

## Incorporating Distiller's Grain in Beef Cattle Diets

As grain prices fluctuate over time, beef cattle producers consider alternative sources of protein and energy. Atop the list of alternative feedstuffs is corn distiller's grain (DG), a co-product of the ethanol industry. Distiller's grain originates from corn grain and presents an opportunity to substitute both energy and protein. Using DG in diets does create some challenges, such as differences in particle size and moisture, as well as sulfur, protein, fat and nutrient content of the diet.



Differences in ethanol production methods result in differences in composition of the co-products, especially the phosphorus and sulfur content. Moisture content also varies depending on the amount of drying, resulting in dried distiller's grain (DDG) or modified-wet distiller's grain (MDG). Solubles may also be added, resulting in DDGS and MDGS. Variation in composition of products among plants and within each plant is common. Table 1 shows the average composition of co-products available at five Michigan ethanol plants.



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**Table 1. Differences in percent composition of distiller's grain across Michigan.\***

	Dry matter (%)	TDN (%)	Crude protein (%)	Fat (%)	Calcium (%)	Phosphorus (%)	Sulfur (%)	Potassium (%)	Sodium (%)
<b>Plant 1</b>									
DDGS	90.13	84	30.81	11.90	-	0.89	0.58	-	0.25
<b>Plant 2</b>									
DDGS	89.44	84.32	34.46	10.88	0.03	0.95	0.71	1.09	0.13
MDGS	53.37	85.89	33.33	12.01	0.03	0.95	0.75	1.13	0.2
<b>Plant 3</b>									
DDGS	90.1	76.70	31.95	11.65	0.025	0.82	0.88	1.00	0.28
MDGS	49.9	77.15	30.50	12.30	0.025	0.83	0.87	1.01	0.29
<b>Plant 4</b>									
DDGS	89.43	90.1	33.98	12.65	0.025	0.83	0.94	1.07	0.24
MDGS	46.43	88.97	33.00	12.97	0.03	0.89	0.97	1.11	0.25
<b>Plant 5</b>									
DDGS	90.2	-	29.9	11.4	0.05	0.94	1.01	1.23	0.24
Average DDGS	89.86	83.78	32.22	11.70	0.03	0.87	0.82	1.10	0.23
Average MDGS	49.90	84.00	32.28	12.43	0.03	0.89	0.86	1.08	0.25

\*All data reported on a dry matter basis except DM. Data obtained from specification sheets provided by each refinery (May-July 2008). Contact your local ethanol refinery for the latest analysis and information on purchasing DG.

Feeding high levels of DG in beef cattle diets can create animal health and environmental challenges. Including distiller's grain in amounts greater than 20% of the ration dry matter (DM) may lead to environmental concerns due to excess nitrogen (N), phosphorus (P) and sulfur (S) in the diet. All supplemental phosphorus and sulfur should be removed from the diet. Depending on the diet, sodium (Na) and potassium (K) may also be removed.

Frequently, the amount of DG fed is limited by the amount of sulfur in the total diet. The maximum tolerable level of sulfur (S) is 0.4% of the diet (NRC, 1996). A diet that contains 40% DG that has a 1% S content will exceed that level. If more than 30% DG is being fed, a water analysis for S content is recommended. Animals consuming sulfur amounts above the recommended levels are at risk to contract Bovine Polioencephalomalacia. This is also referred to as "polio" in cattle and is a disease of sulfur toxicity or thiamine deficiency resulting in blindness, incoordination and sudden death.

The inclusion level of DG in rations can also be limited by the total level of fat in the diet. As a rule of thumb, total fat content of the ration should not exceed 6 to 8% of the diet. Fat levels greater than this can lead to lowered feed intake and reduced performance.

### **Supplementation of Minerals and Vitamins**

Because of the composition of DG, including it in the diet means that the level of supplemental minerals and vitamins needed will change significantly. It is critical that beef cattle diets be thoroughly evaluated for mineral and vitamin levels to prevent nutritional deficiency and toxicity problems. One essential level that should be monitored in all diets is the ratio of calcium to phosphorus. It is recommended that this ratio be 1.5 to 1 or greater. Additional calcium should be added to the diet; limestone is a common and inexpensive source of calcium. When possible, the amount of sulfur in

the supplement should be reduced when high levels of DG are fed. Sample supplements for feedlot cattle and cow diets containing DG are shown in Tables 2 and 9, respectively. Many commercial supplements are also available and are labeled for use in DG diets.

### Feedlot Operations

The fact that feedlots tend to feed the least cost ration results in high inclusion levels of DG. It is essential to evaluate mineral and vitamin content closely to maintain proper growth and feed efficiency. Levels of sulfur greater than .25% of the diet dry matter (DM) can reduce the availability of copper. Vitamins A, D and E are also essential and should be monitored closely to ensure that supplementation is adequate.

All rations presented in the following tables contain a mineral supplement developed by Michigan State University for use with rations containing DG. This supplement was designed to be used in diets with 10 to 50% of the total DM as DG. The composition is listed in Table 2. This supplement contains Rumensin™ and was calculated for a feedlot steer consuming 22 lb DM/day with the supplement added at 4% of the ration DM. The calculated monensin intake is 300 mg/head/day. A steer consuming 18 pounds of DM would obtain 250 mg of monensin per day.

Tables 3-8 illustrate examples of beef cattle feed rations that can be used for both grower and finisher diets. The rations are utilizing MDGS to meet all supplemental N needs or as replacement for a portion of corn

in the diet. When interpreting these tables, please take note that levels will vary depending on the DM intake as a percent of total body weight (BW).

### Cow/Calf Operations

Although distiller's grain (DG) can be an excellent feedstuff for cows and calves, availability and storage are challenges for cow/calf operations unless an operation is close to an ethanol plant. Wet distiller's grain with solubles (WDGS) and modified-wet distiller's grain (MDGS) are typically shipped in 26-ton truckload lots. This should be fed within 5 to 12 days because of the risk of spoilage. For longer term storage, WDGS and MDGS can be stored in sealed piles or horizontal silos. It is important to exclude oxygen to prevent spoilage. Dry distiller's grain (DDGS) is easier to store than WDGS and MDGS. DDGS can be stored for longer periods of time and, therefore, can be better utilized by small operations. DDGS has a fine particle size and is susceptible to wind erosion. Therefore, it should be covered during storage. Because cow/calf producers are more likely to utilize DDGS than WDGS or MDGS, the rations listed in Tables 10 and 11 contain only DDGS.

In beef cow operations, it is common for distiller's grain to be used as a protein and energy supplement in diets containing low-quality forage. Special care should be taken in evaluating which ration to use for your herd on the basis of desired DM intake (DMI), breed, mature cow weight and stage of gestation.

**Table 2. Michigan State University supplement composition for grower and finisher diets containing distiller's grain.\***

	Dry matter content, %	Inclusion rate, % of DM	Inclusion rate, % As-fed	Amount, lb/ton
<b>Ingredient</b>				
Ground corn	86	7.8	8.7	173.5
Limestone	100	71.7	70.7	1413
TM premix**	99	2.4	2.4	47
Vitamin E	99	0.05	0.06	1
TM salt	99	17.9	17.8	357
Rumensin 80	100	0.4	0.4	8.5
<b>Total</b>	-	<b>100</b>	<b>100</b>	<b>2000</b>

\*Composition of supplement based on dry matter content of individual feedstuffs.

\*\*Akey TM Premix #4.

**Table 3. MDGS replaces all supplemental crude protein in the diet: feedlot grower ration for an animal weighing 500-600 lb (MDGS=16.5% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	2.0	2.2	2.4	2.6
			Pounds per head per day					
<b>Ingredient</b>								
Corn	88	45	6.2	7.0	5.6	6.2	6.8	7.3
Corn silage	35	34.5	4.7	13.5	10.8	11.9	13.0	14.1
MDGS	49.9	16.5	2.3	4.5	3.6	4.0	4.4	4.7
MSU supplement	98.6	4	0.6	0.6	0.5	0.5	0.5	0.6
<b>Total as-fed</b>				25.6	20.5	22.6	24.7	26.7
<b>Total DM intake</b>			13.8		11	12.1	13.2	14.3

\*Ration DM content: 53.5%.

**Table 4. MDGS used as an energy source in the diet: feedlot grower ration for an animal weighing 500-600 lb (MDGS=30% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	2.0	2.2	2.4	2.6
			Pounds per head per day					
<b>Ingredient</b>								
Corn	88	32	4.4	5.0	4.0	4.4	4.8	5.2
Corn silage	35	34	4.7	13.3	10.7	11.8	12.8	13.9
MDGS	49.9	30	4.4	8.8	6.6	7.3	7.9	8.6
MSU supplement	98.6	4	0.6	0.6	0.5	0.5	0.5	0.6
<b>Total as-fed</b>				27.7	21.8	24.0	26.0	28.3
<b>Total DM intake</b>			14.1		11	12.1	13.2	14.3

\*Ration DM content: 50.6%.

It is important to feed cows and developing heifers differently on the basis of their nutritional demands. Ensuring that calcium, minerals and vitamins are sufficient for gestation and lactation is essential. Factors of growth, gestation and lactation have been included in Tables 10 and 11. All of these rations have been formulated using the sample supplement shown in Table

9. This supplement has been formulated to minimize both phosphorus and sulfur content. Because of availability and cost of alternative sources of nutrients, not all sulfur sources were removed from this supplement. When using commercial supplements, be sure that they are labeled for use in cow/heifer diets.

**Table 5. MDGS used as an energy source in the diet: feedlot grower ration for Holstein calves weighing 300-500 lb (MDGS=30% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	2.0	2.2	2.4	2.6
<b>Pounds per head per day</b>								
<b>Ingredient</b>								
Corn	88	36	4.0	4.6	3.3	3.6	3.9	4.3
Corn silage	35	30	3.4	9.6	6.9	7.5	8.2	8.9
MDGS	49.9	30	3.6	7.2	4.8	5.3	5.8	6.3
MSU supplement	98.6	4	0.5	0.5	0.3	0.4	0.4	0.4
<b>Total as-fed</b>				21.9	15.3	16.8	18.3	19.9
<b>Total DM intake</b>			11.5		8.0	8.8	9.6	10.4

\*Ration DM content: 52.2%.

**Table 6. MDGS replaces all supplemental crude protein in the diet: feedlot finisher ration for an animal weighing 800-1,300 lb (MDGS=10% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	1.8	2.0	2.2	2.4
<b>Pounds per head per day</b>								
<b>Ingredient</b>								
Corn	88	83	17.1	19.4	17.8	19.8	21.8	23.8
Corn silage	35	3	0.6	1.7	1.6	1.8	2.0	2.2
MDGS	49.9	10	2.1	4.1	3.8	4.2	4.6	5.1
MSU supplement	98.6	4	0.8	0.8	0.8	0.9	0.9	1.0
<b>Total as-fed</b>				26.0	24.0	26.7	29.3	32.1
<b>Total DM intake</b>			20.6		18.9	21	23.1	25.2

\*Ration DM content: 78.9%.

**Table 7. MDGS used as an energy source in the diet: feedlot finisher ration for an animal weighing 800-1,300 lb (MDGS=30% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	1.8	2.0	2.2	2.4
<b>Pounds per head per day</b>								
<b>Ingredient</b>								
Corn	88	58.5	12.1	13.7	12.6	14.0	15.4	16.8
Corn silage	35	7.5	1.6	4.4	4.1	4.5	5.0	5.4
MDGS	49.9	30	6.0	12.0	11.4	12.6	13.9	15.2
MSU supplement	98.6	4	0.8	0.8	0.8	0.9	0.9	1.0
<b>Total as-fed</b>				30.9	28.9	32.0	35.2	38.4
<b>Total DM intake</b>			20.5		18.9	21	23.1	25.2

\*Ration DM content: 65.9%.

**Table 8. MDGS used as an energy source in the diet: feedlot finisher ration for an animal weighing 800-1,300 lb (MDGS=40% of ration on a DM basis).\***

	DM content of feedstuff, %	% of ration DM intake	Predicted intake		% of BW			
			DM intake	As-fed intake	1.8	2.0	2.2	2.4
<b>Pounds per head per day</b>								
<b>Ingredient</b>								
Corn	88	46	9.5	10.8	9.9	10.9	12.1	13.2
Corn silage	35	10	2.1	5.9	5.4	6	6.6	7.2
MDGS	49.9	40	8.0	15.9	15.2	16.8	18.5	20.2
MSU supplement	98.6	4	0.8	0.8	0.8	0.9	0.9	1.0
<b>Total as-fed</b>				33.4	31.3	34.6	38.1	41.6
<b>Total DM intake</b>			20.4		18.9	21	23.1	25.2

\*This ration contains levels of sulfur higher than recommended (NRC, 1996). Ration DM content: 60.8%.

**Table 9. Mineral/vitamin supplement composition for use in cow diets containing distiller's grain.\***

	Nutrient concentration in ingredient	Ingredient in supplement, as-fed %	Ingredient required per ton of supplement, lb
<b>Ingredient</b>			
White salt	39% Na	26.9	537
Limestone	34% Ca	23.7	475
Magnesium oxide	57% Mg	17.6	353
Manganese sulfate	32% Mn	1.2	23.3
Zinc sulfate	35.5% Zn	0.9	17.8
Copper sulfate	25.2% Cu	0.4	8.0
Sodium selenite	1.6% Se	0.2	4.7
EDDI**	79.5% I	0.01	0.2
Cobalt sulfate	33% Co	0.01	0.2
Vitamin A 650	650,000 IU/g	0.09	1.72
Vitamin E	1,000 IU/g	0.2	3.8
Oil	-	1.3	25
Sweetener		7.5	150
Grain or byproduct carrier	-	20.0	400
<b>Total</b>		100	2000

\*Average daily supplement consumption formulated to be 79.0 g/hd (0.174 lb).

\*\*Ethylenediamine dihydroiodide.

**Table 10. Rations formulated for a developing beef heifer weighing 550-800 lb with desired weight gain of 1.75 lb/day (assume no environmental stress factors included).**

Ingredient	Ingredient dry matter content, %	Amount as-fed, lb/hd/d	
		Sample diet 1	Sample diet 2
Corn silage	35	-	36.5
DDGS	90	6	4
Corn grain	88	5	-
Medium quality mixed hay	92	8	-
MSU supplement	100	0.2	0.2
Limestone	100	0.2	0.2
<b>Total lb as-fed</b>	-	19.4	40.9

**Table 11. Rations formulated for a British x Continental cow with a mature weight of 1,350 lb and estimated calf birth weight of 90 lb (assume no environmental stress factors included).**

Ingredient	Ingredient, DM %	Amount as-fed, lb/hd/d				
		Mid gestation	Mid gestation	Mid gestation (limit-fed)	Late gestation (limit-fed)	Late gestation
Corn silage	35	-	-	-	30	-
DDGS	90	3.5	6	5	4	5
Medium quality						
Grass hay	92	21	-	16	9	24
Corn stalks	75	-	26	-	-	-
MSU Supplement	100	0.2	0.2	0.2	0.2	0.2
<b>Total lb as-fed</b>	-	25	32	21	43	29

**Suppliers of Distiller's Grains and Contact Information**

Supplier	Address	Telephone
Andersons Ethanol, LLC	26250 B Drive North Albion, MI 49224	1-800-537-3370
Global Ethanol	7025 Silberhorn Hwy Blissfield, MI 49228	517-486-6190
POET Biorefining	1551 Empire Drive Caro, MI 48723	989-672-1222
Marysville Ethanol, LLC	2510 Busha Highway Marysville, MI 48040	810-364-8100
Carbon Green BioEnergy, LLC	7795 Saddlebag Lake Rd Lake Odessa, MI 48849	Cenex Harvest Services 1-800-769-1066

For additional information or further assistance in formulating beef cattle rations containing distiller's grain, please contact the Beef AoE educator in your region.

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