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Decomposition and nitrogen release patterns of shrubs/trees leafy biomass in the Sahelian zone of Senegal in West Africa

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Abstract

In open-parkland systems of the West African Sahel, farmers often apply leafy plant biomass to their croplands to maintain soil productivity. Nonetheless, there is a need for research that examines how shrub and tree leaf biomass decompose and mineralize to better understand processes of nutrient cycling in these agroecosystems. The present study therefore aims at monitoring decomposition and nitrogen (N) release of leafy biomass of selected shrub and tree species from the region. Using the litterbag technique, our study was conducted in the Louga Region of Senegal with leaves of *Faidherbia albida* (Delile) A.Chev., *Pterocarpus lucens* Lepr., *Guiera senegalensis* J. F. Gmel., and *Piliostigma reticulatum* (DC.) Hochst. Each litterbag was filled with 26 g of leaves which were placed on the soil surface and sampled at weeks 2, 4, 8, and 16. Decomposing leaves lost on average 30 % of their initial dry weight in the first four weeks after placement. At weeks 2, 4, 8, and 16, DM losses of *F. albida* were with 43 %, 43 %, 51 %, and 44 %, respectively, significantly ($p < 0.05$) larger than those of *G. senegalensis*. Only at week 2 average N releases of *F. albida* and *P. lucens* were significantly (9 %, $p < 0.05$) higher than of *G. senegalensis* and *P. reticulatum*. Nitrogen fixing trees and shrubs species (*F. albida* and *P. lucens*) had a higher decomposition and nitrogen release because of their lower C/N ratios. To improve application efficiency for crop yields, use of mulched leaves should be tailored depending on the type of leafy biomass to optimize synchronization of nutrient release with crop nutrient demands.

Keywords: Agroforestry, litter quality, litterbag technique, nutrient cycling, organic agriculture