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Liquid Manure Analysis Comparisons

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Abstract
Sioux County, Iowa, has by far the highest concentration of livestock in northwest Iowa. According to the 1997 Census of Agriculture, there were 174,053 cattle and calves, and 762,294 hogs and pigs. Land application of manure can create environmental risks to surface and ground water. The main objective of the Sioux County Manure Project is to (a) identify problems with manure application and (b) develop information that livestock producers can use to improve management of manure as a fertilizer source, match manure nutrient application to crop needs, and reduce negative environmental impacts. This part of the project was to identify nutrient levels present in manure so that better nutrient planning for crops can take place. Manure from several operations was compared for nutrient value; then, manure samples collected during application of manure were compared with samples collected before application.

Disciplines
Agricultural Science | Agriculture

Liquid Manure Analysis Comparisons

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Introduction

Sioux County, Iowa, has by far the highest concentration of livestock in northwest Iowa. According to the 1997 Census of Agriculture, there were 174,053 cattle and calves, and 762,294 hogs and pigs. Land application of manure can create environmental risks to surface and ground water. The main objective of the Sioux County Manure Project is to (a) identify problems with manure application and (b) develop information that livestock producers can use to improve management of manure as a fertilizer source, match manure nutrient application to crop needs, and reduce negative environmental impacts. This part of the project was to identify nutrient levels present in manure so that better nutrient planning for crops can take place. Manure from several operations was compared for nutrient value; then, manure samples collected during application of manure were compared with samples collected before application.

Materials and Methods

Mary Hettinga, project coordinator, took two manure samples from the manure storage of each cooperator prior to manure application. Typically, samples were pulled approximately six weeks before application so that application rates could be adjusted according to test results. First, a profile sample of the entire depth of the pit was pulled with a long tube, emptied into a bucket, mixed, and subsampled. Second, a sample was dipped from the top of the manure storage basin with a two-gallon ice cream bucket, stirred, and subsampled. These samples came from manure storage that had not been agitated.

The cooperators then took samples from the pit as they were applying the manure. Pits were agitated before sampling. Samples were collected from the first load, from what was estimated to be the middle load, and from one of the last two loads.

As soon as possible after they were obtained, all samples were shipped by the project coordinator to a commercial laboratory for nutrient analysis. Data collected from these samples included total nitrogen, ammonium, phosphate, potash, and total solids. Data were collected from 57 swine-finishing manure storage facilities, six swine nursery pits, one farrowing-only storage basin, three pits with farrowing and nursery manure mixed together, and eight dairy manure pits.

Results and Discussion

Results in this report focus on the 19 manure pits that were located under finishing swine buildings having dry feeder systems and the 26 pits under finishing swine facilities equipped with wet/dry feeder systems.

The samples taken from the top of the manure storage compared closely to the samples taken during manure application; however, ammonium content consistently was over-estimated. The core samples, on average, tested high for ammonium and phosphate relative to nutrient levels from samples taken during application. Ranges of sample results varied widely, indicating a need to sample stored manure for nutrient content at each swine production storage facility. Significant amounts of crop nutrients are available in swine manure. A sample taken from the top of the stored manure provides an accurate estimate of the amounts of nitrogen and potash found in the total stored manure. Proper planning can contribute to improved environmental and financial management.

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Table 1. Manure sample comparisons from under the building, dry feed system swine finishing facilities in Sioux County, IA (N=19).

Sample location from pit	Average, lb/1,000 gallons	Range, lb/1,000 gallons	Standard deviation
Nitrogen			
Top sample	52.2	34.7 - 71.9	10.7
Profile sample	58.3	34.8 - 94.3	15.1
First load sample	57.0	33.9 - 74.3	12.7
Middle load sample	58.0	30.4 - 86.3	14.1
Last load sample	61.1	42.1 - 79.2	11.6
Ammonium			
Top sample	44.5	29.1 - 70.3	11.8
Profile sample	44.6	27.9 - 86.2	15.7
First load sample	32.5	19.3 - 49.2	8.8
Middle load sample	32.5	17.7 - 46.7	8.2
Last load sample	32.8	21.7 - 54.9	9.1
Phosphate			
Top sample	39.4	18.4 - 54.6	10.3
Profile sample	48.3	24 - 120.5	21.9
First load sample	39.1	13.2 - 55.8	12.3
Middle load sample	39.7	12.7 - 70.4	14.4
Last load sample	56.3	24.9 - 103.4	20.7
Potash			
Top sample	38.6	18.3 - 55.7	9.8
Profile sample	38.5	26.0 - 52.8	8.4
First load sample	40.5	27.1 - 52.5	8.0
Middle load sample	41.5	26.9 - 62.8	9.7
Last load sample	41.0	25.4 - 62.6	9.9

Table 2. Manure sample comparisons from under the building, wet/dry feed system swine finishing facilities in Sioux County, IA (N=26).

Sample location from pit	Average, lb/1,000 gallons	Range, lb/1,000 gallons	Standard deviation
Nitrogen			
Top sample	56.7	21.0 - 83.5	14.9
Profile sample	61.3	27.3 - 98.3	18.7
First load sample	58.2	27.5 - 89.5	15.1
Middle load sample	59.3	28.5 - 92.8	15.4
Last load sample	64.6	41.7 - 95.4	13.3
Ammonium			
Top sample	45.5	16.3 - 74.2	14.2
Profile sample	47.3	18.7 - 85.9	18.1
First load sample	36.8	17.2 - 71.1	13.0
Middle load sample	35.5	20.4 - 70.2	13.1
Last load sample	38.2	19.4 - 77.8	13.0
Phosphate			
Top sample	36.7	16.5 - 59.5	12.8
Profile sample	46.9	22.4 - 78.3	14.3
First load sample	38.22	12.6 - 71.7	11.31
Middle load sample	41.5	14.5 - 77.2	11.9
Last load sample	51.4	34.1 - 87.8	12.7
Potash			
Top sample	42.8	27.2 - 62.4	7.3
Profile sample	43.7	29.8 - 60.2	7.2
First load sample	45.5	19.3 - 63.5	9.4
Middle load sample	46.4	19.2 - 68.5	9.5
Last load sample	47.0	21.5 - 67.5	7.9