

ABSTRACT

This study was conducted with the main aim of finding out the effects of phosphorus quantity and intensity relationships on P availability of soils. For this purpose, four soils (three Ultisols and one Alfisol) were collected from different locations of Sri Lanka, namely, Matale, Mapalana, Ambewela and Maha Illuppallama. To assess P availability of these soils a pot experiment was conducted using rye grass (Lolium multiflorum L.) as the indicator plant. Phosphorus was added to all soils at the rate of 20 mg 100 g⁻¹ soils, and the P status was evaluated using quantity, intensity and buffer capacity parameters. Olsen-P, CAL-P and Bray 2-P values were taken as quantity measurements, while the concentrations in a soil suspension of 0.1 M KCl (soil:solution = 1:10) served as the intensity measurement. To obtain information on P buffer capacity a sorption study was conducted by equilibrating soils at increasing concentrations of P in a medium of 0.1 M KCl. The amount of P sorbed (x) served as the quantity factor while equilibrium P concentration (c) represented the intensity factor. Using these sorption data, sorption isotherms were plotted according to different mathematical models, and buffer capacities and other sorption indices were calculated. In addition, P replenishing speed was calculated by a continuous extraction method. To evaluate P uptake, three cuts of rye grass were taken within a period of 72 days and the cumulative P uptake was calculated. To obtain additional information on P uptake a seedling experiment with mung bean (Brassica juncea L.) was conducted according to the Neubauer technique. The P treatments were identical to the P levels of the sorption study. Seedlings were harvested after two weeks and the P uptake was calculated.

In the pot experiment the cumulative P uptake showed a significant linear relationship with P quantity measured as Olsen-P ($r=0.68^{**}$), CAL-P ($r=0.85^{***}$) and Bray 2-P ($r=0.7^{**}$), as well as with intensity ($r=0.65^{**}$) values. The multiple regression analyses showed that the incorporation of buffer capacity calculated according to most mathematical models improved the P uptake relationship with Olsen-P, but this was not the case for CAL-P, Bray 2-P and P intensity. Phosphorus replenishing speed estimated by the continuous extraction method did not significantly improve any P status measurement with P uptake.

In the seedling experiment, P uptake exhibited a significantly better relationship with the intensity values ($r = 0.80^{***}$) than with quantity values ($r = 0.43^*$). This shows that for relatively short vegetation periods P availability is more dependent on P intensity than P quantity. When buffer capacity concept was applied as in the case of pot experiment, the relationship of P uptake with quantity values improved, but not with intensity values. However, multiple regression equations indicated that at equal quantity levels, increasing P buffer capacity decreased P uptake. This again shows the importance of intensity value when P availability for a very short period is concerned, since the intensity at the same quantity level decreases with the increasing buffer capacity.