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Substitution of modified distillers grains with soybean meal with or without hulls had negligible effects on growth performance, efficiency, and carcass traits in yearling steers.

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Rationale and Approach

Traditionally, corn dry-milling co-products are used as a standard feed ingredient in American feedlots for at least 20 years, whereas oilseed meals are rarely used. However, recent increases in the demand for biodiesel may result in changes to long-held supplemental protein price relationships in the United States, influencing protein source decisions of feedyard operators. The objective of this research was to examine the effects of soybean meal (SBM) with or without additional soybean hulls (SBH) in replacement of modified corn distillers grains plus solubles (MDGS) on growth performance, efficiency of dietary net energy utilization, and carcass trait responses in finishing beef steers.

Steers (n = 240) were allotted to one of 24 pens (n = 10 steers per pen; 8 pens per treatment) and assigned to one of three treatments: MDGS fed at 15% diet DM (MDGS) replaced by either soybean meal and corn (9 and 6% of DM, respectively; SBM), or soybean meal and soyhull pellets (9 and 6% of DM, respectively; SBM-SBH). Dietary concentrations of crude protein and neutral detergent fiber based on tabular values and weekly batching records were 12.3 and 17.6%, 12.8 and 14.5%, and 12.8 and 17.8% for MDGS, SBM, and SBM-SBH, respectively (Table 1).

Findings

Growth performance and carcass trait data are in Table 2. In the first 21 d the soybean meal showed advantages over MDGS. Day 21 BW was greater (P = 0.01) in the SBM and SBM-SBH compared to MDGS, reflected by 41 and 38 % greater ADG (P = 0.01) observed in the SBM and SBM-SBH treatments, respectively. Soybean meal also increased DMI (P = 0.01) and improved feed efficiency (P = 0.01) compared to MDGS. However, differences between MDGS and SBM were reversed between d 21 and d 49, with MDGS increasing ADG (P = 0.03) and gain to feed ratio (G:F; P = 0.01) during this period.

Cumulatively, there were no differences amongst treatments for carcass-adjusted final BW, DMI, ADG, or feed efficiency ($P \geq 0.11$). Dietary treatment had no effect on hot carcass weight, dressing percentage, ribeye area rib fat marbling score, USDA Yield Grade, percent empty body fat (EBF), or final body weight adjusted to 28% EBF ($P \geq 0.11$). Also, distribution of USDA Quality or Yield grades were unaffected by treatment and dietary treatment did not affect liver abscess incidence and severity ($P \geq 0.11$).

Implications

Feeding supplemental protein sources with enhanced diet conditioning attributed and greater concentrations of ruminally undegradable protein sources (MDGS) provided no advantage to cattle performance. Therefore, protein source decisions can be based upon price per delivered crude protein and impact on diet costs.

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Table 1. Diet Composition (DM basis)[a].

	Treatment[b]		
Item	**MDGS**	**SBM**	**SBM-SBH**
Ingredient Composition, %			
Dry-rolled Corn	69.78	75.17	69.48
MDGS	14.74	0	0
Soybean Meal	0	9.26	8.97
Soybean Hull Pellets	0	0	5.91
Roughage[c]	11.48	11.58	11.62
Liquid Supplement[d]	4.02	3.99	4.01
Nutrient Composition[e]			
Dry Matter, %	65.41	72.24	72.17
Crude Protein, %	12.23	12.45	12.68
Neutral Detergent Fiber, %	16.62	13.59	16.75
Fat, %	4.67	4.05	4.01
Nem[f], Mcal/cwt	93.03	92.56	90.76
NEg[g], Mcal/cwt	62.99	62.57	61.00

[a]All values except dry matter are on a DM basis.
[b]MDGS – modified distillers grains as CP source; SBM- soybean meal and corn replacing MDGS; SBM-SBH – soybean meal and soyhulls replacing MDGS
[c]Roughage source was ryelage from d 1 to 44, corn silage from d 45 to 105, & sorghum silage from d 106 to 118
[d]Liquid supplement contained (DM basis): 27.0% CP, 20.154% non-protein nitrogen, 38.765 Mcal/cwt of NEm, 26.265 Mcal/cwt of NEg, 0.316% ether extract, 20.273% total sugars, 58.823% ash, 16.923% calcium, 0.40% P, 1.538% K, 0.255% Mg, 7.935% NaCl, 3.415% Na, 0.493% S, 4.615 ppm Co, 250.00 ppm Cu, 40.0 ppm I, 50.0 ppm EDDI, 243.067 ppm Fe, 500.00 ppm Mn, 4.00 ppm Se, 2,253.846 ppm Zn, 36,000.00 IU/lb Vitamin A, 250.00 IU/lb Vitamin E, and 750.769 g/ton monensin sodium
[e]Tabular net energy from Preston (2016) and tabular nutrient compositions from NASEM (2016)
[f]Net energy for maintenance
[g]Net energy for gain

Table 2. Influence of dietary treatment on growth performance and carcass trait responses (deads and removals excluded).

	Treatments[a]				*P*-value		
Item	MDGS (1)	SBM (2)	SBM-SBH (3)	SEM	Overall	SBM effect (1 vs 2,3)	Starch effect (2 vs 3)
Steers, n	79	79	80				
Pens, n	8	8	8				
Initial BW[b], lbs	963	956	957				
d 1 to 21							
d 21 BW[b], lbs	1038	1082	1077	4.4	0.01	0.01	0.01
ADG, lbs	3.57	5.96	5.73	0.206	0.01	0.01	0.01
DMI, lbs	22.15	24.22	23.34	0.148	0.01	0.01	0.01
G:F	0.161	0.246	0.245	0.0080	0.01	0.01	0.01
F:G[c]	6.39	4.10	4.10				
d 22 to 49							
d 49 BW[b], lbs	1202	1224	1220	5.2	0.02	0.01	0.05
ADG, lbs	5.84	5.10	5.11	0.199	0.03	0.01	0.15
DMI, lbs	27.24	27.21	27.69	0.220	0.26	0.46	0.36
G:F	0.214	0.187	0.185	0.007	0.01	0.01	0.16
F:G[c]	4.72	5.44	5.44				
d 50 to d 77							
d 77 BW[b], lbs	1365	1393	1384	8.9	0.12	0.06	0.12
ADG, lbs	5.87	6.03	5.86	0.254	0.87	0.80	0.60
DMI, lbs	31.31	31.73	32.15	0.365	0.30	0.18	0.99
G:F	0.190	0.190	0.182	0.0068	0.71	0.88	0.53
F:G[c]	5.26	5.26	5.49				
d 78 to d 118							
d 118 BW[b], lbs	1521	1533	1515	8.3	0.33	0.80	0.17
ADG, lbs	3.79	3.41	3.18	0.188	0.11	0.05	0.74
DMI, lbs	32.35	31.76	31.45	0.383	0.27	0.13	0.76
G:F	0.117	0.108	0.101	0.0054	0.15	0.07	0.80
F:G[c]	8.55	9.26	9.90				
Cumulative (live-basis)							
ADG, lbs	4.73	4.89	4.73	0.070	0.22	0.37	0.09
DMI, lbs	29.08	29.33	29.28	0.212	0.68	0.39	0.57
G:F	0.117	0.108	0.101	0.0054	0.15	0.54	0.07
F:G[c]	6.13	5.99	6.17				
Cumulative (HCW/0.625)							
Final BW[d], lbs	1508	1497	1481	8.5	0.11	0.09	0.81
ADG, lbs	4.61	4.58	4.44	0.071	0.22	0.25	0.56
DMI, lbs	29.08	29.33	29.28	0.212	0.68	0.39	0.57
G:F	0.159	0.156	0.152	0.0023	0.13	0.11	0.73
F:G[c]	6.29	6.41	6.58				

Item	Treatments[a] MDGS (1)	SBM (2)	SBM-SBH (3)	SEM	*P*-value Overall	SBM effect (1 vs 2,3)	Starch effect (2 vs 3)
Carcass Trait Responses							
Hot carcass wt., lbs	942	936	926	5.3	0.11	0.09	0.81
Dressing percentage[e]	61.96	61.14	61.23	0.291	0.13	0.05	0.22
Ribfat, in	0.61	0.62	0.62	0.016	0.90	0.69	0.99
Ribeye area, in sq.	13.95	13.70	13.66	0.110	0.17	0.07	0.42
Marbling[f]	535	549	531	10.9	0.51	0.74	0.27
Calculated YG	3.65	6.72	6.69	0.062	0.74	0.47	0.57
Quality Grade Distribution, %							
Select	6.4	3.9	8.8		0.70		
Low Choice	26.9	26.0	28.8				
Average Choice	42.3	42.9	40.0				
High Choice	18.0	23.4	18.8				
Prime	6.4	3.9	3.8				
Yield Grade Distribution, %							
1	1.3	1.3	0.0		0.70		
2	24.4	15.2	18.3				
3	52.6	62.0	53.7				
4	21.8	20.3	26.8				
5	0.0	1.3	1.2				
Liver Abscess Prevalence, %[g]							
Normal	76.9	73.4	64.6		0.11		
A-	11.5	13.9	11.0				
A	5.1	1.3	6.1				
A+	6.4	11.4	18.3				

[a]MDGS – modified distillers grains as CP source; SBM- soybean meal and corn replacing MDGS; SBM-SBH – soybean meal and soyhulls replacing MDGS
[b]A 4% pencil shrink was applied to BW measures to account for gastrointestinal tract fill.
[c] Calculated as: 1/G:F
[d] Determined from carcass-adjusted growth performance.
[e] Calculated as: (HCW/Final BW shrunk 4%) × 100.
[f]Small[00] = 400
[g]Elanco scoring system: Normal (no abscesses), A- (1 or 2 small abscesses), A (2 to 4 small abscesses), A+ (1 or more abscesses greater than 1 inch in diameter)