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A Survey of Manure Characteristics from Bedded Confinement Buildings for Feedlot Beef Production -Final Report

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Summary and Implications

Nutrient concentrations of manure sampled from four areas within bedded beef confinement facilities were similar, but dry matter of the manure was variable by area sampled. Nutrient concentrations in the manure were affected by time of sampling and by producer facility. Manure from bedded confinement buildings for beef production can be a valuable, consistent source of nutrients for crop production; however producers need to sample and test the manure from their facility to be able to manage it.

Introduction

Bedded confinement buildings are being used more frequently for beef production in the Midwest. Because of higher commercial fertilizer prices, feedlot producers need to be able to manage manure nutrients for crop production. Knowing the amount of nutrients in the manure is the first step in this process. However, there has not been an effort to analyze manure samples from the bedded confinement buildings. This project aimed to characterize nutrient and dry matter concentration of bedded manure from several operations using different management practices and various types of facilities over a three-year time period.

Materials and Methods

Twelve producers with bedded confinement buildings participated in this survey. The buildings included hoop structures and mono-slope facilities. Some producers cleaned the entire pen weekly or biweekly and others maintained a manure pack for one turn of cattle or longer. Within a building or pen, four different areas were identified to determine if there was variation in manure characteristics. The apron along the feed bunk was typically cleaned weekly and was an area that was sampled. If the entire pen was totally cleaned on a weekly or biweekly basis that area was sampled separately and was identified as bedded pen sample. If a bedded pack was allowed to build from four inches to over 2 feet deep, the pack was sampled separately and referred to as a deep pack samples. The pack, pen and apron samples were taken from one pen at each producer facility over the three year period. In some facilities, stockpiles of manure cleaned from the pens were established outside the cattle pen. The stockpiled area was a separate sample area and called stockpile samples. Several locations within each area of the pen were sampled, mixed in a container and a small subsample taken of the composite for

analysis. The deep pack samples were taken either using a core type device or a tined fork to get a sample representing a profile of the entire depth of the pack. Apron and bedded pens were sampled using a shovel to scrape a 2 to 3 foot length the width of the shovel to obtain a sample. Stockpile samples were taken by going from the surface of pack to approximately 2 feet into the pile in several locations of the stockpile. Three samples were taken in August 2007; Fifty eight samples were obtained from January through July of 2008 and 20 samples from April-November of 2009 for a total of 81 samples. Sampling dates were random and did not correspond to any specified schedule. The samples were analyzed for dry matter, total N, P₂O₅, K₂O, and S by a commercial laboratory. Fifty-four of the samples were analyzed for ammonia concentration. The data were analyzed using the General Linear Models procedure of SAS 9.1. Variables accounted for in the analysis of variance were producer facility, sample area and year. Sample date served as a quantitative variable. Manure characteristics of dry matter, total N, P₂O₅, K₂O, and S were dependent variables. Least square means are reported.

Results and Discussion

Means and standard deviation for dry matter and nutrient concentrations for all samples are shown in Table 1. Variation of dry matter of the manure was significant in the statistical model and was primarily affected by area sampled. The source of manure by producer facility or timing of sample did not appear to be major factors influencing dry matter concentrations. Table 2 shows means for dry matter by area sampled. Even though the area sampled in the pen had an effect, the differences in dry matter concentration would most likely not affect manure management from a practical standpoint. Also, the differences in dry matter concentration would appear to be much less than typical seasonal differences from open feedlot manure.

Variation in nutrient concentrations with the exception of ammonia was also significant in the statistical analysis. Table 3 shows nutrient concentrations on a dry matter basis by area sampled in the facilities. In this survey, area sampled in the pen did not have a major effect on nutrient concentration of the manure. However, producer facility and time of sampling did have significant effects on nutrient concentrations with the exception of ammonia. Table 4 shows nutrient concentrations by producer facility. P₂O₅ and K₂O concentrations were the two nutrients that were affected most significantly. The effects of time of sampling and producer facility may be related to diet, length of time cattle had been on feed, producer management, or changes in the manure characteristics over time. Limited sampling

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of diets and nutrient analysis of those diets did not correlate to manure nutrient concentrations in this project. Other research has shown a direct correlation between increased diet nutrient concentration and nutrient concentrations in the manure.

These results would indicate that manure from bedded confinement facilities within an operation is a consistent source of fertilizer nutrients for crop production without having to adjust for manure nutrient differences from several areas in the pen. Because of variation among producers and time of sampling producers should take representative sample manure from their facility and test it several times during the year to determine nutrient concentration.

The bedded confinement buildings are also being adopted to reduce environmental impact of runoff of manure nutrients. The expected amount of nutrients in manure and amount of manure produced annually per space was calculated using ASAE Standard D384 for manure characteristics and an estimated pounds and nutrient concentration for the added bedding. The average concentration of nutrients in the samples compared to calculated values would indicate 77% of total N, 76% of P₂O₅, 61% of K₂O, and 77% of S of the nutrients excreted or added in the bedding were captured in the manure. The ammonia concentrations would suggest that approximately 8.6 % of the nitrogen in the manure was in an inorganic form.

It could be hypothesized that a greater amount of nutrients are captured in the confinement building manure as compared to an open lot since there is less exposure to rainfall, sunlight, drying and other environmental effects, plus more of the manure is actually captured for land application.

Table 1. Means and Standard Deviation of manure characteristics.

<u>Variable</u>	<u>Mean</u>	<u>Standard Deviation</u>
Dry matter %	30.86	3.78
N lbs/ton	61.97	13.62
NH ₃ lbs/ton	5.34	2.92
P ₂ O ₅ lbs/ton	36.12	11.89
K ₂ O lbs/ton	42.02	11.44
S lbs/ton	8.30	1.64

Table 2. Least square means of dry matter by area sampled in the facility.

<u>Area sampled</u>	<u>Dry matter %</u>
Apron	30.09
Bedded pen	29.87
Stockpile	30.09
Deep pack	33.75

Table 3. Least square means of nutrient concentration by area sampled in the facility.

<u>Area sampled</u>	<u>Pounds per ton dry matter basis</u>				
	<u>N</u>	<u>NH₃</u>	<u>P₂O₅</u>	<u>K₂O</u>	<u>S</u>
Apron	77.76	5.58	44.40	44.23	7.58
Bedded pen	66.47	7.26	43.02	50.38	7.89
Stockpile	67.26	4.64	42.45	46.70	7.34
Deep pack	69.02	4.72	40.66	48.02	7.22

Table 4. Least square means of nutrient concentration by producer.

<u>Producer</u>	<u>Pounds per ton dry matter basis</u>			
	<u>N</u>	<u>P₂O₅</u>	<u>K₂O</u>	<u>S</u>
1	68.19	44.06	51.53	7.67
2	63.97	40.04	42.98	7.71
3	87.53	51.69	52.99	8.20
4	66.22	32.01	36.30	6.88
5	68.84	36.05	44.48	7.04
6	55.99	37.69	38.73	6.65
7	67.53	44.85	50.28	8.15
8	63.74	42.40	46.23	6.54
9	69.03	37.94	40.62	7.03
10	78.55	53.86	56.92	8.16
11	73.81	47.89	58.00	8.88
12	78.11	43.07	48.93	7.45

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