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Research Article

Testing of Agriculture Hand Tool Design Using Ergonomics Principles

Promilakrishna Chahal*

Department of Family Resource Management, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India

ABSTRACT

In India, women play an important role in agricultural field operations. Women are found to involved labour intensive activity on field, but still no specific tools and technologies are developed and tested on women to reduce their drudgery experiences in crop production activities. By keeping all these point, the present study was conducted to evaluate the carrot production system by improving some tools for work. The study was conducted on 30 farmers (43.3% male and 56.7% female) of Behbalpur village of Hisar district, who were found to be engaged in carrot production system. Majority of the respondents (60.0%) were belonged to the age group of 32-42 years, and one third of the respondents (33.3%) were having education up to high school. Maximum respondents (93.3 per cent) were having farming as main occupation and majority of them (86.7 per cent) were having land between 2.5-10.0 acres. Out of 14 carrot production these activities; harvesting was found to be most time taking activity with time involvement of 3602.6 ± 52.8 minutes, followed by separating green from carrot (3043.7 ± 45.1), irrigation (2672.4 ± 21.5 minutes) and weeding (2411.3 ± 23.1 minutes). Rating of perceived exertion score was also found too high in harvesting (x=4.7) packing/loading (x=4.2) and weeding (x=4.1). Results unveiled that most of drudgery prone activities were performed by female like; weeding (DI-83.67), separating green (DI-70.67), harvesting, (DI-69.33) packing and loading (DI-56.33), and collecting carrot (DI-55.67) with their drudgery rank of I, II, V, VI, respectively. So tools used in carrots production (especially weeding, collecting carrot, and separating green, packing/loading) were modified and their performance and acceptance level were tested on the bases of scales. As per result on effect of improved tools, heart rate and blood pressure (systolic-122.9 ± 8.4 to 128.4 bp/min and diastolic-79.3 ± 8.3 to 85.7 ± 8.3 bp/min) of workers in weeding activity was found significantly higher (t value 3.07, 3.7 and 3.84) in tradition method but in improved tool the heart rate and blood pressure were near to normal value, which reflect that improved tool (hand wheel hoe) was easy to use and not affected the heart rate of workers. Grip strength of workers was found to be decreased (30.9 ± 3.5 to 24.1 ± 2.8) in tradition method but had not significantly affect (30.9 ± 3.5 to 28.1 ± 3.1) the workers grip strength by using hand wheel hoe.

Keywords: Agriculture; Harvesting; Drudgery index

INTRODUCTION

Agriculture is considered as the source of living for most of the Indians in rural areas, which is about greater than 70%. Its contribution is about 18% of the gross domestic product in India [1]. Similarly agricultural sectors in India also largely contribute to 49% of the total labour force. Women's involvement in agriculture is complex and diverse. Unlike their male counterpart, women are involved in a wide range of activities in agriculture as well as at home. However, the spectrum of women's participation in agriculture is changing with the changing profile of agriculture and development of non-farm sector. In India, as per census India data, the female Work Participation Rate (WPR), the proportion of workers in total female population, increased from just 12% in 1971 to 25.6% in 2001, while the male WPR remained just over 51. Farming is greatly influenced by the techniques and tools used in various stages and activities involved. With the development of machinery and equipment, the farming process has become easier, more efficient and productive. Still most of the farming activities are carried out by the conventional tools and methods. Some of the crucial factors for poor productivity were like the use of local artisans made tools/equipment; imported tools/equipment which are not suitable for targeted user's physical capacity; anthropometric data are not taken into considerations for tools/equipment design [2]. Ergonomically designed equipments/products enhance the human operating efficiencies and comforts during its operation [3]. However, as an occupational environment, regardless of these

Correspondence to: Dr. Promilakrishna Chahal, Department of Family Resource Management, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, India, Tel: 08168241988; E-mail: promilakrishnachahal@gmail.com

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major technological advances, agriculture is regarded as one of the most demanding and hazardous sectors. As a matter of fact, it is ranked second among occupational injuries, fatalities, and illnesses [4]. It has been reported by many authors and researchers that the farmers engaged in agricultural sectors are highly affected by Musculo Skeletal Disorders (MSD) because of the risk factors evolved in the respective work, repetitive lifting and moving of heavy loads, prolonged trunk flexion (also called stooping), intensive hand work, and working in awkward postures of wrist and trunk [5]. In fact, repetitive and sustained stooping is the primary risk factor for low back pain [6]. A vast majority of rural women in India take part in agricultural field operations. Study on their drudgery experiences in crop production activities is multidimensional as there is excessive reliance on manual labor in this sector. Therefore, there is need to develop suitable technologies for farm women to overcome their drudgery, and increase productivity. Keeping all these point in mind, the present study was conducted to study the effect of traditional and improved tools on workers posture and physiological aspects in term to reduce drudgery at work.

MATERIALS AND METHODS

The present study was conducted under two phases; Phase-I: Study of present situation of workers at carrot farming and Phase-II: Comparison between traditional and improved condition on workers' health.

Phase-I: Study of present situation of workers at carrot farming

Present study was conducted in Behbalpur village of Hisar District. Thirty farmers (men and women) who were found to be involved in carrot farming were taken as respondents. Respondents were selected by purposively sample technique on the basis of their willingness to cooperate for study. Total 14 activities of carrot production including; field preparation, sowing, line making, bed making, irrigation, fertilizing, weeding, pesticides spray, harvesting, collection of carrot, separating green, packing, transportation and washing were studied. Occupational health hazardous in each activity was studied by three parameters; Rating of Perceived Exertion (RPE): A five-point continuum scale was used to study the level of exertion felt by workers in different carrot production activities, time spend in each activity: calculated in minutes and level of drudgery: calculated by using Drudgery Index (DI): Drudgery Index (DI) was calculated with the following Formulae 1:

$$\text{Drudgery Index} = [(x+y+z)*13] \times 100. \quad \text{Formulae 1}$$

x=Co-efficient pertaining to difficulty felt.

y=Co-efficient pertaining time spent in particular farm activity.

z=Co-efficient pertaining to frequency of performance

Frequency of performance of farm activities: Data pertaining to frequency of performance was elicited in a five point scale (1-5) *viz*. daily (5), alternate day (4), weekly (3), fortnightly (2), seasonal (1).

Time spent in farm activities: total times (in minutes) spend by workers per day on respective task.

Difficulty felt in farm activities: The perceived difficulty felt in performance of farm activities was assessed in a five point scale (1-5) i.e. very easy (1), easy (2), neutral (3), difficult (4) and very difficult (5).

Phase-II: Comparison between traditional and improved condition on workers' health

On the basis on RPE, time spend and drudgery index, out of 14 activities, three most hazardous activities were selected and tools used in these activities were replaced by improved tools to analyses the effect of both conditions on workers' health. Working condition was observed by using physiological and biomechanical parameters of workers. Physiological parameters including heart rate (beats/min), grip strength (kg) and blood pressure (bp/min) were recorded before and after the work in both situations; traditional and improved. Data regarding angle of deviation (head, neck and back) were measured at rest and during work by using goniometer. T test was used to determine the difference between traditional and improved condition of workers. Each respondent was interviewed and obtained data for compilation. The effect of tools used on working condition of workers.

Analysis of data

For statistical analysis frequency, percentage, mean, standard deviation, frequency and percentage were used. T-test was used to study the significance of difference (between traditional and improved condition) on doing carrot farming. Co-efficient value of frequency of doing task, difficulty level and average time spend was calculated to find out the level of drudgery in each activity of carrot farming.

RESULTS AND DISCUSSION

Phase-I: Study of present situation of workers at carrot farming

The present study was conducted to find out the existing condition of carrot production farming in Haryana. The present study was conducted on 30 farmers (43.3% male and 56.7% female) who were found to be engaged in carrot production system. In present study, 60.0 per cent respondents were belonged to the age group of 32-42 years, followed by 23.3 per cent were having age between 42.1-53 years and 16.7 per cent were between the age of 53.1-63 years. Data regarding education of the respondents' shows that one third of the respondents (33.3%) were having education up to high school, followed by matric (26.7 per cent) and bachelor degree (16.7 per cent). Few per cent of the respondents were having the education of middle (13.3 per cent) and master degree (10.0 per cent). Maximum respondents (93.3 per cent) were having farming as main occupation. Majority of the respondents (86.7 per cent) were having land 2.5-10.0 acres and having area 1.6-2.5 acres area under carrot cultivation as shown in Figure 1.

Findings in Table 1 reflect the posture adopted, duration of activity and frequency of doing task in one season of crop. As results represent that posture adopted by farmers was different from activity to activity as their level of drudgery depended upon the duration of activity as well as frequency of doing task. Weeding (480 minutes), harvesting (360-480 minutes), collecting carrot and separating green (360-480 minutes) were more time taking activities of carrot production with frequency of doing for 4 days in a season. The most hazardous posture adopted by farmers were squatting (in

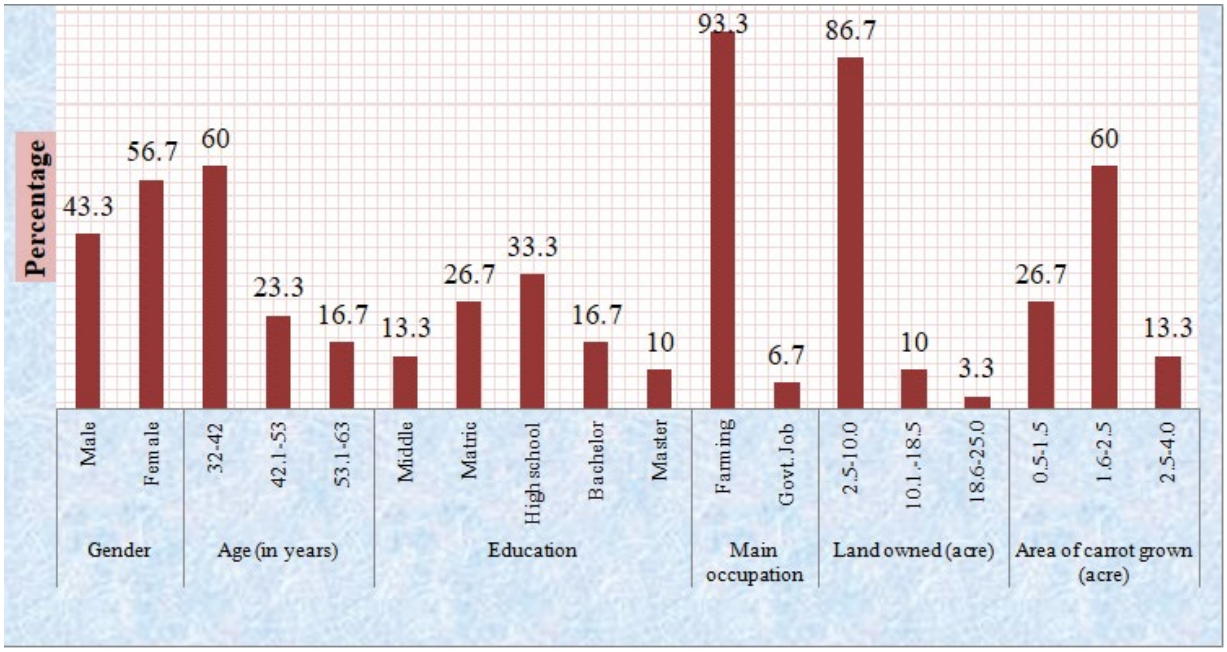


Figure 1: Personal profile of the respondents.

Table 1: Posture adoption and time involvement of respondents in different activities (1 Acre area).

Activities in carrot production	Posture	Duration (minutes)	Frequency of doing task
Field preparation	Sitting	30-45	Once
Sowing	Walking	30-45	Once
Line making	Sitting	20-30	Once
Bed making	Stooping	30-45	Once
Irrigation	Walking	40-50	8 times
Fertilizers	Walking (carrying load)	20-30	2 times
Pesticides	Walking (carrying load)	20-30	Once
Weeding	Squatting	480-500	4 days
Harvesting	Sitting	60-65	Once
Collecting carrot	Squatting	60-80	3-4 days
Separating green	Stooping	360-480	3-4days
Packing and loading	Stooping and walking	120-130	3-4 days
Transportation	Sitting	30-35	2 times
Cleaning/Washing	Walking	30-45	Once

weeding and collecting carrot and separating green), stooping (in bed making, harvesting and collecting carrot and separating green) and stooping and walking (Packing and transportation).

Findings in Table 2 reflect the posture adopted, duration of activity and frequency of doing task in one season of crop. As results represent that posture adopted by farmers was different from activity to activity as their level of drudgery depended upon the duration of activity as well as frequency of doing task. Weeding (2411.3. ± 23.1), harvesting (3602.6 ± 52.8), collecting carrot and separating green (3043.7 ± 45.1) were more time taking activities of carrot production with frequency of doing for 4 days in a season. The most hazardous posture adopted by farmers were squatting (in weeding and collecting carrot and separating green), stooping (in bed making, harvesting and collecting carrot and separating green) and stooping and walking (Packing and transportation). While the nationally representative data indicates that the national average for women's share of total time-use in agriculture is 32 percent, younger women contribute a higher share of the total time provided in agriculture by their age group than older women do in theirs [7]. Women in India are major producers of food in terms of value, volume and number of hours worked. Nearly 63 percent of all economically active men are engaged in agriculture as compared to 78 per cent of women. Almost 50 percent of rural female workers are classified as agricultural labourers and 37% as cultivators. About 70 percent of farm work was performed by women [8]. Results in Table 2 further depict the rating of perceived exertion faced by respondents during different carrot production activities. As per findings it was found that harvesting and collection of carrot were found to be most strenuous activities with means value 4.7, followed by packing/loading and weeding were found hazardous activities with means score of 4.2 and 4.1, respectively. Same was found in case of separating green from carrot. As per results achieved by Gupta and Bisht [9], hand weeding, cleaning of vegetables, planting/sowing, hand weeding and cleaning activities were very exhausting with RPE mean score of 4.8,4.7, 4.6, 4.6 and 4.5.

The data in Table 3 represent a clear view on drudgery index in different carrot production activities. Drudgery index was calculated on the basis of Frequency Coefficient, Difficulty coefficient and Average time spend coefficient in different carrot production activities. As results show that weeding was found to be most drudgery prone activity with coefficient value of p value 0.91, 0.78 and 0.82 for frequency, difficulty and average time spend, respectively. Separating green and packing/loading got II and III ranks with drudgery index of DI:70.67 and DI:69.33. Data in table further define that irrigation and harvesting got IV and V rank respectively with drudgery index of 58.67 and 55.67. Women's' involvement in farm activities is a source of drudgery. Drudgery Index was determined by calculating the time co-efficient, frequency of performance co-efficient, and difficulty co-efficient. Thereafter, three major drudgery prone farm activities prepared by women were identified based on Drudgery Index (01) were sun drying of grains (DI=40.5) uprooting of seedling ranked second (DI=40.2), while transplanting ranked third (DI=39.5) [10].

Results unveiled that most of drudgery prone activities were performed by female like; weeding (DI-83.67), separating green (DI-70.67), packing and loading (DI-56.33), and collecting carrot (DI-55.67) with their drudgery rank of I, II, V, VI, respectively. Only irrigation was IVth drudgery prone activity that was performed by male respondents only. Male respondents were found to be involved in activities which required outdoor activity, decision making, contact to seller and trader and in which machine performed the task. Women do many of the most difficult farm tasks in India such as transplanting, weeding, harvesting, and post-harvest processing of produce. All of these tasks are time-consuming and full of drudgery. Women are involved in more strenuous activities as compared to men [11].

On the basis of drudgery index, rating of perceived exertion level and time spend in each activity; three carrot farming activities; weeding, separating green and picking/loading were found to be most hazardous activities. Traditional working tools used in three more hazardous activities (weeding, separating green and picking/loading) were replaced by improved tools i.e., hand wheel hoe and sickle, carrot green cutter, trolley and head load manager, respectively and their effect on workers was studied on the basis of postural (back, neck, elbow) and physiological parameters (heart rate, blood pressure and grip strength) of workers.

Table 2: Working condition in carrot production farming.

Activities in carrot production	Time Spend (minutes)	RPE	Rank
Field preparation	78.4 ± 9.5	1.7	VII
Sowing	27.3 ± 6.8	2.5	V
Line making	37.4 ± 8.1	1.5	VIII
Bed making	113 ± 10.2	2.3	VI
Irrigation	2672.4 ± 21.5	1.0	XI
Fertilizers	34.8 ± 8.2	1.1	X
Weeding	2411.3 ± 23.1	4.7	III
Pesticides	66.1 ± 11.5	1.5	IX
Harvesting	60.6 ± 15.8	1.4	VIII
Collecting carrot	314.6 ± 33.1	3.9	IV
Separating green	3043.7 ± 45.1	4.2	II
Packing/loading	455.1 ± 22.6	4.6	I
Transportation	163.2 ± 27.7	1.1	X
Washing	127.4 ± 18.9	1.0	XI

Phase-II: Comparison of traditional and improved condition on workers' health

The findings in Table 4 show the posture adopted by workers in traditional and improved conditions. The posture was analyzed in three body regions; back, neck and elbow. Posture of each body regions was analyzed by the angle of flexion and extension of each part and degree of change from normal posture. Regarding weeding activity in tradition condition sickle was a used worker which was improved by hand wheel hoe. Posture of back, neck and elbow were found to be significantly improved (t value:8.04, 9.59 and 2.73) by using hand wheel hoe. Back angle was significantly decreased (t value:8.04) from 35.90° ± 4.380° to 13.90° ± 3.340°. Same was found in case of neck (42.30° ± 3.650° to 25.00° ± 3.910°) and elbow (138.40° ± 6.940° to 106.50° ± 8.180°). In separating grass activity no significant effect was found of improved tool on working posture of workers. Besides, loading carrot activity, posture of back and elbow was found to be significantly improved by using trolley. Angle of back (47.70° ± 7.90°) and elbow (129.20° ± 6.10°) was found to be significantly improved/decreased after using trolley

Table 3: Drudgery index for farm activities.

Carrot production activities	Frequency coefficient	Difficulty coefficient	Average time spend coefficient	Drudgery index	Rank
Field preparation	0.59	0.11	0.12	09.63	XIV
Sowing	0.13	0.14	0.14	13.67	XI
Line making	0.12	0.16	0.16	14.67	X
Bed making	0.51.	0.31	0.16	32.67	VII
Irrigation	0.44	0.57	0.75	58.67	IV
Fertilizers	0.11	0.13	0.16	13.33	XII
Weeding	0.91	0.78	0.82	83.67	I
Pesticides	0.56	0.24	0.15	31.67	VIII
Harvesting	0.73	0.44	0.52	56.33	V
Collecting carrot	0.50	0.56	0.61	55.67	VI
Separating green	0.68	0.75	0.69	70.67	II
Packing/loading	0.94	0.63	0.51	69.33	III
transportation	0.10	0.14	0.12	12.00	XIII
Washing	0.14	0.18	0.13	15.00	IX

and head load manager. In line similar findings were reported by Gupta and Bisht [9] female labours working in agricultural fields with traditional methods were found to be having postural stress and work-related musculoskeletal disorders.

The data in Table 5 reflect the physiological parameters (heart rate, grip strength and blood pressure: systolic and diastolic) of workers in different carrot production activities. As the table shows that physiological parameters were taken in three conditions; at rest, during using traditional tool and improved tool. Heart rate of workers in weeding activity was found significantly higher (t value 3.07) in tradition method but in improved tool the heart rate was near to normal value, which reflect that improved tool (hand wheel hoe) was easy to use and not affected the heart rate of workers. In line same result was found in grip strength and blood pressure of workers. Grip strength of workers was found to be decreased (30.9 ± 3.5 to 24.1 ± 2.8) in tradition method but had not significantly affect (30.9 ± 3.5 to 28.1 ± 3.1) the workers grip strength by using hand wheel hoe. The blood pressure (systolic and diastolic) of workers was significantly found to be increasing (122.9 ± 8.4 bp/min to 130.5 ± 5.1 bp/min in case of systolic and 79.3 ± 8.3 bp/min to 82.9 ± 7.7 bp/min in diastolic) after doing activity by traditional tool, besides this blood pressure was found to be near to rest level (122.9 ± 8.4 bp/min to 124.6 ± 7.1 bp/min in systolic and 79.3 ± 8.3 bp/min to 79.8 ± 7.2 bp/min in diastolic) after doing task by improved tool (hand wheel hoe). Results in table further explain the physiological parameters of workers in activity of separating grass form carrot. In traditional task knife was used by workers and in improved task green grass cutter was used by same workers. As the table shows that no significant difference was found in heart rate (t value 1.66 and 0.01) Blood Pressure; systolic (t value 0.08 and 0.19) and blood pressure; diastolic (t value 0.02 and 0.38) of workers at rest and at activity by using traditional and improved tools. Only grip strength was found to decrease (by using traditional tool comparative to improved tool. Regarding the loading activity of carrot trolley was used as improved tool instead of that traditional workers were carrying load on head or on hand. All the physiological parameters were found to be significantly improved by using improved tool. As per findings heart rate of workers was found to be significantly increasing by using traditional tool (78.4 ± 6.2 beats/min to 92.9 ± 5.8 beats/min with t value 2.6) and decreased by using improved tool (78.4 ± 6.2 beats/min to 82.0 ± 6.6 beats/min with t value 1.94). In line same results was found in case of blood pressure and grip strength. Blood pressure was workers was found to be near to rest level after using improved tool, besides this traditional tool was found to be significantly (t value 3.7 and 3.84) increasing the blood pressure of workers in both form systolic (122.9 ± 8.4 to 128.4 bp/min) and diastolic (79.3 ± 8.3 to 85.7 ± 8.3 bp/min).

Table 6 represent the activities involved in carrot production and tools used to perform the specific task. For present study tools used in carrot production (weeding, collecting carrot, separating green, packing/loading) were modified/improved and their performance and acceptance level were tested on the bases of scales. For weeding hand or sickle were existing tools which were replaced by hand wheel hoe and sickle. Regarding separating carrot from green, carrot green cutter was modified by existing sickle/knife. In case of packing/loading trolley and head load manager tools were used as modified tools. As per findings hand wheel hoe and sickle were found to be increasing productivity level up to 73.3 per cent, followed by using of trolley and head load manager in packing and loading was increasing the productivity level of 50.0 per cent and carrot green cutter was increasing the productivity by 33.3 per cent in separating green activity. The root cause of women's suffering is ignorance, age old methods of doing the work, inappropriateness of the technology, attitudinal constraints such as innate conservation and resistance to change [12]. The farm women perform agricultural tasks with the age old traditional tools since gender friendly appropriate tools are either not available or are insufficient in number or unawareness. Unsafe, hazardous, unhealthy and long hours of work with age old traditional and cumbersome tools accelerate health related problems of women farmers [13,14].

Table 4: Posture analysis of workers in traditional and improved conditions of carrot production.

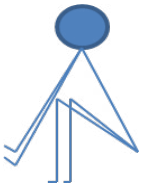
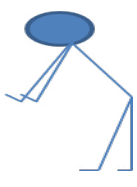
Activity	Body region	Posture In existing condition)	Traditional tool (mean+standard deviation)	Posture (in improved condition)	Improved tool (mean+standard deviation)	t-value
Weeding	back		35.9 ± 4.38		13.9 ± 3.34	8.04**
	neck		42.3 ± 3.65		25.0 ± 3.91	9.59**
	elbow		138.4 ± 6.94		106.5 ± 8.18	2.73*
Separating grass	back		36.1 ± 4.2		35.0 ± 4.1	0.31
	neck		42.6 ± 3.8		38.8 ± 4.8	0.01
	elbow		138.0 ± 6.1		126.5 ± 3.1	0.29
Loading	back		47.7 ± 7.9		19.1 ± 3.2	1.97*
	neck		44.6 ± 3.7		15.9 ± 2.9	1.74
	elbow		129.2 ± 6.1		105.8 ± 6.8	5.57**

Table 5: Physiological parameters of workers in different carrot production activities.

		Weeding		Separating grass from carrot		Loading carrot	
Variable	At rest	Traditional tool	Improved tool	Traditional tool	Improved tool	Traditional tool	Improved tool
Heart rate beats/min)	78.4 ± 6.2	88.4 ± 6.9	81.7 ± 6.2	82.2 ± 5.4	79.7 ± 6.4	92.9 ± 5.8	82.0 ± 6.6
	t-value	3.07	1.5	1.66	0.01	2.6	1.94
Grip Strength (kg)	30.9 ± 3.5	24.1 ± 2.8	28.1 ± 3.1	22.7 ± 3.1	25.3 ± 2.7	22.6 ± 3.1	26.2 ± 3.5
	t-value	4.2	0.01	7.5	1.3	2.6	1.2
BP (systolic) (bp/min)	122.9 ± 8.4	130.5 ± 5.1	124.6 ± 7.1	126.6 ± 6.6	124.0 ± 5.6	128.4 ± 6.2	123.6 ± 5.1
	t-value	8.9	0.01	0.08	0.19	3.7	0.05
BP diastolic) (bp/min)	79.3 ± 8.3	82.9 ± 7.7	79.8 ± 7.2	81.8 ± 6.6	79.4 ± 6.9	85.7 ± 8.6	82.4 ± 8.3
	t-value	2.02	0.34	0.02	0.38	3.84	0.07

Table 6: Traditional and improved tools used in carrot production.

Activities in carrot production	Existing equipment/tools used	Improved equipment/tools used	% production increased
Field preparation	Tractor and Kassi	-	-
Sowing	By hand	-	-
Line making	Kassi	-	-
Bed making (Kyari banana)	Kassi	-	-
Irrigation	-	-	-
Fertilizers	By hand	-	-
Pesticides	By Pump	-	-
Weeding	By hand or by sickle	Hand wheel hoe	73.3%
Harvesting	By tractor or by Kassi	-	-
Collecting carrot	By hand	-	-
Separating green	Existing Sickle/knife	Carrot green cutter	33.3%
Packing/loading	Overhead (in bori)	Trolley	50.0%
Transportation	Tractor	-	-
Washing	By machine	-	-

CONCLUSION

Agricultural hand tools design as the transformation of a concept into a product with the aim of satisfying farmers' needs whilst ensuring respect for the environment, legislation and corporate profitability. The initial stage of a agricultural tool design process therefore involves identifying and formalizing various expectations of farmers (users) with regard to the product to be designed, amongst are which those relating to ergonomics features either explicitly or implicitly.

Carrot farming was a 9 months winter crop; involving 14 activities including; field preparation, sowing, line making, bed making, irrigation, fertilizing, weeding, pesticides spray, harvesting, collection of carrot, separating green, packing, transportation and washing. In village, both; male and female were found to be engaged in carrot production. Maximum per cent of the respondents were having up to 10 acres area under carrot farming and were found to be involved in carrot production for more than 10 years. Villagers were adopting various postures for completion of task. Some postures were very strenuous and their time of adopting was also high, which was creating the postural problems in workers. Activities like; weeding, separating green and packing and loading were more time taking activities with involvement of hazardous posture like squatting, stooping and stooping with walking. On the basis of occupational health, three activities; weeding, separating green and packing/loading were found to be more hazardous. Time involvement, rating of perceived exertion and drudgery index in these three activities was high than other activities. Tools/techniques used in these three activities were replaced by improved tools and effect of these tools was studied. In study it was found that improved tools were found to be improving the physiological condition of workers. Workers physiological health was found to be better after using improved tools. In weeding process, use of sickle was significantly increasing the heart rate, grip strength and blood pressure of workers, whereas by using hand wheel hoe (improved tool) all the physiological parameters of workers were remain same as at rest level. In packing and loading activity, effect of traditional tools was found significantly affecting the health of workers; besides trolley (improved tool) was improving the working condition of workers by maintain the health at level of rest.

As per findings improved tool; hand wheel hoe, used for weeding was significantly improving the posture of workers, besides, green grass cutter used in separating green instead of knife/sickle was not found appropriate to users and not improving their working posture. Trolley used in loading as improved tool was significantly improving the posture of back and elbow of workers but the use of trolley in field was not a good tool as it was demanding more force to move, which simultaneously causing physical stress in workers. Other side use of improved tools was significantly increasing the productivity of workers. use of hand wheel hoe was increasing the productivity by 73.3 per cent, followed by trolley was found to be increasing the productivity level of 50.0 per cent and carrot green cutter was improving the workers productivity by 33.3 per cent in

separating green activity. Agriculture production has experienced a relatively high diffusion of advanced technologies, however, as an occupational environment, regardless of these major technological advances, there is need to develop technologies as per need and requirement of farmers. big technologies only work at large field, technologies should be developed for small crop or small farmers, so they can do agriculture smoothly which could enhance their oductivity and efficiency at work.

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