

## Work load on women using cono weeder in SRI method of paddy cultivation

A. Mrunalini\* and M. Ganesh

ANGR Agricultural University, Rajendranagar, Hyderabad - 500 030, Andhra Pradesh, India

### ABSTRACT

*Workload of 30 women belonging to the age group of 21 to 40 years was compared during weeding with the use of Cono weeder in paddy crop grown in SRI method against conventional method of hand weeding. It was found that cono weeder enhanced the pace of work and doubled the productivity, saved time up to 76 per cent and optimized the human effort through improved postures and reduced the muscular fatigue as compared with the hand weeding process.*

**Key words:** Workload – women using cono weeder; SRI cultivation

Manual labour remains as the highest input in rice production in the country and most of the agricultural operations like seeding, uprooting, transplanting, weeding, harvesting etc are still done by women. Millions of farm women work in these activities without any mechanical advantage, experience drudgery due to low output, more time at task, physical strain and other occupational problems. To bring in mechanisation to more people, especially to women who do much of the laborious and backbreaking work the ergonomic fit of women farmers to farm tools is being explored. Agricultural Engineering has succeeded in designing several hand operated implements but the advantage of these implements is yet to be received by the large number of farm women in different cropping systems. The compatibility of the technology to women is to be identified before its access and this factor became one of the presumed lapses for low technology use by women for different activities. The System of Rice Intensification (SRI) is being practiced as a sustainable management practice in some of the tropical countries of Asia. While the practice has been the concern of the agronomists in the perspective of increased crop yield and sustainability, filling the data gap with respect to time and energy spent by women in this method using improved weeders is of particular interest to scientists interested in women's work improvement. Implements like cono weeder helped to save labour time and the number of person-days required for weeding from 30

to 10 as they become more experienced. It was also reported that some of the most convinced and convincing SRI users are women, and research should include women and their work dimension in SRI. The present study was planned with the objectives to study the workload of women while using the cono weeders against the work out put and to obtain qualitative ratings on perceived exertion while weeding in the two methods.

### MATERIAL AND METHODS

Thirty women subjects from the age group of 21 – 40 years were selected for the study. The selected workers were screened as per their physical fitness by step exercise on step stool (29.0 x 45 x 24.0 cm) and distributed as per their qualified score average (Varghese, 1994). Their basal metabolic index was also calculated. The workload of the selected task was estimated using heart rate count which is the number of ventricular beats per minute. Heart rate is a sensitive and discriminating measure for evaluating strain in muscular work (Kroemer et al. 1997). The discriminating sensitivity of heart rate as a measure of work load was established as linear with ambient temperature, the proportion of static to dynamic effort used and the number of muscles involved in the activity. As women continuously attend to weeding activity from morning till evening in bending postures, with static load on them, heart rate measurements were taken by tying the heart rate

monitor (Polar Vantage NV HRM) to the subject's body for four hours to note minute wise recording for that specified duration.

An overall assessment of the level of body pain is a difficult exercise to be done through questionnaire or rating scale especially when more complex activities are to be studied with several sites of pain in an operator, each at a different intensity. Body map is the technique used for identifying the sites and intensities of pain. The technique helps in knowing the extreme level of pain, obtaining some overall integrated assessment of the total effect. Corlette and Bishop (1976) developed this technique for ensuring human comfort, occupational safety and analysis of body pain. The use of body map developed by them is of particular importance in this context as it facilitates to query on the extent of body pain experienced by the subjects on the five-point scale. Time required to weed by conventional method was compared with the use of cono weeder and production was determined by rate of coverage of area per unit time.

The Average Resting Heart Rate (RHR beats.min<sup>-1</sup>), recorded during rest, average working heart rate (AWHR beats.min<sup>-1</sup>) recorded during work duration and recovery heart rate (Rec HR beats.min<sup>-1</sup>) recorded during recovery were used to compute Total Cardiac Cost of Work as per the following formulae. The total cardiac cost, energy and time cost were estimated as per the formulae worked out by Varghese *et al.*, (1989).

Total cardiac cost = Cardiac cost of work (CCW) +  
Cardiac Cost of recovery (CCR)

CCW =  $\Delta$  HR beats.min<sup>-1</sup> x duration of work

WHR = Average working heart rate – Average resting heart rate

CCR =  $\Delta$  Recovery HR x duration of recovery

$\Delta$  Recovery HR = Average recovery heart rate –  
Average resting heart rate

Energy cost (kjm<sup>-1</sup>) = 0.159 x Heart rate

Time cost = total time taken for the task.

PHR = Peak Heart Rate

Measurements on ambient temperature and humidity were taken using normal room thermometer and digital hygrometer at the place of work to study the heart rate behavior under the influence of known environmental conditions.

## RESULTS AND DISCUSSION

Distribution of the sample frequency against the Physical Fitness index (Figure 1) and Basal Metabolic index (BMI) indicated that 50 per cent women were found to be normal as per BMI score and the rest were distributed as of underweight (29%) and grade-1 obesity (21%). This show that nearly 30 per cent were suffering from nutritional imbalance. Seven percent of the subjects scored poor on their physical fitness exercise on Step test followed by 14 percent as low average, 35 per cent as high average. About 28 percent demonstrated good while the others (14%) very good physical fitness grade. This show that only about 43 per cent of the subjects were at an acceptable level of physical capacity to physically exercise. It is here there is a need to improve upon the physical capacity of nearly 57 per cent women through nutritional intervention and exercise.

The use of cono weeder as per data presented in Table 1 showed an increase in the physiological parameters such as in AWHR, PHR and physiological cost of work (PCW) compared to conventional weeding method. The increase in working heart rate (beats.min<sup>-1</sup>) over the conventional method was up to 1.5 times and peak heart rate per minute was up to 1.02 times. The energy expenditure (kJ min<sup>-1</sup>) during work also had increased up to 45 per cent while the peak energy levels were up to 24 per cent over the conventional method. It indicates that the physiological cost and energy cost per unit time of activity had increased when the cono weeder was used compared to conventional method. The increase was the result of modifying the task of weeding done in static bending posture into dynamic movement of legs in the puddle soil when cono weeder was pushed along the rows. It might be focused here that the main draw back in the contributions of

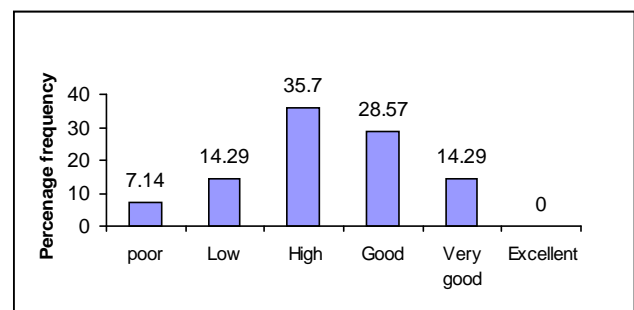


Fig. 1 Basal Metabolic Index Status of Women

women in agriculture was the wasteful utilization of physical effort in the tasks due to uncomfortable postures resulting in low productivity, physical strain and muscular stress. This was found optimally modified when the cono weeder was used and the increase in working heart rate per minute is compared against her improved productivity. There was an increase of nearly 2.47 times in the coverage of distance when the cono weeder was used for 30 minutes duration. This observation explained that about 1.7 hours of time was required to perform weeding in bending posture in the conventional method which should be finished with in 30 minutes when cono weeder is used. The estimated total cardiac cost would be 2567 beats for 1.7 hours in conventional method as against 1610.8 beats for 30 minutes in the improved method.

The postural bending was reduced to a greater extent when measured with Leighton flexo meter while using the cono weeder and conventional methods (Table 2). This was a welcoming feature as the subjects

would be able to dynamically move in faster pace in standing position than in bending position. Table 3 indicated the incidence and magnitude of muscular-skeletal pain experienced by women in weeding task by conventional and cono weeder method. The pain was reported as very severe by subjects as per score at neck region. This was followed by severe pain perception at the upper arm, shoulder and wrist in conventional method. Moderate pain scores were recorded at elbows, lower arm, low back, knees, calf muscles and at feet in conventional method. The subjects reported relief in pain scores due to paddy weeding using the cono weeder at neck, upper arm, elbows, low back and feet. However, an increase in pain was experienced in lower arm, upper leg, knees and calf muscles. The feature reported here point at the relief given to the subjects in body pain due to the postural improvement. Therefore, there is a need for organized efforts to improve the mechanical efficiency of the farm women through right postures and through

**Table 1. Workload between cono weeder and conventional method**

Physiological parameters	Conventional	Improved method (cono weeder)	Test of significance between methods	Percentage difference
Average Resting Heart Rate (beats.min <sup>-1</sup> )	82.68	83.01		
Average working heart rate (beats.min <sup>-1</sup> )	104.85	139.13		
ΔWorking Heart Rate (beats.min <sup>-1</sup> )	22.17	56.12	2.25 significant	34.28 (154.6%)
Average Peak Heart Rate Δ (beats.min <sup>-1</sup> )	122.75	164.14	2.4 significant	
Peak Heart Rate (beats.min <sup>-1</sup> )	40.07	81.13	2.85 significant	41.06 (102.7%)
Average work Energy expenditure (kJ min <sup>-1</sup> )	7.95	14.50	2.27 significant	6.55 (45.17)
Peak work energy expenditure (kJ min <sup>-1</sup> )	10.79	13.40		2.64 (24.18)
Average TCCW (Beats) (Total cardiac cost of work)	755.1	1610.8	84.6 significant	855.7 (113.32)
Average PCW (beats) (Physiological cost of work)	25.17	53.69	24.2 significant	28.52 (113.09 %)
Average RPE	4.0	4.0	nil	
<b>Out Put Parameters</b>				
Total time taken for the activity (min)	30	30		-
Average distance traveled (Sq.m)	27.6	96		-
Coverage of land (hrs/acre) per person	101	21		-
	12.6 man days	3 man days		-
<b>Environmental Parameters</b>				
Mean Temp °C	28	25.7	-	
Humidity %	40	62.6	-	

**Table 2. Postural analysis in weeding by conventional method and the use of Cono weeder**

Weeding method	Conventional	Cono weeder
Postural analysis		
Angle of normal curve	195	195
Angle while bending	255	201
Angle of deviation	60	6

and back to larger muscle groups such as upper leg and calf muscles.

Therefore, it might be emphasized that the mechanical advantage given to women in paddy weeding with the use of cono weeder had effectively reduced the wasteful time utilization at the weeding task and enhanced the productivity and effective use

**Table 3. Incidence of body pains during conventional method and the use of cono weeder**

Body parts	Conventional method	Cono weeder	Reduction in pain score (%)
Max score	50	50	
Eye	-	-	-
Neck	50	0	100 % R
Shoulder joint	43	43	No reduction
Upper arm	46	34	26% R
Elbows	38	31	18.4 R
Lowerarm	36	46	27% I
Low back	34	23	32.35% R
Wrist/ hands	42	35	16.6% R
Buttocks	-	-	-
Upper Leg/Thigh	26	34	30.7% I
Knees	35	40	14.28% I
Calf muscles	35	38	8.57% I
Ankles/ Feet	32	22	31.25% R

Pain score : 50 – severe, 40 – 50 moderate, 30- 40 moderate, 20 -30 mild, 10- 20 very mild R =Reduction; I = Increase

mechanical advantage given with the design of suitable paddy weeder. Also, there is requirement for evaluating the push force and corresponding effort needed and popularizing the weeders evaluated for the advantage of women.

Thus the use of cono weeder significantly reduced the time needed for weeding task when compared to conventional method. The reduction attained using the cono weeder was effective in reducing the total physiological effort needed to complete the task. It also indicated that the conventional method of weeding done in bending postures is a potential risk factor to strain the sensitive body sites to severe muscular pain. The postural improvement attained due to the use of cono weeder not only had relieved the women of pain at several sites but had also transferred the strain from delicate muscle regions such as neck

of energy. In the process the muscular stress at the sensitive muscle groups was reduced.

## REFERENCES

- All India Coordinated Research Project on Home Science, Annual Report, 1998-99, Ergonomics of Farm Women's Drudgery, Post Graduate and Research Center, ANGRAU, Hyderabad.
- Corlette EN and Bishop RP1976. A Technique for Assessing Postural Discomfort, Ergonomics, 19: 175-182
- Gite LP and Singh 1997. Ergonomics in Agricultural And Allied Activities In India, Technical Bulletin No. CIAE/97/ 70: 12-13
- Varghese MA and Saha P1994. A Rapid appraisal of occupational workload from a modified scale of perceived exertion: Ergonomics, Vol. 37(3): 485 – 491