Abstract

Knowledge on the dynamics of soil water and nutrients is essential in monitoring optimum soil condition for their maximum use and crop production. This is particularly true with coarse textured acid lateritic soil where the intrinsic constraints for nutrient availability get further aggravated by the adverse residual effects of wetland rice cultivation, and reduce the productivity of wheat. The optimum soil condition for wheat in this soil can be attained by adopting suitable agro-management practices after establishing their favourable influence on the dynamics of water and nutrients. With this major objective a comprehensive field investigation comprising two experiments, were conducted on a lateritic soil of Kharagpur, India during Nov-March of 1994-95 and 1995-96 to study the effects of agro-management practices on the dynamics of water, N, P and S and productivity of wheat. The first experiment included 2 levels each of soil moisture regime as induced by timing 6.0 cm water at IW/CPE ratios of 0.6 and 1.0, depth of tillage: 10 and 20 cm, liming: 0.0 and 3.0 t ha^{-1} and method of fertilizer N placement: broadcasting and band placement, while the second experiment evaluated the effects of 3 levels of rice crop residue incorporation: 0.0, 1.75 and 3.50 t ha^{-1} along with 3 levels of liming: 0.0, 1.5 and 3.0 t ha^{-1} and 2 levels of tillage depth: 10 and 20 cm. Fertilizer N was applied as urea in two equal splits of 50 kg N ha^{-1} at sowing and CRI stage while P and K were basally applied respectively as SSP (including S) and MOP @ 50 kg P_2O_5 ha^{-1} (37.2 kg S ha^{-1}) and 50 kg K_2O ha^{-1}. An attempt was also made to predict N distribution in soil and its uptake by wheat crop with the help of N Solute transport model.

The results of the investigation revealed that the physico-chemical environment of acid lateritic soil can be adequately improved for wheat by applying lime along with rice crop residues. With their applications, the water retentivity of the soil was also improved. Following application of fertilizers the hydrolysis of urea and subsequent volatilization of ammonia, which followed First order kinetics, were fastened by liming, high soil moisture and broadcast application of urea but was reduced by band placement of urea. Availability of N, P and S increased progressively with increase in level of liming upto 3.0 t ha^{-1}. Being strongly related to water use which was enhanced by liming and deep tillage, the use of N was increased by liming, wet moisture regime, band placement of fertilizer N and deep tillage, P by liming and deep tillage and S by liming alone. The combination of liming, deep tillage, wet moisture regime and band placement of fertilizer N also maximised wheat yield, water and N use efficiencies. NO_3^--N distribution in the soil was reasonably predicted by N solute transport model.