MINNESOTA - Improved Predictability of Fertilizer N Need for Corn Following Alfalfa
Matt Yost, Jeff Coulter, University of Minnesota; Michael Russelle, USDA-ARS

Accounting for alfalfa nitrogen (N) credits to first-year corn reduces fertilizer N costs, over-application of N, and the risk of nitrate loss to ground water. It is equally important, however, to avoid inadequate N supply for corn. To test current University guidelines, researchers conducted N rate trials on 31 fields of first-year corn after alfalfa in Minnesota and Wisconsin during three cropping seasons. Fertilizer N increased first-year corn grain yield on 3 of 31 fields, but there were no clues in the data to predict which farm fields would need fertilizer N.

With funding from the Minnesota Agricultural Fertilizer Research and Education Council, nearly all previous research on fertilizer N response in first-year corn following alfalfa were analyzed. This research represents 288 fields in North America and covers a wide range of weather, soil, and crop management conditions.

On coarse-textured soils, fertilizer N was almost always needed to optimize grain yield of first-year corn after alfalfa (Table 1). Researchers speculate N loss by leaching is the primary reason. In contrast, fertilizer N was required to optimize first-year corn grain yield in only 18% of fields with medium-textured soils and in 47% of fields with fine-textured soils. The higher number of responsive fields with fine-textured soils may have been due to delayed N mineralization and increased denitrification when soils were wet.

Table 1. Response of grain yield to fertilizer N in first-year corn after alfalfa.

Soil Texture[†]	Total Fields	Responsive Fields	Predictability of Responsive Fields[‡]	Range of EONR in Responsive Fields[§]
	#	%	% Correctly Predicted	lb N/ac
Coarse	25	96	– #	36-152
Medium	244	18	75-89	45-240
Fine	19	47	89	18-196

[†] Coarse-textured soil = loamy sand; medium-textured soil = loam, silt loam, sandy loam, fine sandy loam; fine-textured soil = clay loam, silty clay loam, sandy clay loam. No research found on sand and clay soils.
[‡] Predictability based on alfalfa stand age at termination and weather conditions from October-March prior to corn planting.
[§] EONR = economically optimum fertilizer N rate based on a 0.1 fertilizer N cost-grain price ratio.
[#] No prediction equation was possible because only one field of corn did not require fertilizer N after alfalfa.

On coarse-textured soils, only 1 of 25 fields did not need fertilizer N (Table 1), but more field research is needed to predict that unusual situation. For medium- and fine-textured soils, researchers could correctly identify the need for fertilizer N in 75-89% of the cases using prediction models that include alfalfa stand age and weather conditions prior to corn planting.

Where fertilizer N was needed, the economically optimum N rates varied widely for all soil texture groups. Work is being done to refine predictions of these optimum N rates, and a tool will be produced to help growers know which fields need fertilizer N and how much to apply.