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Recommended Citation
Al-Kaisi, Mahdi, "Corn Residue Removal Effects on Grain Yield and Soil Quality" (2009). *Iowa State Research Farm Progress Reports*. 626.
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Corn Residue Removal Effects on Grain Yield and Soil Quality

Abstract
In recent years there has been an increasingly greater focus on removing corn residue from fields following harvest. The two main reasons are for use as a low cost feedstuff for cattle production and for future use in cellulosic ethanol production. This leads to the question of "What effects will there be from removing corn residue following harvest?" This trial was set up to address potential soil quality concerns as well as look at impacts on grain yield.

Keywords
Agronomy

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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Corn Residue Removal Effects on Grain Yield and Soil Quality

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Introduction

In recent years there has been an increasingly greater focus on removing corn residue from fields following harvest. The two main reasons are for use as a low cost feedstuff for cattle production and for future use in cellulosic ethanol production. This leads to the question of "What effects will there be from removing corn residue following harvest?" This trial was set up to address potential soil quality concerns as well as look at impacts on grain yield.

Materials and Methods

This study was established in 2008 to document the impact of residue removal on corn yield and soil quality. This trial was conducted on an east facing site of Monona silt loam soils with a 5–14% slope. The trial was replicated three times with four levels (treatments) of residue removal and fertility variations (Table 1). In plots with residue removed, the residue was baled following a single pass of a spoke-type hay rake after corn harvest. The trial had no fall or spring tillage and was no-till planted in corn residue from the previous year. A pre-plant burndown herbicide application was used followed with a post-emergence application in mid-June. Grain yield was determined using a yield monitor.

Results and Discussion

The results show that residue cover from the control plot is 70%, which is greater than the other treatments (Table 2). This is expected for residue measurements taken after planting and fertilizer application. Additionally, residue cover can be affected by the previous growing season yield.

Corn yield response to different residue and fertility treatments showed the effect of residue removal on crop response (Table 2). The effect of residue removal seems to have two effects. These effects are changes in soil environment and nutrients due to residue removal. The analysis showed no statistical differences between yields of all treatments, but removing residue for Treatment 3 and 4 showed a yield advantage over no residue removal (Treatment 1). The treatment where no nutrients were reapplied seemed to have lower yields. The yield differences can be attributed to nutrient loss from residue removal. However, the source of nutrients shows differences because manure P and K had more than 20 bushels/acre yield advantage over other treatments.

Fall stalk nitrate concentration is an indicator of how efficient nitrogen was utilized. The established limits for fall stalk nitrates place levels below 2,000 ppm as marginal to deficient nitrate accumulation. Concentrations above 2,000 ppm indicate optimal to excessive nitrate accumulation or luxury nitrogen use. However, there were no statistically significant differences between fall stalk nitrate concentrations of all treatments, even though Treatments 2 and 3 are above the optimum level.

Acknowledgements

Appreciation is extended to Wayne Roush and Don Hummel. Additional thanks goes to Brad Hanson for plot harvest.

Table 1. Final plant population, grain yield, and fall stalk nitrate test results from four residue removal and fertility treatments at the Western Research and Demonstration Farm.

Treatment	Description and fertilizer program[1, 2].
1	No residue removed.
2	Residue removed.
3	Residue removed; P and K applied back as commercial fertilizer based on residue and grain removal; P rate equaled 75 lb/acre; K rate equaled 79 lb/acre.
4	Residue removed; P and K applied back as manure fertilizer based on residue and grain removal and manure P analysis; P rate equaled 75 lb/acre; K rate equaled 223 lb/acre; manure application rate equaled 5.7 tons/acre.

[1]A blanket application of 60 lb K_2O/acre was applied across all treatments in addition to the above described fertility programs. This was to adjust for low soil test K. No blanket application of P_2O_5 was applied because soil test P was in the high test category.
[2]Nitrogen application was targeted at 165 lb N/acre. Nitrogen credits were taken for nitrogen in the manure and commercial fertilizer blend.

Table 2. Residue estimation, grain yield, and fall stalk nitrate concentration from residue removal and fertilizer treatments at the Western Research and Demonstration Farm.

Treatment	Residue estimation	Grain yield	Fall stalk nitrate concentration
	%	bu/acre	ppm
1	70.2	201.8	1876
2	35.0	174.7	2497
3	26.7	204.2	3497
4	33.3	228.5	2033
$LSD_{(0.05)}$	11.1	63.1	2687