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# Study on effect of twin wheel hoe on efficiency and ergonomic parameters for farm women involved in soybean weeding

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**Abstract**
The present study was undertaken in adopting village powarkheda block Hoshangabad of Krishi Vigyan Kendra, Hoshangabad for performing weeding efficiency of farm women by use of the twin wheel hoe. Reduction of women's drudgery with the use of twin wheel hoe was asses in the term of energy expenditure. The ergonomic cost was calculated by measuring heart rate, energy expenditure, and total cardiac cost of the work. The results indicate that the 18.32 men/ha required by hand weeding with the use of khurpi whereas 10.84 men/ha rquired through twin wheel hoe with the total saving of 7.48 man/ ha and weeding efficiency was 545.60sqm /man/day and 922sqm/man/day respectively with less knee pain (13.33%).

**Keywords:** drudgery, ergonomic, weeding, soybean, twin wheel hoe

## Introduction

Women in India are the major workforce in the house- hold activities as well as Agriculture which gave them double the workload. 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. During this activity their body gets tired and their efficiency reduces. Verma *et al*., (2016) [9] found that during the farm activities women adopt an unnatural body posture due to which their physiological workload increases and also they face many types of muscular-skeletal problems, as a result, the efficiency of women to work decreases to a greater extent. Analyzing the workload of any person the heart rate is a simple and a reliable method with coorelate to oxygen consumption this method to assess the physiological cost of work in agriculture (Badiger et.al 2006) [1] Generally heart rate is used as an ergonomic measure to evaluate the physiological or functional demands of work on the individual workers (Hasalkar *et al*., 2004) [2]

Soybean (Glycine max (L.) Merrill) which is major oilseed crops in the world. In India soybean as established major Kharif crop in Madhya Pradesh. Madhya Pradesh has the major share in the area (70%) and production (65%) of soybean in India and hence known as soy state. In the area and with an average production and productivity, district Hoshangabad is one of the dominant districts in the production of soy crop soybean growing the crop. Soybean occupied an important place in the Indian economy because of getting more foreign exchange. It contains 40% protein Soybean a highly nutritious legume and oilseed crop (vegetarian meat) is grown abundantly, covering an area of 4167.1 thousand hectares producing about 4434.4 thousand tones. Because of its high protein (40%) and oil content (20%) and well balanced amino-acid makes up makes it a cheap and suitable option as supplemented food in M.P. Soybean is mostly used by solvent extraction plants and thus plenty of defatted soy-flour is available which contains a high content of protein (50%0. This protein can be utilized in various food formulations to improve their nutritional quality characteristics (Joshi *et al*, 2004) [3].

Weeding is one of the most important farm operations in the soybean crop production system. Delay and negligence in weeding operation affect the crop yield approximately 40-60% (Singh 1988) [5]. Weeding in soybean is done by farm women with the help of hand tools like a sickle, khurpi and so on. Women performed this activity is in bending and squatting posture for longer time. This posture increases the fatigue and drudgery of farm women while weeding which leads to aches and pains in the back, knee and cervical region. Therefore the present study was aimed to ensure better health and safety and to improve work efficiency reduce drudgery of farm women by introducing twin wheel hoe developed by CIAE Bhopal (MP). This twin wheel hoe tested through the heart rate method at field level.

## Materials and Methods

The field experiment was conducted in the farmer's field in village powarkheda during the month of August 2015 in soybean producing block Hoshangabd of District Hoshangabad, Madhya Pradesh. The study was carried out on 15 farm women of these villages involved in a soybean weeding activity aged between 25-45 years with normal health, without any major illness were selected. Weeding with a twin wheel hoe were compared with traditional weeding equipment khurpi. Working principle of twin wheel hoe consists of twin wheels, frame, V-blade with tyne, U clamp and a handle. The cutting and uprooting of weeds in the field is done through push and pull action. It's Lightweight, simple to operate which improves the work posture and also reduces the drudgery of the women worker. This is operated at optimum soil moisture condition and preferably after 20-25 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance (Singh and Gite 2007) [5].

During the experiment, the anthropometric rod and weighing balance were used to measure the physical characteristics like height and weight of farm women. One hour of time was given for both the treatments, i.e. khurpi and hand operated twin wheel hoe. Each trial was of 60 minutes duration. Various parameters viz., time, profile, weeding efficiency, field capacity (output $m^2$ /hr) was measured with the help of measuring tape.

### 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.

### 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) [8] which is as follows

EER (kj/min) = 0.159×HR (beats/min) - 8.72

Where,

EER = Energy Expenditure Rate (kj/min)

HR = Heart rate (beats/min)

**Cardiac cost of work can be calculated as per the formula given**

by (Varghese *et al.* 1994) [8]

CCW= Δ heart rate x duration of activity/output

Δ heart rate (Beats/min) = Average working heart rate-average heart rate during rest

Physiological cardiac cost of work = Δ Heart rate x duration of activity /output

**After performing the activity respondent were asked to rate the perceived exertion on a five point scale every time.**

## Results and Discussion

After conducting the front line demonstrations in the block of Hoshangabad to evaluate the weeding of soybean through ergonomic point, the results are presented in the respective tables. The mean age of farm women was 34.5years, whereas the basic body dimensions were measured an average was a workout as mean height and weight was 156.41cm and 49.30 kg respectively (Table 1).

The results represented in table 2 depict ergonomic assessment of weeding of soybean through khurpi and twin wheel hoe. As per comparison with the traditional practice of weeding by khurpi and twin wheel hoe the results indicate that the 18.32 farm women /ha required by hand weeding with the use of khurpi whereas 10.84 farm women/ha rquired through twin wheel hoe with the total saving of 7.48 farm women/ ha and the efficiency of farm women was increased 40.82% in terms of labour saving. The average working heart rate observed in traditional practice weeding by khurpi and twin wheel hoe was 98.0 beats/min and 110.2beats/min respectively. With the use of twin wheel hoe the weeding of soybean was 922$m^2$/day as compared to the traditional practice of weeding I. e. 545.6$m^2$/day similar results reported by (Sharma *et al*, 2015) [4] in terms of weeding with khurpi and twin wheel hoe 60.3$m^2$/hr and 112.3 $m^2$/hr respectively.

The results presented in Table 3 depict ergonomic assessment of weeding with khurpi and twin wheel hoe.The average working heart rate observed in traditional and improved method is 98.0 beats/min and 110.20 beats/min respectively. The change in heart rate was 8.80 and 11.72 beats/min, respectively, and time spent for weeding was one hour. So the use of improved tools twin wheel hoe save 21.12. Percent cardiac cost of worker per unit of output. With the use of improved equipment, farm women found a light rate of perceived exertion compared to traditional method. There is no reference available to correlate the present results. Whereas the use of the twin wheel hoe (Tripathy *et al*, 2016) [7] found working heart rate 107.0 beats/ minute.

Occurrence of health hazards in any farm practice affects the working efficiency and productivity of the performance. Table 4 presents the traditional practice the percentage of respondents reported the occurrence of Palm pain (80%), shoulder pain (60%), backache pain(73.33%), waist pain (80) and knee pain (93.33%) whereas using of twin wheel hoe the occurrence of palm pain (46.67%), shoulder pain (33.33%), backache pain(40.0%), waist pain (20%) and knee pain (13.33%) respectively.

**Table 1:** Anthropometric dimension of Farm women involved in weeding in soybean (N=15)

| S. No. | Parameters | Mean |
|---|---|---|
| 1 | Age(Yrs) | 34.5 |
| 2 | Height(cm) | 156.41 |
| 3 | Weight(Kg) | 49.30 |

**Table 2:** Comparative analysis of traditional soybean weeding by khurpi and Twin wheel hoe (N=15)

| S. No. | Parameters | Weeding by Khurpi | Weeding by Twin wheel hoe |
|---|---|---|---|
| 1 | Area covered ($m^2$/hr/farmwomen) | 68.2 | 115.25 |
| 2. | Area covered ($m^2$/day/farmwomen) | 545.60 | 922.0 |
| 3. | Labor required (farmwomen/ha) | 18.32 | 10.84 |
| 4 | Efficiency(%)of farm women | - | 40.82 |

**Table 3:** Ergonomic parameters and perceived exertion rate while performing weeding in soybean (N=15)

| S. No. | Physical parameters | Weeding with khurpi | Weeding with twin wheel hoe |
|---|---|---|---|
| 1 | Average working Heart Rate ( beats/min) | 98.0 | 110.20 |
| 2. | Average Heart Rate during rest ( beats/min) | 89.20 | 98.48 |
| 3. | Δ Heart rate (beats/min) | 8.80 | 11.72 |
| 4 | Average energy expenditure (kj/min) | 6.86 | 8.80 |
| 6. | Cardiac cost of work | 7.74 | 6.10 |
| 7. | Saving in cardiac (%) | - | 21.12 |
| 8. | Rate of perceived exertion | Moderately heavy | Light |

**Table 4:** Comparisons Health hazards during weeding in soybean with Khurpi and twin wheel hoe (N=15)

| Health Hazards | Weeding with Khurpi | | Weeding with twin wheel hoe | |
|---|---|---|---|---|
| | Yes (%) | No (%) | Yes | No |
| Palm Pain | 80 (12) | 20 (3) | 46.67 (7) | 53.33 (8) |
| Shoulder Pain | 60 (9) | 40 (6) | 33.33 (5) | 66.67(10) |
| Backache Pain | 73.33 (11) | 26.67 (4) | 40.0 (6) | 60.0 (9) |
| Waist Pain | 80 (12) | 20 (3) | 13.33 (2) | 86.67(13) |
| Knee Pain | 93.33(14) | 6.67(1) | 20 (3) | 80 (12) |

Parantheses indicate no of farm women

## Conclusions

Weeding of soybean by khurpi is a time consuming and tedious operation. Farm women feel used to traditional weeding practice it as a maximum drudgery prone activity, because of its monotony in performance, continuous sitting with bending of the knee and performing is for a longer period of time. Women feel comfortable, they earn money by reducing the labour with the use of twin wheel hoe. Use of hand operated twin wheel hoe reduce the health hazards but also increase the efficiency of workers. It is easily operated at optimum soil moisture condition and preferably after 20-25 days of sowing i.e. when the weeds are small i.e. 1 to 3 cm height for better weeding performance. The output increased 40.82% with the saving of time and less knee pain followed by waist pain, shoulder pain and back pain. There is a greater need to provide twin wheel hoe to farm women because twin wheel hoe avoids bending/squatting postures. It is easy to maintain and reduces the drudgery while weeding.

## References


1. Badiger C, Hasalkar S, Hosamani S. Drudgery reduction of farm women through technology intervention. Karnataka J Agric. Sci. 2006; 19(1):182-184.
2. Hasalkar S, Budihal R, Shivalli R, Biradar N. Assessment of work load of weeding activity in crop production through heart rate. J Hum. Ecol. 2004; 14(3):165-167
3. Joshi SS, Bargle PC, Jha K, Singh V, Varghese S. Development acceptability and shelf life studies of soy-fortified maize sattu. J Food Sci. Technol. 2004; 41(6):674-677.
4. Sharma B, Singh SRK, Gupta S, Shrivastava MK, Verma S. Improving efficiency and reduction in drudgery of farm women in weeding activity by twin wheel hoe. Indian Res. J Ext. Edu. 2015; 15:76-80.
5. Singh G. Development and fabrication techniques of improved grubber. Agricultural mechanization in Asia, Africa and Latin America. 1988; 19:42-46.
6. Singh SP, Gite LP, Agrawal Nidhi, Majumdar J. Woman friendly improved farm tools and equipments. Technical bulletin Central institute of Agricultural Engineering Bhopal, 2007.
7. Tripathi SP, chundawat GS, Somvanshi SPS, Shrivastava DC. Drudgery reduction of farm woman through twin wheel hoe for weeding in soybean crop. Res. Environ. Life Sci. 2016; 9(7):819-821.
8. Varghese MA, Saha PN, Atreya N. A rapid appraisal of occupational workload from modified scale of perceived exertion. Ergonomics. 1994; 37(3):485-491.
9. Verma S, Bajpai D, Shrivastava AK, Dhakad SS. Effect of maize Sheller on efficiency and ergonomic parameters for farm women in Hoshangabad district of Madhya Pradesh. Res. Environ. Life Sci. 2016; 9(4):484-486.