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Research Paper

Ergonomic assessment of existing methods of harvesting flowers from the fields

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■ **ABSTRACT :** Woman plays a significant and crucial role in agricultural development, livestock production, horticulture and floriculture post harvest operation, agro-social forestry and fisheries etc. as a manager, decision maker and skilled farm worker. Women in agricultural families perform many farm related activities both within and outside the household in most parts of the country. So far, as floriculture is concerned, women participates in almost all activities right from preparatory tillage to harvesting of the flowers. In this study attempt has been made to study the role performed by farm women engaged in floriculture. Punjab ranks high on the horticulture map of the country. The demand for flowers is escalating fast with the rising living standards of people. The cultivation of flowers has turned into commercial venture due to high returns per unit area, generation of employment opportunities and as a viable option for diversification in agriculture. Harvesting of flowers is also one of the tedious activity and plucking of flowers is done mainly with hands. There is intensive involvement of rural women in this activity and further they perform this activity with drudgery prone methods thus putting large demands on their time and energy. Moreover, wrong practices followed while plucking shortens the life of flowers and also such flowers are not acceptable in the market. Therefore, keeping this in view, All India Coordinated Research Project on Home Science, FRM Component of PAU, Ludhiana have done the ergonomic assessment of existing methods of harvesting flowers from the fields being performed by women workers. The parameters for ergonomic assessment were working heart rate, energy expenditure and drudgery scores on five point scale. The results revealed that as no improved technology and methods were used/available for plucking of flowers from the fields this activity was considered as drudgery prone activity by the women workers. All the respondents (30 women) were plucking the flowers with only one hand while other hand was used for holding the polythene bag used for collecting the plucked flowers. It was observed that more time was needed to pluck the flowers as plucking was done with only one hand. Further they found this way of plucking flowers very tedious which also reduces the output of work.

■ **KEY WORDS:** Ergonomic, Harvesting, Drudgery

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Growing of flowers is an important component of diversification of agricultural cropping pattern. Punjab ranks high on the horticulture map of the country. The horticulture scenario in the state has metamorphosed from traditional open cultivation to commercial and hi –tech cultivation of flowers. The demand for flowers is escalating fast with the rising living standards of people. The cultivation of flowers has turned into commercial venture due to high returns per unit area, generation of employment opportunities and as a viable option for diversification in agriculture. Harvesting of flowers is also one of the tedious activity and plucking of flowers is done mainly with hands. There is intensive involvement of rural women in this activity and further they perform this activity with drudgery prone methods thus, putting large demands on their time and energy. Moreover, wrong practices followed while

plucking shortens the life of flowers and also such flowers are not acceptable in the market. Therefore, keeping this in view, All India Coordinated Research Project on Home Science, Family Resource Management Component of Punjab Agricultural University, Ludhiana have done the ergonomic assessment of existing methods of harvesting flowers from the fields being performed by farm workers. The parameters for ergonomic assessment were working heart rate, energy expenditure and drudgery scores on five point scale. The results revealed that as no improved technology and methods were used/available for plucking of flowers from the fields, this activity was considered as drudgery prone activity by the farm workers. All the respondents (30 women) were plucking the flowers with only one hand while other hand was used for holding the polythene bag used for collecting the plucked flowers. It was observed that more time was needed to pluck the flowers as plucking was done with only one hand. Further, they found this way of plucking flowers very tedious which also reduces the output of work.

■ RESEARCH METHODS

Field survey was conducted to know the existing flower plucking practices followed by farm women and the constraints face by them during plucking of rose and marigold flowers, so that improved technology could be developed to reduce their drudgery. An interview schedule was developed and interview cum observation techniques was used to collect data. Doraha block was selected randomly to collect data as this block from Ludhiana has maximum flower cultivation in the district. A total sample of 60 farm women were intensively involved in flower plucking from Doraha block were purposively selected as respondents. For conducting the field experimental flower fields with good rose and marigold cultivation in village Doraha were purposively selected because of easy accessibility and intensive involvement of farm women in flower plucking.

A total sample of 30 farm women in the age group of 21 to 45 years were purposively selected for conducting the field experiments who were involved in flower plucking for more than 5 years. Data were collected during the months of November to February as flowers were in full blooming stage during these months.

The following parameters were used to do the ergonomic evaluation of flower plucking activity:

Heart rate	Polar heart rate monitor
Energy expenditure	0.159 x heart rate (bpm)-8.72
Total cardiac cost of	CCW + CCR work (TCCW) (Cardiac cost of work + Cardiac cost of recovery)
Muscular fatigue	Grip dynamometer.

Ergonomic evaluation of plucking flowers involved the following parameters:

Heart rate (resting, working and recovery) Beats /min

Energy expenditure	= 0.159 x heart rate (bpm) -8.72
Total cardiac cost of work	= CCW + CCR
Cardiac cost of work (CCW)	= (Average working heart rate- Average resting heart rate) x Duration of activity
Cardiac cost of recovery (CCR)	= (Average recovery heart rate- Average resting heart rate) x Duration of activity.

$$\text{Physiological cost of cost} = \frac{\text{TCCW}}{\text{Total time of work}}$$

Recording of physiological parameters:

- Before the respondents started the flower plucking, her started time, blood pressure, muscular grip strength and heart rate (bpm) for five minutes were recorded.
- After starting the activity the heart rate (bmp) at the intervals of half an hour were recorded for the entire period (2 Hours) of the activity.
- Again, when she completed the activity for 2 hours the closing time and grip strength was recorded.
- The respondent was then given rest and her recovery heart was recorded till complete recovery.

Parameters used to assess the drudgery experiences:

Following six parameters were used on five point scale with 1score for minimum and 5 for maximum:

–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.

Drudgery experiences:

- Very demanding (5), demanding (4), moderate (3), less demanding (2), Very less demanding (1)
- Very exhausted (5) exhausted (4), moderately exhausted (3), mildly exhausted (2), No exhaustion (1)
- Very painful (5), painful (4), moderately painful (3), mild pain (2), no pain (1)
- Very heavy loads (5), Heavy loads (4), moderately heavy loads (3), light loads (2), no loads (1)
- Very difficult (5), difficult (4), Moderately difficult (3), easy (2), Very easy (1)
- Very heavy (5), Heavy (4), moderately heavy (3), light (2), very light (1).

■ RESEARCH FINDINGS AND DISCUSSION

Before conducting ergonomic assessment it was necessary to know the existing practices being followed by farm women for plucking of flowers because without diagnosis of the existing condition the improvements can't

be made.

Data in Table 1 reveals the existing practices being followed by the respondents while plucking flowers from the field. A glance at the table shows that all the respondents were plucking the flowers directly with finger tips and were not using any tool or protecting aid. For collecting the plucked flowers maximum percentage of the respondents (82.5%) used the polythene bag which was held in one hand and other hand was used for plucking the flowers while, a few of them (17.5%) used the polythene sacks tied around the side of waist for collecting the picked flowers. This indicated the lack of awareness and knowledge about appropriate technologies among farm women. The plucking was done only in the morning for two hours (5am to 7am) and a farm women on an average plucked 4kg of rose and 40 kg of marigold flowers in two hours. However, plucking of rose was done every day while marigold flowers were plucked after every three days.

Data pertaining to the constraints faced by the respondents involved in flower plucking activity as shown in Table 2 indicates that all of them had finger injuries while plucking rose caused by sharp thorns and because majority of the women worked on contract basis their prime interest was to pluck maximum flowers even at the cost of their health. There were also scratches on fingers, hands and lower arms as they move ahead and separate the flowers from the plant. The other body parts affected included neck, shoulder, back, legs and feet. Further, no appropriate tools/devices either

Table 1: Existing methods followed for flower plucking activity by the respondents

Existing methods	Number	Percentage
Use of finger tips directly	60	100
Use of polythene bags for collecting plucked flowers	53	82.5
Use of old polythene sacks around the waist for collecting plucked flowers	7	17.5

Table 2: Constraints faced by the respondents involved in flower plucking activity

Constraints	Mean scores	Percentage
Scratches and cuts on fingers	30	100
Body aches	30	100
Exertion due to seasonal workload	30	100
Lack of appropriate tools/devices	30	100
Decreased efficiency in performing household activities	30	100

Table 3: Ergonomic assessment of existing method of plucking flowers from the field

Parameters of ergonomic assessment	Existing method
Average working heart rate (Beats/min.)	95.29
Average peak heart rate (Beats/min.)	108.13
Average energy expenditure (Kj/min.)	6.43
Peak energy expenditure (Kj/min)	8.47
Average TCCW (Beats / min.)	432
Average PCW (Beats / min.)	7.2
Average work load	Light
Average peak work load	Moderately heavy

Table 4: Rating on drudgery experience of traditional cotton picking method followed by rural women

Drudgery experience	Existing method (Scores)
Rating on work demand (Score 1-5)	4
Rating on feeling of exhaustion (Score 1-5)	5
Rating on Posture assumed in work (Score 1-5)	4
Rating on manual loads operatives (Score 1-5)	3
Rating on difficulty perception (1-5)	4
Rating on work load perception (1-5)	3

for plucking or for collecting the plucked flowers were being used which led to decreased efficiency in performing the household activities as reported by all the respondents.

Ergonomic assessment of existing flower plucking practices:

The ergonomic assessment of existing method being used by farm women for collecting the plucked flowers was done by using the standard parameters. The in-depth analysis of work process was done and flower plucking activity was found as the drudgery prone activity. The results of above assessment has been discussed in the Table 3.

Ergonomic cost of flower plucking activity in terms of average and peak heart rate, were calculated for 30 farm women and results for the same have been enclosed in the Table 3. It was observed from the values of average working heart rate was found to be 95.29/bpm whereas as value of peak heart rate observed during activity was 108.13bpm. Average energy expenditure was found to be 6.43Kj/min where as its peak value was 8.47Kj/min. Total cardiac cost of work and physiological cost of work was found to be 432 beats/min and 7.2 beats/min, respectively. On the basis of the value of heart rate the average and peak work load was found to be within the permissible limits. Similar result was also obtained by Kaur (2002); Meyers and Chapman (2001) and Oberoi and Singh (2007).

Drudgery experience were calculated on the basis of scores gained on different parameters like feeling of exhaustion, posture assumed, perception on manual loads operative, difficulty faced and work load perception. The scores were given to 1-5 indicating very painful/ difficult/ demanding to no pain/ very easy/ very less demanding. It is clear that scores for the drudgery experiences related to all the parameters were found to 5,4 and 3 indicating that the activity was mostly considered as exhaustive, demanding, painful, difficult and heavy in terms of feeling of exhaustion, difficulty perception and manual workloads by all the women workers. This may be due to the reason that no improved technology and methods were followed by rural women while performing this activity either for plucking or for collecting the plucked flowers (Table 4).

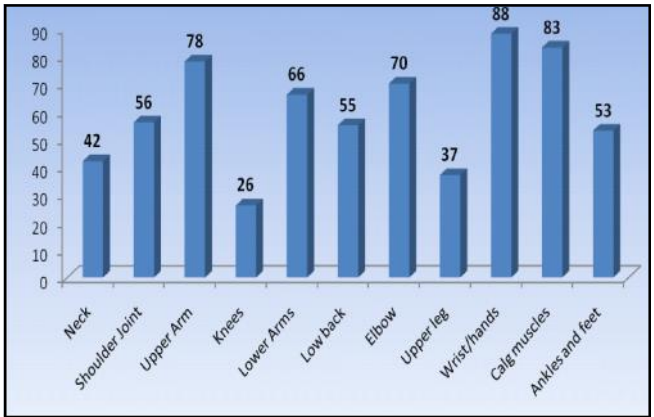

Fig. 1: Average incidence of musculo-skeletal pains during flower plucking with existing method

Intensity of musclo-skeletal problems:

Incidence of musculo- skeletal pains was also measured on five point scale ranging from very mild to very severe pain. It was found that respondents felt maximum pain in wrist/ hands (88%) muscles caused by dried brackets and thorns as plucking was done with finger tips causing injuries and pain in fingers, hands and lower arms followed by calf muscles (83%),upper arm (78%), shoulder and elbow (70%), lower arms (66%), low back (55%), ankles/ feet (53%), neck (42%), upper leg (37%) and knees (26%). This could be due to the reason that plucking of flowers was done in completely wet fields and it was difficult to move from one plant to another while plucking as their feet got pressed down in the wet muddy fields. Results of Vergeese *et al*. (1994) correborate with the present results.

Conclusion:

To summarize it may be concluded that farm women were plucking the flowers (rose and marigold) with only one hand while other hand was used for holding the polythene bag used for collecting the plucked flowers. It was observed that more time was needed to pluck the flowers as plucking was done with only one hand. They found this way of plucking flowers very tedious which also reduces the output of work. Further, no appropriate tools/devices either for plucking or for collecting the plucked flowers was being used which led to decreased efficiency in performing the household activities as reported by all the

respondents. Keeping in view, there is a great need to design women friendly tools keeping in view the ergonomic parameters of women involved in flower plucking activity. One such technology (harvest bag for collection of Plucked flowers) was developed for the women to reduce their drudgery in this activity. This bag has adjustable straps uniformly and evenly distributed over shoulders and waist. It has shaped pocket in the front which makes the bag friendlier and reduces drudgery while putting plucked flowers in the bag and also saves time as both hands are free to pluck the flowers which also increases the output.

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