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The Effect of *Azolla* on N Use Efficiency in Rice-Wheat Rotations of Nepal

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Abstract

The efficiency of applied urea -N is very low in farmers' fields of Nepal. High temperatures combined with high floodwater pH during the day (effect of the activity of the photosynthetic aquatic biomass) favor the losses of newly applied mineral fertilizer N by the process of ammonia volatilization, particularly during the early growth stages of lowland rice. Previous studies under controlled conditions in pots as well as under field conditions in the Philippines could show that a dense cover of the floodwater by the floating fern *Azolla* can reduce NH₃ losses by buffering diurnal variations in floodwater chemistry and by direct N absorption. While increasing the role of *Azolla* in reducing ammonia volatilization and N sequestration and N use efficiency in a rice (*Oryza sativa* L.) — wheat (*Triticum aestivum* L.) cropping system of Nepal was investigated in farmers' fields between 2001 and 2002. Five urea N rates (0 – 30 – 60 – 90 – 120 kg split-applied N ha⁻¹), sole *Azolla* (5 t ha⁻¹) and *Azolla* plus urea (60 kg N ha⁻¹) application to lowland rice were compared and residual effects were evaluated in the subsequent wheat crop. *Azolla* coverage decreased the floodwater pH by 1.8 units and the ammonia partial pressure by 0.336 Pa, thus reducing the potential for ammonia volatilization from the flooded rice field after urea application. Consequently, the application of *Azolla* in combination with urea increased rice yields by 10–14 % above the sole urea treatment. The ¹⁵N-recovery of the first urea application in the soil-plant system was less than 40 % and did not differ between *Azolla* and sole urea treatments. However, ¹⁵N-recovery for the second dose of urea (topdressing) was significantly higher with *Azolla* (90 %) than in sole urea treatments (75 %). While no significant residual effects on the subsequent crop of wheat were observed, *Azolla* contributed to the reduction of ammonia volatilization and increased the efficiency of applied urea N in lowland rice.

Keywords: N-recovery, ¹⁵N, *Oryza sativa*, *Triticum aestivum*, urea