



Use of radionuclide ^{137}Cs as sediment tracer to study soil erosion and the efficiency of agricultural soil practices

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Water erosion is a process of land degradation that affects a large part of agricultural land in Morocco. In 22 watersheds over 15 millions hectares, according to the report of "Plan National d'Aménagement des Bassins Versants", about 11 million hectares are highly threatened by erosion. This phenomenon is responsible on progressive reduction of soil fertility and agricultural production, desertification, and a socio-economic impairment. Furthermore it is a major source of organic and inorganic pollution of surface water

Obtaining reliable data on the rate of soil loss over several spatial and time scales allow assessing the extent of this problem and maximizing conservation measures to be adopted to ensure sustainable agricultural development and less water pollution

For several years' Moroccan scientists and managers were focused on this problematic. Several techniques were developed (experimental plots, modelling...) but have shown a number of important limitations. The use of environmental radionuclides ^{137}Cs as sediment tracer is an excellent and innovator tool for documenting rates and patterns of soil redistribution within the landscape on medium term.

^{137}Cs is an artificial radionuclide, with half life of 30 years, produced from atmospheric nuclear-weapons occurred in the late 1950s and early 1960s. ^{137}Cs measurements provide informations on soil redistribution occurred over the past 45 years. The ^{137}Cs technique was extensively and successfully applied in several regions of the world [1-9]. In Morocco, the potential of the use of ^{137}Cs technique was demonstrated [10-13] and some constraints were identified depending on the local conditions.

The proposed study, integrated into the European project "DESIRE", was conducted in Sehoul watershed, nearby Rabat. Sehoul, located in the Bouregrag basin, is one of the Moroccan regions which suffers from a significant degradation of natural resources.

The aim of this work was focused on the use of radionuclide ^{137}Cs technique to assess quantitative soil losses and to study the efficiency of land practices followed by the farmers during the last 45 yrs in this region.

Three representative agricultural parcels, under same natural conditions, were selected, where two of them with legume/wheat rotation; one cultivated with barley and maize/wheat rotation and the other site with lupine, beans and maize/wheat rotation. The third field, vine is cultivated as monoculture for more than 40 years. Legume/rotation is a recent practice introduced in the region to meet the food needs of the population in terms of legumes.

The mean slope for all studied fields is about 10% with surface area of about, 4 ha, 4 ha and 3ha, respectively. Fields are cultivated in the opposite direction of the slope. Reference samples were taken from flat area in forest site next to studied fields.

Spatial distribution of ^{137}Cs measurements has permitted to show the soil particles behaviors, lateral and longitudinal movements, identifying the areas most vulnerable to erosion, participating in exports of polluting and the most likely contributing to deterioration of the ecosystems downstream.

Proportional (PP) and masse balance 2 (MB) models were used to convert ^{137}Cs measurements to quantitative soil losses. Obtained assessments of soil erosion in the three studied filed, by using those models, lead to a negative sediment balance, more erosion than sedimentation. Net erosion rates were found of about 17,5 t.ha-1.y-1 (PM) 12.5 t.ha-1.y-1 (MB2) for the field planted with barley and maize/wheat rotation and 3 t.ha-1.y-1 (PM), 2 t.ha-1.y-1 (MB2) for the field cultivated with lupine, beans and maize/wheat rotation and 12 t.ha-1.y-1 (PM), 8 t.ha-1.y-1 (MB2) for the last one, with vine monoculture. Site with wheat-barley and maize/wheat rotation

presents less erosion. It appears that this technique prevents or mitigates land degradation in cultivated land. Also, vine used as monoculture gives less erosion in this region.