



Sulf-N<sup>®</sup> Ammonium Sulfate

**ADVANCING  
FORAGE YIELDS**

**ADVANSIX**

## The Sulf-N® Advantage

Sulf-N® ammonium sulfate fertilizers (21-0-0-24S) supply nitrogen and sulfur in a versatile, easy-to-spread form that combines cost efficiency with agronomic excellence.



## Ammonium Nitrate vs. Ammonium Sulfate

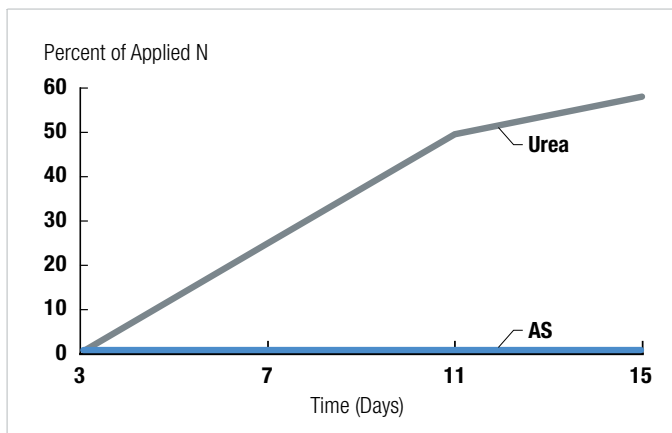
Sulf-N® ammonium sulfate is easy and safe to transport and apply. There are no special Department of Transportation (DOT) rules, placarding or record-keeping requirements. On most soils, it is an excellent alternative to ammonium nitrate, performing as well or better in side-by-side trials.

In University of Florida studies, ammonium sulfate (AS) increased yields of bahiagrass by up to 25% and ryegrass yields by 16% compared to ammonium nitrate. In both cases, ammonium sulfate also improved protein content and digestibility versus ammonium nitrate.

## Urea vs. Ammonium Sulfate

Topdress applications of Sulf-N® ammonium sulfate resist the volatilization process that can cause major nitrogen (N) loss when urea is spread without incorporation from tillage or timely rainfall.

## Ammonia Volatilization from N Fertilization



AS = Sulf-N® ammonium sulfate

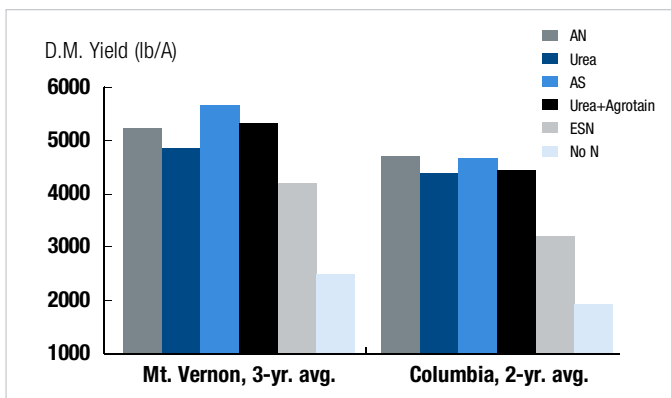
Soil = silt loam, pH 6.3; N rate = 180 lb/acre

Source: Lab incubation study, U. of Arkansas, 2008

## Efficient Nitrogen

Sulf-N<sup>®</sup> ammonium nitrogen is readily available for root uptake. It resists leaching in sandy soils, denitrification in poorly drained soils and can be surface-applied to most soils with minimal risk of volatilization loss.

## Alternative Nitrogen Fertilizers Source Effect on Tall Fescue Yield



Soil = silt loam

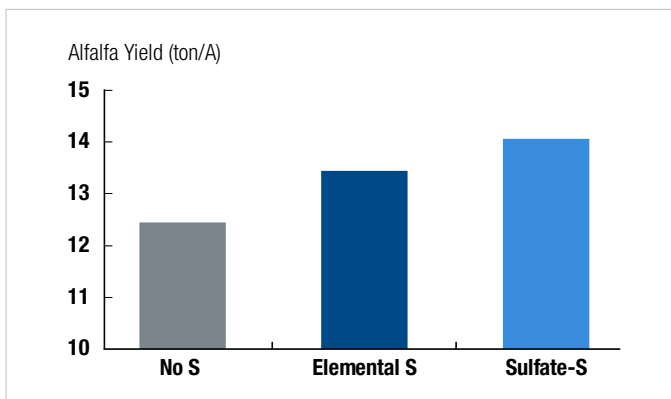
N rate = 75 lb/A in March

Source: University of Missouri, 2005 - 2007

## Essential Sulfur

Sulf-N<sup>®</sup> fertilizers provide sulfate sulfur, the only form that is immediately available for root uptake. Roots cannot absorb elemental sulfur until it is transformed by soil microbes into sulfate.

## Elemental vs. Sulfate Sulfur Source Effect on Alfalfa Yield



Soil = sandy loam

S rate = 25 lb/A/yr.

Source: University of Wisconsin, 1997 - 2000

## Do Your Forages Need Sulfur?

Sulfur deficiencies are occurring on more soil types. If you answer yes to one or more of the following questions, then your forages may benefit from sulfur fertilization.

**Are your crops slow to green up after emergence or after the first nitrogen topdress?** Cool soil temperatures delay the release of sulfur from organic matter and can cause early season deficiencies. Plants may outgrow symptoms later in the season, but usually not before yield, and possibly quality, has been affected.

**Have you noticed that some parts of your fields are lighter than others?** Sulfur availability can vary from one spot in a field to another. Patches of light-green growth within a field of darker growth usually mean there is a sulfur deficiency.

**Are you seeing low sulfur levels in animal feed rations?** This could be an indicator of sulfur deficiency in fields where silage is grown.

**Are you using less manure – or no manure – for fertilizer?** Without organic matter from manure, potential sulfur deficiencies are more likely. Check fields furthest from your barn first.

## Watch for Spots



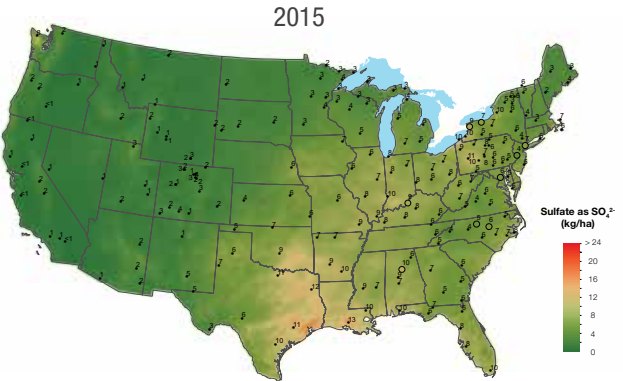
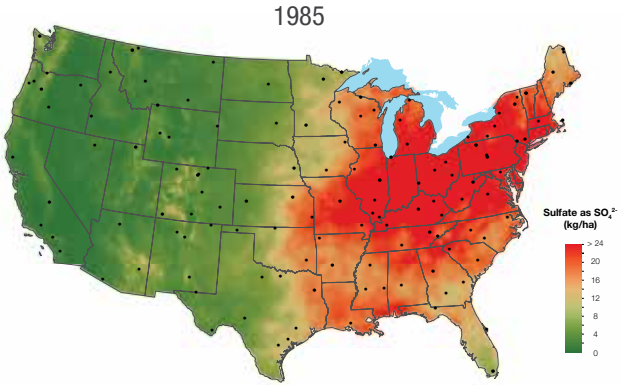
Soil sulfur levels can vary widely within a field and create patches of light-green to yellow deficiency symptoms.

*Photo Courtesy: Wes Alexander, Virginia Tech University Extension*

## Changing Sulfur Trends

Air pollution control has dramatically reduced the amount of “free” sulfur available to crops throughout the eastern half of the United States and Canada. This “free” sulfur originates from industrial emissions and eventually lands in growers’ fields, mostly as sulfates (see deposition maps below). This is a major reason why more sites and soil types are responding to sulfur fertilization.

### Sulfate Ion Wet Depositions, 1985 versus 2015



National Atmospheric Deposition Program/National Trends Network  
[nadp.isws.illinois.edu](http://nadp.isws.illinois.edu)

## Research Highlights

Independent research demonstrates the benefits of applying ammonium sulfate to silage, hay and pasture fields.

### CANADA

**Soil type:** sandy loam

**Crop:** orchardgrass

**Yield advantage:**

1.78 MT D.M./Ha, 1999 – 2000

*C. Lapierre & R. Simard, Agriculture and Agrifood Canada*

### MINNESOTA

**Soil type:** loam

(2 - 3% O.M.)

**Crop:** orchardgrass/alfalfa

**Yield advantage:**

1.75 T D.M./A, 2005 – 2006

*D. Meyer, North Dakota State University*

### FLORIDA

**Soil type:** sandy

**Crop:** limpoggrass hay

**Yield advantage:**

0.6 T D.M./A, avg. across

2 sites, 2003 – 2004

*M. Adjei, IFAS, University of Florida*

### NEW YORK

**Soil type:** gravelly loam

**Crop:** no-till corn silage

**Yield advantage:**

0.3 T D.M./A, 2003

*E. Thomas, Miner Institute*

### IOWA

**Soil type:** silt loam

(2 - 3% O.M.)

**Crop:** alfalfa

**Yield advantage:**

1.59 T D.M./A, avg. of

cuts 2 and 3 across 3 sites,

2005 – 2006

*B. Lang, Iowa State University Extension*

## Response to Sulfur on Alfalfa



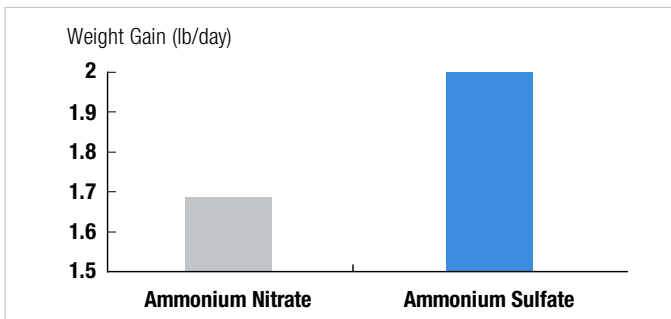
*Photo courtesy: Brian Lang, Iowa State University Extension*

## A Growing Need

Research links higher forage yield and quality to higher output of beef and milk production, less reliance on feed supplements and higher profit margins.

**More beef.** In a continuous stocking study by Virginia Tech, fertilizing tall fescue with ammonium sulfate increased average daily calf gains by 18% compared to treating fescue with a similar amount of nitrogen from ammonium nitrate. The total weight gain advantage was 47 pounds per calf over a five-month period (159 days).

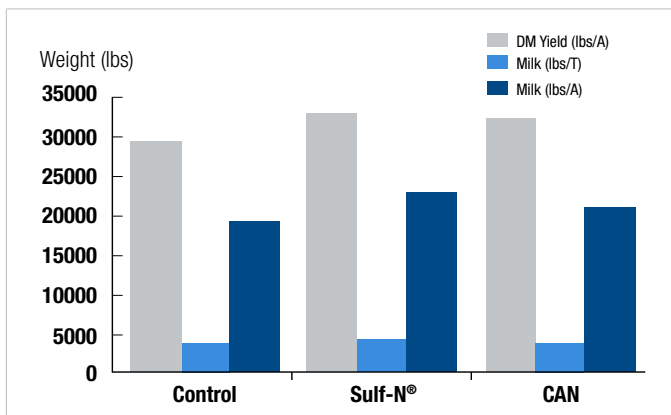
### Effect of S Fertilization of Tall Fescue on Weight Gain\*



\*Suckling calves; continuous stocking grazing system  
N rate = 60 lb/A in April/May  
Source: Virginia Tech, 1995 - 1998

**More milk.** In a field study at Miner Institute, the increase in forage yield produced by ammonium sulfate versus calcium ammonium nitrate translated into milk yield increases of 680 lbs. per acre, using the Milk Calculator developed by the University of Wisconsin.

### Corn Silage Response to Sulfur Effect on Milk Production



N rate in starter = 42 lb/A  
Source: Miner Institute, Chazy, New York 2003



## Response to Sulfur on Tifton 85 Bermudagrass



Photo courtesy: Vince Haby, Texas Tech University.

## Nutrient Uptake for Forage Crops

Forage	Yield T/A	Uptake (lb/A)			
		N	P <sub>2</sub> O <sub>5</sub>	K <sub>2</sub> O	S
Alfalfa	8	450	100	480	40
Bahiagrass	7	303	87	242	27
Bermudagrass	10	500	140	420	40
Bromegrass	5	220	65	315	20
Clover - Grass	6	300	90	360	30
Corn Silage	32	266	114	266	33
Fescue	3.5	135	65	185	20
Orchardgrass	6	300	100	375	35
Reed Canarygrass	5	200	75	225	20
Ryegrass	5	215	85	240	40
Sorghum-Sudan	8	320	122	467	21
Timothy	4	150	55	250	16

Source: IPNI

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