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Nutritive Value of Distillers Grains:

Conventional vs. Dakota Gold™

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The dairy industry in the US utilizes huge volumes of plant biomass in rations for their cows. In California alone, lactating dairy cows consume approximately 12.5 million metric tons of feed dry matter annually. In the past, US dairy rations were primarily based upon combinations of forages (hays or silages), grains (often corn or barley) and protein rich supplements (often by-product meals from the oil plant crushing industries). However as disposal options, such as land filling and sewage disposal, of by-product plant products from the food processing industries have been eliminated, dairy farms are increasing being looked to as markets for by-product plant 'wastes'. In California, the number of plant by-products used in the dairy industry numbers in the hundreds, and includes materials generated by the truck crop, brewing, flour milling, distilling, citrus, and nut industries, among others. It has been estimated that approximately 25% of the plant biomass consumed by lactating dairy cows in California is a by-product plant waste created by another industry. Without dairy cows, disposal of these plant by-products would be a serious environmental problem.

Fortunately, most plant by-products have nutritional value to ruminant animals, including dairy cows, with economic value based primarily on nutritive value. For lactating dairy cows, with high dietary energy requirements, it is the feed's energy value that is the primary determinant of economic value, since low energy feeds both restrict animal productivity directly (due to their low energy levels *per se*) and because feeds with low energy levels often have high levels of slowly fermented neutral detergent fiber (NDF), which restricts voluntary feed intake of the mixed rations to which they are included.

While energy, and other nutrient, levels of feeds are key attributes of their economic value, the other characteristic that has value is the consistency of those nutrient levels both within and among batches. Production levels of dairy cows are much higher than 20 years ago and the productivity levels of the cows are much closer to their genetic potential than even 10 years ago. This means that the mixed rations provided to cows must be much more nutritionally consistent than in the past, both to maximize animal performance and minimize the nutrients not utilized and excreted in feces and urine.

Distillers Dried Grains in the Dairy Industry

The fermentation end product of the ethanol distilling industry (i.e., distillers dried grains) has been used as a feed for dairy cattle for some time. However the sharp increase in ethanol production in the Midwestern US, due to its inclusion as a motor fuel additive, has dramatically increased production of distillers dried grains, the bulk of which is being targeted at the dairy industry.

Distillers dried grains has long been recognized to be a valuable feed for the dairy industry due to relatively high levels of fat and protein, as well as its relatively low levels of NDF, which can be highly digestible. It is also a good source of several macro and micro-minerals that are nutritionally required by dairy cows. In the past, the relatively high level of phosphorus (P) has generally been considered to be beneficial, but with environmental concerns relative to P excretion in dairy manure, and reductions in recommended levels of P in lactation rations, the high P level in distillers dried grains is now more of a detriment than a benefit.

Due to variation in methods of production both among and within distilling facilities, distillers dried grains has also been known to be a by-product feedstuff with wide variability in both its nutrient content and the digestibility of both its crude protein (CP) and NDF components. This has generally been considered to be detrimental to its economic value, since nutrient consistency among batches, and high nutrient digestibility, increase the economic value of any feed destined for the dairy feed industry.

A New Distillers Dried Grains

To overcome the problem of high variability in the nutrient composition of distillers dried grains, Dakota Gold Marketing has introduced a new distillers dried grain product that is produced with a consistent process both among and within distilling facilities.

Comparison of 10 samples of Dakota Gold™, each from a separate production facility, with 14 samples of conventional distillers dried grains collected from commercial dairy farms in the San Joaquin Valley of California, suggests that conventional distillers dried grains and Dakota Gold have similar levels of dry matter, organic matter, fat and CP, although NDF and ADF levels are lower for the Dakota Gold distillers dried grains (Table 1). In addition, the level of the soluble CP fraction is increased, while acid detergent insoluble CP (ADICP), which is generally considered to be largely indigestible, is sharply decreased. The energy value, as net energy for lactation (NE_l), is about 13% higher for the Dakota Gold distillers dried grains. Perhaps more importantly, the variation in all organic components, including the 30 h *in vitro* digestibility of NDF (dNDF), is dramatically reduced.

The levels of most minerals including calcium, P, magnesium, potassium, chloride, iron, manganese and molybdenum are lower in the Dakota Gold distillers dried grains, whereas sulfur, sodium, zinc and copper are higher (Table 2). As with the organic components, the variability in the levels of minerals are sharply lower in the Dakota Gold distillers dried grains.

Table 1. Organic Components of Distillers Grains.

Sample	DM	OM	Fat	CP	SolP	UndP	NDF	dNDF	ADF	NEl
	%	---------- % DM ----------			------ % CP ------		% DM	% NDF	% DM	Mcal/kg
Distillers Grains (dehy/corn/w solubles)										
1	89.8	97.5	3.2	24.0	21.0	16.3	48.7	84.6	18.2	1.80
2	90.8	95.5	13.3	31.7	13.0	17.4	31.9	71.8	17.6	2.04
3	92.0	94.9	15.7	34.1	4.0	35.2	31.4	95.8	26.9	2.15
4	86.5	94.6	14.4	32.1	13.0	11.2	33.3	74.0	22.1	2.09
5	90.1	94.1	9.8	28.6	11.0	28.7	33.3	67.2	19.9	1.80
6	91.2	95.0	6.0	26.5	14.0	21.5	31.3	71.7	23.6	1.81
7	90.5	94.9	10.4	30.2	8.0	48.7	34.0	70.5	29.9	1.72
8	87.0	95.3	12.9	30.9	12.0	30.1	32.9	78.1	20.9	1.99
9	91.5	95.0	14.6	29.1	3.0	35.4	31.2	74.0	27.6	1.99
10	90.2	94.9	12.4	29.8	13.0	31.9	30.4	81.1	25.8	2.00
11	89.4	95.2	9.3	33.0	8.0	46.4	34.8	70.9	31.0	1.67
12	90.9	94.6	11.9	31.5	11.0	41.3	29.0	82.9	26.0	1.93
13	90.2	94.5	13.7	29.9	9.0	23.7	34.1	71.5	20.6	1.97
14	91.0	95.1	13.6	29.9	15.0	16.4	35.2	73.3	16.7	2.04
Mean	**90.1**	**95.1**	**11.5**	**30.1**	**11.1**	**28.9**	**33.7**	**76.2**	**23.3**	**1.93**
CV (%)	1.7	0.8	30.4	8.6	41.4	40.6	13.9	10.0	19.7	7.5
Distillers Grains (Dakota Gold)										
1	88.2	95.5	12.6	31.1	16.8	10.0	28.7	76.7	14.8	2.19
2	89.1	95.6	11.4	30.4	17.1	6.5	31.2	76.1	13.5	2.15
3	86.8	95.6	10.5	31.9	20.6	6.3	27.0	77.4	14.0	2.17
4	88.3	95.4	11.5	30.1	18.3	6.9	30.7	78.0	14.4	2.16
5	88.6	95.4	12.3	31.8	17.1	6.9	26.4	81.1	13.3	2.25
6	87.4	95.7	12.0	28.8	17.6	5.0	28.4	77.5	13.1	2.22
7	89.1	95.5	12.5	29.5	19.5	8.6	25.5	76.4	14.2	2.22
8	88.0	95.4	11.2	29.7	15.7	9.1	29.3	78.5	15.5	2.16
9	89.7	95.1	12.6	32.7	15.6	12.4	23.9	76.8	16.1	2.21
10	87.2	95.2	12.1	31.0	16.8	10.6	30.2	76.2	15.4	2.14
Mean	**88.2**	**95.4**	**11.9**	**30.7**	**17.5**	**8.2**	**28.1**	**77.5**	**14.4**	**2.19**
CV (%)	0.3	0.1	1.9	1.3	2.8	8.8	2.7	0.6	2.2	0.5

Conclusions

The overall nutritive value of this group of Dakota Gold distillers grains was higher than a group of conventionally produced distillers dried grains products, due primarily to higher digestibility of its protein and NDF components, and slightly lower levels of NDF. The variability in the nutrient levels of this group of Dakota Gold distillers grains was much lower than a group of conventionally produced distillers dried grains products.

Based upon this assessment, Dakota Gold distillers dried grains has a sharply higher economic value versus conventionally produced distillers dried grains.

Table 2. Mineral Components of Distillers Grains.

Sample	Ca	P	Mg	K	S	Na	Cl	Fe	Mn	Zn	Cu	Mo
	----------	----------	% DM	----------	----------	----------	----------	----------	----------	ppm DM	----------	----------
Distillers Grains (dehy/corn/w solubles)												
1	0.03	0.57	0.11	0.28	0.31	0.02	0.31	136	8	66	1	1.0
2	0.09	0.90	0.32	1.03	0.62	0.05	0.17	126	35	79	2	1.6
3	0.09	0.91	0.37	0.99	0.57	0.06	0.17	160	50	61	6	2.7
4	0.11	1.01	0.34	1.16	0.67	0.08	0.19	192	33	56	4	1.0
5	0.13	0.97	0.44	1.16	0.52	0.21	0.21	195	73	76	1	2.9
6	0.12	0.66	0.25	0.87	0.50	0.07	0.07	156	19	49	4	1.5
7	0.07	0.82	0.35	0.99	0.70	0.19	0.13	124	37	61	2	2.7
8	0.10	0.90	0.32	1.15	0.69	0.05	0.16	173	35	54	3	1.0
9	0.07	0.94	0.40	1.15	0.62	0.04	0.20	139	38	86	1	2.4
10	0.13	0.91	0.33	1.18	0.58	0.07	0.17	169	34	60	2	1.1
11	0.06	0.82	0.34	0.91	0.60	0.21	0.12	158	40	62	1	3.2
12	0.08	0.96	0.45	1.11	0.57	0.07	0.15	276	57	70	2	3.4
13	0.05	1.14	0.32	1.16	0.43	0.19	0.70	204	15	79	5	1.0
14	0.08	0.85	0.32	1.17	0.40	0.12	0.19	107	16	102	1	1.9
Mean	**0.09**	**0.88**	**0.33**	**1.02**	**0.56**	**0.10**	**0.21**	**165**	**35**	**69**	**3**	**2.0**
CV (%)	34.4	15.9	24.8	23.2	20.5	66.8	71.9	25.9	49.8	20.9	66.1	46.0
Distillers Grains (Dakota Gold)												
1	0.04	0.66	0.33	0.93	0.62	0.16	0.17	83	16	76	5	1.0
2	0.02	0.68	0.31	0.96	0.30	0.10	0.16	65	15	77	4	0.7
3	0.02	0.60	0.30	0.85	0.89	0.10	0.15	72	15	100	4	0.8
4	0.03	0.71	0.33	1.00	0.58	0.18	0.16	72	17	89	5	0.8
5	0.03	0.66	0.30	0.91	0.64	0.31	0.15	85	13	84	4	0.5
6	0.02	0.68	0.29	0.94	0.49	0.12	0.13	68	13	180	5	0.4
7	0.02	0.75	0.30	0.98	0.59	0.13	0.13	72	15	220	5	0.5
8	0.02	0.69	0.28	0.89	0.71	0.11	0.12	78	17	85	5	0.6
9	0.02	0.77	0.28	0.95	0.57	0.07	0.14	68	17	80	7	0.9
10	0.02	0.78	0.32	1.00	0.55	0.16	0.16	66	13	96	5	1.0
Mean	**0.02**	**0.70**	**0.30**	**0.94**	**0.59**	**0.14**	**0.15**	**73**	**15**	**109**	**5**	**0.7**
CV (%)	9.2	2.5	1.9	1.6	8.0	14.8	3.5	3.0	3.5	14.4	5.7	9.9

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