

# Evaluation of different weeders for drudgery reduction of farm women in Jharkhand

■ V.K. PANDEY, R.K. SINGH, V.P. RAI AND D. ORAON

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See end of the Paper for authors' affiliation

Correspondence to :

**V.K. PANDEY**

Krishi Vigyan Kendra  
(B.A.U.), CHATRA  
(JHARKHAND) INDIA  
Email : [vinod.bau@rediffmail.com](mailto:vinod.bau@rediffmail.com)

■ **ABSTRACT** : Weeds are the most under estimated crop pest in tropical agriculture, although they cause higher reduction in crop yield than other pest and disease. In agriculture rural women play a vital role for maximum operation of crop production. Drudgery reduction has a serious problem for farm women in this respect the present research assess three types of weeders on ergonomic parameters, man days required with a view to promote health. The experiment was conducted in Gidhour village of Chatra district, Jharkhand, 20 farm women in the group age of 25 to 35 years were selected in normal health. The result revealed that all three weeder proved efficient on ergonomic parameters reduced working heart beat energy and cast of cultivation compared to traditional tools (Spade). Among all three weeders grubber (Three tynes) with wheel was best weeder in respect to reduction of working heart beat energy expenditure and cost of cultivation. The yield of cauliflower was highest (278q/ha) in technology option grubber (three tynes) with wheel.

■ **KEY WORDS** : Weeder, Energy, Expenditure, Heart beat, Mandays

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Women in agriculture makeup substantial portion of rural population. They contribute 86% of work in intercultural activities in agriculture (Census of India, 2011) weeding is a process of removing unwanted plants by hand or with traditional tools such as Kudali and Khurpi. As reported by Nag and Dutt (1979)

A huge population of small and marginal farmers grow *Rabi* season cauliflower but weed stress stands as hard problem because hoeing and weeding is highly labour intensive during *Rabi* season. In spite of enough technologies in mechanization of agriculture, farmers still practice hand weeding to keep weeds down in the field for avoiding drudgery and expenses on labour some farm implements tested at a time in terms of drudgery

reduction for recommendation to the farmers with this view a set of three farm implements have been tested on ergonomic parameters in comparison to the traditional method of weeding (Spade). All three weeders were made up iron, light in weight and easy to operate. The long handle provided facilities weeding by giving pressure by both hands as well as also improve posture one sharp shovel provided in wheel hoe weeders and three sharp shovel provided in grubber weeder and grubber weeder with wheel, respectively. All three weeders were designed by CIAE, Bhopal.

## ■ METHODOLOGY

The experiments were conducted in participatory

mode in farmers field of Chatra district of Jharkhand. The details technological options are mentioned here under.

TO<sub>1</sub> : Farmers practice (Spade) two hoeing 1<sup>st</sup> 25 DAT 2<sup>nd</sup> 50 DAT.

TO<sub>2</sub> : Grubber weeder (Three tynes) two hoeing 1<sup>st</sup> 21 DAT, 2<sup>nd</sup> 45 DAT

TO<sub>3</sub> : Wheel hoe two hoeing 1<sup>st</sup> 21 DAT, 2<sup>nd</sup> 45 DAT

TO<sub>4</sub> : Grubber weeder (Three tynes) with wheel. Two hoeing 1<sup>st</sup> 21 DAT 2<sup>nd</sup> 45DAT

The experiment was conducted in Gidhour village of Chatra district Jharkhand, 20 farm women in age group of 25-35 years were selected in normal health.

All treatments were tested in Randomized Block Design with 10 replications in the plots of 200m<sup>2</sup> during Rabi season 2014 and 2015. The soils of experimental fields were sandy loam in texture having pH 6.3 with available N 220kg/ha, P<sub>2</sub>O<sub>5</sub> 12kg/ha and K<sub>2</sub>O 216kg/ha. The cauliflower cultivar Pusa Katakai was selected for the experiments. The crops were raised by applying a basal dose of composed 220q urea 1.5q, SSP 3.0q and MOP – 1.0q/ha. The remaining 7.50q urea/ha was applied as top dressing in two split doses.

#### Health status through step stool test :

Selected farm women was given full rest and her resting heart rate was measured with stethoscope after completeness then after they ready to perform the stepping activity on the step test ergometer for maximum 5 min. With uniform stepping during the stepping activity the heart rate was recorded every minute. After 5 min of stepping activity the farm women was asked to stop the activity and sit comfortably on chair. The recovery pulse rate was recorded after every minute for period of 5 min.

Physical fitness index (PFI) was calculated by using the formula which inter pretation of scores was given by Varghese *et al.* (1994)

$$PFI = \frac{\text{Duration of stepping (sec) x 100}}{\text{Sum of 1}^{\text{st}}, 2^{\text{nd}} \text{ and } 3^{\text{rd}} \text{ min recovery HR}} \text{ each selected}$$

women was ready for the operating the implements by giving rest for 20 min. She was then asked to perform the activity for 30 min and heart rate was recorded at an interval of 1min each. After completing the working time recovery heart rate was recorded for period of 5min or till she required her resting state at an interval of 1 min each. The heart rate during the rest work and recovery were recorded while working with traditional as well as improved implements.

#### Body mass index :

The body mass index was calculated by measuring height of farm women and weight and using quetelet (QI) index in following formula given Garrow by Arrow

$$(1981) (QI) = \frac{\text{Weight (kg)}}{\text{Height (m)}}$$

#### Physiological cost of work :

The energy expenditure (KJ/min) was calculated by the following formula proposed by Varghese *et al.* (1994).

$$\text{Energy expenditure} = 0.159 \times \text{HR (b min}^{-1}) - 8.72$$

Circulatory stress was evaluated from cardiac cost of work (CCW) and cardiac cast of recovery (CCR). The cardiac cost of recovery is the occurring between the end of work and return to the pre activity state (Saha, 1976)

$$\text{Energy expenditure} = 0.159 \times 144 - 8.72 = 14.176$$

The following formulae were used for calculation of physiological cost of work (PCW) and total cardiac cost of work (TCCW)

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

CCW = (Average working heart rate – Average resting heart rate) x duration of activity.

CCR = (Average recovery heart rate – Average resting heart rate ) x duration of activity.

Physiological cost of work (PCW) = TCCW/ Total time of activity.

Table A : Physical characteristics of the farm women in weeding of cauliflower		(n=20)
Physical characteristics	Mean	Standard deviation
Age (Years)	30.2	± 7.8
Height (cm)	144.2	± 5.31
Gross weight (kg)	49.2	± 9.35
Body mass index (BMI)	24.3	± 3.24

**Table B : Classification of work load**

Physical work load	Energy expenditure (KJ/min)	Heart beat (beats min <sup>-1</sup> )
Very light	Up to 5	Up to 90
Light	5.5 – 7.5	91-105
Moderate	7.6 – 10.0	106-120
Heavy	10.1 – 12.5	121-135
Very heavy	12.6-15.0	136-150
Extremely heavy	<15.0	Above 151

The above rating of perceived exertion scale developed by Varghese *et al.* (1994)

**Table C : Performance of different weeders in respect to mandays required, heart beat, energy expenditure and yield over the farmers practice**

Technology	Man days required/ha	Average working heart beat (bpm)	Average resting heart beat (bpm)	Energy expenditure KJ/min	Yield q/ha	Grass income (Rs./ha)	Net income (Rs./ha)	BC ratio
TO <sub>1</sub> : Farmers practice (Spadi) Two hoeing 1 <sup>st</sup> 25 DAT 2 <sup>nd</sup> 50 DAT	78.61	144	89	14.17	261.15	313380	248380	1:4.82
TO <sub>2</sub> : Grubber weeder (Three tynes) two hoeing 1 <sup>st</sup> 21 DAT, 2 <sup>nd</sup> 45 DAT	24.25	125	86	11.95	270.40	324480	266230	1:5.51
TO <sub>3</sub> : Wheel hoe two hoeing 1 <sup>st</sup> 21 DAT, 2 <sup>nd</sup> 45 DAT	28.36	130	87	11.15	275.25	330300	272550	1:5.71
TO <sub>4</sub> : Grubber weeder (Three tynes) with wheel. Two hoeing 1 <sup>st</sup> 21 DAT 2 <sup>nd</sup> 45 DAT	20.16	119	85	10.20	278.5	324200	286450	1:6.99

## ■ RESULTS AND DISCUSSION

The effectiveness of different weeders were assessed on the basis of mandays required per hectare, average working heart beat (bpm), energy expenditure KJ/min, yield q/ha and BC ratio. Statistical analysis of data revealed significant different among of all treatments for all parameters recorded. Result indicated that weeding through grubber with wheel hoe (Three tynes) two hoeing 1<sup>st</sup> 21 DAT and 2<sup>nd</sup> 45 DAT (TO<sub>4</sub>) gave maximum yield (278.5 q/ha) lowest mandays required (20.16/ha) lowest average working heart beat bpm (119) and high BC ratio (1:6.99) followed by TO<sub>3</sub>, TO<sub>2</sub> and TO<sub>1</sub>.

All three weeders were found compatible, easy to handle and applicable in field situation. Grubber weeders with wheel (Three tynes) was found to most efficient for weeding vegetable field among all. It was observed that the use of weeders improved posture and efficiency of labour. The body discomfort reduced with use of weeders because it employed standing posture eliminating muscular fatigue and excessive loading of inter vertebral disc of back bone. This proved that weeders are ergonomically sound women friendly drudgery reducing and improves efficiency of farm

women.

Authors' affiliations:

**R.K. SINGH, V.P. RAI AND D. ORAON**, Krishi Vigyan Kendra (B.A.U.), CHATRA (JHARKHAND) INDIA

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