

NITROGEN FERTILIZER EFFICIENCY IN A LONG-TERM RESEARCH TRIAL

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Abstract

In 1993, a long term crop rotation study (The Living Field Laboratory) was initiated at the W.K. Kellogg Biological Station, Hickory Corners, MI, designed to investigate the benefits of cover crops in various integrated systems compared to a conventional system without cover crops. Today, with the rising cost of production (i.e. energy and fertilizer) and continued environmental concerns, there are strong incentives for corn producers to accurately assess N requirements and improve fertilizer efficiency. This is especially important on soils prone to N leaching losses such as sandy loams in south-western Michigan. Here, we compare and contrast N fertilizer recoveries of continuous corn versus rotated corn with and without a cover crop for the 2006 growing season. The experimental design consisted of split/split plots in a randomized complete block with four replicates where each plot was split with cover or no cover crop and with N or no N fertilizer application. Crimson clover was interseeded into continuous corn, however failed to establish due to dry conditions in 2005; and red clover was frost-seeded into wheat in a corn-soybean-wheat rotation. Ammonium nitrate fertilizer was applied at the V6 growing stage and rates were 105, 135, 75, and 105 lbs/A for continuous corn with cover, continuous corn without cover, rotated corn with cover, and rotated corn without cover, respectively. The predominant soil type is an Oshtemo Sandy Loam with approximately 1.5% organic matter. Growing conditions were favorable in 2006 with just enough precipitation occurring at every critical stage of corn development. All four treatments produced similar yields (average of 162 bu/A) suggesting that there was not a yield penalty associated with continuous corn compared to rotated corn. Apparent N fertilizer recoveries ranged from 63 to 80% with the lowest value in continuous corn with 135 lbs/A of N and the highest value in rotated corn with 75 lbs/A of N. These data suggest that side-dressing N fertilizer combined with good growing conditions produced excellent fertilizer recovery with nominal N leaching losses during the growing season and little remaining N available for leaching during the subsequent winter.

Nitrogen rate, grain yield, and apparent fertilizer recovery of continuous corn versus rotated corn with and without a cover crop.

Rotation	Cover	N Rate (lbs/A)	Yield (bu/A)	Plus N Plant Accumulation (lbs/A)	Zero N Plant Accumulation (lbs/A)	Fertilizer Recovery %
C-C	+	105	156.9	140.5	64.5	72
C-C	-	135	165.8	144.2	59.5	63
C-S-W	+	75	168.0	151.9	92.2	80
C-S-W	-	105	158.2	143.1	66.0	73

*Note: crimson clover failed to establish for C-C.

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