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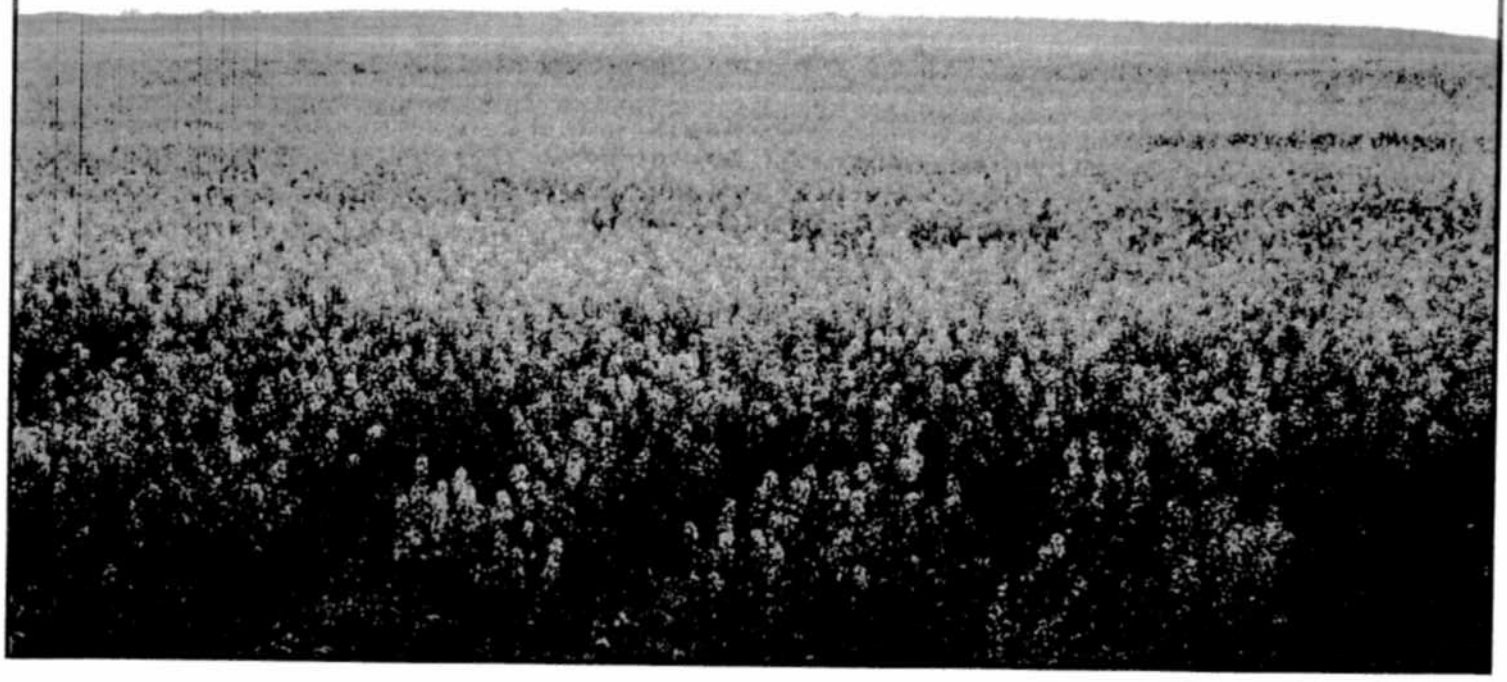

Organic Amendment and Residue Removal Rates Influence Soil Productivity

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Summary

Removing crop residue could affect different soil quality parameters and plant productivity. The first objective of this study is to evaluate the influence of removing crop residue at different rates (0%, 45–55%, and 60–85%) on crop productivity. The second objective is to assess the advantages to soil productivity of using an organic amendment instead of crop residue. In 2011, an irrigated continuous corn study site was established at the Kansas State University Southwest Research-Extension Center in Tribune, KS. Incorporated beef manure was compared with no-till commercial fertilizer (urea) applied at 180 lb N/a. The preliminary data suggest that manure addition improved the productivity compared with commercial fertilizer. The influence of residue removal will be evaluated in subsequent years.

Introduction

Interest in using crop residues as a renewable feedstock for biofuel production is great, but removing crop residue could have a negative impact on soil organic C (SOC) levels, and consequently on soil quality and plant productivity. Management practices that include adding organic residue as a nitrogen (N) source could compensate for removing the residue and prevent the deterioration of soil quality and grain yield through time. The objectives of this study are to (1) identify the rate of residue removal that maintains soil productivity and (2) evaluate the advantages of using beef manure as an N source vs. commercial fertilizer as a replacement for crop residue.

Procedures

The experiment site was established in 2011 on an irrigated field at the Tribune Unit of the Kansas State University Southwest Research-Extension Center. The management practices consist of continuous corn and two N-sources (beef manure and commercial fertilizer) applied at the same rate (180 lb N/a). The plots received commercial fertilizer (urea) were manage in no-till, whereas the beef manure (13.3 ton/a) was incorporated in the plots that received manure. All plots received 50 lb/a of P_2O_5. Three rates of corn residue removal were chosen: 0%, 45–55%, and 60–85%. The experiment units (15 ft by 30 ft) were organized in a randomized complete block design with four replications. On April 18, 2011, before corn planting, solid beef manure and commercial fertilizer (urea) were applied. Corn (hybrid Pioneer 1151XR) was seeded on May 7 at 32,000 seeds/a using a John Deere 1700 planter with 30-in. row spacing. Corn biomass was evaluated at R6 growing stage. Grain was hand-harvested on September 27, 2011. Grain yields were determined at 15% moisture. The corn residue was removed at different percentages using a Carter harvester, and the residue remaining in each plot was evaluated in October after the grain harvest.

Results

The first-year corn grain yield and plant biomass production (Table 1) were significantly affected ($P \leq 0.05$) by N source. The addition of manure greatly ($P \leq 0.05$) increased corn yield compared with fertilizer treatment. The N-source had no influence on corn biomass and residue remaining. The amounts of residue remaining were significantly influenced by the amount of residue removed. Overall, the preliminary data suggest that manure addition improved corn productivity, whereas the influence of different rates of residue removal could take several growing seasons. The influence of manure addition and residue removal on soil quality parameters is being conducted and will be reported throughout the study.

Table 1. The effect of nitrogen (N) source and residue removal rate on corn yield and corn biomass production in Tribune, KS, 2011

N-source	Residue removal rate	Corn yield	Corn biomass	Residue remaining
	%	bu/a	lb/a	
Fertilizer	0	250.7	10116	22858
	45-55	255.0	11002	12539
	60-85	254.5	10142	8797
Manure	0	271.6	11092	24198
	45-55	268.8	10733	12479
	60-85	269.6	10559	7378
N source (mean)		0.007*	NS[1]	NS
Fertilizer		253.4 b	10420	14672
Manure		270.0 a	10794	14685
Residue removal rate (mean)		NS	NS	<0.0001*
0%		261.2	10604	23528 a
45–55%		261.9	10867	12419 b
60–85%		262.0	10350	8087 c

[1] NS = not significant.
* Significant at $P<0.05$.
[ab] Values followed by a different letter are significantly different.