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Variation of chemical properties as affected by soil redistribution due to water and tillage erosion

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The variation in soil nutrients is crucial to the understanding of productivity of soil undergoing erosion overall, as the latter can result in a decline in soil quality and crop production in the whole landscape. Two toposequences (a long slope and terraced field series) were selected from hilly areas of the Sichuan Basin, China to determine the effects of soil redistribution rates and topographic changes on P, K, and $CaCO_3$, and examine the contribution of water and tillage erosion to the variation and distribution pattern in these chemical properties within different landscapes. For the long slope, soil loss occurred at upper slope positions and soil accumulation was present at lower slope positions. However, terrace banks create a line of zero downslope transport of soil, and lead to abrupt changes in ^{137}Cs inventories over very short distances between the upper (or lower) part of the terrace and the lower (or upper) part of the neighbouring terrace. Extractable K concentrations are significantly related to ^{137}Cs inventories on both the long slope and terraced fields, which suggests that the distribution of extractable K is closely linked to soil redistribution. However, it is noticeable that no close relationship between extractable P concentrations and ^{137}Cs inventories was found on the terraced fields, while there was a highly significant correlation between the two variables on the long slope. The variation in extractable P by soil redistribution was enhanced on the long slope, but was concealed on the terraced fields due to the presence of $CaCO_3$. It is suggested that the variation in extractable P not only depends on soil redistribution in relation to fine soil particles, but is also influenced by other factors such as P-fixation onto $CaCO_3$, the concentration of which itself is linked to soil erosion and redistribution. Therefore, extractable P dynamics with refer-

ence to soil erosion are relatively complex on carbonate-rich soil and parent materials in areas such as those represented by the Sichuan Basin. Tillage erosion, the dominant soil redistribution process on terraced fields, was found to be a major contributor to the variation in soil chemical properties in the terraced field landscape, while water erosion plays an important role in the variation in soil chemical properties in the long slope landscape. In the case of carbonate-rich soils or parent materials, however, tillage erosion did not create accumulations of extractable P in depressions, whereas water erosion results in extractable P losses at upper slope positions and accumulation at lower slope positions.

Keywords:

Chemical property, soil nutrient, soil redistribution, spatial variation, tillage erosion