Plant covers, soil macrofauna and geranium cropping

A. CHABANNE[1], J. BOYER[1], R. MICHELLON [2], L. SEGUY[3]
1. Cirad, Station des Colimaçons - 29 Rue Leconte Delisle 97416 La Chaloupe-Saint-Leu
andre.chabanne@cirad.fr - johnny.boyer@cirad.fr
2. Cirad, BP 319 - Antsirabe 110 - Madagascar
roger.michelon@cirad.fr
3. c/o Tasso de Castro, BP 504 - Agencia Central CEP 74000-970 Goiânia GO - Brazil - lucien.seguy@cirad.fr


Geranium cropping on straw mulch.
© A. Chabanne

In the highlands of western Réunion, the abandonment of fallowing, the use of monocropping and crop rotations under bare soil conditions, and excessive application of pesticides has led to physical, chemical and biological soil degradation. The technical and socioeconomic performances of farms with geranium (Pelargonium x asperum) *as main crop have been markedly affected by these trends. They have also had a detrimental effect on the environment—already weakened by serious natural constraints. Cropping over plant covers could enhance the sustainability of such farms under these adverse conditions.*

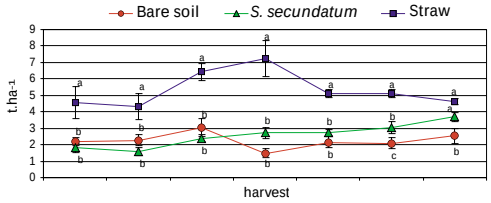
Material and methods

On a highly eroded andosol plot, an experimental block design was used with six replications. The tests were carried out by farmers over an 18-month period. Two types of cover were tested: a sugarcane *(Saccharum officinarum)* straw mulch derived from crop residue (especially leaves) obtained after sugarcane harvests; a live *Stenotaphrum secundatum* cover planted in a geranium field, kept alive and controlled with low-dose selective herbicide treatments.

Results

As compared to a control geranium crop grown on bare soil, the sugarcane straw mulch treatment led to significantly higher production of green above-ground biomass (Fig. 1). *S. secundatum* only had a significant positive effect on crop yields after 1 year of cropping.

Fig. 1. Geranium green above-ground biomass production (t.ha^{-1}). Vertical bars represent the standard error.



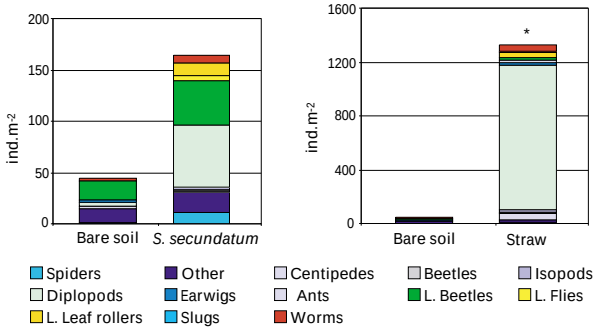
a, b, c: The same letter for the same date indicates that the difference was not significant (Newman-Keuls test; p< 0.05).

Since essential oil yields were not significantly affected by the different treatments, the resulting overall production showed the same patterns. In one crop year involving five harvests, 80 l.ha^{-1} of essential oil was yielded when cropping over sugarcane straw mulch, compared to 35 l.ha^{-1} when cropping on bare soil.

With both treatments involving plant cover, a study of mean soil macrofauna densities (Fig. 2) revealed a biodiversity renewal, especially with straw mulch (13 taxa), and a substantial increase in the number of diplopods and earthworms per square metre.

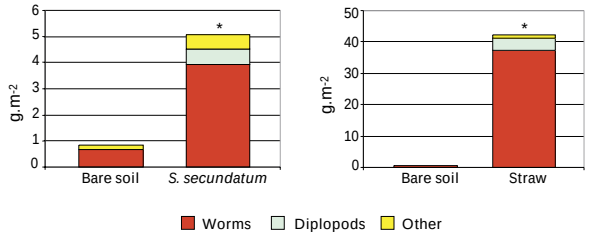
A study of mean biomass (Fig. 3) revealed that two groups markedly benefitted from the plant covers (especially the straw mulch), i.e. earthworms and diplopods, which feed on the litter layer.

Fig. 2. Mean density of the different soil macrofauna taxa.



*: Significant differences (ANOVA, p< 0.05, for mean total densities) relative to the control (bare soil).

Fig. 3. Mean biomass of the different soil macrofauna groups. Other: pools the 11 other taxa.



*: Significant differences (ANOVA, p< 0.05, for mean total densities) relative to the control (bare soil).

Conclusions

On eroded soils, sugarcane straw mulch cover quickly increased essential oil yields. The fact that soil macrofauna diversity was renewed and taxa density and biomass were increased indicated enhancement of biological soil fertility.

It takes time to establish live *S. secundatum* plant cover. This involves forming a litter layer sufficient to reactivate biological processes, especially with respect to bioregulatory cycles.

The results of this field test highlighted the technical and economic benefits of the tested proposals. Farmers are appreciative of the reduction in their labour time and herbicide inputs. Despite the phase required to establish live plant cover and the close management necessary to maintain it, this is an efficient way of building up *in situ* biomass.

Centre de coopération internationale en recherche agronomique pour le développement
Cirad-Editions - maquette@cirad.fr - September 2001