POSTER PRESENTATIONS

Soil compaction resulting from tyres and a rubber track for single axle loads in the range of 10-12 tonnes

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Introduction. The selection of the appropriate undercarriage gear for a particular load and soil condition is an important consideration to reduce soil compaction due to machinery traffic. This paper summarises results reported in earlier studies[1a-b; 2] which were conducted to investigate the effects of tyre and rubber track systems on soil compaction. The objectives were to: **(1)** determine the changes in soil bulk density (SBD) from soil deformation data to provide a valuable indicator for tyre selection, and **(2)** determine the potential benefits of a rubber track system to mitigate soil damage caused by machinery traffic.

Materials and Methods. The studies were conducted in a soil bin facility using a sandy loam soil maintained at 10% (w w^{-1}) moisture content. The tests were performed on three different SBD (low: 1.20; medium: 1.40; and high: 1.60 t m^{-3}) which were uniform to a depth of 700 mm. The tyres (680/85R32; 800/65R32; 900/65R32) were inflated to the recommended pressures (0.22; 0.25; 0.19 MPa respectively) for the working load (10 t). The rubber track (CLAAS Terra-Trac®, 635 mm width) was tested on the medium SBD only and it carried a total load of 12 t. Soil displacement was measured in the soil profile following a single passage of the tyres/track over the soil. For this, talcum powder stripes were placed in between layers of soil to provide traceability of the soil movement beneath the undercarriage system. The resultant increase in SBD was derived from soil deformation data as described in full in [1a-b].

Results and Conclusions. The initial soil strength was the main factor influencing the extent of soil deformation and the resultant increase in SBD. The 900 mm section tyre produced the lowest increase in SBD across all SBD conditions (14.2%) compared with the 680 mm (15.8%) and 800 mm (17%) section tyres respectively ($P<0.05$). This was due to its relatively larger contact area and lower inflation pressure. At medium SBD, the rubber track produced significantly ($P<0.05$) less soil deformation (*c*.40%) compared with the tyres which translated into lower increases in SBD (13% *vs*. 18%) despite the heavier load. For the rubber track, soil displacement at 500 mm depth was negligible whereas the tyres displaced soil to 600 mm depth. This demonstrated the advantage of the use of rubber tracks to minimise soil compaction throughout the soil profile. For the tyres, linear relationships ($R^2 \geq 0.94$; $P<0.05$) were established between the SBD prior to traffic, and the estimated increase in SBD after traffic. These relationships enable prediction of potential damage to the soil before harvesting operations are conducted.

References. [1a]Ansorge, D.; Godwin, R.J., 2007. The effects of tyres and a rubber track at high axle loads on soil compaction: 1. Single axle studies. *Biosystems Engineering 98 (1): 115-126.*

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