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Sampling Wet Distillers Grains Plus Solubles to Determine Nutrient Variability

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Summary

Dry matter, protein, fat, phosphorus, and sulfur were measured on 100 wet distillers grains plus solubles (WDGS) samples per ethanol plant (6 plants total) with 10 samples/day, 5 consecutive days, and 2 separate months (periods). Coefficients of variation were 1.5% to 4.5% for DM within plant. Fat in WDGS averaged 11.8% and ranged from 10.7% to 13.1% across plants, with ranges of 2 to 5 percentage units within plant. Coefficients of variation were 5% to 8% and as great as 36% within plant for sulfur. The variation in protein and phosphorus were minimal.

Introduction

Wet distillers grains plus solubles (WDGS) is becoming more common as a cattle feed, yet nutrient composition is not well developed. Three nutrients that are important to measure in WDGS are DM, fat, and S. If DM content varies, then the price paid on a DM basis will vary in addition to dietary inclusion on DM basis. Knowing the fat content and variability in WDGS is important with high inclusion levels as too much fat could decrease ADG instead of improving performance. Sulfur from WDGS is important (average and variability) as high dietary S may cause problems associated with polioencephalomalacia (PEM, polio, or "brainers") and decrease performance. Limited data exist on average as well as variation in DM, fat, and S of WDGS.

Procedure

Six ethanol plants in Nebraska agreed to sample WDGS for conducting nutrient analysis. The samples represented a semi-truck load of WDGS that a cattle producer would receive. Samples were taken from 4 to 5 locations in the WDGS pile to be loaded on the truck or directly from the loader that filled the truck. These samples were combined, mixed thoroughly, then a smaller quantity of 0.5-1.0 lb was placed into a plastic, air-tight bag. Ten samples were taken per day for five consecutive days, with 50 samples total during the week. Samples were frozen and shipped overnight to the UNL ruminant nutrition laboratory for analysis. This report represents the first two sampling periods, late summer 2006 and winter 2007, of four total periods being conducted.

Analysis was conducted in duplicate and included DM, CP, P, S, fat, and ash content. Dry matter was determined by drying in a 60°C forced air oven for 48 hours, which is the simplest and most accurate means for determining DM (Wilken, *2008 Nebraska Beef Report*, pp 128-129). The samples were ground through a 1mm Wiley Mill after drying for nutrient analysis. Crude protein was calculated from % nitrogen using a LECO nitrogen analyzer. Phosphorus and sulfur were determined by wet ashing with nitric and perchloric acids and analyzing colorimetrically. Fat was determined by extraction with petroleum ether under pressure.

Results

Samples were collected from ethanol plants producing traditional WDGS (30%-35% DM) and modified WDGS (42%-48% DM); therefore, DM values for each plant were calculated relative to their actual average and converted to a percentage based on 100 (Table 1). Dry matter content varied from plant to plant. Coefficients of variation for DM within plants ranged from 0.9%-7.1%, indicating more variation in some plants than others. However, variation was not necessarily the same across the 2 periods for a plant. Loads varied within a day, within a plant, as well as across days. Overall, cattle feeders should be aware of some variation potential in DM from load to load from a plant.

Fat (% of DM) averages did not result in numeric differences across sampling periods within plants (Table 2), suggesting there are processing differences from plant to plant that influence fat levels. The overall fat average among plants was 11.8%, but averages between plants ranged from 10.7% to 13.1%. Because solubles contain more fat than wet grains, higher fat content in WDGS may be related to the amount of solubles added to wet distillers grains. Coefficients of variation within plants ranged from 1.9%-8.8%. Fat is an excellent energy source; therefore, higher fat levels in WDGS is desirable unless dietary inclusion is greater than 40%-50% of diet DM. High inclusion of fat in diets may depress cattle intake and eventually feed conversion. Therefore, the fat content of WDGS interacts with its inclusion level in feedlot and forage diets.

Sulfur (% of DM) varied across ethanol plants (Table 3) and tended to be greater in period 1 (0.84%) than period 2 (0.75%). The overall sulfur average of WDGS from these plants was 0.79%. Coefficients of variation were higher for sulfur than any of the other nutrient tested and ranged from 3.5%-36.3%, with most plant

Table 1. DM means, coefficients of variation, and minimum and maximum values for WDGS from each ethanol plant.

	Ethanol Plant					
	A	B	C	D	E	F
Period 1						
Mean	100	100	100	100	100	100
CV%	1.5	3.6	2.7	2.2	1.2	3.5
Minimum	96.5	89.3	91.1	93.7	96.8	90.8
Maximum	105.7	107.9	105.0	103.9	102.0	104.8
Period 2						
Mean	100	100	100	100	100	100
CV%	1.4	0.9	4.0	4.7	1.2	7.1
Minimum	97.0	97.7	89.6	91.6	97.8	86.0
Maximum	102.2	102.2	108.1	114.2	102.5	111.2

Table 2. Average fat (% DM), coefficients of variation, and minimum and maximum values for WDGS from each ethanol plant.

	Ethanol Plant					
	A	B	C	D	E	F
Period 1						
Mean	12.5	10.8	12.7	12.4	11.5	11.5
CV%	2.8	7.6	3.3	4.4	3.5	6.7
Minimum	11.6	7.2	11.6	11.2	10.7	9.6
Maximum	13.0	12.6	13.5	13.6	12.5	13.1
Period 2						
Mean	11.7	10.7	13.1	11.7	11.8	11.7
CV%	1.9	2.3	5.6	3.9	8.7	8.8
Minimum	11.2	10.1	11.8	10.4	10.3	9.8
Maximum	12.4	11.1	15.3	12.9	13.5	13.3

Table 3. Average S (% DM), coefficients of variation, and minimum and maximum values for WDGS from each ethanol plant.

	Ethanol Plant					
	A	B	C	D	E	F
Period 1						
Mean	0.71	0.72	0.83	1.06	0.81	0.90
CV%	36.3	8.4	6.1	7.8	5.5	6.3
Minimum	0.44	0.58	0.73	0.90	0.69	0.79
Maximum	1.72	0.84	0.93	1.26	0.93	1.04
Period 2						
Mean	0.76	0.74	0.72	0.69	0.76	0.82
CV%	12.8	4.8	5.9	8.6	3.6	4.2
Minimum	0.61	0.64	0.60	0.61	0.69	0.73
Maximum	0.95	0.82	0.80	0.83	0.82	0.89

CVs at 5% to 7%. The range in sulfur content among plants was 0.65% to 0.90%; however, the greatest range within an individual plant was 0.44% to 1.72% sulfur. Clearly, sulfur content and variation among plants and between loads within the same plant are different and should be carefully monitored.

Protein averaged 31% of DM for all samples with CVs of 1.3% to 3.9% within plants. Phosphorus averaged 0.82% of DM with CVs of 1.3% to 6.0% within plants.

Statistical correlations were conducted among nutrients to determine if any relationships exist. Fat was significantly correlated ($P < 0.01$) to P ($r = 0.71$) and fat was correlated to S ($r = 0.17$). Fat and P are concentrated more in distillers solubles than wet grains; therefore, one potential cause of the observed variation is the amount of solubles added back to wet grains to produce WDGS. As the correlation between fat and S was poorer, the reason is likely due to more than just the proportion of distillers solubles to wet grains.

This sampling project characterized nutrient variability, which was different for each nutrient tested, both across ethanol plants and within the same plant. The three most critical measures are DM, fat, and S. While DM is commonly measured, more sampling and analysis of DM, fat, and S would be useful to determine accurate averages and ranges that producers might observe in WDGS.

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