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Assessing penetration resistance in Phalaris arundinacea harvest operations under minimum tillage conditions

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Harvesting operations of perennial forage crops can lead to soil compaction problems, which in turn lead to poorer soil structure, increased erosion, and reduced organic matter. The present study focuses on the evaluation of soil compaction caused by harvesting operations of *Phalaris arundinacea* (Reed Canary Grass) by measuring soil penetration resistance in two different areas of the farm of the University of Tuscia. The measurements were carried out in two consecutive years following the biomass harvesting operations. These field trials are part of the H2020 project CERESiS (ContaminatEd land Remediation through Energy crops for Soil improvement to liquid biofuels Strategies) (GA 101006717), which started in November 2020 and will continue until the end of the project in 2024. *P. arundinacea* is a species that lends itself to biomass production and phytoremediation of contaminated soils. The areas with different textures were treated with a minimum tillage system, notably, only a secondary tillage of the field with a disc harrow was carried out in late winter 2021 and sown in spring 2021. Part of each area was allocated for control and was fenced off after sowing, to avoid any trampling. The remaining areas were divided into 3 plots in which the operations were repeated. Measurements were taken in 2021 and 2022 following harvesting operations using a John Deere 5100 GF tractor with disc mower. Penetration resistance and soil moisture measurements followed, to verify the impact of the operations and the effect of soil type on compaction. For penetration resistance, 15 measurements per plot were taken up to a depth of 80 cm using an electronic penetrometer model Penetrologger (Royal Eijkelkamp Soil &Water; Giesbeek, The Netherlands). The results of the soil analysis indicate different chemical and physical characteristics between the two areas, in particular, one area has a clay texture and the other a sandy loam texture. The data collected from the measurements of penetration resistance pointed out significant differences between the plots subjected to tractor passage for harvesting operations and the control areas. Differences were also observed between the two areas, which was an expected result given the different texture and humidity recorded; thus, confirming the effect that this parameter can have on compaction and giving an indication of when to avoid entering the field. It was interesting to note that an effect on the soil can already be seen after two years, despite the minimal intervention. Inspection at different depths showed a general tendency for resistance to penetration to increase with increasing depth, a greater difference between treatments (with tractor and control) up to 40 cm and a tendency to overlap beyond this depth. It will now be interesting to see how this will evolve over the next few years and to assess how the increase in penetration resistance can be further reduced. Compaction affects many other soil parameters, in a context of climate change, it is crucial to implement strategies to reduce it in agricultural operations.

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