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Rashmi Shukla
Scientist, Krishi Vigyan Kendra, Jabalpur, Madhya Pradesh, India

Siddharth Nayak
Scientist, Krishi Vigyan Kendra, Jabalpur, Madhya Pradesh, India

Correspondence
Rashmi Shukla
Scientist, Krishi Vigyan Kendra, Jabalpur, Madhya Pradesh, India

Ergonomic evaluation of improved technique comparative study of traditional and improved sugarcane stripper

Rashmi Shukla and Siddharth Nayak

Abstract
India is largest country and the second largest producer of sugarcane in the world. Sugarcane based traditional Indian sweetener is jaggery. In India 25-30 % sugarcane produced. This produce utilize for jaggery. Jaggery is easily available in rural area it is nutritious and medicinal use for human being. In this study sugarcane stripper is used for cutting of sugarcane strips. It helps to reduce the drudgery involved and chances of injury to workers in sugarcane striping operation.

Keywords: sugarcane stripper, drudgery reduction, farm women

Introduction
Sugarcane is a native crop of India. Sugarcane is planted in furrows or on ridges or in flat fields. Varying cultivation practices introduce a number of design constraints on sugarcane harvesting machines. Most of the sugarcane harvesting in India and other developing countries is manual. Harvesting sugarcane is a very painstaking, time-consuming and high strength job. Sugarcane stripper does the job of detopping and dressing of the cane. Our study put emphasis on the objectives of sugarcane leaf stripping as follows;

- To measure the average heart rate during work and during rest of women performing the selected activity with traditional method and with the use of improved tools.
- To measure the change in work output with the use of traditional and improved methods related to selected activity.
- To compare the cardiac cost of work, time required for cleaning, number of strokes/batch for sieving saving with traditional and improved method.
- To make the necessary recommendations to women to reduce their health hazards an drudgery while performing the leaf stripping activity.

Methodology
Present study was conducted with 25 number of farm women in Surajgawan village of Narsinghpur District of Narsinghpur. Selected twenty five farm women were in the age group of 25-40 years with normal health without any major illness. The suitability of the women for the study was ascertained by measuring the body temperature, heart rate, blood pressure etc.
De topping and stripping by sickle by traditional method and manual operated sugarcane stripper developed by IISR Lucknow. During the experiment various parameters viz time profile output, heart rate, work pulse, cardiac cost, saving in cardiac cost. Stop watch was used to record the time.

Working Principle
It is a hand tool for stripping of leaves and detopping of cane after harvest. The stripper works by separating and pushing the leaf sheaths away from stalk. A knife is welded on the stem of the stripper for detopping of canes and for cleaning roots etc.

Table 1: Characteristics of the farm women

S.No.	Characteristics	Range	Mean
1	Age years	25 - 40	32.5
2	Weight / kg.	40 - 58	49
3	Height / cm	140 - 156	148
4	HR test, beats/min	111 - 124	117.5
5	Blood pressure/mm.Hg.	110/80-130/90	120/85

Details of farm women

Age years	Education Status	Health (Blood pressure/mm. Hg)	Working/Non-working	Body weight/kg	Caste/Religion	Offspring (Children) Male	Female	Any other major illness	Marital status
26	5	*85-110*	working	42	OBC	-		x	Unmarried
28	x	*80-120*	working	44	SC	1	-	x	Married
28	8	*80-125*	working	46	SC	1	-	x	Married
23	x	*85-120*	working	42	SC	1	-	x	Unmarred
35	8	*80-125*	working	53	SC	2	-	x	Married
37	5	*90-130*	working	54	ST	1	1	x	Married
37	x	*95-110*	working	52	OBC	1	2	x	Married
37	x	*80-130*	working	53	OBC	1	1	x	Married
40	x	*90-140*	working	54	ST	2	-	x	Married
39	x	*95-125*	working	57	SC	2	1	x	Married
40	x	*80-130*	working	46	SC	2	2	x	Married
40	x	*85-125*	working	45	OBC	1	1	x	Married
25	5	*80-130*	working	40	ST	-	-	x	unmarried
32	x	*85-120*	working	46	OBC	1	1	x	Married
38	x	*90-135*	working	45	ST	1	1	X	Married
27	x	*80-120*	working	42	SC	1	2	X	Married
24	x	*80-125*	working	40	OBC	-	-	x	Married
30	x	*80-120*	working	40	OBC	2	-	X	Married
40	x	*85-120*	working	46	OBC	1	1	X	Married
29	4	*85-110*	working	45	SC	1	-	X	Married
28	x	*85-110*	working	47	ST	1	-	X	Married
36	x	*90-120*	working	56	OBC	1	1	X	Married
37	x	*90-135*	working	52	SC	2	-	X	Married
37	8	*80-130*	working	50	SC	1	2	X	Married
40	8	*85-120*	working	42	ST	2	-	X	Married

Table 2: Specification of Sugarcane stripper

S. No	Particulars	Sugarcane Stripper
1	Overall dimensions (1x20? mm	350 x 70
2	Weight (kg.)	0.37
3	Cost Rs.	100

Source: (S.P. Singh, L.P. Gite, Nidhi Asiwal, J. Majumder (2007) women friendly improved farm tools and equipments).

The heart rate was recorded by using the digital heart rate monitor. Based on the heart rate records the following parameters were calculated.

- Average heart rate during rest and work.
- Estimated Energy Expenditure
  Rate kj/min = VO_2 (1 t/min) x 20.93 Kj/1t.
  VO_2 Value of Oxygen = (0.0114 x WHR-0.68) x 20.93
  = (0.0114 x 102 = 0.68) x 20.93
  = 0.4828 x 20:91 = 10 kj/min.
- DHR (beats/min) = Average working Heart Rate (WH/R)
- Average heart rate during rest.
- Output (m^2/hr)
- Cardiac cost of worker per unit of output (beats/sqm) = DHR x duration /output.

Classification of Agricultural work

Variable	Light	Moderate	Heavy	V. Heavy	Extremely Heavy
Energy Expenditure (kj/min)	5.1 - 7.5	7.6 - 10.00	10.1-12.5	12.6 - 15	< 15

Comparative parameters between traditional sickle and sugarcane stripper

S. No	Parameters	Traditional Sickle	Sugarcane Stripper
1	HR during work beats/min	120	114
2	WHR average	108	120
3	WHR Maxima	130	118
4	Output, kg/h	36	45
5	EER Avg. (kj/min)	10.36	9.40
6	Saving in CCW	-	40%

Analysis

Sugarcane stripper saves almost half the time and increase working and reduce 40% drudgery of farm women over traditional practice. The mean heart rate of the subject was found to be 120 beats/min. in traditional practice (sugarcane stripper) during work. The average working heart rate (HR work) of the subjects when they work in traditional practice ranged between 118 to 122 beats/min with a mean HR value of 120 beats/min. The corresponding HR values with the use of sugarcane stripper ranged between 105-112 beats/min with a mean value of 108.5 beats/min. The maxima heart rate value found to be 130 beats/min with traditional practice whereas by using sugarcane stripper maximum HR value was found 118 beats/min.

The energy expenditure rate (EER) with use of traditional method was observed to be 10.36 kj/min whereas with the use of sugarcane stripper observed to be 9.40 kj/min.

The work efficiency is measured ins terms of output was 36 kg/h with traditional practice and with the use of sugarcane observed to be 45 kg/h. About 40% saving in cardiac cost of workers per unit of output with the sugarcane stripper as compared to traditional practice. Using the sugarcane stripper the hand injury has been reduced.

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