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A Case Study of Traditional and Improved Tools for Cleaning and Grading of Grains by Farm Women

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A B S T R A C T

Rural Indian women are extensively involved in agricultural activities. Grain cleaning and grading for women in rural area is a big problem because they use traditional sieve for cleaning and grading manually in sitting posture. This posture increases the fatigue and drudgery of farm women while cleaning and grading which results in aches and pains in the back and cervical region. This is time consuming method and output realized is less. Hence there is a need to study the SWOT analysis of improved tools for cleaning and grading of grains with disseminated approach and their impact on farm women. To ensure better health and safety, to improve work efficiency and to reduce the drudgery of farm women during cleaning and grading of grains, the study was undertaken with the objectives to create awareness among rural farm women about the drudgery involved in the work with the reasons; introduction and dissemination of improved tools like double screen grain cleaner and spiral grader for farm women for cleaning and grading of grains; to assess the comparative ergonomics of cleaning and grading performance with traditional and improved methods; to assess the percentage reduction of ergonomic cost of work and feedback from the farm women on the reduced drudgery. Results of the study showed that double screen grain cleaner and spiral grader improved the work posture, therefore reduced aches and pains in the back and cervical region of women in cleaning and grading of grains and enhanced the work efficiency and health of farm women. The farm women could clean and grade grains 184.32 kg/hour and 166.19 kg/hour using improved tools – spiral grader and double screen grain cleaner as compared to the farm women who took one hour in cleaning and grading of 23.62 kg of grains by traditional method. There was saving in cardiac cost of farm women per unit of output for cleaning and grading of grains using improved tools as compared to the continuous sitting position while cleaning and grading of grains traditionally. Women feel comfortable and 41% adoption shows increase not only in efficiency but in terms of money also by reducing aches and pains in the back and cervical region with increased output.

Introduction

Women play a key role in improving agricultural productivity and food security in the farming communities (Agarwal 2013; Aly and Shields 2010). Their activities vary from land preparation to post harvest operations. Grain cleaning and grading for women in rural area is a big problem because they use traditional sieve for cleaning and grading manually in sitting posture. This posture increases the fatigue and drudgery of farm women while cleaning and grading which results in aches and pains in the back and cervical region. This is time consuming method and output realized is less.

Many of such activities are drudgery prone to varying degree. Even women suffer from different health problems which adversely affect their working efficiency and family welfare Chandra *et al.*, 2013). Drudgery of farm women in various field operations could be reduced by providing improved farm tools and equipment and the attention of farm women was directed towards the women friendly improved farm tools (Patel *et al.*, 2015). Farm women from the unorganized sector are vulnerable as new and improved technologies are inaccessible for them. It is imperative that they are exposed to these technologies and encouraged and motivated to adopt the new technologies which would help them to improve their quality of life

Hanging grain cleaner is an important machine especially designed for wheat cleaning and grading. The machine is operated by hands to sieve the grain batches of 5 -10 kg and clean. The machine parts consist of main frame, scalper/grading screen, draper rod, handle, shutter etc. It is hanged by eyelets at the top so weight of machine doesn't come to arms of worker. Once filled, it removes the impurities from grain by swinging action.

Hence there is a need to study the SWOT analysis of improved tools for cleaning and grading of grains with disseminated approach and their impact on farm women. To ensure better health and safety, to improve work efficiency and to reduce the drudgery of farm women during cleaning and grading of grains, the study was undertaken with the objectives to create awareness among rural farm women about the drudgery involved in the work with the reasons; introduction and dissemination of improved tools for farm women for cleaning and grading of grains; to assess the comparative ergonomics of cleaning and grading performance with traditional and improved methods; to assess the percentage reduction of ergonomic cost of work and feedback from the farm women on the reduced drudgery.

Materials and Methods

Selection of respondents

Thirty farm women who were actively engaged in cleaning and grading of grains were selected for the present study from KVK adopted villages of Morena district of Madhya Pradesh. Care was taken to select farm women who were healthy, non-pregnant, non-lactating, and free from any other serious health hazards. These farm women were randomly selected from 60 farm women of Morena district. Suitability of the experimental women was ascertained by measuring the following physiological parameters before the start of the activity.

Body temperature recorded for 3 minutes: Not above 99°F

Blood Pressure: 120-80 ± 10

Heart Rate: 70-90 bpm

Body height, weight and BMI of each subject were measured (Table 1). The grading of health status of women on the basis of BMI was done. The BMI scores were interpreted as per the classification given by Garrow (1987). The heart rate during rest, work and recovery were recorded while working with traditional as well as improved methods. Milking cleaning and grading of grains was compared with working in existing situation.

Potential for use revolving stool for cleaning and grading of grains

SWOT (strengths, weaknesses, opportunities and threats) analysis for use of improved tools for cleaning and grading of grains by farm

women in Morena district is presented in Table 2. It indicates that use of improved tools by farm women for cleaning and grading of grains could be a useful implementation for reducing the drudgery of farm women with increased output.

Apart from this, there are certain other advantages, which ensure the possibility of adoption of improved tools. These are useful in cleaning and grading of grains, time saving and more income per unit time. Thus it could be a good tool for farm women empowerment.

Constraints of using improved tools

Major conspicuous constraints of using improved tools is unavailability and lack of awareness among the farm women about benefits of using improved tools, poverty, illiteracy, lack of knowledge of improved tools, poor communication network and hand to mouth leaving attitude of farm women (Table 2).

Dissemination approach of improved tool for cleaning and grading of grains

Keeping in view the drudgery reduction of farm women in cleaning and grading of grains by spiral grader and double screen grain cleaner, higher efficiency, increase output, etc., it was planned to disseminate the technology of using improved tools for cleaning and grading of grains in Morena district as an vital tool for empowerment of women.

A schematic sketch of approach for the dissemination of use of improved tools for cleaning and grading of grains by farm women in Morena district is depicted in Figure 1. However, for better understanding, the same it has been briefly described here.

Creating awareness and developing desire

Farm women are not always aware of the improvements they could make by using scientific and technological knowledge. Thus, first of all, the attention of farm women was directed towards the women friendly improved farm tools especially of double screen grain cleaner by conducting informal meetings and discussion with them. Their interest was stimulated by explaining them how it could contribute towards their drudgery reduction. This interest was later transferred into desire by continuous persuasions and motivation for use of improved tool.

Capacity building

A training programme for this group of women beneficiaries for their empowerment was organized with the objectives of imparting knowledge and skill of improved farm tools, along with gaining confidence of farm women towards their participation in sustainable development of other aspects.

Follow up: Distribution of double screen grain cleaner

After training, the participating farm women were fully motivated for use of double screen grain cleaner, but being extremely poor and having no outside support, they showed inability to purchase it and thus needed financial support.

Thus to encourage and disseminate the technology of using improved farm tools, Krishi Vigyan Kendra, Morena, arranged double screen grain cleaner for cleaning and grading of grains with the condition that they would return back these improved tools after 6 months, which they agreed to. The women received enough moral support from their families.

Women's opinion

To know the farm women's opinion on the use of improved tool for cleaning and grading of grains, four factors namely stress factor, work output, tool factors and field acceptability were assessed. The percentage of attained score over maximum was categorized as given below:

upto 20%= highly unacceptable
20-40% = unacceptable
40-60%= Neutral
60-80%= Acceptable
>80%= highly acceptable

Assessment of ergonomic parameters

Physiological workload

This is to refer that physiological or muscular effort required on the part of worker to accomplish a task or an activity. The period during which the work continues is known as work period and period during which the physiological function return to resting level is known as recovery period. Hence, to evaluate total physiological expenditure, physiological reaction both during the work and during the recovery period is considered.

Hence, the respondents were prepared by giving a rest for 15 minutes under shade before start of the experiment. The heart rate was recorded by using the heart rate monitor continuously during rest (15 minutes), during work (30 minutes) and during recovery (5 minutes) after the work.

Following formula was used to calculate the total cardiac cost of work (TCCW) and physiological cost of work (PCW) (Varghese *et al.*, 1994).

$$\text{Physiological cost of work} = \frac{\text{Total cardiac cost of work}}{\text{Duration of work (min)}}$$

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

CCW = (Average working heart rate – Average resting heart rate) x Duration of work (30 min)

CCR = (Average recovery heart rate – Averaged heart rate) x Duration of recovery (5 min)

Energy expenditure

Energy expenditure during work was also calculated by average heart rate (AHR) by using regression equation given by Varghese *et al.*, (1994).
Energy Expenditure = 0.159 X HR (bmin-1) – 8.72

Subjective evaluation of postural discomfort

For the assessment of overall discomfort rating (ODR), a 10-point Visual Analogue Discomfort Scale (0-No discomfort, 10-Extreme discomfort) was used which was developed by Corlett and Bishop (1976). A scale of 70 cm length was fabricated having 0 to 10 digits marked on it equidistantly. A movable pointer was provided to indicate the rating. At the end of each trial, respondents were asked to indicate their overall discomfort rating on the scale. The overall discomfort ratings given by each of the twenty subjects were added and averaged to get the mean rating.

Rating of Perceived Exertion

Pain is the indicator of discomfort. The perceived discomfort will be recorded in terms of pain felt in various parts of the body by the subjects while performing the activity. The Rating Exertion scale developed by

Varghese *et al.,* (1994) will be used to subjectively assess the exertion perceived.

Results and Discussion

Physical characteristics of the respondents

Basic anthropometric data of the subjects have been presented in Table 1. As shown in the table, the mean age of the selected farm women was 32.1 years with the average height of 150.7 cm and mean for gross body weight was 47.6 kg. The mean body mass index was calculated to be 21.2 which meant that they were in the normal category.

Physiological parameters

Working heart rate

The data presented in Table 3 shows the comparison of average working heart rate between the two methods of cleaning and grading of grains. The average working heart rate with the traditional method was found to be 94.33 beats/ min, which found to be 99.68 beats/ min and 103.97 beats/min while performing activity with the improved tool of spiral grader and double screen grain cleaner, respectively.

The percent saving in cardiac cost of work was observed to be less with the improved method (spiral grader-78.39 percent and double screen grain cleaner-61.57 percent) compared to the traditional method of cleaning and grading of grains (Table 3).

Energy expenditure

Average energy expenditure during cleaning and grading of grains was found 7.13 KJ/min and 7.82 KJ/min with spiral grader and double screen grain cleaner, respectively over the 6.27 KJ/min for traditional method of cleaning and grading of grains (Table 3).

Work output

The results presented in table 4 depict the work output of the cleaning and grading of grains with the traditional and improved methods. The productivity of the farm women increased over the traditional method of sitting in squatting position while cleaning and grading of grains. The farm women could clean and grade grains 184.32 kg/hour and 166.19 kg/hour using improved tools – spiral grader and double screen grain cleaner as compared to the farm women who took one hour in cleaning and grading of 23.62 kg of grains by traditional method.

Hanging type double screen grain cleaner was found with 4-5 times increased output as compared to local sieve. Similar result was also found with increased output when compared hanging type cleaner grader with conventional method (Badiger *et al.,* 2006a).

Subjective evaluation of postural discomfort

The mean values of Overall discomfort rating (ODR) of the respondents are presented in Table 5. It was noted that overall discomfort rate was 7.2 with traditional method of cleaning and grading of grains. This activity is full of drudgery with reduced production cost. The traditional method employs continuous strenuous posture while cleaning and grading of grains with traditional method. On the other hand, the discomfort rate was found to be 6.0 and 5.4 while using improved tools.

Musculo-skeletal problems

Musculo-skeletal problems and posture were evaluated by asking the respondents as to where they felt pain in their body after cleaning and grading of grains with traditional and improved methods. Table 5 depicts that

cleaning and grading of grains with traditional method in continuous sitting posture cause severe pain in the back and cervical region and the farm women perceived the task as moderately heavy. On the contrary using improved tools for cleaning and grading of grains induced moderate to light discomfort/pain in legs, knees and feet. Musculo- skeletal problems were reported very low as the spiral grader and double screen grain cleaner help the women in maintaining comfortable posture during cleaning and grading of grains. It also reduces the pain in back and cervical region significantly due to the comfortable posture.

Rating of Perceived Exertion

The results in Table 6 depict the average rate of perceived exertion as expressed by the respondents while performing the cleaning and grading of grains with both traditional and improved methods. The activity of cleaning and grading of grains was perceived heavy by the respondents because women had to work in a particular posture for the entire duration. Hence the stress was felt more. According to the farm women, the physical drudgery reduced and they did not complain for aches and pains in the back and cervical region with the use of improved tools.

Farm women's opinion

The opinion of farm women for cleaning and grading of grains with traditional and improved methods is presented in Table 7.
The percentage of attained score for traditional method was found to be 62.9 per cent while in case of spiral grader and double screen grain cleaner, it were 78.6 and 82.2 per cent, respectively. Thus rate of perceived opinion for improved tools fall in the category of highly acceptable tool as compared to traditional method of cleaning and grading of grains.

Adaptation and dissemination of the improved tool

Introduction and dissemination of spiral grader and double screen grain cleaner saves not only the time but increases 87 percent and 84.9 percent of working efficiency of farm women and reduces 10.2 and 12.8 percent drudgery with spiral grader and double screen grain cleaner, respectively against the traditional method of cleaning and grading of grains. After use of improved tools for cleaning and grading of grains, the farm women have developed a feeling of economic empowerment. Now they are able to be made double screen grain cleaner easily from the local carpenter/artisan at their own. It indicates the successful transfer of the double screen grain cleaner for cleaning and grading of grains by the farm women. Now they build up their self-confident and capable to explain the proven technology to other needy resource poor farm women.

Table.1 Physical characteristics of the selected respondents

Parameters	Mean	S.D.
Age (years)	32.1	±6.08
Height (cm)	150.7	±4.9
Weight (kg)	47.6	±5.9
BMI (Body Mass Index)	21.2	±2.5

Table.2 SWOT analysis for cleaning and grading of grains and pulses by improved implements

Strengths	• **Consists of main frame, grading screen, draper rod, rubber grip over handle** • **Operated in oscillating mode** • **Selection of screen according to grain size**
Weaknesses	• Pressure as on specific time • Unawareness and unavailability of improved implements for cleaning and grading of grains and pulses • Lack of interest • Input free attitude of farm women
Opportunities	• A good tool for farm women empowerment • Useful in cleaning and grading of grains and pulses • Time saving more income per unit time
Threats	• Exploitation of farm women by middle men by purchasing of improved implements at very high rates • Poor care and management by farm women may lead to reduce efficiency

Table.3 Circulatory stress and physiological parameters of the respondents working with the traditional and improved method of cleaning and grading of grains

Technology used	**Physiological parameters**		
	Average working heart rate (beats/min)	**Average energy expenditure (kilojoule/min)**	**Saving in cardiac cost %**
Traditional method	94.33	6.27	0
Improved method-Spiral grader	99.68	7.13	78.36
Improved method-Double screen grain cleaner	103.97	7.82	61.57

Table.4 Work output of the respondents working with the traditional and improved method of cleaning and grading of grains and pulses

Technology used	Work output (kg/hr)
Traditional method	23.62
Improved method-Spiral grader	184.32
Improved method-Double Screen Grain Cleaner	166.19

Table.5 Mean value of overall discomfort rating (ODR) and musculo-skeletal problems in cleaning and grading of grains and pulses by traditional and improved implements

Technology used	Overall Discomfort Rating	Musculo-skeletal problem
Traditional method	7.2	Severe pain in legs, knees, feet, ankle and calf muscles
Spiral grader	6.0	Moderate to light pain in legs, knees, ankles and calf muscles
Double Screen grain cleaner	5.4	Moderate to light pain in legs, knees, ankles and calf muscles

Table.6 Perceived exertion rate while performing the cleaning and grading of grains and pulses with traditional and improved implements

Sl. No.	Technology used	Rate of perceived exertion
1.	Traditional method	Heavy
2.	Spiral grader	Moderate
3.	Double Screen grain cleaner	Moderate

Table.7 Farm women's opinion on the use of traditional method and improved method of cleaning and grading of grains and pulses with traditional and improved implements

Factor assessed	Maximum attainable score	Attained score			Per cent of attained score over maximum			Remark		
		T1	*T2*	*T3*	*T1*	*T2*	*T3*	*T1*	*T2*	*T3*
Stress factor	10	6	7.0	8.0	60.0	70.0	80.0	Acceptable	Moderately acceptable	Highly acceptable
Work output	10	6	8.5	8.0	60.0	85	80.0			
Field acceptability	15	10	12	13	66.7	80	86.7			
Over all	35	22	27.5	29	62.9	78.6	82.2			

T1- Traditional method T2- Improved method- Spiral grader
T3: Improved method Double Screen grain cleaner

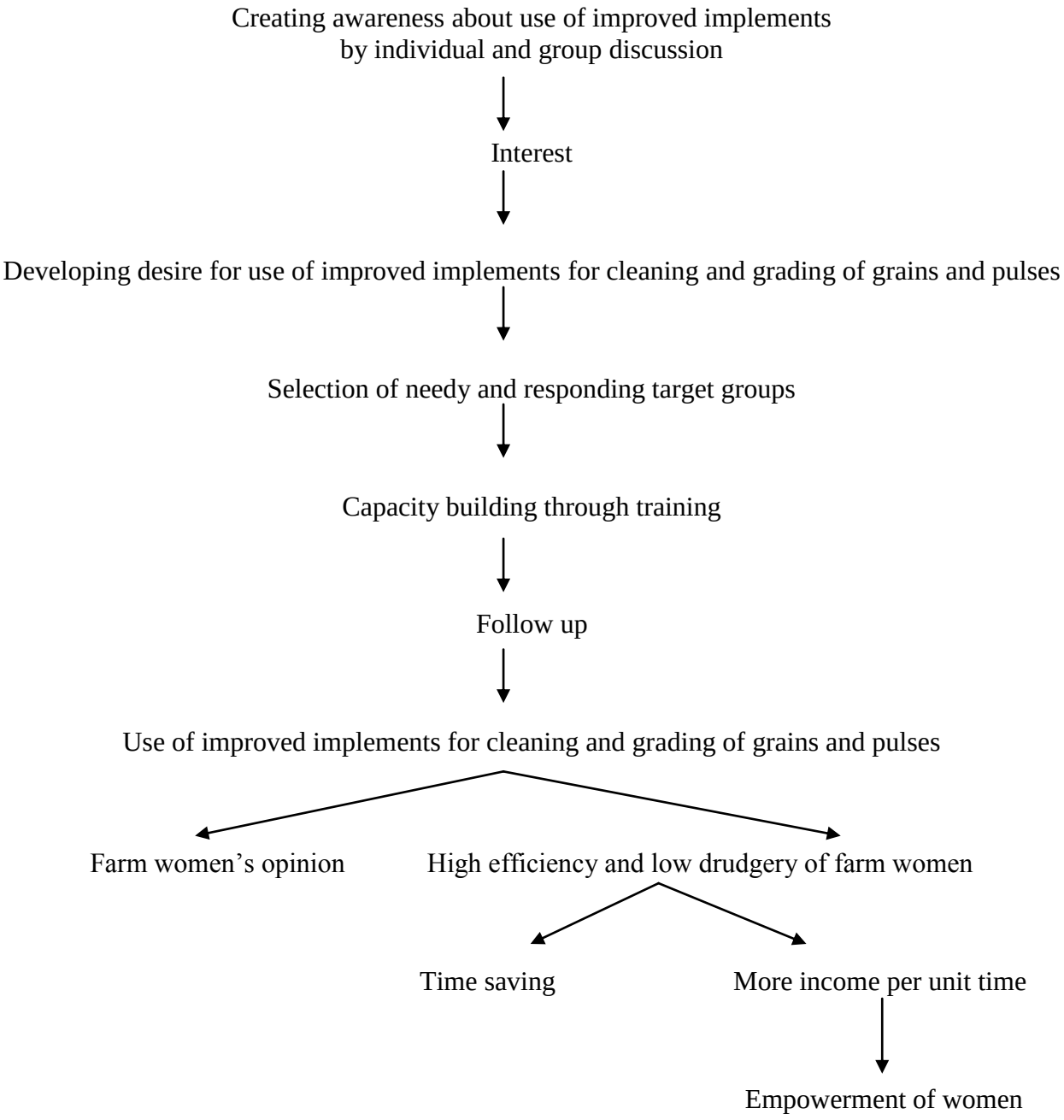

Figure.1 Flow chart showing disseminated approach of revolving stool for cleaning and grading of grains and pulses with traditional and improved implements

A large number of women are working in agriculture and performing strenuous tasks. Majority of the agricultural and allied activities were perceived as difficult to perform by the farm women. Cleaning of grains by traditional sieve is a time consuming and tedious operation. Farm women feel use of traditional sieve it as a maximum drudgery prone activity, because of its monotony in performance, continuous sitting and performing is for a longer period of time. Drudgery reducing tools and equipment are proved to be a boon for farm women. Results of the study showed that

double screen grain cleaner and spiral grader improved the work posture, therefore reduced muscular stress of women in cleaning and grading of grains and enhanced the work efficiency and health of farm women. There was saving in cardiac cost of farm women per unit of output for cleaning and grading of grains using improved tools as compared to the continuous sitting position while cleaning and grading of grains traditionally. Women feel comfortable and 41% adoption shows increase not only in efficiency but in terms of money also by reducing aches and pains in the back and cervical region with increased output. This is a kind of women empowerment.

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