ABSTRACT

A research was carried out at the Ngongongeri Farm Kenya to determine effects of tillage depth and speed on drawbar power and performance of disc and mouldboard ploughs so as to develop a mathematical model that would assist farmers, machinery managers and policy makers to properly match implements to tractors and the size of tractors to import based on soil types and conditions. The implements used were a standard 2-bottom mouldboard plough and a 3-bottom disc plough. Tillage depths used were 6.5 cm, 12.5 cm and 22.5 cm while the forward speeds were 1.3 km/h, 2.3 km/h and 3.0 km/h with the width of both implements fixed at 80 cm. Preliminary field studies of soil parameters were conducted and the analysis of parameters showed homogeneity hence a completely randomized design was used. Two tractors were used with a digital pull dynamometer located in between the tractors to take the readings of draught at various depths and speeds of tillage. The measured draught was used to calculate the drawbar power and specific power. The results showed increase in drawbar power with increase in tillage depth and forward speed at all the levels of the parameters tested for both the ploughs used with mouldboard plough having higher values of power requirement at all levels of the parameters investigated. The specific drawbar power increased with increase in forward speed and decreased with tillage depth for the implements used. Mathematical models were developed to predict specific drawbar power given by: Ys = −0.27 X1 + X 2 + 0.13X 3 and Ys = −0.41X1 + 3.43X 2 + 0.15X 3 for disc and mouldboard ploughs respectively based on depth (X1), speed (X2) and width of cut (X3). The predicted values from the models fitted well to the measured values with some minimal residuals, hence can be used in matching of these implements to tractors in silt loam soils. Soil pulverization ratio increased with increase in speed while trench specific resistance decreased with increase in tillage depth. Mouldboard plough had better soil inversion at all levels of interaction between speed and depth of tillage as compared to disc plough. The results of the study showed that the mouldboard plough had better performance in terms of soil slice inversion and pulverization as compared to the disc plough at all levels of the factors tested. Therefore, based on the tillage power and specific power disc ploughs should be encouraged to minimize the cost of tillage. While looking at the field in terms of performance in primary tillage then shallow mouldboard tillage should be encouraged to take advantage of good inversion properties.