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Litterfall production and associated macro and micro-nutrient fluxes in indigenous agroforestry systems landscape, Ethiopia

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Abstract

Production of litter from standing trees, shrubs, and other herbaceous species in agroforestry (AF) systems contributes significantly to maintaining and enhancing soil fertility. The contribution of litterfall to nutrient cycling in AF systems at the stand level in Ethiopia remains understudied. The study aimed to compare litterfall production and investigate associated macro and micro-nutrients in enset based, enset-coffee based and coffee-fruit tree-enset based AF systems. Five farms were selected randomly from each AF system and each farm had three replications. Litterfall traps were randomly assigned in a 10×10 metre farm plot and litterfall collection was carried out for one year. A multiple linear regression model was developed to examine the effect of climatic factors (temperature, rainfall, wind speed, and relative air humidity) on litterfall production. The annual litterfall production of the AF system as stand level per unit area of land was the highest for the coffee-fruit tree-enset based AF system (average 9.8 tone ha⁻¹), followed by the coffee-enset based (4.1 tone ha⁻¹), and the Enset based (3.7 tone ha⁻¹). The associated annual fluxes Ca, K, Mg, Mn, Na, P, and S (kg ha⁻¹) in the AF system with the highest litterfall sepcifically, coffee-fruit tree-enset based AF were 186, 99, 23, 6, 1, 8 and 10 respectively. The corresponding C and N fluxes (kg ha⁻¹) were 4692 and 192 respectively. The result of one-way ANOVA followed by post-hoc testing (Fisher's LSD test) (n=12) showed that the coffee-fruit tree-enset based AF system was significantly different ($p < 0.05$) for the nutrients Ca, K, Mg, Mn, Na and P. The annual nutrient flux of nutrients in the current study was considerably higher than ones reported for some forests and AF systems of tropical regions. The results of multiple regression analysis using stepwise backward model fit method revealed that, out of the four climatic factors, temperature was the only predictor which has a significant effect on litterfall production and included in the model. In general, the implication of good nutrient flux is the sustainable production of crops, fruits, vegetables, and other spices as a result of efficient nutrient cycling of different elements within the system.

Keywords: Coffee, enset, indigenous Agroforestry system, nutrient fluxes