



Rotary weeder for drudgery reduction of women during weeding in rice field

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Received: 17 February 2012; Revised: 16 June 2012

Key words: Drudgery reduction, Farm women, Weeding tools

With the advancement of agriculture, farm women are being encouraged to use weeding tools like cono weeder, rotary weeder and peg type dry land weeder *etc.*, instead of hand weeding. Evaluation of the performance of rotary weeder for drudgery reduction of farm women (FW) is inevitable as weed infestation is one of the limiting factors in the paddy cultivation. The weeding operation is mainly done by women in the paddy and vegetable field in want of availability of men labour. Agarwal (2007) advocated technology model for use by the women. It is expected that role of women will increase in field operation in agriculture (Das). Rotary weeder acts by uprooting and burying of weeds in between standing rows of paddy crop in wet lands. It disturbs the top soil and increases aeration also. The equipment is operated in standing posture thus avoids bending involved during uprooting of weeds by hands in traditional practice. The objectives of the study was to evaluate rotary weeder and hand weeding in terms of its ergonomic effectiveness such as - Energy requirement, Subjective judgement of Work Related Body Discomfort (WRBD), Work performance in comparison with hand weeding for drudgery reduction of Farm Women during paddy weeding.

The study was carried out on 10 farm women of the age group of 25-45 years which were involved in paddy weeding activity. The field experiment was conducted in the month of July to September. Mean age of the respondents engaged in weeding was 30 years, body height 156.5 cm and body weight as 46.5 kg. Stopwatch was used to measure the time required and a meter tape was used to measure the area covered. Assessment of physiological stress was done by recording of using a Digital Heart Rate Monitor. In the morning, resting heart rate (RHR) of the respondent was recorded and after completion of the activity, working heart rate (WHR) was recorded. From the average values of heart rate, energy expenditure was calculated with the help of formulae given by Varghese *et al.* (1994) which is as follows:

1. Energy expenditure rate (EER) and cardiac cost

$$EER (k_j/min) = 0.159 \times HR (\text{beats/min}) - 8.72$$

where, EER = Energy expenditure rate (k_j/min), HR = Heart rate (beats/min)

From the values of change in heart rate (beats/min) and output (m^2/hr), the cardiac cost was calculated. The experiments were conducted during *Kharif* seasons of two consecutive years in 2010 to 2011 at farmers field.

The heart rate, cardiac cost and energy expenditure rate of 10 women are given alongwith mean values (Table 1).

Values of HR were 40.8 and 19.8 beats/min for hand weeding and rotary weeder, respectively (Table 2). The cardiac cost ($beats/m^2$) was 39.62 and 22.29, respectively for hand weeding and rotary weeder. The Energy expenditure rate (K_j/min) was 11.04 and 15.99, respectively for hand weeding and rotary weeder.

Table 1. Heart rate (HR), cardiac cost (CC) and energy expenditure rate (EER)

FW	HR (beats/min)		Cardiac cost (beat/ m^2) of area harvested		Energy expenditure rate (K_j/min)	
	Hand weeding	Rotary weeder	Hand weeding	Rotary weeder	Hand weeding	Rotary weeder
S1	31	18	35.4	17.1	11.0	15.9
S2	49	22	46.0	26.8	10.8	15.8
S3	42	23	44.2	22.2	10.5	16.1
S4	40	23	43.4	21.3	10.6	16.1
S5	39	19	39.6	22.5	10.6	15.9
S6	19	39	39.6	23.2	12.1	16.1
S7	12	42	25.0	21.2	10.6	15.9
S8	24	44	51.1	24.4	10.8	16.1
S9	16	49	33.3	26.2	11.6	16.1
S10	22	33	38.6	18.0	11.6	15.9
Mean value	20	41	39.6	22.30	11.04	15.99

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Table 2. Heart rate response and output during weeding

Farm women	Heart rate (beats/min)		Output (m ² /hr)	
	Hand weeding	Rotary weeder	Hand weeding	Rotary weeder
S1	121	155	29	112
S2	123	154	30	110
S3	125	156	31	111
S4	122	156	32	113
S5	122	155	29	104
S6	131	156	29	112
S7	122	155	29	110
S8	123	156	28	111
S9	128	155	29	113
S10	128	156	34	104
Mean value	124	155	30	110

diture rate was 11.04 and 15.99k_j/min for hand weeding and rotary weeder, respectively (Fig.1). The mean output of farm women was 30 and 110 (m²/hr) for hand weeding and rotary weeder, respectively (Fig. 2).

Table 2 shows Heart Rate (HR) of the FW during weeding ranged between 121 to 131 beats/min for hand weeding and 154 to 156 for rotary weeder. The mean of HR during hand weeding and rotary weeder was 124.5 and 155.4, respectively. The mean values of area covered by hand weeding and rotary weeder was 30 and 110 m²/hr respectively. Ergonomic results showed that the energy requirements for FW were 16.0 and 11.04 kJ/min in rotary weeder and hand weeding respectively. The area covered by the rotary weeder was 110 m²/hr as compare to 30 m²/hr by hand weeding (nearly 4 times). The Overall Rated Perceived Exertion (ORPE) was used to express WRBD. It was more in hand weeding due to continuous bending posture as against standing posture.

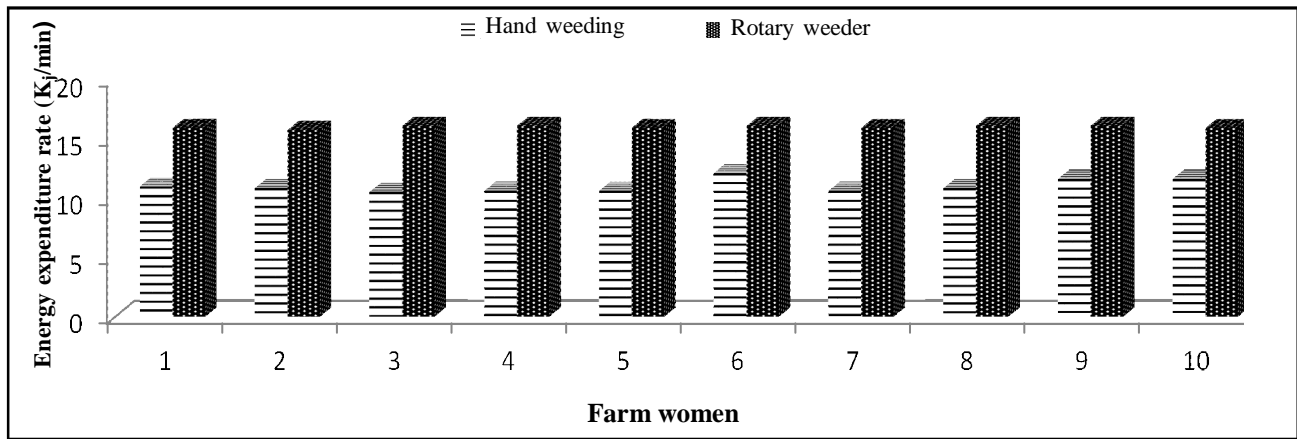


Fig. 1. Trend of energy expenditure rate (K_j/min)

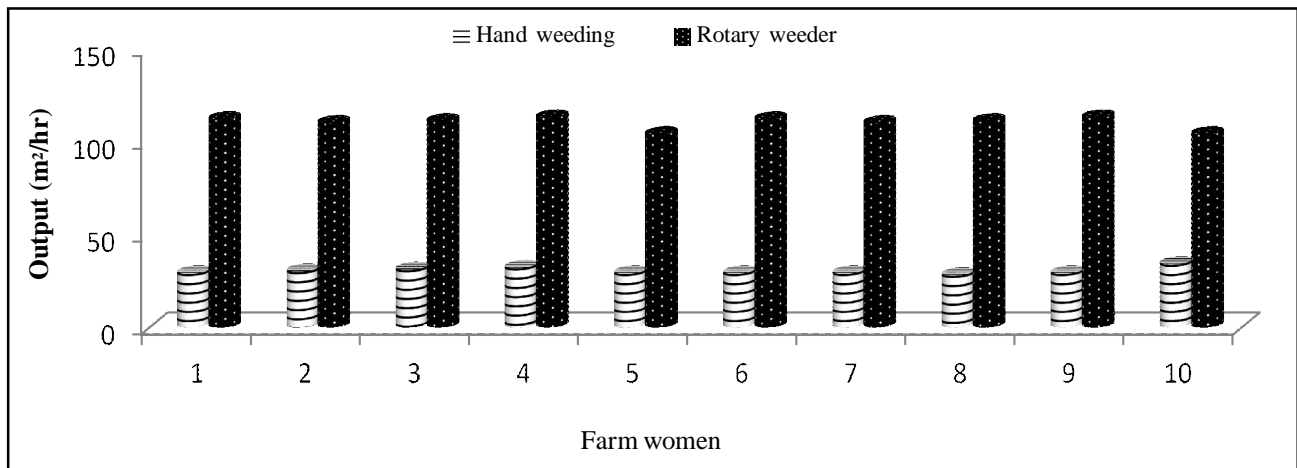


Fig. 2. Trend of output (m²/hr)

SUMMARY

The study was conducted in Sinduri village of Shahdol district in Madhya Pradesh to evaluate rotary weeder's ergonomic effectiveness in terms of energy requirement, subjective judgement of Work Related Body Discomfort (WRBD) and work performance in comparison with hand weeding. Ergonomic results showed that the energy requirements for farm women were 16.0 and 11.04 kJ/min for rotary weeder and hand weeding, respectively. The area covered by rotary weeder was 110 m²/hr as compare to 30m²/hr by hand weeding (nearly 4 times).

The Overall Rated Perceived Exertion (ORPE) was used to express WRBD. It was more in hand weeding due to continuous bending posture as against standing posture.

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