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Net Mineralization Response to Fertilizer Application and Site-Specific Setting in a No-Till Dryland Wheat Agroecosystem in the Pacific Northwest (USA)

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Application of nitrogen (N) fertilizers is pivotal to maintaining agricultural productivity. Nutrient management is typically guided by a combined assessment of crop yield requirements, residual soil inorganic N concentration, and predicted N supply from organic matter. However, laboratory assays employed to forecast mineralization potential do not reflect in situ processes occurring in soils, processes that can vary spatially within a field. Furthermore, fertilizer application alters biogeochemical cycles through a variety of mechanisms including priming effects and microbial community alterations.

This study investigates in-situ ammonification/nitrification rates utilizing mineralization cores as part of a five-year Site-Specific Climate-Friendly Farming (SCF) project. In-depth accounting of nitrate and ammonium production and flux was possible via a six bag mixed-bed ion exchange resin system. Soil cores (7.5 cm diameter by 15 cm deep) were isolated from the surrounding soil by three resin bags sealed in the top and bottom of individual plastic cylinders. Fifteen locations were selected across a commercial direct-seed wheat field based on statistical clustering of primary and secondary topographic variables. In each location surface soil-resin cores were installed in fertilized and unfertilized plots immediately after spring planting and removed before harvest. In situ ammonification/nitrification rates will be analyzed as a function of both fertilizer application and site-specific environmental characteristics as determined from soil moisture monitoring, soil characterization, and crop analysis at each measurement location. This site-specific information on N transformations and availability can then be used to guide site-specific crop management.