COMMENTS AND LETTERS TO THE EDITOR

Comments on “Effects of Terpenoids on Nitrification in Soil”

Bremner and McCarty (1988) recently published the results of a series of experiments directed at testing my hypothesis (White, 1986b) that terpenoids may play an important role in the inhibition of nitrification in some ecosystems. Although I agree that the results of their experiments indicate immobilization of N rather than inhibition of nitrification as a result of addition of terpenoids, I do not agree with their conclusion that “the terpenoid hypothesis ... is invalid.” Rather, I feel that the challenge is to determine why their results are in apparent conflict with my results. I suggest that there are a number of factors that may contribute to the discrepancy, and that the results of Bremner and McCarty (1988) in fact may be compatible with my current hypothesis.

Since I first proposed the hypothesis (White, 1986b), I have further refined my ideas with regard to a possible mode of action for inhibition of nitrification by monoterpenoids, that is by binding with the ammonia monooxygenase enzyme in a manner analogous to acetylene (White, 1988). Given this mechanism of action, the results of Bremner and McCarty (1988) could be interpreted in another manner. The following factors may have affected the results of Bremner and McCarty (1988):

1. A major factor that has received little attention in the soil literature is that measured soil concentrations of terpenoids and other organic compounds represent free or loosely bound quantities that is in excess of the soil sink capacity. In Horner et al. (1988), the amount of a soil to a particular level of extractable complexes may be orders of magnitude more than calculated because there are multiple potential fates added to soils. A number of physicochemical factors may interact to determine the “sink” strength for terpenoids (or other organics). Terpenoids are highly reactive and are subject to various reactions (e.g., photochemical—Peterson and Tingey, 1980; Riba et al., 1987). Terpenoids could react with fulvic-humic acid complexes, be adsorbed on clay or organic matter, or be absorbed by soil organic matter. The strength of this sink would increase with increasing clay or organic matter content. In experiments with autoclaved soil from a ponderosa pine (Pinus ponderosa Dougl. ex P. Lawson & Lawson) stand containing 16% clay and 4.3% organic matter (representing high adsorptive-absorptive surfaces), concentrations were only 30% of calculated levels for limonene additions at 30 mg kg⁻¹ levels (White, 1988, unpublished data). Bremner and McCarty used soils with higher clay content (28-48%) and about equal or greater amounts of organic C; therefore, sink strength should be higher in the ponderosa pine soil. For a given