Reply

I. C. R. Holford has suggested that the Langmuir adsorption isotherm data of Green et al. (1978) and McCallister and Logan (1978) is misinterpreted because no correction was made for native adsorbed phosphate. Holford suggests that what was measured was residual adsorption capacity and that the "checkmark" phenomenon found in our Langmuir isotherms is eliminated when correction is made for native adsorbed P. It was our intention to measure only residual adsorption capacity, and therefore, our reference to the Olsen and Watanabe (1957) procedure was misleading since their procedure did correct for surface adsorbed P by "P exchange. We were using the Langmuir isotherm to examine the relative sorption of P by soils and sediments, a process determined by the sorption characteristics of the soil or sediment, but also by the degree to which the adsorption capacity had already been saturated.

I would concur with Holford that the term residual adsorption capacity should be used in instances where no correction is made for "native", or more correctly, "previously" adsorbed P. Holford has also suggested that, if Fig. 1 of McCallister and Logan (1978) is corrected by adding 50 μg P/g (Holford’s estimate of native adsorbed P, and one he considers conservative), then the data is better fit to a two-phase Langmuir model than to a single line. Using the 50 μg P/g estimate which we feel should be closer to 25 μg P/g (based on desorption and Bray P1 extractable P data for the Hoytville soil in Fig. 1 of McCallister and Logan), we find that either a single- or two-phase model is satisfactory in describing the data. The single-phase model has an r² of 0.976, while the r² values for the two-phase Langmuir isotherms were 0.978 and 0.987. The two-phase model has greatest utility at low equilibrium phosphate concentrations, but at this range, the native adsorbed P has its most significant effect on net adsorption.

Holford has correctly recognized the failure of Green et al. (1978) and McCallister and Logan (1978) to correct Langmuir adsorption data for native adsorbed P. We contend that our omission was not in clearly indicating our intention to measure residual adsorption capacity, and we laud the effort of Holford in bringing this to the readers’ attention.

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Literature Cited


Potentially Mineralizable Nitrogen in Soil: The Simple Exponential Model Does Not Apply for the First 12 Weeks of Incubation

Stanford and Smith (1972) have shown for widely different soils that the cumulative mineralized nitrogen, Nₖ, is a linear function of the square root of time, at least for the first 9 weeks of incubation. While no fundamental significance was ascribed to the parabolic relation, the data obtained for long incubation periods also fit an exponential relation. The exponential model is based on the premise that only one form of potentially mineralizable nitrogen exists and that this nitrogen decomposes at a rate proportional to its concentration. With this model, the relation Nₖ = N₀(1 - e⁻kt) can be derived (Stanford and Smith, 1972) where N₀ is the amount of inorganic nitrogen released, Nₖ is the nitrogen potentially mineralizable at the beginning of the experiment, and k is the time invariant specific rate of mineralization. If the model is relevant, the parabolic function should represent a numerical approximation of the exponential form, whatever the time interval chosen during the incubation.

Least-square fitting of Nₖ = N₀e⁻kt against the data generated by Nₖ = N₀(1 - e⁻kt), with k = 0.054 week⁻¹ (the average specific rate for soils at 35°C and optimum water content) gives α values which depend on the time interval considered (Fig. 1). For data obtained between t = 0 (as well as t = 2 weeks) and t > 16 weeks, 1/α stabilizes around 7.0 (Fig. 2), which agrees with the values, 6.5 < 1/α < 6.9, experimentally obtained by Stanford and Smith (1972) when N₀ is computed with the exponential relation for incubation lasting 59 weeks. For shorter incubations, agreement between α and β remains satisfactory as...