



Soil bacterial community shifts associated with sugarcane straw removal

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In Brazil, the adoption of the mechanical unburned sugarcane harvest potentially increase the quantity of residue left in the field after harvesting. Economically, this material has a high potential for second generation ethanol (2G) production. However, crop residues have an essential role in diverse properties and processes in the soil. The greater part of the uncertainties about straw removal for 2G ethanol production is based on its effects in soil microbial community. In this sense, it is important to identify the main impacts of sugarcane straw removal on soil microbial community.

Therefore, we conducted a field study, during one year, in Valparaíso (São Paulo state - Brazil) to evaluate the effects of straw decomposition on soil bacterial community. Specifically, we wanted: i) to compare the rates of straw removal and ii) to evaluate the effects of straw decomposition on soil bacterial groups over one year.

The experiment was in a randomized block design with treatments arranged in strip plot. The treatments are different rates of sugarcane straw removal, namely: no removal, 50, 75 and 100% of straw removal. Soil sampling was carried out at 0, 4, 8 and 12 months after the sugarcane harvest (August 2015). Total DNA was extracted from soil using the Powersoil™ DNA Isolation kit. And the abundance of bacterial in each soil sample was estimated via quantification of 16S rRNA gene. The composition of the bacterial communities was estimated via terminal restriction fragment length polymorphism (T-RFLP) analysis, and the T-RF sizes were performed on a 3500 Genetic Analyzer. Finally, the results were examined with GeneMapper 4.1 software.

There was bacterial community shifts through the time and among the rates of sugarcane straw removal. Bacterial community was firstly determined by the time scale, which explained 29.16% of total variation. Rates of straw removal explained 11.55% of shifts on bacterial community. Distribution through the time is an important driver of bacterial community variation in sugarcane areas with straw removal and the bacterial community showed clusters according to the sampling date: early sampling (0 and 4 months) and late sampling (8 and 12 months). Alterations on the straw composition over the decomposition process is associated with these shifts on material community among the sampling date.

Moreover, the rates of straw removal separated the bacterial community in two groups: high (75 and 100% of straw removal) and low (50% and no straw removal) rates of straw removal. This pattern could be attributed to differences in the soil environment (humidity and temperature), a strong driver of shifts on bacterial community.

In conclusion, the bacterial community was affected by the time since the straw removal and by the rates of straw removal. Finally, both straw removal management and soil quality should be carefully evaluated, in order to maintain the sustainability of 2G sugarcane ethanol production in Brazil.