HIGH MOISTURE EAR CORN FOR FEEDLOT STEERS

M.T. Van Koevering[1], W. J. Hill[2], F.N. Owens[3], D.R. Gill[3], C.A. Strasia[4] and J. J. Martin[5]

Story in Brief

High moisture ground shell corn (GS), high moisture ground ear corn (GE) and high moisture rolled shelled corn (RS) were fed to feedlot steers to evaluate effects on performance and carcass characteristics. Eighty-four steers (345 kg) were divided into three groups and fed each diet for 123 days. Final live weight (carcass adjusted) and daily gains (carcass adjusted basis) tended to be greater with RS than GE. Dry matter intakes for steers receiving GE and RS were 9.5 and 6.0% higher, respectively, than for steers receiving GS. Dry matter intakes of the corn grain portion of the diet by steers receiving the GE was 14.1 and 20.8% lower than steers receiving GS and RS, respectively, due to the presence of the cob in GE at approximately 20% of diet dry matter. Efficiency of feed conversion was 13.2 and 10.3% greater for steers receiving GS and RS than steers fed GE. However, gain per unit of corn was 7.5% greater with GE diets than GS and 10.8% greater for GE than RS. Calculated net energy for gain was 14.3 and 11.0% greater for GS and RS than GE. Carcass weight, similar to final live weight, tended to be greater for steers fed RS than for steers fed GE. Dressing percentage and KPH were the lowest for steers fed GE. No other carcass traits were affected by dietary treatments. Per acre harvested, GE produced 7.5% more beef than GS due to the increased amount of dry matter harvested. The calculated net energy for gain value of the corn plus cob (1.37 Mcal/kg) was 12.7% lower than for the corn grain (1.62 Mcal/kg). This means that on a weight basis, the cob has only about 23% as much net energy for gain as does grain.

(Key Words: Feedlot Steers, High Moisture Grain, Ear Corn.)

Introduction

Corn can be harvested in various high moisture forms (corn silage, ear corn silage, high moisture shell grain) and dry forms (ear corn, shelled corn) and processed by various methods (rolled, ground, flaked). Many feedlots in the Great Plains ensile rolled or shelled corn grain for feeding feedlot steers.

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[1]Research Associate [2]Graduate Assistant [3]Regents Professor [4]Area Extension Specialist, Guymon OK [5]Dean of Agriculture, Panhandle State University.

To maximize energy density of the product, grain is ideal, but leaving the cob, husk and stalk plus leaves in the field reduces total yield of digestible dry matter. Harvest of the cob plus grain will increase dry matter yield about 20%, but specialty equipment often is considered necessary and the feeding value of high moisture ear corn is not clear, ranging from 85 to 105% that of high moisture corn grain.

Compared with tub grinding corn grain, rolling typically results in larger, more uniform particle size and thereby reduces the incidence of metabolic disorders and feedlot death losses. However, feed efficiency typically is poorer for rolled than ground dry corn and probably for high moisture corn as well.

Materials and Methods

Animals and Diets. Eighty four crossbred steers (345 kg) were selected from a larger group based on uniformity in size, weight and breed-type, leaving steers of primarily British x Continental breed-type. Upon arrival at Panhandle State University in Goodwell, OK, steers were individually weighed, identified, and blocked into four weight groups based on initial weight. Steers then were processed routinely and implanted with a combination implant containing 120 mg trenbolone acetate and 24 mg estradiol (Revalor®-S, Hoechst-Roussel Agri Vet Company, Somerville, NJ). Steers (n = 21) from each weight group were randomly assigned to pens (7 steers/pen) with four pens per treatment. Treatments consisted of either high moisture ground shelled corn (GS), high moisture ground ear corn (GE) or high moisture rolled shelled corn (RS).

Steers had ad libitum access to their high concentrate diets for the 123-day feeding period. Chopped alfalfa, used as a roughage source, was removed stepwise from the diet to adapt cattle to their final diet. Diet compositions and analyses are shown in Table 1. Steers were receiving their final diet by day 23 of the study.

Cattle were initially weighed directly off the truck; these initial weights were used for allocation. Weight gain and feed efficiency were calculated based on this initial (shrunk) weight and final live weights which were calculated as hot carcass weight divided by.62% (standard dressing percentage). Net energy values were calculated for each treatment using the equations for yearling steers as reported by Hays et al. (1986).

Carcass Data Collection. Cattle were trucked to Dodge City, KS for slaughter. At slaughter, livers were examined for the presence and severity of abscesses. Carcass data for all slaughter groups were obtained approximately 48 hours postmortem and yield and quality grades were determined.

Grain Harvesting, Processing and Ensiling. All grain was harvested using a commercially available John Deere combine in a 2-day period from a single field when the dry matter on three consecutive days tested at approximately 70%. Combine settings for GS and RS were similar to those used

Table 1. Composition of diets (dry matter basis).

	Diet sequence				
Ingredient	1	2	3	4	Final
			(%)		
Corn, source	44.50	54.50	64.50	74.50	85.50
Alfalfa hay, pelleted	50.00	40.00	30.00	20.00	9.00
Pelleted supplement[a]	5.50	5.50	5.50	5.50	5.50

Calculated composition:

	Final diet
Nutrients	DM %
Dry matter, %	100.00
NEm, Mcal/kg	96.34
NEg, Mcal/kg	61.80
Crude protein, %	11.80
K, %	.69
Ca, %	.51
P, %	.33

commercially. The GE was harvested by decreasing the concave setting, so that the cob was crushed as it was harvested. All the sieves were removed from the rear of the combine, except the one directly below the concave auger, and the fan speed was increased to remove the husk and trash. This system of harvesting high moisture ear corn with a commercially available combine worked extremely well, and would allow GE to be harvested without investing in specialized equipment. Immediately following the harvest of each treatment, the corn was trucked to a commercial feedlot where it was either ground through a large tub grinder or rolled through a commercial roller mill. The processed corns were ensiled into three separate large (2.4 m diameter) plastic sealed feed storage bags (Ag-Bags®, Blair NE). Corn from all treatments was allowed to ferment for approximately 60 d following ensiling prior to initiation of the feeding trial. Samples from each treatment were obtained on a weekly basis for analysis of fermentation end products (VFA, ethanol, lactate and ammonia), nitrogen profile (total N and its components: pepsin insoluble N, total soluble N and soluble NPN), and in situ digestion.

Data Analysis. Data were analyzed on a pen basis using least squares analysis with a linear model that included effects of treatment (df = 2), and steer weight block (df = 3) with the treatment by weight block interaction serving as the error term. Orthogonal contrasts were used to compare dietary treatments. Least squares means were calculated and are reported.

Results and Discussion

Steer Performance. Results are presented Tables 2 and 3. Final live weight and daily gains on a carcass adjusted basis both tended ($P < .11$ and $P < .13$, respectively) to be greater for steers fed RS than for steers fed GE. However, differences were smaller when expressed on a live weight basis. This is due to greater gut fill and lower dressing percentage for steers fed GE diet.

Dry matter intake for steers receiving GS was 9.6 and 6.0% lower ($P < .01$) than for steers receiving GE and RS, respectively. Increased DMI with GE may be due to its lower energy content due to presence of the cob. The increased particle size of RS than GS presumably lowered digestibility and this could explain the higher DMI of RS than GS. Differences between DMI remained quite consistent throughout the entire feeding period. No problems in diet adaptation were apparent.

Dry matter intake of the corn grain portion of the diet by steers receiving the GE was 14.1 and 20.8% lower ($P < .01$) than for steers receiving GS and RS, respectively, due to the presence of the cob at approximately 20% of diet DM. This means that steers fed GE diets had 7.5% greater ($P < .09$) and 10.8% greater ($P < .03$) gains per unit of corn grain than steers fed GS or RS, respectively. This increase in weight gain per unit of corn harvested for GE is equivalent to an increase in beef production per acre of 7.5 to 10.8% over GS and RS, respectively.

Efficiency of feed conversion was 13.2 and 10.3% greater for steers receiving GS and RS than for steers fed GE. Although steers fed RS diets consumed more feed than steers fed GS, the increase in weight gain with RS was great enough to compensate for any difference in feed efficiency. Calculated net energy for gain of the diet was 14.4 and 11.0% greater ($P < .04$) for steers fed GS and RS diets as compared to those fed GE. Net energy for gain values for high moisture corn grain DM in the GS diet, calculated according to the NRC (1984), was 1.62 Mcal/kg. The corn plus cob in the GE diet provided 1.37 Mcal/kg, being 12.7% less than for the high moisture grain. If the ear corn is 20% cob and net energy is 12.7% lower, then the net energy of the cob alone calculates to be .37 Mcal/kg ((1.37-1.62*.8)/.2). This means that the net energy value of the cob is only 23% that of the grain alone. If net energy values had been calculated on a live weight rather than a carcass weight basis, the cob would have greater value because dressing percentage tended to be lower for steers fed GE.

For every 100 kg DM harvested from GE, yield for GS would be 80 kg due to absence of cob (56 versus 72 pounds per bushel). Multiplied by NE values, this means that for every 137 Mcal GE harvested, NE yield for GS was 130 Mcal. Harvest and storage of the cob with the grain, although adding 20% to the weight, added only about 5.4% to the NE. If the cob were used to substitute for roughage of the diet, the monetary value of the cob should be

Table 2. Effects of high moisture corn on performance of feedlot steers[a].

	Ground shell (1)	Ground ear (2)	Rolled shell (3)	SEM	Comparisons 1 vs 2	2 vs 3	1 vs 3
No. of pens	4	4	4				
No. of steers	28	28	27				
Initial wt, lb	761	760	761	.69	.41	.15	.46
Final live wt, lb	1178	1167	1183	14.9	.62	.46	.80
Final carcass adj. wt, lb[b]	1212	1190	1224	13.2	.28	.11	.53
Daily gains, lb							
0 to 57	3.37	3.37	3.56	.18	.98	.47	.49
58 to 113	4.01	3.84	3.91	.13	.40	.76	.57
Live 0 to 113	3.69	3.60	3.73	.13	.65	.50	.83
Carcass 0 to 123	3.67	3.49	3.76	.11	.29	.13	.56
DMI lb/day							
0 to 57	20.55	22.33	21.91	.32	.01	.38	.02
58 to 113	23.37	25.75	24.97	.40	.01	.21	.03
Live 0 to 113	21.95	24.03	23.42	.33	.01	.25	.02
Carcass 0 to 123	21.84	23.93	23.14	.32	.01	.14	.03
Corn intake	18.67	16.37	19.78	.26	.01	.01	.02

[a] Least squares means; SEM n = 4.

[b] Calculated as hot carcass weight/.62.

Table 3. **Effects of high moisture corn on performance of feedlot steers[a].**

	Ground shell(1)	Ground ear(2)	Rolled shell(3)	SEM	Comparisons 1 vs 2	2 vs 3	1 vs 3
Feed/gain							
0 to 57	6.14	6.74	6.24	.30	.20	.28	.81
58 to 113	5.84	6.71	6.40	.15	.01	.31	.05
Live 0 to 113	5.96	6.71	6.31	.20	.04	.22	.26
Carcass 0 to 123	5.97	6.88	6.17	.18	.01	.03	.46
Gain/feed							
Carcass 0 to 123	.168	.146	.163	.005	.02	.05	.45
Gain/corn	.197	.213	.190	.006	.09	.03	.48
Calc. energy in diet							
ME, Mcal/kg DM	3.19	2.90	3.12	.06	.02	.05	.44
NEm, Mcal/cwt DM	98.37	84.86	94.86	2.97	.02	.05	.43
NEg Mcal/cwt DM	64.52	56.40	62.59	1.66	.01	.04	.44

[a] Least squares means; SEM n = 4.

much greater than as a substitute for grain in the diet. All these values were calculated based on hot carcass weights.

Carcass Characteristics. Carcass weights, similar to final live weight, tended ($P < .11$) to be greater with the RS than the GE diet. Dressing percent and KPH being the lowest for steers fed GE, were greater ($P < .08$ and $P < .02$, respectively) for steers fed GS and RS. No other carcass traits were affected by dietary treatments.

Literature Cited

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