Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 2 *Dairy Research (1984-2014)*

Article 288

2001

Impact of dairy manure addition on soil nutrients in northeast and south central Kansas

T. Strahm

Joseph P. Harner

James P. Murphy

See next page for additional authors

Recommended Citation

Strahm, T.; Harner, Joseph P.; Murphy, James P.; and McCormack, G. (2001) "Impact of dairy manure addition on soil nutrients in northeast and south central Kansas," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 2. https://doi.org/10.4148/2378-5977.3213

Impact of dairy manure addition on soil nutrients in northeast and south central Kansas

Abstract

Sixty four percent of the fields (14 of 22) in northeast and south central Kansas would be able to apply dairy manure on a nitrogen basis if the current swine manure application regulations were adopted. Due to high phosphorus levels in some fields, two of the 11 fields in northeast Kansas could not have any manure applied to them. Two other fields in northeast and four fields in south central Kansas would have to limit manure application rates to annual phosphorus required by the crops. Our results indicate minimal accumulation of nitrogen and potassium in the soil profile.; Dairy Day, 2001, Kansas State University, Manhattan, KS, 2001;

Keywords

Dairy Day, 2001; Kansas Agricultural Experiment Station contribution; no. 02-133-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 881; Dairy; Nutrients; Soil; Manure

Authors

T. Strahm, Joseph P. Harner, James P. Murphy, and G. McCormack

IMPACT OF DAIRY MANURE ADDITION ON SOIL NUTRIENTS IN NORTHEAST AND SOUTH CENTRAL KANSAS

T. Strahm [1], J. P. Harner [1], J. P. Murphy [1], D. V. Key [2], G. McCormack [3], M. J. Brouk, and J. F. Smith

Summary

Sixty four percent of the fields (14 of 22) in northeast and south central Kansas would be able to apply dairy manure on a nitrogen basis if the current swine manure application regulations were adopted. Due to high phosphorus levels in some fields, two of the 11 fields in northeast Kansas could not have any manure applied to them. Two other fields in northeast and four fields in south central Kansas would have to limit manure application rates to annual phosphorus required by the crops. Our results indicate minimal accumulation of nitrogen and potassium in the soil profile.

(Key Words: Nutrients, Soil, Manure.)

Introduction

Nutrients are recycled to the land during manure application. Best Management Practice (BMP's) require laboratory analysis of the manure nutrients and soil sampling. Many producers utilize results from soil sampling and analysis to determine application rates for commercial fertilizers. Manure may be applied to the land after application of fertilizers without consideration of the potential to accumulate nutrients in the soil profile. Kansas regulates the quantities and amounts of swine manure that may be applied to fields. The application rates are based on yearly soil tests. The objective of this study was to determine the nutrient content in soil profiles that receive dairy manure and to determine the impact of the swine regulations if they were applied to the dairy industry.

Study Procedures

Eleven fields from seven dairies in northeast Kansas and 11 fields from five dairies in south central Kansas were selected for this study. The fields receiving manure in northeast Kansas were predominately clay soils. Those in south central region were sandy soils. Soil samples were collected randomly throughout the fields. At least 10 soil samples were collected from each field. Samples from each field were thoroughly mixed and composite samples were sent to the Kansas State University (KSU) Soils Lab. Soil cores were collected at 0 to 6 inches and 6 to 24 inches. Samples were analyzed for phosphorus, potassium, ammonium and nitrate. The available nitrogen per acre was estimated using an agronomic equation.

Results

Figure 1 shows the soil phosphorus (P) concentrations at 0 to 6 inch and 6 to 24 inch depths from fields located in northeast Kansas. The P concentrations ranged from 15 to 345 ppm in the top 6 inches. Fields 2W and 4E exceeded 150 ppm in the top 6 inches. Using the swine regulations, no manure could be applied to these fields because the P level exceeded 100 ppm. Fields 4W and 9W could have manure applied based on the crop P use rate rather than nitrogen. Manure

---

[1]Department of Biological and Agricultural Engineering.
[2]Nemaha County Extension Agent.
[3]Reno County Extension Agent.

applications to seven of the 11 (64%) fields could still be based on crop nitrogen use. Soil P levels from 6 to 24 inches ranged from 0 to 31 ppm. Again, fields 2W and 4E had the highest P concentrations at 31 and 20 ppm, respectively.

Potassium (K) concentrations ranged from 197 to 475 ppm, except field 2W (1,256), for the top 6 inches (Figure 2). At soil depths of 6 to 24 inches, K concentrations ranged from 142 to 347 ppm, except 4E (962). With the exception of these two fields, decreases in K from 0 to 6 inches and soil depths of 6 to 24 inches appeared fairly consistent.

Figures 3 and 4 show the ammonium and nitrate concentrations in the soil profile. Ammonium concentrations from 0 to 6 inches varied from 3.5-8.5 ppm and reduced to 1.4 to 3.6 ppm at soil depths of 6 to 24 inches (Figure 3). Nitrate concentrations in five fields ranged from 5-10.2 ppm in the top 6 inches. The remaining fields had nitrate concentrations ranging from 22.5 to 76 ppm. The 6 to 24 inch samples showed a similar pattern. The five fields with lower levels in the upper profile have nitrate concentrations of from 0.6 to 5.9 ppm in the deeper profile. The other six samples varied from 11.5 to 24.1 ppm.

Figure 5 shows an estimate of the nitrate available on a per field basis in northeast Kansas. Nitrate concentrations in the soil profile from 0 to 24 inches exceeded 150 lb/acre on five of the 11 fields.

Figure 6 shows the soil phosphorus (P) concentrations at 0 to 6 inches and 6 to 24 inches from fields located in south central Kansas. The P concentrations ranged from 15 to 76 ppm in the top 6 inches. No fields had P concentrations high enough to limit application of manure using the swine regulations. Fields 4E, 5N, 7E and 7S could have manure applied based on the crop P usage rate rather than nitrogen. Manure applications to seven of the 11 (64%) fields could still be based on crop nitrogen usage. Soil P concentrations from 6 to 24 inches were less than 20 ppm.

Potassium (K) concentrations ranged from 105 to 350 ppm for the top 6 inches (Figure 7). At soil depths of 6 to 24 inches, K concentrations ranged from 100 to 190 ppm. With the exception of three fields, decreases in K from 0 to 6 inches to soil depths of 6 to 24 inches appeared fairly consistent.

Figures 8 and 9 show the ammonium and nitrate concentrations, respectively, in the soil profile. The ammonium levels from 0 to 6 inches varied from 2.8-14.2 ppm and reduced to 1.5 to 8.6 ppm at soil depths of 6 to 24 inches (Figure 8). Nitrate concentrations in the fields ranged from 7.5 to 25 ppm in the top 6 inches. The results indicate leaching of nitrates in some fields such as 7E, 7S, 7N and 4E.

Figure 10 shows an estimate of the nitrate available on a per field basis in south central Kansas. Nitrate concentrations in the 24 inch soil profile exceed 100 lb/acre on two of the 11 fields.

Conclusions

In south central Kansas, no fields receiving manure showed high concentrations of P and nitrate (NO3-N) in the soil profile (0 to 24 inches). The K concentrations varied depending on the depth in these fields. None of the farms appear to have fields with excess nutrients. In northeast Kansas, two fields showed high concentrations of P and nitrate (NO3-N) in the soil profile (0 to 24 inches). The K concentrations varied depending on the depth in these fields. Only one of the farms seems to have soils with excess nutrients. Data from this preliminary study suggest that 64 % of the fields where dairy manure is applied would be in compliance with the current swine regulations. Manure application rates on six fields would need to be adjusted to meet the crop phosphorus requirements.

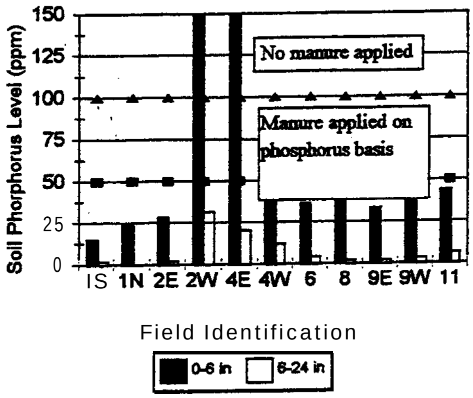

Figure 1. Soil Phosphorus Concentrations from Fields in Northeast Kansas Receiving Dairy Manure.

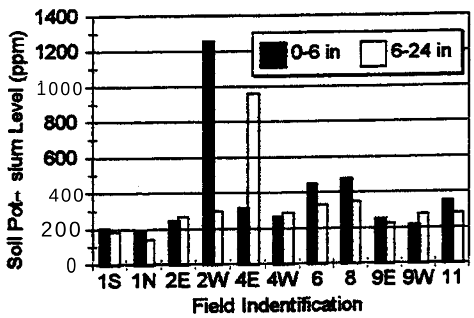

Figure 2. Soil Potassium Concentrations from Fields in Northeast Kansas Receiving Dairy Manure.

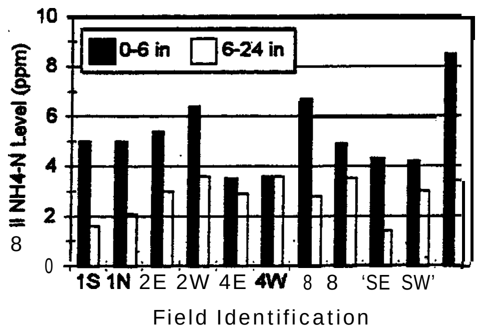

Figure 3. Soil Ammonium Concentrations from Fields in Northeast Kansas Receiving Dairy Manure.

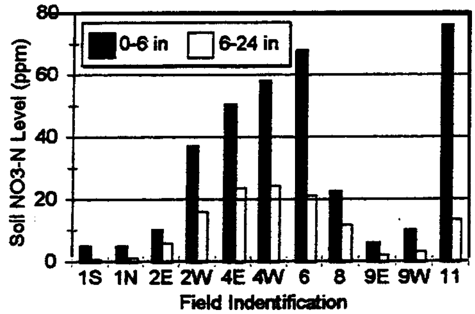

Figure 4. Soil Nitrate Concentrations from Fields in Northeast Kansas Receiving Dairy Manure.

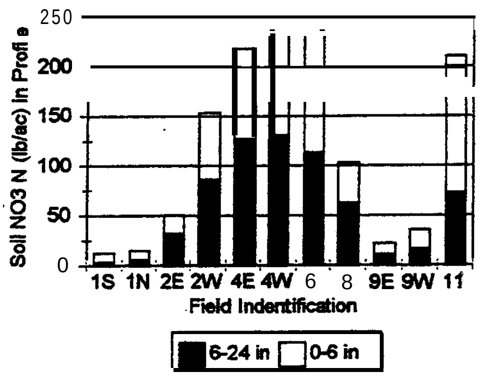

Figure 5. Soil Nitrate (lb/acre) Available for Crop Utilization from Fields Receiving Dairy Manure in Northeast Kansas.

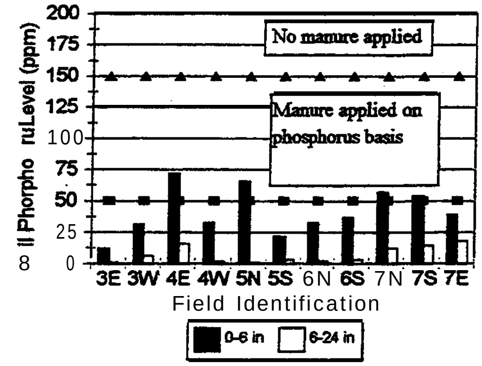

Figure 6. Soil Phosphorus Concentrations from Fields in South Central Kansas Receiving Dairy Manure.

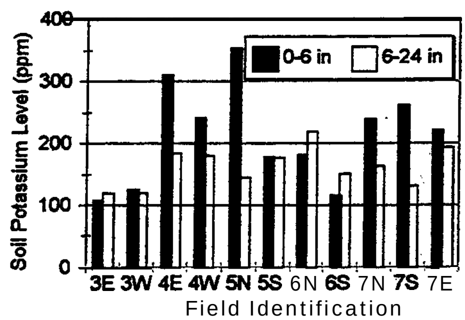

Figure 7. Soil Potassium Concentrations from Fields in South Central Kansas Receiving Dairy Manure.

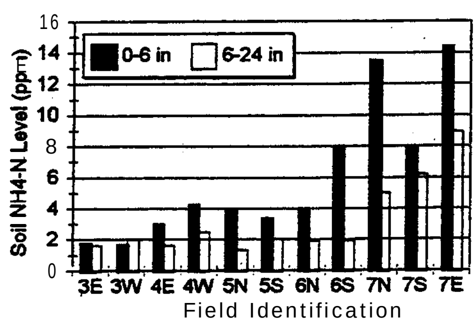

Figure 8. Soil Ammonium Concentrations from Fields in South Central Kansas Receiving Dairy Manure.

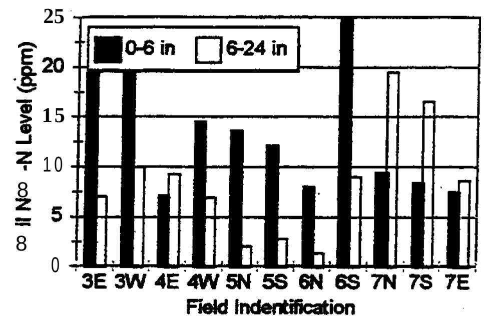

Figure 9. Soil Nitrate Concentrations from Fields in South Central Kansas Receiving Dairy Manure.

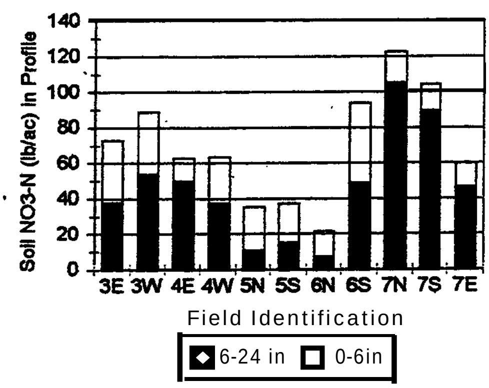

Figure 10. Soil Nitrate (lb/acre) Available from Crop Utilization from Fields Receiving Dairy Manure in South Central Kansas.