

ABSTRACT

The present study was undertaken to evaluate the traction potential of radial-ply tyres used in agricultural tractors in the country. The study was conducted in two phases. In the first phase the deflection and contact characteristics of four radial-ply tyres (12.4 R 28, 13.6 R 28, 14.9 R 28 and 16.9 R 28) were studied on a hard surface. The normal load on the test tyres was varied from 4.91 to 19.13 kN and inflation pressure from 41 to 207 kPa. Based on the test observations, three empirical models were developed to predict deflection, ground contact area and ground pressure of the radial-ply tyres. These models were also compared with a few existing models and were found to perform well. The developed deflection model was used to determine the possible combinations of normal load and inflation pressure to achieve the desired deflection of 20, 24 and 28 per cent for each test tyre.

In the second phase of the study, traction performance of the same test tyres were evaluated in soil bin under controlled laboratory conditions. The experimental set-up consists of a soil bin filled with lateritic sandy clay loam soil, a single wheel test rig for mounting the test tyres and a loading device for varying the drawbar pull. A torque transducer was used to measure the torque input to wheel axle and a ring transducer was used to measure the drawbar pull. A zero condition test was conducted on a hard surface to determine the rolling radius of each wheel. The wheel slip was calculated by determining the theoretical and actual velocities of the wheel. The tests were conducted under soft, medium and hard bed condition with 20, 24 and 28 per cent tyre deflection. The test observations were used to calculate the coefficient of traction and the tractive efficiency at different values of wheel slip under varying test conditions. The characteristic curves of radial-ply tyres showing the variation of slip and tractive efficiency with coefficient of traction were plotted for soil (cone index), wheel (tyre deflection and size) and system (normal load) parameters. Finally the test data were utilized to develop regression models for prediction of gross traction ratio and motion resistance ratio in terms of wheel, soil and system parameters. The developed empirical models were compared with some of the prominent models and were found to perform well. The developed model was also used to compare radial and bias-ply tyre performance.

Keywords: Traction potential, radial-ply tyre, agricultural tractors, deflection, ground contact area, inflation pressure, soil bin, lateritic sandy clay loam soil, zero condition test, cone index, tractive efficiency, empirical traction models.

