

# UTILIZATION OF N AND P FROM TURKEY LITTER AND FERTILIZER BY GRAIN SORGHUM GROWN ON A CLAYPAN SOIL

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## Introduction

Use of poultry litter as an alternative to commercial fertilizer has increased in recent years in southeastern Kansas because of the availability from production facilities in surrounding states. Little information is available on nutrient management of turkey litter waste compared to commercial fertilizer for claypan soils in southeastern Kansas.



Application of turkey litter on research plot at Greenbush (Girard, KS)

## 3-year Total Nitrogen Budget (lb/acre)

	Control	Fert	TL-N	TL-P	TL-P-C
<b>Inputs:</b>					
Fertilizer	0	360	0	310	310
Turkey Litter	0	0	643	85	85
<b>Total</b>	<b>0</b>	<b>360</b>	<b>643</b>	<b>395</b>	<b>395</b>
<b>Outputs:</b>					
Runoff	7	36	59	37	25
Grain Removal	60	102	119	101	107
<b>Total</b>	<b>67</b>	<b>138</b>	<b>177</b>	<b>138</b>	<b>132</b>
<b>Storage:</b>					
Non-decomposed stalks	27	60	45	41	41
Soil (0-12")	-98	-21	97	-32	248
<b>Total</b>	<b>-71</b>	<b>39</b>	<b>142</b>	<b>9</b>	<b>289</b>
<b>Unaccounted for:</b>	<b>4</b>	<b>183</b>	<b>324</b>	<b>248</b>	<b>-26</b>

## Objectives

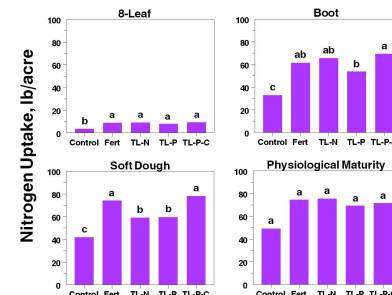
- To compare grain sorghum yield, yield components, and nutrient uptake influenced by applications of turkey litter waste and fertilizer
- To determine the influence of tillage on yield and nutrient uptake with the use of turkey litter

## Turkey Litter Analyses

- % (dry matter basis) -

	2005	2006	2007	Avg.
Total N	3.82	2.73	3.24	3.26
NH <sub>4</sub> -N	0.53	0.22	0.45	0.40
NO <sub>3</sub> -N	0.16	0.15	0.16	0.16
Org-N	3.13	2.36	2.63	2.71
"PAN"	2.15	1.51	1.84	1.83
<b>Total P</b>	<b>2.75</b>	<b>2.18</b>	<b>2.72</b>	<b>2.55</b>

Organic N is calculated from Total N minus (NH<sub>4</sub>-N and NO<sub>3</sub>-N)  
Potentially available N (PAN) is estimated to be the sum of the fraction of Org-N that mineralizes (assumed to be 50%) plus the fraction of NH<sub>4</sub>-N that does not volatilize (assumed to be 80%) plus NO<sub>3</sub>-N



## Treatments

**Control:** No N or P from fertilizer or turkey litter

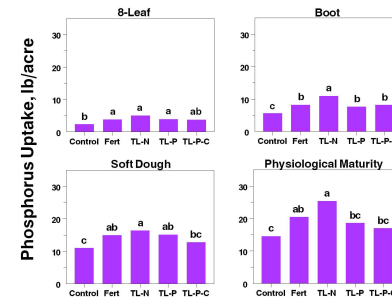
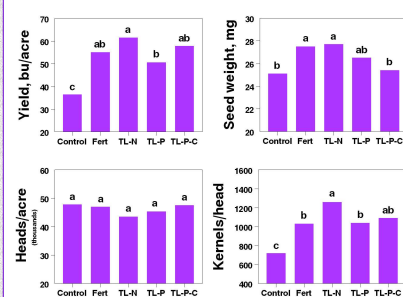
**Fert:** Only commercial fertilizer to supply 120 lb N/acre and 50 lb P<sub>2</sub>O<sub>5</sub>/acre with no turkey litter

**TL-N:** (Turkey Litter: N based) – Turkey litter applications to supply 120 lb N/acre for the sorghum crop (~ 3-3.5 ton Litter/acre (dry basis) – that also provides excess P (~350-400 lb P<sub>2</sub>O<sub>5</sub>/acre))

**TL-P:** (Turkey Litter: P based) – Turkey litter applications to supply 50 lb P<sub>2</sub>O<sub>5</sub>/acre with supplemental fertilizer N to supply a total of 120 lb/acre (~ 0.5 ton Litter/acre (dry basis))

**TL-P-C:** (Turkey Litter: P based) – Same as "TL-P" treatment but with incorporation of litter and fertilizer by conventional tillage [chisel and disk]

All treatments were no-till except TL-P-C  
Grain sorghum grown in 2005, 2006, and 2007  
Individual plot size = 1.0 acre; 2 reps – 1 % slope



## 3-year Total Phosphorus Budget (lb/acre)

	Control	Fert	TL-N	TL-P	TL-P-C
<b>Inputs:</b>					
Fertilizer	0	66	0	0	0
Turkey Litter	0	0	504	66	66
<b>Total</b>	<b>0</b>	<b>66</b>	<b>504</b>	<b>66</b>	<b>66</b>
<b>Outputs:</b>					
Runoff	1	11	27	8	5
Grain Removal	24	33	51	36	36
<b>Total</b>	<b>25</b>	<b>44</b>	<b>78</b>	<b>44</b>	<b>41</b>
<b>Storage:</b>					
Non-decomposed stalks	7	19	17	16	7
Soil (0-12")	-40	0	291	8	2
<b>Total</b>	<b>-33</b>	<b>19</b>	<b>308</b>	<b>24</b>	<b>9</b>
<b>Unaccounted for:</b>	<b>8</b>	<b>3</b>	<b>118</b>	<b>-2</b>	<b>16</b>

## Summary

Three-year average grain sorghum yields were 39 to 69% greater with application of fertilizer and/or turkey litter than obtained in the control. Yield was 21% greater with N-based turkey litter application compared with P-based litter applications, but yield was intermediate with fertilizer only or when P-based turkey litter was incorporated. Yield response was correlated to the number of kernels per head with both responding similarly to treatments. Although early through midseason N uptake was affected by treatments, the differences were not significant by physiological maturity. In contrast, marginal P uptake differences due to treatments early in the season became more pronounced with time. Budgets suggest that the high turkey litter rates applied in the N-based treatment result in greater amounts of unaccounted-for nutrients, especially P, than in the fertilizer, P-based turkey litter, or control treatments.