40 years of Studies on the Relationships Between Grass Species, N Turnover and Nutrient Cycling in the Lamto Reserve in the Ivory Coast (Côte d'Ivoire)

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Introduction The Lamto Station, dominated by grass savannas, was created in 1963. Among other problems, the relationships between savanna grasses (mainly *Andropogoneae* supertribe) and nutrient cycling, mainly nitrogen (N), have been intensively studied. Such grass systems are of major interest. Savannas represent 25% of terrestrial biomes and are second to tropical forests in the contribution to terrestrial primary production and are predominant in African social and economic environments. The *Andropogoneae* grasses are of particular interest for pastures. Second, savannas are generally extremely nutrient-poor, especially for N, which often limits productivity. Third, little is known about possible controls of grasses on N processes (e.g. nitrification) which could provide plants with potential advantages in competing for N, and induce changes in system N balance. Finally, these areas are considered to be non-emitting for NO and N_2O as a result of extremely low nitrification.

Results For over 40 years, grass cartography, systems, reproduction and genetic variability have been studied in the Lamto savannas. Distinct high (HN) and low (LN) nitrification sites have been discovered. Nitrification was positively (HN) or negatively (LN) correlated with root densities of distinct grass populations of the same species (Figure 1, Lata *et al*., 2000). *In situ* plots showed that populations directly controlled nitrification (Lata *et al*., 2004) and were adapted to different N forms: NH_4^+ (LN) or NO_3^- (HN). In LN sites, the denitrification level was 10-fold less than HN sites. In competition experiments, LN grass out competed HN grass. Isotopic fractionation (^{15}N) (Abbadie *et al*., 1992) showed that grasses used N mainly from their own root system. Recent experiments showed that other controls were exerted on N fluxes: climate (rainfall), trees or termite mounds.

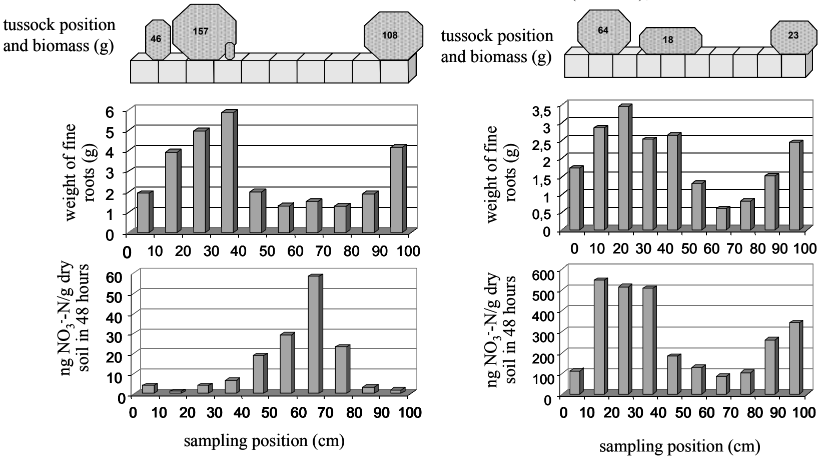

Figure 1 Transects in the LN site (left) and the HN site (right) at 0-10 cm depth. From top to bottom: tussock biomass, total fine roots weight and nitrifying enzyme activity

Conclusions An ability to inhibit nitrification, either through inhibition or superior plant competitiveness compared with microorganisms, could give a strong competitive advantage to LN plants. Our results suggest that grass species have important consequences for N cycling at population scales. For individual plants, N turnover is rapid and tightly controlled. Grasses seem well adapted to low N levels typical of the savanna ecosystems and, with other environmental patterns, create a high degree of 'patchiness' of nutrient resources at landscape scales.

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