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Effect of soil structure on the growth of bacteria in soil quantified using CARD-FISH

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It has been reported that compaction of soil due to use of heavy machinery has resulted in the reduction of crop yield. Compaction affects the physical properties of soil such as bulk density, soil strength and porosity. This causes an alteration in the soil structure which limits the mobility of nutrients, water and air infiltration and root penetration in soil. Several studies have been conducted to explore the effect of soil compaction on plant growth and development. However, there is scant information on the effect of soil compaction on the microbial community and its activities in soil. Understanding the effect of soil compaction on microbial community is essential as microbial activities are very sensitive to abrupt environmental changes in soil.

Therefore, the aim of this work was to investigate the effect of soil structure on growth of bacteria in soil. The bulk density of soil was used as a soil physical parameter to quantify the effect of soil compaction. To detect and quantify bacteria in soil the method of catalyzed reporter deposition-fluorescence *in situ* hybridization (CARD-FISH) was used. This technique results in high intensity fluorescent signals which make it easy to quantify bacteria against high levels of autofluorescence emitted by soil particles and organic matter.

In this study, bacterial strains *Pseudomonas fluorescens* SBW25 and *Bacillus subtilis* DSM10 were used. Soils of aggregate size 2-1mm were packed at five different bulk densities in polyethylene rings (4.25 cm^3).The soil rings were sampled at four different days. Results showed that the total number of bacteria counts was reduced significantly ($P<0.05$) with increasing bulk density of soil for both bacterial strains. Also, a significant difference in the number of bacteria was observed in each bulk density of soil overtime.

Therefore, the results indicate that the compaction of soil affects the growth of bacteria and thus would affect their activity in soil. A further research is required to understand the complete effect of compaction on the microbial processes in soil for good crop productivity and better soil management.