

STAND AGE AFFECTS FERTILIZER NITROGEN RESPONSE IN FIRST-YEAR CORN FOLLOWING ALFALFA

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Abstract

Through a symbiotic relationship with soil bacteria, alfalfa can acquire nitrogen (N) from the atmosphere, use the N for its own growth, and contribute large amounts of N to subsequent crops. To estimate this N contribution, most land-grant universities use book-value N credits based on alfalfa stand density at termination. However, a recent literature analysis indicated that alfalfa stand density is not a reliable predictor of grain yield response to fertilizer N in first-year corn. That analysis pointed to other factors such as soil texture, alfalfa stand age, and weather conditions as more reliable predictors of response to fertilizer N. Our objectives were to determine how alfalfa stand age affects N availability and fertilizer N requirements for first-year corn following alfalfa. To meet these objectives, fertilizer N rates were applied to no-tillage corn following fall-terminated 1-, 2-, and 3-yr-old alfalfa stands at Lamberton and Waseca, MN in each of three years. Fertilizer N was applied at planting as broadcast NH_4NO_3 at rates from 0 to 150 lb N/ac. In nonfertilized plots, plant DM, plant N content, and soil inorganic N content to 2 ft were collected at the V6, V10, and R1 corn growth stages. At both locations, alfalfa stand age had minor impacts on these in-season soil and plant N measurements. On medium-textured soil at Lamberton, first-year corn following 3-yr-old alfalfa stands required no fertilizer N to economically optimize grain yield, but required 60 and 80 lb N/ac following 2- and 1-yr-old stands, respectively. On fine-textured soil at Waseca, first-year corn required 85 lb N/ac following both 2- and 3-yr-old stands, but 105 lb N/ac following 1-yr-old stands. Although corn yield response to N was affected by alfalfa stand age, pre-sidedress soil nitrate test concentrations did not differ among stand ages. Final alfalfa stands were greater than 5 plants/sq ft in all but one site-year. Thus, with corresponding book-value N credits of 150 lb N/ac for these stands, current guidelines underestimated corn fertilizer N needs by 50 to 100 lb N/ac in all situations except following 3-yr-old stands at Lamberton. These results confirm that alfalfa stand age affects the frequency and level of response to fertilizer N in first-year corn, and support the role of soil texture in altering the effect of stand age.

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