

Intervention of Cotton Picker in Drudgery Reduction of Farm Women

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ABSTRACT

Cotton is one of the hugely grown commercial crops in India, mainly in the states of Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Telangana, Andhra Pradesh, Karnataka and Tamil Nadu. It is one of the main raw materials of the textile industry. Women are majorly involved during the cotton picking period, which is one of the labour - intensive activity in the cotton farming. Despite these problems, mechanization is still lagging in the cotton picking activity, which causes lot of drudgery and musculo skeletal issues among them. This can in turn influence the work efficiency of the labour. Though there are cotton picking machines available in the market, farmers and farm labour do not purchase and use them, as they are expensive. Neither the farm labour involved in picking will be interested, as they are unaffordable for them; nor will the farmer be interested to provide the labour with some machinery as he feels they are unnecessary or think it as an additional financial burden. With these insights, the current study tried to do the ergonomic evaluation of a mechanized or hand operated cotton picker. The study was conducted on ten farm women involved in cotton picking at Lillipur village, Maheshwaram mandal, Telangana state. The study results showed that most of the sample were having a work experience between 6 - 9 years, worked for 4 - 8 hours per day in the picking season. The perceived exertion rating given by the respondents for the Conventional method i.e., manual plucking of cotton was 'Average', whereas it changed to 'Heavy' for the Improved method i.e., mechanical plucking of cotton using Cotton Picker. The Drudgery Index for the Conventional method was 35.15 and 25.67 for the Improved method i.e., using a Cotton Picker. The parameters related to physiological workload like resting heart rate, working heart rate, recovery heart rate, CCW, CCR etc., also showed positive changes while using the Improved method of cotton picking. On the whole, the Physiological Cost of Work (PCW) was decreased from 2.62 to 1.25 in the Improved method. This study, through its results showed some facts that increase in efficiency, drudgery reduction, saving time and effort of the labour can be done by using improved methods in farming activities. The results give an indication that taking up such small mechanization measures can surely help the farming community in a long run.

Keywords: Cotton picker, Ergonomics, Conventional method, Improved method, Drudgery, Mechanization

INTRODUCTION

Cotton, a commercial crop in India is majorly grown in the states of Punjab, Haryana, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Telangana, Andhra Pradesh, Karnataka and Tamil Nadu. Telangana state, the current

study location produces the highest cotton in the South India region. As per the Meeting of the COCPC (2021), the provisional data says that India got 1st place in the world in cotton acreage with 120.69 Lakh Hectares area under cotton cultivation, i.e., around 36% of world area of 333 Lakh Hectares. India is on top in the world with an estimated production of 362.18 lakh bales (6.16 million metric tonnes during cotton season 2021 – 22), i.e., 23% of world cotton production of 1555 lakh bales (26.44 million metric tonnes). Telangana state, the study area produces the highest cotton in the South India region. The state produced 66.45 lakh cotton bales in 2021 - 22 season, 14.63% higher than the previous season. This shows the immense potential of the cotton production both in terms of employment and economy. ILO (2019) highlighted that the cotton farming is one of the most challenging and labour - intensive activities. Lakhs of migrant and bonded labourers are involved in the cotton farming. An article in The New Indian express (2019) says the cotton farming in Telangana has reportedly been employing thousands of children and adolescents as unpaid and invisible labour. They are not only dropping out of school but are also exposed to hazardous pesticides, says ILO. There are many farmers and farm labourers in Telangana, both men and women are involved in cotton farming and related activities as the climate and soil is feasible to grow the crop. But there are not many machinery or equipment available in the market for cotton farming activities, which can reduce the drudgery and increase the worker's efficiency. On the other side, whatever few equipment or machinery are there in the market are not being used by the farming community, as they are not aware of them or cannot afford them or do not have access to them. One of such equipment is a Cotton Picker. But most of the farmers involved in Cotton farming, are not aware of these cotton pickers. Very few of them in the state who know about their use and benefits might be knowing through some awareness programmes conducted by the manufacturers or research organisation or some Government interventions. Hence, this study tried to bring in awareness about the cotton picker among few farm women involved in cotton picking activity through an intervention study.

REVIEW OF LITERATURE

Cotton Corporation of India and Tata Institute of Social Studies conducted a CSR project (2016 – 17) on The Cotton Picker machine. Majority of the beneficiaries who were interviewed from all three project locations i.e., Maharashtra, Telangana and Gujarat reported that the machine is of good quality, it is sturdy and would not break easily. They reported that the cotton plucking machine is more efficient, quality of cotton picked is cleaner and is cost effective as the requirement of labour reduces. Some of the farmers were unable to adapt to technology and found it difficult to pick cotton with the machine due to which it hampered the productivity in terms of cotton picked in a day. Some of the beneficiaries stated that manual cotton picking sometimes caused skin diseases on the hands and fingers; and there was an incidence of decrease of these diseases with the use of cotton plucker. Despite these benefits, some of the beneficiaries were dissatisfied with the cotton plucker as they found

it is more time consuming and less productive to work with it, and preferred picking the cotton manually as it was more comfortable for them. But, the research team observed that these issues can be addressed by providing more training and practical demonstrations on the use of the cotton plucker machine.

Raju and Majumdar (2013) conducted an evaluation of portable Cotton Picker. Contract manual harvesting was found to be 30 per cent more efficient than battery powered portable cotton picker. Higher load on the heart of the workers was noticed with higher output of seed cotton regardless of the methods of harvesting (manual and mechanised). The results highlighted that portable cotton pickers are of high speed, precise and no need of defoliation, but adequate training and willingness to adopt the machine is a must. Adequately trained pickers can pick (40 - 80%) more seed cotton, using a cotton picker. An increase of area covered in a given time can also be increased (nearly 40%).

Suman et al. (2012) in their technology intervention study found that the quantity of cotton plucked with hands was 20 kgs. per day, whereas by using the cotton picker there was an increase in the quantity plucked (38 kgs. per day). This showed that there is an increase in the work efficiency with the cotton picker. The drudgery of women reduced by 28.57 per cent with the use of cotton picker, and there was 50 per cent reduction in time required to harvest the same area. There were 44.4 per cent less health disorders observed when cotton was plucked using the cotton picker. Thus review of literature revealed that few studies were conducted on drudgery related studies in cotton production, few comparative studies on manual picking versus cotton bag picking and negligible number of studies were conducted on cotton picker.

OBJECTIVES OF THE STUDY

The present study was conducted based on the following objectives:

1. To study the demographic profile, physical characteristics and work patterns of selected farm women involved in cotton picking activity.
2. To explore the feasibility and advantages of Cotton Picker in plucking the cotton.
3. To analyse and compare the perceived exertion rating, drudgery and physiological workload of the respondents, while practicing conventional and improved methods.

METHODOLOGY

An experimental research design was adopted for the present study to analyse the effect of intervention of a cotton picker in drudgery reduction of farm women. The study was conducted on a sample of 10 farm women involved in Cotton picking activity in Lillipur village of Maheshwaram Mandal, Telangana State, India. Data was collected regarding general profile characteristics of the respondents, their work experience, number of working hours (per day), wages earned (per day), land details, physical characteristics, BMI, perceived exertion while performing the cotton picking activity, drudgery

index and physiological workload. The results were analysed using frequencies, percentages, mean, standard deviation (S.D.) and formulas related to body mass index (BMI), drudgery index and physiological workload.

RESULTS AND DISCUSSION

Details of the Study Location

Table 1 shows the details of the study location.

The study was conducted in Lillipur village, Maheshwaram Mandal, Telangana State. The seed variety used in the study location (fields) was Bayer Cotton. The soil type in the location was Black Cotton soil, Red soil and Murram. The spacing between two Plant rows was 0.6 mts; and Plant to Plant Spacing was 0.3 mts. The yield gained was around 1.5 - 2 tonnes per acre.

Age of the Respondents

Table 2 depicts the details of the age of the respondents.

The results showed that an equal percentage (40%) of the respondents were above 36 years of age and between 25 - 30 years. The remaining respondents were below 25 years old and between 31 - 35 years of age (10% each respectively). It implies that from a young age, farm women are involved in cotton picking activity.

Marital Status of the Respondents

Table 3 displays the details of the marital status of the respondents.

Table 1. Details of the study location.

Name of the village	Lillipur
Name of the production system	Cotton
Conventional method	Manual Picking
Name of the technology used (Improved method)	Cotton Picker
Seed Variety	Bayer Cotton
Soil Type	Black Cotton soil + Red soil + Murram
Row to Row spacing	0.6 mts
Plant to Plant spacing	0.3 mts

Table 2. Distribution of the respondents by age (n = 10).

Age	F	%
Below 25 years	1	10.00
Between 25 - 30 years	4	40.00
Between 31 - 35 years	1	10.00
Above 36 years	4	40.00
Total	10	100.00
Mean		31.60
S.D.		7.8

Table 3. Distribution of the respondents by their marital status (n = 10).

Marital Status	F	%
Married	9	90.00
Married but separated/ divorced/ widow	1	10.00
Total	10	100.00

Majority of the respondents were married, i.e., 90 per cent. The remaining 10 per cent were either married but separated or divorced or a widow, which might be the main factor for them to do the farm work to earn for her daily living. Similar scenario can be seen in most of the rural areas, as the women generally tend to get married off at young age and are involved in both household and farm activities.

Family Type of the Respondents

Table 4 highlights the details of the family type and size of the respondents.

Majority of the respondents belonged to nuclear family (60%) whose family size was small, i.e., up to 4 members and the remaining (40%) belonged to joint family, whose family size was medium, i.e., 5 to 8 members. The results are in resonance with the general situation seen in the current day society regarding the type of family, i.e., most of the families now-a-days are of nuclear type and are of small size.

Educational Status of the Respondents

Table 5 shows the details of the educational status of the respondents.

Majority (80%) of the respondents had vocational education. An equal percentage of the respondents (10%) had either completed primary school education or high school education.

Better educated women tend to be more informed about nutrition and healthcare, have fewer children who are healthy, marry at a later age and have a choice to become mothers whenever they feel to be so. They are more likely to participate in the formal labour market and earn higher incomes (The World Bank, 2022). The respondents of the study are in disadvantaged position as they were not having good level of education.

Table 4. Distribution of the respondents by their family type and size (n = 10).

Parameter	F	%
(a) Family Type		
Nuclear	6	60.00
Joint	4	40.00
Total	10	100.00
(b) Family Size		
Small (up to 4 members)	6	60.00
Medium (5 to 8 members)	4	40.00
Total	10	100.00

Table 5. Distribution of the respondents based on their educational status (n = 10).

Educational Status	F	%
Primary	1	10.00
Middle	-	-
High school	1	10.00
Graduate	-	-
Vocational	8	80.00
Total	10	100.00
Mean		6.2
S.D.		1.8

Family Occupation of the Respondents

This sub - section narrates the details of the family occupation of the respondents. The results showed that cent per cent of the respondents belonged to agricultural families. None of them depended on service provision or other occupations.

Work Experience of the Respondents

Table 6 shows the details of the work experience of the respondents.

The results depicted that around 40 per cent of the respondents were having 6 - 9 years of work experience, followed by 9 - 12 years (30%), above 15 years (20%) and 12 - 15 years (10%). It is observed that all the respondents had above 6 years field experience, which implies that they started working in the field from 19 years onwards.

This showed that majority of the respondents started involving themselves in the farm work from their younger age only, hence had a good working experience in farms. As most of them had no good education, they had no option of doing a formal job. Hence, some of them might have been forced to take up the farm work in order to supplement the family income; and some of them might have taken up the farm work based on their choice, as they were used to that work since their young age only.

Table 6. Distribution of the respondents based on the years of their work experience (n = 10).

Work Experience	F	%
6 - 9 years	4	40.00
9 - 12 years	3	30.00
12 - 15 years	1	10.00
Above 15 years	2	20.00
Total	10	100.00
Mean		4.1
S.D.		1.2

Number of Working Hours (Per Day) of the Respondents in the Farm

This sub - section highlights the details of the number of working hours (per day) of the respondents in the farm. It can be noticed that all the respondents (100%) worked for 4 - 8 hours per day in the farm. In other words, farm women with young children or elderly were working for 4 hours, while women with older children were working for 8 hours.

Women are always disadvantaged in this case, as they must do double work i.e., household work and farm work. Hence, they have an additional physical and psychological work burden compared to men. The number of working hours spent on doing the household work by the women goes unnoticed, unaccounted and unpaid. Results also highlighted that all the respondents (100%) used to work for 4 to 6 days per week in the field.

Wages Earned (Per Day) by the Respondents

This sub - section showcases the details of the wages earned (per day) by the respondents while performing the farm activities. It was found that the respondents earned a daily wage between Rs. 200 - Rs. 350, based on the number of hours working in the field. The wages are also paid based on the quantity of cotton picked, i.e., Rs. 11/ kg is being paid. When correlating the wage earnings with the number of working hours, it is pathetic to see that despite working hard for around 8 hours, the farm women get very less wages.

Land Details of the Respondents

This sub - section narrates the details of the land holding, land possession and nature of the land owned by the respondents.

The results showed that cent per cent of the respondents hailed from small farming families, i.e., owning 2 - 5 acres. When the results related to wages earned and land possession were correlated with each other, it can be noticed that despite having the land ownership, all the respondents used to work for other farmers to earn wages and support their family with the money earned. Mostly the ownership of the lands is in the hands of men.

Majority (90%) of the lands owned by the respondents and their families were rain fed i.e., the lands were dependent on rain for their irrigation needs. Hence, additional resources and investments were required by them to provide water to their fields. Only few i.e., 10 per cent were irrigated lands.

Telangana, is one such state where the agriculture is mostly rain fed. Hence, the respondents and their families might be habituated to such situations for doing their farming activities. Another observation from this situation is, some of the respondents and their families might not be taking the risk of farming on their own in the lands, as there was less water available. Instead, they kept working in other farmer fields to reduce the costs and risks involved in irrigation of their fields.

Physical Characteristics of the Respondents

Table 8 depicts the mean of the physical characteristics of the respondents.

Table 7. Mean of the physical characteristics of the respondents (n = 10).

Physical Characteristics	Mean	S.D.
Height (in cm.)	150.53	5.5
Weight (in kg.)	47.3	5.4

Table 8. Distribution of the respondents based on their BMI (n = 10).

BMI (kg./m ²)	F	%
Under weight (18.5 or less)	-	-
Normal weight (18.5 to 24.99)	1	100.00
Overweight (25 to 29.99)	-	-
Obesity (class 1) (30 to 34.99)	-	-
Obesity (class 2) (35 to 39.99)	-	-
40 or greater (Morbid obesity)	-	-
Total	10	100.00
Mean	20.82	
S.D.	1.5	

The mean (average) height of the respondents was found to be 150.53 centimeters (i.e., 4'10" approximately) and the mean (average) weight was found to be 47.3 kilograms.

According to the NIN standards revised in 2020, the average height of Indian females is 162 centimeters (i.e., 5.3 feet) and the average weight of the Indian females is 55 kilograms. The results showed that the respondents of the study do not have the ideal height and weight when compared to the National Standards.

BMI of the Respondents

Table 9 highlights the results related to the BMI of the respondents.

Body mass index (BMI) is the standard indicator of undernutrition, which is obtained by the calculation of a person's weight in kilograms divided by the square of height in meters.

$$\text{BMI} = \text{weight in kgs.} / (\text{height in mts.})^2$$

The results showed that cent per cent of the respondents were having an ideal BMI, i.e., 18.5 - 24.99, which is in the healthy weight range category. It is virtuous to note that none of the respondents have a BMI which represent the overweight or obesity categories of BMI.

In general, rural women are less exposed to junk foods, processed funds and restaurant meals. They generally consume healthier foods which are mostly homemade. Moreover, they are involved in both household and farm activities. Hence, the current study respondents might be showing this positive phenomenon of being in a category of ideal BMI.

Table 9. Mean value of overall discomfort rating (ODR), responses on musculo – skeletal problems (MSP) and perceived exertion (RPE) experienced by respondents (n = 10).

Methods	ODR	MSP	RPE
Conventional method	3.3	Back pain, shoulder, leg pain and finger muscle pain	Average
Improved method	5	Upper arm, shoulder	Heavy

Perceived Exertion of the Respondents While Performing the Cotton Picking Activity

Table 10 displays the results related to the respondents' rating for their perceived exertion during the cotton picking activity using the Conventional and Improved Methods.

Conventional Method is the method of doing a work since a long period of time. In the current study, the conventional method used by the respondents during the cotton picking activity was using either a plastic bag or tying one end of saree around the waist to collect the picked cotton, mostly in a bent posture throughout the harvesting activity. Similar results were found in a study conducted by Chauhan et al. (2012) that musculoskeletal problems were observed among elder group.

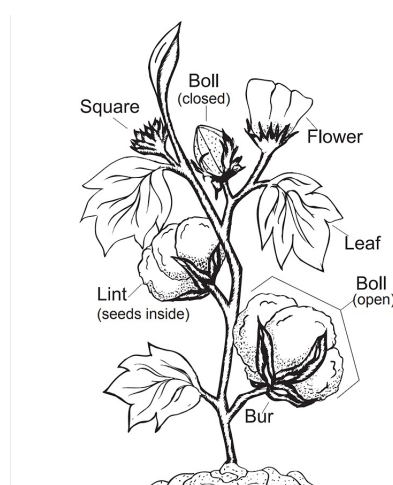
Improved Method is the method adopted to make a work easier, better and faster. The improved method used for cotton picking activity in this study is the usage of NOVA Cotton picker.

The results showed that the perceived exertion rating given by the respondents for the Conventional method, i.e., manual plucking of cotton was 'Average', whereas in Improved method, i.e., mechanical plucking of cotton using Cotton Picker, respondents perceived the exertion as 'very difficult'. Maske et al. (2020) too studied that hand pain, shoulder pain, waist pain and head ache were experienced by workers during cotton picking in traditional method.

Perception is a factor which varies from one to another and is based on a person's thoughts and feelings rather than some scientific support. The results related to the 'Heavy' response for the perceived exertion rating given while using the improved method for cotton picking might not be scientifically correct, as they are based on personal perceptions of the respondents.

The perceptions regarding the improved method may be due to various factors: (a) The respondents may not be used to the Cotton picker, as it is a new equipment for them to use. (b) As it is a new equipment, the respondents do not have a positive attitude towards it. (c) The respondents might be reluctant to change their old working procedures. (d) The respondents may not know the scientific benefits of the Cotton picker in terms of the increased productivity and efficiency, increased quantity of cotton picked in a certain time etc. Hence, they felt that the improved method is 'Very Difficult', which proves the Theory of Adoption. In other words, respondents should have readiness to accept the new technology because in the traditional method, the workers generally hold the bur tightly and pull all the cotton from the boll in

one go, whereas while using the cotton picking machine one must hold each bur and put proper pressure to pull the cotton from the boll.



Source: Parts of a Cotton Plant, The California Foundation for Agriculture in the Classroom

All these reasons might have made the respondents to give a perceived exertion rating of 'Heavy' for the improved method of cotton picking, i.e., by using a Cotton Picker.

On a positive note, the farm women involved in cotton picking activity can always be made aware of certain technologies and equipment like Cotton Pickers, harvesting bags, ring cutters etc.; developed by the manufacturers as they are developed with the aim of improving efficiency and reducing the drudgery among the farm workers.

Drudgery Index of the Respondents While Performing the Cotton Picking Activity

Table 11 shows the calculated values of the Drudgery Index of the respondents while performing the cotton picking activity using the Conventional and Improved methods.

The Drudgery Index (DI) was calculated based on the following:

X = Coefficient pertaining to the degree of difficulty felt during the work

Y = Coefficient pertaining to the time spent in a particular activity

Z = Coefficient pertaining to the frequency of performance

$$\text{Drudgery Index} = [(X + Y + Z) / 3] \times 100$$

The Drudgery Index for the Conventional method was 35.15 and 25.67 for the Improved method, i.e., using a Cotton Picker. The Perception rating given by all the respondents was 'Heavy' for the Improved method, but the Drudgery Index was found to be the opposite of it. This indicates that as the respondents were not used to the operation of Cotton picker, their perception rating was given as 'Heavy'. But when the scientific method was used to calculate the Drudgery Index, it showed positive results. The results indicated that there was a reduction in the drudgery while using the Improved method.

Table 10. Drudgery index of the respondents while performing the cotton picking activity (n = 10).

Parameter	Coefficient values	
	Conventional Method	Improved Method
Difficulty Score (X)	0.82	0.92
Performance Score (Y)	1.00	1.00
Time spent: Minutes/ day (Z)	1.00	0.71
Drudgery Index = $X+Y+Z / 3 * 100$	35.15	25.67

Table 11. Physiological workload of the respondents while performing the cotton picking activity (n = 10).

Parameters	Conventional Method	Improved Method	% increase or decrease
Time taken to complete the work (minutes/ per day)	480 minutes	280 - 450 minutes	↓ 6.25 - 41.66
Output (kgs./ day)	45 - 50 kgs	60 - 75 kgs	↑ 33.33 - 50.0
Average resting heart rate (beats/ min)	78.50	78.50	-
Average working heart rate (beats/ min)	110.97	96.00	↓ 13.49
AHR over rest (beats/ min)	88.03	81.10	↓ 7.87
Average energy expenditure during rest (kJ/ min)	3.76	3.76	-
Average energy expenditure during work (kJ/ min)	8.92	6.54	↓ 26.68
Cardiac Cost of work (CCW)	973.00	524.60	↓ 46.08
Total Cardiac cost of work (TCCW/ 30 min.)	1257.98	600.60	↓ 52.25
Physiological Cost of work (PCW)	2.62	1.25	↓ 52.29

Hence, it can be inferred that the farm women may not be knowing about the drudgery involved in the Conventional method. Training them in using the Improved method and educating them about the drudgery related aspects and musculoskeletal disorders is essential.

Physiological Workload of the Respondents Which Performing the Cotton Picking Activity

Table 12 shows the physiological workload of the respondents while performing the cotton picking activity using the Conventional and Improved Methods.

The results emphasized that the time taken to pluck cotton in the given field area for the respondents in a single day decreased while using the Improved Method (280 - 450 minutes), compared to the Conventional Method (480 minutes). The output per day also was increased in the Improved method (60 - 75 kg), compared to the Conventional Method (45 - 50 kg).

Coming to the Physiological workload assessment, the average resting heart rate of the respondents was found to be 78.50 beats per minute,

in both the methods. The average working heart rate was increased to 110.97 beats per minute while using the Conventional method, and increased to 96.00 beats per minute while using the Improved method, compared to the average resting heart rate. Chauhan et al (2012) too found that average heart rate during picking cotton was significantly lower among younger group.

Based on the Workload classification given by Varghese *et al.* (1994), the results indicated that the physical workload of the Cotton picking activity using Conventional method was 'Moderate', and it was changed to 'Light' activity while using the Improved method.

The average energy expenditure during work was 8.92 kJ/ min in Conventional method, and 6.54 kJ/ min in Improved method. The CCW, TCCW also showed positive (reduced) recordings while using the Improved method. On the whole, the Physiological Cost of Work (PCW) was decreased from 2.62 to 1.25 in the Improved method.

These results were also in contrast to the Perceived exertion rating given by the respondents which again indicated that scientifically drudgery and physiological cost of workload was decreased while using the Improved method of Cotton Picking, but the respondents did not have awareness about these aspects.

CONCLUSION

The results of the current study on the intervention of cotton picker in drudgery reduction of farm women indicated that the Improved method of Cotton picking i.e., using a Cotton picker has a positive impact on reducing the drudgery and physiological workload of the respondents. As the respondents may not be used to work with a Cotton picker or did not have a positive attitude towards it or were reluctant to change their old working procedures; they did not give a positive perceived exertion rating for the Improved method, when compared to the Conventional method. But, as the Improved method has certain benefits like increased work efficiency and output, reduced physiological workload and drudgery which is evident through the results of scientific calculations done; it is important to create an awareness among the farm women regarding the Improved method of cotton picking. They should be made understood that taking up small mechanization measures in their farming practices and activities can surely help them in making their work faster and better; in turn safeguarding their human and non-human resources.

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