# IMPACTS OF DIRECT PLANTING ON PERMANENT SOIL COVER (DPPSC) TECHNIQUES ON SOIL BIOLOGICAL ACTIVITY IN NORTHERN VIETNAM

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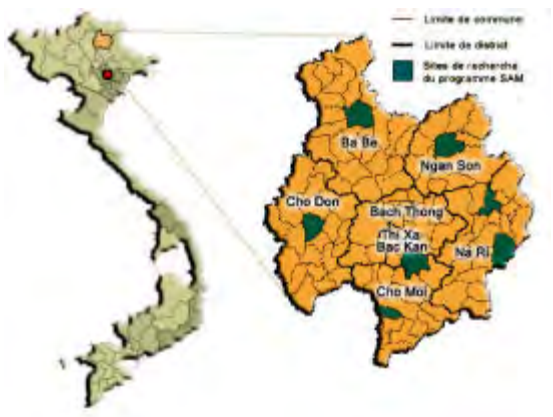


*Experimental sites in Northern Vietnam*

***The role of soil fauna, especially macro fauna, in soil genesis processes is now well known (Ketterings et al, 1997, Caesar-Thon That and Cochran, 2000). Thus, soil macro-fauna and its activity can accurately reflect soil functioning: recent works showed a direct and proportional relationship between earthworms activity and vegetal growth.***

***To prevent soil degradation upon cultivation, cropping practices enabling the creation and the protection of an environment favourable to micro- and macro-fauna have been created, based on Direct Planting on Permanent Soil Cover (DPPSC). Such systems have been developed for acid, ferrallitic soils of Northern Vietnam mountains, proposing a range of alternative to the traditional slash-and-burn systems, based on permanent soil cover with plants such as Brachiaria species and* Arachis pintoï *(Husson et al, 2001). Between 2000 and 2002, studies on soil biological activities under these systems have been conducted.***

## - Field diagnosis of biological activity,

based on observation in various horizons of soil structure, texture, pH, organic matter, soil aeration, root systems and fauna, evaluation of soil lixiviation and analysis of biological activity showed:

- A rapid soil degradation (biologically but also chemically and physically) upon cultivation with traditional systems, confirmed by measurements of biological activity.
- The fast recovery of soil biological activity with all the systems based on DPPSC.
- The extremely powerful root system of Brachiaria sp. which allow fast oxygenation of hydromorphous pastures, recycling of nutrients and increase in organic matter, even in the deep horizons (over 1 m).

*Brachiaria brizantha roots and oxidized rhizosphere*

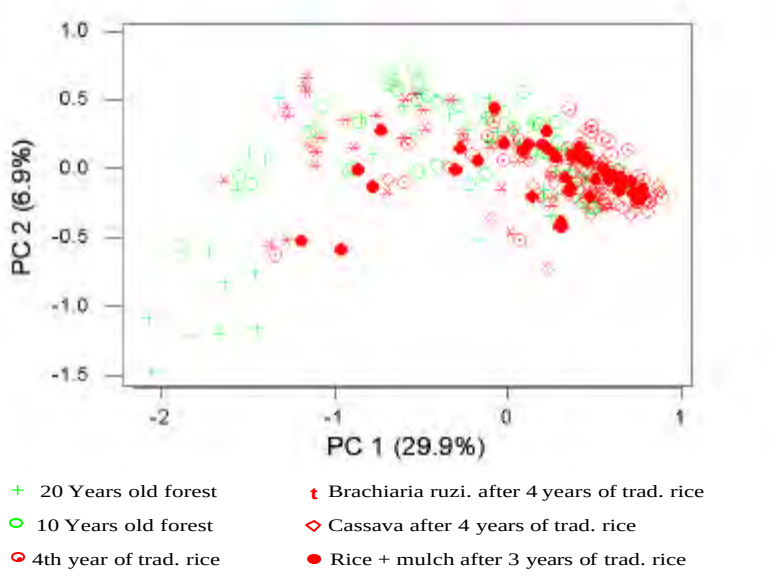


*Figure 1: Principal Component Analysis of FAME profiles. Only fatty acids 20 carbons and less in length considered (only microbial activity) in the analysis. Number in parenthesis on each axis indicate the percent variance explained by this axis.*

## - Study of soil microbiological activity

(analysis of 3 replications per system), for various horizons, **by FAME method** (Fatty Acid Methyl Ester, Kennedy, 1994). The Eukary method of the Microbial Identification System (MIS) by Microbial ID, Inc. (MIDI, Newark, DE) was used to develop a fatty acid profiles which were compared through principal component analysis (PCA). It showed:

- Different microbial populations between pasture, and all other systems or forests.
- Discrimination along PC1 indicating an evolution of microbial population with degraded systems on the right side (the most degraded being "Cassava") and favourable ones on the left side (20 years old forest).
- Microbiological populations identical for "Brachiaria" (after less than two years of *Brachiaria ruziziensis*) or after 10 years of natural forest regeneration.

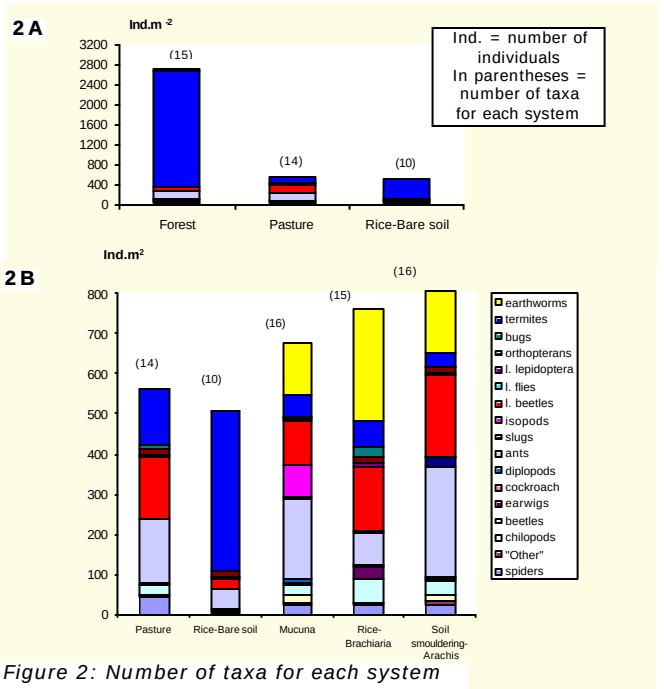


*Figure 2: Number of taxa for each system*

**Numbering and identification of macro-fauna populations (10 replications per system) showed:**

- A significant decrease in biodiversity (number of taxa) and density of the macrofauna with traditional systems of rice monocropping with bare soil and pasture as compared to preceding forest (Figure 2A).
- A rapid raise of biodiversity and density of the macrofauna from degraded soil when cultivated with a permanent soil cover associated to the main crop ("Arachis", "Brachiaria/rice" and "Mucuna"), but with differences according to cover crop species and crops management (Figure 2B).
- A replacement of termites by earthworms (having a very positive action on soil) which are not present when soil is not kept covered.

## - Conclusions

***These changes in micro and macro-fauna populations, abundance, and diversity and the soil biological activity all follow the same trends: a rapid decrease upon cultivation with traditional systems, and a fast improvement when a vegetal cover is permanently kept on the soil and plants with strong root systems improve its structure. These evolutions are similar to trends in yield evolution under various cropping practices. DPPSC systems proved to be highly efficient in restoring biological activity and fauna diversity in degraded soils.***

**References:**

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