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Ergonomic Evaluation of the Farm Women during Weeding

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ABSTRACT

The study was carried out in Chhindwara district of Madhya Pradesh State to determine the time profile, weeding efficiency and physiological stress of women while performing the weeding activity. Weeding is an important agricultural unit operation. Delay and negligence in weeding operation affect the crop yield up to 30 to 60 per cent. With regard this, a manually operated Twin Wheel hoe was tested ergonomically in soybean and cotton field. The field experiment was carried out on 20 women each falling between the age group viz. 25 – 45 years. The results revealed that mean age of the respondents was 32.5 years with mean body height was 152.8 cm and mean weight was 45.2 kg. The weeding efficiency of the wheel hoe was satisfactory and it was easy to operate. Weeding efficiency was obtained up to 92.5 %. During weeding operation, Average heart rate of women was found to be 88.0 beats/min. as compared to local sickle as 90.5 beats/min by saving of 34% cardiac cost of worker. Women perceived drudgery reduction by 26.6 percent. . There was 50 percent reduction in number of labour needed per day in turn giving economic benefit of Rs. 300/day. The overall performance of the wheel hoe was promising.

In developing countries like India women are most silent participants in economic life and also an important work force in agriculture and allied fields. Because of the low literacy rate, a large section of women are compelled to work in field as labourers. Besides being involved in household chores, they attend to arduous field operations like sowing, transplanting, weeding, interculturing, harvesting, threshing and agro-processing in crop production, fuel and fodder cutting, water fetching, cleaning of houses, cooking, child rearing, household maintenance and dairying/animal husbandry in allied fields (Singh et al., 2007). Moreover most of the work-studies are directed towards the measurement of external forces and time spent in work. During these activities they adapt unnatural body posture due to which their physiological workload increases and also they faces many types of musco-skeletal problems as a result the efficiency of women to work decreases to a greater extent (Jyotsana et al, 2005). The general trend existing in rural India is limited resources available to women because of low socio-economic status in the society and within that limited access to resources, there exists a strong disparity that, most of the women's earnings goes towards nutritional security of the households. Most women cannot invest in the technology. Introduction to new technologies in agricultural operation adopted by farm women leading to the mechanization will reduce the drudgery and improve the efficiency. About 78 per cent of economically active women are engaged in agriculture compared to 63 percent of men. Almost 50 per cent of rural women are classified as agricultural labourers and 37 percent as cultivators. In such conditions where participation of women in agriculture is as high as 95 per cent, the women need to have the précised agricultural tools and implements (Shirahatti et al).

To ensure better health and safety and to improve work efficiency and to reduce the drudgery of women it is important to have an understanding of the occupational workload of farm women by studying the efficiency, heart rate, energy expenditure, their fatigability, which could be assessed through physiological parameters by assessing heart rate and by estimating energy expenditure of some drudgery-prone activities the rural women perform in farms, homes and in allied fields. Hence in view of the above, an attempt has been made to study the time profile, weeding efficiency and physiological stress of women during weeding with twin wheel hoe and compared their performance with traditional method of weeding by conventional tool.

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Based on above considerations, the present study was undertaken with the following objectives:

1. To minimize drudgery and increase the efficiency of the farm women in short spin of time.
2. To execute the ergonomic analysis of the activities performed by the women and to study the circulatory stress and physiological cost of agricultural activities.

METHODOLOGY

The study was carried out in Chhindwara district with 20 farm women in the year 2007-08 involved in weeding activity in soybean and cotton crop, aged between 25-45 years without having any physical deformity. Twin wheel hoe was introduced to the farm women for weeding. It is manually operated equipment, consists of twin wheels, frame, V-blade with tyne, U clamp, scrapper and handle. During the experiment various parameters viz., time profile, weeding efficiency and physiological stress were studied. The anthropometric rod and weighing balance were used to measure the physical characteristics like height and weight. Stop watch was used to record the time. Weeding efficiency calculated by the formulae-

$W = \{(W1 - W2) / W1\} \times 100$

Where, W = Weeding efficiency, %

- W1= Count of weeds between two rows before weeding.
- W2= Count of weeds between two rows after weeding

The heart rate was recorded by using the digital heart rate monitor. Based on the heart rate records the following parameters were calculated-

- Average heart rate during rest and work.
- Estimated Energy Expenditure Rate kj/min= VO_2 (lt/min) x 20.93 kj/lt

VO_2 (value of Oxygen) =(0.0114 x WHR - 0.68) x 20.93

= (0.0114 x 102 – 0.68) x 20.93

= 0.4828 x 20.93 = 10 kj/min

- Δ HR (beats/min) = Average Working Heart Rate (WHR) – average heart rate during rest
- Output (m^2/hr)
- Cardiac cost of worker per unit of output (beats/sqm) = Δ HR x duration / output

RESULTS AND DISCUSSION

To evaluate the weeding activity through ergonomic point of view, 20 respondents of age group between 25 to 45 years were selected at random and average age was counted as 32.5 years, measuring body height of 152.8 cm and body weight as 45.2 kg (Table 1).

Table 1: Physical characteristics of selected respondents (N=20)

Physical characteristics	Mean ± S.D.
Age (yrs)	32.5 ±6.01
Height (cm)	152.8 ±5.57
Weight (kg)	45.2 ±4.94

Table 2: Evaluation of performance data of different parameters of the farm women while Weeding (N=20).

Particulars	Mean values ± S.D	
	Local Sickle	Twin Wheel Hoe
Time spent (min/100sqm area)	60 ±3.25	31 ±2.74
Average working heart rate (beats/min)	90.5 ±4.60	88.0 ±2.69
Average heart rate during rest (beats/min)	94.8 ±2.33	93.4 ±1.98
Weeding intensity%	43 ±5.03	32 ±5.13
?HR (beats/min)	4.3 ±0.41	5.4 ±0.85
Output (sqm/hr)	100 ±13.12	193 ±21.24
Cardiac cost (beats/sqm)	2.58 ±0.36	1.70 ± 0.53
Saving in cardiac cost/kg (%)	-	34 ±1.06

Table 3: Performance evaluation of Wheel hoe in Cotton Crop

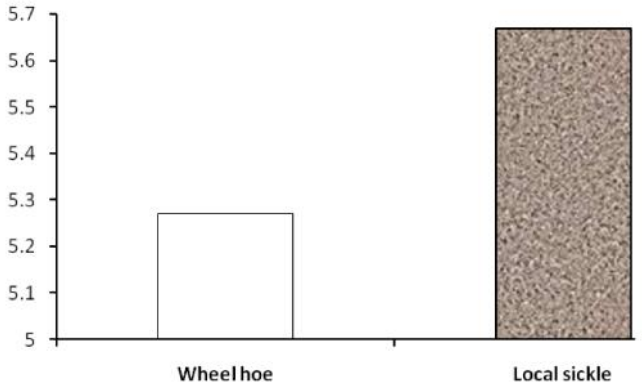
S.No.	Parameters of observation	Local Tool	Wheel Hoe	% Change Due to Technology
1.	Work done (area in ha)	0.2	0.2	-
2.	Output in hour (area cleaned)	6	4	33.3
3.	Labour Employed	6	3	50.0
4.	Labour Wages @ Rs 18.75/hr (@ Rs 150/day; working hrs 8 in a day)	675	225	66.7
5.	Economic benefit (INR)/season (20 days working season)	13500	4500	66.7
6.	Drudgery Score	30	22	26.7
7.	No. of users preferring the technology	3	17	85.0

Table 2 revealed that in soybean crop twin wheel hoe required 31 min for weeding the 100 sqm area while local sickle required 61 minute. So it is clear from the table that twin wheel hoe saves more than half the time against the sickle and increases twice of working efficiency as the output recorded by twin wheel hoe was 193 sqm/hr as compared to local sickle by which only 100 sqm/hr area was weeded. During weeding with wheel hoe, the average ?HR was 5.3 beats/ min. while by sickle it was recorded as 4.3 beats/ min. The cardiac cost of worker was 2.58 beats/ sqm during weeding with sickle while 1.7 beats/ sqm by wheel hoe. So the wheel hoe saves 34% cardiac cost of worker per unit of output and the weed intensity was also found to reduced by 25.6%.

Facts of performance evaluation of wheel hoe in cotton crop are presented in table 3, data revealed that an increase in output to 33.3 percent resulted when area was cleaned /weeded with wheel hoe. Thus there was saving in labour time to complete the weeding activity. Women perceived drudgery reduction by 26.6 percent. When compared to the traditional tool the saving in money increased to 66.7 percent per cotton cropping season. There was 50 percent reduction in number of labour needed per day in turn giving economic benefit of Rs. 300/day. This activity continues at least for 20 days during the cropping period thus resulting in saving of Rs 9000 per 0.2 ha per season. Out of 20 respondents to whom intervention was given for weeder and who used weeder for cotton crop 17 preferred (85%) the technology.

Fig 1 depicted that it is an accountable for energy expenditure during the course of weeding by wheel hoe and calculated as 5.27 kj/min while it was found 5.67 kj/ min in case of weeding with local sickle.

Fig 1: Comparison of energy expenditure (kj/min) of farm women between weeding with wheel hoe and local sickle.



Similar studies of weeding and intercultural operations by women power Ergonomic evaluation of push pull type weeder with women operators was carried out in Bhubaneshwar by using three types of weeder namely Rotary Peg Weeder (RPW), Wheel Hoe (WH) and Wheel Finger Weeder (WFW) were evaluated including machine parameters and ergonomic parameters. The body parts discomfort score revealed that, wheel Finger Weeder performed better followed by RPW and WH. The grading of work showed that, weeding with WH was heavy followed by RPW and WFW for women operators (Behera et al. 2007).

CONCLUSION

During weeding farm women usually adapts squatting posture and they continue to work in this posture for long duration without adapting any other posture due to which they reported severe pain in lower back and knees. Introduction of wheel hoe saves not only the time but increases 48.2% of working efficiency of farm women and reduces 34 % drudgery against the local sickle. The

average weeding efficiency for the wheel hoe was found 92.5 %, 50 percent reduction in labour shows that the performance of twin wheel hoe is promising and efficient. 85% women preferred this technology. Reduction in drudgery of women would facilitate women to get involved in development works and decision-making process. Hence periodic training programmes should be organized to emphasize on educating workers regarding recognition of musculo-skeletal disorders and importance of rest pauses and maintaining proper posture while performing agricultural activities.

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