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Water Erosion in Relation with Soil Management System and Crop Sequence during 20 Years on an Inceptisol in South Brazil

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Soil erosion still remains persistent at the world scale, even if big efforts have been done to control and reduce it, mainly using soil crop residues to protect soil surface. Although in South Brazil the main management system for most crops is no tillage and direct drilling, water erosion prevails as the most important soil erosion type, which is due both, to the high erosivity and the evenly distribution of rainfall over the year. Moreover, some crops are still grown under soil tillage systems consisting of ploughing, harrowing and less frequently chiselling. Starting 1992, a field experiment under natural rainfall has been conducted on an Inceptisol located in Lages, Santa Catarina State, Brazil, which objective was to assess rainfall water erosion. Two soil cover conditions and four soil management systems were studied: I) a crop rotation, which included oats (*Avena strigosa*), soybean (*Glycine max*), common vetch (*Vicia sativa*), maize (*Zea mays*), fodder radish (*Raphanus sativus*) and common bean (*Phaseolus vulgaris*) under the following soil management types: 1) ploughing plus two levelling operations (CT), chiselling plus levelling (RT) and direct drilling with no tillage (NT), and II) bare soil (BS) without crop cover tilled by ploughing plus two levelling. In more than 90% of the study cases, soil losses were collected for single rain events with erosive power, whose erosivity was calculated. Total rain recorded during the 20 year experimental period was approximately 66,400 mm, which is equivalent to roughly 105,700, MJ mm ha^{-1} h^{-1} (EI_{30}), whereas soil losses in the BS treatment were higher than 1,700 $t.ha^{-1}$. On average, soil losses under RT treatment showed a 92% reduction in relation with BS, whereas under CT the reduction in relation to BS was about 66%. Soil management by direct drilling (NT) was the most efficient system to minimize water erosion, as soil losses decreased about 98% when compared with BS. Moreover, soil management systems with a crop rotation, i.e., RT, CT, and NT, showed a lower efficiency in the reduction of water losses with regard to the efficiency of soil losses decrease. So many rainfall events during our experimental period showed similar water losses for all the management and crop systems, which was mainly true for rainfalls causing high volumes of runoff and with a small time interval between successive events. During the autumn-winter seasons water losses were lower than in the spring-summer seasons, whereas greater soil losses in the spring-summer season were solely recorded in the CT and BS treatments. Heavy water losses by runoff recorder under conservation tillage, specifically in the NT management system suggest the need for adoption of additional structural conservation practices, such as for example terracing, in order to supplement the positive effect of soil cover by crop residues in controlling water erosion. Soil losses showed a positive correlation with rainfall erosivity and the significance of this relationship decreased as the efficiency of soil management system for the control of soil erosion increased.