

Understanding Genotype, Crop Sequence, Plant Density, N-Fertilizer Rate, Effects on Corn Stover Quantity and Quality

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Although corn stover has little direct economic value for most farmers, it is critical to ecosystem performance and sustainability. Studies describing responses in maize stover traits relevant to the system performance and sustainability are limited. The objective of this study was to determine and dissect plant density, N-fertilizer, hybrids, and crop rotation impacts on maize grain yield, stover quantity, and stover C:N ratio.

Materials and Methods

Four rainfed field experiments were conducted at the Boone researchfarm in two contiguous fields during 2021 and 2022. In both years, one field was on continuous corn, and the other was in a corn-soybean rotation, resulting in four crop sequence-year combinations. Three commercial genotypes were evaluated across N-fertilizer rates (0, 130, and 300 lb. N acre⁻¹) and plant densities (15,500, 31,000, and 46,500 plants acre⁻¹), totaling 27 treatments in each field. The planting dates were mid-May in both seasons. The grain yield and stover ratio were estimated at physiological maturity by destructively sampling plants from each plot. After grounding the samples, the stover N content was determined using a CHNS Elemental Analyzer (Elementar Americas). Grain yield is reported at 15 g. kg.⁻¹ moisture, while stover at 0 g. kg.⁻¹ moisture.

Results

Corn grain yield across experiments and treatments ranged from 26 to 270 bushels acre⁻¹, stover amount from 1.0 to 5.7 ton acre⁻¹, and stover C:N ratio from 34 to 125. The N-fertilizer rate explained the largest proportion of the trait variation. The grain yield difference between the lowest and largest N rate was 79 bushels acre⁻¹, the stover difference 1.0 ton acre⁻¹, and 36 units of CN ratio. Plant density was the second largest source of variation across traits. The grain yield difference between plant densities was 25 bushels acre⁻¹, the stover difference 0.6 ton acre⁻¹, and five units of CN ratio. Genotype explained less than 1% of trait variations, being less than eight bushels acre⁻¹, the grain yield difference across genotypes, 0.1 ton acre⁻¹ in stover, and two units of CN ratio. These results show the impact of N-fertilizer not only in corn grain yield, but also in the amount and quality of the stover left in the field.

Table 1. Minimum, Maximum, and Genotype, N-rate, Plant density, and Crop sequence effect on grain yield, stover amount, and stover CN ratio.

Main effects	Grain yield	Stover amount	Stover CN
	Bushels acre ⁻¹	Ton acre ⁻¹	
Minimum	26	1.0	34
Maximum	270	5.7	125
Genotype	Hybrid 1	167	3.3
	Hybrid 2	158	3.4
	Hybrid 3	161	3.3
N rate (lb. N acre ⁻¹)	0	111	2.7
	130	185	3.6
	300	190	3.7
Plant density (plants acre ⁻¹)	15 500	151	2.9
	31 000	176	3.4
	46 500	160	3.6
Crop sequence	Maize-maize	149	3.1
	Soybean-maize	175	3.5
Year	2021	156	3.2
	2022	169	3.4

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