

PERFORMANCE EVALUATION OF MECHANICAL LAND PREPARATION FOR RICE CULTIVATION: A CASE STUDY IN ANURADHAPURA DISTRICT, SRI LANKA

D. R. L. S. K. Senavirathna, E. J. Kosgollegedara, P. D. Kahandage,
G. V. T. V. Weerasooriya and S.R. Manawaduge

*Department of Agricultural Engineering and Soil Science, Faculty of
Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka.*

In paving the way for future low-carbon mechanization in rice cultivation, a detailed analysis of machinery is essential, encompassing both mechanical and economic performance. The study aimed to assess the land preparation process in rice cultivation, focusing on the Anuradhapura area as a case study. Twenty-two divisional secretariat (DS) divisions were surveyed, and data were collected on power sources of 8–12 and above 12 for power tillers (PTs), 45–50 and above 50 for four-wheel tractors (4WTs), and implements such as rotavators, disc ploughs, and tine tillers for land preparation of rice. A field experiment was also conducted to assess the performance of prevalent tools and implements. Performance indicators including field capacity, field efficiency, energy consumption, CO₂ emission, and direct and indirect costs were evaluated. The survey revealed that 49.14% of 4WTs and 50.86% of PTs were used for land preparation of rice. Use of Rotavator, Tine tiller, and Disc plough were 58.9%, 33.3%, and 7.7%, respectively for primary land preparation with 4WTs, while the use of Rotavator and Tine tiller were 72.8% and 27.1%, respectively for secondary land preparation. Moreover, the rotavator is the implement used with PTs for both primary and secondary land preparation. In primary and secondary land preparation, field capacity and field efficiency of 4WTs with rotavator, significantly higher than in disc and tine tiller ($p \leq 0.05$). Besides, 4WTs with rotavator recorded the significantly lowest fuel consumption, energy utilization, and greenhouse gas emission for both primary and secondary land preparation ($p \leq 0.05$). When compared to rotavators with 4WTs and PTs, it was found that 4WTs exhibited the lowest fuel consumption and energy utilization, with statistical significance ($p \leq 0.05$). Moreover, comparatively lower machinery cost was recorded for 4WTs with rotavator ($p \leq 0.05$). In summary, it is evident that use of rotavators with 4WTs emerges as the sustainable option for land preparation of rice in Sri Lanka.

Keywords: Energy utilization, Field efficiency, Greenhouse gas emission, Paddy land preparation, Rotavator