THE EVALUATION OF DISTILLERS CO-PRODUCTS IN DAIRY BEEF PRODUCTION

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Feeding dairy beef, predominantly Holstein steers, has evolved into a highly specialized segment of the US beef industry. Producing acceptable-quality carcasses from dairy steers requires feeding high-energy diets and marketing them at a young age, 12 to 14 months, and weighing 1150 to 1300 lbs. Several aspects of the dairy beef program are unique compared with beef cattle. The calves are not reared with their dams, but fed liquid milk replacer from birth to weaning (typically 4 to 5 weeks). Within a few days after birth the calves are provided dry starter feed, usually a high quality grain mixture, to stimulate rumen development so the calves can be weaned early to dry feed. Following weaning the calves are fed high-energy grower diets until weighing 300 to 400 lbs. Because Holsteins require 10 to 12% more energy than beef breeds for maintenance, high-energy diets must continue to be fed during the growing/finishing phase if they are to produce adequately-marbled carcasses at 12 to 14 months of age. A popular growing/finishing program in smaller-scale operations is to feed in self-feeders whole corn along with supplemental nutrients and fiber combined in a pellet. The alternative is to daily feed high-grain diets with roughage during the growing/finishing phase similar to beef cattle.

Byproduct feeds from many sources have been successfully fed to beef cattle. The specialized nature of producing beef from dairy breeds has not resulted in interest in feeding byproducts. A limited amount of research has been reported with feeding corn processing co-products to dairy beef. DiCostanzo et al. (1990) fed growing Holstein steer calves for 125 days (115 to 400 lbs live weight) diets in which ground corn was replaced by 21 or 44% dry corn gluten feed and observed an increase in feed intake and daily gain, but a decrease in feed efficiency. Feeding brewers grains or wet corn gluten feed as sources of supplemental protein in corn silage and corn grain based diets fed to growing/finishing Holstein steers (approximately 200 to 1200 lbs resulted in gain and feed efficiency similar to steers fed soybean meal (Fox and Ketchen, 1991). No results have been reported on the effects of feeding corn processing byproducts on carcass measurements.

The dramatic increase in production of fuel ethanol from corn is resulting in an abundant supply of distillers co-products at prices competitive with corn grain and sources of supplemental protein. Wet and dry distillers co-products have been extensively evaluated in growing/finishing beef cattle and found to be excellent feeds that can replace a significant portion of the corn grain and supplemental protein fed to cattle. Based on the success of using the co-products from the ethanol industry in beef cattle, experiments were planned to determine the value of distillers grains with solubles (DGS) in production of dairy beef. Objectives of the experiments were to compare the cost of production with conventional corn-based diets, to determine if performance of the cattle could be improved and if carcasses would meet packer/consumer

expectations, and to establish the optimum level of wet or dried DGS that could be fed to dairy steers.

The Iowa Corn Promotion Board supported two feeding trials to determine the effects of feeding different concentrations of wet or dry DGS on performance and carcass value of Holstein steers and one project to compare the sensory attributes and shelf life of loin steaks from the cattle in the two feeding trials. The feeding trials were conducted at Iowa State University and the University of Illinois and the meat evaluation at the University of Minnesota. The final reports of the three studies are available online at:

Iowa study http://www.iowacorn.org/forms/ISUstudy_results.pdf A. Trenkle
Illinois study http://www.iowacorn.org/forms/dairybeefstudy_results.pdf C.B. Rincker and L.L. Berger
Minnesota study http://www.iowacorn.org/forms/UMstudy_finalreport.pdf R. Gill, D.L. Roeber and A. DiCostanzo

Methods

Iowa experiment: In mid August, two hundred twenty-five Holstein steer calves were purchased from one farm that buys newborn calves over a 7 to 10-day period and raises them to about 400 lbs. The calves had been self fed whole shelled corn and a pelleted protein supplement. After arrival at the research farm they were fed a dry rolled corn and supplement mixture with long grass hay. During the next two weeks the calves were transitioned to a diet containing dry rolled corn and 10% corn silage. One hundred ninety-two steers (429.6 ± 2.1 lbs initial wt.) were selected and allotted to 32 pens with six calves per pen. Each of the following eight dietary treatments was randomly assigned to four different pens:

1. Dry rolled corn-10% corn silage + 3% chopped grass hay with urea supplement
2. Dry rolled corn-10% corn silage + 3% chopped grass hay with soybean meal supplement
3. Dry rolled corn-10% corn silage + 3% chopped grass hay with 10% dry distillers
4. Dry rolled corn-10% corn silage + 3% chopped grass hay with 20% dry distillers
5. Dry rolled corn-10% corn silage + 3% chopped grass hay with 40% dry distillers
6. Dry rolled corn-10% corn silage + 3% chopped grass hay with 10% wet distillers
7. Dry rolled corn-10% corn silage + 3% chopped grass hay with 20% wet distillers
8. Dry rolled corn-10% corn silage + 3% chopped grass hay with 40% wet distillers

On days 91, 140 and 224 of the experiment the diets were changed to contain less urea and soybean meal to reduce the concentration of protein in the diets as the steers increased in weight. The percentage of crude protein in the diets fed initially were approximately 14.4, 16.5, 16.5, 16.5 and 16.6 in the urea, soybean meal, 10% DGS, 20% DGS and 40% DGS diets, respectively. The percentage crude protein in the final diets were approximately 11.5, 11.5, 11.5, 12.5 and 16.6 in the urea, soybean meal, 10% DGS, 20% DGS and 40% DGS diets, respectively. The calves were housed in a south exposed open front building in pens (12 X 40 feet) with concrete floors and with concrete feed bunks under the roof. The steers were fed total mixed diets twice per day and had ad libitum access to water. The quantity of feed given the cattle was initially limited and gradually increased until they were on full feed. The steers had been

implanted with Synovex-S prior to purchase and re-implanted with Component E-S on days 32, 119 and 224 of the study. The steers were weighed at 28-day intervals and final weights taken at 299 d before transporting to Packerland (Green Bay, WI) to be harvested. Pen means were used as the experimental unit in the statistical analysis and data were analyzed by analysis of variance with diets as experimental treatment.

Illinois experiment: In August three hundred fifty Holstein steer calves were purchased, initially fed a pelleted grain mix and long-hay and gradually changed to an 85% concentrate-15% corn silage diet. Three hundred twenty steers (420.7 ± 71.5 lbs initial wt.) were selected and assigned to 40 pens with eight calves per pen. Each of the following ten dietary treatments was randomly assigned to four different pens:

1. Whole corn-15% corn silage with soybean meal based supplement to 14% CP
2. Whole corn-15% corn silage with 12.5% dry distillers and urea to 14% CP
3. Whole corn-15% corn silage with 25% dry distillers (14-15% CP)
4. Whole corn-15% corn silage with 50% dry distillers
5. Whole corn-15% corn silage with25% wet distillers
6. Whole corn-15% corn silage with 50% wet distillers
7. Whole corn-15% corn silage with 37.5% dry distillers to 750 lbs then 20% to harvest
8. Whole corn-15% corn silage with 20% dry distillers to 750 lbs then 37.5% to harvest
9. Whole corn-15% corn silage with 37.5% wet distillers to 750 lbs then 20% to harvest
10. Whole corn-15% corn silage with 20% wet distillers to 750 lbs then 37.5% to harvest

The calves were housed in a south exposed open front building with concrete fenceline feed bunks and pens (12 X 40 feet). The steers were fed ad libitum and the cattle were weighed in 28-day intervals. After 112 days, both treatments 7 and 8 along with 9 and 10 were switched to represent the change from 20% to 37.5% and from 37.5% to 20% for both wet distiller grain and dry distiller grain (DM basis). Implants were administered twice during the course of the trial, at 56 days with Component E-S and at 168 days with Ralgro-Magnum. Fecal samples were collected on a per pen basis, sub sampled, and then analyzed for nitrogen, phosphorus, and sulfur. Cattle were then weighed at 270 d and sent to Packerland (Green Bay, WI) to be harvested. Effects of dietary treatment were analyzed using the GLM procedure of SAS. Orthogonal contrasts were used for the control versus distiller grain diets, dry distiller grain versus wet distiller grain, and diet change from 20 to 37.5% distiller grain versus 37.5 to 20% distiller grain. Linear and quadratic contrasts were also used for the level of dry and wet distiller grain.

Minnesota study: Strip loins were taken from each of four steers in each of all four replicate pens (pen was used as the experimental unit) of all eight treatments in the IA experiment and from soybean control, 12.5%, 25% & 50% dry DGS and 25% & 50% wet DGS in the IL experiment (n = 16/treatment group, representing 45.7% and 66.6% of steers from IL and IA, respectively). Strip loins were aged for 13 d at 21 ^{0}C for subsequent color, tenderness, and palatability evaluation. In order to predict color stability and subsequently consumer acceptability of steaks throughout retail display,

color of steaks was measured objectively by using a HunterLab Miniscan XE spectrophotometer and subjectively by a trained panel. Tenderness was measured using the Warner-Bratzler shear force instrument on steaks cooked to 70 ^{0}C. For sensory/palatability evaluation, 95 consumers were recruited to evaluate tenderness, flavor, and juiciness in cooked steaks. Each panelist evaluated 14 steak samples (one from each of the treatments in the IL and IA studies) using a nine-point, end-anchored hedonic scale, where 1 = dislike extremely and 9 = like extremely.

Results

Iowa experiment (See Tables 1, 2, 3, 4 & 5): During the initial 91 days of the trial, representing a growing period, steers fed soybean meal gained faster than those fed the diet with urea. Calves fed all levels of wet DGS consumed less feed compared with the urea or soybean meal controls. Steers fed 40% wet DGS had slower gains. Feeding soybean meal as well as 20% or 40% wet DGS compared with the urea control improved feed efficiency. Feed efficiency of calves fed 20% or 40% wet DGS was superior to those fed all levels of dry DGS. Feed cost of gain during the first 91 days was reduced by feeding 40% dry DGS or 20% & 40% wet DGS, but increased by feeding soybean meal with the following feed prices: corn $2.25/bu, dry DGS $85/ton (90% DM), wet DGS $28.33/ton (30% DM), soybean meal $225/ton and urea $340/ton. During the entire trial, feeding wet or dry DGS did not affect performance except steers fed 40% wet DGS consumed less feed and had less gain, and steers fed 10% wet DGS consumed less feed with the same gain and improved feed efficiency. Feed cost of gain during the 299 days of the study using the same feed prices was increased by feeding soybean meal and reduced by feeding 10% wet DGS compared with the urea control. Except for the steers fed 40% wet DGS that had lighter carcasses, feeding wet or dry DGS did not affect carcass weight, area of ribeye, thickness of backfat, marbling, quality grades or yield grades. Feeding wet or dry DGS improved dressing percent. Value of the carcasses was not affected by feeding DGS when the value was based on grade and yield or on a grid with premiums and discounts for quality and yield grades. Feeding 40% wet DGS tended to reduce carcass value ($/carcass) in a grade and yield program as well as a premium and discount grid because of reduced carcass weight.

Illinois experiment (See Tables 6 & 7): Performance values for average daily gain (ADG), dry matter intake (DMI), and feed efficiency expressed in feed:gain were evaluated for the growing period (112 d) and for the entire trial (270 d). Steers fed all treatments performed well and were profitable. Steers had a significant linear decrease in ADG with an increasing level of wet DGS diets ($P = 0.0202$) and steers which shifted from high DGS (37.5%) to low DGS (20%) had significantly lower ADG than steers switched from low DGS (20%) to high DGS (37.5%) ($P = 0.0035$). There was a significant quadratic effect on DMI with increasing wet DGS ($P < 0.0001$). Steers fed 25% wet DGS ate more DM than those fed 0% or 50% wet DGS. There was a linear increase in F:G as the level of dry DGS increased ($P = 0.0266$). Steers had a quadratic response in F:G with wet DGS levels ($P = 0.0296$). Steers fed 50% wet DGS were the most efficient (5.68 F:G). Wet DGS diets were significantly more efficient when contrasted against dry DGS diets ($P = 0.0009$). There was a linear increase in both P

and S levels in the feces with increasing dry DGS (P < 0.0001, < 0.0001) and a quadratic effect for wet DGS treatments (P = 0.0403, = 0.0356). When harvested, steers fed DGS had a higher dressing percent than control (P = 0.03). The most profitable diets were determined by the relative price of corn and DGS. When dry DGS was priced at $110/ton and wet DGS $100 with $2.50/bushel corn, low levels (12.5-25%) tended to be most profitable. When dry DGS were priced at $90/ton and wet DGS at $80/ton with $2.50/bushel corn, the 25-37.5% diets tended to be most profitable.

Minnesota study (See Tables 8 & 9): At 138 h of retail display, the color of steaks from each treatment group of the IL experiment averaged a consumer acceptability score of moderately unacceptable (score of 4) or less. In the IL experiment, steaks from steers fed 25% wet DGS had higher a* values (P < 0.05) after 138 h than all other treatments except for those from steers fed 12.5% dry DGS. In the IA experiment, a greater (P < 0.05) percentage of steaks from steers fed 40% dry DGS and 40% wet DGS were considered to have 'moderately unacceptable' color after 138 h of retail display than the other treatment groups. In the IA experiment, steaks from steers fed 40% wet or dry DGS had lower a* values (P < 0.05). No differences (P > 0.05) were observed in shear force values (average shear forces from IL and IA were 3.53 ± 2.90 lb and 3.53 ± 2.93 lb, respectively) or taste panel attributes (5.7 ± 2.1, 6.0, 1.9, and 5.6 ± 2.1 for tenderness, flavor, and juiciness in the IL experiment, and 6.2 ± 2.1, 6.2 ± 1.8, and 5.8 ± 2.0 for tenderness, flavor, and juiciness in the IA experiment). From this study, it can be concluded that feeding distillers' grains at up to 50% of the diet DM does not have a detrimental effect on color stability, tenderness, or sensory/palatability traits.

Conclusions

Holstein steers fed wet DGS had superior feed efficiency compared with those fed dry DGS, however feeding 40% or 50% of diet dry matter as wet DGS depressed feed intake, gain and carcass weight. Feeding wet or dry DGS did not have an effect on measurements used to determine economic value of the carcass. Wet or dry DGS can be fed to Holstein steers without affecting performance, carcass value, color stability of steaks during retail display, or consumer ratings of sensory/palatability traits of the steaks.

Depending on price of DGS relative to corn and protein supplement, feeding DGS might reduce feed cost of gain. Costs of gain for feeding 10% and 20% DGS were compared with the control diet across a range of prices for DGS (0.8, 0.9, 1.0 and 1.1 times the cost of corn on a dry basis), a range of prices for corn ($1.50, $2.00, $2.50 and $3.00/bu) and holding prices for silage, urea and supplemental vitamins and minerals constant.

When DGS prices less than corn (80 or 90%):

1. There were always positive returns from feeding wet or dry DGS.
2. There were greater returns from feeding wet compared with dry DGS.
3. Returns from feeding wet DGS increased as corn prices increased.

4. Returns from feeding dry DGS tended to decrease with increasing corn prices, but remained positive.

When dry DGS prices equal to or greater than corn (100 or 110%):

1. There were positive returns from feeding wet or dry DGS when corn prices were $1.50.
2. Returns were zero or negative when corn prices were $2.00 or more per bu.
3. Returns were more positive from feeding 10% dry DGS when corn prices increased.

When wet DGS prices equal to or greater than corn (100 or 110%):

1. There were positive returns to feeding 10 or 20% DGS at all corn prices.
2. When 10% DGS fed, returns tended to increase with increasing corn prices.
3. When 20% DGS fed, returns tended to decrease with increasing corn prices.

Table 1. Feedlot performance of Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	Starting Wt.	Ending Wt.	Daily gain	Feed DM	Feed/gain
	lbs	lbs	lbs	lbs/d	
Urea	434	1375	3.15[a]	19.4[a]	6.18[a]
Soybean meal	429	1370	3.14[a]	19.4[a]	6.17[a]
10% Dry DGS	428	1330	3.02[a]	18.8[a]	6.25[a]
20% Dry DGS	430	1317	2.97[ab]	18.8[a]	6.35[a]
40% Dry DGS	432	1321	2.97[ab]	18.8[a]	6.33[a]
10% Wet DGS	430	1367	3.13[a]	18.5[a]	5.90[b]
20% Wet DGS	428	1342	3.06[a]	18.7[a]	6.14[ab]
40% Wet DGS	426	1258	2.78[b]	17.2[b]	6.19[a]
SEM	2.1	19.9	0.066	0.33	0.079

[ab]Within a column, means that do not have a common superscript differ ($P < 0.05$).

Table 2. Measurements of carcasses from Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	Carcass wt.	Dressing	Marbling	Ribeye area	Backfat
	lbs	percent	score[a]	sq in.	in.
Urea	798.2	58.1[b]	565	12.25	0.25
Soybean meal	805.9	58.8[bc]	637	12.00	0.30
10% Dry DGS	789.7	59.3[c]	578	12.21	0.25
20% Dry DGS	786.0	59.6[c]	593	12.47	0.27
40% Dry DGS	792.3	60.0[c]	601	11.89	0.28
10% Wet DGS	812.6	59.4[c]	639	12.12	0.29
20% Wet DGS	798.5	59.5[c]	626	12.20	0.27
40% Wet DGS	751.2	59.8[c]	602	11.82	0.24
SEM	13.57	0.31	24.2	0.26	0.024

[a]Marbling score: Slight[0] = 400, Small[0] = 500, Modest[0] = 600.
[bc]Within a column, means that do not have a common superscript differ ($P < 0.05$).

Table 3. Quality grades of carcasses from Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	Choice$^-$ and greater %	Prime No	Choice$^+$ No	Choice No	Choice$^-$ No	Select No
Urea	83.3		2	5	13	4
Soybean meal	91.3		7	9	5	2
10% Dry DGS	75.0		3	8	7	6
20% Dry DGS	83.3	1	4	4	11	4
40% Dry DGS	73.9	1	5	3	8	6
10% Wet DGS	91.3	2	6	4	9	2
20% Wet DGS	83.3	3	7	4	6	4
40% Wet DGS	83.3	2	2	5	11	4

Table 4. Yield grades of carcasses from Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	Average call YG	Average calc YG	YG 1 No	YG 2 No	YG 3 No	YG 4 No
Urea	2.00	2.87	3	18	3	
Soybean meal	2.25	3.09	2	13	8	
10% Dry DGS	1.79	2.83	8	13	3	
20% Dry DGS	2.17	2.76	2	16	6	
40% Dry DGS	2.12	3.01	4	13	6	
10% Wet DGS	2.45	3.04	1	12	9	1
20% Wet DGS	2.21	2.89	4	11	9	
40% Wet DGS	1.96	2.78	4	17	3	
SEM	0.16	0.11				

Table 5. Feed cost of gain and carcass value of Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	1 to 91 d $/lb gain[a]	1 to 299 d $/lb gain[a]	Program I $/carcass[b]	Program II $/carcass[b]
Urea	0.214[c]	0.297[c]	912.74	932.47
Soybean meal	0.255[d]	0.335[d]	924.61	950.53
10% Dry DGS	0.214[c]	0.299[c]	897.53	923.10
20% Dry DGS	0.209[c]	0.300[c]	901.17	916.79
40% Dry DGS	0.201[e]	0.295[c]	898.47	919.03
10% Wet DGS	0.206[c]	0.283[e]	935.51	952.76
20% Wet DGS	0.195[ef]	0.290[ce]	914.28	940.66
40% Wet DGS	0.186[f]	0.288[ce]	858.82	880.92
SEM	0.003	0.004	18.86	19.99

[a]Ingredient costs used to calculate feed cost per unit of gain: corn grain, $2.25/bu; corn silage, $22/ton; hay, $65/ton; urea, $340/ton; soybean meal, $225/ton; molasses, $100/ton; dry DGS, $85/ton; wet DGS, $28.33/ton and supplemental ingredients ranged from $5 to $60/100 lbs.

[b]Two programs were used to establish a value for the carcasses. Program I was based on the price paid for the cattle, which was $1.16/lb for Prime and Choice carcasses, $1.06/lb for Select carcasses and a $10/lb discount for yield grade 4 carcasses. Program II was based on $1.16 for Choice^{-} YG 3 carcasses with premiums of $6.00/lb for Prime, $3.00/lb for Choice^{+} and Choice^{0}, $3.00/lb for YG 1 and $2.00/lb for YG 2 and discounts of $10/lb for Select carcasses and $10/lb for YG 4.

[cde]Within a column, means that do not have a common superscript differ ($P < 0.05$).

Table 6. Feedlot performance of Holstein steers fed wet or dry distillers grains during a 270-day growing and finishing period (IL trial).

Diet	Daily gain, lbs	Feed DM, lbs/d	Feed/gain
Soybean meal	3.09	17.75	5.93
12.5% dry DGS	3.20	18.85	6.08
25% dry DGS	3.14	19.47	6.21
50% dry DGS	3.06	19.01	6.21
25% wet DGS	3.15	18.70	5.94
50% wet DGS	2.95	16.76	5.68
37.5% to 20% dry DGS	3.24	19.82	6.13
20% to 37.5% dry DGS	3.07	19.32	6.30
37.5% to 20% wet DGS	3.06	17.82	5.83
20% to 37.5% wet DGS	3.15	18.22	5.80

Table 7. Measurements of carcasses from Holstein steers fed wet or dry distillers grains during a 270-day growing and finishing period (IL trial).

Diet	Dressing	Carcass wt	Marbling	Ribeye area	Backfat	YG
	%	lbs	score[a]	sq in	in	
Soybean meal	60.2	725.6	559.7	11.26	0.23	2.62
12.5% dry DGS	61.3	759.3	557.7	12.00	0.27	2.61
25% dry DGS	61.1	745.6	565.4	11.39	0.22	2.63
50% dry DGS	59.8	715.6	525.3	11.05	0.19	2.56
25% wet DGS	61.5	751.3	560.6	11.47	0.25	2.72
50% wet DGS	60.4	706.5	520.6	11.18	0.19	2.51
37.5% to 20% dry DGS	61.1	758.5	542.5	11.23	0.26	2.82
20% to 37.5% dry DGS	60.8	728.5	559.1	11.54	0.21	2.50
37.5% to 20% wet DGS	60.7	725.9	523.1	11.73	0.19	2.38
20% to 37.5% wet DGS	61.9	752.8	531.9	11.66	0.23	2.61

[a]Marbling score: Slight^0 = 400, Small^0 = 500, Modest^0 = 600.

Table 8. Color, shear force values and palatability attributes of strip loin steaks from Holstein steers fed wet or dry distillers grains during a 299-day growing and finishing period (IA trial).

Diet	Color[a]	Warner-Bratzler	Sensory evaluation[b]			
			Tenderness	Juiciness	Flavor	Dislike[c]
	a*	lbs				
Urea	7.70[d]	5.45	6.25	5.79	6.38	34.7
Soybean meal	7.18[d]	3.26	6.15	5.85	6.29	33.7
10% Dry DGS	7.17[d]	3.19	6.31	5.81	5.98	37.9
20% Dry DGS	5.84[ef]	3.23	6.04	5.75	6.16	36.8
40% Dry DGS	5.32[f]	3.04	6.39	5.86	6.14	38.9
10% Wet DGS	7.55[d]	3.32	6.35	6.13	6.39	29.5
20% Wet DGS	6.84[de]	3.28	6.00	5.68	5.95	41.1
40% Wet DGS	5.17[f]	3.26	6.13	5.85	6.05	34.7
SEM	1.75	0.06	0.22	0.23	0.22	0.50

[a]HunterLab MiniScan a* values at 138 h of retail display. + value = redness, - value = greenness.
[b]Tenderness, juiciness and flavor: 1 = dislike extremely, 9 = like extremely.
[c]Percentage of panelists that indicated they were unpleased with the sample.
[def]Within a column, means that do not have a common superscript differ (P < 0.05).

Table 9. Color, shear force values and palatability attributes of strip loin steaks from Holstein steers fed wet or dry distillers grains during a 270-day growing and finishing period (IL trial).

Diet	Color[a]	Warner-Bratzler	Sensory evaluation[b]			
			Tenderness	Juiciness	Flavor	Dislike[c]
	a*	lbs				
Soybean meal	5.24[d]	3.25	5.51	5.49	5.74	47.4
12.5% dry DGS	6.33[ef]	2.94	6.07	5.81	6.31	38.9
25% dry DGS	5.70[df]	3.13	5.62	5.50	5.99	45.3
50% dry DGS	5.69[df]	3.65	5.56	5.44	5.75	49.5
25% wet DGS	7.30[e]	3.19	6.15	6.05	6.12	34.7
50% wet DGS	6.09[df]	3.24	5.47	5.22	5.86	50.5
SEM	1.75	0.08	0.30	0.31	0.23	0.60

[abc]See Table 8.
[def]Within a column, means that do not have a common superscript differ (P < 0.05).

References

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