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ERGONOMIC EVALUATION OF SEED PLACEMENT TUBE FOR COTTON DIBBLING OVER CONVENTIONAL METHOD



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Short Profile

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ABSTRACT:

A field experimental study was conducted to evaluate the performance of seed placement tube for cotton dibbling over conventional method with six women subjects as users of technology. Variables observed were physical characteristics, time for area covered while dibbling, postural analysis as per OWAS, RULA, postural shifts, its duration and repetitive strain index. Results revealed that the use of seed placement tube could save about 24 minutes and one could cover an additional area of 176sq.m over manual hand dibbling method. OWAS score and the trunk flexion in conventional dibbling indicated the immediate need for postural correction which is extreme range of

motion with high frequency. Seed placement tube reduced the repetitive strain and postural deviations over conventional method of dibbling and thus reduced drudgery of women.

KEYWORDS

Ergonomic evaluation, Dibbling, Seed placement tube, Drudgery.

INTRODUCTION

In India, rural women play a significant role in agriculture and other agro based activities. The daily work schedule of rural women is very demanding and arduous. It was estimated that during peak period, women work every day for about 8-9 hours in agriculture and 4 hours in household activities. There are certain agricultural operations in which female agricultural workers are considered better than male workers.

Women carryout many jobs as weeding, transplanting, harvesting, threshing and storing grains, tending animals and providing fuel and water. These tasks often have serious consequences for women due to the uncomfortable postures and low or no technologies. The performance of agricultural sector where women often are crucial manual power resource would grow better when the constraints effecting women's productivity are reduced.

The conventional practice was to dibble cotton seeds in a row, manually by bending and while the distance between seed placement was marked. The method, besides being wasteful in human energy utilization, is not precise and lead to low productivity. Women were experiencing physical strain during the sowing season. A seed placement tube is a sowing device that leads seeds into the soil, which is immediately covered. The performance of seed placement tube for cotton dibbling was tested on ergonomic variables and compared to conventional method as an immediate cost effective measure of technology intervention.

REVIEW OF LITERATURE:

A study was conducted on seed treatment drum by Singh et al. (2007). No saving was observed in cardiac cost of worker with the equipment in comparison to the traditional practice and in relation to practices compared. But the equipment provided safety to the worker as direct contact with chemicals was avoided. The ergonomically not worker friendly bending and squatting postures were avoided when the seed treatment drum was used.

The average physiological cost of work was observed to be lowe while using the chaff cutter, sickle, bhendi plucker, and seed treatment drum, weeder and groundnut stripper. Use of only three technologies viz shovels paddy thresher and wheelbarrow showed increased physiological cost of work compared to traditional method. The work out put increased with all the improved technologies except chaff cutter and seed treatment drum. Most of the technologies were liked and accepted by the women (Badiger et al 2004).

A study was conducted by Jatinder and Aruna (2012) on ergonomic interventions in weeding operation for drudgery reduction of hill farm women in India. Experimental data were conducted on representative sub sample of 60 hill farm women of both states to assess physiological workload and musculoskeletal problems both while working with traditional tools along with improved tools. Physical fitness level and physiological variables were selected for comparison. . The results showed that heart rate values were more than acceptable limits for task performed with the traditional tools as compared with improved tools. Significant reduction in the heart rate was observed while working with improved tools. Analysis of MSDs showed that the postural stress and severity of pain in various body parts was reduced by adopting new technology. Hence, the use of improved weeding tools was recommended over the existing ones for drudgery reduction.

METHODOLOGY

Field experimental design was selected with six subjects as users of technology for the study. Conventional dibbling against the use of seed placement tube were the treatments compared. Subjects were screened on with no previous medical ailments. Their physical characteristics were observed as per age, stature. Work rate (sq.m/ hour); total labour hours spent (min) in sowing activity were selected as work output variables. Postural analysis was done using OWAS work sheet ((Karhu et al. (1977) and RULA score sheet ((Atamney and Corlett, 1993). Trunk flexion was recorded using goniometer. Video recording was done in order to measure the number of postural bends per unit area measured and postural holding time. Repetitive Strain Index (Moore and Garg (1995) was also studied in terms of efforts/ min; Hand/Wrist posture, Speed of work and Duration of task per day as variable components on which qualitative ratings were used. Each experiment was conducted for a period of 30 minutes and treatments were compared on Random block design.

RESULTS AND DISCUSSION

Physical characteristics: The mean age was reported as 34 years and stature 153 cm. All the subjects were categorized as having mesomorph body type and with no previous medical ailments.

Performance on ergonomic variables

Table 1, Display the ergonomic variables on which the performance of two treatments was compared. It can be observed from the data, that the use of seed placement tube could save about 24 minutes over hand dibbling method and one could cover an additional area of 176sq.m. The Ovako working Posture Assessment System (OWAS) score was 3 on 12 indicating that there was immediate need for postural correction.

Table 1. Ergonomic variables compared between conventional dibbling and seed placement tube			
Variable	Conventional dibbling	Seed placement tube	Change
Mean Time taken per acre (min)	2.45	2.05	24 min
Mean Area covered (sq.m) / hour	1798	1974	176 sq.m
Postural analysis			
OWAS score	3	1	Significant
RULA score	6	2	Significant
Degree of trunk flexion	>60 ⁰	20 ⁰	40 ⁰
Frequency (no. of postural bends per acre)	177	No bends	
Postural holding time (min)	2.41	3.6	
Postural shift time (min)	2.1	-	

The trunk flexion also indicated that the range of motion was 600 forward in conventional seed dibbling which could be considered as extreme. The inter-vertebral extension at cervical thoracic and lumbar regions due to forward flexion, lead to the risks and disorders such as spondylitis and spinal disc herniation. The possibility of risk was found to be further more intensive when the frequency of postural shifts was observed. As per the video recorded observation, women were required to bend about 177 times to complete an acre of sowing. That means for every 2 min. the worker needs to bend forward while sowing. Moreover, each bending was to be held in stability nearly for 2.4 min. All the above directs to infer the possibility of occupational musculoskeletal disorders effecting lumbar and cervical vertebrae where as the use of seed placement tube had reduced such constrained postural efforts hindering workers' health and productivity. The information furnished in Table 1 support the above discussion.

Repetitive strain index

As the sowing task is a repetitive activity, the upper limbs were analyzed with the Moore and Garg strain index for its intensity and duration of exertion efforts per minute, and/ wrist posture, speed of work and for the duration of task per day.

S.No.	Strain Index Parameters	Conventional dibbling		Sowing using seed placement tube	
		Right	Left	Right	Left
1.	Intensity of exertion	3	1	1	1
2.	Duration of exertion	1.0	0.5	0.5	0.5
3.	Efforts per minute	3.0	0.5	3.0	3.0
4.	Hand/Wrist posture	1.5	1.0	1.0	1.0
5.	Speed of work	1.0	1.0	1.0	1.0
6.	Duration of task per day	0.50	0.50	0.75	0.75
	Final Score	6.75	0.12	1.1	1.1
		Some risk (right hand)		safe	

The analysis revealed that the dibbling method of sowing was more exertive as they need to make a hole and push the seed into the soil using index finger. This activity was repetitive. The seed placement tube helped the same process with less effort. The repetitive strain index for the right hand in the conventional method was 6.75 which indicated that the dibbling method induced risk to right hand. Sowing with seed placement tube though involved both the hands, reduced exertion score to 1.1, as the seed dropping was done in upright position with arms in normal range of motion.

CONCLUSION

It can be concluded that the use of seed placement tube could save about 24 minutes over hand dibbling method and one could cover an additional area of 176sq.m. Overall, the seed placement tube could reduce OWAS score to (1) indicating that postural correction could take place and further relieved the forward trunk flexion with high frequency. The repetitive strain index score also confirmed the reduction in exertion of upper limbs in cotton sowing. Therefore the seed placement tube was found to be an indigenous and immediate alternative to relieve drudgery compared to sowing cotton by conventional dibbling method. The trunk flexion (600) also indicated that the extreme range of motion for about 177 times to complete an acre of sowing in conventional seed dibbling. The seed placement tube helped the same process with less effort. The ergonomic variables viz; RSI, OWAS and work output thus indicated the advantage of seed placement tube over conventional dibbling method.

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