

Effects Of Residue Quality And Climate On Plant Residue Decomposition And Nutrient Release Along The Transect From Humid Forest To Sahel Of West Africa

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Abstract

Field litterbag studies were conducted in the 2000 rainy season and the 2000/2001 dry season along the transect of West African major agroecological zones (agroeco-zones) to measure the decomposition of, and N and P release from 5 plant residues (leaves of woody species) with increasing quality: *Dactyladenia barteri*, *Pterocarpus santalinoides*, *Alchornea cordifolia*, *Senna siamea* and *Gliricidia sepium*. The decomposition rate constant (wk^{-1}) ranged from 0.034 (*Dactyladenia*, subhumid zone) to 0.49 (*Gliricidia*, humid zone) in the rainy season, and from 0.01 (*Dactyladenia*, subhumid zone) to 0.235 (*Pterocarpus*, arid zone) in the dry season. The direct correlation between the decomposition rate of plant residues and their quality was only valid in agroeco-zones where there is not moisture stress. Similarly, the direct correlation between the decomposition rate of plant residues and moisture availability was only valid for plant residues with high quality. The decomposition rate of the low quality plant residue could increase from humid to arid zone in West Africa. In the arid zone, the low quality plant residue could also decompose faster than high quality plant residue. The climate-residue quality interactive effects on plant residue decomposition in West Africa were attributed to the feedback of low quality plant residue's mulching effect, soil fauna and appreciable photodegradation in dry regions. A decomposition equation that could be used to predict the decomposition rate of plant residues with various qualities across agroeco-zones in West Africa was obtained from this study. The equation was expressed as follow: $k = 0.122 - 0.000747*PRQI^2 - 0.0233*PRQI*CI + 0.00337*CI*PRQI^2$, in which k is the decomposition rate constant (wk^{-1}), $PRQI$ the plant residue quality index, and CI the climate index (ratio of rainfall to sunshine hours cumulative during the entire decomposition). The response of N and P release from plant residues to residue quality and climate was similar to that of residue decomposition. At the late stage of the dry season decomposition, the high C/N and C/P ratio plant residue (*Dactyladenia* leaves) that immobilized N and P in wet zones showed a release of N and P in the dry zone.

Keywords Decomposition rate constant - N and P release - Mulching effect - Soil fauna - Photodegradation - Nigeria - Niger