

Multiseason recoveries of organic and inorganic nitrogen-15 in tropical cropping systems

ABSTRACT

In tropical agroecosystems, limited N availability remains a major impediment to increasing yield. A ¹⁵N-recovery experiment was conducted in 13 diverse tropical agroecosystems. The objectives were to determine the total recovery of one single ¹⁵N application of inorganic or organic N during three to six growing seasons and to establish whether the losses of N are governed by universal principles. Between 7 and 58% (average of 21%) of crop N uptake during the first growing season was derived from fertilizer. On average, 79% of crop N was derived from the soil. When ¹⁵N-labeled residues were applied, in the first growing season 4% of crop N was derived from the residues. Average recoveries of ¹⁵N-labeled fertilizer and residue in crops after the first growing season were 33 and 7%, respectively. Corresponding recoveries in the soil were 38 and 71%. An additional 6% of the fertilizer and 9.1% of the residue was recovered by crops during subsequent growing seasons. There were no significant differences in total ¹⁵N recovery (average 54%) between N from fertilizer and N from residue. After five growing seasons, more residue N (40%) than fertilizer N (18%) was recovered in the soil, better sustaining the soil organic matter N content. Long-term total recoveries of ¹⁵N-labeled fertilizer or residue in the crop and soil were similar. Soil N remained the primary source of N for crops. As higher rainfall and temperature tend to cause higher N losses, management practices to improve N use efficiency and reduce losses in wet tropical regions will remain a challenge.

Keyword: FUE, fertilizer use efficiency, NUE, nitrogen use efficiency, SOM, soil organic matter