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Improving Predictions of Nitrogen Availability to Help Manage Nitrogen Inputs

Why Does it matter?

Modern crop varieties require large quantities of nitrogen (N) to maximize harvestable yields. A significant portion comes from fertilizer while a portion is supplied from soil organic matter. Past research has identified several laboratory methods for predicting N availability but none have worked well across a wide range of soils and management conditions. The limited success of soil tests for estimating N fertility means that, recommendations for fertilizer N application are based on predicted crop need and do not accurately take into account the amount of N potentially available from the soil. Better prediction of N release from the soil could help reduce N fertilizer usage and increase profits. In addition, applying the correct amount of N would help insure best yields while reducing the potential for N losses to groundwater and runoff to surface waters.

What was done?

Researchers from USDA's Agricultural Research Service (ARS) at the J. Phil Campbell, Sr. Natural Resource Conservation Center in Watkinsville Georgia led a team of ARS, Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA, the Brazilian Federal Agency for Research on Agriculture) and university scientists investigating methods for improving prediction of soil N availability. Multiple laboratory methods, designed to evaluate different fractions of soil organic matter N availability, were compared over a range of soils from nine tillage experiments across the southern USA.

What was found?

The methods that measured total soil carbon and nitrogen, and that relied on incubation of soil samples for various lengths of time provided the best predictions of potentially available N. Of these, total soil nitrogen and carbon are the easiest and fastest to determine but do not consistently indicate the quantity of mineralizable N across soils. The incubation methods take more time but are good indicators of potentially mineralizable N. Combining the types of methods improved the ability to predict potential N availability. The best combination occurred when we included total N and measurement of microbial respiration.

What is the impact?

Nitrogen makes up about 58 percent of the 22 million tons of chemical fertilizer nutrients (nitrogen, phosphate, and potash) used in the U.S. With fertilizer being 30 to 45% of the crop production input costs, reducing N inputs even by 5 to 10% would represent a major savings to most row crop producers. By further refining the approach outlined in this research and adoption by soil testing laboratories, soil based N recommendations could help producers save $10 to $20 per acre in reduced fertilizer costs and provide an environmental benefit by reducing the potential N fertilizer losses to surface and ground waters . This information should be useful to Soil Testing Laboratory Directors and agencies involved in environmental protection.

Research Team and Contact information

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Assessing Indices for Predicting Potential Nitrogen Mineralization in Soils under Different Management Systems

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