

Characterization of Drudgery in Sugarcane Production System

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Abstract: A study was carried out in Uttar Pradesh at Bareilly district, in four villages namely Anandpur, Mandwa Bansipur, Basai and Ganeshpur to characterize drudgery of farm workers in sugarcane production system. 160 farm workers were selected for data collection by recall method on six factors viz; physical load, posture load, repetitive strain load, physiological load, time load and musculoskeletal disorder load. Results confirmed that factors contributed to the variance in drudgery load of activities.

Keywords: Drudgery, Farm Workers, Sugarcane Production, Characterization

1. Introduction

Sugarcane occupies a very important place in rural economy of India. About 6 million farmers and a large number of agricultural labourers are occupied in sugarcane cultivation. The sugarcane work is regarded as a heavy work that by definition is an activity that requires great physical exertion and is characterized by high power consumption and high demands of the heart and lungs. Such activity is also characterized by repetitive movements of the arms, legs and trunk, load of cane bundles or weight. Rocha (2007) identified risks of musculoskeletal problems in 17.9% of the workers. To relieve the drudgery of farm workers in production system activities, it is needed that the activities are characterized by associated factors contributing to drudgery so that suitable interventions could well be designed. Therefore, the study was planned with an objective to characterize drudgery by the factors most associated with it.

2. Review of Literature

Sunita et al. (2012) conducted a study on drudgery reduction of farm women with cotton picking bags. Picking efficiency, energy expenditure, carrying capacity, ease, comfort, safety, loading and unloading etc. were evaluated between Hisar and Parbhani designed cotton bags. Results revealed that cotton bags designed by Hisar was having 50% higher carrying capacity, ease in tying, 37% less load on heart beats, 18% lower energy (kJ) expenditure and proved significantly superior over Parbhani designed picking bags. Hisar bag required 25% and 15% extra cloth and costs respectively over Parbhani bag. No significant difference was reported due to age and type of bag.

Agricultural jobs requires a considerable amount of physical labour, ergonomic hazards and associated musculoskeletal disorders have become an increasingly recognized occupational challenge in farmers (Kirkhorn, S. R., Earle-Richardson, G. and Banks, R. J. 2010). MSDs are often the most commonly reported non-fatal injury in farmers, and the associated burden and costs are substantial (Fathallah F. A 2010).

Bauyon, Liza Rosanes et al (2010). The study was done on farmers working in sugarcane plantation in the province of Batangas, Philippines. The individual attributes work characteristics and frequency and severity of stress symptoms were obtained from the constructed Checklist for Identifying Ergonomic Risk Factors in Sugarcane Production. REBA and RULA analysis indicated that sugarcane farm workers especially in harvesting process are exposed to a likely high risk of musculoskeletal disorder pertaining to posture, load, movement activity, and movement distance. Recommendations in order to minimize farm workers' exposure on postulated risk factors of work-related musculoskeletal disorder and other related illness include the development of an easily applicable in field and suitable guideline for the proper execution of manual works on farming specifically on sugarcane harvesting process was suggested.

A study by AICRPH (2004) and DDK (2007) observed that cotton picking manually involved a lot of drudgery due to posture and abrasion of fingers due to sharp points of dried bracts. Through the efforts of testing and popularizing cotton harvest bags, they opined that picking efficiency was increased and labour costs, trash contents were decreased.

3. Methodology

Characterization in the context is the concept of portraying the qualities of an activity in the sugarcane production system that is either constraining the effective work performance of a worker or causing risk to health and safety of worker. survey method was followed based on criteria of accessibility, willing cooperation of respondents, four villages were selected the present study was carried out in Uttar Pradesh at Bareilly district, in four villages namely Anandpur, Mandwa Bansipur, Basai and Ganeshpur. Purposive and Random sampling technique was used to select the study area and samples.

Interview schedule was developed and standardized to collect the data from farm workers by recall method. The interview schedule contained general information, where

in details on subject’s age, years of farming, family size and income, land holding status, gender participation and technology used were elicited apart from six variables viz; physical load, posture load, repetitive strain load,

physiological load, time load and musculoskeletal disorder load. Each factor was measured using quantitative and qualitative methods as furnished in Table 1.

Table 1: Parameters of characterizing drudgery

S. No.	Drudgery parameters	Variable	Qualitative perception rating 5 points
1.	Physical load	Weight of the load (kg) Distance of the load displacement (km) Height lifted	Physical load very heavy – very light (5-point scale)
2.	Posture	Nature of the posture Body part involved	Postural discomfort rating (5-point scale)
3.	Repetitive strain	Frequency of repetitions	Repetitive strain rating score (5-point scale)
4.	Time	Hours/day No. of days	Time load rating, very high duration to very less duration (5-point scale)
5.	MSDs	Body part involved Body disorder symptoms, frequency	Pain rating
6.	Physiological load	Heart rate	Physiological load rating, very heavy – very light (5-point scale)

Activities were considered as independent and the six variables as dependent variable for the purpose of understanding the source of variation among activities and factors for the purpose of the study. Total drudgery was calculated using linear combination method as per the formula given below:

$$\text{Total Drudgery} = \text{dr (PL)} + \text{dr (P)} + \text{dr (RS)} + \text{dr (T)} + \text{dr (MSDs)} + \text{dr (PysL)}$$

Where, dr (total) = total drudgery:

- PL – Physical load (25 Points)
- P – Posture load (25 Points)
- RS – Repetitive Strain load (25 Points)
- T – Time load (25 Points)
- MSDs – Musculoskeletal Disorders (25 Points)
- PysL – Physiological load (25 Points)

$$\text{Drudgery index \% (DI)} = (100 * \text{dr (total)} / 150)$$

Table 2: Drudgery level categorization

Drudgery index	Expected Equivalent Heart Rate
< 10% = Very Low	
10-20% = Low	Up to 90 b. min ⁻¹
20-30% = Moderate	91-105 b. min ⁻¹
30-40% = High	106-120 b. min ⁻¹
40-50% = Very High	121-135 b. min ⁻¹
> 50% = Extremely High	136-150 b. min ⁻¹

4.Results and Discussions

Gender participation

All the activities of sugarcane production were exclusively done by male farm workers. These activities were land preparation (removal of stalk & stubble, tractor ploughing, leveling) planting, weeding, fertilizer application, harvesting and load transport.

Technology use

Maximum number of activities of sugarcane production was being done manually viz. Placing sets in row, weeding, fertilizer application, and bundling of sugarcane. Ploughing was done by the tractor. Rest of the activities was done using different tools. Traditional “kassi” was the common tool used for hand weeding. Forming ridges and furrows were done with the local tool called *favda*.

Cutting and cleaning of sugarcane was done with the help of sickle. Therefore, farm workers were not satisfied with all these hand tools and local tools. Forming ridges and furrows and hand weeding activities were physically exhaustive and physically demanding so the farm workers were not satisfied whereas cutting of sugarcane and cleaning of sugarcane activities are physically demanding, repetitive and monotonous.

Drudgery load as per activity

As per drudgery index Viz. tractor ploughing and leveling (49%), Planting by Traditional Method (60%) and fertilizer application (52%) were categorized as having high level of drudgery. Weeding (74%) and load transport (75%) were categorized as having very high level of drudgery. Whereas Planting by Traditional Method (88%) and harvesting (83%) activities were having unacceptable limit of drudgery among the farm workers.

Table 3: Characterization of drudgery in sugarcane production system

Load catg.	Heavy	Unacceptable	Heavy	V. Heavy	Heavy	Unacceptable	V. Heavy
Drudgery index (%)	49	88	60	74	52	83	75
Drudgery load	73	133	90	111	78	125	112
MSD load	14	21	16	17	12	20	22
Time load	10	22	15	18	12	22	14
physiological load	16	23	18	20	11	21	21
Repetitive strain load	13	22	19	21	19	22	16
Posture load	11	22	12	16	9	19	15
Farm activity	Tractor ploughing and leveling	Planting by Traditional Method	Planting by Planter Method	Weeding	Fertilizer application	Harvesting	Load transport

Table 4: Ranking of drudgery experience parameters with respect to different activities

Farm Activity	Work demand	Feeling of exhaustion	Posture load	Perception on Manual loads	difficulty perception	work load perception
Land preparation	IV	IV	III	I	III	II
Planting by traditional Method	III	I	II	V	III	IV
Planting by planter Method	II	IV	III	V	II	I
weeding	V	IV	II	III	III	I
Fertilizer application	V	VI	III	II	IV	I
Harvesting	II	III	I	VI	V	IV
Load transport	II	III	VI	V	IV	I

Ranking of the drudgery experience parameters with respect to different activities of sugarcane production system concluded that maximum manual load was ranked in land preparation followed by work load, difficulty, posture load, feeling of exhaustion and work demand. In planting by traditional method feeling of exhaustion was ranked first followed by posture load, work demand, difficulty perception, work load, and manual load Whereas in planting with planter method work load was ranked first followed by work demand, difficulty, posture load, exhaustion and manual load. In weeding activity

work load was ranked first followed by posture load, manual load, difficulty, exhaustion and work demand. Maximum work load was ranked in fertilizer application activity followed by manual load, posture load, exhaustion, work demand and difficulty. In harvesting activity posture load was ranked first followed by work demand, exhaustion, work load, difficulty and manual load. In load transport activity work load was ranked first followed by work demand, exhaustion, difficulty, manual load and posture load.

Table 5: ANOVA for drudgery load on sugarcane production activities and load factors

Factor 1	Activities	Mean for loads
	Tractor Ploughing	16.50
	planting traditional	15.86
	planting planter method	17.92
	Weeding	19.08
	Fertilizer Application	17.55
	Harvesting	15.82
	Load Transport	18.03
	Sem ± 0.124 CD 5%.345 F1-97.21**	
Factor 2	Drudgery loads	Mean for activities
	Physical load	18.22
	Posture load	16.86
	Repetitive strain Load	15.82
	Physiological load	17.80
	Time Load	16.65
	MSD Load	18.17
	Sem ± 0.1151 CD 5%.319 F2-69.98**	

* **Significant at 1% level of significance

5. Conclusions

From the above study, it was concluded that the drudgery load was varied based on activities and factors from low to very high level As per calculated value of ANOVA, there was found significant variation between activities and drudgery loads. This infers that all the activities were not at the similar order of drudgery load. if we compare mean values of each activity we can find from the table that no significant difference was found between traditional planting and harvesting activity. Posture load and time load were having non significant relation and physical load and MSD loads were also having non significant relation. From the calculated value of ANOVA significant variation was found among drudgery loads and activities.

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