Evaluation of N Products for Cotton and Corn

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ABSTRACT

Because of high fertilizer N prices, growers are interested in using less expensive sources of N and using fertilizer additives to reduce ammonia volatilization losses from urea sources. An experiment on a Lucedale fine sandy loam (fine-loamy, siliceous, thermic Rhodic Paleudults) in Central Alabama was conducted 2007 through 2011 to compare traditional and non-traditional sources of N for high-residue, conservation tilled corn and cotton under non-irrigated conditions. Treatments varied slightly each year. Materials evaluated included urea, ammonium nitrate, urea-ammonium sulfate blends, UAN solutions, Agrotain®, Nutrisphere®, ESN®, Nitamin N-fusion®, poultry broiler litter, calcium chloride, and others. Yield differences in N sources were minor and generally would not justify one product over another. Ammonia volatilization losses in the field were measured for 14 d after sidedress application. Most volatilization occurred within two or three days after application.

OBJECTIVES

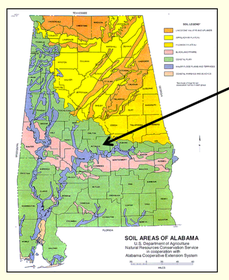
1) Determine the effect of N stabilizers on the rate of ammonia volatilization from surface applied urea-based N fertilizers.

2) Determine the effect of alternative N sources on yields of non-irrigated cotton and corn in Central Alabama

Attempts were made in 2007, 2008, and 2009 to estimate ammonia volatilization losses in the field for 14 d after side dressing using static chambers installed randomly between rows as seen above.

METHODS

- Years: 2007-2011
- Location/soil: Prattville (AL) Research Unit on a Lucedale fine sandy loam (*Fine-loamy, siliceous thermic Rhodic Paleudults*)
- Treatments: Various N materials applied as a sidedress to non-irrigated, no-till cotton and corn planted into rye residue; randomized block with 4 replications per crop.
- Plots: 4.6 x 9,2 m
- N rates: Cotton = 100 kg N ha^{-1} (78 kg N ha^{-1} as a sidedress)
  Corn = 134 kg N ha^{-1} (112 kg N ha^{-1} as a sidedress)
- Higher and lower N rates were used in some treatments for comparison.
- Ammonia volatilization was estimated in 2007-2009 using static chambers installed between rows of selected treatments; data were collected for 14 d following sidedress N application.
- Data collected: cotton lint yield; corn grain yield; leaf analyses (not shown).



Prattville Research Unit
Soil: Lucedale s.c.l.
Fine-loamy, siliceous thermic Rhodic Paleudults

N Sources Used

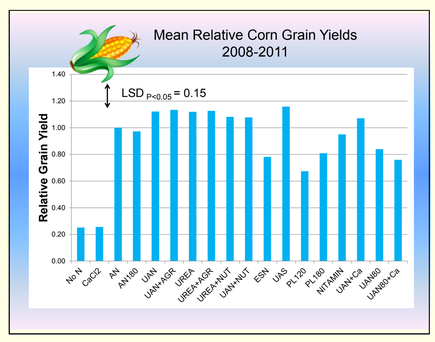
- No N
- Urea
- Urea + liquid $CaCl_2$
- Urea + Agrotain®
- Urea + Nutrisphere® N
- UAN solution (28-0-0)
- UAN solution+ Agrotain®
- UAN solution + liquid $CaCl_2$
- UAN solution + Nutrisphere® N
- Ammonium nitrate (34-0-0)
- Urea-Ammonium sulfate blend (34-0-0)
- ESN® (44-0-0)
- Nitamin Nfusion® (22-0-0)
- Poultry broiler litter (~3-3-4)

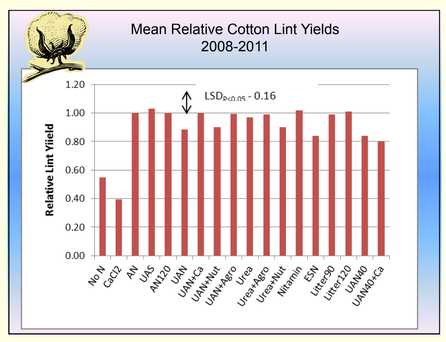
Photos from studies: (A) sidedressing cotton; (B) inside of ammonia collection chamber; (C) drought stressed corn showing treatment differences; (D) installing chambers after sidedressing.

RESULTS

Mean crop yield by year during the 5-yr study. No yield in 2007 due to drought.

Year	Corn Grain --kg ha^{-1}--	Cotton Lint –kg ha^{-1}--
2007 (drought)	0	0
2008	5210	1110
2009	3640	880
2010	5140	630
2011	5710	1460

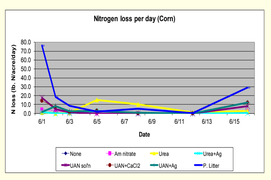


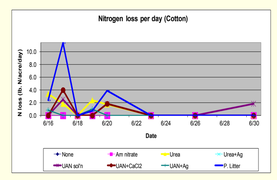


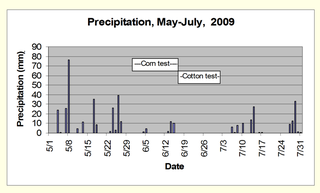
AN = Am. Nitrate (34-0-0) @ 120 lb. N $acre^{-1}$ (134 kg N ha^{-1})
AN180 = Am. Nitrate (34-0-0) @ 180 lb. N $acre^{-1}$ (202 kg N ha^{-1})
UAN = liquid UAN solution 28-0-0
UAN+AGR = UAN solution plus Agrotain®
UAN+NUT = UAN solution plus Nutrisphere® N
UAN+Ca = UAN solution plus calcium chloride
UREA+AS = urea-ammonium sulfate blend (34-0-0)
NITAMIN = Nitamin N-Fusion®

UREA = prilled 46-0-0
UREA+AGR = urea plus Agrotain®
UREA+NUT = urea plus Nutrisphere® N
ESN = Environmentally Smart Nitrogen®
PL180= Poultry litter @ 180 lb. total N $acre^{-1}$ (202 kg N ha^{-1})
PL120 or Litter120 = Poultry litter @ 120 lb. total N $acre^{-1}$ (134 kg N ha^{-1})
Litter90 = Poultry litter @ 90 lb. total N $acre^{-1}$ (100 kg N ha^{-1})
CaCl2 = liquid calcium chloride solution

Mean corn grain and cotton lint yields over 4 yr relative to the standard ammonium nitrate treatment indicate no advantage to using the more expensive N sources as a sidedress. Controlled release N products may fail to supply enough N. Potential ammonia volatilization losses did not appear to affect yields. Calcium chloride had no effect on yields.







Estimated ammonia volatilization losses and rainfall during the ammonia collection period are shown only for 2009 for selected treatments because of low rainfall during the collection period in 2009. Each year was very different. Estimated values are obviously not very realistic but relative differences are. High losses were experienced with surface application of poultry litter. Losses from urea and UAN solutions were not affected by calcium chloride treatments. Agrotain® did not reduce urea losses when applied to a high residue cover but did reduce losses when both urea and UAN solutions were applied to a bare soil (data not shown).

CONCLUSIONS

- The newer, controlled release N products failed to produce a consistent yield advantage over traditional N materials such as urea, UAN solutions, or a urea-ammonium sulfate blend.
- Poultry litter results in very high ammonia losses when applied as a sidedress to both cotton and corn.
- Attempts to accurately measure ammonia losses in the field using static chambers produced good relative losses but estimating total N losses were elusive.

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