

manures on conventional and conservation tillage fields

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Introduction

Poultry manure analysis & typical application rates lead to general awareness of multiple nutrient issues, but specific effects associated with different sources, soils & tillage management are not well understood.

Objective

To evaluate the residual effects of different poultry manures on soil fertility parameters



Figure 1. Poultry manures were applied prior to cotton in 2008 and 2010. No manures were applied to corn in 2009. Inorganic N treatments were applied to all crops.

Table 1. Nutrient composition of poultry manures.

Year	Source	C:N	N	P	K	Ca	Zn	CCE
			%					
2008	LM	9	3.5	1.2	2.6	9.0	0.07	10.8
	BL	14	2.5	0.7	1.9	2.0	0.04	0.3
	CLM	5	7.1	1.2	2.9	6.8	0.05	10.5
2010	LM	-	3.4	2.3	2.9	8.9	0.07	-
	BL	-	2.9	1.8	2.7	3.6	0.05	-
	CLM	6	5.6	1.7	3.0	7.8	0.05	8.8

Table 2. Poultry manure nutrients applied to achieve the high N rate (90 kg N/ha).

Year	Source	P	K	Ca	Zn	Lime
		kg/ha				
2008	LM	27	59	206	1.6	247
	BL	22	61	64	1.3	10
	CLM	14	33	77	0.6	118
2010	LM	54	68	209	1.6	---
	BL	50	74	99	1.4	---
	CLM	24	43	111	0.7	126

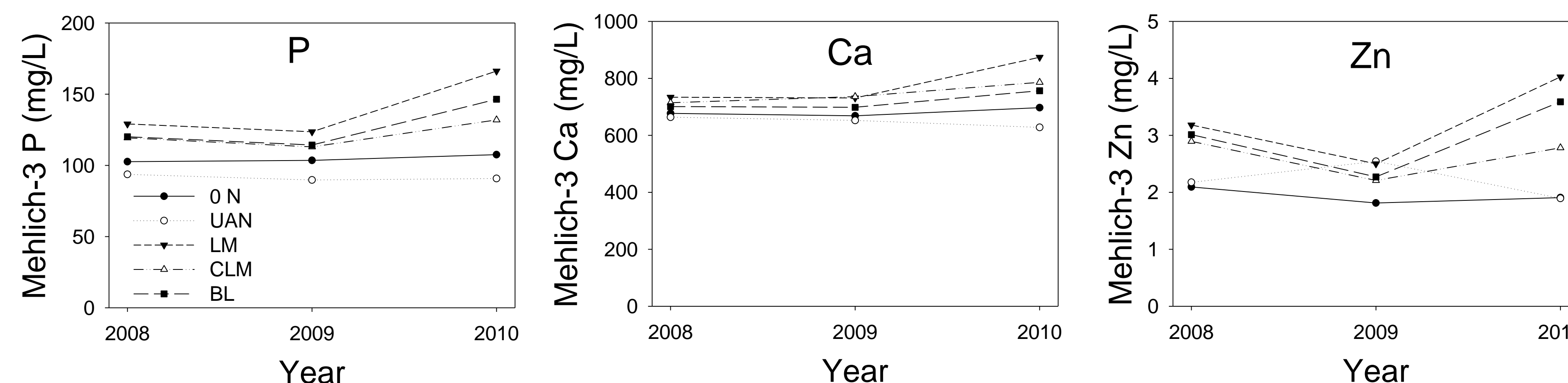


Figure 2. Changes in the 0-10 cm soil depth layer averaged across 4 experiments (both sites & both tillage methods) associated with different N sources. Vertical lines represent differences required for significance, $p < 0.05$, Tukey-Kramer test.

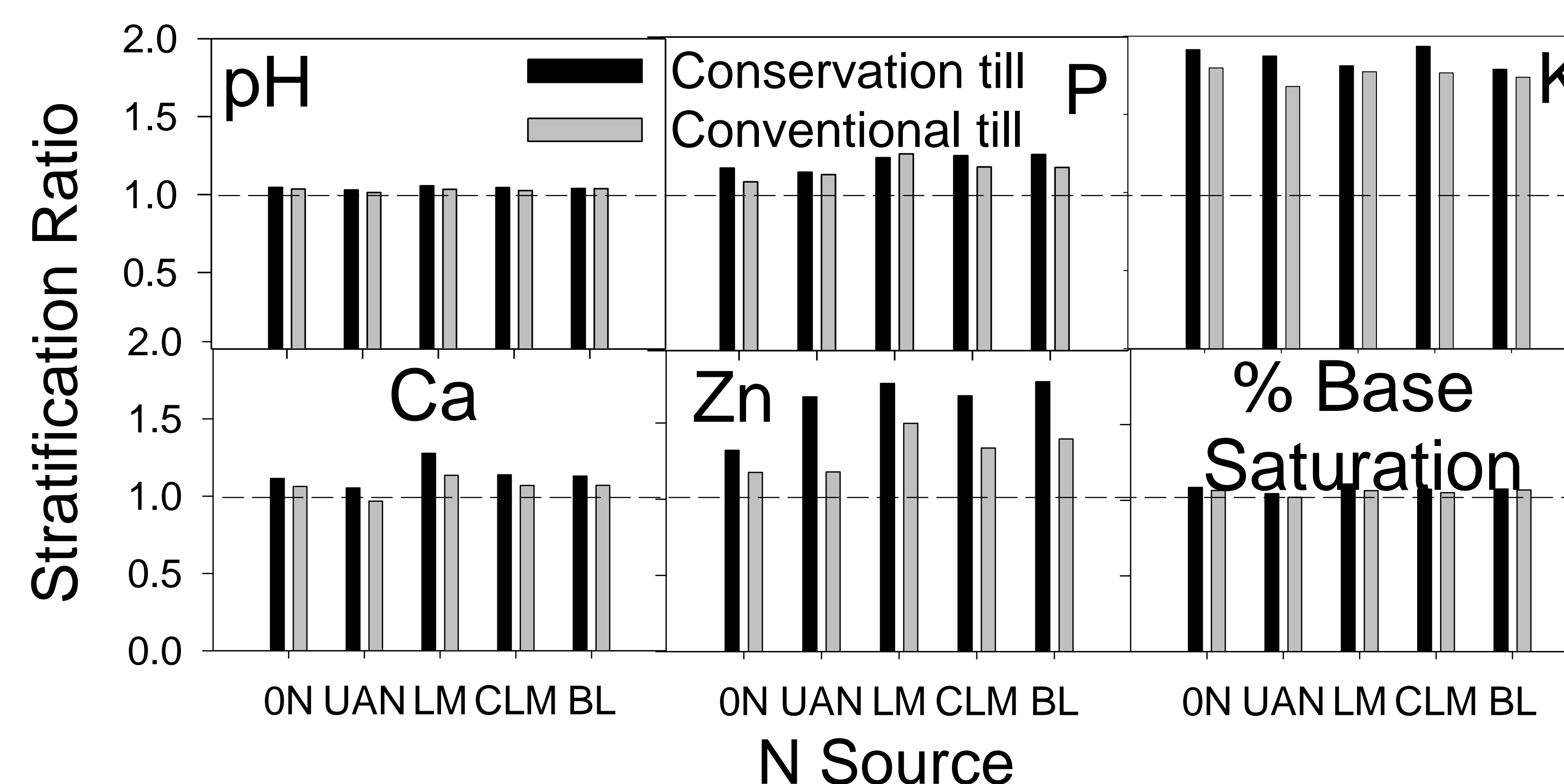


Figure 3. Soil stratification ratios for each N source pooled across sites and years.

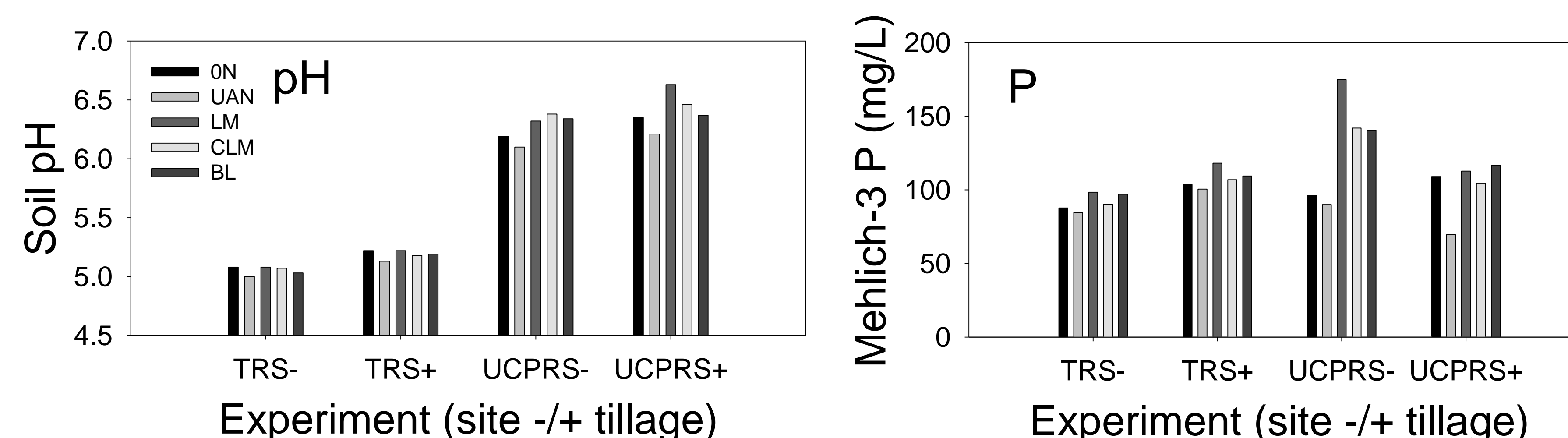


Figure 4. Means for each experiment and N source combination, pooled across depths and years. Vertical lines represent differences required for significance, $p < 0.05$, Tukey-Kramer test.

Table 3. ANOVA results for manure & inorganic N sources. Probabilities of significance: * 0.05, ** 0.01, and *** 0.001.

Effects	df	pH	P	K	Ca	Zn	base sat.
Fixed Effects							
Year (Y)	2	*				*	
Depth (D)	1			*		*	*
N Source (N)	4	*	*	***	*	***	**
Y x D	2		***	**	*	**	
Y x N	8		***		**	***	
D x N	4	**	***		***	***	**
Y x D x N	8		***			*	
Random Effects							
Expt (E)	3	**			**		
E x Y	6		***	*			
E x D	3	*	***	***			
E x N	12	*	***				
E x Y x D	6	***		***	**		***
E x Y x N	24		***	*			**
E x D x N	12			**			**
E x Y x D x N	24						

Summary

- CLM had the highest N concentration, thus lower P, K, & Zn inputs than other manures.
- After the 2nd poultry manure application (i.e. 2010), soil Ca levels were higher with all 3 manures than with UAN, and P & Zn levels were higher with LM & BL than with UAN.
- Stratification ratios were slightly greater with conservation tillage than with conventional tillage for all parameters.
- Little depth stratification was noted for pH, Ca, & base saturation, mean ratios were all similar to 1.
- Stratification was most pronounced for K and Zn.
- Poultry manure treatments at UCPRS had higher soil pH and P than with UAN, probably due to crop removal & nitrification without additional lime or P inputs with the UAN. Mean trends were similar at TRS, but not differences were not significant.

Acknowledgements

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Methods & Materials

4 Experiments: 2 Sites x 2 Tillage methods

Sites

Tidewater Res. Sta. (TRS)
Portsmouth fine sandy loam
(Typic Umbraquults)

Upper Coastal Plain Res. Sta. (UCPRS)
Norfolk loamy sand
(Typic Paleudults)

Tillage

Conventional tillage (chisel, disk)

Conservation tillage

(TRS: no-till, UCPRS: strip-till)

5 N Sources

Non-amended check treatment

Inorganic N: cotton, 134 kg N/ha; or corn, 202 kg N/ha as UAN30%

Manures at 90 kg N/ha to cotton in 2008 & '10 (no manure for corn in '09)

-Layer manure (LM)

-Composted layer manure (CLM)

-Broiler litter (BL)

Layout

RCBD with 4 replicates

Soil samples

0-10 cm & 10-20 cm depths post-harvest.

Mehlich-3 extractant used for soil nutrients, and pH was determined in water.

Data analysis

SAS PROC Mixed, with Tukey-Kramer test for means comparisons

Experiment and replication were random effects

Stratification ratio calculated as soil test value in 0-10 cm layer divided by value in 10-20 cm layer.