

EFFECT OF CORN DENSITY ON GROWING STEER INTAKE AND PERFORMANCE

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ABSTRACT

The objective of this study was to evaluate the effect of low corn density resulting from insufficient growing degree days on the intake and performance of growing steers. Increasing inclusion of low-density corn did not affect dry-matter intake (DMI), average daily gain (ADG) or dietary net energy gain NE_g , but the feed-to-gain ratio (F: G) was improved. Low-density corn is a suitable alternative to regular-density corn in a growing diet.

Introduction

Insufficient growing degree days are a major impediment to corn production in the northern Great Plains. Market price is based on U.S. No. 2 corn, which has a requirement of 54 lbs./bu (USDA, 1996). Corn that does not qualify for U.S. No. 2 grade may incur discounts. A study was conducted to evaluate the effect of reduced corn density in a finishing diet. Low-density corn is typically discounted in the marketplace and may be more economical for livestock production provided performance is not negatively impacted.

Early research in lambs indicated total digestible nutrients (TDN) and digestible energy (DE) decreased with decreasing corn density as low as 35 lbs./bu (Thornton, et al., 1969). Subsequent research indicated bushel weight had no effect on crude protein content of corn (Dale, 1994). A study in growing and finishing hogs reported corn with densities of 40 lbs./bu, 45 lbs./bu, 50 lbs./bu and 55 lbs./bu had no effect on ADG or the gain-to-feed ratio (G:F) (Johnson, 1995).

Little research has been conducted on low-density corn in cattle diets. However, Weichenthal, et al. (1998), conducted a growing study comparing corn that averaged 56.2 lbs./bu and 46.8 lbs./bu. In the growing study, DMI, ADG and G:F all were similar. Corn with a density less than 54 lbs./bu appears to be a suitable alternative to U.S. No. 2 corn. However, limited data exists in growing and finishing beef cattle, especially with regard to corn which is low density due to insufficient growing degree days.

Corn of three different densities was obtained from a local producer in fall 2004. Corn with a density of 54.5 lbs./bu and 39.1 lbs./bu were fed to 59 growing steers. Steers were housed at the Animal Nutrition and Physiology Center on the NDSU campus and individually fed using a Calan Broadbent feeding system (American Calan, Northwood, N.H.). Dry-matter intake and ADG were not affected by treatment. The F: G increased with increasing low-density corn inclusion. Dietary NE_g also increased with increasing low-density corn inclusion. We conclude that low-density corn is a suitable alternative for U.S. No. 2 corn in a growing diet.

Materials and Methods

Sixty crossbred and purebred beef steers were stratified by initial weight (633 ± 24 lbs.) and assigned randomly to one of four dietary treatments. The treatments consisted of low-density, 39.1 lbs./bu corn - 11.3% crude protein (CP), 26.7% neutral detergent fiber (NDF), 6.9% acid detergent fiber (ADF) - replacing 0%, 33%, 67% or 100% of high-

density corn (56.0 lbs./bu) in the diet. The diet dry matter (DM) was composed of dry-rolled corn (42%), corn silage (35%), mixed hay (15%), concentrated separator byproduct (5%) and supplement (3%) that provided 25 grams/ton Rumesin (DM basis). The diets were formulated to provide a minimum of 0.6% calcium (Ca) and 0.3% phosphorus (P), and provide 13% CP.

The steers were fed individually once daily, using a Calan Broadbent feeding system. The steers were trained to use the system for approximately 28 days prior to the beginning of the project. Body weight was measured for three consecutive days at the beginning and end of the study to compute an average and interim body weight (BW) was measured every 28 days. Individual feed offered was recorded daily and individual feed refusal was recorded weekly. Weekly feedstuff samples were collected to determine diet DM and analyze nutrient composition. Calves were implanted with Synovex S on day 0 and were fed for 96 days. Data were analyzed with the Mixed model of SAS with linear and quadratic contrasts of low-density level ($P \leq 0.05$). In addition, G:F was analyzed with PROC REG of SAS to determine the effect of low-density inclusion ($P \leq 0.05$).

Results

The effect of low-density corn inclusion on gain, DMI, gain efficiency and dietary net energy are presented in Table 1. Low-density corn inclusion did not affect final BW ($1,002 \pm 29$ lbs.; $P = 0.58$) and ADG (3.84 ± 0.13 lbs./day; $P = 0.49$). Daily DMI (22.16 ± 0.66 lbs./day; $P = 0.24$) was not different among treatments, nor was DMI as a percentage of average BW (2.73 ± 0.08 percent, $P = 0.12$). Increasing the level of low-density corn inclusion improved F:G ($P = 0.03$). Dietary NE_g also increased as the level of low-density corn increased in the diet ($P = 0.02$). This data agrees with that of Weichenthal, et al. (1998), where they found no effect of 47 lbs./bu corn on DMI, ADG or F:G, compared with 56 lbs./bu corn.

Table 1. Effect of low-density corn inclusion on gain, DMI, gain efficiency and net energy.

	LD 0 HD 100	LD 33 HD 67	LD 67 HD 33	LD 100 HD 0	SEM ^a	Lin <i>P-value</i>
Steers	15	14	15	15		
Final weight, lb	999	992	996	1021	29	0.58
ADG, lb/d	3.81	3.84	3.77	3.95	0.13	0.49
DMI, lb/d	22.95	22	21.85	21.85	0.66	0.24
DMI, % of BW	2.83	2.73	2.7	2.66	0.08	0.12
F:G	6.07	5.78	5.81	5.57	0.17	0.03
Dietary NE_g , Mcal/cwt	51.26	53.52	54	56.7	1.36	0.02

^a Standard error of the mean, n = 14.

No research is available to indicate the NE_g value of low-density corn in a growing ration. Previous research (Birkelo, et al., 1994) indicates low-density inclusion in finishing diets increases NE_g ; however, in a companion study (Larson, et al., 2006), we found decreasing corn density resulted in decreased NE_g in finishing diets.

Here we demonstrated the opposite effect in a growing ration. We hypothesize this may be due, in part, to less inhibition of ruminal fiber fermentation due to the decrease of starch content in the lighter test-weight corn. In a finishing diet, ruminal fiber fermentation likely is insufficient for fiber to provide energy for growth; however, in a 50% roughage growing ration, ruminal fiber fermentation provides a significant portion of dietary NE_g. Increasing starch in the rumen has a negative impact on fiber utilization; therefore, in a diet where fiber provides a major portion of NE_g, decreasing starch content could improve NE_g.

Implications

Corn production in the northern Great Plains is subject to cool growing seasons, which will result in a reduction of growing degree days and subsequent decrease in density and starch content of corn grown under these conditions. These data indicate increasing inclusion of low-density corn has no effect on DMI or ADG in a 50% concentrate diet. However, F:G and NE_g were improved with increasing low-density corn inclusion. Therefore, we can conclude that low-density corn is an excellent substitute for high-density corn in a growing diet for beef cattle.

Literature Cited

- Birkelo, C.P., R.H. Pritchard, M. Buhman, S. Grosch and C. Willms. 1994. Net energy of finishing diets containing light or normal test weight corn. South Dakota State Univ. Beef Rep. 94:2-5.
- Dale, N. 1994. Relationship between bushel weight, metabolizable energy, and protein content of corn from an adverse growing season. J. Appl. Poultry Res. 3:83-86.
- Johnson, L.J. 1995. Use of low-test-weight corn in swine diets and lysine/protein relationship in corn. Swine Hlth. Prod. 3:161-164.
- Larson, D., R. Duvall, M. Bauer and G. Lardy. 2006. Effect of corn density on finishing steer intake, performance, and carcass characteristics. Presented at Midwestern Section ASAS and Midwest Branch ADSA 2006 Meeting, Des Moines, Iowa. Abstract 132.
- Thornton, J.H., R.D. Goodrich and J.C. Meiske. 1969. Corn maturity. II. Digestibility of nutrients and energy value of corn grain of various maturities and test weights. J. Anim. Sci. 29:983-986.
- USDA. 1996. Subpart D – United States standards for corn. U.S. Department of Agriculture. Weichenthal, B.A., I.G. Rush and B.G. Van Pelt. 1998. Light-test weight corn for growing and finishing steers. Prof. Anim. Sci. 14:114-117.

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