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Effect of Harvest Method on the Nutrient Composition of Baled Cornstalks

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Summary

This experiment was conducted to determine the effect of chopping corn residue prior to baling on the nutrient composition of cornstalk bales. One dryland corn field planted with a single variety of corn was used. After harvest, one half of the field was chopped with a stalk chopper. The remaining half was not chopped. Each half of the field was then raked into windrows, baled, and wrapped with plastic netting. Ten round bales were harvested from each half of the field (chopped and not chopped). Three core samples were then collected from each bale and pooled for analysis. Pooled samples were dried and analyzed for crude protein, crude fat, ash, acid detergent fiber (ADF), neutral detergent fiber (NDF), neutral detergent insoluble nitrogen (NDIN), lignin, calcium (Ca) and phosphorus (P). Total digestible nutrients were then calculated from the analyses. Neutral detergent insoluble nitrogen was greater ($P < 0.01$) in chopped cornstalks than in cornstalks that had not been chopped. Calcium concentrations were greater ($P < 0.05$) and phosphorus concentrations tended to be greater ($P < 0.10$) in chopped cornstalks than in those that had not been chopped. The remaining nutrients were not affected by processing. Chopping cornstalks prior to baling did not negatively affect their nutritional value for beef cattle. However, because of differences in varieties, growing conditions, and agronomic practices, caution should be exercised in extrapolating these results.

Introduction

Crop residues are a critical resource for beef cattle production systems throughout the Upper Midwest. Without question, the most economical means of harvesting crop residue is by grazing. However, because of unpredictable fall and winter weather or management challenges (fencing, water supply, etc.), many producers elect to bale at least a portion of their available crop residue.

Agronomic practices can be variable for corn producers in the Upper Midwest. Tillage practices range from conventional tillage to no tillage and multiple other variations. Consequently, residue management can vary accordingly. The desired amount and particle size of the crop residue can vary dramatically.

Variation in the nutrient composition of different parts of a corn plant has been clearly documented (Fernadez-Rivera and Klopfenstein, 1989; Rasby et al., 1998). Since cattle will select the highest quality diet available, processing residue likely has minimal impact on animal performance when corn residue is grazed. However, when cornstalks are harvested mechanically, the effect of processing is not well documented. This experiment was designed to determine if chopping corn residue prior to harvest negatively affects the nutrient composition of cornstalk bales.

Materials and Methods

One dryland corn field planted with a single variety was used for this experiment. After harvest, one half of the field was chopped with a stalk chopper. The remaining half was not chopped. Each half of the field was then raked into windrows, baled, and wrapped with plastic netting. Ten round bales were baled on each half of the field (chopped and not chopped). Three core samples were then collected from each bale using a Penn State Forage Sampler and pooled for analysis.

Each pooled sample was dried at 105°C for 3 hr (NFTA Method 2.2.2.5) and ground. Ground samples were analyzed for crude protein (AOAC Official Method 990.03), crude fat (AOAC Official Method 2003.05), ash (AOAC Official Method 942.05), ADF (AOAC Official Method 973.18), NDF (AOAC Official Method 2002.04), neutral detergent insoluble nitrogen, lignin (AOAC

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Official Method 973.18, Ca (AOAC Official Method 968.08), and P (AOAC Official Method 931.01). Total digestible nutrients were then calculated (NRC, 2001).

Data were analyzed as a completely randomized design using the GLM procedure of SAS (SAS, 1999). Significance was declared at $P < 0.05$.

Results and Discussion

Neutral detergent insoluble nitrogen was greater ($P < 0.01$) in chopped cornstalks than in cornstalks that had not been chopped (Table 1). Calcium concentrations were greater ($P < 0.05$) and phosphorus concentrations tended to be greater ($P < 0.10$) in chopped cornstalks than in those that had not been chopped (Table 1). The remaining nutrients were not affected by processing (Table 1). Total ash content of the bales was not different (Table 1). Therefore these differences are not likely related to soil contamination. Rather, it is possible that Ca and P are found in greater concentration in the stem, but analyses of individual parts of the cornstalk were not performed.

Implications

Based on these findings, chopping cornstalks prior to harvest did not negatively affect their nutritional value for beef cattle. However, caution should be exercised when extrapolating these results. There is potential for significant variation in the nutrient composition of various components of the cornstalk (husk, leaf, and stem) based on growing conditions and variety. Further research is required to better quantify the effect of chopping cornstalks prior to harvest on nutrient composition

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Tables

Table 1. Effect of processing prior to harvest on nutrient composition of baled cornstalks

	Harvest Method		
Item	Chopped	Not chopped	SEM[a]
Dry matter, %	79.0	81.2	1.04
Crude protein, %	5.4	5.5	0.18
Fat, %	0.79	0.81	0.10
Ash, %	21.3	23.0	1.48
ADF, %	68.2	67.6	1.20
NDF, %	100.0	98.2	1.77
NDIN[b], %	0.59	0.41	0.03
Lignin, %	6.8	6.7	0.19
Ca[c], %	0.52	0.45	0.02
P[d], %	0.17	0.15	0.01
TDN, %	40.9	39.5	0.68

[a]SEM = standard error of the mean.
[b]Means differ ($P < 0.01$).
[c]Means differ ($P < 0.05$).
[d]Means differ ($P < 0.10$).