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Soil organic matter content and composition as affected by exotic forest plantations in Southern Brazil

Deborah Pinheiro Dick (1,2), Graciele Sarante Santana (2), Heike Knicker (3), Francisco Javier Gonzalez-Vila (3), and Jose Antonio Gonzalez-Perez (3)

(1) Federal University of Rio Grande do Sul, Chemistry, Physical- Chemistry, Porto Alegre, Brazil (deborah.dick@ufrgs.br, 55-51-33087304), (2) Federal University of Rio Grande do Sul, Depto. of Soil Science, Agronomy Faculty, Porto Alegre, Brasil, (3) Institute for Natural Resources and Agrobiology, IRNAS-CSIC, Reina Mercedes Ave., 10, E-41012, Seville, Spain

The global demand for forest products such as wood, pulp and paper promoted the expansion of silviculture areas and also the forest industry sector in the last 15 years in Brazil and the area occupied by planted forest reached 7 million hectare in 2012. Eucalyptus is the most frequently cultivated species with 70 % of the planted forested area, followed by 23 % of Pinus and 2 % of Acacia. The impact of the forest system on the soil properties normally varies according to climate conditions, tree species, stand age, soil class, silviculture practices and soil previous condition. In this context, the aim of this study was to investigate the changes of the SOM content and chemical composition by means of biomarkers and analytical Pirolysis, in order to assess the alterations promoted by forest plantation system. The impact of 7 years of Acacia and Eucalyptus plantations on the chemical properties and on the molecular composition of soil organic matter (SOM) was evaluated in profiles of Cambisols in Southern Brazil. Control soil samples were collected from adjacent areas, corresponding to the original soil conditions before plantation. The soil exchangeable ions and pH were determined and the molecular composition of SOM was assessed by Pyrolysis-Gas Chromatography/Mass Spectrometry (GC/MS) and by analyzing the free lipids composition extracted by Soxhlet method using GC/MS. Acacia plantation lead to a reduction of the contents of exchangeable P, K+, Ca2+ and Mg2+ and a decrease of the soil pH until 40 cm, whereas under Eucalyptus plantation only the exchangeable K+ content decreased. In both sites, nitrogen content was depleted in the superficial soil 5 cm after forest plantation but no change was found in the soil carbon content along the investigated 80 cm profile. Alterations at the molecular level of the soil organic matter composition occurred in both sites. The enrichment of polysaccharide-derived compounds and C31 alkane on the SOM composition, which were derived from the litter, indicated input of biomass from original vegetation in soil under Acacia plantation. At the Eucalyptus plantation site an increase of the proportion of degraded compounds on the SOM composition was observed. The distinct results found for the two forest systems can be partially associated with the C:N ratio of the respective litter. The comparatively faster decomposition of Acacia litter was probably favored by its lower C:N ratio (18) when compared to Eucalyptus litter (35), thus resulting in a biomass input of Acacia litter into the soil. Although the presently employed techniques for the investigation of soil organic matter composition encompass only 10 % of the soil organic matter, we could detect alterations which were not possible by quantitative analysis.