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RESEARCH ARTICLE

Impact of Mechanization in Groundnut Production System for Drudgery Reduction and to Enhance Farm Income

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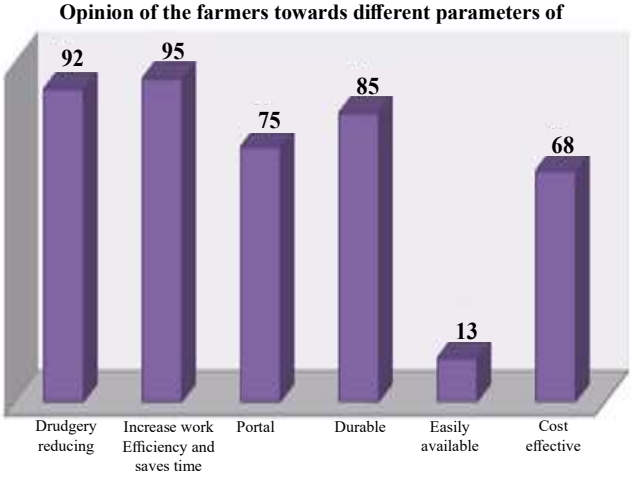
HIGHLIGHTS

- The farm women work as programmed robots destined for drudgery as they are deprived of technology access, health care access, and employment alternatives.
- It is essential to empower farm women with scientific knowledge and gender friendly appropriate technologies developed on the principles of ergonomics.
- The improved farm tools increase the work efficiency, reduce the drudgery of farm women and labour wages.
- Hence, the Government and other agricultural institutions should organize intensive training programmes on use of these farm technologies to promote and popularize them.

GRAPHICAL ABSTRACT



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ABSTRACT

Context: They work as programmed robots destined for drudgery as they are deprived of technology access, health care access, and employment alternatives.

Objective: The present study the acceptance of mechanization in groundnut production system by farmers for drudgery reduction and to enhance the farm income.

Method: The study was conducted in groundnut growing villages of Dharwad district during 2021-23. To introduce the mechanization in groundnut production system, the technology package consisted of a saral kurpi, fertilizer trolley, manual and mechanized groundnut strippers, and decorticators was formulated. Further the package was introduced through organizing training programmes to the farming community. The total no. of beneficiaries of these training progrmmes was 100 farm women.

Results & Discussion: The results of the pre-test training programme revealed that the farm women had less knowledge regarding improved technologies in groundnut production systems before the training programmes. The post-test scores showed knowledge gain among the farm women with respect to all the technologies. In addition, the majority of the farm women accepted the technology package and opined that these are gender-friendly, drudgery reducing, convenient, and comfortable to use. But only with respect to availability of the tools, the farmers/ farmwomen opined the difficulty in availability of the technologies.

The pre-test training programme results showed that prior to the training programmes, the farm women knew less about new technologies in groundnut production systems. The post-test results demonstrated the farm women's increased knowledge of all the technologies. Furthermore, the majority of farm women accepted the technology package and expressed their opinions that it is handy, comfortable, drudgery-reducing, and gender-friendly.

A large portion of India's population works in agriculture. It is a primary activity that generates food grains as well as raw materials for industries. India has a wide variety of food and non-food crops that are grown during three primary agricultural seasons—rabi, kharif, and summer—due to its large geographical area.

Farm women work physically demanding jobs viz., planting crops, harvesting, threshing/processing, marketing. The agricultural women endure arduous physical labour, particularly when performing agricultural activities manually. The tedious, long duration and monotony nature of farm activities lead to drudgery of farm women. Drudgery is hard, mindless, backbreaking work. In present era of modernization farming practices are still lacking innovation approaches for the various crop growing operation (Khambalkar, 2012).

Mechanized agriculture is the process of using agricultural machinery to mechanize the work of agriculture, greatly increasing farm worker productivity. The effective mechanization contributes to increase production in many ways: the timeliness of operation, the good quality of work and thirdly reduction in drudgery and labour cost. The mechanization of agriculture has advanced significantly in the previous few years. Farmers typically use mechanical equipment for a variety of agricultural tasks, such as threshing, irrigation, plant protection, and sowing. The use of improve tools increases work efficiency (Singh, 2018). The widespread consensus is that large-scale farmers have been the only ones to benefit from contemporary technologies. But the truth is that, through custom employment, even small farmers are embracing and using certain farm equipment for effective farm management. However, they must be educated in this field.

Groundnut is a major oil seed in India and is considered the “king of oilseeds.” It is one of the most important food and cash crops in our country. In groundnut production, women are involved in all stages of crop production, processing, and food preparation. All these activities are performed manually in traditional manner leading to drudgery of farm women and lower work efficiency. Here, the use of small agricultural implements helps to increase productivity and lessen labor-intensive tasks. Therefore, it is crucial to equip farm women with scientific knowledge and gender-neutral technology that is based on ergonomics. Regarding this, the Family Resource Management component of AICRP-HSc held training with the following objectives.

- To determine the roles played by women in the groundnut production system
- To introduce and popularize the technology package in groundnut production system to reduce the drudgery of farm women
- To research the technology package's acceptability

METHODOLOGY

The exploratory research design type was used in the study. The purposive random method was used to select four villages viz., Sulla, Surshettikoppa villages from Hubli taluk and Marewad and Kotur villages from Dharwad taluks were selected for conducting trainings on popularization of agricultural tools and technologies in groundnut production system for farm women. In these village the major crop grown was groundnut.

Further random sampling method was used to select 100 farm women for training programmes The study included farm women who were cooperative, cooperative, healthy, and consistently engaged in farm tasks. The study was carried out during the year 2021-23.

The survey method combined with personal interview method was used to gather information on role of women in the groundnut production system and to study their acceptability of farm tools. It is one of the most important quantitative methods.

The technology package consisting from farm tools/equipment’s used for different groundnut production activities were identified and formulated based on the needs of the farming community. The training programmes were organized to popularize the technology package. The acceptability of the farm technologies was assessed on three-point Likert scale i.e., agree (2), neutral (1) and disagree (0). Garrett's ranking technique was used to rank the preference indicated by the respondents on different factors to accept technologies. As per this method, respondents have been asked to assign the rank for different factors and the outcomes of such ranking have been converted into score value. Then for each factor, the scores of everyone are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is the most important factor and ranked I.

The impact of mechanization in groundnut production system was analysed by assessing the drudgery score. Drudgery Score was calculated by

using six drudgery parameters namely Rating on work Demand, Rating on Feeling of Exhaustion, Rating on Posture assumed in work, Rating on Manual Loads Operatives, Rating on Difficulty perception, Rating on work Load Perception. The five-point Likert scale was used to assess the opinion of farm women. The details of the technology package is given below

Farm activity	Technology
Weeding	Saral kurpi and Cycle weeder
Fertilizer application	Fertilizer trolly
Groundnut stripping	Motorized groundnut stripping
Groundnut decortication	Manual and mechanized groundnut decorticators

RESULTS

The Socio-Economic status of the selected villages is represented in the Table 1. The results revealed that than more than half percentage (51%) belonged to middle age followed by old age (39.00%) and young age group (10 %). This is probably because the farm women who performing the farm activities regularly were selected for the study. Majority respondents were educated up to primary school (49.00%) followed illiterates (25%), High school (20 %), PUC (5 %) and only meager percentage of the respondents (1%) degree holders. Majority of respondents belonged to nuclear family (74%) followed by joint family (26%). A few of these reasons for this can be interpersonal differences amongst the family members which can lead to conflicts and arguments, conflict regarding the family business, a desire for personal freedom etcetera. It was interesting to study that majority of the respondents (61%) were living in pukka house followed by kaccha house (39%).

Table 1. General information of the respondents (N=100)

Particulars	No.	%
Age		
Young (<25)	39	39
Middle (26-40)	51	51
Old (>40)	10	10
Education		
Illiterate	25	25
Primary school	49	49
High school	20	20
PUC	05	05
Degree	01	01
Family Type		
Nuclear	74	74
Joint	26	26

Table 2. Participation of women in groundnut poroduction activities (N=100)

Activities	No.	%
Sorting of Seeds	78	81.00
Land Cleaning and Preparation	62	62.00
Weeding	82	82.00
Manure/ Fertilizer Application	65	65.00
Harvesting	68	68.00
Drying and Decortication	84	84.00
Marketing	18	18.00
Value Addition	100	100.00

The involvement of women in groundnut production is displayed in Table 2. The women participation was maximum in value addition (100%). The women did value addition to groundnut by preparing chikki, laddu, holige chutney etc. The maximum number of women were involved in drying and decortication (84%). Further, the women participation was observed in weeding (82%), sorting of seeds (81%), harvesting (68%), Manure/ Fertilizer Application (65%). Similar findings were reported by Singh *et al.*, 2016). The least participation of women was observed in marketing activity (18%). The primary reasons why women are still employed in agriculture are unemployment, poverty, illiteracy, and ingrained customs.

Figure 1 shows the farm women's pre- and post-test knowledge scores on the technology package in the groundnut production system. The findings demonstrated that, across all of the chosen villages, farm women's pre-test knowledge scores were lower than their post-test knowledge scores. The results of the t test, which were shown to be positively significant, further confirmed this. This demonstrates unequivocally that prior to the training project, the farm

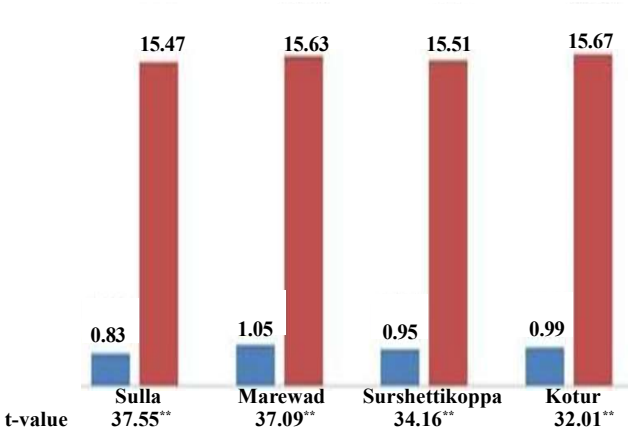

Figure 1. Pre- and post-test knowledge scores of farm women regarding technology package in the groundnut production system

Table 3. Acceptability of the weeding tools by the selected farmers (N=100)

Particulars	Weeding tools					
	Saral kurpi			Cycle weeder		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Drudgery reducing	91(91.00)	9 (9.00)	-	95(95.00)	05 (5.00)	-
Increases work efficiency and saves time	100 (100.00)	-	-	91(91.00)	09 (9.00)	-
Portable	100 (100.00)	-	-	100 (100.00)	-	-
Durable	100 (100.00)	-	-	100 (100.00)	-	-
Easily available	-	-	100 (100.0)	100 (100.0)	-	-
Cost effective	76 (76.00)	24 (24.00)	-	87 (87.00)	13 (13.00)	-
Overall acceptability	70 (70.00)	30 (30.00)	-	74 (74.00)	26 (26.00)	-

Figures in the parenthesis indicate percentage

Table 4. Acceptability of fertilizer trolley and motorized groundnut stripper by the selected farmers (N=100)

Particulars	Technologies					
	Fertilizer Trolley			Motorized groundnut stripper		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Drudgery reducing	100(100.00)	-		100(100.00)	-	-
Increases work efficiency and saves time	100(100.00)	-	-	100(100.00)	-	-
Portable	100(100.00)	-	-	100(100.00)	-	-
Durable	100(100.00)	-	-	200(100.00)	-	-
Easily available	-	100(100.00)	-	-	100(100.00)	-
Cost effective	100(100.00)	-	-	100(100.00)	-	-
Overall acceptability	100(100.00)	-	-	100(100.00)	-	-

Figures in the parenthesis indicate percentage

women were unaware of new agricultural instruments.

The acceptability of weeding tools by the selected farmers is shown in Table 3 regarding usage of Saral Kurpi the respondents opined that it is portable durable and cost effective. Further, they expressed that it increases work efficiency and saves time.

Table 4 displays the information pertaining to the selected farmers' acceptance of the motorized groundnut decorticator and fertilizer trolley. The farm women readily embraced these technologies and concurred that they are cost-effective, portable, durable, and reduce drudgery while also increasing labour productivity and saving time. According to the farm women, these technologies are not widely accessible. The rationale was that AICRP-WIA (FRM) was developing these technologies, and they were still in the process of being commercialized. As a result, they are not sold in stores.

Table 5 shows the acceptability of the different groundnut decorticators (CIAE Bhopal model, UAS, Raichur model and Motorized groundnut decorticator) by the selected farmers. The farmers expressed that sitting type of groundnut decorticator was convenient to use for women, while standing type was more suitable for men. However, the work output of both manual decorticators was high, but needed more human energy. Hence work-rest-work schedule was administered. Further, the farm women opined that the work out of all three models of ground nut decorticators is significantly higher than traditional method, hence they save time and labour cost.

Over all opinion of the farm women regarding popularized improved farm technologies: It is clear from these Tables that majority of the farm women accepted farm technologies and opined that these are gender friendly, drudgery reducing, convenient and comfortable to use. However there was certain barrier observed with women (Chauhan and Saikia, 2021: Noopur *et al.,* 2023). But only with regard to availability of technologies namely, Saral kurpi, fertilizer trolley, motorized groundnut stripper and ground nut decorticators, their opinion was either

Table 5. Acceptability of the groundnut decorticators by the selected farmers (N=100)

Particulars	Groundnut decorticators						Small Scale Mechanized Groundnut Decorticator		
	Sitting type groundnut decorticators			Standing type Groundnut decorticators			Mechanized Groundnut Decorticator		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree	Agree	Neutral	Disagree
Drudgery reducing	100 (100.00)	-		100 (100.00)	-	-	100 (100.00)	-	
Increases work efficiency and saves time	100 (100.00)	-	-	100 (100.00)	-	-	100 (100.00)	-	-
Portable	100 (100.00)	-	-	100 (100.00)	-	-	100 (100.00)	-	-
Durable	100 (100.00)	-	-	200 (100.00)	-	-	100 (100.00)	-	-
Easily available	-	100 (100.00)	-	-	100 (100.00)	-	-	100 (100.00)	-
Cost effective	100 (100.00)	-	-	100 (100.00)	-	-	100 (100.00)	-	-

Table 6. Acceptability rankings for the different farm tools by the selected farmers

Particulars	Farm tools						
	Saral kurpi	Cycle weeder	Fertilizer Trolley	Motorized groundnut stripper	Sitting type Groundnut decorticator	Standing type Groundnut decorticator	Mechanized Groundnut Decorticator
Drudgery reducing	III	V	II	II	II	III	I
Increases work efficiency and saves time	II	III	III	I	I	I	II
Portable	I	I	I	III	IV	II	V
Durable	V	IV	IV	V	V	V	IV
Easily available	VI	II	VI	VI	VI	VI	VI
Cost effective	IV	VI	V	IV	III	IV	III

neutral or disagree, as to purchase these tools order has to be given in advance to respective institutions. Whereas meager percentage of the farm women did not accept the technologies readily as they needed time to accept and get accustomed with new and improved farm technologies.

Acceptability rankings for the different farm tools by the selected farmers is depicted in Table 6. Garrett's ranking technique is used to understand major reasons for acceptability of different tools used in groundnut production system by farmer women. The farm women ranked the reason ‘portable’ as first, further, increases work efficiency and saves, drudgery reducing and cost effective as second, third and fourth ranks respectively as acceptability reason for saral kurpi. The farm women ranked ‘lack of encouragement’, ‘portable, easily available, increases work efficiency and saves time’ and ‘cost effective’ as first, second, third and fourth respectively. With respect to acceptability of fertilizer trolley, the farm women expressed ‘portable’, ‘drudgery reducing’, ‘increases work efficiency and saves time’, ‘durable and cost effective’ as the reasons for accepting fertilizer trolley. They ranked these factors from first to fifth respectively. With respect to motorized groundnut stripper, ‘increases work efficiency and saves time,’ ‘drudgery reducing’, ‘portable’, ‘cost effective’ and ‘durable’ were the major reasons for acceptance of the tool by farm women and they were ranked from first to fifth respectively. Further, the rural women ranked ‘increases work efficiency and saves time’, ‘drudgery reducing’, ‘cost effective’, and ‘cost effective’ as the major reasons for acceptance of sitting type groundnut decorticator and ranked them from first to fourth respectively.

Table 7. Impact of farm mechanization on drudgery reduction of farm women w.r.t. groundnut stripping activity

Particulars	Motorized groundnut stripper	Traditional method	KVK model	CIAE model	Udaipur model
Drudgery Score (6-30)	16.10	27.45	24.80	24.50	26.45
Reduction of drudgery experienced over (Score)					
Traditional method	11.35 (41 %)				
KVK model	8.70 (35 %)				
CIAE model	8.40 (34 %)				
Udaipur model	10.35 (39 %)				

Table 8. Impact of farm mechanization on drudgery reduction of farm women w.r.t. groundnut decortication activity

Particulars	Small scale motorized groundnut decorticator	Traditional method	UAS, Raichur model	CIAE, Bhopal model
Drudgery Score (6-30)	1.88	19.13	21.66	21.07
R*eduction of drudgery experienced over (Score)*				
Traditional method	17.25 (90 %)			
UAS, Raichur model	19.78 (91 %)			
CIAE, Bhopal model	19.19 (91 %)			

Similarly, 'increases work efficiency and saves time,' 'portable' and 'drudgery reducing' were ranked by the farm women from first to third respectively as the reasons for acceptance of standing type groundnut decorticator. While 'drudgery reducing', 'increases work efficiency and saves time' and 'cost effective' were raked as first, second and third respectively for mechanized groundnut decorticator.

The impact of farm mechanization on drudgery reduction of farm women w.r.t. groundnut stripping activity is depicted in Table 7. The farm women perceived less drudgery while working with motorized groundnut stripper (DS:16.10) as compared to traditional (DS:27.45) and other methods. The reduction of drudgery experienced by farm women over traditional method was 41 per cent followed by Udaipur model (39%), KVK model (35%) and CIAE model (34%).

Similarly, The impact of farm mechanization on drudgery reduction of farm women w.r.t. groundnut decortication activity is shown in Table 8. The farm women perceived less drudgery while working with Small scale motorized groundnut decorticator (DS:1.88) as compared to traditional (DS:19.13) and other methods. The reduction of drudgery experienced by farm women over traditional method was 90 per cent followed by UAS, Raichur model (91%) and CIAE, Bhopal model (91%).

DISCUSSION

Based on the study, the majority of respondents were middle-aged, with the remaining respondents being younger and older. The majority of responders had only completed primary education, with illiterates following. The majority of those surveyed were from nuclear families. These findings are consistent with those of Nisha Tiwari1, 2021, who found that that majority of farmwomen belonged to middle age group and only were of young age group. Majority of farmwomen were illiterate, only some had secondary school education.

In addition, women were observed to participate in weeding, seed sorting (Raksha and Chauhan, 2015), harvesting, and applying manure and fertilizer (65%). Desai and Sumangala (2016) found comparable results, noting that women participated in weeding operations at the highest level. Aliyu, Y (2022) similarly observed similar results, finding that women were more involved in seed sorting, drying, and decortications. The present results, which demonstrated that women's engagement was maximal in grain drying, storage, and processing operations and substantial in field cleaning, raising seedling nurseries, and weeding, were also supported by the findings of Chayal and Dhaka (2010) and Jethi (2008)

Further the results of the present study indicated that women were unaware of the improved agriculture

tools and were using traditional agricultural tools. These results are on par with findings of Singh (2023). The study show that the majority of the respondents knowledge level were increased after participation in the training programme. It was found from the study that there is acute financial problem in purchase of farm machinery among the respondents and there is also need for more awareness and training programme for rapid farm mechanization in the region. Pandey (2013) and Bhushan (2016) also find that women farmers had very less knowledge about all the aspects of tubular maize sheller but after training there was a very significant gain.

Regarding the acceptability of weeding tools by the selected farmers, the respondents opined that Saral Kurpi portable durable and cost effective. Further, they expressed that it increases work efficiency and saves time. The study on par with the results of the study conducted by Joshi (2015). Similar opinion was expressed for acceptability of cycle weeder too (Chitagubbi *et al.*, 2021). This finding is supported by the findings of the study conducted by Tiwari *et al.*, 2021.who found that majority of farmwomen had high level of adoption of drudgery reducing tools and implements. Farm women adopted the improved technique- Twin Wheel Hoe as it had increased the efficiency to work, reduced the drudgery (Sharma, 2015). Similar results were found by Singh (2016) and Bhushan (2016) also.

The farm women enthusiastically accepted motorized groundnut decorticator and fertilizer trolley technologies and concurred that they are cost-effective, portable, durable, and reduce drudgery while also increasing labour productivity and saving time. According to the farmers, standing groundnut decorticators were better suited for men, while sitting models were more practical for women. Desai., et al. (2018) reported similar results. Therefore, a greater number of such training programmes on improved/ farmer friendly agricultural tools and technologies may be organized for the benefit of the farm women.

According to the farm women, mechanization "increases work efficiency and saves time and cost effectively," which suggests that it has a beneficial influence on labour cost reduction and increases farm income. Further, it was motivating to study the impact of farm mechanization on reduction of drudgery of farm women. The mechanization has made impact on all the drudgery parameters namely Rating on work Demand, Rating on Feeling of Exhaustion, Rating on Posture assumed in work, Rating on Manual Loads Operatives, Rating on Difficulty perception, Rating on work Load Perception. The drastic reduction in drudgery of farm women w.r.t. to all drudgery parameters was observed while using the improved farm tools. This encourages farm women to use the improved tools in groundnut production system.

CONCLUSION

It can be concluded from the study that it is essential to empower farm women with scientific knowledge and gender friendly appropriate technologies developed on the principles of ergonomics. Hence, the Government and other agricultural institutions should organize intensive training programmes on use of these farm technologies to promote and popularize them. Joshi (2015) has also concluded that mechanization is one important aspect which needs attention. Light weight, low-cost machines suitable for use from sowing to harvest, storage etc. would reduce the loss and drudgery of the farming community. It should give subsidy on purchase improved farm technologies to hasten the adoptability rate among farming community. It should promote the local fabricators to produce these farm tools in large scale and make them easily available for the farmers/farm women.

Data availability : Data would be made available on request

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Appendix : Table, graphs are enclosed

Authors' contribution: First author conceived the concept, design and methodology, collected the data and performed the analysis, developed the farm technologies-motorized groundnut stripper and saral kurpi. Organized the training programmes to popularize the farm technologies. Second author Developed the farm technologies-Mechanized maize sheller and small-scale mechanized ground nut decorticator. Third author Developed the farm technologies-Saral kurpi and small-scale mechanized ground nut decorticator.

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