Increased Ammonium/Nitrate (NH 4 + /NO 3 -) ratios along Faidherbia albia Stand age gradients: An indication for Ecological Processes and Communities Successions

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Abstract

Increased in soil total nitrogen (TN) as influenced by *Faidherbia albida* here after *F. albida* have been explored for decades. However, changes in ammonium (NH_4^+) to nitrate (NO_3^-) ratios as influenced by the tree and the relationships with other soil physicochemical and biological properties were not explored. Thus, the present study was carried out in 2023 to investigate changes in soil NH_4^+/ NO_3^- ratios and the relationships with biotic and abiotic factors across different stand age of *F. albida* in a semi-arid *Arenosols* at Abraha we Atsbeha, northern Ethiopia. Soil NH_4^+ and NO_3^- were extracted using analytical grade potassium chloride solution and their concentrations were determined by colorimetric method using UV-VIS spectrophotometer (Model: UV-VIS Spectrophotometer, Series No.: AE1605020). One-way analysis of variance (ANOVA) was done to compare means and Pearson correlations using IBM SPSS Statistics Version 20, and redundancy analysis (RDA) using CANOCO software to understand the relationships among soil physicochemical and biological variables. Our results indicated that TN, NH_4^+, NO_3^- and NH_4^+/ NO_3^- ratios significantly ($P < 0.05$) increased with *F. albida* stand age. The most important thing here was that the proportion of NH_4^+ has been succeeding over NO_3^- and this could have profound effect on both below and above ground features of the *Arenosol* agro-ecosystem. Moreover, redundancy analysis (RDA) showed that NH_4^+ concentration strongly associated with soil moisture content (MC), cation exchange capacity (CEC), TN, extractable base cations (K, Ca, Mg), extractable phosphorus (EP), soil organic Carbon (SOC), organic matter (OM) microbial biomass carbon (MBC), clay texture, abundance of nematodes, density of fibrous rooted weeds while it was found to have negative relationships with soil bulk density, sandy texture and pH. Our findings enabled us to accept the hypothesis that NH_4^+/ NO_3^- ratios would increase with increasing *F. albida* stand age. In conclusion, increased *F. albida* stand age in agro ecosystems would increase NH_4^+/ NO_3^- ratios. Consequently, this triggered below and above ground communities successions and ultimately surpasses production and productivity of arid and semi-arid *Arenosols*.

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