Optimizing cultural practices for saving water and fertilizer for rice- maize cropping system in Semi Arid Tropics

Dakshina Murthy Kadiyala, Yuncong Li, Rao Mylavarapu, M.D.Reddy, J.W.Jones, K.R.Reddy and G.B. Reddy

Abstract

Irrigated low-land rice uses 24-30% of world's freshwater resources. With fresh water becoming increasingly scarce, the traditional low-land rice cultivation is no longer sustainable. Therefore, there is an urgent need to develop technology for rice production with relatively low water demand. Aerobic rice is considered a promising option under these water scarce scenarios. A field experiment in India was conducted to compare crop growth, water use and nitrogen (N) use efficiency between aerobic and flooded rice. The results indicated an average 41% reduction in water use and 27% reduction in yield as compared to the flooded rice. The water use efficiency was 0.46 g grain per kg water for aerobic rice in comparison to 0.36 g grain per kg water for flooded rice. Nitrogen balance measured using ^{15}N showed that flooded rice plants recovered 30.2-34.7% of applied N. Approximately 23.4-27.7% of applied N remained in the 0-30 cm soil after harvesting the rice. In aerobic plots, rice crop recovered 20.0-23.2% of applied N, 20.0 -24.8% N remained in the soil. This indicated very poor nitrogen use efficiency for the first crop. Rice was followed by maize crop which recovered 3.34% to 3.94% of the N derived from N fertilizer applied to the previous rice crop. Nitrogen recovery decreased in the subsequent two crops (0.28 to 1.21%). A scenario study was done using CERES rice model to analyze the effect of water regimes and N levels on the aerobic rice yields. Seasonal and sequence analysis of Decision Support Systems for Agrotechnology Transfer (DSSAT 4.5) was used to select the best combination of moisture regimes and N application rates for sustainable production of rice-maize cropping system in semi arid tropics.