

BURNETT CENTER INTERNET PROGRESS REPORT

No. 5 - January, 2000

Effects of SarStart DSC on performance and carcass characteristics of finishing beef steers fed dry-rolled or steam-flaked corn diets

C. F. Ward , M. L. Galyean, P. J. Defoor, G. A. Nunnery, G. B. Salyer, H. M. Derington, and C. H. Parsons

Department of Animal Science and Food Technology
Texas Tech University, Lubbock 79409-2141

Introduction

Sarsaponin is a steroidal glycoside of sarsasapogenin derived from *Yucca schidigera* (Zinn et al., 1998) that is frequently used as a surfactant (tempering agent) in grain processing. Zinn et al. (1998) reported a linear increase in efficiency of microbial protein synthesis when increasing levels of sarsaponin (in the form of SarTemp) were added as a tempering agent to corn before rolling and feeding to finishing beef steers. Increasing the level of surfactant also resulted in a linear increase in longissimus muscle area (Zinn et al., 1998). Additional research is needed to determine the efficacy of sarsaponin in beef cattle finishing diets beyond its use as a tempering agent. Our objective was to evaluate the effects of SarStart DSC (a source of sarsaponin and other saponins) on performance by beef cattle fed finishing diets based on either dry-rolled or steam-flaked corn.

Experimental Procedures

Cattle. One hundred thirty (130) steers of Angus, Red Angus, Angus x Hereford, and Red Angus x Hereford breeding from one ranch near Ogallala, NE, were received at the Texas Tech University Burnett Center on May 20, 1999. The next morning, all cattle were processed as follows: 1) placement of an ear tag in each steer's left

ear; 2) vaccination with Bovishield 4+Lepto (Pfizer Animal Health); 3) vaccination with Fortress 7 (Pfizer Animal Health); 4) treatment down the back line with Dectomax Pour-On (Pfizer Animal Health); and 5) individual BW measurement. Steers were returned to the same pens to which they had been sorted off the truck the evening before and fed a 60% concentrate starter diet.

Experimental Design. Processing BW data were used to sort the steers to treatment groups. Of the original 130 steers, the two steers with the lightest BW and the eight heaviest steers were designated as Extra cattle. Because of a relatively large range in BW of the remaining 120 steers (approximately 200 lb), and relatively uniform distribution of BW across the range, the cattle were arbitrarily split into Light and Heavy weight blocks. Hence, the 60 steers of lightest BW were designated as the Light block, and the 60 steers of heaviest BW were designated as the Heavy block. Four dietary treatments, arranged in a 2 x 2 factorial, were used in a randomized block design with replicated pens within blocks. Pen was the experimental unit (six pens per treatment with five steers per pen). The four treatments were as follows:

- **DR0** – diet based on dry-rolled corn without SarStart DSC;

- **DR+** – diet based on dry-rolled corn with 55.6 mg/kg (dry matter [DM] basis) of added SarStart DSC;
- **SF0** – diet based on steam-flaked corn without SarStart DSC;
- **SF+** – diet based on steam-flaked corn with 55.6 mg/kg (DM basis) of added SarStart DSC.

The experiment was started on May 27, 1999, when cattle were weighed and implanted, after which they were sorted to their assigned concrete, partially slotted floor pens at the Burnett Center. Light block steers were implanted with Ralgro (Schering Plough Animal Health), and Heavy block steers were implanted with Revalor S (Hoechst Roussel Vet). All cattle were switched from the 60% concentrate starter diet to their assigned 70% concentrate diet at a feeding rate of 17 lb per steer.

Experimental Diets. Ingredient composition of the diets fed during the experiment is shown in Table 1. These data reflect adjustments for the average DM matter content of feed ingredients for the period during which a given diet was fed. Each diet contained the same intermediate premix (Table 2), which supplied protein, various minerals and vitamins, Rumensin (30 g/ton, DM basis), and Tylan (8 g/ton, DM basis). The SarStart DSC was added to the diet by means of a premix. This premix comprised .5% of the dietary DM and was a mixture (DM basis) of 1.112% SarStart DSC and 98.888% ground milo. For diets without SarStart DSC, the premix (.5% of the dietary DM) was 100% ground milo.

Management, Feeding, and Weighing Procedures. The four treatment diets were mixed in a 45-cubic foot capacity Marion paddle mixer and delivered to the pens with

a Rotomix 84-8 self-propelled mixer unit. The amount of feed allotted to each pen within treatment was weighed to the nearest 2 lb by use of the load cells and indicator on the Rotomix 84-8 unit. Mixing and feeding order of treatment diets throughout the experiment was DR0, SF0, DR+, and SF+. Clean-out of the Rotomix 84-8 was monitored closely to avoid cross-contamination of diets.

Dry matter determinations on ingredients used in the experimental diets were made every 2 wk throughout the experiment. These ingredient DM values were used to calculate the DM percentage of each dietary ingredient during the experiment. In addition, samples of mixed feed delivered to feed bunks were taken weekly throughout the experiment. These bunk sample DM values (adjusted for feed refusals) were used to compute average DM intake (DMI) by the cattle in each pen. Samples of feed taken from the bunk were composited for each intermediate weight measurement period of the experiment. Composited samples were ground to pass a 2-mm screen in a Wiley mill and analyzed for DM, ash, CP, ADF, Ca, and P (AOAC, 1990; Table 3).

Each feed bunk of the 24 pens was evaluated visually at approximately 0700 to 0730 daily. The quantity of feed remaining in each bunk was estimated, and the suggested daily allotment of feed for each pen was recorded. This bunk-reading process was designed to allow for accumulation of 0 to 1 lb of unconsumed feed per pen. Pens of cattle that maintained a given level of feed intake for a 3-d period were challenged to consume a higher level (.4 lb/steer). Feed bunks were cleaned, and unconsumed feed was weighed at intervals corresponding to intermediate weigh dates throughout the trial. Dry matter content of

these bunk weighback samples was determined in a forced-air oven by drying approximately 20 h at 100°C.

After 28, 56, and 84 d on feed, steers in all pens were weighed before the morning feeding. All BW measurements taken during the experiment were obtained using a single-animal scale (C & S Single-Animal Squeeze Chute set on four load cells) that was calibrated with 1,000 lb of certified weights (Texas Dept. of Agriculture) on the day before each scheduled weigh day. These BW measurements were taken to assess performance of the cattle on a regular basis. On d 56, at the time of a regularly scheduled BW measurement, each steer in the Light block was implanted with Revalor S (Hoechst Roussel Vet). After the 84-d BW measurement, it was estimated that the Heavy block steers would have sufficient finish to grade USDA Choice within 3 to 4 wk. Hence, all steers were weighed at approximately 0500 on September 16, 1999 (d 112), and Heavy block steers were shipped to the Excel Corp. slaughter facility in Plainview, TX. Light block steers remained on feed for an additional 26 d, and on October 12, 1999 (d 138) the Light block steers were weighed at approximately 0600 and shipped to the Excel Corp. slaughter facility in Plainview, TX. Of the original 120 steers that started the experiment, three steers died or were removed from the experiment for reasons unrelated to treatment, resulting in a total of 117 steers (57 Heavy block and 60 Light block steers) being sent to the Excel Corp. facility.

Carcass Evaluation. Personnel of the West Texas A&M University Beef Carcass Research Center obtained all carcass measurements. Measurements included hot carcass weight, longissimus muscle area, marbling score, percentage of kidney, pelvic,

and heart fat (KPH), fat thickness measured between the 12th and 13th ribs, yield grade, and liver abscess score. Liver abscess scores were recorded on a scale of 1 to 7, with 1 = no abscesses, 2 = A-, 3 = A, 4 = A+, 5 = telangiectasis, 6 = distoma (fluke damage), and 7 = fecal contamination that occurred at slaughter. Of the 117 steers sent to the slaughter plant, data were obtained on 116 carcasses for hot carcass weight, yield grade, quality grade, and dressing percent, whereas data were obtained on 113 carcasses for longissimus muscle area, marbling score, KPH, and fat thickness.

Statistical Analyses. All data were analyzed with pen as the experimental unit. A randomized block design was employed, and computations were made with the GLM procedure of SAS (1987). Pen means for daily gain and average daily DMI were included in the data file, and feed:gain ratio was computed as the quotient of daily DMI divided by daily gain. The effects of grain processing method, SarStart DSC, grain processing method x SarStart DSC, block, and block x treatment interactions were included in the model for pen-based data. Carcass data were entered on an individual animal basis and analyzed with a model that included effects of grain processing method, SarStart DSC, grain processing method x SarStart DSC, block, block x treatment interactions, and pen within block x treatment. Pen within block x treatment was specified as the error term for testing treatment effects. Residual mean square in this model for carcass data (not used for testing) would include individual animal variation. Carcass quality grade and liver abscess score data were analyzed by Chi-square procedures (SAS, 1987) using individual animal data.

Results and Discussion

Performance Data. Performance data for the experiment are shown in Table 4. No grain processing method x SarStart DSC or block x treatment interactions ($P > .05$) were noted; hence, main-effect means (DR vs SF and 0 vs + SarStart DSC) averaged over the two blocks are presented.

Initial BW did not differ ($P \geq .21$) among treatments, averaging 806.1 lb (Table 4). Final live BW was greater ($P < .03$) for cattle fed SF vs DR; however, final BW did not differ as a result of SarStart DSC addition to the diet. Steers fed the SF diet consistently gained faster than those fed the DR diet throughout the study, with an 8.2% increase ($P < .02$) for the overall feeding period for SF compared with DR. Addition of SarStart DSC to the diet resulted in a 3.4% non-significant ($P < .26$) increase in daily gain for the overall feeding period.

Daily DMI was greater ($P < .01$) by cattle fed DR vs SF for each of the cumulative periods of the study (Table 4). For the overall feeding period, cattle fed DR consumed 7.5% more DM than those fed SF. Addition of SarStart DSC to the diet did not affect DMI during any of the cumulative periods or the overall trial ($P \geq .83$). Consumption of SarStart DSC averaged 494 mg/animal daily, compared with a target consumption of 500 mg/animal daily.

The increased DMI and lower daily gain by cattle fed DR resulted in a greater ($P < .01$) feed:gain ratio than for cattle fed SF for each of the cumulative periods of the study. For the overall feeding period, feed:gain ratio was improved by 14.3% for SF vs DR. Addition of SarStart DSC to the diet resulted in a numerical improvement in feed:gain ratio during each of the cumulative periods

of the study; however, differences were not significant. For the overall feeding period, SarStart DSC tended ($P < .16$) to improve feed:gain ratio by 3.4%.

Zinn et al. (1998) applied either 43, 172, or 430 mg of SarTemp per kilogram of corn as a tempering agent (all levels of SarTemp were sprayed on to corn in 40 g of water per kilogram of corn) for rolled corn in beef cattle finishing and metabolism studies. The three levels of SarTemp-treated rolled corn were compared with dry-rolled and steam-flaked corn control diets. Tempering rolled corn with SarTemp increased daily gain 9% and improved feed:gain by 5% compared with untreated dry-rolled corn. It is difficult to compare the results of the present experiment with those of Zinn et al. (1998). In the present experiment, SarStart DSC was added to the diet as a dry premix rather than in liquid form as a tempering agent in the Zinn et al. (1998) study. Consumption of SarStart DSC averaged 494 mg/animal daily in the present study; the equivalent level of sarsaponin in the Zinn et al. (1998) study was provided by the 172 mg of SarTemp/kg of corn treatment (C. McNeff, personal communication).

Dietary NEm and NEg concentrations were calculated (NRC, 1996) from performance data for the main effects of grain processing method and SarStart DSC. Calculated values for NEm of DR and SF were 2.05 and 2.27, respectively, whereas NEm values for the 0 or + SarStart DSC diets were 2.14 and 2.17 Mcal/kg of DM, respectively. Corresponding NEg values were 1.39 and 1.58 for DR vs SF, and 1.47 and 1.50 Mcal/kg of DM for 0 vs + SarStart DSC, respectively. Values for NEm and NEg based on dietary ingredient composition (NRC, 1996) were 2.08 and 1.42 Mcal/kg of DM for DR diets and 2.15

and 1.47 Mcal/kg of DM for SF diets. The increase in NE values calculated from performance data for the SF diet would require tabular NEm and NEg values for steam-flaked corn of 2.49 and 1.77 Mcal/kg of DM to achieve the performance-based results. Current values suggested by NRC (1996) for steam-flaked corn are 2.33 and 1.62 Mcal/kg of DM for NEm and NEg, respectively. Zinn (1987) suggested that, based on performance data, NEm and NEg values of steam-flaked corn should be 2.54 and 1.77 Mcal/kg of DM, respectively.

Carcass Data. Carcass data are shown in Table 5. As with performance data, no grain processing method x SarStart DSC interactions ($P > .10$) were noted. Hot carcass weight was greater ($P < .05$) for cattle fed SF vs DR corn, reflecting the greater daily gain by cattle fed SF corn. Fat thickness was greater ($P < .01$) in carcasses of cattle fed SF than in those fed DR, and yield graded tended ($P < .07$) to be greater for cattle fed SF corn. Marbling score tended ($P < .13$) to be slightly lower for the carcasses of cattle fed SF than for those fed DR corn. Percentage of carcasses grading USDA Choice was 30% greater with DR corn than with SF corn. Conversely, percentage of carcasses grading Select was 93.3% greater with SF corn than with DR corn. This distribution of quality grades tended to differ ($P < .06$) between grain processing methods. Reasons for this large increase in percentage of Choice carcasses with DR vs SF corn are not readily apparent. No other carcass characteristics were affected by grain processing method.

Addition of SarStart DSC to the diet did not affect any of the carcass measurements except dressing percent, which was lower ($P < .05$) in cattle fed the diet with SarStart DSC than in those fed the diet without

SarStart DSC. Examination of the analysis of variance for dressing percent revealed that the Block x SarStart DSC term in the model was significant ($P < .01$), which resulted from cattle in the Heavy block fed a diet with added SarStart DSC having a much lower dressing percent (60.68) than Heavy-block cattle that were not fed SarStart DSC (62.15%). However, dressing percent was similar with or without SarStart DSC (61.35 vs 61.07%) in cattle in the Light block. Because of the Block x SarStart DSC interaction for dressing percent, no attempt was made to calculate a carcass-adjusted final weight (hot carcass weight divided by dressing percent).

The distribution of USDA quality grades was not affected ($P \geq .58$) by the addition of SarStart DSC to the diet (Table 5). The percentage of carcasses that graded Choice was 66.67% for carcasses from cattle that did not receive SarStart DSC vs 69.49% for carcasses from cattle that were fed SarStart DSC.

Liver score data are shown in Table 6. The distribution of liver scores did not differ ($P \geq .55$) between grain processing methods or between the 0 and + SarStart DSC diets. On average, 84.04% of the livers were not condemned, and contamination in the slaughter process was the most common reason for liver condemnation. Actual rates of liver abscesses (A- or A+ in Table 6) were relatively low, averaging 3.7 and 6.78% for DR and SF, respectively, and 5.55 and 5.08% for diets with or without SarStart DSC, respectively.

Summary and Conclusions

Under the conditions of the present experiment, feeding steam-flaked corn-based diets to finishing beef steers resulted in

substantial improvements in daily gain and feed:gain ratio compared with feeding dry-rolled corn-based diets. This finding is consistent with previous reports in the literature (e.g., Zinn, 1987). The effects of adding SarStart DSC did not interact with grain processing method. Averaged over grain processing method, addition of SarStart DSC to the diet increased daily gain by 3.4% ($P < .26$) and improved feed:gain by 3.4% ($P < .16$). Because only one level of SarStart DSC was used in this experiment (55.6 mg/kg of dietary DM), and the general trend in gain and feed:gain ratio with the addition of SarStart DSC was positive throughout the feeding period, additional research to evaluate the dose-response relationship for this product might prove beneficial.

Literature Cited

- AOAC. 1990. Official Methods of Analysis (15th Ed.). Association of Official Analytical Chemists. Washington, DC.
- NRC. 1996. Nutrient Requirements of Beef Cattle (7th Ed.). National Academy Press, Washington, DC.

SAS. 1987. SAS/STAT Guide for Personal Computers (Version 6 Ed.). SAS Inst. Inc., Cary, NC.

Zinn, R. A. 1987. Influence of lasalocid and monensin plus tylosin on comparative feeding value of steam-flaked versus dry-rolled corn in diets for feedlot cattle. *J. Anim. Sci.* 65:256-266.

Zinn, R. A., E. G. Alvarez, M. F. Montaña, A. Plascencia, and J. E. Ramirez. 1998. Influence of tempering on the feeding value of rolled corn in finishing diets for feedlot cattle. *J. Anim. Sci.* 76:2239-2246.

Acknowledgements

This experiment was supported, in part, by a grant from SarTec, Inc., Anoka, MN. The authors thank Kirk Robinson (Burnett Center Manager) and Ricardo Rocha (Burnett Center Assistant Manager) for their assistance with the experiment.

Table 1. Ingredient composition (% DM basis) of the experimental diets^a

Ingredient	Percentage of dietary concentrate											
	70				80				90			
	DR0	DR+	SF0	SF+	DR0	DR+	SF0	SF+	DR0	DR+	SF0	SF+
Cottonseed hulls	15.09	15.09	15.14	15.14	9.79	9.79	10.09	10.09	4.97	4.96	5.01	5.01
Ground alfalfa hay	15.27	15.27	15.32	15.32	9.84	9.84	10.14	10.14	4.92	4.92	4.97	4.97
Corn ^b	54.55	54.55	54.46	54.46	65.54	65.54	64.56	64.56	75.20	75.20	75.14	75.14
Cottonseed meal	3.99	3.99	3.98	3.98	3.94	3.94	3.98	3.98	3.85	3.85	3.91	3.91
Molasses	4.11	4.11	4.10	4.10	4.05	4.05	4.19	4.19	4.20	4.20	4.17	4.17
Fat (yellow grease)	3.06	3.06	3.06	3.06	2.98	2.98	3.09	3.09	3.00	3.00	2.92	2.92
Urea	.92	.92	.92	.92	.91	.91	.94	.94	.89	.89	.89	.89
Treatment premix ^c	.51	.51	.52	.52	.50	.50	.51	.50	.49	.50	.50	.51
TTU premix ^d	2.50	2.50	2.50	2.50	2.45	2.45	2.50	2.50	2.48	2.48	2.49	2.48

^aDR0 = dry-rolled corn-based diet without SarStart DSC; DR+ = dry-rolled corn-based diet with SarStart DSC; SF0 = steam-flaked corn-based diet without SarStart DSC; and SF+ = steam-flaked corn-based diet with SarStart DSC.

^bDry-rolled (DR) or steam-flaked (SF) corn.

^cTreatment premixes for DR0 and SF0 diets contained ground milo only, whereas treatment premixes for DR+ and SF+ diets contained 1.112% (DM basis) SarStart DSC mixed with ground milo.

^dPremix composition is shown in Table 2.

Table 2. Composition of the TTU premix used in experimental diets

Ingredient	%, DM basis
Cottonseed meal	23.9733
Limestone ^a	42.1053
Dicalcium phosphate	1.0363
Potassium chloride	8.0000
Magnesium oxide	3.5587
Ammonium sulfate	6.6667
Salt	12.0000
Cobalt carbonate	.0017
Copper sulfate	.1572
Iron sulfate	.1333
EDDI	.0025
Manganese oxide	.2667
Selenium premix, .2% Se	.1000
Zinc sulfate	.8251
Vitamin A, 650,000 IU/g ^a	.0122
Vitamin E, 275 IU/g ^a	.1260
Rumensin, 80 mg/lb ^a	.6750
Tylan, 40 mg/lb ^a	.3600

^aConcentrations noted by the ingredient are on a 90% DM basis.

Table 3. Chemical composition of the experimental diets^a

Ingredient	Percentage of dietary concentrate											
	70				80				90			
	DR0	DR+	SF0	SF+	DR0	DR+	SF0	SF+	DR0	DR+	SF0	SF+
Dry matter, % ^b	88.55	89.05	85.45	85.49	88.82	89.02	83.39	83.09	87.74	87.50	82.17	82.01
Ash, %	4.67	4.45	4.86	4.72	4.25	4.36	4.44	4.58	4.64	4.57	4.78	4.67
Crude protein, %	11.55	11.80	12.61	11.50	11.78	12.25	11.57	11.77	12.89	12.81	12.83	13.46
ADF, % ^c	16.11	17.25	15.96	16.95	9.57	11.62	9.49	10.55	5.45	5.36	5.44	5.52
Calcium, %	.69	.71	.70	.69	.58	.60	.59	.60	.61	.61	.62	.61
Phosphorus, %	.23	.22	.23	.22	.28	.27	.24	.24	.31	.32	.31	.31

^aDR0 = dry-rolled corn-based diet without SarStart DSC; DR+ = dry-rolled corn-based diet with SarStart DSC; SF0 = steam-flaked corn-based diet without SarStart DSC; and SF+ = steam-flaked corn-based diet with SarStart DSC.

^bAll values except Dry matter, % are expressed on a DM basis. Values for the 90% concentrate diet represent the average of analyses conducted on a sample of each diet composited across the 28-d (or 26-d) periods of the experiment.

^cADF = Acid detergent fiber.

Table 4. Effects of grain processing method and SarStart DSC on performance by finishing beef steers

Item	Grain processing method ^a			SarStart DSC ^b			SE ^d
	DR	SF	OSL ^c	0	+	OSL ^c	
Initial BW, lb	806.4	805.7	.86	808.6	803.5	.21	2.74
Final BW, lb	1,236.9	1,269.8	.03	1,248.0	1,258.7	.43	9.26
Daily gain, lb							
d 0 to 28	3.82	4.08	.14	3.83	4.07	.18	.119
d 0 to 56	3.96	4.37	.01	4.09	4.24	.31	.098
d 0 to 84	3.45	3.92	.01	3.65	3.73	.54	.093
d 0 to 112	3.38	3.63	.06	3.45	3.57	.32	.082
d 0 to end ^e	3.42	3.70	.02	3.50	3.62	.26	.076
Daily DMI, lb/steer							
d 0 to 28	17.98	16.52	.01	17.19	17.30	.27	.068
d 0 to 56	19.76	18.49	.01	19.02	19.23	.33	.152
d 0 to 84	19.89	18.70	.01	19.24	19.34	.71	.183
d 0 to 112	20.05	18.72	.01	19.37	19.39	.95	.217
d 0 to end ^e	20.27	18.85	.01	19.53	19.60	.83	.226
Feed:gain							
d 0 to 28	4.76	4.08	.01	4.55	4.29	.18	.131
d 0 to 56	5.02	4.25	.01	4.69	4.57	.40	.093
d 0 to 84	5.79	4.78	.01	5.34	5.23	.52	.112
d 0 to 112	5.95	5.18	.01	5.66	5.46	.17	.096
d 0 to end ^e	5.96	5.11	.01	5.63	5.44	.16	.091

^aGrain processing method main effect: DR = dry-rolled corn; SF = steam-flaked corn.

Table 4 (continued). Effects of grain processing method and SarStart DSC on performance by finishing beef steers

^bSarStart DSC main effect: 0 = no added SarStart DSC; + = 55.6 mg/kg of SarStart DSC in the dietary DM.

^cObserved significance level for grain processing method or SarStart DSC main-effect comparisons.

^dPooled standard error of main-effect means, n = 12 pens per main-effect mean.

^eCattle in the Heavy block were on feed for 112 d, whereas cattle in the Light block were on feed for 138 d, resulting in an average of 125 d on feed.

Table 5. Effects of grain processing method and SarStart DSC on carcass characteristics of finishing beef steers

Item	Grain processing method ^a			SarStart DSC ^b			SE ^d
	DR	SF	OSL ^c	0	+	OSL ^c	
Hot carcass wt, lb	759.6	777.6	.05	769.0	768.3	.94	5.85
Dressing percent	61.39	61.24	.58	61.61	61.02	.05	.192
LM area, sq. in. ^e	12.47	12.76	.36	12.67	12.57	.76	.225
Fat thickness, in.	.48	.54	.01	.52	.50	.21	.014
KPH, % ^f	2.09	2.03	.31	2.06	2.07	.88	.039
Yield grade	2.95	3.12	.07	3.08	2.99	.31	.060
Marbling score ^g	446.2	420.6	.13	440.2	426.7	.41	11.30
Choice, %	77.20	59.32	*	66.67	69.49	**	-
Select, %	21.05	40.68	*	31.58	30.51	**	-
Standard, %	1.75	0.00	*	1.75	0.00	**	-

^aGrain type main effect: DR = dry-rolled corn; SF = steam-flaked corn.

^bSarStart DSC main effect: 0 = no added SarStart DSC; + = 55.6 mg/kg of SarStart DSC in the dietary DM.

^cObserved significance level for grain processing method or SarStart DSC main-effect comparisons.

^dPooled standard error of main-effect means, n = 12 pens per main-effect mean.

^eLM = longissimus muscle.

^fKPH = kidney, pelvic, and heart fat.

^g300 = Slight⁰; 400 = Small⁰; 500 = Modest⁰.

*Distribution differs by Chi-square test, $P < .06$; **Distribution does not differ by Chi-square test, $P \geq .58$.

Table 6. Distribution of liver scores (% of total) in finishing beef steers as affected by grain processing method and SarStart DSC

Item ^c	Grain processing method ^a		SarStart DSC ^b	
	DR	SF	0	+
Not condemned	83.33	84.75	83.33	84.75
A-	1.85	3.39	3.70	1.69
A	0.00	0.00	0.00	0.00
A+	1.85	3.39	1.85	3.39
Distoma (fluke)	5.56	1.69	5.56	1.69
Telangiectasis	0.00	1.69	1.85	0.00
Contamination ^d	7.41	5.09	3.71	8.48

^aGrain type main effect: DR = dry-rolled corn; SF = steam-flaked corn.

^bSarStart DSC main effect: 0 = no added SarStart DSC; + = 55.6 mg/kg of SarStart DSC in the dietary DM.

^cDistribution of liver scores within main-effect means does not differ by Chi-square test, $P \geq .55$.

^dLiver condemned because of contamination with feces or digestive tract contents at the plant.