Value of Modified Wet Distillers Grains in Cattle Diets without Corn

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Summary

Two experiments were conducted to evaluate modified wet distillers grains (DGS) as a supplement for roughages. Wet DGS was superior to a mixture of corn and wet DGS as a supplement with tub-ground grass hay for growing steer calves in a 112-d study. Performance of steers fed the grass hay supplemented with DGS or the mixture of corn and DGS was superior to calves fed corn silage. However when DGS was priced the same as corn on a dry basis, cost of gain was less for steers fed corn silage. When DGS was prices at 75% or less the cost of corn, cost of gain was less for calves fed the hay and DGS. Only when DGS was prices at 50% the cost of corn and when cost of corn was above $3/bu was cost of gain less for calves fed hay and the mixture of corn and DGS compared to calves fed corn silage. In the second experiment steer calves weighing 690 lbs were fed a typical corn-based finishing diet for 186 days or a diet of tub-ground corn stalks supplemented with modified wet DGS for 210 days. Steers fed the stover-DGS diet did not gain as well as steers fed the corn-based diet and produced fewer USDA Choice grading carcasses (31% vs. 83%). Cost of gain was less for steers fed the stover-DGS diet at all costs of DGS up to equal to the cost of corn on a dry basis as well as prices of corn from $2 to $4/bu. Results of these two preliminary studies indicate that modified wet DGS is a suitable supplement for mid to lower quality roughages for feeding cattle and it is possible to produce acceptable grading beef without grain. For such programs to be financially successful the price of DGS relative to corn grain on a dry basis and final weight of the cattle are important considerations.

Introduction

With increased numbers of ethanol plants, production of ethanol has created an increased demand and price for corn grain. An increase of $1.00/bu in corn price results in an increase in feed cost/cwt gain of $9.50. Based on its chemical composition, distillers grains (DGS) is a nearly ideal supplement for roughage-based diets for ruminants. Because starch is utilized during the fermentation to make ethanol it is not present in DGS to cause negative associative effects often observed when corn grain is used as supplement for roughage diets. If corn grain becomes limiting for feeding livestock, alternative feeding programs will need to be developed to feed cattle. The objective of this study was to evaluate modified wet DGS as a feed for supplementing lower quality grass hay or corn stalks when fed to growing and finishing steers.

Materials and Methods

Two studies were conducted to evaluate feeding distillers grains in roughage-based diets without corn. In the first experiment crossbred steers mostly black with a few red and white steers weighing 620 lbs when allotted were purchased for this study. The steers were implanted with Component E-S at the start of the experiment. After arrival at the research farm the calves were placed in pens of six animals and fed a ration containing dry rolled corn, corn silage and chopped grass hay. About three weeks after arrival 72 steers were allotted at random from outcome groups based on weight to 12 pens of six steers. Four pens were randomly assigned to each of three diets shown in Table 1. Because of late delivery of wet DGS, all the steers were fed the silage diet for the first 24 days. In the second experiment, preconditioned and weaned steers, predominantly Angus with some red and Charolais cross steers; weighing 690 lbs were purchased for this experiment. The steers were implanted with Component E-S at the start of the experiment and reimplanted with Component TE-S 126 days later. Upon arrival at the farm the calves were managed similarly to those in the first experiment. Seventy two steers were allotted at random from outcome groups based on weight to 12 pens of six steers and started on the experimental diets shown in Table 2. Six pens were assigned at random to each of two dietary treatments shown in Table 2. Steers receiving DGS and corn stover were fed on average during the trial 38.7% tub ground corn stalks, 59.7% modified wet DGS and 1.6% supplement.

In both experiments the concentrate portion of the diet was prepared as a mix. The concentrate mixture, corn silage, tub-ground roughage or wet DGS were weighed and mixed in a mixer wagon prior to delivery to the cattle. The starting weight of each steer was the average of two weights taken early in the morning on two consecutive days prior to feeding but with access to water. The cattle were fed twice per day and the amount of feed offered the cattle was gradually increased until their appetite was satisfied after which they were fed according to appetite. If the amount of feed consumed decreased, they were offered less feed and feed that accumulated in the bunks was removed and sampled for determination of dry matter. The mixed concentrate portion of the diets, corn silage, ground corn stover and wet distillers grains were periodically sampled for chemical analysis. Average dry matter of the DGS was 53.6% and on a dry basis contained 25.9% protein, 15.0% ether extract, 27.5% NDF and 8.9% ADF. Feed costs were determined based on performance of the cattle and

representative feed costs at the time the data were summarized (See footnote to Table 5).

The final weight of each steer was the average of two weights taken on consecutive days. Daily gain for each steer was calculated from beginning and ending weights and the average daily gain calculated for each pen. Steers in the first experiment were fed 112 days and then used in another study. The control steers in the second experiment were sold after being fed for 186 days. Steers receiving the stover and DGS mixture were fed 210 days. Weights of hot carcasses were taken after slaughter, and measurements on the carcasses were obtained after a 24-hr postmortem chill. The federal grader in the plant called marbling score, percentage of kidney, pelvic and heart fat (KPH) and yield grade. Area and fat thickness over the ribeye between the 12th and 13th ribs on the left side of each carcass were measured. The value of each carcass in the second experiment was established by using a representative grid at the time the data were summarized (See footnote to Table 4).

Pen means were used as the experimental unit in the statistical analysis. Data were analyzed by analysis of variance. Main effects in the statistical analysis were diets. Differences were considered to be statistically significant at $P < .05$. Treatment means and probabilities of difference due to diet are presented.

Results and Discussion

Performance of the steers in the first experiment is summarized in Table 3. Feeding growing steers hay and corn with DGS or hay and DGS in approximate proportions of the grain and stover in corn silage increased feed intake and gain and tended to improve feed conversion compared with steers fed corn silage. The improved responses observed with the diets containing DGS could be the result of reduced negative associative effects associated with supplementing fiber with starch. Compared with the corn-based diet, feeding tub-ground corn stover and DGS resulted in reduced feed intake and poorer performance (Table 4). The poorer performance is likely the result of reduced energy intake and could be due to the poor quality of the corn stalks (80.4% NDF, 50.3% ADF and 3.6% crude protein). Though the steers fed stover and DGS were fed an additional 24 days they weighed 100 lbs less when harvested. Coupled with lower dressing percentage the carcasses from the steers fed stover and DGS were 110 lbs lighter. Carcasses from the steers fed stover and DGS contained less fat and consequently had lower USDA quality grades, but improved yield grades. Average value of the carcasses was $1.38/lb for the steers fed corn and $1.35 for those fed stover and DGS. However because of reduced carcass weights the value per carcass was reduced $171 by feeding stover and DGS.

In Experiment 1 if modified wet DGS was priced equal to corn grain on a dry basis feed costs were lower for steers fed silage at all prices of corn grain (Table 5, Figure 1). Using a combination of corn and DGS to supplement grass hay was less costly than corn silage only when DGS was priced at 0.5 times cost of corn and corn cost over $3/bu. Supplementing the grass hay with DGS alone reduced cost at all prices of corn grain when the wet DGS was priced at 0.75 or less the price of corn. When price of DGS was less than the cost of corn on a dry basis the advantage to feeding DGS increased with higher prices for corn grain. In Experiment 2 feed costs of the stover and DGS diet were less than the corn-based diet at all prices of DGS and corn. When DGS was priced at 0.5 times the cost of corn on a dry basis the reduction in feed cost was nearly $160 per head or $19.40 per hundred lbs gain with corn priced at $4/bu.

The potential profit or loss from substituting modified wet DGS for corn grain at different prices for corn and wet DGS are shown in Figures 3 and 4 for the two experiments. In the first experiment feeding growing steers hay supplemented with corn and DGS or DGS increased net return per steer because of increased weight gain, not because of lower feed costs. With price of DGS related to price of corn the economic advantage of feeding DGS increased modestly as price of corn increased. In the second experiment feeding stover and DGS significantly reduced cost of gain but reduced net return per steer because of reduced carcass weight more than reduced carcass value. If these steers had been fed to similar carcass weight the economic results might have been different.

As price of corn increases, substituting wet DGS for corn grain has potential to improve net returns to cattle feeding, but it appears that cost of DGS on a dry basis should be less than the cost of corn. If finishing cattle with less grain that results in reduced rates of gain to maintain net returns it will be important to not significantly reduce final weights.

Implications

Based on results of two studies it appears that modified wet DGS is superior to corn grain for supplementing high-roughage diets containing minimal or no grain for feeding growing and finishing cattle. However for such programs to be financially successful the price of DGS relative to corn grain on a dry basis and final weight of the cattle are important.

Acknowledgments

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Table 1. Formulated composition of diets fed in Experiment 1 (Dry basis)[1].

	Diets		
	Corn silage	Hay + corn + DGS	Hay + DGS
Dry rolled corn	1.75	26.43	2.50
Corn silage	92.48		
Ground hay		47.98	47.92
Cane molasses	0.058	0.21	0.032
Modified distillers grains		23.92	47.92
Urea	1.31		
Soybean meal	3.25		
Limestone	0.61	1.04	1.20
Dicalcium phosphate	0.078		
Sodium chloride	0.30	0.30	0.30
Vitamin A premix[2]	0.08	0.08	0.08
Trace mineral premix	0.024	0.024	0.024
Rumensin premix[3]	0.0195	0.0195	0.0195

[1]Based on variability of dry matter content of ingredients, predominantly the wet DGS, during the experiment the composition of the diets fed were corn silage: 92.8% corn silage & 7.2% grain mix; hay+corn+DGS: 10.4% corn silage, 24.4% grain mix, 40.4% ground hay & 24.8% DGS and hay+DGS: 10.8% corn silage, 4.0% grain mix, 39.3% ground hay & 45.8% DGS.
[2]Provided 1,400 IU of vitamin A activity per pound of diet dry matter.
[3]Provided 15.6 mg sodium monensin per pound of dry matter.

Table 2. Formulated composition of diets fed in Experiment 2 (Dry basis)[1].

	Diets	
	Corn-based	Stover + DGS
Dry rolled corn	73.58	0.19
Corn silage	8.00	
Ground corn stalks	4.00	38.07
Cane molasses	0.75	
Modified distillers grains		60.00
Soybean meal[2]	12.24	
Limestone	1.01	1.32
Sodium chloride	0.30	0.30
Vitamin A premix[3]	0.08	0.08
Trace mineral premix	0.024	0.024
Rumensin premix[4]	0.0195	0.0195

[1]Based on variability of dry matter content of ingredients, predominantly the wet DGS, during the experiment the concentration of DGS fed in the diet with stover averaged 1.61% grain mix, 38.68 ground stover & 59.71 DGS..
[2]After 41 days the concentration of soybean meal was reduced to 4.1%, 0.5% urea added, and dry rolled corn increased to 81.22% in the corn-based diet.
[3]Provided 1,400 IU of vitamin A activity per pound of diet dry matter.
[4]Provided 15.6 mg sodium monensin per pound of dry matter.

Table 3. Performance of steers fed corn silage; mixture of ground hay, corn grain and modified wet distillers grains or mixture of ground hay and modified wet distillers grains (Experiment 1).

	Diets			P[1]
	Corn silage	Hay+corn+DGS	Hay+DGS	
Beginning wt, lbs	620	617	620	0.136
Ending wt, lbs	933[a]	968[ab]	984[b]	0.022
Gain, lbs/d	2.80[a]	3.13[ab]	3.25[b]	0.021
Feed intake, lbs DM/d	14.2[a]	16.0[b]	15.4[b]	0.001
Feed/gain	5.08	5.11	4.75	0.049

[1]P is probability of a statistical difference.
[ab]Differences between means that do not have a common superscript are statistically significant (P < .05).

Table 4. Performance and carcass measurement of steers fed corn-based or ground corn stover and modified wet distillers grains (Experiment 2).

	Diets		P[1]
	Corn-based	Stover + DGS	
Beginning wt, lbs	694	692	0.452
Ending wt, lbs	1382	1278	0.001
Gain, lbs/d	3.70	2.79	0.001
Feed intake, lbs DM/d	20.5	19.6	0.005
Feed/gain	5.56	7.02	0.001
Carcass wt, lbs	848.2	738.0	0.001
Dressing %	61.3	57.8	0.001
Back fat, in	0.63	0.35	0.001
Ribeye area, sq in	13.5	12.5	0.003
KPH, %	2.26	2.17	0.128
Marbling score[2]	548	458	0.001
Avg called yield grade	3.00	2.44	0.003
Quality grades			
Choice	8	1	
Choice -	22	10	
Select	6	22	
Standard		3	
% USDA Choice	83.3	30.6	0.001
Yield grades			
2	5	20	
3	27	16	
4	4		
Carcass value[4], $	1168.45	997.45	0.001

[1]P is probability of a statistical difference.
[2]Marbling score, 400 = Slight[0], 500 = Small[0], 600 = Moderate[0].
[3]Certified Angus Beef. Percentages of carcasses eligible for CAB (black hair coat) 88.9, 83.3 and 82.9 for 0, 24.9 and 47.0 % DGS, respectively. Of eligible carcasses there were 21.9, 26.7 and 13.8% CAB from steers fed 0, 24.9 and 47.0% DGS, respectively.
[4]Grid: $140/Cwt for USDA Choice YG 3; quality grade: Prime +$29, CAB +$7, Select -$9, NR -$12; yield grade: YG 1 +$6.5, YG 2 +$2.5, YG 4 -$15 and weight: 951-1050 lbs -$18, >1050 lbs -$35, 526-550 lbs -$18, <525 lbs -$30.

Table 5. Feed costs in relation to cost of corn and price of distillers grains (Experiment 1).

Corn, $/bu	Price distillers grains[1]	Diets		
		Corn silage	Hay + corn + DGS	Hay + DGS
		Feed cost[2], $/head		
2.00		83.95	109.18	106.05
2.50		96.33	123.68	120.22
3.00	1.0	108.71	138.19	134.39
3.50		121.09	152.70	148.56
4.00		133.47	167.2	162.73
2.00		83.95	102.43	94.02
2.50		96.33	115.25	105.19
3.00	0.75	108.71	128.07	116.35
3.50		121.09	140.89	127.52
4.00		133.47	153.71	138.68
2.00		83.95	95.68	82.00
2.50		96.33	106.82	90.16
3.00	0.50	108.71	117.95	98.32
3.50		121.09	129.09	106.48
4.00		133.47	140.22	114.64

[1]Price of distillers grains on a dry basis expressed as 1.0, 0.75 or 0.50 times the cost of corn on a dry basis (12% moisture).
[2]Feed costs other than corn and DGS were as follows: corn silage, 8 x cost corn ($/bu) + 5; tub-ground hay, $70/ton, tub-ground corn stover, $45/ton; soybean meal, $200/ton; urea, $375/ton; molasses, $175/ton; minerals and other supplemental ingredients, $400/ton.

Table 6. Feed costs in relation to cost of corn and price of distillers grains (Experiment 2).

Corn, $/bu	Price distillers grains[1]	Diets	
		Corn-based	Stover + DGS
		Feed cost[2], $/head	
2.00		180.70	151.21
2.50		213.18	176.15
3.00	1.0	245.66	201.10
3.50		278.14	226.04
4.00		310.62	250.99
2.00		180.70	126.33
2.50		213.18	145.05
3.00	0.75	245.66	163.78
3.50		278.14	182.51
4.00		310.62	201.23
2.00		180.70	101.45
2.50		213.18	113.96
3.00	0.50	245.66	126.46
3.50		278.14	138.97
4.00		310.62	151.48

[1,2]See footnotes for Table 5.

Figure 1. Cost of gain (Experiment 1). Calculations based on ingredient prices shown in Table 5.

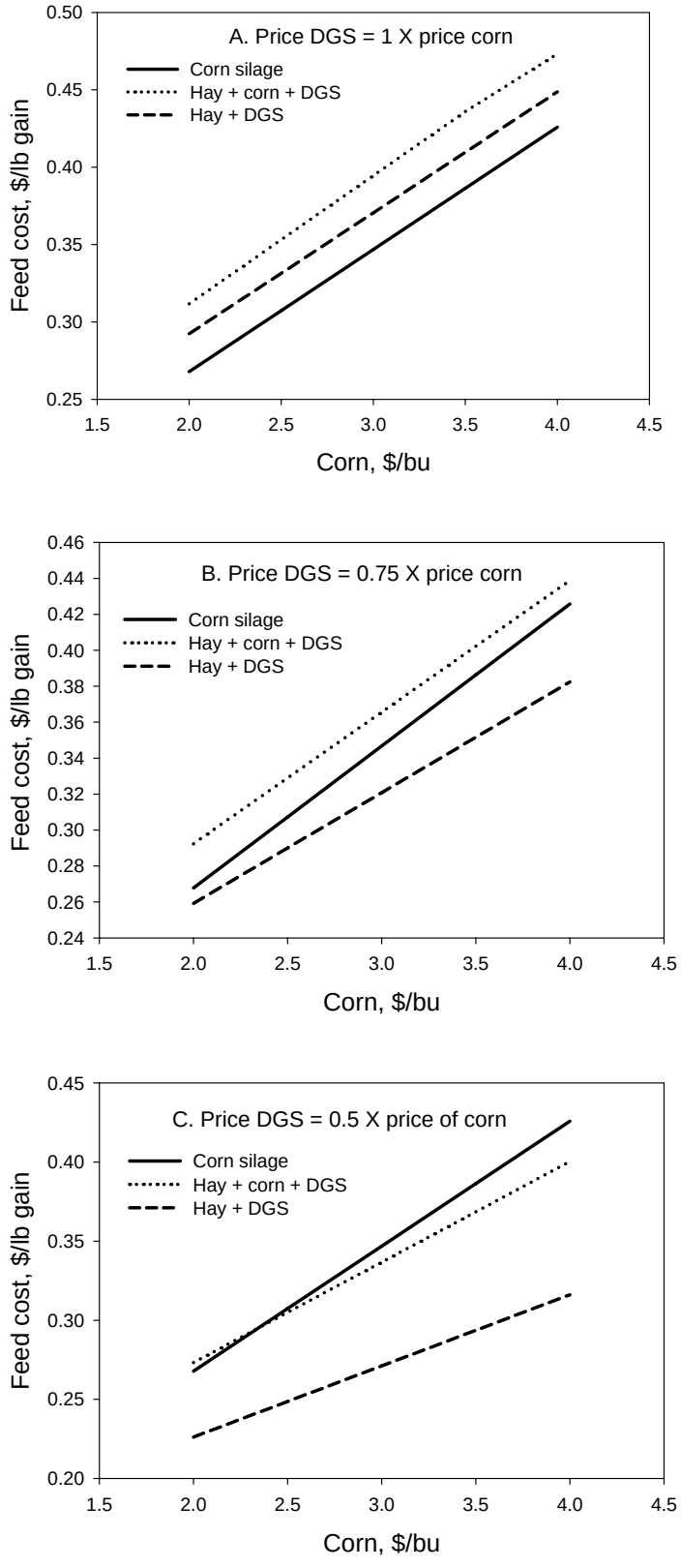

Figure 2. Cost of gain (Experiment 2). Calculations based on ingredient prices shown in Table 5.

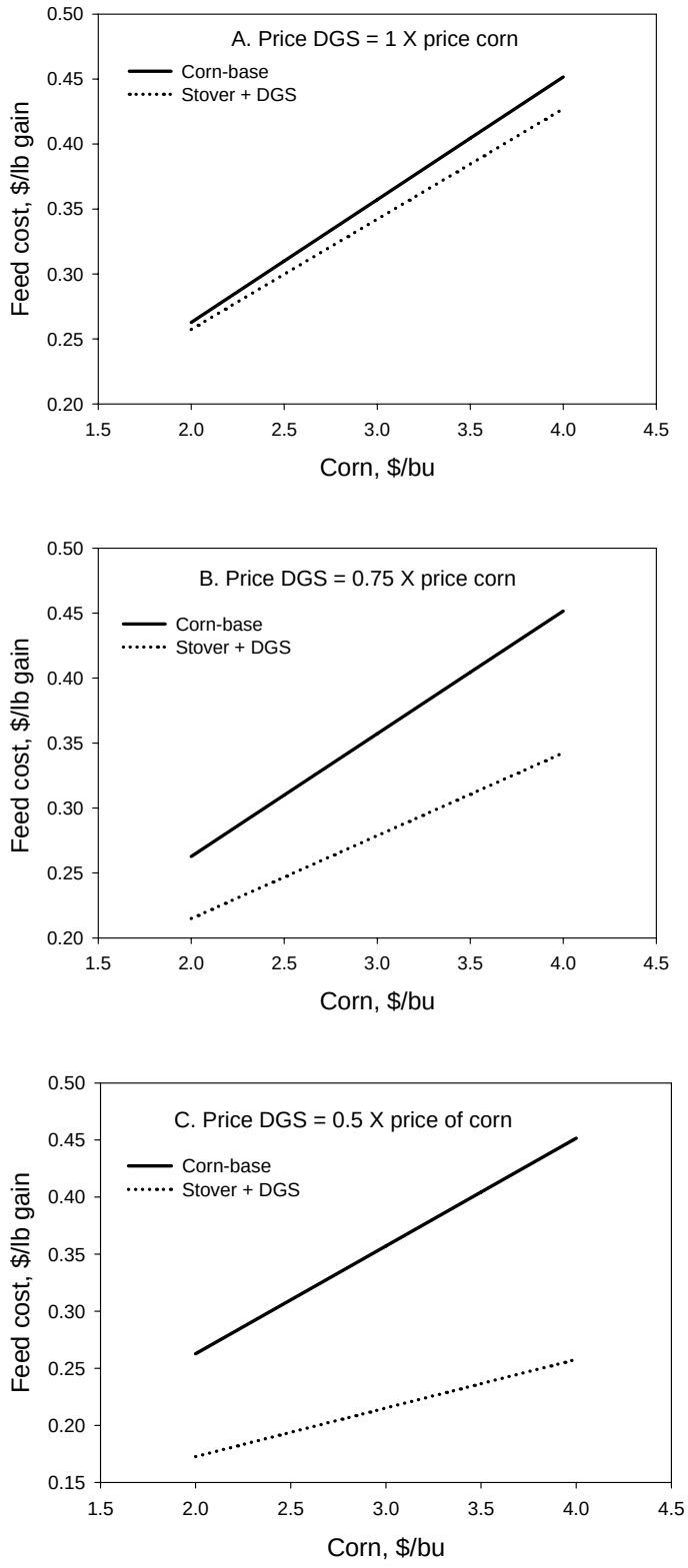

Figure 3. Comparison of net income from feeding growing steers diets containing corn silage, ground hay supplemented with corn and wet distillers grains or ground hay supplemented with wet distillers grains. Net income based on purchase price of $1.20/lb for feeder cattle, $0.30 per day for non feed costs, feed costs shown in Table 5 and feeder value of $0.95/lb at the end of the study.

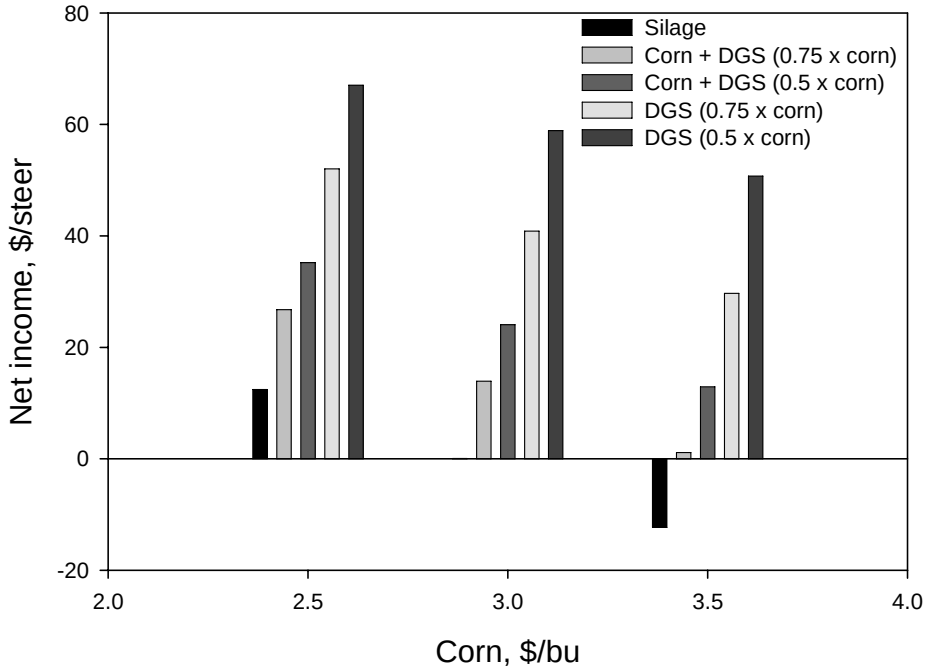

Figure 4. Comparison of net income from feeding growing and finishing steers fed a corn-based diet or ground corn stover supplemented with wet distillers grains. Net income based on purchase price of $1.15/lb for feeder cattle, $0.30 per day for non feed costs, feed costs shown in Table 6 and carcass value shown in Table 4.