

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

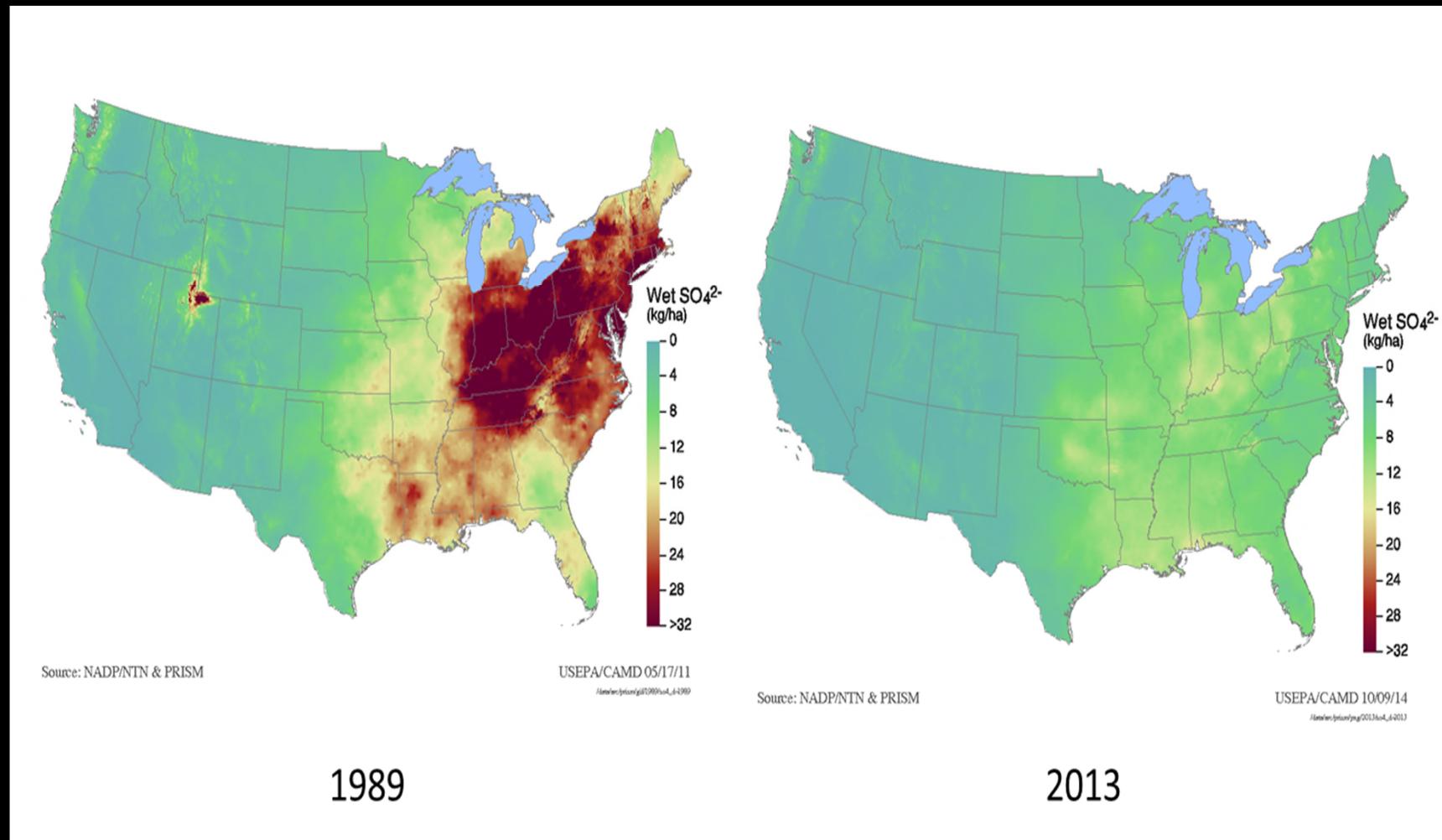
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# JUSTIFICATION

- 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,  $\text{SO}_4^{2-}$ , thus making it prone to leaching like nitrate ( $\text{NO}_3^-$ ).
- 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





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 <sup>-1</sup> -----						
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 <sub>4</sub> <sup>+</sup> -N	NO <sub>3</sub> <sup>-</sup> -N	NH <sub>4</sub> <sup>+</sup> -N	NO <sub>3</sub> <sup>-</sup> -N	NH <sub>4</sub> <sup>+</sup> -N	NO <sub>3</sub> <sup>-</sup> -N
ppm						
<b>0-6</b>	2.03	2.55	1.15	1.81	0.79	1.26
<b>6-12</b>	1.85	0.99	0.96	1.59	0.83	1.13
<b>12-24</b>	2.11	1.14	1.08	1.16	0.60	1.93
<b>24-36</b>	2.65	2.25	5.31	1.08	1.37	2.21
<b>Total</b>	8.63	6.93	8.50	5.63	3.59	6.52

# RESULTS

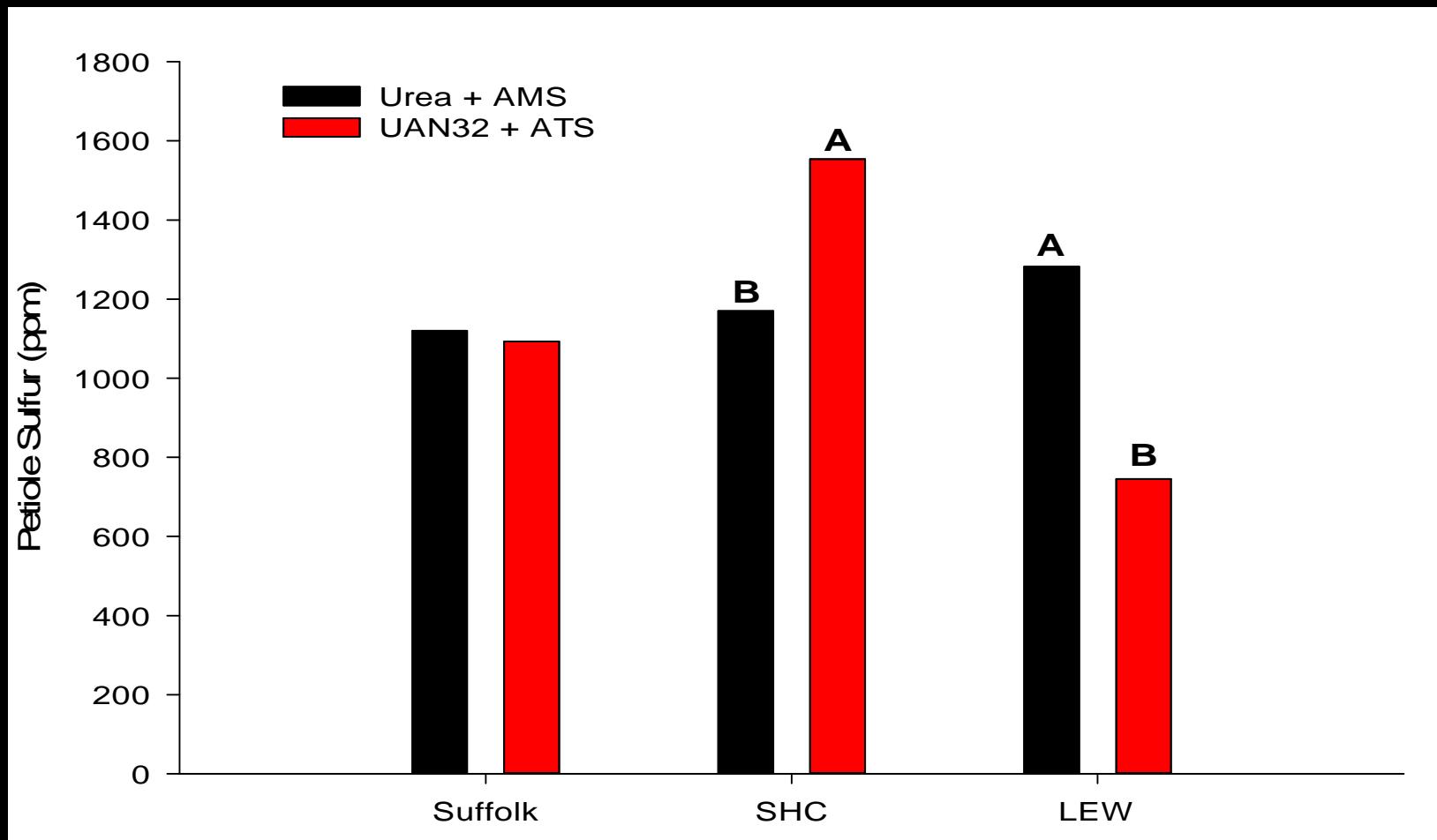
GRANULAR N/S FORMULATIONS

VERSUS

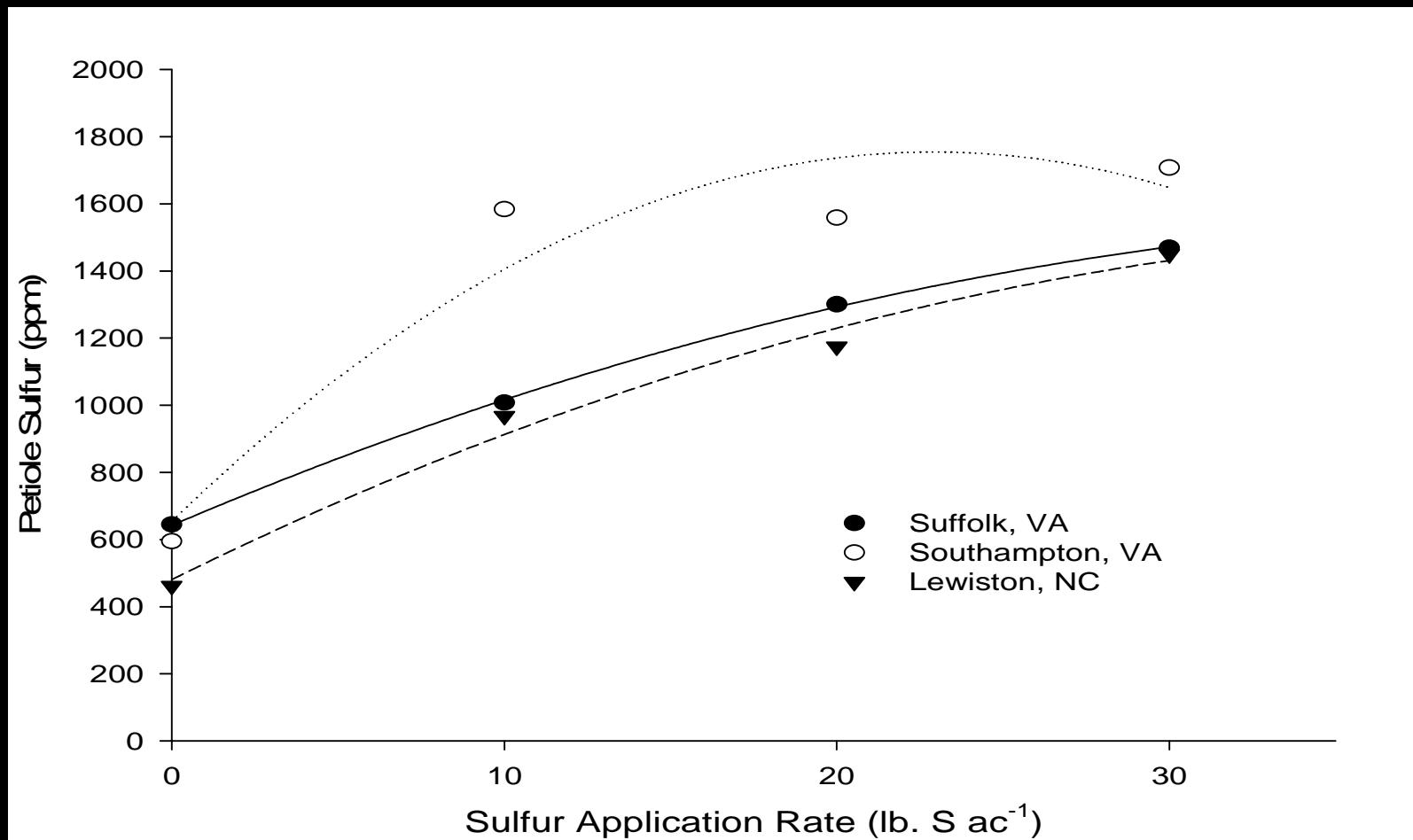
FLUID N/S FORMULATIONS



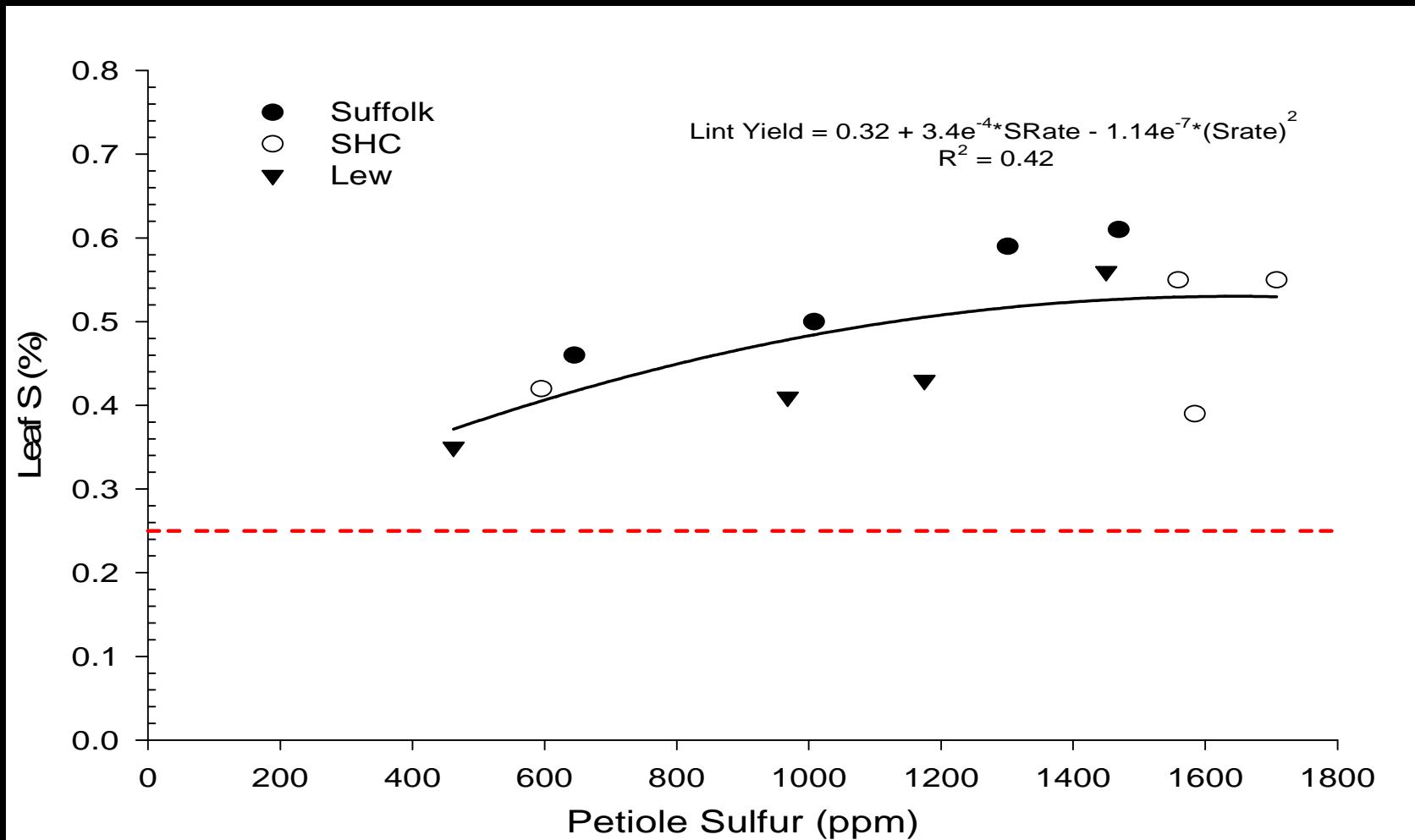
# PETIOLE S CONCENTRATION AND FERTILIZER SOURCE



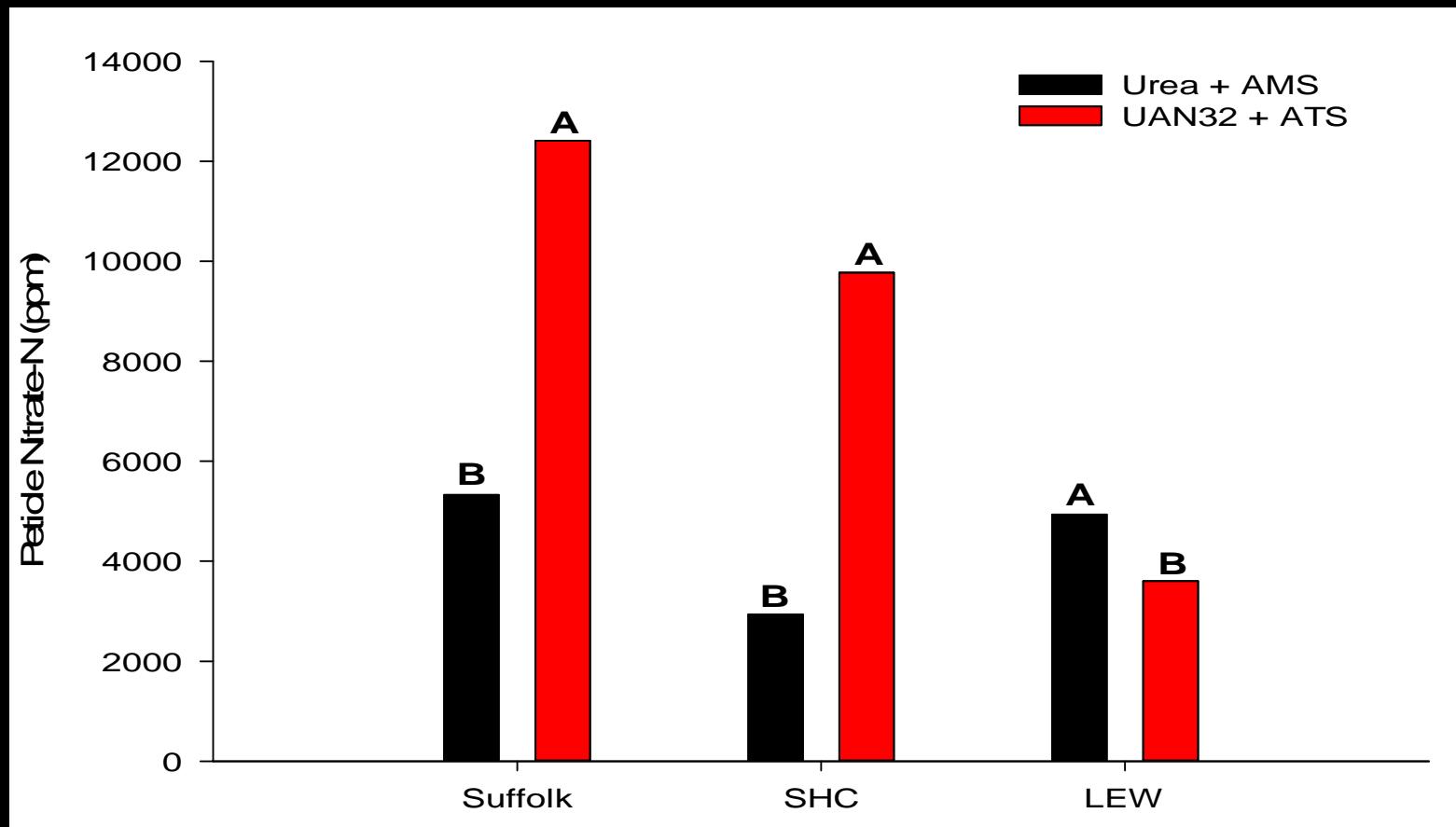
# PETIOLE SULFUR DURING 1ST WEEK OF BLOOM



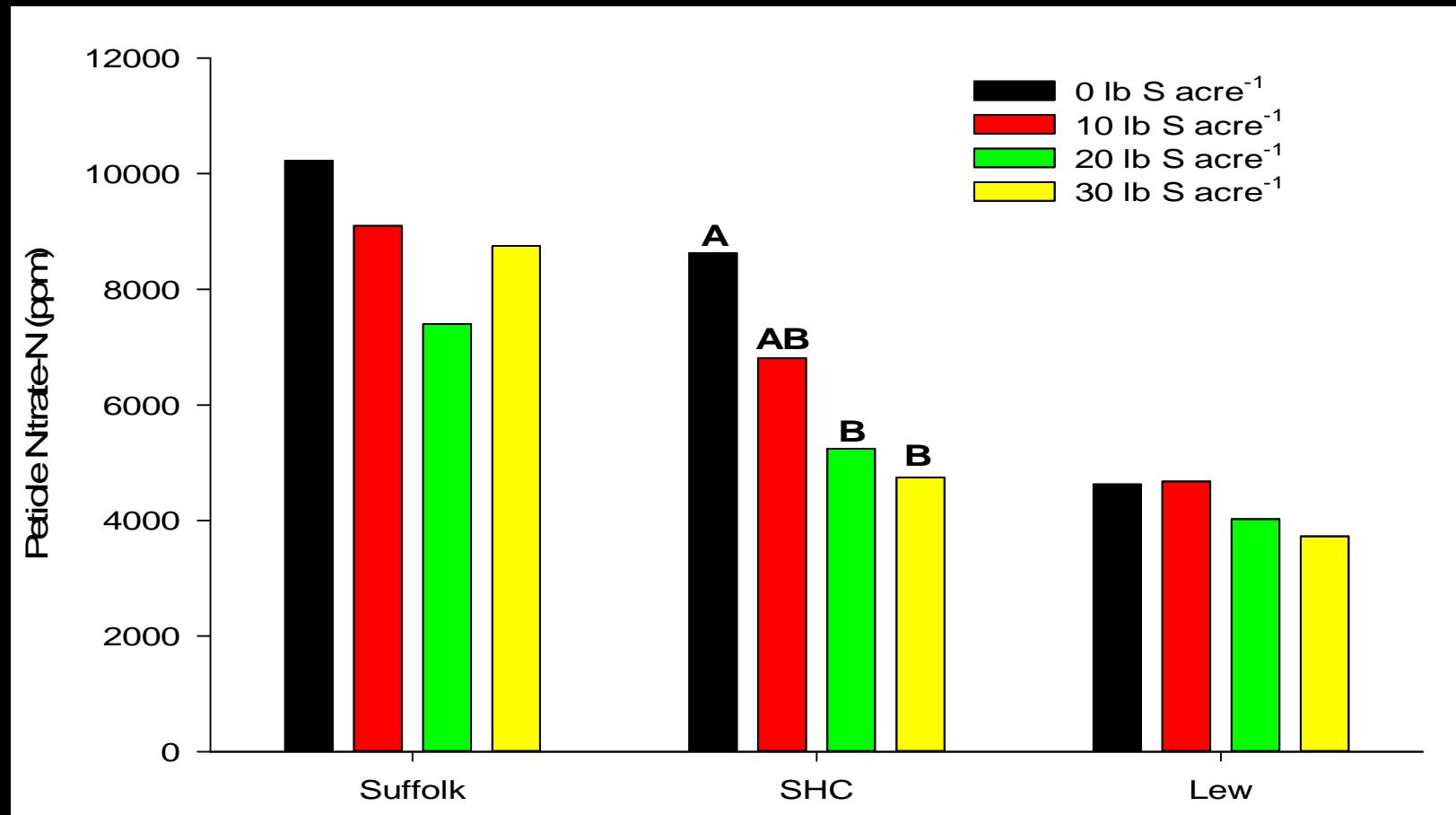
# PETIOLE SULFUR AND LEAF SULFUR COTENT



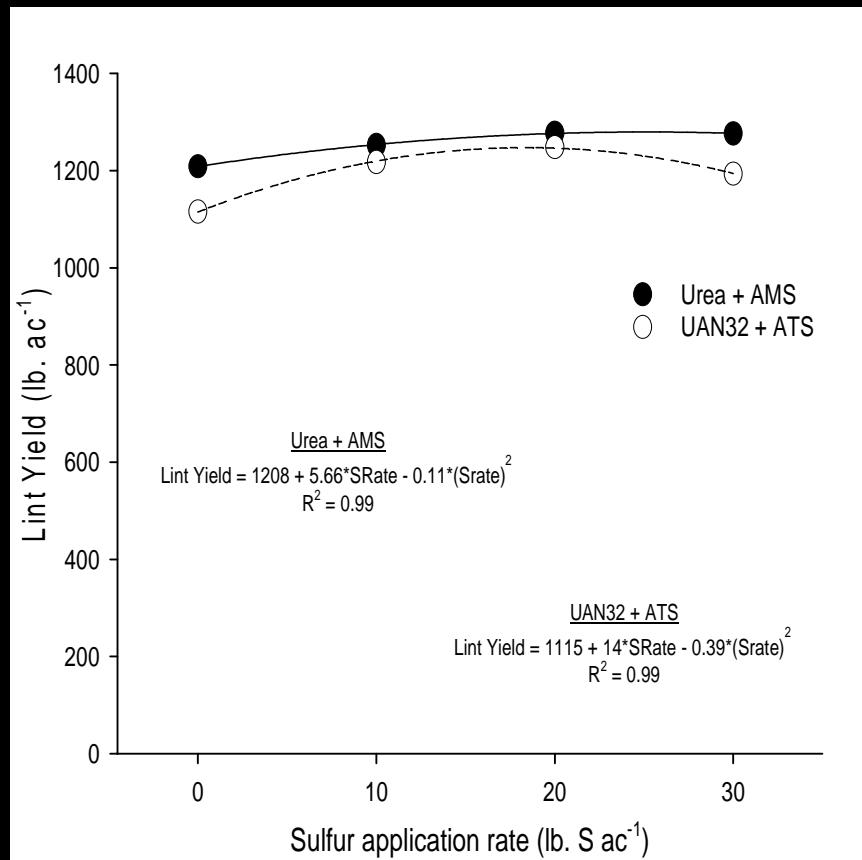
# FERTILIZER SOURCE AND PETIOLE NITRATE-N AT 100 LB N ACRE<sup>-1</sup>



# PETIOLE NITRATE-N AND SULFUR RATE DURING THE 1<sup>ST</sup> WEEK OF BLOOM



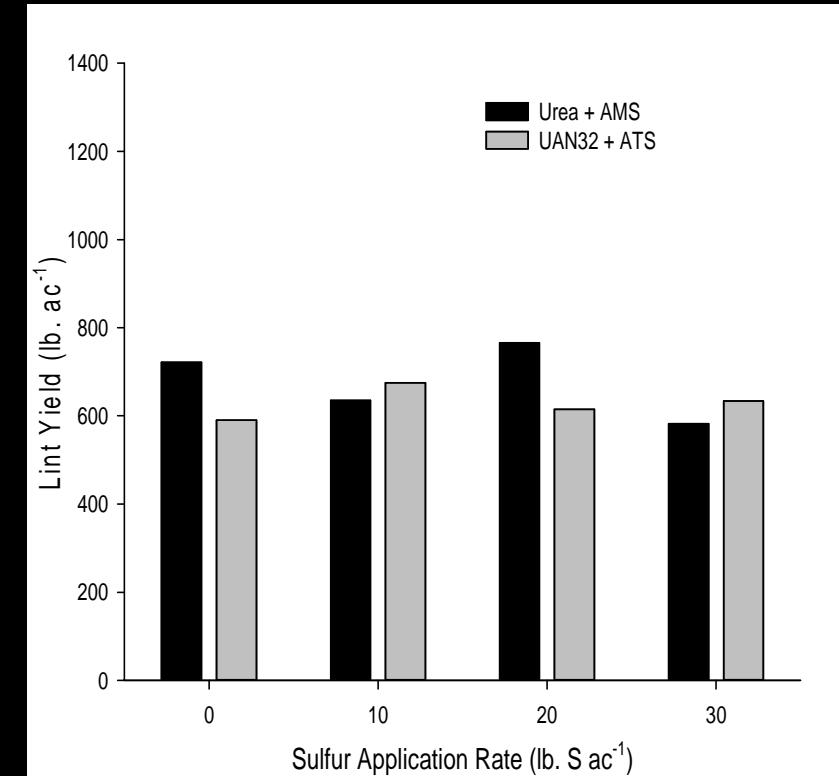
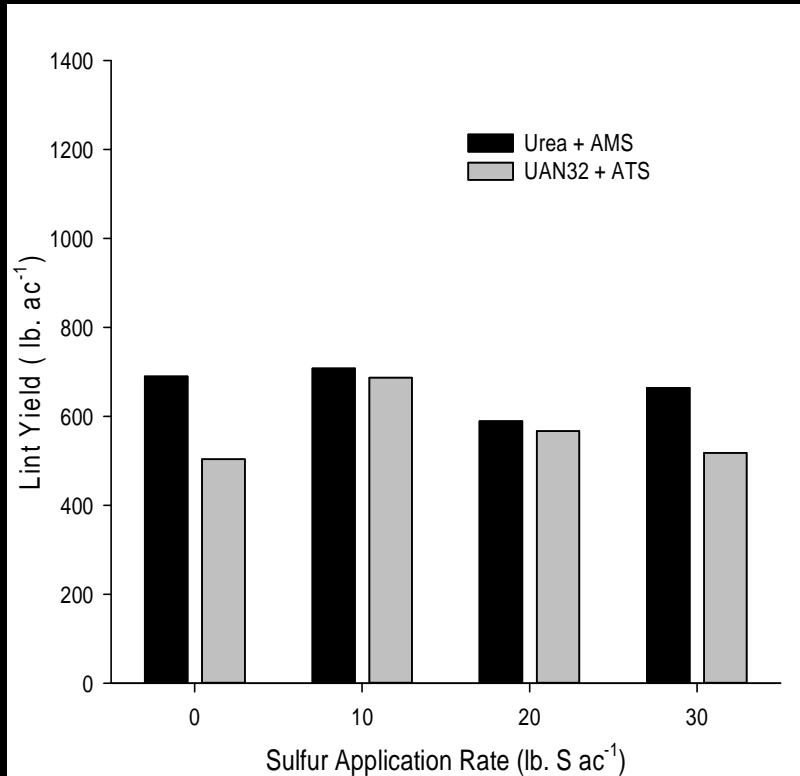
# LINT YIELD AND N/S SOURCE SUFFOLK, VA



# LINT YIELD AND N/S SOURCE

Southampton, VA

Lewiston, NC

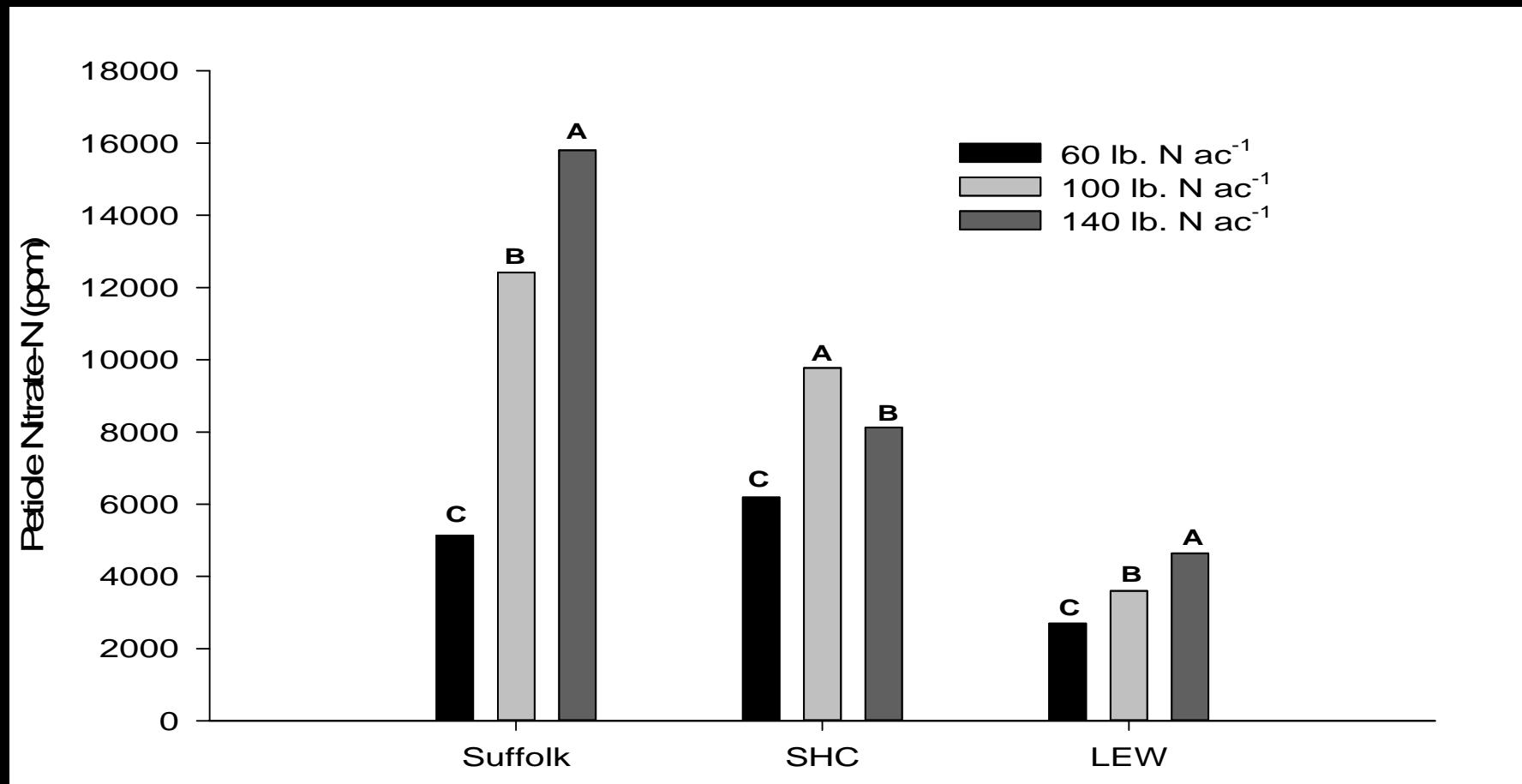


# RESULTS

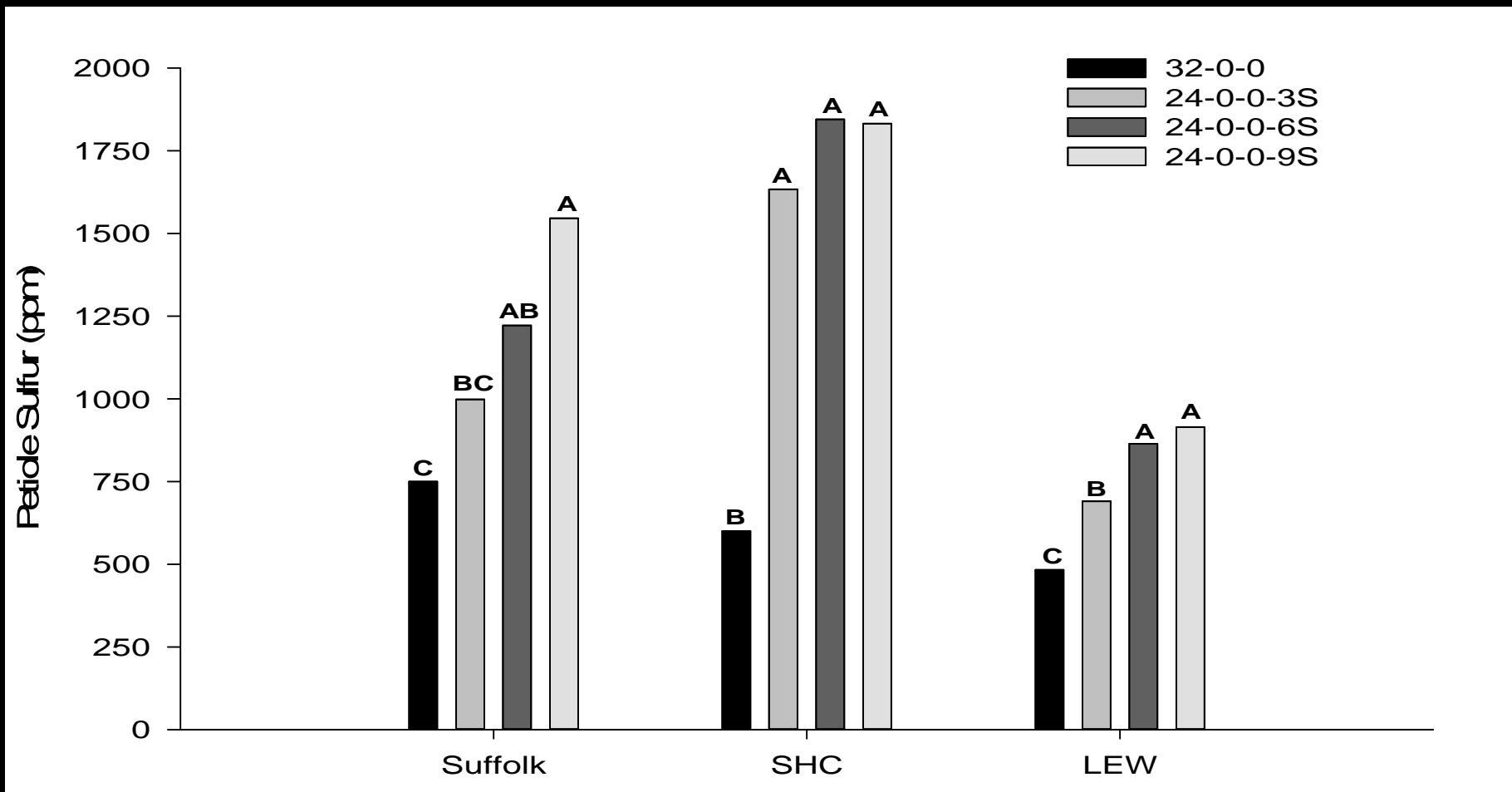
FLUID N/S FORMULATIONS AND  
VARYING NITROGEN RATES



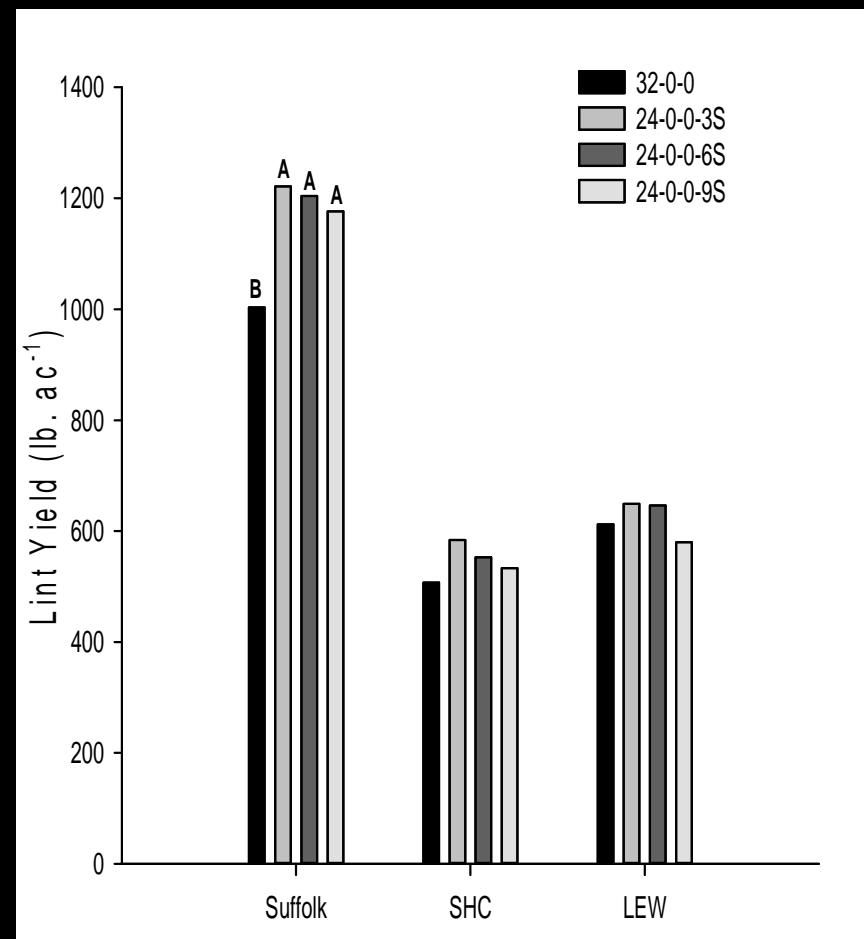
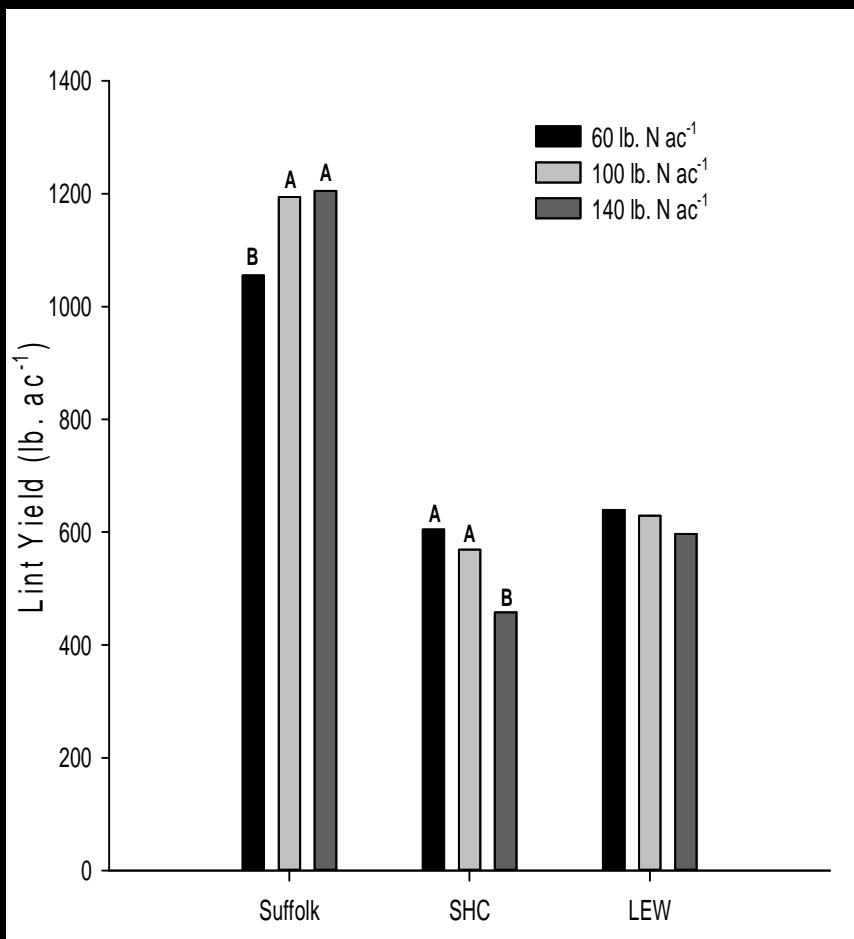
# PETIOLE NITRATE-N AND NITROGEN RATE



# PETIOLE SULFUR FOR FLUID N/S FORMULATIONS

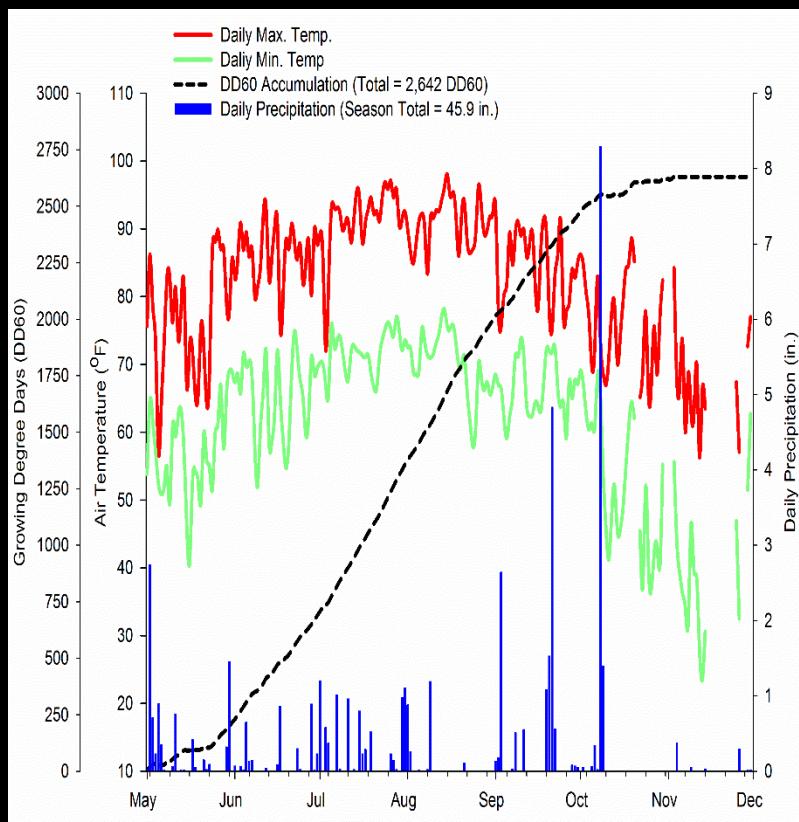


# FLUID N/S FORMULATIONS AND LINT YIELD

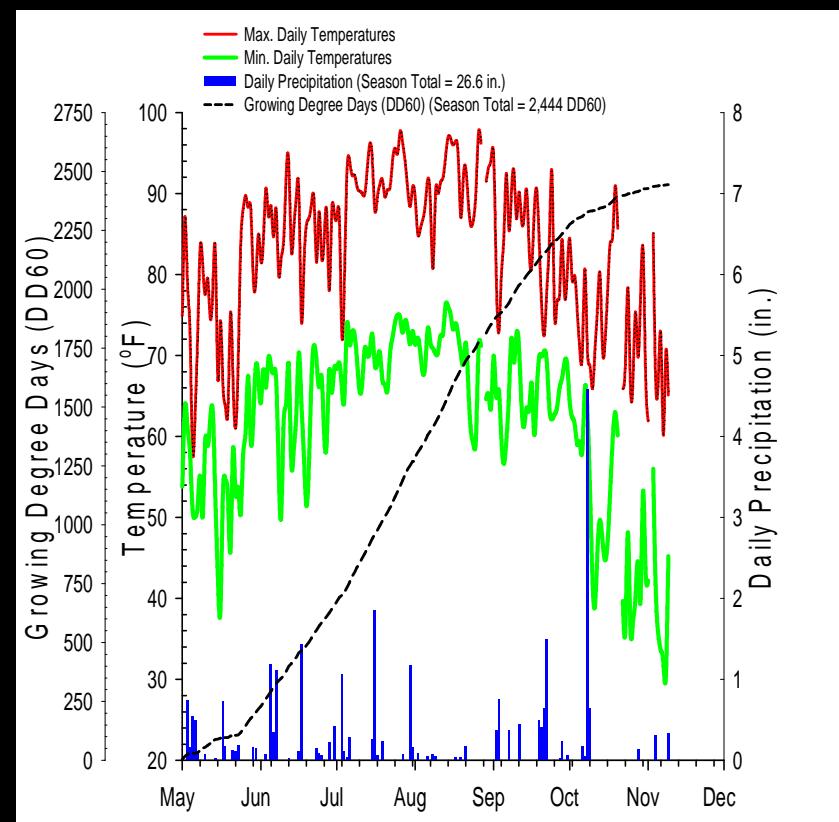


# WEATHER DATA FOR LOCATION

TAREC

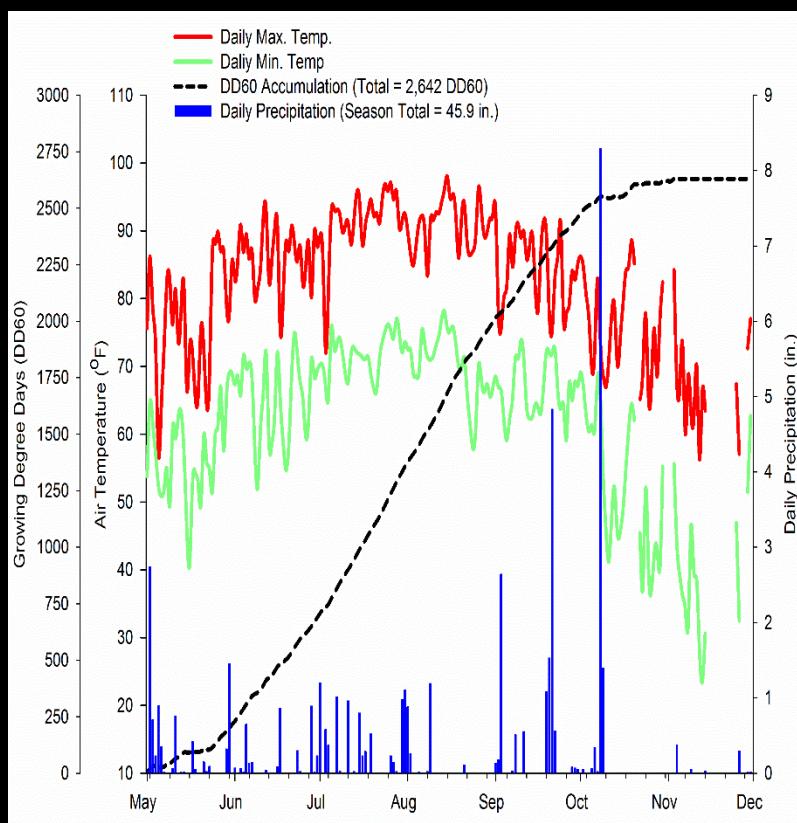


SHC



# WEATHER DATA FOR LOCATION

TAREC



Lewiston

