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Enzyme assays and measures of soil microbial activity in relation to trace element and nutrient availability

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Soil enzyme activity has been determinated to evaluate microbial activity in soil and soil functionality since long time. For this purpose, several indices based on soil enzyme and microbial activity have been created to assess soil fertility, soil functionality and sustainability of agricultural practices. Despite the extensive literature, to date the value of this kind of measurement is still questionable due to technical misapplications, lack of methods standardization, use of single measurements to estimate soil microbial activity, difficulty in discriminating between the contributes of the different enzyme locations, limited fundamental research at the molecular level. Some enzyme activities involved in lignine and cellulose degradation are significantly correlated to soil decomposition processess, but hydrolases activities are generally not correlated to with nutrient turnover. Recently, nutrient turnover models including enzyme-mediated soil organic matter decomposition have been proposed; it has been hypothesized that soil enzyme activiy may respond non lineraly to the decomposition rate, and thus may impair the C:N ratio, and divert C mineralization from growth to maintenance. The use of this soil enzyme activity-based conceptual approach has revealed that the C flow might be enzyme-limited whilst microbial growth may be N-limited, even in soils where microbial respiration does not increase upon N supply. These findings might be important for our better understanding of nutrient cycling in the agro-ecosystems and soil nutrient supplying capacity to crops. Our contribution addresses the relationship between soil enzyme activity and soil microbial activity determinations in relation to trace element and nutrient availability in soil. Future research needs for a better interpretation of the meanining of soil enzyme activity are also proposed.