2014 Southeast Hay Convention

Effect of Polymer-Coated Urea on Bermudagrass Forage Production

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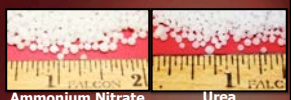
GRASS

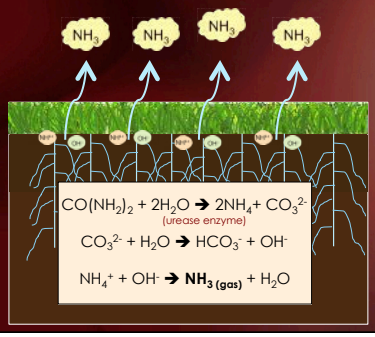
Introduction

- Without AN, users of N face risky alternatives.
  - NH_3 volatilization loss



Ammonium Nitrate (AN) | Urea

Ammonia Volatilization Of Urea



1. Fertilizer Application
2. Hydrolysis of Urea
3. NH_3 gas Volatilized

Factors Increasing Volatilization

- ↑ Temperature
- ↑ Humidity
- ↑ Wind
- ↑ Soil Moisture
- ↑ Soil pH
- ↑ Organic Matter / Thatch
- ↓ Rainfall/ Irrigation after application

Introduction

- Without AN, users of N face risky alternatives.
  - NH_3 volatilization loss
- Enhanced Efficiency (EE) N products may reduce volatilization loss
  - Urease inhibition
  - Encapsulate & release

Ammonium Nitrate (AN) | Urea

AGROTAIN NBPT

ESN SmartNitrogen Polymer Coating

Environmentally Smart Nitrogen

- N release through coating rather than breakdown of coating
- Release manipulated through polymer chemistry and thickness
- Moisture is required; soil temperature is primary regulator

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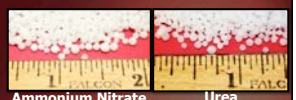
Introduction

- Without AN, users of N face risky alternatives.
  - NH_3 volatilization loss
- Enhanced Efficiency (EE) N products may reduce volatilization loss
  - Urease inhibition
  - Encapsulate & release
  - NBPT and ESN treated urea have reduced volatilization by 64 and 81%, respectively. (Connell et al., 2011)
  - ESN releases N too slowly and reduces yield compared to NBPT treated urea and conventional AN.



Ammonium Nitrate (AN) | Urea

AGROTAIN — NBPT

ESN SmartNitrogen — Polymer Coating

Goal and Objectives

To evaluate the potential of ESN:Urea Blends (0%, 50%, 75%, 100% ESN) in two split applications relative to AN or Urea split into four equal applications.

Ammonium Nitrate

Urea

Compare these ESN blends and conventional systems in terms of:

1. Total forage production per year
2. Forage yield distribution within the growing season
3. Ammonia volatilization loss
4. Recovery of the total N fertilizer applied to the crop

Treatments Compared

N Source	Apps	Application Rate at: Green up	After H1	After H2	After H3	After H4	Total Rate
		(lb of actual N acre^{-1})					
AN							
Urea							
0% ESN							
50% ESN							
75% ESN							
100% ESN							
Check							

Treatments Compared

N Source	Apps	Application Rate at: Green up	After H1	After H2	After H3	After H4	Total Rate
		(lb of actual N acre^{-1})					
AN	4	75	75	75	75	0	300
Urea	4	75	75	75	75	0	300
0% ESN							
50% ESN							
75% ESN							
100% ESN							
Check							

Treatments Compared

N Source	Apps	Application Rate at: Green up	After H1	After H2	After H3	After H4	Total Rate
		(lb of actual N acre^{-1})					
AN	4	75	75	75	75	0	300
Urea	4	75	75	75	75	0	300
0% ESN	2	150	0	150	0	0	300
50% ESN							
75% ESN							
100% ESN							
Check							

Treatments Compared

N Source	Apps	Application Rate at: Green up	After H1	After H2	After H3	After H4	Total Rate
		(lb of actual N acre^{-1})					
AN	4	75	75	75	75	0	300
Urea	4	75	75	75	75	0	300
0% ESN	2	150	0	150	0	0	300
50% ESN	2	150	0	150	0	0	300
75% ESN	2	150	0	150	0	0	300
100% ESN	2	150	0	150	0	0	300
Check	0	0	0	0	0	0	0

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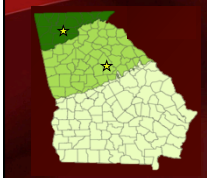
Materials and Methods



- Sites: Two UGA Ag. Exp. Stations
  - Calhoun
  - Eatonton
- 'Russell' bermudagrass, 4 harvests
  - 2010-12
  - New locations each year
- Experiment Design: RCB
  - 4 replications
  - Data analyzed by Proc Mixed in SAS
- Plots harvested with a forage plot harvester to a height of 2.5 in
  - Samples dried, ground (1 mm)

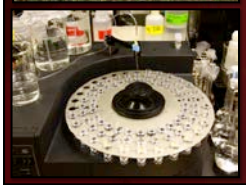
Materials and Methods

- Analyzed for nutritive quality at FEW lab *
- Analyzed for nitrate conc. *
  - Colorimetric determination by nitration of salicylic acid (Cataldo et al., 1975).
  - Reported as $(NO_3\text{-}N)$ ion mg kg^{-1} in DM
- N Recovery Calculation

$$\frac{N\ Removed_{(fertilized\ plot)} - N\ Removed_{(control\ plot)}}{N\ Application\ Rate}$$

* Data not shown

Materials and Methods

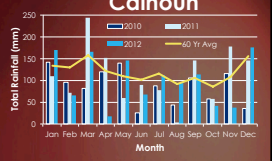


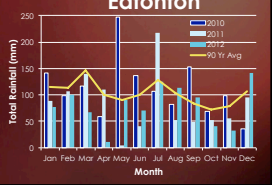
- Ammonia Volatilization Traps
  - 100 mL 0.1 M H_2SO_4 acid traps
  - Covered by pvc pipe enclosure for 7 days in the field
- Analyzed for ammonium conc.
  - Extract colorimetrically analyzed for NH_4 (Mulvaney, 1996)
  - Reported as NH_4-N conc. (mg L^{-1})

Results and Discussion

Weather Data

- 2010
  - Rainfall below average at both locations
- 2011
  - Calhoun: drought throughout growing season
  - Eatonton: heavy rain in mid-season
- 2012
  - Average rainfall at both locations





Objectives

Compare these ESN blends and conventional systems in terms of:

1. Total forage production per year
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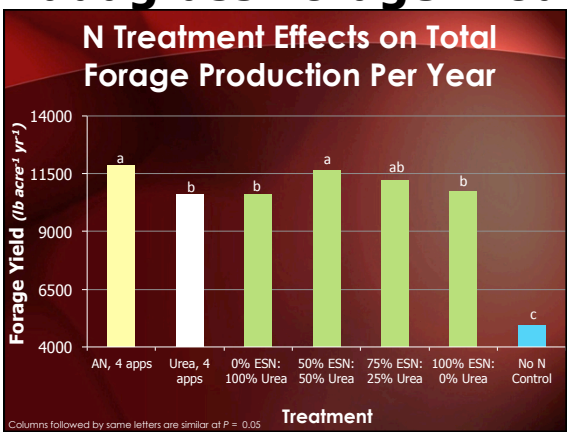

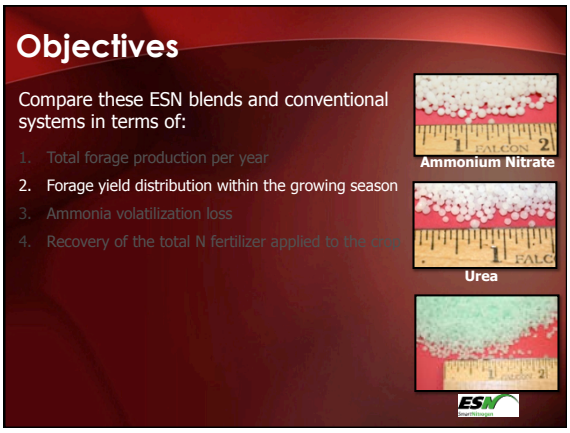

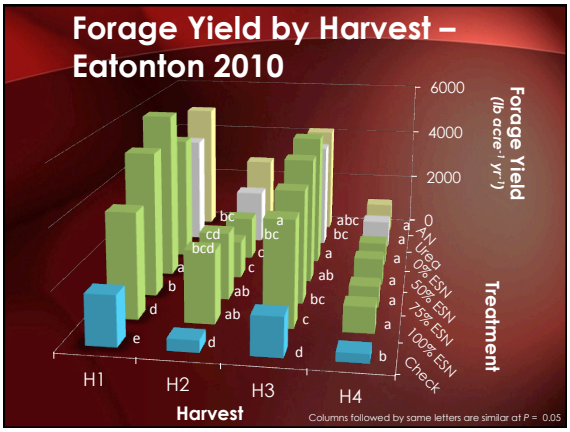

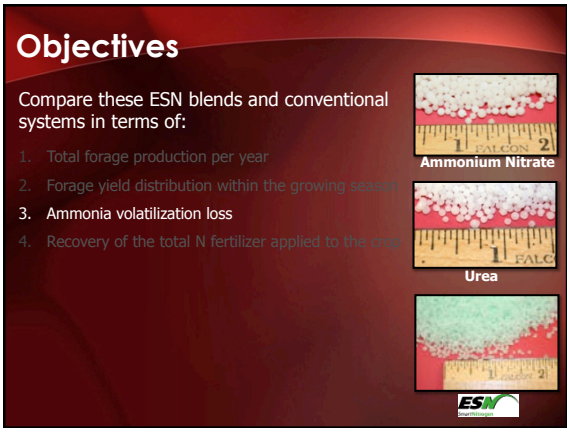

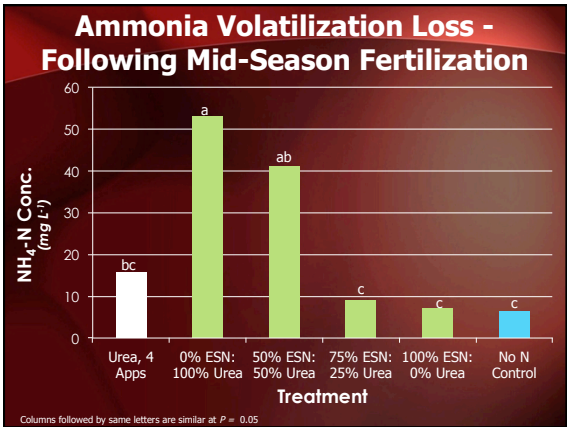

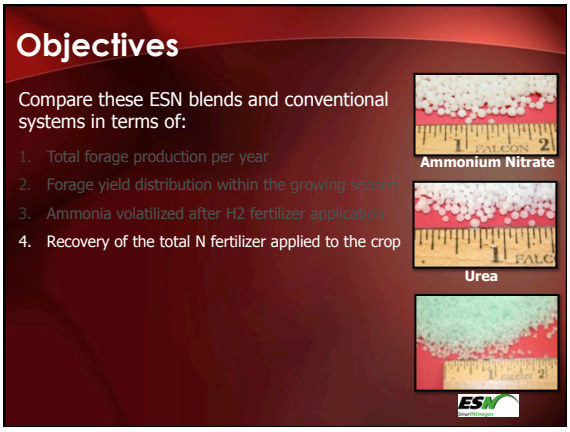

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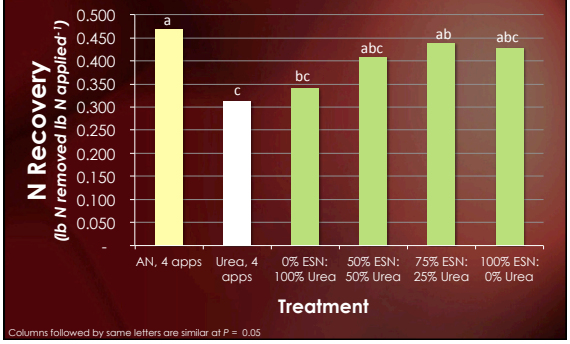
Effect of Treatment on the Recovery of Applied N



Columns followed by same letters are similar at $P = 0.05$

Conclusions

- Total yield of the 50 and 75% ESN blends were similar to that of AN.
- Throughout the growing season, 50 and 75% ESN blends achieved slow release of N without erratic forage distribution.
- ESN blends reduced the amount of ammonia volatilization/trapped.

Conclusions

- ESN blend applications split twice per season recovered similar amounts of applied N as conventional AN, applied four times.
- The nutritive value of the ESN blends were generally similar to AN (data not shown).
  - Nitrate levels in ESN blends of 50 and 75% were lower than AN (data not shown).

Implications

- Two equal split applications of a 50%:50% or 75%:25% blend of ESN:Urea could provide an alternative to conventional AN recommendations.
  - Economic analyses should be conducted to assess the cost-effectiveness of this promising alternative.
- Use of such blends reduces NH_3 volatilization loss and increases the recovery of applied N, reducing potential environmental threats.

Basic Cost Analysis

Trt.	lb N	lb as urea	$ as urea	lb as ESN	$ as ESN	trips	$ trips	Total	Yield (lb/A/yr)	Forage Cost	Forage Value	net revenue
100 Urea x 4	300	300	$210	0	$-	4	$20	$530	9461	0.0560	$1,324.50	**$794.50**
100 Urea x 2	300	300	$210	0	$-	2	$10	$520	9483	0.0548	$1,327.63	**$807.63**
50 Urea: 50 ESN	300	150	$105	150	$115.50	2	$10	$530.50	10426	0.0509	$1,459.63	**$929.13**
25 Urea: 75 ESN	300	225	$157	75	$57.75	2	$10	$525.25	10035	0.0523	$1,404.88	**$879.63**
100 ESN	300	0	$-	300	$231	2	$10	$541	9606	0.0563	$1,344.88	**$803.88**

Values Determined Assuming

Urea Price: $0.70/ lb N

ESN Price: $0.77/ lb N

1 trip across the field: $5

Total Cost: $300 + fert $ + trip $

Forage Cost: Total Cost / Yield

50 lb DM @ $7/bale: $0.14/ lb DM

Forage Value: Yield x $0.14/lb DM

Net Revenue: Forage Value – Total Cost

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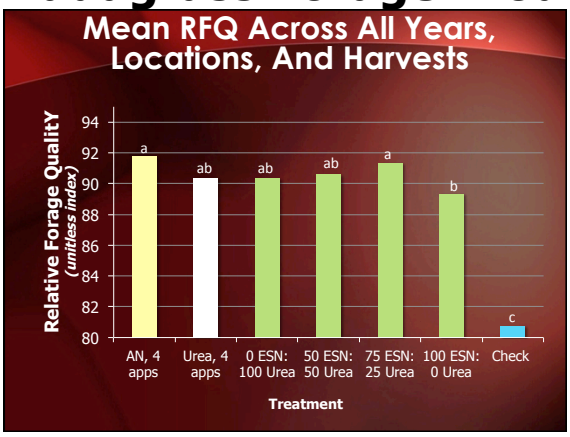

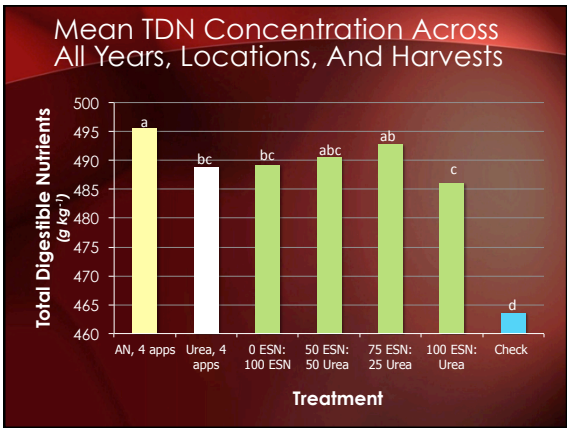

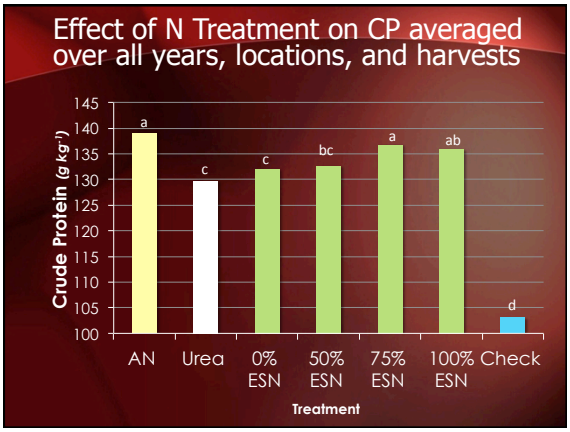

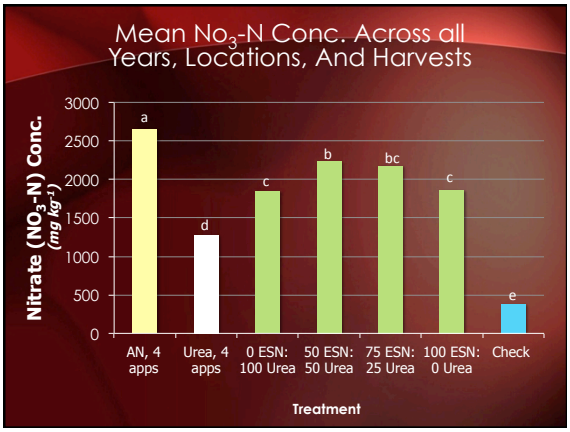

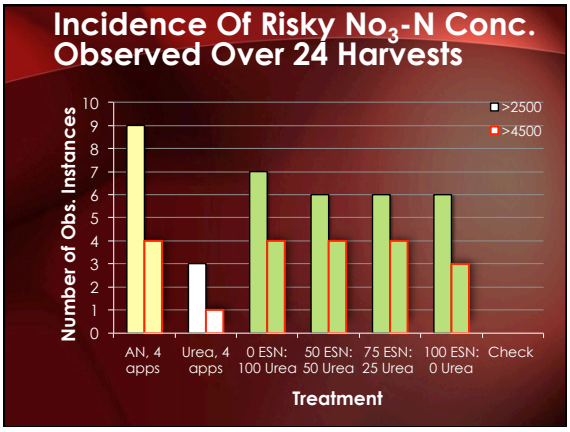

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