Impact of cultivation practices (cover crops) on soil macrofauna in Réunion

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Most farming practices are detrimental to soil organic matter reserves, leading to a significant decrease in biological activity and an increased risk of erosion. Soil invertebrate populations (macrofauna) are also sharply reduced in annual crop systems. The role of macrofauna in pedological processes and in the regulation of microbial activity has been fully described (Lavelle et al., *1999). Some agroecological practices and especially plant covers—straw mulch or perennial plants intercropped with annual crops—can enhance the sustainability of tropical cropping systems (Séguy* et al., *1996). This study was aimed at assessing the effects of two plant covers (greater bird's food trefoil,* **Lotus uliginosus,** *and oat,* **Avena sativa***) on soil macrofauna populations in Réunion (Indian Ocean).*

Material and Methods

Using an experimental block design with five replications, soil macrofauna was first sampled in 1999 prior to sowing the maize crop in the test plots:

- on bare soil
- with trefoil cover
- with oats (unmown).

The second sampling was done at the end of the maize crop cycle (in 2000) with three treatments:

- maize cropped on bare soil
- maize intercropped with trefoil
- maize intercropped with oat.

Macrofauna were sampled using the technique recommended in the TSBF handbook (Tropical Soil Biology and Fertility, Anderson and Ingram, 1993).

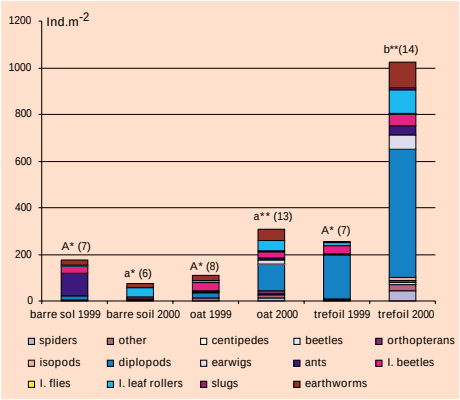


Figure 1. Mean total soil macrofauna density.

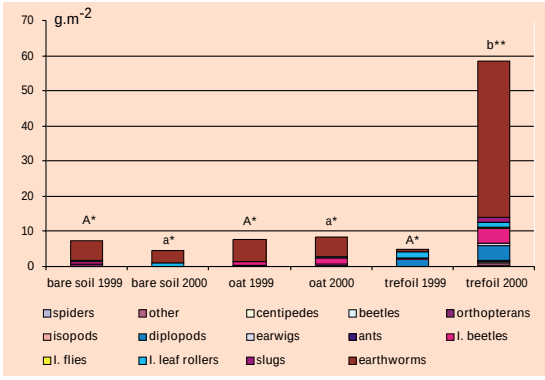
The same capital letter = a significant difference ($p < 0.05$) between three treatments for the first sampling (1999). The same small letter = a significant difference ($p < 0.05$) between three treatments for the second sampling (2000). The same number * = a significant difference ($p < 0.05$) between the two sampling dates for the same treatment. In parentheses = the number of taxa.

l. = larva
Ind. = number of individuals

Figure 2. Mean total soil macrofauna biomass.

The same capital letter = a significant difference ($p < 0.05$) between three treatments for the first sampling (1999). The same small letter = a significant difference ($p < 0.05$) between three treatments for the second sampling (2000). The same number * = a significant difference ($p < 0.05$) between the two sampling dates for the same treatment.

l. = larva
g = gramme



Results

❑ The results of the first sampling (1999) before sowing the maize crop, just before mowing the oat crop and under 3 month-old trefoil cover, revealed no significant differences between the three treatments with respect to soil macrofauna population density and mean total biomass (Figures 1, 2).

❑ At the end of the maize crop cycle (5 months, in 2000), a second sampling was carried out and a significant increase in soil macrofauna density was noted under trefoil and oat cover as compared to the control on bare soil (Figure 1). A significant increase in mean biomass was only noted under trefoil cover (Figure 2).

❑ For the same treatment, a comparison between the two sampling dates highlighted a significant increase in macrofauna density and biomass under trefoil (Figures 1, 2), but only in density under oat cover (Figure 1).

❑ For the taxa studied (14), there was a substantial increase in biological diversity under both plant covers (Figure 1).

Conclusions and Discussion

Cropping generally leads to a decrease in soil macrofauna. The use of perennial plant covers (trefoil) and mulch (oat straw) helps to restore soil macrofauna by increasing their densities, biomass and diversity.
Some of these macrofauna taxa, are more sensitive to the type of plant cover used, e.g. earthworms, whose mean biomass represents more than 50% of the total macrofauna biomass, and diplopods (phytophages, saprophages). Diplopods seem to be characteristic of trefoil since they were found in high densities under this cover. These taxa have a direct and indirect impact on fresh organic matter (litter) and on soil organic matter. Other studies have highlighted the effects of earthworms on soil nutrient dynamics and soil structure.

References

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Séguy L, Bouzinac S, Trentini A, Côrtes NA (1998) Brazilian frontier agriculture. Agriculture et Développement Spécial Brésil, 64 pp.

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