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Effects of mulch cover on soil erosion by water at different spatial scales: a review

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Mulching (i.e. the application of e.g. crop residues, woodchips or pine needles on the soil surface) is a common technique used to control soil erosion by water and by wind. The effect of mulch cover (MC, %) on soil erosion rates by water has been studied in field and laboratory experiments for a large range of environmental conditions. All studies conclude that mulching can be very effective in reducing water erosion rates by protecting the soil surface against the erosive forces of rain and overland flow. However, the effectiveness of mulches in reducing water erosion rates varies widely depending on the site and plot characteristics (e.g. erosivity, erodibility, spatial scale, topography and mulch type). So far, little is known about the reasons for the variation in effectiveness and of the factors controlling this variation. The spatial scale of the field or laboratory experiments is an important factor influencing the relation between mulch cover and water erosion rates. Extrapolating results to other spatial scales without understanding the influence of scale on the relation between MC and water erosion rates can cause serious errors. The influence of spatial scale on the relation between mulch cover and water erosion rates has also implications for the application of soil erosion models. In this study, all available data on the effectiveness of mulches in reducing water erosion rates is collected from the literature in order to analyse the role of spatial scale of the field and laboratory experiments and its influence on the effectiveness of MC in reducing water erosion rates. In all studies investigated (n=82), the spatial scale of the experiments ranges from 0.17-11000m^2 and the erosion rates (splash, interrill, rill, rill and interrill erosion) range from 0-3314 t ha^{-1} h^{-1}. In general, relative erosion rates (relative to a bare soil surface) decrease exponentially with increasing MC. However, the scatter of the data indicates that the effectiveness of a given MC can differ significantly depending on the scale,

slope gradient and soil type. There is a clear tendency for the effectiveness of a mulch cover in reducing relative erosion rates to increase with an increasing plot scale of the experiments and hence with the dominant erosion process (interrill versus interrill/rill erosion). This is in line with reported findings for rock fragment covers. The results indicate that on large field plots relatively less MC is needed to reduce water erosion rates compared to smaller erosion plots.