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ABSTRACT BOOK

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HERE TODAY, GONE TOMORROW? BIOLOGICAL NITRIFICATION INHIBITORS' PERSISTENCE AND DISSIPATION IN A RANGE OF AGRICULTURAL SOILS

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Biological nitrification inhibitors (BNIs) are emerging as sustainable alternatives to synthetic nitrification inhibitors, offering the potential for a more environmentally friendly nitrogen management in agricultural soils. Secreted by plant roots, BNIs have been shown to reduce nitrification activity in soil. However, their environmental fate remains insufficiently understood. Although BNIs are naturally derived, assuming that they require no monitoring may lead to underestimations of their persistence, efficacy, and behavior. We evaluated the dissipation of five BNIs—2-methoxy-1,4-naphthoquinone (MQN), sakuranetin, 1,9-decanediol, 2,7-dimethoxy-1,4-naphthoquinone (zeanone), and 6-methoxy-2(3H)-benzoxazolone (MBOA)—across ten soils selected for their different physicochemical characteristics like texture, pH and organic matter content. BNI concentrations were quantified using high-performance liquid chromatography (HPLC) methods developed and validated as part of this study. In general, BNI compounds showed low persistence in neutral to alkaline soils, while higher DT50 values were mostly observed in low-pH soils. For zeanone and MQN, DT50 values ranged from 0.29 to 88.5 days and 0.16 to 11.84 days, respectively. Sakuranetin and MBOA exhibited DT50 values ranging from 1.35 to 6.62 days and 0.31 to 7.46 days respectively. Soil fumigation performed on two representative soils—one acidic and one alkaline—significantly retarded the dissipation of sakuranetin (DT50 4.85 vs. 13.11 days in acidic, 2.68 vs. 9.23 days in alkaline soil) and MBOA (DT50 7.46 vs. 40.96 days in acidic, 1.31 vs. 3.4 days in alkaline soil), suggesting a key role for soil microorganisms in their dissipation. Ongoing work will explore correlations between soil properties and BNI dissipation, including determination of the DT50 of 1,9-decanediol which is still pending. This knowledge is essential to evaluate the true agricultural potential of BNIs and to design application regimes that ensure their efficacy in regulating nitrogen transformations in soil. Our results further highlight the need to systematically assess the fate of naturally derived compounds in soil, especially considering their reduced stability and implications for field-level performance and agronomic decision-making.

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