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Editorial

N Mineralization in Production Agriculture

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1. Introduction

Nitrogen (N) plays a key role in the synthesis of aminoacids, proteins, ribonucleic acid (RNA), and deoxyribonucleic acid (DNA) needed to promote and sustain plant growth and is, therefore, the single most important nutrient needed for agricultural production. However, N availability is often limited or exists in forms that are unavailable for plant uptake. Within the soil-plant root zone, N continuously cycles among various organic (unavailable) and inorganic (available) forms. Thus, careful management is crucial to supply sufficient plant-available N from the continuous cycle for sustainable agricultural production.

Understanding the effects of N management (and how it relates to the N cycle) in soil ecosystems is essential to determining N availability. This special issue includes a broad range of articles addressing the impact of N mineralization from animal manures, soil organic matter (SOM) under elevated CO_2, tannings in forest and pasture soil, and horticultural potting media.

Understanding the dynamics of soil N mineralization is essential when developing N management practices for crop and forage production. While much research has been conducted on N mineralization, much more work is needed to understand the dynamics of the N cycle. As new agronomic practices are developed, new studies are needed to determine the impact on N fertilization. For example, due to increasing costs of traditional potting substrates, horticultural growers are expressing interest in alternative, lower-cost substrates. In this special issue, a study undertaken to determine the extent of N immobilization in the high wood-fiber content substrate—clean chip residual—is presented. Likewise, interest in bioenergy production has led to the development of cropping systems where cover crops are being harvested for biomass, but the impact on N mineralization is unknown. In another paper in this special issue, research on N a management in cotton (*Gossypium hirsutum* L.) is examined as impacted by cover crop harvest.

The advent of new crops and management systems into new areas also brings uncertainty into the N management. For example, Potatoes (*Solanum tuberosum*) are an important high-value commodity for producers in the Mid-Atlantic Region, but current production recommendations were based on white potatoes and practices for Russet potatoes have not been researched. A study presented in this issue examines the potential impact on N management for growing Russet potatoes in this region.

Improvements in scientific knowledge regarding soil N cycling have the potential to help develop improved N fertilizer management. For example, tannins are reactive secondary metabolites produced by plants and are believed to affect the N cycle through several direct and indirect mechanisms that reduce rates of net N mineralization or nitrification. A study on the impact of tannins and related phenolic compounds on the solubility of soil N and resulting management of N availability and retention in agricultural soils is presented.

Recent increases in commercial N fertilizer prices and high demand for organic production have generated renewed interest in animal manure as a nutrient source. Manure nutrients, as well as legumes, have been used to increase soil fertility since the beginning of agricultural production. However, use of animal manures depends on N mineralization process to provide plant-available N. Research is needed to understand the long-term impact of animal manure application and the impact on the soil environment. In this special issue, a study on N uptake by sugarbeet (*Beta vulgaris* L.) in years following manure application is presented.

Recent changes in the animal production systems and manure handling after it has been collected have led to uncertainty as to how N mineralization from animal manures may be impacted. In this special issue, studies addressing the potential impact on N mineralization from changes in the animal manure management are presented. For example, a study to examine the potential changes in N mineralization due to storage with and without animal urine is presented. In another paper, a study was conducted to determine how raw dairy slurry and anaerobically digested slurry applied to reed canary grass (*Phalaris arundinacea*) affected forage production. Also, recent poultry litter management practices have resulted in changes to the composition of the litter (cake versus total cleanout). At the same time, the use of chemical additives has potentially changed the N mineralization potential of the litter. A study to examine these potential changes on N mineralization is presented in this special issue.

In addition, increasing global atmospheric carbon dioxide (CO_2) concentration has led to concerns regarding its potential effects on terrestrial ecosystems and the long-term storage of C and N in soil. Studies are needed to understand how changes to plant inputs due to elevated CO_2 may impact soil N mineralization. In this special issue, research is presented that examines the responses to elevated CO_2 in a grass ecosystem invaded with a leguminous shrub *Acacia farnesiana* (L.) Willd (Huisache) on soil N and C dynamics. Also, a paper is presented which examines the impact of elevated atmospheric CO_2 concentration on the effects of terrestrial C and N dynamics, including CO_2 release back to the atmosphere and soil C sequestration.

2. Conclusion

Nitrogen mineralization varies across climates, regions, landscapes, and soil management depending on many factors. The increased research knowledge obtained in these studies will provide valuable information for improving management practices which will, in turn, increase the available supply of N to the soil-plant system. This special issue includes 11 new studies on N mineralization in production agriculture, but much work yet remains undone. As world population continues to increase, ongoing research on N mineralization will be needed to improve soil productivity and N supply to crops where industrially produced commercial fertilizer is not the sole nutrient source.

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