

#### Module 9.1-4 Enhanced efficiency fertilizer nitrogen choices reduce nitrous oxide emissions in Colorado corn.

Enhanced efficiency nitrogen fertilizers (EENFs) may be defined as “products with characteristics that allow increased plant uptake and reduce the potential of nutrient losses to the environment (e.g., gaseous losses, leaching, or runoff) when compared to an appropriate reference product”. Generally, EENFs may include: stabilized nitrogen (N) sources which have nitrification and/or urease inhibitors; slow-release N sources, which are slowly and somewhat unpredictably broken down by soil microbes; and controlled-release N sources, which have more predictable release rates than slow-release sources but the rates and patterns of release may vary under fluctuating field conditions. Nitrous oxide (N<sub>2</sub>O) emissions associated with the use of several different EENFs were evaluated (measured one to three times per week across the growing season, using vented, closed chambers) on a low organic matter, calcareous clay loam soil under irrigated corn-based systems in Colorado from 2002 to 2012. The N rate was either 202 or 246 kg of N/ha per season.

Depending on the tillage system and year, reductions in N<sub>2</sub>O emissions with some EENFs ranged up to 79% compared to urea and up to 48% compared to urea ammonium nitrate solution (UAN). Subsurface banding of one polymer-coated urea tended to increase N<sub>2</sub>O emissions compared with UAN, but decreased emissions compared with urea.

As illustrated in the table below, there are several N source options to reduce N<sub>2</sub>O emissions in continuous corn systems, but the agronomic and economic benefits may vary under different tillage systems and must also be considered.

**Table 1.** Irrigated continuous corn, average growing-season N<sub>2</sub>O emissions reductions with different enhanced efficiency N fertilizer sources (EENFs) under different tillage systems in Colorado, USA. **Adapted from** multiple tables in Halvorson et al., 2014.

Tillage (years)	EENF source*	EENF N <sub>2</sub> O emissions reduction compared with:	
		———— % ————	
		Urea	Urea Ammonium Nitrate (UAN)
No-till (2007-2011)	ESN	43	18
Strip-till (2009-2011)	ESN	40	8
No-till (2009-2010)	ESNssb	10	-47
Strip-till (2009-2010)	ESNssb	33	-15
No-till (2007-2011)	SuperU	49	19
Strip-till (2009-2011)	SuperU	48	22
No-till (2007-2010)	UAN+AP	57	37
Strip-till (2009-2010)	UAN+AP	70	50
Strip-till 2009-2010)	UAN+Nfusion	57	28
No-till (2007-2008)	Duration III	31	4

\* ESN = a polymer-coated urea;

ESNssb = a polymer-coated urea subsurface banded;

SuperU = a stabilized urea containing urease and nitrification inhibitors;

UAN+AP = a stabilized urea ammonium nitrate (UAN) solution containing urease and nitrification inhibitors with AgrotainPlus;

UAN+Nfusion = a mixture of UAN and soluble methylene ureas and urea triazones, the latter being slow-release N sources;

Duration III = a polymer-coated urea.

[Trade names are included for the benefit of the reader and do not imply any endorsement or preferential treatment of the product by the authors or IPNI.]

**Source:** Halvorson, A.D., C.S. Snyder, A.D. Blaylock, and S. J. Del Grosso. 2014. Agron. J. 106:715–722.

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