Drudgery Reduction of Farm Women Through Three Tined Hand Hoe (Grubber Weeder) For Interculture in Vegetable Crops

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ABSTRACT

Among the agricultural operation, weeding is crucial activity which involves lot of drudgery. The three tined hand hoe (grubber weeder) is one of the improved hoe developed by CIAE, Bhopal for weeding and intercultural in vegetable crops. It is long handled weeding tool and can be easily maneuvered between the rows and around the plants. The present study was conducted in vegetable fields on 15 farm women within the age group of 21-45 years in district of Shajapur (M.P.), having normal blood pressure, body temperature and not suffering from any chronic illness. The objective of the trial was to analyze the efficiency of grubber weeder to reduce the drudgery among the farm women. Before conducting the demonstration, training on drudgery reducing equipments was imparted to farm women. Ergonomic cost of work was assessed by heart rate, energy expenditure (EER), overall discomfort ratio (ODR), working depth, and working width. ODR was calculated on 5-point scale ranging from 1-5. Working width and depth was calculated in inches. Results show that mean heart rate during work in operation of this weeder s that is local weeder and grubber weeder were 98.5 and 111 beats/min, respectively. EER was 6.94 and 8.72 Kj/min. Working depth 13 and 21/mm. Working width 100 and 165/mm. Total drudgery reduction 61.8%. The study thus recommend the weeder use of grubber weeder among the farmwomen which may ultimately helps is raising the production of the crop by reducing the fatigue among farmwomen.

Keywords: *Drudgery reduction; Three tined hand hoe (grubber weeder); Farm women; Weeder.*

Women in India play a major role in shaping the economy of the country. The women work force in agriculture and allied sectors is estimated to be around 92 million which amounts to 40 per cent of the total rural workers in the country (*Singh et al, 2010*). Women in India are the major workforce in the households 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. *Jyotsna et al.(2005*), 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 correlate to oxygen consumption this method to assess the physiological cost of work in agriculture (*Badiger et al, 2006*). 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*). Weeding is one of the most important form operations in crop production system. Weeding operation is major problem for farm women. Delay and negligence in weeding operation after the crop yields due to weeds in uplands crops vary from 40-60% and in many cases cause complete crop failure. Majority of the farm women do weed control using hand tools like sickle, khurpi, and so on. Therefore, timely weeding is very much essential for a good yield, this can only be achieved by using mechanical weeders which perform simultaneous job

for weeding and hoeing and can reduce the time spent on weeding (man hours), cost of weeding and drudgery involved in manual weeding (*Goel et al, 2008*). Farm women in agricultural activities are affected by a host of factors, which include regional variations in nature of work, socio- economic status of the farm families, family traditions, change in nature of activities due to mechanization, introduction and time and labour saving implements and variations in agro-climate conditions. It was observed that more than 75 % women involved in activities like winnowing, weeding, grading, threshing, and cleaning of field farm operations (*Singh et al, 2014*). Drudgery is a term used to represent the dissatisfactory experiences that constrain work performance in any activity (*Technical module, 2009*). It can be reduced by women friendly farm tools and equipments with increased output. In fact, drudgery is termed for hard work, monotony, time consuming, use of traditional tools with inappropriate working posture in field (*Sridhar et al, 2015*). Women performed this activity is in bending and squatting posture for longer time. This posture increases the fatigue and drudgery of farm women. These activities are not only time and labor intensive, monotonous, repetitive and more drudgery prone but causes considerable physical and mental fatigue and other health problems (*Singh et al, 2018*). Therefore the present study was aimed to ensure better health and safety and to improve work efficiency reduce drudgery of farm women by introducing three tined hand hoe developed by CIAE Bhopal (MP). These three tined hand hoes (Grubber weeder) tested through the heart rate method at field level. The objective of the trial was to analyze the efficiency of grubber weeder to reduce the drudgery among the farm women in weeding and interculture in vegetable crops (Tomato, Chili).

METHODOLOGY

This study was carried out with farm women in adopted village Tilawad govind and Girwar under OFT & FLD programme conducted in year 2016-17 , 2017-18 by krishi vigyan Kendra , Shajapur Madhya Pradesh. 15 farm women aged between 21-45 years without having any physical deformity, whose body temperature and blood pressure are normal and those who are not suffering with any cardio-respiratory and chronic diseases were selected to assess and compare the impact of improved technologies over conventional one. Weeding with a three tined hand hoe (grubber weeder), were compared with traditional weeding equipment khurpi. Working principle of three tined hand hoe consists of the V-blade hand hoe is a long-handled weeding for operation in between the crop rows. Wooden handle is inserted in the ferrule. The cutting and uprooting of weeds in the field is done through push and pull action. It is 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*).

During the experiment various parameters viz., time and activity profile, weeding efficiency and physiological stress were studied. Comparative study was carried out with improved technology three tined hand hoe were taken for both the treatments i.e. traditional khurpi and three tined hand hoe for assessing the drudgery for weeding in vegetable crop. Well prepared interview questionnaire was carried out for collecting the data; especial attention was given to the selected sample size as regards to their physical fitness and prevalence of any serious health hazard. The anthropometry 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 three tined hand hoes. Each trial was of 60 minutes duration. Various parameters viz., time, profile, weeding efficiency, field capacity (output m2 /hr) was measured with the help of measuring tape. 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-

$$W = \frac{W1 - W2}{W1} \times 100$$

Where, W = Weeding efficiency, per cent

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 heart rate monitor. Based on the heart rate records the following parameters were calculated-

- Average heart rate during rest and work.
- The energy expenditure per minute was estimated from the heart rate with the help of formulae (*Kwatra et al, 2010*)

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 (kj/min) =0.159 × HR (beats/min) – 8.72

- HR (beats/min) = Average working heart rate – average heart rate during rest
- Output (kg/hr, sqm/hr)
- Cardiac cost of worker = "HR × duration / output

The results were statistically analyzed using test of significance (t-test at 5 per cent level of probability) and simple regression (r) (*Shnedecor et al., 1967*)

Cardiac cost of work can be calculated as per the formula given by (*Varghese et.al.1994*)

Total cardiac cost of work (TCCW) and physiological cost of work (PCW) were determined by using average heart rate during rest and work, recovery heart rate and duration of work recovery using following formulae-

CCW= Δ heart rate × 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

TCCW = Cardiac cost of work (CCW) + Cardiac cost of recovery (CCR).

Where,

CCW = AHR during of work

AHR = Average working HR - Average resting HR.

CCR = (Average recovery HR - Average resting HR), duration of recovery

$$PCW = \frac{TCCW}{Toatal\ time\ of\ work}$$

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

ODR: Rated overall discomfort ratio (ODR) was calculated on 5.point scale ranging from 1-5. Working width and depth was calculated inches.

RESULTS AND DISCUSSION

The classification of physiological workload was done as per the classification table developed by *Varghese et al.* (*1994*). The work output is measured in terms of the length of the lines weeded in a given time of 30 minutes. After performing the activity the respondents were asked to rate the perceived exertion on a five point scale every time after the use of each technology.

After conducting the OFT & FLD programme in the villages of Shajapur district to evaluate the weeding of vegetable crop through ergonomic point, the results are presented in the respective tables. The mean age of farm women was 31.92 years, whereas the basic body dimensions were measured an average was a workout as mean height and weight was 152.8 cm and 49.20 kg respectively (Table 1).

Table 1. Physical characteristics of the selected sample for evaluation of weeding technology (N=15)

Parameters	Mean
Age (years)	31.92
Height (cm)	152.8
Weight (kg)	49.20

Table 2. Comparative analysis of traditional weeding in vegetable crop by khurpi and Three tined hand hoe (Grubber weeder) (N=15)

Parameters	Weeding by Khurpi	Weeding with Grubber weeder
Area covered (m^2/hr/farmwomen)	55.50	145.60
Area covered (m^2/day/farmwomen)	444	1164.8
Width (mm)	100	165
Depth (mm)	13	21
Labor required (farmwomen/ha)	22.52	8.58
Efficiency (%) of farmwomen	-	61.8

The results represented in Table 2 depict ergonomic assessment of weeding of vegetable crop through khurpi and three tined hand hoe (grubber weeder). As per comparison with the traditional practice of weeding by khurpi and three tined hand hoe the results indicate that the 22.52 farmwomen/ha required by hand weeding with the use of khurpi where as 8.58 farm women/ha required through three tined hand hoe with the total saving of 21.10 farm women/ ha and the efficiency of farm women was increased 61.8% in terms of labour saving. The average working heart rate observed in traditional practice weeding by khurpi and three tined hand hoe was 98.5 beats/min and 111 beats/min respectively. With the use of three tined hand hoe the weeding of vegetable crop was 1164.8 m^2/day as compared to the traditional practice of weeding i. e. 444 m^2/day similar results reported by (*Sharma et al, 2015 and Singh et al, 2011*)

in terms of weeding with khurpi and three tined hand hoe 55.50 m^2/hr and 145.60 m^2/hr respectively.

The results presented in Table 3 depict ergonomic assessment of weeding with khurpi and three tined hand hoe. The average working heart rate observed in traditional and improved method is 98.5 beats/min and 111 beats/min respectively. The change in heart rate was 8.5 and 12.52 beats/min, respectively, and time spent for weeding was one hour. So the use of improved tools three tined hand hoe saves 21.10. 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 three tined hand hoe. (*Tripathy et al, 2016*)

Table 3. Ergonomic parameter and perceived exertion rate while performing weeding in vegetable crop (N=15)

Physical parameters	Weeding by Khurpi	Weeding with Grubber weeder
Average working Heart Rate(beats/min)	98.5	111
Average Heart Rate during rest(beats/min)	90.0	98.48
Ä Heart rate (beats/min)	8.5	12.52
Average energy expenditure (kj/min)	6.94	8.72
Cardiac cost of work	7.77	6.13
Saving in cardiac (%)	-	21.10
Rate of perceived exertion	Moderately heavy	Light

Table 4. Comparisons health hazards during weeding in vegetable crop with Khurpi and three tined hand hoe (Grubber weeder) (N=15)

Health Hazards	Weeding by Khurpi		Weeding with Grubber weeder	
	Yes (%)	No (%)	Yes	No
Palm Pain	80 (12)	20 (3)	45 (7)	55 (8)
Shoulder Pain	60 (9)	40 (6)	32 (5)	68 (10)
Backache Pain	73 (11)	26 (4)	40.0 (6)	60.0 (9)
Waist Pain	80 (12)	20 (3)	12 (2)	82 (12)
Knee Pain	88 (13)	12 (2)	21 (3)	79 (12)

(Parentheses indicate no of farmwomen)

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.%), waist pain (80) and knee pain (88%) whereas using of three tined hand hoe the occurrence of palm pain (45 %), shoulder pain (32 %), backache pain(40.0%), waist pain (12%) and knee pain (21%) respectively.

CONCLUSION

Weeding of intercultural in vegetable crop 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. Women feel comfortable; they earn money by reducing the labour with the use of improved method (Grubber weeder). Use of hand operated three tined hand 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 61.8 % 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 three tined hand hoes to farm women because three tined hand hoe avoids bending/squatting postures. It is easy to maintain and reduces the drudgery while weeding.

From the results, it is concluded in this study an effort is made to introduce improved technologies for weeding activity for the farm women who can increase their efficiency, work output and reduce the drudgery while performing weeding activity.

Recommondation : Weeding with a three tined hand hoe (grubber weeder), were compared with traditional weeding equipment khurpi. Working principle of three tined hand hoe consists of The V-blade hand hoe is a long handled weeding for operation in between the crop rows. Wooden handle is inserted in the ferrule. 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.

The study thus recommended the use of grubber weeder among the farm women which may ultimately helps is raising the production of the crop by reducing the fatigue with low ergonomic cost.

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