

EXTERNAL HYPHAL PRODUCTION OF ARBUSCULAR
MYCORRHIZAL FUNGI AND NITRATE LEACHING AS
INFLUENCED BY BIODIVERSITY AND THE SCALING OF SOIL
NUTRIENTS IN A RESTORED TEMPERATE GRASSLAND

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ABSTRACT

Bingham, Marcus Alan; M.S.; Program of Natural Resources Management; Department of Animal and Range Sciences; College of Agriculture, Food Systems, and Natural Resources; North Dakota State University; May 2004. External Hyphal Production of Arbuscular Mycorrhizal Fungi and Nitrate Leaching as Influenced by Biodiversity and the Scaling of Soil Nutrients in a Restored Temperate Grassland. Major Professor: Dr. Mario Biondini.

The objectives of this study were twofold: (1) To determine the relationship between plant diversity and extraradical arbuscular mycorrhizal (EAM) hyphal length, and to link the relationship to plant productivity; and (2) To determine if increased plant diversity reduces NO_3^- leaching. Two experiments were conducted simultaneously, 1 consisting of 50 plots and the other consisting of 100 plots, all seeded in 1999 with 1, 2, 5, 10, or 20 plant species taxa drawn randomly without replacement from a pool of 49 plant species common to the Great Plains grasslands. An additional factor consisted of two different spatial scaling patterns of soil nutrients. One experiment was sampled for the length of EAM hyphae while the other was sampled for NO_3^- leaching.

EAM hyphal length was increased by plant species richness throughout the upper 20 cm of the rooting zone. This increase was most prevalent under fine-scale N heterogeneity. Functional form richness appeared to be an important factor in the upper 10 cm of the rooting zone. NO_3^- leaching was unaffected by plant diversity but was increased by a factor of two going from fine-scale N heterogeneity to coarse-scale N heterogeneity. Late successional C_4 grasses characterized by high root surface area appear to play an important role in increasing EAM hyphal length and nutrient utilization in high diversity mixed-grass prairie communities.