
Effect of plant diversity on above and below ground food webs, perspectives to enhance pest regulations in agroecosystems

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Abstract

Plant diversification is a promising mean to enhance ecological pest regulation occurring through food webs. However, the complexity of interactions in diversified ecosystems and the multiplicity of pests damaging a crop require i) understanding the effect of plant diversity on food webs and ultimately pests and ii) accounting for potential trade-offs between regulation processes that may be antagonistic. We studied above and below ground food webs including pests in a gradient of banana agroecosystems ranging from monoculture to agroforestry. We measured trophic groups and pests' abundances of soil nematodes' community and litter arthropods' community, as well as plant species richness, soil cover, and soil properties. Using structural equation modeling, we tested the hypothesis i) that vegetation and soil characteristics affected nematodes and arthropods food webs and ii) that these food webs were implied in the regulation of banana plant-parasitic nematodes and of the banana weevil (*Cosmopolites sordidus*), respectively. Above ground, low plant species richness and low living cover proportion supported higher abundances of pioneer dominant ant species. In turn, these ant species negatively affected the abundance of *C. sordidus*, suggesting top-down control. Below ground, plant species richness and bare soil cover proportion positively affected the abundance of bacterivorous and fungivorous nematodes, in turn enhancing predatory nematodes' abundance. Nevertheless, potential subsequent top-down control of plant-parasitic nematodes was dampened by the diversity of *Musaceae* which had a strong antagonistic bottom-up effect. We discuss the implications of our results to comprehensively design plant-diversified agroecosystems that improve pest regulation processes and agronomic performances.

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