Effect of Method of UAN Application on Forage Yield and N Losses

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- **Objective** 1: Ammonia loss from UAN and urea
- **Objective 2**: Forage yield/runoff losses under rainfed conditions
- **Objective 3**: Runoff losses/rainfall simulation

Introduction - Ammonia Loss

- UAN application: *Dribble or Broadcast*

- Kansas - April 1984 (Moyer and Sweeney,1990):
  - Dribble: 25% greater tall fescue yield than broadcast

- Kansas - March 1985, February 1986:
  - No difference between dribble and broadcast
  - Lower temperatures in February and March

- No measurement of ammonia losses

Objective 1

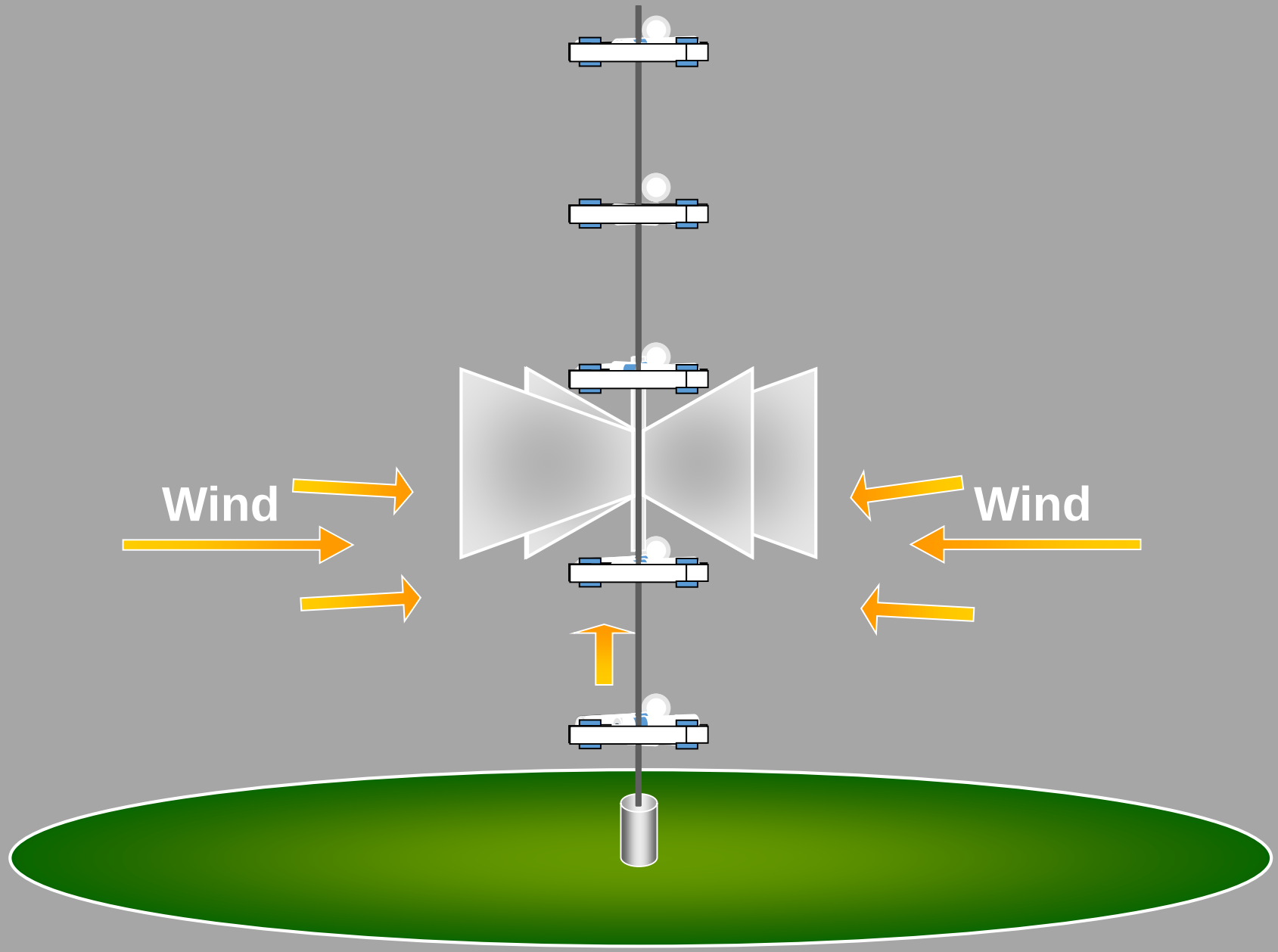
- Evaluate ammonia losses from three treatments:
  - Urea-Broadcast
  - UAN-Dribble
  - UAN-Broadcast

Materials and Methods

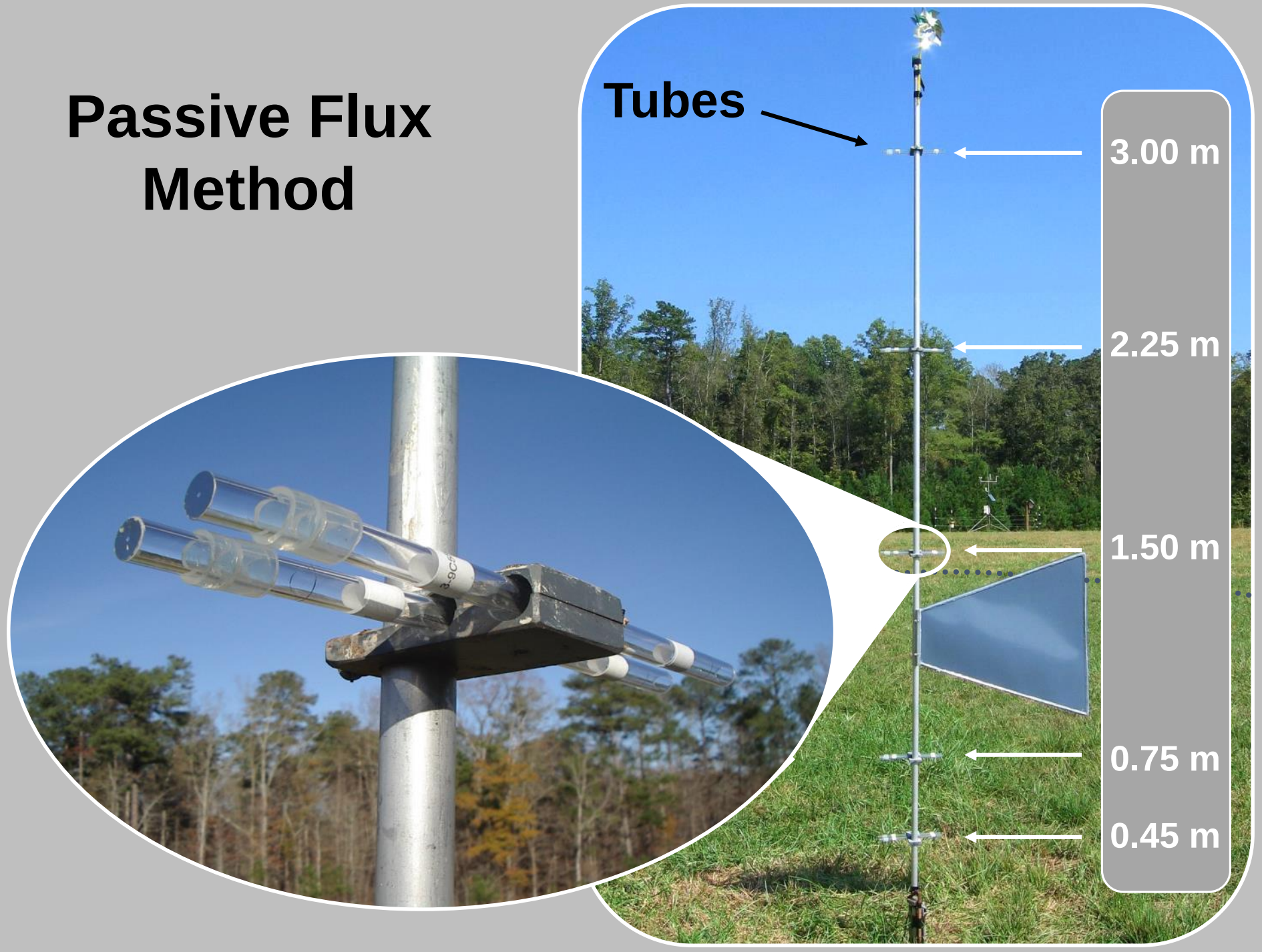
- Tall fescue/bermudagrass grassland
- Circular plots, 65 ft in diameter, 3 reps
- 90 lb N/A – 6 studies over 3 years


10/15/2011
© 2011 Google
Google earth
Imagery Date: 10/15/2011
1993
33°24'20.18" N 83°29'05.36" W elev 160 m
Eye alt 680 m

Passive Flux Method

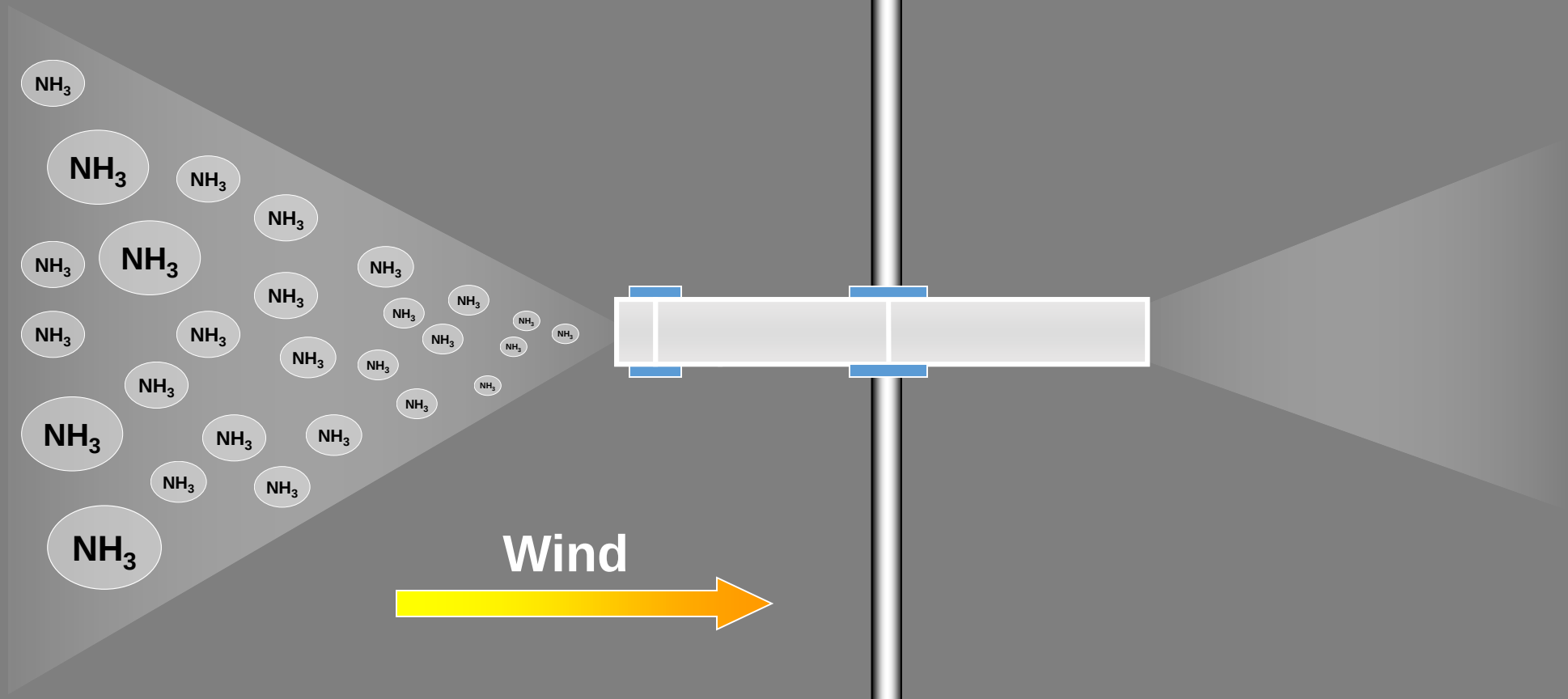


Passive Flux Method



Horizontal Flux

$$C_2O_4H_2 + 2\,NH_3 \longrightarrow C_2O_4(NH_4)_2$$

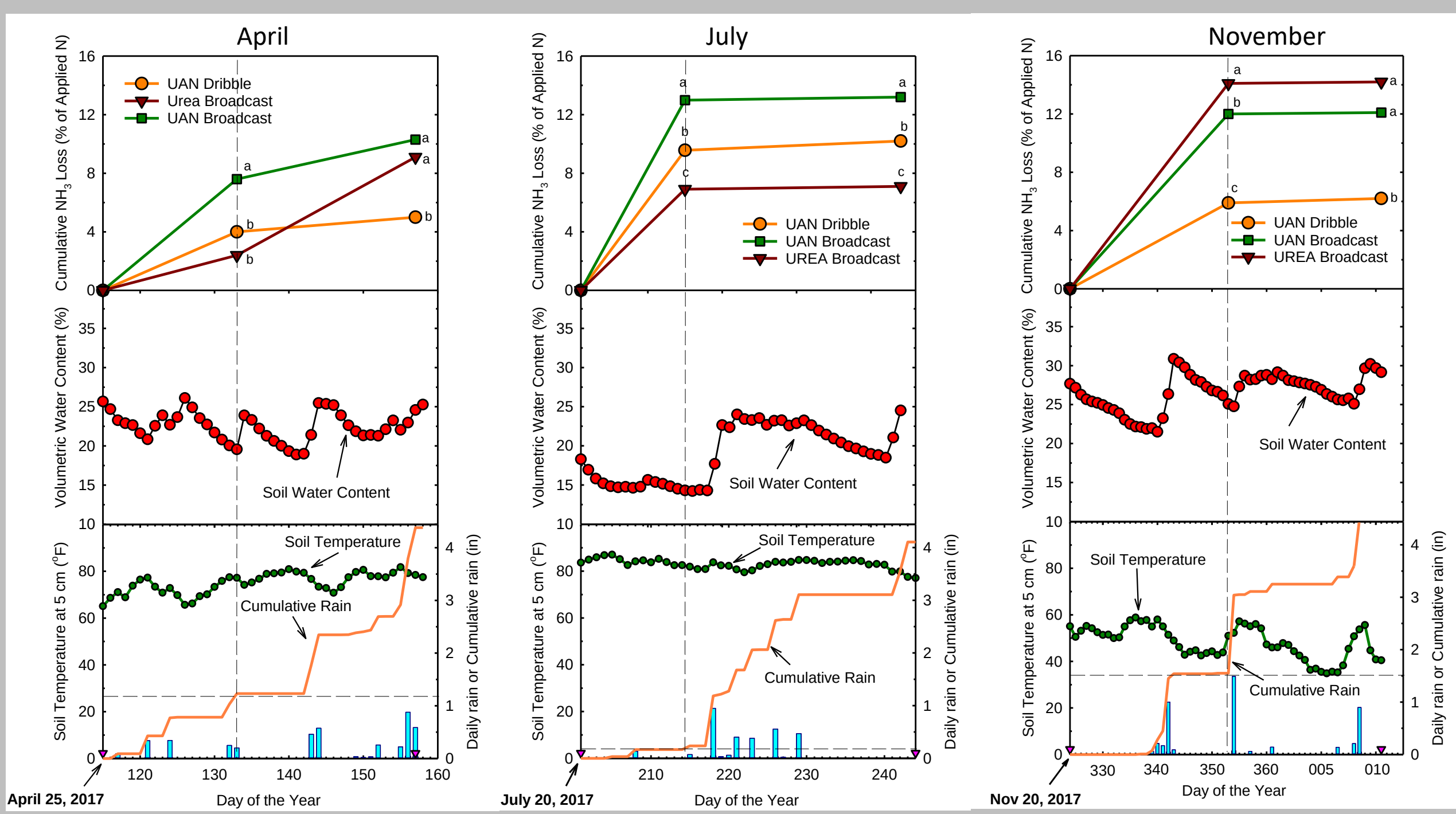


Materials and Methods

- Dribble nozzles placed 10 inches apart
  - StreamJet TP0002 (40 psi)

- Broadcast nozzles placed 20 inches apart
  - Visiflo flat spray TP11004 (40 psi)

Results


April
Cumulative NH3 Loss (% of Applied N)
UAN Dribble
Urea Broadcast
UAN Broadcast
Volumetric Water Content (%)
Soil Water Content
Soil Temperature at 5 cm (°F)
Soil Temperature
Cumulative Rain
Daily rain or Cumulative rain (in)
Day of the Year
April 25, 2017
July
UAN Dribble
UAN Broadcast
UREA Broadcast
July 20, 2017
November
Nov 20, 2017

Date	Urea	UAN-B	UAN-D	Temp	Rain	W.Cont.
	-------- % Lost ----------			-- ºF --	--- in --	%
Apr-17	9.1 ab	10.3 a	5.0 b	65	0.88	0.26
Jul-17	10.5 c	19.7 a	14.8 b	78	0.17	0.18
Nov-17	21.2 a	17.9 a	9.3 b	46	1.30	0.27
Jun-18	15.4 a	13.1 a	11.0 a	78	1.85	0.23
Jun-19	13.8 a	9.2 b	9.2 b	75	1.27	0.23
Oct-19	10.8 b	17.3 a	5.4 c	65	0.86	0.10
Average	13.5	14.6	9.1			

Summary – Objective 1

- UAN-Dribble lost 37% less NH_3 than UAN-Broadcast

- UAN-Broadcast lost equal/greater NH_3 than Urea-Broadcast

Introduction – Urea in Surface Runoff

- Harmful algal blooms can be caused by species that use urea as substrate
- Urea-N concentrations > 0.06 ppm were correlated with Pfiesteria spp. in Chesapeake Bay tributaries

Objective 2

- Evaluate runoff N losses and forage yield from three treatments under rainfed conditions:
  - Urea-Broadcast
  - UAN-Dribble
  - UAN-Broadcast

Materials and Methods

- 10, 2-acre plots
- Urea Broadcast: 3 plots
- UAN Dribble: 3 plots
- UAN Broadcast: 3 plots

- 270 lb N/a applied in two years

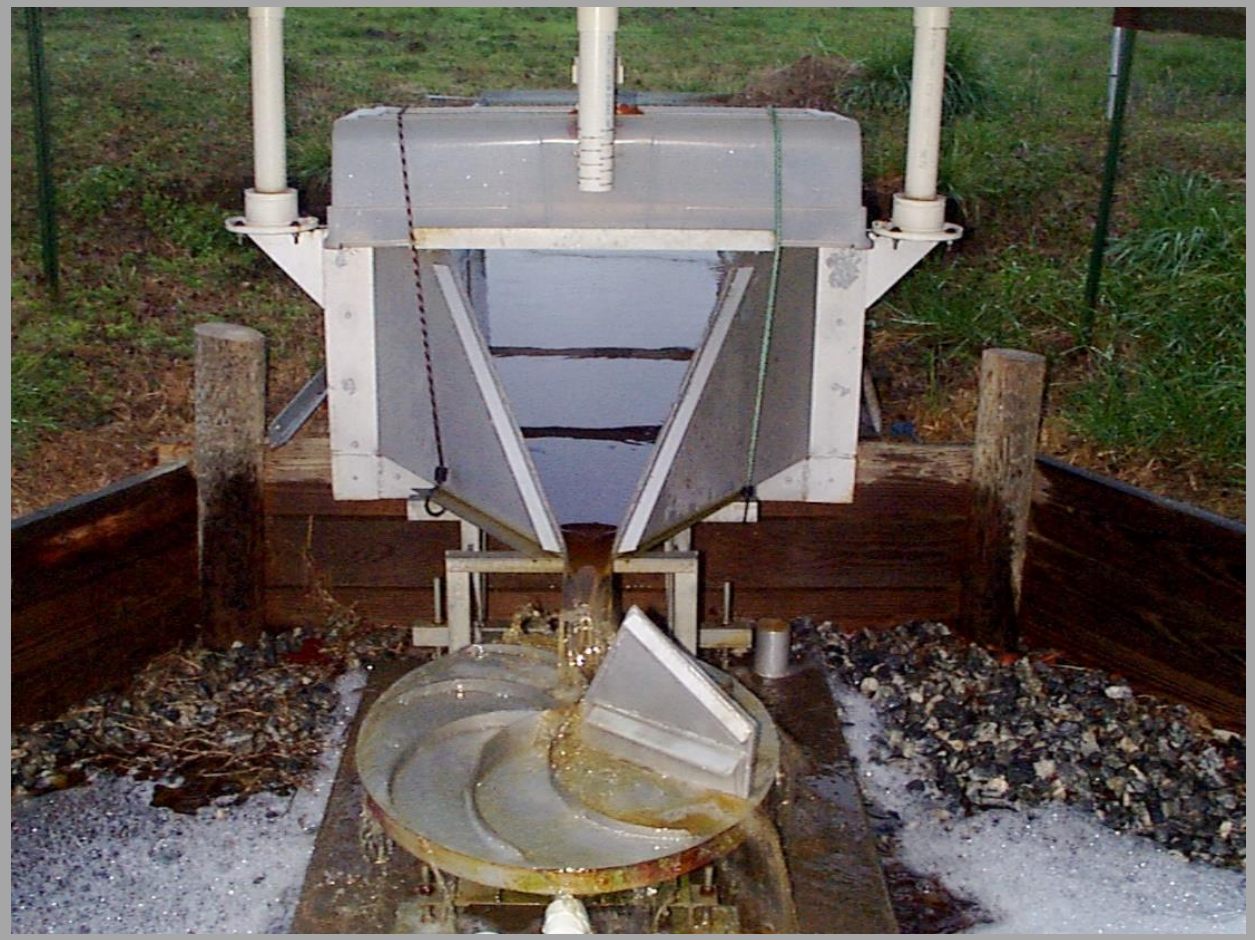
- Soil Series:
  - Cecil, Altavista
  - Sedgefield
  - Helena

- 0-5 cm
- Carbon = 2.6%
- M1 = 150 mg P/kg
- Sand = 59%
- Silt = 21%
- Clay = 20%

Plots were cut for hay

All bales were weighed and sampled for analysis

- Plots instrumented to collect runoff



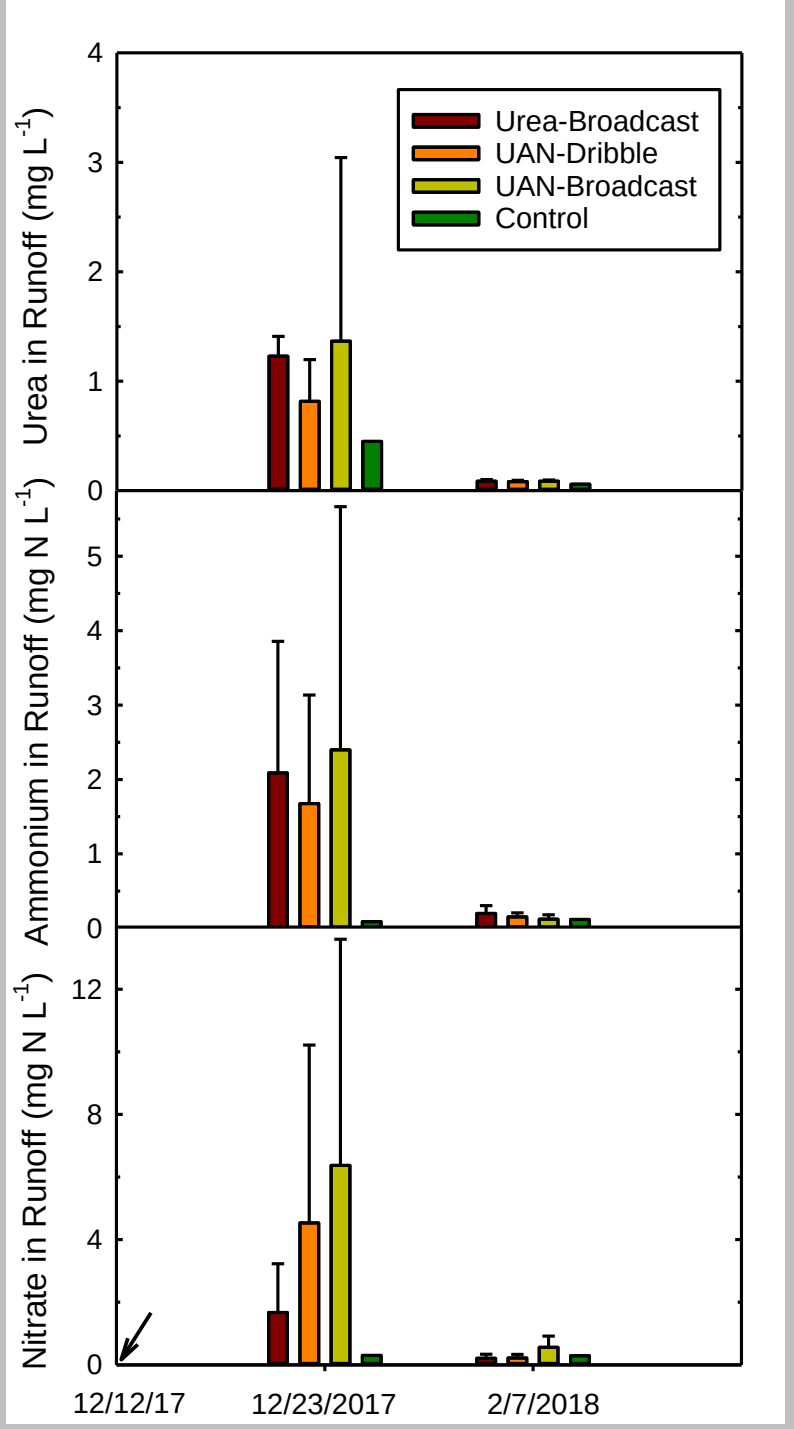
Results

Runoff Results

- Runoff water analyzed for
  - Urea
  - Ammonium-N
  - Nitrate-N

- Elevated levels of all N forms 11 days after application

- Background levels 57 days after application



Forage Yield in Four Harvests (270 lb N/a)

Treatment	Yield	Partial Factor Productivity	Partial Nutrient Balance
	Ton/a	lb forage/lb Fert N	lb N uptake/lb Fert N
Urea-Broadcast	6.8 a	51 a	0.68 a
UAN-Broadcast	6.8 a	50 a	0.66 a
UAN-Dribble	6.2 a	46 a	0.63 a

Objective 3

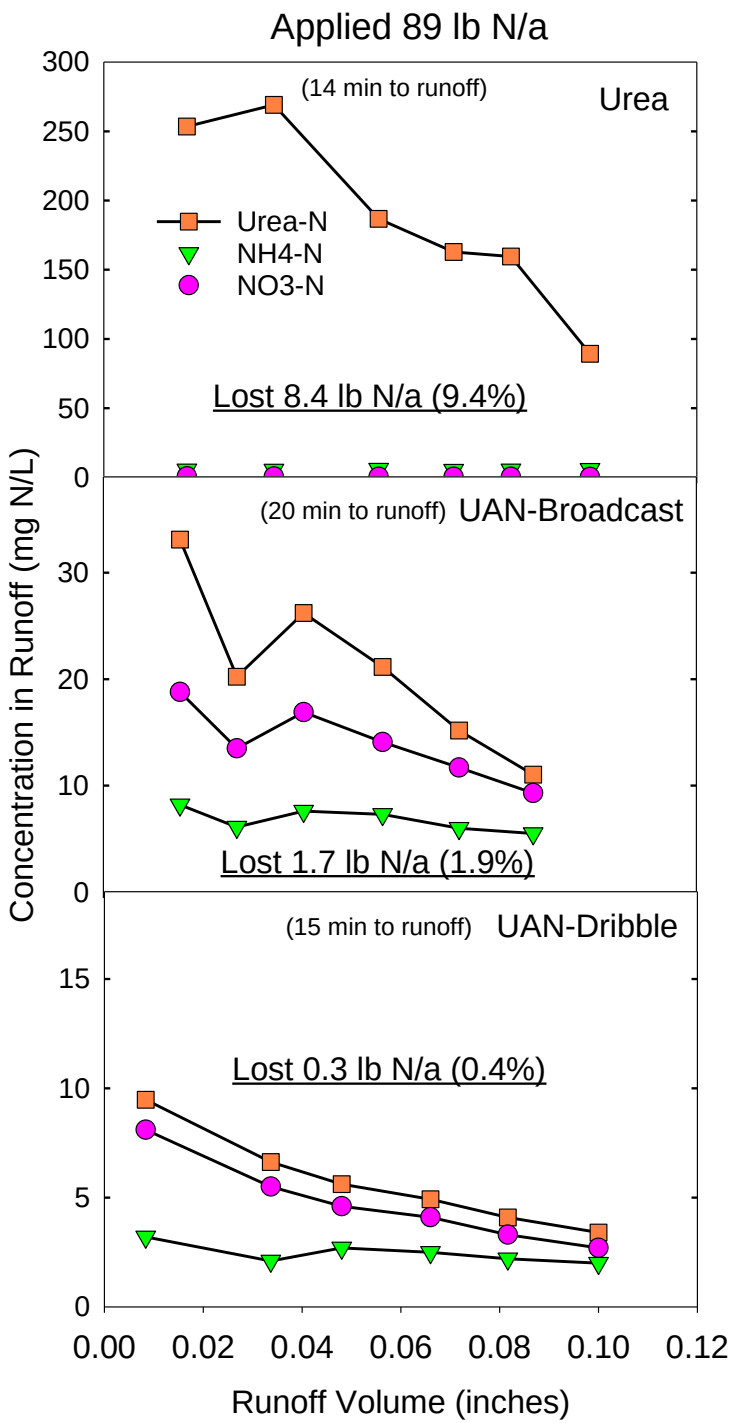
- Evaluate runoff N losses with rainfall simulation:
  - Urea-Broadcast
  - UAN-Dribble
  - UAN-Broadcast

Materials and Methods

- 11 plots, 7 ft x 5 ft
- Urea-Broadcast – 3 plots
- UAN-Dribble – 3 plots
- UAN-Broadcast – 3 plots
- Control – 2 plots

- Rain Intensity: 2 inches/hour; Runoff collected for 30 min
- Analysed for N species

Results



- UAN Broadcast and Dribbled lost less N in runoff than urea
- UAN lost more NO_3-N than NH_4-N

Summary

- UAN-Dribble: 37% less NH_3 loss than UAN-Broadcast.
- No difference among treatments in forage yield.
- Runoff from natural rain had elevated urea concentration in the first event after N application.
- Runoff from simulated rain had greater urea concentrations in the urea treatment than in the UAN treatments.
- UAN treatments lost more nitrate than ammonium.

THANK YOU!