ABSTRACT

In irrigated agriculture, method and scheduling of irrigation are the key factors affecting deep percolation of water and leaching losses of fertilizer nitrogen (N). In order to minimize the losses of water and N and increase their uses by crop, it becomes necessary to assess the influence of methods and scheduling of irrigation on root zone water and N balances. With this major objective, a comprehensive field investigation comprising three experiments, was conducted on a coarse textured lateritic soil during February-May 1998, November 1998-March 1999 and April-June 1999, to study the effects of method and scheduling of irrigation on depth and time changes of water and nitrogen in the root zone of Okra crop. Three irrigation methods: low head sprinkler, check basin and furrow and four irrigation schedules based on 15, 30, 45 and 60% maximum allowable depletion (MAD) of available soil water in the root zone were tested. N was applied in the form of urea at the rate of 120 kg N ha^{-1} in two equal splits: 30 and 75 days after sowing, along with basally applied 60 kg P_2O_5 ha^{-1} and 30 kg K_2O ha^{-1}. A simulation study was also carried out to predict the depth and time variation of soil water, NH_4-N and NO_3-N under different methods and schedules of irrigation with two established water and solute transport models: CHAIN_2D and RZWQM. The relative performance of the models was also evaluated.

The results of the investigation revealed that sprinkler irrigation helped retain higher available soil water storage in the root zone than check basin and furrow irrigation, which resulted in the minimum root zone water storage. The deep percolation and leaching losses of N were maximum under furrow irrigation and minimum under sprinkler with check basin taking the intermediate position. Low volume and high frequency irrigation schedules resulted in higher deep percolation and leaching loss of N than high volume and low frequency irrigation. The maximum use of water and N by Okra crop could be obtained by sprinkler irrigation scheduled at 30% MAD, which appeared to be the threshold limit for the crop. In correspondence to the trends of water and N uses, the maximum fruit yield of Okra was attained under sprinkler irrigation timed at 30% MAD. The distribution of water and N under Okra crop could be reasonably predicted by CHAIN_2D and RZWQM models particularly under high frequency irrigation schedules. The performance of CHAIN_2D was in general superior to that of RZWQM.