ASSESSMENT OF ERGONOMIC PARAMETERS OF RICE TRANSPLANTERS FOR WOMEN OPERATORS

By
GORLA GAYATHRI
(2015 - 18 - 013)

ABSTRACT OF THESIS
Submitted in partial fulfillment of the requirement for the degree of

MASTER OF TECHNOLOGY
IN
AGRICULTURAL ENGINEERING
(Farm Power Machinery and Energy)
Faculty of Agricultural Engineering & Technology
Kerala Agricultural University

Department of Farm Power Machinery and Energy
KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY
TAVANUR, MALAPPURAM-679573
KERALA, INDIA
2017
ABSTRACT

Paddy transplanting is a highly labour intensive operation. To ease the transplanting work, research organizations have developed various types of rice transplanters. These equipments are primarily developed keeping men workers in consideration, despite rice transplanting being performed mostly by women workers. At present there are different models of rice transplanters available in the market. The safety and efficiency aspects of these transplanters with respect to women workers are not being studied. Therefore a study was undertaken to evaluate the existing models of three 8 row self-propelled riding type rice transplanters namely Yanmar, Redlands and Yanji on the ergonomic basis. The physiological cost of work of these transplanters were compared with the traditional method. An anthropometric survey was conducted with 450 women agricultural workers in three zones of Kerala. Ten women subjects were selected, conforming to statistical requirements of anthropometric dimensions and were calibrated in the laboratory by indirect assessment of oxygen uptake.

The energy expenditure was minimum for Yanmar rice transplanter with a value of 9.89 kJ min\(^{-1}\). The energy expenditure of traditional method was increased to the tune of 52.52 per cent when compared to Yanmar rice transplanter followed by Yanji rice transplanter (43.11 per cent) and Redlands rice transplanter (29.46 per cent). A significant difference in heart rate and energy expenditure was noticed in all the selected rice transplanters for all the subjects. The time of operation was significantly influenced the heart rate and energy expenditure of subjects for selected rice transplanters. The average energy expenditure before 9 am was 20.7 kJ min\(^{-1}\) while after 11 am it was increased to 26.6 kJ min\(^{-1}\). The oxygen consumption in terms of VO\(_2\) max was varied from 35 to 85 per cent and indicating that the Redlands, Yanji and traditional method could not be operated continuously for 8 hours without frequent rest pauses except Yanmar rice transplanters.

The overall discomfort rate was maximum for transplanting by traditional method followed by transplanting with Yanji, Redlands and Yanmar rice transplanters. The operation of Yanmar rice transplanter was more safe and easy
when compared with other transplanters. Body part discomfort score was maximum for traditional method with a score of 46.8 while it was minimum for Yanmar rice transplanter with a score of 14.5. The discomfort was noticed in low back, upper back, neck and shoulders of subjects while working with selected rice transplanters. The work rest cycle was 30 minutes of work followed by 2 minutes rest for Yanmar rice transplanter, 9 minutes rest for Redlands, 14 minutes rest for Yanji rice transplanter and 15 minutes rest for traditional method of rice transplanting.

In musculoskeletal disorders survey, 80 per cent of the women workers reported that they had experienced MSD in the past seven days while 37 per cent had experienced MSD problems over the past 12 months. In selected rice transplanters, none of the subjects had experienced pain in any of the body parts after 7 days of operation. In posture analysis, the RULA score was maximum for traditional method (7) followed by Yanji (4), Redlands (4) and Yanmar rice transplanters (2). The sound level of the Yanmar rice transplanter was varied from 91 to 93 dB at different modes when compared to Redlands (94 to 99 dB) and Yanji rice transplanter (97 to 103 dB). The root mean square acceleration was maximum in Yanji rice transplanter at different parts compared with Yanmar and Redlands rice transplanters. An operator seat and helpers seat designs were suggested for Yanji and Redlands rice transplanters based on anthropometric dimensions of agricultural women workers and spatial requirements of transplanters. The recommended dimensions for the operator’s seat were as seat backrest height (39 cm), trapezoidal seat back rest width (38 cm-bottom side, 27.5 cm top side), seat back rest open area (18 cm), trapezoidal seat length (40 ± 3.4 cm), trapezoidal seat width (43 cm – top side, 30 cm –bottom), seat cushion height (10 cm) and backrest cushion height (8 cm). A diameter of 35 cm was suggested for helpers circular seat for more comfortable sitting.