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The effect of dynamic-unconfined loads on soil bearing capacity and hydraulic conductivity

Nicolás Riveras Muñoz[1], Osvaldo Salazar[2], Steffen Seitz[1], Thomas Scholten[1], and Oscar Seguel[2]
[1]Eberhard Karls Universität Tübingen, Institute of Geography, Chair of Soil Science and Geomorphology, Tübingen, Germany (nicolas-andres.riveras-munoz@uni-tuebingen.de)
[2]Universidad de Chile, Facultad de Ciencias Agronómicas, Departamento de Ingeniería y Suelos, Santiago, Chile

Bearing capacity (BC) can explain mechanical soil quality, but its alteration generally comes accompanied by changes in other soil functions. One way to determine BC is by compression tests on undisturbed soil samples, where increasing normal loads are applied at the surface of confined soil core cylinders. Nevertheless, in natural conditions soils are semi-confined, allowing the soil particles to move upward to release the applied forces. Furthermore, in agricultural soils, the loads are primarily dynamic, such as the traffic of machinery or cattle. In this study, we hypothesized that the application of dynamic loads on unconfined soils is more detrimental than static loads, reflected as a decrease in the functionality of two agricultural soils under conventional tillage management. For this purpose, static and dynamic pre-compression tests to determine BC were evaluated in 2 soils, 2 depth levels, and 2 levels of mechanical resistance (8 treatments in total), using semi-confined cylinders, complemented with measurements of saturated hydraulic conductivity (K_s) as an indicator of pore functionality before and after loading. When comparing the dynamic with the static test, it showed no changes in BCwhich was reflected in a homogenization under the studied conditions.. Nevertheless, an increase in K_s from 66 cm h^{-1} in the initial condition, to 186 cm h^{-1} in static condition, and 295 cm h^{-1} in the dynamic test could be shown. The increase in the dynamic test contradicted our initial assumption and could be attributed to cracking of the soils, boosted by the partial confinement of the samples, which allowed sideways movement of the soil against the loads creating zones of preferential flow.