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Light-Test Weight Corn for Growing and Finishing Steers[1]

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Abstract

Light-test weight corn (59.2 to 61.5 kg/hL; 46 to 48 lb/bu) was compared to normal corn (72 kg/hL; 56 lb/bu) in growing and finishing diets for large-frame crossbred steer calves in 2 consecutive yr. The source of the calves was the same each year as was the diet composition. Growing diet dry matter included 32.9% corn silage, 22.3% alfalfa haylage, 37% dry rolled corn, and 7.8% protein supplement. Finishing diet dry matter included 9.2% corn silage, 86.2% dry rolled corn, and 4.6% protein supplement. Rumensin was included in both diets and steers were implanted with Synovex S® at the start of the growing and finishing periods. Using pens of 11 or 12 steers, there were six pens in yr 1 and four pens in yr 2 on each treatment. Growing periods for the 2 yr were 71 and 105 d followed by finishing periods of 182 and 135 d, respectively. Daily gains and feed efficiencies were similar for normal and light-test weights during the growing and finishing periods over both years. Corn protein and moisture averages were slightly higher for the light-test weight corn. Carcass measurements were similar. In these growing-finishing trials with steers, the results did not show any reason for decreasing the net energy values for the light-test weight corn in this study from those assumed for normal corn.

(Key Words: Corn, Light-Test Weight, Steers.)

Introduction

The standard test weight for USDA No. 2 corn in the U.S. is 69.6 kg/hL (54 lb/bu). When a crop growing season is shortened due to late planting or early frost, the test weight may fall substantially below the standard. Most grain dealers and beef feedlot operators will discount the corn price by increments as test weights fall below the standard, suggesting that feed value is less. However, there have been several trials involving corn or grain sorghum with cattle, sheep, hogs, or poultry in which feed value has been similar or only slightly reduced for lower test weight grain (1, 2, 3, 4, 5, 6, 7, 8).

Hicks (4) discussed digestion trials with lambs fed corn differing in test weight due to maturity at harvest. Ears were hand harvested at early milk, early dough, mid-dent, and mature stages, then dried and shelled before determining test weights. Observed TDN values for corn test weights of 64.4 kg/hL (50 lb/bu) and 59.3 kg/hL (46 lb/bu) were 98.7 and 97.4%, respectively, of that for 69.6 kg/hL (54 lb/bu).

Grain sorghum at 45.1, 58.0, or 70.9 kg/hL was fed for 124 d to finishing steers (3). When this grain was dry rolled, there was little difference in gain and no improvement in feed efficiency as test weight increased. When the same grain was steam flaked, there was a decrease in dry matter intake with the heaviest test weight without a decrease in gain, resulting in an improvement in feed efficiency.

Birkelo et al. (2) conducted a metabolism trial with steers averaging 327 kg when they were fed 77.7% whole corn testing 69.3 or 52.6 kg/hL (54 or 41 lb/bu). Diet net energies for maintenance and gain were 15% greater for the light-test weight corn due to greater fecal energy loss and lower digestibility for the normal corn. The authors concluded that low-test weight corn is not inherently lower in net energy than normal corn. This is consistent with the findings of University of Minnesota

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researchers (9), who measured gross energy in three lots of dried shelled corn of unknown maturity with test weights of 45.3, 59.3, and 74.4 kg/hL (35, 46, and 58 lb/bu) and in corn hand harvested at 17, 28, 42, and 78 d post-silking with test weights of 45.1, 60.6, 70.9, and 74.7 kg/hL (35, 47, 55, and 58 lb/bu). There was very little difference in gross energies among the test weights compared in either trial.

Johnson (5) discussed feeding trials with swine fed corn varying in test weight. Growing-finishing pigs were fed high-test weight corn (73.5 kg/hL) and low-test weight corn that ranged from 61.2 to 63.8 kg/hL. There were no statistically significant differences in daily gain, feed intake, or feed efficiency for the various corn test weights. Other trials involving different test weights of corn for pigs have not shown reductions in performance that could be attributed to test weight (6, 7, 8).

Baidoo et al. (1) used 4-wk-old male broilers and adult White Leghorn cocks to assay metabolizable energy in corn with test weights in kg/hL (lb/bu) of 72 (55.9), 7l (55.1), 68 (52.8), 62 (48.1), and 60 (46.6), respectively. The authors concluded that a 4% variation in metabolizable energy relative to a 20% variation in test weight precludes the use of test weight for estimating metabolizable energy in corn for poultry.

Opportunities are infrequent for testing the feeding value of lower test weight corn for growing-finishing cattle. Corn harvested in the Nebraska Panhandle in 1992 and 1993 often had lower test weights than normal, and feeding trials were designed to compare normal and lower test weights during a growing phase for steer calves fed moderate levels of grain, and during a subsequent finishing phase with high levels of grain.

Materials and Methods

Light-test weight corn was evaluated in growing and finishing diets for crossbred, large-frame steer calves in two consecutive years when the growing season ended for some varieties with later planting dates before the grain was mature. Test weight comparisons were 72.7 to 61.5 kg/hL (56.4 to 47.7 lb/bu) and 72.1 to 59.2 kg/hL (56 to 46 lb/bu) in yr 1 and 2, respectively. Test weights were determined by a Dickey-John Grain Analysis Computer II and by standard calibrated weighing cups. The light-test weight corn was purchased from a single source the 1st yr and from two sources the 2nd yr. Control corn (normal test weight) was produced at the Panhandle Research and Extension Center.

The source of the calves in both years was the University of Nebraska Gudmundsen Sandhills Laboratory,

TABLE 1. Corn comparisons for 2 yr of feeding trials with light-test weight corn.

Corn test weight	Normal	Light
Year 1		
Corn test wt, kg/hL (lb/bu)	72.7 (56.4)	61.5 (47.7)
Corn moisture, %	11.7	13.4
Corn DM protein, %	9.8	10.2
Year 2		
Corn test wt, kg/hL (lb/bu)	72.1 (56.0)	59.2 (46.0)
Corn moisture, %	14.3	15.4
Corn DM protein, %	8.6	9.9

TABLE 2. Two years of performance data for light-test weight corn fed to growing steers.

Corn test weight	Normal	Light	SEM
Year 1, 71 d			
No. of steers	73	72	
No. of pens	6	6	
Initial wt, kg (lb)	271 (598)	271 (597)	
Daily gain, kg (lb)	1.13 (2.49)	1.14 (2.51)	0.023 (0.05)
Feed DM/d, kg (lb)	7.5 (16.5)	7.6 (16.8)	0.113 (0.25)
Feed:gain	6.65	6.70	0.14 (0.14)
Year 2, 105 d			
No. of steers	45	44	
No. of pens	4	4	
Initial wt, kg (lb)	279 (614)	287 (632)	
Daily gain, kg (lb)	1.09 (2.39)	1.13 (2.49)	0.025 (0.056)
Feed DM/d, kg (lb)	7.8 (17.2)	8.1 (17.8)	0.127 (0.28)
Feed:gain	7.16	7.12	0.16 (0.16)
Combined data, 2 yr			
No. of steers	118	116	
No. of pens	10	10	
Initial wt, kg (lb)	274 (604)	277 (610)	
Daily gain, kg (lb)	1.12 (2.46)	1.14 (2.51)	0.025 (0.055)
Feed DM/d, kg (lb)	7.6 (16.8)	7.8 (17.2)	0.122 (0.27)
Feed:gain	6.85	6.86	0.15 (0.15)

TABLE 3. Two years of performance data for light-test weight corn fed to finishing steers.

Corn test weight	Normal	Light	SEM
Year 1, 182 d			
No. of steers	73	71	
No. of pens	6	6	
Final wt, kg (lb)	575 (1267)	584 (1287)	
Daily gain, kg (lb)	1.23[a] (2.71)	1.28[b] (2.83)	0.017 (0.038)
Feed DM/d, kg (lb)	8.5 (18.7)	8.3 (18.3)	0.109 (0.24)
Feed:gain	6.92	6.47	0.13 (0.13)
Year 2, 135 d			
No. of steers	44	43	
No. of pens	4	4	
Final wt, kg (lb)	606 (1337)	626 (1381)	
Daily gain, kg (lb)	1.59 (3.50)	1.64 (3.61)	0.022 (0.048)
Feed DM/d, kg (lb)	10.7 (23.5)	10.3 (22.7)	0.132 (0.29)
Feed:gain	6.65	6.32	0.16 (0.16)
Combined data, 2 yr			
No. of steers	117	114	
No. of pens	10	10	
Final wt, kg (lb)	587[c] (1294)	601[d] (1324)	
Daily gain, kg (lb)	1.42 (3.12)	1.46 (3.22)	0.02 (0.043)
Feed DM/d, kg (lb)	9.6 (21.1)	9.3 (20.5)	0.118 (0.26)
Feed:gain	6.79	6.40	0.15 (0.15)

[a,b]Means differ ($P<0.05$).
[c,d]Means differ ($P<0.01$).

so the genetics and prior handling of the calves were nearly identical for both years. Using 11 or 12 steers per pen, there were six pens in yr 1 and four pens in yr 2 on each treatment. Each year the trial was split into growing and finishing phases of 71 and 182 d in yr 1, and 105 and 135 d in yr 2, respectively.

The growing diet dry matter fed in both years consisted of 32.9% corn silage, 22.3% alfalfa haylage, 37.0% dry rolled corn, and 7.8% of a supplement that included protein, Rumensin, minerals, and vitamins. Final finishing diet dry matter in both years included 9.2% corn silage, 86.2% dry rolled corn, and 4.6% of a supplement that supplied 58% crude protein, 32 g of Rumensin per metric ton (29 g/ton) of diet dry matter, minerals, and vitamins. The corn was coarsely processed through a roller mill and the rolls were set with the same spacing for both test weights of corn. The roller adjustment was such that approximately 90% of the light-test weight corn was broken at least once.

Control diets on a dry matter basis were calculated to contain 14.8% crude protein and 1.10 Mcal/kg NEg (0.50 Mcal/lb) in the growing diet and 11.4% crude protein and 1.45 Mcal/kg NEg (0.66 Mcal/lb) in the finishing diet. The calculations assumed 9.0% crude protein in the corn (dry matter basis). Actual chemical analyses of the corn for both test weights in each year are shown in Table 1. The corn generally contained higher levels of protein than initially assumed, except for a lower than average value for normal corn in yr 2. The crude protein analyses of the finishing diets were generally around 12%, except for 11% in the normal corn diet in yr 2.

All steers were implanted with Synovex S® at the start of the growing and the finishing periods.

Carcass measurements were taken at slaughter and final live weights were calculated by dividing hot carcass weights by a common dressing percentage (62). Using pen as the experimental unit, and statistical procedures described in SAS® GLM (10), performance data were analyzed for each year and then for combined years.

Results and Discussion

In the two growing trials of 71 and 105 d, there were no significant differences in daily gain, dry matter feed intake, or feed required per unit of gain in large-frame steer calves fed normal or light-test weight corn (Table 2). Thus combining the data for the two years resulted in 10 pens on each corn with similar performances during the growing phase, feeding a diet that contained 37% dry rolled corn.

In the finishing trials following the growing trials, daily gains were significantly improved ($P<0.05$) with the light-test weight corn in yr 1, but not in yr 2 and not in the combined data for the 2 yr (Table 3). Treatment means for feed dry matter intake and feed required per unit of gain were not significantly different for yr 1 or 2 or for the combined data.

Whereas the crude protein analysis of the normal corn in yr 2 was lower than that for the light-test weight corn, there was little difference in protein levels in yr 1, when cattle performance comparisons for corn test weights were similar to those in yr 2. Light-test weight corn can have a higher crude protein analysis than normal corn, but it is not always higher. Therefore before formulating diets containing it, light-test weight corn should be analyzed for crude protein.

Carcass comparisons are shown in Table 4. Hot carcass weight was significantly greater ($P<0.05$) for the light-test weight corn in the combined data. The other measurements

TABLE 4. Two years of carcass data for light-test weight corn fed to growing and finishing steers.

Corn test weight	Normal	Light	SEM
Year 1, total 253 d			
Hot carcass wt, kg	356	362	
Dressing percentage	64.0	64.2	0.001
Fat thickness, cm	1.05[a]	1.15[b]	0.026
Marbling score[c]	6.09	6.01	0.098
Rib eye area, cm^2	78.1	78.7	0.587
Yield grade	3.16[d]	3.20[e]	0.044
Year 2, total 240 d			
Hot carcass wt, kg	376	388	
Dressing percentage	62.7	63.0	0.001
Fat thickness, cm	1.13[d]	1.03[e]	0.033
Marbling score[c]	5.89	5.88	0.126
Rib eye area, cm^2	90.3	96.1	0.755
Yield grade	2.77	2.48	0.057
Combined data, 2 yr			
Hot carcass wt , kg	364[d]	372[e]	2.27
Dressing percentage	63.5	63.7	0.001
Fat thickness, cm	1.08	1.10	0.028
Marbling score[c]	6.01	5.96	0.11
Yield grade	2.95	2.92	0.50
Rib eye area, cm^2/100 kg hcw	22.7	23.0	

[a,b]Means differ ($P<0.05$).

[c]Marbling scores: Small = 5.0 to 5.9, Modest = 6.0 to 6.9.

[d,e]Means differ ($P<0.1$).

in the combined data were similar, including rib eye area when expressed per unit of hot carcass weight.

Data from these trials indicate that when test weight of corn is at least 59 kg/hl (46 lb/bu), the associated feeding value is not inferior to that for normal U.S. No. 2 corn for beef cattle. This is in agreement with several other U.S. trials with light-test weight corn or grain sorghum fed to growing-finishing cattle (2, 3, 4) and is consistent with results from several trials using pigs or poultry to evaluate feed value of light-test weight corn (1, 5, 6, 7, 8) and with estimates of energy contents for corn with varying test weights (2, 9).

Implications

Corn test weights should have little effect on cattle performance, as evidenced in the two growing-finishing trials reported here or in several other trials reported with cattle, sheep, swine or poultry. Apparently animal utilization of corn usually results in similar net energy per unit of corn weight over a considerable range in test weight. Beef operations can expect normal or near normal feed value for corn when test weight declines up to 20% or more from the standard for USDA No. 2 corn of 69.6 kg/hl (54 lb/bu).

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