

Selection of a stress-based soil compaction test to determine potential impact of machine wheel load

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Abstract

The use of heavy machinery is increasing in agricultural industries in particular cotton farming systems, which induces an increased risk of soil compaction and yield reduction. Hence, there is a need for a technical solution to use available tools to measure projected soil compaction due to farm machinery traffics. The aim of this work was to compare the effects of static and dynamic loads on soil compaction. In this study, three vertosols (common soil for cotton production) were selected to examine soil compaction under a range of static and dynamic loads using uniaxial compression equipment and a modified proctor test, respectively. In general, soils behaved similarly under static and dynamic loads with no significant difference between bulk density values for all moisture contents with a high index of agreement ($d=0.96$, $RMSE=0.056$). The results further indicate better agreement between soil compaction for static and dynamic loads. Uniaxial compression test (static loads) produced higher compaction compared to the modified proctor test (dynamic loads) in particular at moisture contents lower than the plastic limit condition. The variation in soil compaction for static and loads was often evident for loads $[?]600$ kPa, with the highest soil compaction induced under loads $[?]1200$ kPa. The findings of this study confirm the suitability of a modified proctor method to assess soil compaction as an alternative tool under a range of moisture contents and machinery loads for vertosols.