STUDIES ON THE AVAILABILITY OF PHOSPHORUS IN FOUR SOILS OF SRI LANKA

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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 multiflorium L.) as the indicator plant . Phosphorus was added to all soils at the rate of 20 mg 100 g^{-1} soil , 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 eveluate 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 mustard (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 ($r=0.73^{**}$) , 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 .