

Corn Residue Quality throughout the Grazing Season

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Summary with Implications

Changes in in vitro organic matter digestibility and digestible organic matter of corn residue were evaluated throughout the fall grazing and spring grazing seasons. In vitro organic matter digestibility and digestible organic matter were greatest at the beginning of fall grazing and declined over time. Slight weathering resulted in lower quality corn residue available at the beginning of spring grazing compared to the beginning of fall grazing. The in vitro organic matter digestibility of available residue declined 21% over the fall grazing season and 51% throughout the spring grazing season. As the availability of nutrients declines over time, adjustments in feeding management or rotational grazing may be necessary to meet energy requirements of grazing cattle.

Introduction

With the conversion of much grassland to cropland, supply of traditional forage resources has been challenged. However, an increase in acres being planted for corn production has resulted in greater availability of corn residue, which can be a valuable feed resource for grazing situations. Over time, corn residue quality will vary due to selective grazing of the higher quality plant parts (husk and leaves) and weathering. Characterizing a corn residue field for nutrient quality throughout a grazing period is important because adjustments in feeding management or rotational grazing may be necessary to meet the nutrient requirements of animals grazing the field.

Therefore, the direct objective of this study was to determine diet quality of a corn residue field throughout fall and spring grazing periods. A secondary objective was to evaluate the effects of crop rotation on subsequent corn residue quality.

Procedures

Corn plant samples

An irrigated cornfield located at the Eastern Nebraska Research and Extension Center (ENREC) was utilized in the study. The field consisted of 2 sections with different crop rotations: 1) corn-corn rotation and 2) corn-soybean rotation. Three treatments (fall grazed, spring grazed, and non-grazed) with four replications of each treatment have been applied to the field annually. Ten consecutive whole corn plant samples harvested above the anchor root were collected from each field replication prior to grain harvest. Plant samples were separated into individual plant parts (leaf, sheath, husk) and weighed for DM. Plant parts were then composited within replication and analyzed for in vitro organic matter digestibility (IVOMD), digestible organic matter (DOM), and starch.

Corn residue diet samples

Following grain harvest of the corn field, cow-calf pairs grazed the fall grazed (November to February) and the spring (March) field replications at a stocking rate of 1.4 and 0.5 acres per cow-calf pair, re-

spectively. To determine changes in forage quality throughout each grazing period, 6 ruminally fistulated steers were allowed to graze the field replications at the initiation and completion of each grazing season. Prior to sampling, rumen contents were removed from each steer. Fistulated steers were then transferred to the corn residue field where 3 steers per replication were allowed to graze. After approximately 30 minutes of grazing, freshly consumed feed was collected from each steer's rumen and placed in a cooler for later analysis. Former rumen contents were returned to the rumen. Collected samples were analyzed for in vitro organic matter digestibility (IVOMD) using the Tilley and Terry method, which was modified with the inclusion of 1 gram of urea to the buffer. The IVOMD values were also adjusted using in vivo corn residue and grass hay standards. Digestible organic matter (DOM) was then calculated by multiplying the IVOMD and percent organic matter of the original residue sample. A starch analysis (Megazyme Total Starch Assay, Megazyme International Ireland Ltd., Ireland) was conducted to determine the percentage of grain within diet samples.

All data were analyzed using the mixed procedure of SAS. Corn plant data included treatment (spring and fall grazed), crop rotation, and plant part (husk, leaf blade, and leaf sheath) as fixed effects. Data from corn residue diet samples included treatment (spring and fall) and time (beginning and end of grazing season) as fixed effects.

Table 1. Yield of residue measured by clipping individual corn plants (% of grain)

	Treatment ¹			SEM	P-value
	Fall grazed	Spring grazed	Non-grazed		
Husk	5.8	6.1	5.3	0.32	0.22
Leaf	17.6	18.2	16.9	1.04	0.68
Sheath	8.6	8.7	8.2	0.49	0.77
Cob	9.1	9.4	8.5	0.39	0.31

¹ Treatments were due to timing of cattle grazing residue 2 years prior to these samples being collected. Ten plants were collected from each of 4 replications per treatment.

Table 2. In vitro organic matter digestibility and digestible organic matter of corn plant samples by area

Item	Area		SEM	P-value
	C-SB ¹	C-C ²		
IVOMD ³ , %	44.3	44.0	3.0	0.96
DOM ⁴ , %	40.8	40.5	3.2	0.95

¹Area that was in a corn-soybean rotation

²Area that was in a corn-corn rotation

³In vitro organic matter digestibility

⁴Digestible organic matter (as a % of dry matter); calculated as OM content (%) × IVOMD (%)

Table 3. In vitro organic matter digestibility and digestible organic matter of corn plant parts

	Husk	Leaf Blade	Leaf Sheath	SEM	P-value
IVOMD ¹ , %	60.0 ^a	39.7 ^b	32.7 ^c	0.6	<0.01
DOM ² , %	58.1 ^a	33.7 ^b	30.2 ^c	0.6	<0.01

¹In vitro organic matter digestibility

²Digestible organic matter (as a % of dry matter); calculated as OM content (%) × IVOMD (%)

^{a,b,c}Means within a row with unique superscripts differ ($P < 0.05$)

Table 4. In vitro organic matter digestibility and digestible organic matter of corn residue diet samples by treatment and time¹

Item	Fall		Spring		SEM	P-value ²		
	Beginning	End	Beginning	End		Trt	Time	Int.
IVOMD ³ , %	62.1 ^a	48.9 ^b	58.6 ^a	29.0 ^c	3.0	<0.01	<0.01	<0.01
DOM ⁴ , %	58.5 ^a	40.0 ^c	53.5 ^b	25.7 ^d	2.9	<0.01	<0.01	0.04

¹Treatments are due to timing of grazing (fall or spring) and timing of sample collection (at the beginning or end of grazing).

²Trt= fixed effect of treatment; Time= fixed effect of time; Int. = treatment × time interaction

³In vitro organic matter digestibility

⁴Digestible organic matter (as a % of DM); calculated as OM content (%) × IVOMD (%); adjusted for ash content of saliva

^{a,b,c,d}Means within a row with unique superscripts differ ($P < 0.05$)

Results

Amount of residue (as a percentage of grain) per plant is shown by treatment (Table 1). The average amount of leaf blade, leaf sheath, and husk was 31.8 % of the grain. That is 21 lb of residue dry matter/bu of corn at 15.5% moisture. This differs with previous research in which 15.8 lb of leaf and husk were produced per bu of corn (2016 Nebraska Beef Cattle Report, pg 71-73). Grain yield averaged 217 bu/acre and was not influenced by any treatments.

No significant difference was observed for corn residue IVOMD or DOM between the corn-soybean rotation and corn-corn rotation (P -value ≥ 0.95 ; Table 2). Previous treatment (fall, spring, or non-grazed) also did not affect IVOMD or DOM of corn residue harvested prior to grazing ($P \geq 0.97$). Plant parts did differ in IVOMD and DOM ($P < 0.01$; Table 3). The IVOMD and DOM

were greatest for the husk, intermediate for leaf blade, and least for leaf sheath.

A treatment by time interaction was observed for IVOMD of the corn residue diet samples ($P < 0.01$; Table 4). The IVOMD was greatest at the beginning of the fall and spring grazing seasons, intermediate at the end of the fall grazing, and least for the end of the spring grazing season.

A treatment by time interaction was also observed for DOM of the corn residue ($P = 0.01$). The beginning of the fall grazing season had the greatest DOM compared to all other time points within both grazing seasons. The beginning of spring grazing had greater DOM than the end of fall grazing. Digestible OM was least for the end of the spring grazing compared to all other grazing time points. From initiation of grazing to the end of the grazing season, IVOMD declined 21% while DOM declined 32% for the fall grazed treatment. The

decline in quality over time was greater for spring grazing, 51 and 52% for IVOMD and DOM, respectively.

Starch in the diet samples ranged from 0.04% to 6.44% (average of 1.6%) at the beginning of both grazing seasons. The broad range in starch content indicates significant variability expressed in grazing selection among steers. Given that corn consists of 70% starch, approximately 2.2 % of the steer's diet contained corn at the start of the grazing season.

The higher DOM of the corn residue diet samples observed at the beginning of both grazing seasons would suggest that cattle are selectively eating the husk and grain within the field. The difference in DOM observed between the beginning and end of both grazing seasons is evident that as the availability of husk and grain decreases, cattle begin to consume the leaves. Leaves are lower in IVOMD than husks and even lower in DOM because they have a high ash content (approximately 15% ash). In addition, the lower DOM observed at the beginning of the spring grazing compared to the beginning of the fall grazing would indicate that weathering may be responsible for a portion of DOM reduction.

Conclusion

The energy content that a corn residue field provides to grazing cattle is greatest at the beginning of the fall grazing season. However, as cattle selectively consume the higher digestible plant parts and weathering deteriorates the corn residue, the field provides less and less energy to the cattle. Characterizing a field for its nutrient profile is important during the grazing season. As the availability of nutrients declines over time, adjusting feeding management or utilizing rotational grazing may be necessary to continue to meet energy requirements of the grazing cattle.

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