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Effect of rock fragments on soil surface cracks development in Vertisols

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Coarse fragments influence many soil physical properties. Available studies that address the controversial role of rock fragments in soil functioning are often oriented to assess effects of their presence in relation to specific applicative problems like soil erosion or their influence in agricultural practices. Experimental research is mostly based on the evaluation of the effect of rock fragments cover on soil erosion and of coarse fragment content on water infiltration. Much less is known on the role of stones on the development of soil surface cracks, which in turn influence many other soil properties including thermal conductivity and preferential flows. Surface cracks are especially important in Vertisols where cracks occurrence, width and depth constitute diagnostic criteria for Vertisol identification and classification (e.g. WRB, Soil Taxonomy). This is because soil cracks largely affect land management.

In this work we designed a lab experiment in order to evaluate the effect of rock fragments on surface cracks development of a Vertisol. Two concentrations of three different sizes of rock fragments (basaltic type) were mixed with the soil material after sieving and put in flowerpots having diameter of 15cm; then such samples have undergone nine wet/dry cycles. At the end digital images of sample surface were acquired and examined by image analysis. In particular the cracking density was measured by a skeletonization process and the mean width of cracks was determined through a mathematical morphology approach. Results showed that the surface cracking density increased with rock fragments concentration and decreased with the rock fragment size while the mean width of fractures increased with rock fragment size and decreased with rock fragments concentration.