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Organic carbon exportation in a tobacco cropped watershed

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The agricultural land use is indispensable for survival of the humankind; but inadequate agricultural use may disturb or modify steady states generating environmental damage. The amount of organic carbon (OC) in the soil is a result of the balance between addition by primary production and carbon losses, mainly by the oxidation and mineralization by microorganisms activity and depletion by erosion process. The losses will ultimately reduce the primary production, affecting the additions and undermining the soil quality, moving it away from the sustainability. Areas under tobacco (Nicotiana tabacum L.) cropping are generally potential for environmental contamination, because they are based on intensive agricultural operations, with low OC addition, due the removal of almost the totality of the biomass of the main crop. In tobacco, the leaves are the part of commercial interest. This removal, associated with the conventional management of soils makes difficult to preserve the soil OC budget which ends up being rapidly degraded. However, the soil management system also can raise the soil OC content, if not to the original levels, as in the areas under native vegetation, at least, in adequate levels to ensure the soil quality. The organic carbon of an agricultural area may be exported associated to sediments in the fraction associated with minerals (CAM) as in the particulate fraction (POC), or in dissolved form (DOC), however the processes of losses and translocation occurs in distinct ways, as a function of different factors, as soil type, slope length, soil management and climate. The results may also be changed when different scale of observation is adopted. This work was carried out in a rural watershed, cropped with tobacco mainly under conventional management system. Tobacco is still a crop of economic importance in developing countries, such as Brazil. The study was conducted during four years in small plots, hillslopes and catchment scale. In the small plots data was obtained by simulated rainfall, at the hillslope scale, the information assessed was the sediments movement and the carbon enrichment ratio, by the use of collectors positioned in different segments of the catena (upper, mid and down slope position). Each catchment was provided with a Parshall flume with a collecting tank to contain the runoff and sediments losses of each rainfall event. The soil management systems were conventional tillage, minimum tillage and no tillage. An area with native vegetation was also evaluated. The results were compared by regression analysis (small plots) multivariate statistical analysis (hillslope) and the set of all data was analyzed through the elaboration of bayesian network. In small plots scale, under simulated rainfall, only the no tillage, when evaluated at the end of tobacco cropping differed from the others management systems to OC exportation. The exportation was smallest then the others for all OC fractions evaluated (CAM, POC and DOC). During others stages of tobacco cropping, there was not statistical differences. In the hillslope scale it was observed that the sediments movement in conventional tillage areas was more influenced by the format of the hillside (concave or convex) that in areas under no tillage and minimum tillage. Among the areas under conventional tillage, the OC exportation rate was higher in concave areas than in convex areas. Thus, the losses of CAM and POC were higher in the areas under conventional tillage than under no tillage or minimum tillage only in the recently converted areas from native vegetation or prairies to agriculture under conventional soil management. The exportation of DOC, observed in the Parshall flumes, was always higher in the area under no tillage, followed by the native vegetation and then the conventional tillage. The conventional tillage area had a trend of concentration of DOC exportation, which tended to be higher in the period immediately after the soil mobilization, prior the tobacco transplanting or immediately after transplanting. The results also showed that most of CAM and POC are mobilized and lost by mineralization within the area that gave origin to them, while DOC fraction tends to be exported to other segments of the landscape. The exportation of CAM and POC observed in the Parshall flumes were lower than those observed in the small plots and collectors in hillslope,

indicating that the scale of observation affect the obtained results. The probabilistic analysis by bayesian network of all the results demonstrated that only in extreme rainfall events the data obtained in small plots, hillslopes and catchments tend to be equal.