



Deutscher Tropentag, October 11-13, 2005, Hohenheim

“The Global Food & Product Chain—
Dynamics, Innovations, Conflicts, Strategies”

Wheat Straw Application Can Reduce N Losses from Rice-Wheat Cropping Systems in Nepal

SUCHIT SHRESTA, THUWEBA DIWANI, MATHIAS BECKER, KESHAB RAJ PANDE

University of Bonn, Plant Nutrition in the Tropics and Subtropics, Germany

Abstract

Long-term cropping experiments in South Asia indicate declining yield trends in rice-wheat rotations. Particularly under conditions of low external input use, this yield decline is linked to N deficiency and to soil N losses that occur mainly between the harvest of wheat and the transplanting of monsoon season rice. Improved management options must target this dry-to-wet-season transition period (DWT) to effectively control N losses. In the high altitude sites of the Himalayas, this DWT during which the soil aeration status changes from aerobic to anaerobic is too short to grow any crops and the only available option to protect mineral soil N from losses is its temporary immobilisation in the microbial biomass after application of low-quality crop residues (wheat straw). Experiments were conducted in potted soil in the greenhouse and under field conditions at Lumle (Karsi province, 1700 m asl) to study the effect of wheat straw at different application rates (0, 1.5 and 3 Mg ha⁻¹) and methods (mulching vs. incorporation) on soil N dynamics and rice response. In the bare fallow (farmers' practice), a gradual increase in soil moisture resulted in a build-up of 48 kg ha⁻¹ of soil NO₃-N, which declined to <1 kg upon soil flooding. This decline was associated with nitrate leaching (14 kg ha⁻¹) and a peak in nitrous oxide emissions (11 mmol N₂O m⁻²). Straw application reduced the soil nitrate-N peak to 18–33 kg ha⁻¹, with a parallel increase in soil microbial biomass N, a 20–35% reduction in the emission of nitrous oxide, and a 50% reduction in nitrate leaching compared to the bare fallow. The effectiveness of wheat straw in conserving soil N, building soil organic matter and increasing N uptake and the yield of rice increased with straw application rate and the length of the transition season, and tended to be more with straw incorporation than with surface mulching. In areas where wheat straw is no tradable commodity (animal bedding, fuel), it may present a valuable resource to reduce native soil N losses during the relatively short DWT in rice-wheat systems of higher altitudes and increase the yield of rice and possibly of wheat.

Keywords: Denitrification, nitrate leaching, *Oryza sativa*, *Triticum aestivum*