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Effects of Corn Crop Residue Grazing on Soil Physical Properties and Subsequent Soybean Production in a Corn-Soybean Crop Rotation (A Progress Report)

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Abstract
The highest cost to beef cow-calf producers is the feeding of stored feeds in winter months. To lower feed costs, many producers will try to extend the grazing season into the winter. The primary resource for winter grazing in the Midwest is corn crop residues. On the average, corn crop residue grazing will reduce the amount of hay needed to maintain cows by approximately one-half ton per acre grazed over the winter. Although crop residue grazing is quite effective in reducing feed costs, some producers are concerned that corn residue grazing will have an adverse effect on soybean yields the following year resulting from soil compaction. It has already been proven that the use of large machinery will cause soil compaction in wet conditions and that it reduces corn grain yields from 6 to 10%. Furthermore, an increase in soil bulk density can occur in pastures overstocked in wet conditions. The purpose of this study is to determine if corn residue grazing has any effect on soil properties; and if so, when does this occur, and will it cause a reduction of grain crop yield in subsequent years.

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Agronomy, Animal Science

Disciplines
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Introduction

The highest cost to beef cow-calf producers is the feeding of stored feeds in winter months. To lower feed costs, many producers will try to extend the grazing season into the winter. The primary resource for winter grazing in the Midwest is corn crop residues. On the average, corn crop residue grazing will reduce the amount of hay needed to maintain cows by approximately one-half ton per acre grazed over the winter. Although crop residue grazing is quite effective in reducing feed costs, some producers are concerned that corn residue grazing will have an adverse effect on soybean yields the following year resulting from soil compaction. It has already been proven that the use of large machinery will cause soil compaction in wet conditions and that it reduces corn grain yields from 6 to 10%. Furthermore, an increase in soil bulk density can occur in pastures overstocked in wet conditions. The purpose of this study is to determine if corn residue grazing has any effect on soil properties; and if so, when does this occur, and will it cause a reduction of grain crop yield in subsequent years.

Materials and Methods

Beginning in 1999, two locations in Iowa (Chariton, Atlantic) were used to study the effects of corn residue grazing by beef cows on soil characteristics and soybean yields in the following growing season. Cows were allowed to graze inside selected paddocks at monthly periods throughout the fall and winter. For a grazed and ungrazed comparison, grazing exclosures were used inside the grazed paddocks and one paddock was left ungrazed for a control. The use of this design was to determine if grazing had any adverse effects on soil characteristics and under what weather conditions did they occur. Also, equal portions of the fields were planted in soybeans with either no tillage and/or disking the following year to compare interactions of corn residue grazing and tillage treatments. Soil was analyzed for soil bulk density, moisture, penetration resistance, roughness, texture, and type. Corn crop residues were also collected for yield, cover and composition. The following year, soybeans were harvested using a combine equipped with a yield monitor and global positioning system.

Results and Discussion

Crop residue grazed at the Atlantic site had a decrease in the organic matter yield in grazed paddocks, but no differences in the nutritional quality of residue between grazed and ungrazed paddocks were observed. Soil bulk density data

collected from the Atlantic site showed a significant difference between the 0-4 and 4-8 in. depths (P<.010). Bulk density and penetration resistance ratios inside and outside exclosures did not differ between periods grazed indicating that there was no effect of grazing on soil compaction. However, there was an effect of grazing period on soil roughness.

Like the Atlantic site, crop residue organic matter yields at Chariton decreased over winter. Unlike the Atlantic site, there was an increase in concentrations of NDF and ADF and a decrease in CP concentration in crop residue for the grazed paddocks over the ungrazed paddocks. Pre-grazing, post-grazing and post-planting corn crop residue cover did not differ between paddocks grazed and ungrazed, but was different between tilled and no-tilled after soybeans were planted. Soil bulk density data at Chariton were not affected by date grazed. However, penetration resistance in the upper 6 in. for periods grazed at the beginning and end of the season were greater than for paddocks ungrazed or grazed in January or February (P=.077). Soil roughness, however, was less in these paddocks. Regardless of the effects of crop residue grazing on soil characteristics, soybean yields subsequent to grazing date did not differ between paddocks that were ungrazed or grazed at different periods of the winter (Table 1).

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Table 1. Soybean yields in paddocks following winter corn crop residue grazing.

	Grazing period[a]						Significance		
	5	4	3	2	1	C	Date(d)	Till (+)	dxt
				-Atlantic-					
Tillage treatment							NS	< .01	< .01
No-till	55.52	54.61	56.29	56.69	55.13	56.11			
Disking	56.90	56.95	55.37	56.81	58.21	54.29			
				-Chariton-					
Tillage treatment							NS	0.08	NS
No-till	33.20	34.40	35.75	36.05	35.80	35.35			
Disking	34.40	33.65	32.85	33.00	35.35	34.60			

NS = Not Significant

[a] Periods grazed were Atlantic: 5 = Oct. 18-Nov. 9; 4 = Nov. 10-Dec. 7; 3 = Dec. 8-Jan 4.; 2 = Jan 5-Feb. 1; 1 = Feb. 2-Mar. 1; C = Control

Chariton: 5 = Nov. 29-Dec. 27; 4 = Dec. 28-Jan. 24; 3 = Jan. 25-Feb. 21; 2 = Feb. 22-Mar. 20; 1 = Mar. 21-Apr. 13; C = Control