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Managing Rice-Wheat Cropping Systems of Nepal for a More Efficient Soil N Use

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Abstract

The rice-wheat annual double cropping system occupies an estimated 0.5 million hectares in Nepal where it provides food for about 23 million people. The production systems are similar regarding soil type and agronomic management but differ in terms of the climatic environment, stretching from subtropical lowlands to temperate mountain areas. Current production is far below the reported potential, with N-deficiency being the major constraint. Subsistence-oriented smallholder agriculture limits the use of mineral fertiliser and crops have to rely largely on native soil supply for their N nutrition. Between the harvest of winter season wheat and the transplanting of monsoon season rice lies a transition season of variable length (>10 weeks in the lowlands to <5 weeks in the mountains) where the land is typically under bare fallow. During this dry-to-wet season transition period (DWT), the soil aeration status changes from aerobic to anaerobic, resulting in an initial peak of soil N mineralisation and its subsequent disappearance upon soil flooding. Protecting this native soil N from being lost is seen to improve the N nutrition of crops and the currently negative N balances with impact on productivity.

Possible options may include the temporary immobilisation of soil N in the biomass of soil microorganisms and/or of transition season crops. The choice of suitable crops and management options depends on site conditions. Particularly the thermal environment will determine the duration of the vegetative growth phase of the cereals and hence influence the length of DWT available for the cultivation of transition season crops. On the other hand, integration of promising “new” crop species to build soil fertility and generate food and income may offset the existing cropping calendar, pushing the critical growth stages of rice in periods with extreme climatic events and/or result in conflicts of labour time allocation.

A DFG/BMZ-funded collaborative research project between the universities of Bonn and Rampur and the Nepal Agricultural Research Council studied the extent and the processes of soil N transformation, technical options for N conservation and phenological characteristics of cultivars to fit the agronomic calendars of the new cropping systems.

Keywords: *Mucuna*, *Oryza sativa*, *Triticum aestivum*, *Vigna radiata*, wheat straw, *Zea mays*