

## Enhancing Efficiency and Ergonomics for Farm Women: Evaluating the Impact of Twin Wheel Hoe in Vegetable Weeding

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### ABSTRACT

*In agriculture, women are typically engaged in labor-intensive, mostly mechanized processes that require a lot of drudgery. Traditionally weeding vegetable crops involves laborious handwork, but innovative tools like the twin wheel hoe offer promising alternatives. These implements not only tackle weeds efficiently also provide surprising benefits for vegetables crop. Study was carried out in districts named Madla and Jabalpur. Demonstration was conducted under Krishi Vigyan Kendra, Mandla and Jabalpur Year 2016, 2017 and 2018. A total of 30 farm women were selected for the study. Demonstration conducted with farm women in adopted villages farm women participated in an inter-culture activity on vegetable crops using Twin wheel hoes comparison with the traditional weeding using hand hoe, and Khurpi. This study investigated the impact of using a twin wheel hoe on the weeding efficiency and ergonomic parameters of farm women in Piperpani, Bhapsatola Mandla district Raipura village, Jabalpur district. Specifically, it aimed to measure the reduction in physical strain and fatigue associated with traditional hand weeding methods. Farm women adopted long static postures, which increase the static muscular effort resulting in high physiological cost and less productivity. There is a need to design women friendly tools and equipment as women can comfortably operate these tools and equipment. Use of Improved tools will reduce musculoskeletal disorders and increase the efficiency and there by productivity of the worker. Women using the twin wheel hoe achieved significantly higher weeding efficiency compared to those using a khurpi. Additionally, their energy expenditure, heart rate and total output was 112.3m<sup>2</sup>/ha. Twin wheel hoe with khurpi. indicating reduced drudgery physical stress, Heart Rate (Beats/min), Energy Expenditure (kJ/min.) and labour cost also in weeding activities in vegetable field.*

**Keywords:** Drudgery, Ergonomic; Heart Rate; Weeding; Vegetables; Twin wheel hoe.

Women have always played a vital role in food production from time immemorial. They constitute almost half of the work force engaged in agriculture. The rural women participate in a broad range of agricultural activities such as production, processing preservation and utilization of food (Vishwakarma *et al.*, 2015). Most of the field operations like seed sowing, nursery management, seed treatment, weeding, digging, transplantation, winnowing, harvesting, cleaning and preparation and much more are done by farm women with the use of traditional types of equipment. Farm women utilize traditional hand tools like a spade and hand hoe to perform weeding tasks. Agricultural labour often goes unnoticed due to its high workloads, arduous labour, and negative health effects. Additionally,

automated weeders that simultaneously conduct the tasks of weeding and hoeing can be used to accomplish timely weeding. Weeding is a crucial but time-consuming and labor-intensive task in agriculture. Traditionally, farmers have relied on manual weeding, which often involves bending over for long periods and using tools like hand hoes. While effective, this method can be physically demanding and lead to fatigue and even injuries (Goel *et al.*, 2008). Fortunately, technological advancements offer alternative solutions like mechanical weeders while others are manually operated. They work by tilling the soil in clay sand soil, sandy loam soil, loamy sand soil between crop rows, uprooting weeds in the operation. (Behera and Swain, 2005), When you perform any physical activity of body requires more

oxygen to fuel of muscles. Heart rate is measuring an ergonomic measure to evaluate the physiological or functional demands of work on the individual workers (Hasalkar et al., 2004).

Twin wheel hoe is manually operated equipment for weeding and intercultural operations. It consists of twin wheels, frame, v-blade, v clamp and a handle. The cutting and uprooting of weeds in field is done through push and pull action. It is light weight, simple to operate which improves the work posture and this machine is easily operated and useful for farm women. Optimum operation of twin wheel hoe depends on soil moisture condition and preferably after 25- 30 day of sowing i.e., when the weeds are small i.e. 1 to 3 cm. in height for better weeding performance. On an average, they save Rs. 500 to 1000/acre towards the labour cost for weeding operation. A farmwomen can cover 1.0 - 1.5-acre land per day using twin wheel hoe weeder.

## METHODOLOGY

The study was carried out on 30 farm women of the age group of 25-45 years involved in weeding activity of vegetable crop. Using the anthropometric measurement and physical parameter respectively the physical characteristics like height and weight was measured. Evaluate during activities ergonomic changes, such as improved tools. The heart rate responses for every minute were recorded by using the heart rate monitor. Each respondent was tied the heart rate monitor and switched on to record the heart rate at resting i.e. resting heart rate (RHR) and working i.e. working heart rate (WHR). Five minutes rest was given to record the resting heart rate during the cleaning of wheat grains. The field experiment was conducted in the month of Sept-Oct. During the experiment various parameters viz., time and ergonomically stress were studied. Time and Activity profile Stopwatch was used to measure the time required and a meter tape was used to measure the area covered.

### Assessment of physiological stress :

1. Heart Rate Heart rate was recorded 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. Average heart rate recovery period.
2. Energy Expenditure Rate and Cardiac Cost From

the average values of heart rate and energy expenditure was calculated with the help of formulae given by (Varghese et al., 1994) which is as follows  $EER (kJ/min) = 0.159 \times HR (beats/min) - 8.72$  Where, EER = Energy Expenditure Rate (kJ/min) HR = Heart rate (beats/min) From the values of change in heart rate (beats/ min) and output (kg/hr).

3. Describe the Workload: Workload of activity was categorized as per the following classification of workload (Table 1) in different occupations proposed by Varghese et al (1994).

## RESULTS AND DISCUSSION

Table 1 shows physical characteristics of the respondents, in which mean age of the respondents engaged in weeding operation was average, these women were 38.26 years young, standing heighted at 156.26 cm and weight were 54.86 kg, reflecting the diversity of body types in study.

**Table 1. Selected anthropometric dimensions of farm women during weeding (N=30)**

Physical characteristics	Mean	Mean $\pm$ S.D.
Age (yrs)	38.26	38.26 $\pm$ 8.26
Height (cm)	156.26	156.26 $\pm$ 4.71
Weight (kg)	54.86	54.86 $\pm$ 3.24

The results presented in Table 2 depicted the work output of the weeding activity with the traditional and improved technologies. Improved technologies have significantly higher work output than the traditional method. The Data shows time and output of the farm women during weeding ranged between 46 to 60.3 Output (m<sup>2</sup> /ha) by Khurpi and 98.8 to 112.3(m<sup>2</sup> /ha) weeding by twin wheel hoe. The output difference between the two methods is nearly ten times. Similar study has also indicated increase in work output with saving in cardiac cost by Singh et al (2011). Traditionally, weeding has been a laborious task, relying heavily on manual tools and demanding countless hours of bending and straining. This not only lose more energy and reduces work output also contributes to fatigue and musculoskeletal pain. Weeding of vegetables crop is an activity where musculo-skeletal problems are very noticeable."The variation in heart rate and oxygen consumption for the weeder may be attributed to the design configurations of the weeder since all other parameters were controlled to be at constant level" in a more engaging and informative way (Thiyagarahan,

**Table 2. Change in heart rate, energy expenditure and output by use of twin wheel hoe over traditional khurpi (N=30)**

Parameters	Khurpi	Hand hoe	Twin wheel hoe
Output, m <sup>2</sup> /ha.	60.3	98.2	112.3
Av. working heart rate, b/min	105.8	110.8	117.6
Av. energy expenditure working, KJ/min	7.97	8.89	9.97
% increase in efficiency	-	62.85	86.23

*et. al, 2012*). Av. working heart rate, b/min of the farm women during weeding of vegetable crop field between 117.6 beats/min compare to local method weeding by khurpi 105.8. Energy expenditure increases with the average working heart rate during the cleaning in both methods. Traditional and Local method of weeding is a

time-consuming and drudgery laden task. Results are in conformity with the study conducted by *Singh et. al (2018)*, also found decrease in physiological cost of work and increased work out put compared to conventional method. In agriculture, weeding is one of the important large workforce activity and adoption shows increase not only in, efficiency but in terms of cost saving also by reducing labour engagement during weeding, productivity of worker is increased with the equipment than traditional method is said by *Sharma et. al (2015)*.

## CONCLUSION

The study concluded that using a twin wheel hoe increases weeding efficiency by 86.23% means less time spent fighting weeds and get more time for other tasks. It is easily operated at optimum soil moisture condition and preferably after 25-30 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance.

## REFERENCES

- Behera, B.K. and Swain, S. (2005). Proceedings of International Ergonomics Conference, HWWE, IIT, Guwahati, Assam, India. pp. 138.
- Goel, A.K.; Behera, B.K.; Mohanty, S.K. and Nanda, S.K. (2008). Development and ergonomic evaluation of manually operated weeder for dry land crops. *Agric Eng Int: CIGR Journal*, **10**: 1-10.
- Hasalkar, S.; Budihal, R.; Shivalli, R.; Biradar, N. (2004). Assessment of the workload of weeding activity in crop production through heart rate. *J Hum. Ecol.*, **14**(3): 165-167.
- Sharma, B.; Singh, S.R.K.; Gupta, S.; Shrivastava, M.K. and Verma, S. (2015). Improving efficiency and reduction in drudgery of farm women in weeding activity by twin wheel hoe. *Indian Res. J. Ext. Edu.*, **15**(1): 76-80.
- Singh, A.; Yadav, R.K. and Singh, D. (2018). Efficacy of improved tools for farm women toward drudgery reduction and efficiency enhancement. *Indian Res. J. Ext. Edu.* **18**(3): 32-37.
- Singh, A.; Gautam, U.S. and Singh, S.R.K. (2011). Ergonomic evaluation of the farm women during weeding. *Indian J of Ext Edu.*, **47**(3&4): 57-60.
- Thiyagarahan, R.; Kathirvel, K.K. and Jayashree, G.C. (2012). Ergonomical evaluation of three row finger type rotary weeding for paddy. *Mysore J. Agric. Sci.*, **46**(3): 538-544.
- Varghese, M.A.; Saha, P.N. and Atreya, N. (1994). A rapid appraisal of occupational workload from modified scale of perceived exertion. *Ergonomics*, **37**(3): 485-491.
- Vishwakarma, N.; Sharma, A.; Kumar, A. and Rai, H.S. (2015). Hanging type double screen grain cleaner- A drudgery reduction boon of tribal farm women, *Bioved*, **26**(1,2): 1-3.

