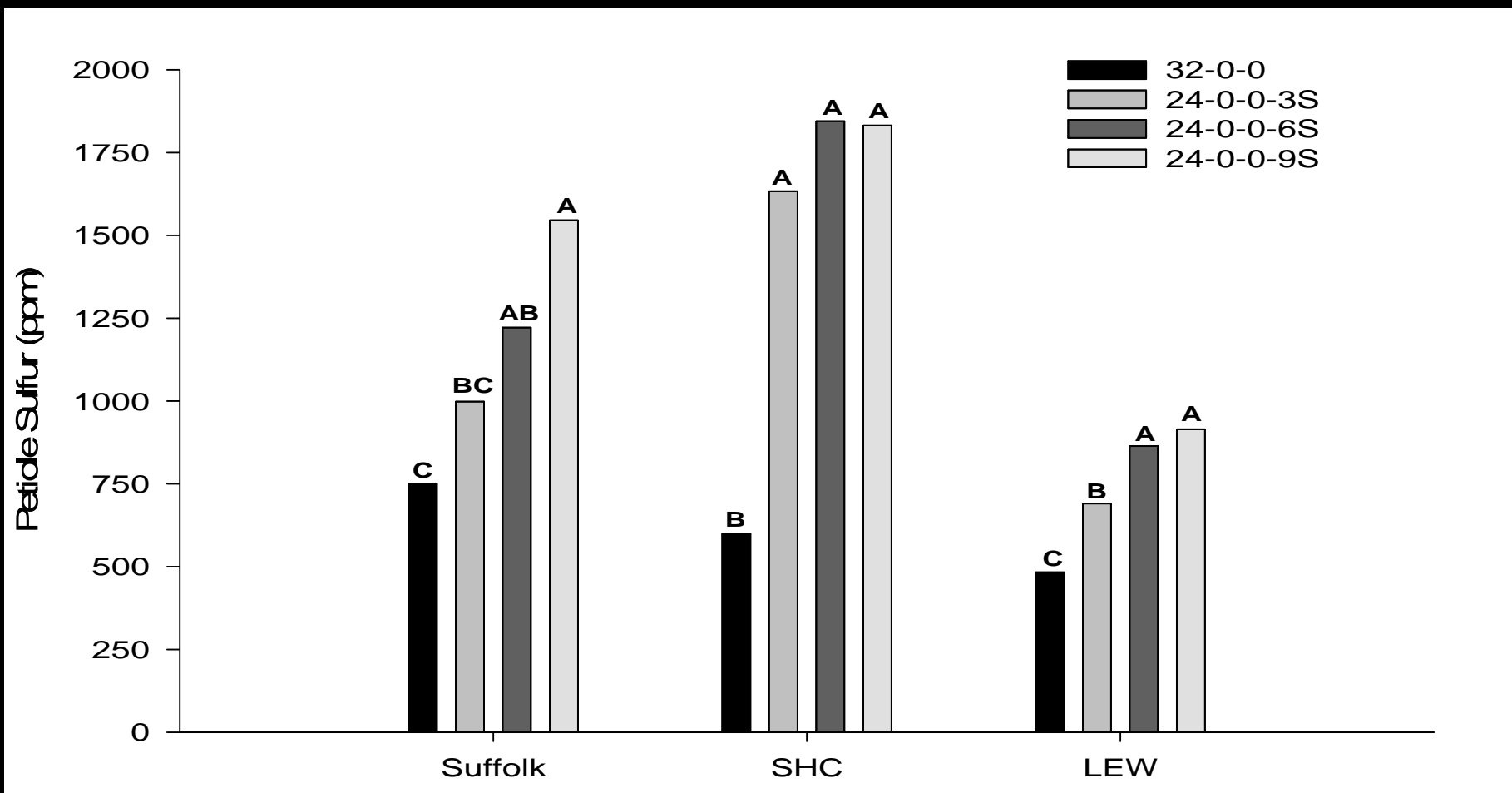
FLUID N/S FORMULATIONS AND
VARYING NITROGEN RATES



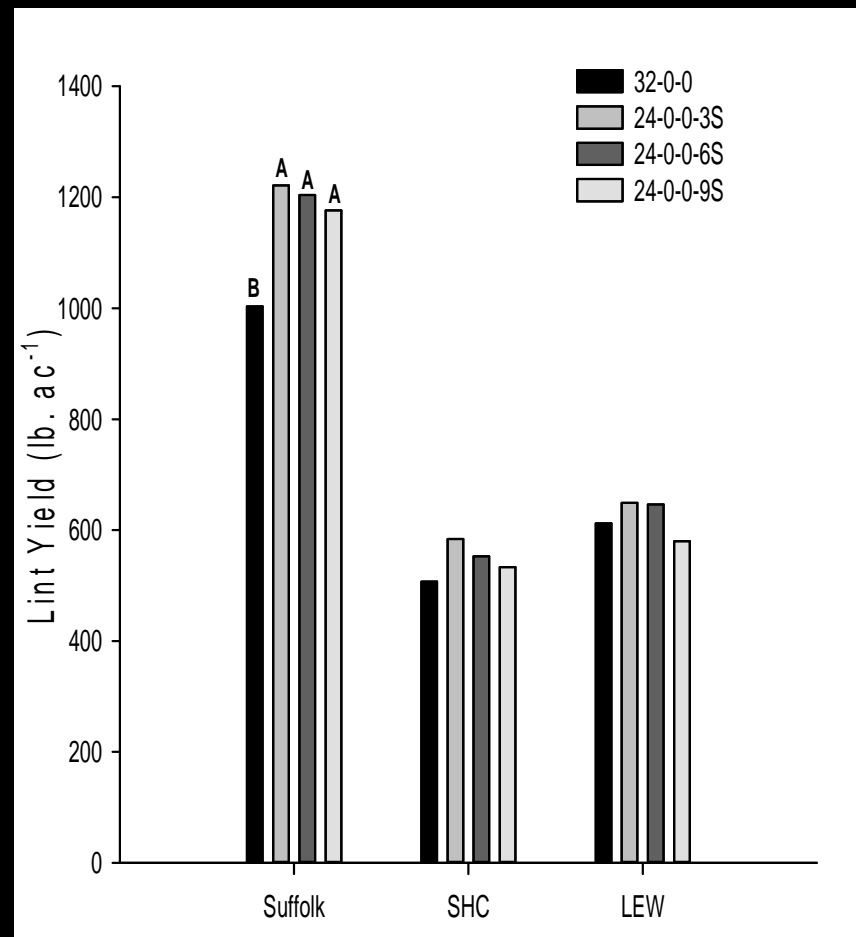
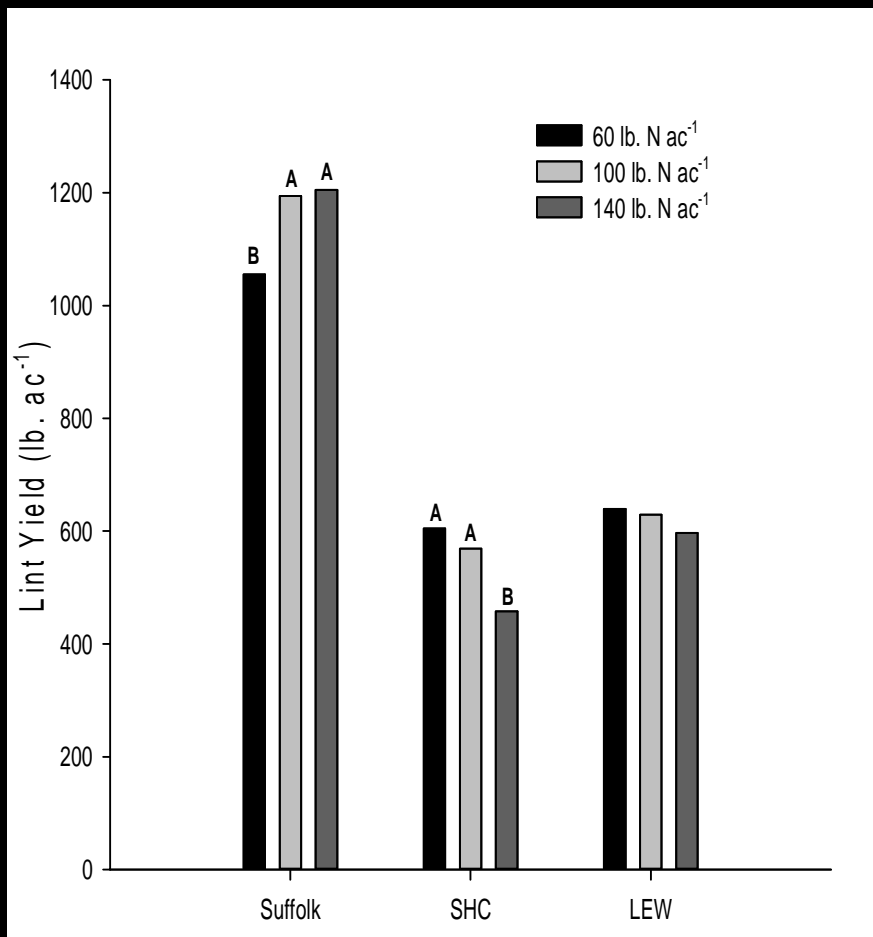
PETIOLE NITRATE-N AND NITROGEN RATE



PETIOLE SULFUR FOR FLUID N/S FORMULATIONS

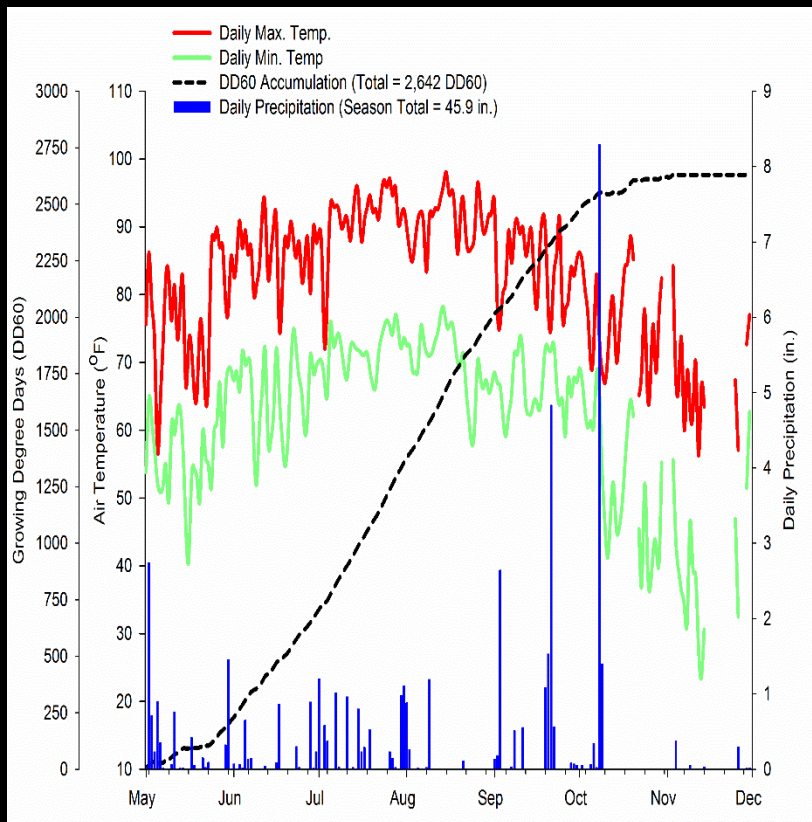


FLUID N/S FORMULATIONS AND LINT YIELD

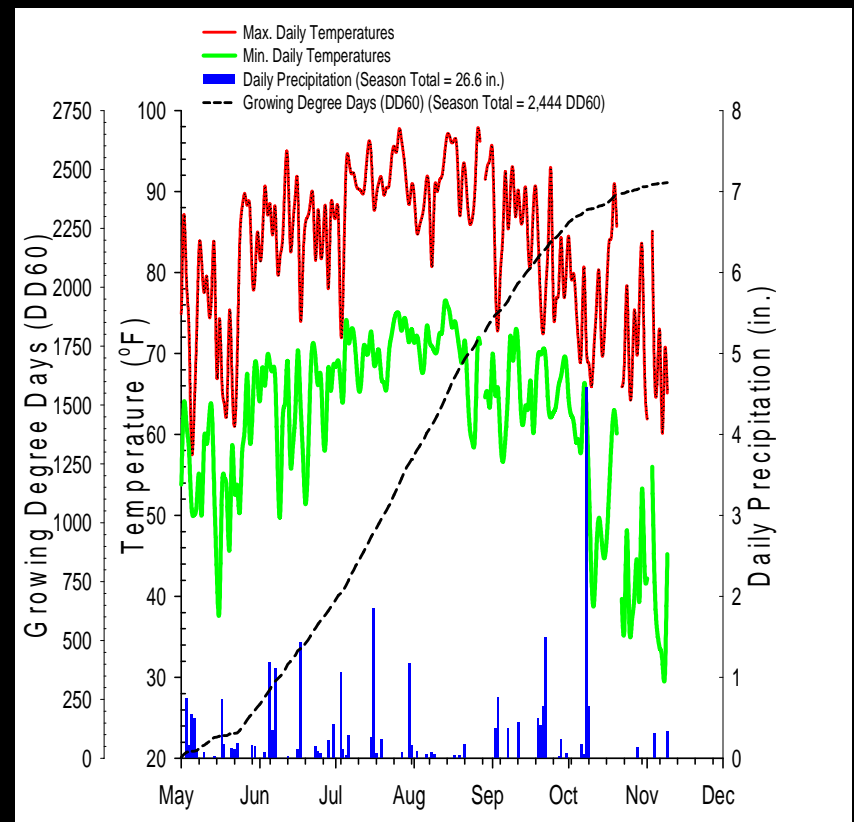


WEATHER DATA FOR LOCATION

TAREC

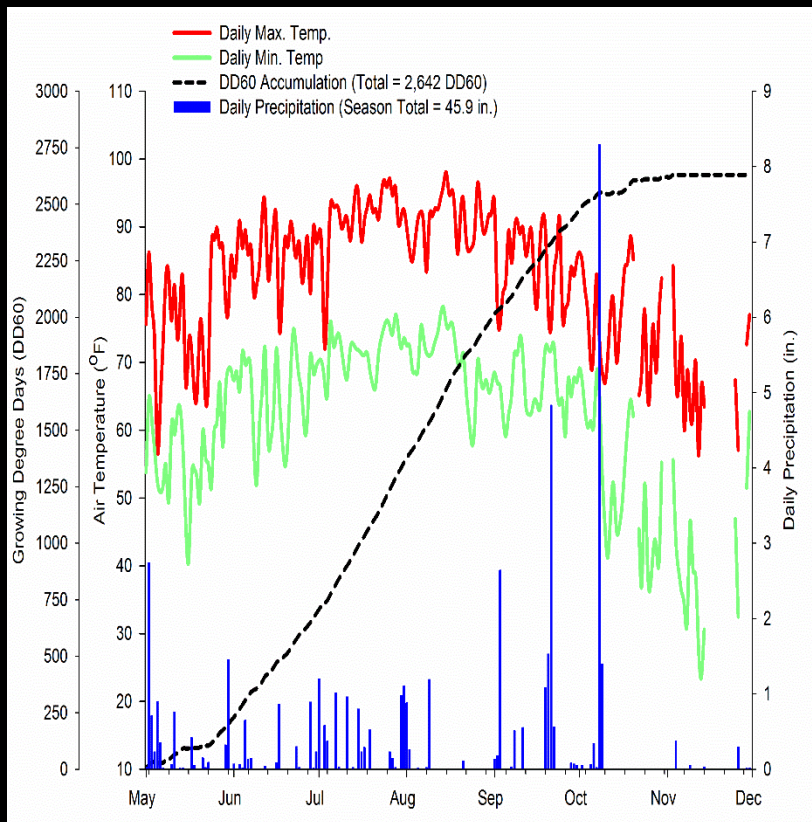


SHC



WEATHER DATA FOR LOCATION

TAREC



Lewiston

