RESPONSE OF SOIL N CYCLING, NITRIFYING ORGANISMS, AND WINTER WHEAT TO NITRIFICATION INHIBITORS IN NORTHERN IDAHO

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ABSTRACT

Leaching of fertilizer nitrogen contributes to environmental pollution and is an economic loss for agricultural producers. Leaching of inorganic nitrogen fertilizers is intensified when applied to areas of high rainfall zones in excess of crop requirements. Reduction of this nitrogen loss may be achieved through the application of nitrification inhibitors at the time of planting to prevent the transformation of ammonia to more leachable nitrate by nitrifying organisms. Much research on nitrification inhibitors has been done in the areas of the Midwest for corn production but is lacking in the Pacific Northwest for winter wheat production. To help address the lack of research in this area, two research trials were conducted in northern Idaho during the 2019-2020 and 2020-2021 growing seasons. Two varieties of winter wheat, soft white winter wheat LCS Hulk and hard red winter wheat LCS Jet, were tested separately at each trial location. For each variety and trial location, five nitrogen treatment rates of UAN 32 (0, 50, 100, 150, 200 lbs N/A) were mid-row banded with and without the nitrification inhibitor, nitrapyrin (Instinct® II). Soil was sampled at four intervals during the growing season. Extractable soil ammonium in the mid-row band of the control treatment remained elevated until late spring but soil nitrate declined by early spring. Application of nitrapyrin increased extractable ammonium and reduced extractable soil nitrate by up to 6%. Soil samples were also obtained in early winter and early spring to quantify the abundance of ammonia-oxidizing bacteria and archaea. Nitrifying archaeal populations did not respond to the nitrification inhibitor treatment. However, bacterial populations were significantly decreased by 7% in the Instinct® II treated samples compared to the control. Winter wheat yield and associated measurements were not impacted by nitrapyrin treatment. The limited agronomic benefit of nitrapyrin in this study may be due to 25% of UAN 32 fertilizer already being in the nitrate form and toxic concentrations of ammonia in the mid-row band limiting nitrification and thus benefits of reduced nitrification due to nitrapyrin. Greater agronomic benefits from nitrification inhibition may be attainable in sandy soils or with broadcast fertilizers.