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Comparison of Untreated Mature Switchgrass and Cornstalks as Roughage in Beef Cattle Feedlot Diets

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Cover Page Footnote
We gratefully acknowledge CenUSA Bioenergy and support by Agriculture and Food Research Initiative Competitive Grant No. 2011-68005-30411 from the USDA National Institute of Food and Agriculture. We also extend our gratitude to the farm staff at the Iowa State University Armstrong Research Farm.

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Summary and Implications

A feeding trial using 121 crossbred steers was conducted to evaluate the utilization of untreated mature switchgrass as a roughage source in feedlot diets. Steers were fed either cornstalks (STALK) or switchgrass (SWITCH) as roughage at 14.2% of diet DM. Performance and carcass characteristics were evaluated relative to roughage source. Cattle fed SWITCH had lesser marbling scores but backfat, HCW, KPH, ribeye area, and yield grade did not differ between treatments. Cattle fed SWITCH had lesser DMI than did STALK cattle but carcass-adjusted ADG and G:F did not differ between treatments. Untreated switchgrass may replace cornstalks at low inclusions in finishing diets, and digestibility of this low quality roughage may be improved through alkaline treatment.

Introduction

Environmental stewardship and agricultural sustainability are common subjects of discussion across the United States. The CenUSA Bioenergy project is focused on creating a bioenergy industry based on pyrolysis of perennial grass biomass to create liquid fuels. The increased production of perennial grasses on land that is unsuitable or marginal for row crop production would help minimize soil erosion and nutrient run-off, promoting a more sustainable agricultural system, complementing the Nutrient Reduction Strategy, and helping to protect our nation's water supply. Incorporation of perennial grass hay into beef feedlot rations could create additional marketing options and incentives for farmers to shift production away from row crop toward perennial grasses. The beef feedlot industry also stands to gain additional roughage sources which will be increasingly important as the cellulosic ethanol industry begins to compete with livestock producers for corn stalk residue and other forms of fiber and roughage.

Materials and Methods

Steers were randomly allocated to 1 of 4 pens (n = 30 or 31 per pen), with 2 pens receiving STALK and 2 pens receiving SWITCH as roughage. Diets included corn, modified distillers grains, mineral supplement, and 1 of the 2 roughage sources. Based on initial nutrient analyses, diets were developed to be equivalent in percent dry matter of each feedstuff. Finishing rations across treatments contained 14.2% roughage on a dry matter basis and STALKS and SWITCH were equal in total Neutral Detergent Fiber with levels of 29.3%. Finishing rations were formulated to be comparable across treatments in terms of energy with STALK rations containing 1.39 Mcal/kg and SWITCH rations containing 1.37 Mcal/kg. Cattle were fed ad libitum and bunks were managed to achieve nearly slick bunks each morning. Cattle were fed for 131 days with Revalor IS implants administered on d 27 and d 77 of the feeding period, and Optaflexx fed the final 32 d on feed at 300 $mg \cdot steer^{-1} d^{-1}$. On d 10 of the feeding period feed was analyzed with Penn State Particle Separator several times throughout the day to monitor for sorting. Cattle were marketed on a common date and carcass data were collected. Data were analyzed using the MIXED procedure of SAS.

Results and Discussion

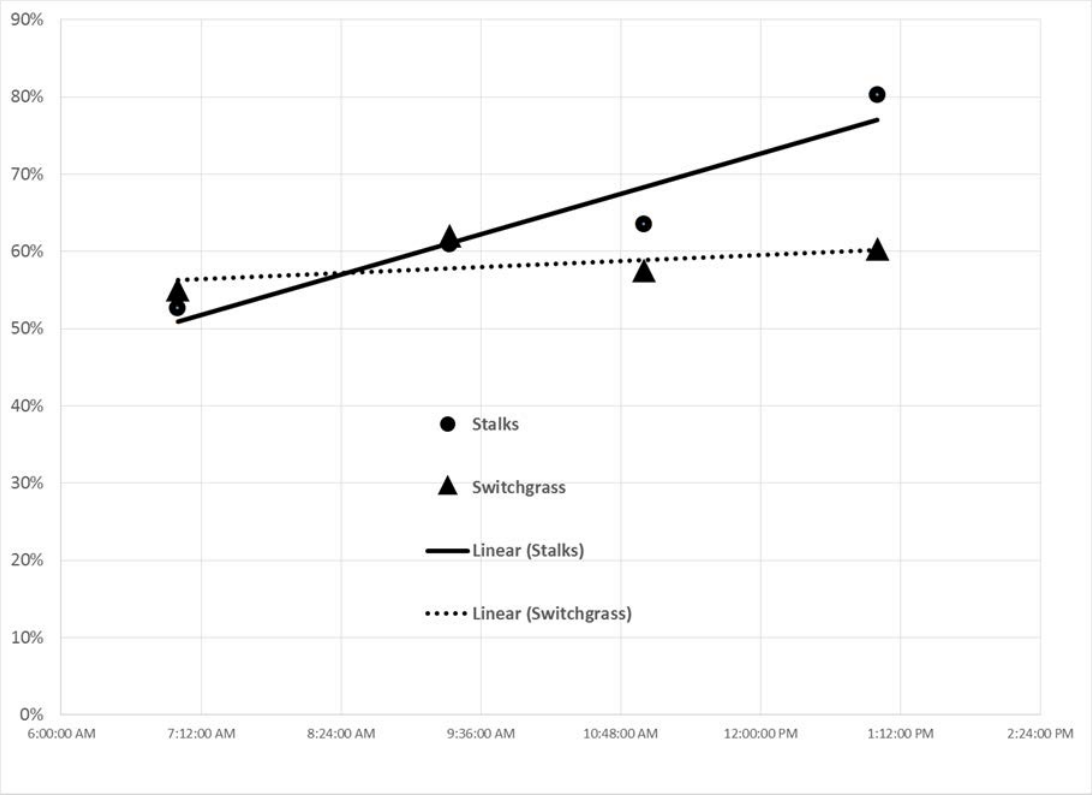
Performance and carcass data are reported in Table 1. When compared to STALK cattle, SWITCH cattle had lesser marbling scores ($P = 0.0095$). Backfat, HCW, KPH, ribeye area, and yield grade did not differ between treatments ($P \geq 0.19$). Additionally, carcass-adjusted ADG did not differ between treatments ($P = 0.43$). Cattle fed SWITCH had lesser DMI than did STALK cattle ($P = 0.0004$) but G:F did not differ between treatments ($P = 0.9783$). These data support the hypothesis that mature untreated switchgrass may replace cornstalks at low inclusions in beef feedlot finishing diets. Although mature switchgrass is low in digestible nutrients, it seems to offer enough effective fiber to maintain rumen function and promote digestive health. Palatability did not prove to be a problem and as shown in Figure 1 the STALK cattle actually sorted more than the SWITCH cattle. These findings support that the feedlot industry could utilize mature switchgrass as an alternative roughage source thereby providing an additional marketing option for switchgrass beyond the biofuel industry.

Table 1. Comparison of cornstalks and switchgrass as roughage sources in feedlot beef diets.

	Treatment[1]			
Item	STALK	SWITCH	SEM	P-Value
Performance measurements				
Average daily gain[2], kg	1.77	1.70	0.051	0.43
Dry Matter Intake, kg	12.02	11.53	0.007	0.0004
Gain:Feed, kg:kg	0.1471	0.1473	0.005	0.99
Carcass characteristics				
Hot carcass wt, kg	386.36	378.63	4.64	0.36
12th rib back fat, cm	1.24	1.13	0.05	0.26
KPH, %	2.35	2.25	0.05	0.29
Ribeye area, cm^2	87.26	87.97	0.98	0.66
Yield grade	3.09	2.87	0.08	0.19
Marbling score[3]	1047.5	1022.0	1.77	0.0095
Quality grade[4]	16.95	16.60	0.04	0.02

[1] Treatment based on roughage fed: STALK fed cornstalks and SWITCH fed switchgrass.
[2]Carcass-adjusted ADG calculated from HCW and 63% dressing percentage.
[3]Marbling score: 900 = Slight 0, 1000 = Small 0, 1100 = Modest 0, etc.
[4] Quality grade: 15 = Select$^-$, 16 = Select$^+$, 17 = Choice$^-$, 18 =Choice^0, 19 = Choice$^+$, etc.

Figure 1. Percentage of cornstalk and switchgrass from TMR in top 2 trays of particle separator at 0.5 hour, 3 hours, 4.5 hours, and 6.5 hours after feeding.



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