

A major challenge in developing agroforestry approaches that utilize tree-leaf biomass for provision of N to crops is to ensure synchrony between the N released from decomposing prunings and N demand by crops. A study was conducted in the subhumid highlands of Kenya to assess the rate of decomposition and mineralization of soil-incorporated *Calliandra calothyrsus* Meissner (*calliandra*) and *Leucaena leucocephala* (Lam.) de Wit (*leucaena*) tree biomass and maize roots (*Zea mays* L.) both in an alley cropping and a sole cropping system. The amount of mineralized N peaked four weeks after planting (WAP) maize in all the treatments during both seasons of 1995. Cumulative mineralized N at week 20 ranged from 114 to 364 kg N ha<sup>-1</sup> season<sup>-1</sup>, the absolute control treatment giving the lowest and the prunings-incorporated treatments giving the highest amounts in the two seasons. Total N uptake by maize, ranging from 42 to 157 kg ha<sup>-1</sup> season<sup>-1</sup>, was lowest in the 'alley-cropped, prunings-removed' treatments, and highest in the 'non alley-cropped-prunings-incorporated' treatments. The apparent N recovery rate by maize was highest in the fertilizer applied treatments in the two seasons. Decomposition rate constants (kD) ranged from 0.07 to 0.21 week<sup>-1</sup>, and the rates among the different plant residues were as follows: *leucaena* < *calliandra* < maize roots. Nitrogen release rate constants (kN), ranging from 0.04 to 0.25 week<sup>-1</sup>, followed a similar pattern as the rate of decomposition with *leucaena* releasing the highest amount of N followed by *calliandra* and lastly by maize roots.