

Suitability assessment of protective clothing for ginning process workers

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■ **ABSTRACT** : The present paper is outcome of the research work under taken in All India Co-ordinated Research Project -Clothing and Textile (AICRP-CT) on mitigating occupational hazards. Here protective clothing and accessories were developed and field tested to assess the suitability among ginning mill workers. Two aprons, five masks, two types of hand gloves and ear muff for male workers were designed, developed and field tested during threshing to find out the suitability. The results of study revealed that developed functional clothing and accessories were found highly suitable by the cotton ginning workers.

■ **KEY WORDS**: Functional clothing, Ginning, Face mask, Occupational hazards

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India has a long and rich tradition of producing variety textile. The textile industry is the second largest industry after agriculture in terms of number of person employed multi-directional contribution to the domestic economy. There are numerous health and safety issues associated with textile industry, National Institute of occupational safety and health (NIOS -1999) reported a priority list of ten leading work- relation illnesses and injuries. Three criteria were used to develop the list *i.e.* the frequency of occurrence of the illness or injury, its severity in individual cases and its potential for prevention.

Ginning is the process of separating the cotton fibre adhering to the seed for the conversion of the cotton into a continuous thread. In short, the purpose of ginning is to separate cotton fibres from the seed. Ginning industries are mostly small units and located in semi-rural and small towns of the district. During the ginning

process, dust fibres and lint are generated which causes air pollution. The ginning process is the most important mechanical treatment that cotton undergoes before it is converted into yarns and fabrics. There are over 3,500 factories in India dispersed in nine major cotton-growing states. Maharashtra and Gujarat states are having largest ginning and pressing units out of top 10 cotton growing states *viz.*, Panjab, Haryana, Rajasthan, Gujarat, Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh, Orissa and Tamil Nadu. The cotton ginning industry, like other processing industries, has many hazards. Information from workers' compensation claims indicates that the number of injuries is highest for the hand/fingers, followed by back/spine, eye, foot/toes, and arm/shoulder, leg, trunk and head injuries (Ahsann *et al.*, 2000 and Anjum *et al.*, 2009). Total economic costs for gin injuries and health disorders include direct costs

(medical and other compensation) and indirect costs (time lost from work, downtime, loss in earning power, higher insurance costs for workers' compensation, loss of productivity and many other loss factors). Direct costs are easier to determine and much less expensive than indirect costs.

Ginning process generates fibre dust which is inhaled by the workers and causes byssionosis disease and so many other respiratory diseases. Some physical hazards also occur *i.e.* hearing impairment and eye irritation. The noise is a cause, which created hazard in the work place. Noise exposure at work can cause critical hearing damage. It is one of the most occurring health problem which can be difficult to identify because the effects build up slowly with time. Similarly sometimes eye irritation also found in ginning process workers due to small fibre dust particles. Babel *et al.* (2013 and 2014) concluded that the problems encountered due to wool spinning were headache (95%), Fatigue (93.3%), Coughing and sneezing (48.82%) itching/irritation in eyes (43.3%), and skin allergies. Problem of hearing loss due to noise pollution was reported by 21.7% respondents. Majority of respondents were wearing dhoti kurta followed by pant shirt. None of respondents were using personnel protective devices to protect themselves. It is recommended that awareness should be generated among spinning mill workers about the use of personnel protective devices like face mask and ear muffs (Bala, 2006).

Literature revealed that ginning process workers were facing the problems related to coughing and sneezing, eye irritation, breathlessness due to presence of dust in the work environment. Workers were taking no precautionary measures to avoid the inhalation the fibre dust. This is the predisposing factor causing health problem. Hence the need arises for the use of appropriate protective clothing for preventive them to expose to fibre dust. For this purpose some personal protective clothing was prepared and field trials were carried out to assess the suitability of these protective clothing and accessories.

■ RESEARCH METHODS

In the present study the problems encountered by the textile workers during textile processing was studied and appropriate functional clothing were designed and developed in the research lab. of AICRP- CT MPUAT To test the appropriateness of the designed and developed clothing and accessories field testing was

carried out. The designed and developed clothing and accessories were given for wear trial for five days during ginning. For the purpose 15 ginning workers were selected purposively. To measure the response three point rating scale was developed weighted mean score (WMS) was calculated. On the basis of WMS Suitability level was decided as: Highly suitable: 2.34-3.00, Suitable: 1.67-2.33, somewhat suitable 1.00-1.66.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

General information of the respondents:

Majority (60%) of respondents were in the age group of 41-50 years, 40.00 per cent were between the age group of 31-40 years. Eighty per cent of the respondents belonged to nuclear family and rest were from joint family. Sixty per cent had medium family size while rest had small family size. It was good to note that none of the respondent was illiterate, equal percentage of respondents (20% in each category) were educated upto primary, middle and higher secondary The most significant and vital factor which has its bearing on the economic status of the family is its income. The standard of living of a family is based on the economic condition of that family. It is, therefore, imperative to have a glance at the economic returns of the household under the study. Table depicts that 60 per cent of the respondents were in the income range of Rs. 5000-10000 per month 23.33 per cent earned upto Rs. 10,000-20,000 per month. Remaining 6.67 per cent earned Rs. 5,000 month.

Assessment of aprons :

Table portrays that both the apron obtained 2.8 (highly suitable) in design assessment aspect, 2.6-2.7 was reported for comfort assessment, fabric secured 2.71, durability/ serviceability got 2.7-2.8 (highly suitable) and adoption feasibility was also 2.6 for apron without hood and with hood it was slightly more with the WMS of 3.0. So it was found that this apron was liked by the ginning process workers.

Assessments of face mask :

Hood mask:

Data presented in Table 1 shows that design

assessment of hood mask WMS was 2.6, comfort assessment for suitability was 2.5, fabric secured 2.56, durability/serviceability reported 2.6 and adoption feasibility also got 2.6 overall WMS. That means all the aspects came under category of highly suitable. Hood mask was made by hosiery fabric, this mask protected the wearer from inhalation of small cotton fibres and prevent from health hazards. They were ready to pay 45-50 Rs./- for the mask.

Pleated mask:

Data revealed that 2.6 overall WMS obtained for design assessment, 2.5 for comfort assessment, 2.5 secured in case of fabric, 2.6 WMS found for durability/serviceability. That means respondents said these all four aspects are highly suitable. Respondents were ready to pay 20 Rs./- for this mask.

Beak mask:

Data pertained from Table that beak mask design

Table 1 : General profile of the respondents			(n=15)	
Sr. No.	Aspects	Categories	No. of respondents	
			Frequency	Percentage
1.	Age (in years)	31-40	6	40.0
		41 -50	9	60.0
2.	Family type	Nuclear	12	80.0
		Joint	3	20.0
	Family size	Small (upto 4 members)	6	40.0
		Medium (5-8 members)	6	60.0
3.	Education	Upto primary	3	20.0
		Upto middle	3	20.0
		Upto metric	6	40.0
		Higher secondary	3	20.0
4.	Monthly income (Rs.)	Upto 5000	3	20.0
		5000-10000	9	60.0
		10000-20000	3	20.0

Table 2 : Suitability assessment of apron with hood by ginning process workers					
Sr. No.	Functional features of Apron	Apron with hood		Apron without hood	
		WMS	Overall WMS	WMS	Overall WMS
1.	Design assessment				
	Overall Appearance	2.8	2.8	2.8	
	Drapes well when used	3.0		2.6	2.8
	Covers entire upper body	2.7		2.7	
2.	Comfort assessment				
	Easy to wear	2.8		2.4	2.63
	Easy to remove	3.0	2.7	2.7	
	Breathable during working	2.7		2.8	
3.	Fabric				
	Texture	2.8		2.8	
	Thickness	3.0	2.71	3.0	
	Softness/Stiffness	2.7		2.7	2.71
	Breathable	2.7		2.7	
	Protects body from fibre dust	2.4		2.4	
	Absorbency of perspiration	2.7		2.6	
4.	Durability/ Serviceability	2.8	2.8	2.7	2.7
5.	Adoption feasibility	3.0	3.0	2.6	2.6
	Overall WMS		2.8		2.68



(2.1) and comfort assessment (2.56) durability/ serviceability all three got 2.46, overall WMS, fabric secured 2.56 (suitable) and adoption feasibility reported 2.47. Similar to pleated mask they agreed to adopt this mask. They were ready to pay 20 Rs./- for this mask.

Triangular mask:

It is evident from Table that this mask was found highly suitable (3) in three aspects (comfort assessment, durability/ serviceability, adoption feasibility) for ginning

process workers. Similar WMS was secured in design assessment and fabric (2.75). Respondents reported that it was easy to put on and easy to put out, easy to maintain and more comfortable. They were ready to pay 20 Rs./- for this mask similar to pleated and beak mask.

Knitted fabric mask :

It is clear from Table that design assessment got 2.56 overall WMS. Comfort assessment obtained 2.5, fabric assessment reported 2.56, durability/serviceability

Table 3 : Suitability assessment of different types of mask by ginning workers

Sr. No.	Functional features of masks	WMS of Different types of mask				
		Hood mask	Pleated mask	Beak mask	Triangular mask	Knitted mask
1.	Design assessment					
	Overall Appearance	2.6	2.6	2.0	2.75	2.6
	Drapes well when used	2.6	2.6	2.4	2.75	2.46
	Covers entire face	2.6	2.6	2.0	2.75	2.7
2.	Comfort assessment					
	Easy to wear	2.6	2.6	2.6	3.0	2.4
	Easy to remove	2.5	2.5	2.46	3.0	2.5
	Breathable during working	2.4	2.4	2.7	3.0	2.6
3.	Fabric					
	Texture	2.6	2.6	2.7	2.75	2.46
	Thickness	2.5	2.5	2.7	2.75	2.7
	Softness/Stiffness	2.5	2.5	2.46	2.75	2.46
	Breathable	2.46	2.46	2.6	2.75	2.6
	Protects face from fibre dust	2.46	2.46	2.46	2.75	2.46
	Absorbency of perspiration	2.46	2.46	2.7	2.75	2.7
4.	Durability/ Serviceability	2.6	2.6	2.46	3.0	2.46
5.	Adoption feasibility	2.6	2.6	2.0	3.0	2.6

got 2.46 and last adoption feasibility got 2.6. All four aspects except durability/ serviceability of knitted fabric mask were highly suitability category.

When different masks were compared with each other, through results in Table 4, it was found that firstly triangular mask had highly suitability then secondly hood mask had good suitability as compare to other 3 masks (Beak mask, Pleated mask and Knitted mask).

Assessments of hand gloves:

Two types of hand gloves knitted fabric and jeans fabric gloves were given to respondents for wear trial during ginning process and their responses were

recorded on three point rating scale.

Weighted mean scores results reveals that in terms of overall appearance both gloves scores are similar. Size assortment results reveal that fit or grip was found better of knitted gloves then jeans fabric gloves. Fitting at wrist and finger was also found better of knitted gloves. Comfort assessment data were nearly similar for both the type of gloves. Fabric feature texture and thickness were found highly suitable while softness of jeans fabric was in the category of suitable. Durability and serviceability of knitted fabric was found less and fall under the category of somewhat suitable. When enquired it was told by the respondents that knitted fabric gloves

Sr. No.	Functional feature of Masks	Overall WMS				
		Hood mask	Pleated mask	Beak mask	Triangular mask	Knitted mask
1.	Design assessment	2.5	2.6	2.1	2.75	2.56
2.	Comfort assessment	2.4	2.5	2.56	3	2.5
3.	Fabric	2.56	2.56	2.56	2.75	2.56
4.	Suitability or serviceability	2.6	2.6	2.7	3	2.7
5.	Adoption feasibility	2.6	2.6	2.46	3	2.46
	Overall WMS	2.53	2.57	2.47	2.9	2.56

Sr. No.	Functional feature of gloves	Knitted fabric		Jeans fabric	
		WMS	Overall WMS	WMS	Overall WMS
1.	Design assessment				
	Overall Look/ Appearance	2.8	2.8	2.8	2.8
	Size assortment				
	Length of gloves	2.8	2.85	2.8	2.53
	Width of gloves	3.0		3.0	
	Fit/grip	2.8		2.2	
	Fitting at wrist	2.8		2.4	
	Fitting at fingers	3.0		2.2	
	Covers entire palm	2.7		2.6	
2.	Comfort assessment				
	Easy to wear	2.8	2.83	2.8	2.73
	Easy to remove	3.0		2.8	
	Grip while working	2.7		2.6	
3.	Fabric				
	Texture	2.8	2.71	2.8	2.43
	Thickness	3.0		3.0	
	Softness/Stiffness	2.7		2.0	
	Breathable	2.7		2.2	
	Protects palm	2.4		2.4	
	Absorbency of perspiration	2.7		2.2	
4.	Durability or serviceability	1.6	1.6	2.4	2.4

Table 6 : Suitability assessment of ear muffs by ginning process workers		(n=15)
Sr. No.	Functional features of accessories	WMS
1.	Design assessment	
	Overall appearance	2.6
	Drapes well when used	2.7
2.	Covers entire ear	2.8
	Comfort assessment	
	Easy to wear	2.6
	Easy to remove	2.7
3.	Breathable during working	2.8
	Material quality	
	Texture	2.8
	Thickness	2.8
	Softness/Stiffness	2.6
	Comfortable	2.7
4.	Protects ear from noise	2.8
	Durability/ Serviceability	2.7
5.	Adoption feasibility	2.7

were toned with in fifteen days.

Assessment of ear muffs:

Ear muff were purchased from market and handed over to ginning process workers and opinion was recorded on three point rating scale.

The data revealed that the design assessment got 2.7, comfort assessment and durability/ serviceability obtained 2.7 (highly suitable), material got 2.7 (highly suitable) and last adoption feasibility gained 2.7 (highly suitable). That means readymade earmuffs had good results.

Conclusion:

It was concluded that knitted gloves were not useful for ginning process workers; apron with hood was more likely preferred by them as compared to without hood apron. In case of masks triangular mask highly accepted and respondents said ear muffs and goggles can be used when processing was done so that it provides hearing and vision protection. So it is essential that people should know (who are engaged in this type of work) that such type of personal protective clothing is very useful for them when they work in fibre dust environment.

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