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Corn Grown Under Drought-Stressed Conditions Does Not Have Lower Energy Content than Corn Grown in a Previous “Normal” Year

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Summary and Implications

Record-breaking heat and lack of rainfall during the 2012 growing season resulted in drought-stressed growing conditions. An experiment was conducted to investigate the impact of these conditions on nutrient composition and apparent total tract digestibilities (ATTD) of energy in corn, and determine if relationships exist between corn quality measurements, nutrient content, and digestibility of energy. Twenty-eight samples of corn from the 2012 crop, plus 2 samples of corn from the 2011 crop to serve as a positive control, were collected across the Midwest using yield as an initial screen for drought impact. Each sample was graded by an official U.S. grain inspection agency and analyzed for ether extract and crude protein content. Diets were formulated using each of the 30 corn samples plus vitamins, minerals, and 0.4% titanium dioxide as an indigestible marker. Sixty individually-housed barrows (PIC 359 X C29; initial BW=34.2±0.18 kg) were randomly allotted in an incomplete crossover design with 30 diets and 4 collection periods. Each of the 4 collection periods consisted of 6 days adjustment to the test diet followed by 3 days of fecal sample collection followed by 5 days of feeding a fully balanced grower diet. Diet and fecal samples were analyzed for dry matter (DM), titanium dioxide, and gross energy (GE). ATTD coefficients were then determined. Mean ATTD coefficients of GE between the 2011 and 2012 corn samples were not different (84.3 vs. 83.1 respectively; $P>0.10$). Comparing 2011 with 2012, there were no differences in ether extract (4.07% vs. 3.96%; $P>0.10$) or crude protein (8.56 vs. 9.19%; $P>0.10$). There were no differences in physical characteristics, except for 1,000 kernel weight, which varied among samples by 220% (176 to 386 grams). No relationships were found between any single corn quality measurement, physical or chemical, and digestibility of energy ($P>0.10$). In conclusion, ATTD of corn grown under drought-stressed conditions was not different in energy content from corn grown in the previous year under “normal” conditions.

Introduction

Record-breaking heat and lack of rainfall during the 2012 growing season resulted in drought-stressed growing conditions. There are no data in the literature describing the nutritional value to pigs of corn grown under these conditions. Therefore, an experiment was conducted to investigate the impact of these conditions on nutrient composition and ATTD of energy in corn, and determine if relationships exist between corn quality measurements, nutrient content, and digestibility of energy

Materials and Methods

Corn samples

Twenty-eight samples of corn from the 2012 crop, plus 2 samples of corn from the 2011 crop to serve as a positive control, were collected across the Midwest using yield as an initial screen for drought impact. Corn was collected using 5 yield categories: <50 bu./acre, 50-100 bu./acre, 100-150 bu./acre, 150-200 bu./acre, and >200 bu./acre. Care was taken to ensure enough samples were collected from each yield category. Each sample was graded by an official U.S. grain inspection agency and analyzed for ether extract and crude protein content.

Test Diets

Diets were formulated using each of the 30 corn samples plus vitamins, minerals, and 0.4% titanium dioxide as an indigestible marker. Diets were fed at a level of approximately 2.6 times the estimated energy required for maintenance (NRC 2012) based upon the average initial BW of the pigs at the beginning of 4 collection periods.

Animals

This experiment was conducted at the Iowa State University Swine Nutrition Research Farm under the approval of the Institutional Animal Care and Use Committee (#9-12-7441-S). In this experiment, 60 individually-housed barrows (PIC 359 X C29; initial BW=34.2±0.18 kg) were randomly allotted in an incomplete crossover design with 30 diets and 4 collection periods. Each of the 4 collection periods consisted of 6 days adjustment to the test diet followed by 3 days of fecal sample collection followed by 5 days of feeding a fully balanced grower diet; the latter was fed to ensure that the protein-deficient test diets did not impair digestion functions in subsequent collection periods.

Analysis

Diet and fecal samples were analyzed for DM, titanium dioxide, and GE. ATTD coefficients were then determined. Data were analyzed using the PROC MIXED procedure of SAS (SAS Inst. Inc., Cary, NC) with the individual pig and corn sample as the experimental unit for analyzing the data from the digestibility trial and analysis of the chemical constituents, respectively.

Results and Discussion

Mean ATTD coefficients of GE between the 2011 and 2012 corn samples were not different (84.3 vs. 83.1 respectively; $P>0.10$). Comparing 2011 with 2012, there were no differences in ether extract (4.07% vs. 3.96%;

$P>0.10$) or crude protein (8.56 vs. 9.19%; $P>0.10$). There were no differences in physical characteristics, except for 1,000 kernel weight, which varied among samples by 220% (176 to 386 grams). No relationships were found between any single corn quality measurement, physical or chemical, and digestibility of energy ($P>0.10$). In conclusion, ATTD of corn grown under drought-stressed conditions was not different in energy content from corn grown in the previous year under “normal” conditions.

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