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Protective Clothing for Ginning Mill Laborers

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ABSTRACT Cotton is one of the major cash crops grown in the country. Ginning sector acts as bridge between the farmers field and textile industry. Cotton industry workers are exposed to various hazards in the different departments of textile factories, especially in the ginning, spinning and weaving sections which play an important role in the high incidence of industrial health hazards. The health hazards among the laborers in these ginning factories have been overlooked. This may be attributed to ignorance and lack of awareness among the workers regarding safety measures and non usage of protective clothes at workplace. The attempt was made to design and develop user friendly styles for various ginning activities and to assess the suitability, comfortability, functionality and acceptability of the styles with respect to the performance or work efficiency. Wear trials of the above functional clothing revealed that the garments were very much suitable for ginning activities. The comfortability of all the garments over the existing clothing practices were found to be statistically significant. Further there is a need to create awareness among the workers for usage of functional clothing and emphasize on benefits of protective clothing.

INTRODUCTION

Cotton is one of the major cash crops grown in the country. In terms of global production, India is the third largest producer of cotton after China and the United States. When cotton is harvested it is transported to ginning mill for further process. Ginning sector acts as bridge between the farmers field and textile industry. Ginning is an important transfer point in the cotton value chain. After harvesting, it is transported to the ginning factories for initial processing (Baffes 2005). Ginning plays a significant role in determining the quality of raw material for textile industry.

The function of the gin is to separate lint from gin to create two marketable products, fiber and seed. The gin must also be equipped to remove foreign matter, control moisture and remove other contaminants that significantly reduce the value of the bale. Ginning factories are placed at pivotal position in the cotton value chain. They are the major clients of the cotton growers and provide raw material to the textile, clothing industry and the oil mills, so millions of people in India have their livelihood dependent upon performance of this sector.

The fact that exposure to organic dust including cotton dust has deleterious effect on human being is recognized since the start of farming. Cotton industry workers are exposed to various hazards in the different departments of textile factories, especially in the ginning, spinning and weaving sections which play an important role in the high incidence of industrial health hazards (Talikoti et al. 2012). Ginning factories discharge large amounts of cotton dust, which leads to decreased pulmonary function in the exposed subjects. Byssinosis and other related respiratory abnormalities are well-known occupational respiratory diseases in textile mill workers caused by cotton dust pollution (Jannet and Jeyanthi 2006).

Cotton ginning and pressing have been identified as traditional industries under the unorganized sector which functions on a seasonal basis. The textile industry in India provides employment to large population, but the health hazards among the laborers in these ginning factories have been overlooked. Workers of spinning mill also face related health hazards such as allergic bronchitis, byssinosis and hearing loss/hearing difficulty, reported by Kale et al. (2016).

This may be attributed to ignorance and lack of awareness among the workers regarding safety measures and non usage of protective clothes at workplace. Most of female labourers wear old

shirt as upper garment, *saree pallu* for head during ginning activities. These clothing do not cover the body and protect against dust or dirt (Vastrad et al. 2013). Textile industry workers are more prone to develop different health related ailments due to their occupational environments. Conclusively, textile industry workers must change their work style and should use proper protection equipments to reduce the health hazards (Singh 2015).

All clothing is known to perform multiple functions from aesthetic to basic protection from the foreign elements. 'Functional clothing' can be defined as a generic term that includes all such types of clothing or assemblies that are specifically engineered to deliver a pre-defined performance or functionally to the user, over and above its normal functions. Such clothing would normally be made from a mixture of innovative materials and functionality in this case would imply the added value or function that a garment is expected to perform. It can be clothing that protects individuals who are exposed during work or that can facilitate body movements. Functional clothing assemblies are ergonomically designed so as to have a minimum inhibitory effect on movement and provide maximum comfort and performance to the user (Gupta 2011). Hence an attempt was made to design and develop user friendly styles for various ginning activities and to assess the suitability, comfortability, functionality and acceptability of the styles with respect to the performance/work efficiency.

METHODOLOGY

Designing Functional Clothing

With respect to performance of activities, different styles of protective clothing were designed such as apron and headgear cum mask. The functional features (Fig.1) of each designed garment are as mentioned in Table 1.

Table 1: Designing features of protective clothing

S. No.	*Type of garment*	*Type of fabric used*	*Features*
1	Apron	Unbleached	• Front opening • Full sleeves with elastic at cuff • Two pockets
2	Headgear cum mask -I	Unbleached	• Built in mask using muslin cloth
3	Headgear cum mask -II	Blended	• Double layered head cover • Elastic at forehead

Wear Trials

Designed protective clothes were given for wear trials to thirty respondents of ginning mill labourers.

Assessment of Suitability, Comfortability, Functionality and Acceptability of Functional Clothing

Sample Selection

Totally 30 respondents were interviewed to elicit the information on designed functional clothing.

Tools Used

Self-structured questionnaire with five rating scale was used to elicit information on suitability, comfortability, functionality and acceptability of designed functional clothing among the ginning mill labourers.

Statistical Analysis

The details of the scores given to the suitability/comfortability/functionality/acceptability parameters indicated in the Table 2.

Table 2: Scores given

Highly suitable/comfortable/functional/acceptable	5
Fairly suitable/comfortable/functional/acceptable	4
Moderately suitable/comfortable/functional/ acceptable	3
Less suitable/comfortable/functional/acceptable	2
Not suitable/comfortable/functional/acceptable	1

RESULTS

Apron

Suitability

Table 3 depicts the suitability, comfortability, functionality and acceptability of the de-

Table 3: Suitability, comfortability, functionality and acceptability of apron in ginning activity (N=30)

S. No.	Clothing parameter	Old shirt		Apron	
		Mean	SD	Mean	SD
I	*Suitability*				
1	Appearance /style of the garment	3.6	0.67	4.6	0.49
2	Colour of the garment	3.4	0.49	3.4	0.50
3	Size assortment	2.8	0.99	3.7	0.65
4	Fit	2.7	0.79	3.8	0.99
5	Fabric quality	1.9	0.84	3.7	0.65
6	Construction quality	3.3	0.46	4.7	0.65
7	Cost effectiveness	3.4	0.49	3.9	0.54
	t-value	-	4.328**		
II	*Comfortability*				
1	Easy donning	4.1	0.57	4.7	0.48
2	Easy doffing	4.2	0.63	4.6	0.52
3	Comfortable for				
A	0-1hrs of activity	3.8	0.63	4.8	0.42
B	1-2 hrs of activity	2.9	0.57	4.1	0.74
C	2-3 hrs of activity	2.3	0.67	3.4	0.52
D	More than 3 hrs of activity	1.7	0.67	2.9	0.74
4	Proper fit/drapeability	2.7	0.67	3.8	0.63
5	Comfort in performing specific activity	2.6	0.52	4.3	0.67
6	Absorbency	2.4	0.52	3.7	0.48
7	Comfortable due to fabric used	3.6	0.52	4.7	0.48
8	Covers the body thus making wearer comfortable	3.8	0.63	4.9	0.32
9	Aeration	2.4	0.52	3.5	0.35
	t-value	-	11.451**		
III	*Functionality*				
1	Protection from external material/ dust/ dirt/ thorny substances, etc others	3.8	0.63	4.5	0.53
2	Protection from sun	3.9	0.70	4.6	0.70
3	Protection from pesticides	-	-	-	-
4	Suitability in activities	2.8	0.88	4.4	0.70
5	Hastens the process	2.6	0.63	3.2	0.92
	t-value	-	3.595*		
IV	*Acceptability*				
1	Durability (no. of trails)				
A	0-5 trails	3.6	0.52	4.9	0.32
B	5-10 trails	2.8	0.42	4.8	0.42
C	10-20 trails	2.3	0.67	3.8	0.42
D	Entire crop period	1.5	0.53	2.9	0.32
2	Wash ability				
A	o wash	3.7	0.48	4.8	0.42
B	1-2 wash	3.1	0.32	4.3	0.48
C	2-3 wash	2.4	0.52	3.8	0.42
D	More than 3 washes	1.6	0.52	2.9	0.57
3	Resistance to dust/soil	2.3	0.48	3.8	0.42
	t-value	-	16.463**		

*Significant at 5% level ** Significant at 1% level

signed apron for ginning activities. Data revealed that designed apron was more suitable than old shirt in ginning activities due to its construction quality (4.7), followed by its appearance/style (4.6) and fit and cost effectiveness (3.9).

It is observed from t - values that suitability of designed apron used by women labourers engaged in ginning activities was (4.328) found to be highly significant than the old shirt.

Comfortability

Further Table 3 explains the comfortability of the designed apron over the existing clothing used by women labourers in ginning. Apron covers the body and makes the wearer comfortable (4.9), comfortable for 0-1 hrs of activity (4.8), comfortable due to fabric used (4.7) and comfortable in performing specific activity (4.3).

The t-values revealed that the designed apron (11.451) was highly significant over the old shirt.

Functionality

It is also observed from Table 3 that the newly designed apron was found more functional than existing old shirt because as it provides protection from the sun (4.6), protection from external dust/dirt substances (4.5) and suitable for ginning activities (4.4).

Statistically, it is proved that functionality of the designed apron used by women labourers (3.595) was highly significant.

Table 4: Suitability, comfortability, functionality and acceptability of headgear cum mask in ginning activity (N=30)

S. No.	*Clothing parameters*	*Saree pallu*		*HGM-I*		*HGM-II*	
		Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*
I	*Suitability*						
1	Appearance /style of the garment	3.6	0.52	4.3	0.82	4.5	0.71
2	Colour of the garment	3.2	0.42	3.7	0.48	3.4	0.52
3	Size assortment	2.7	0.83	3.6	0.84	4.1	0.74
4	Fit	1.8	0.42	3.5	0.85	3.7	0.82
5	Fabric quality	1.7	1.06	3.7	0.82	4.8	0.42
6	Construction quality	2.8	0.42	4.7	0.68	4.6	0.70
7	Cost effectiveness	3.2	0.42	4.2	0.63	3.6	0.70
	t-value	-	3.667*	5.381**			
II	*Comfortability*						
1	Easy donning	4.2	0.63	4.5	0.71	4.6	0.52
2	Easy doffing	4.1	0.57	4.3	0.82	4.5	0.71
3	Comfortable for						
a	0-1hrs of activity	3.3	0.48	4.9	0.32	4.9	0.32
b	1-2hrs of activity	2.6	0.52	4.2	0.63	4.3	0.48
c	2-3hrs of activity	1.6	0.52	3.7	0.48	3.9	0.32
d	More than 3 hrs of activity	1.1	0.32	2.8	0.42	3.0	0.47
4	Proper fit/drapeability	3.0	0.67	3.9	0.88	4.1	0.74
5	Comfort in performing specific activity	1.9	0.74	4.3	0.67	4.0	0.67
6	Absorbency	1.7	0.67	3.6	0.70	3.2	0.42
7	Comfortable due to fabric used	2.7	0.67	4.7	0.48	4.6	0.52
8	Covers the head and face thus making wearer comfortable	3.4	0.52	4.6	0.52	4.7	0.48
9	Aeration	2.0	0.47	3.9	0.57	3.3	0.48
	t-value	-	7.346**	8.369**			
III	*Functionality*						
1	Protection from external material/dust/ dirt/thorny substances, etc others	2.8	0.42	4.4	0.52	4.8	0.42
2	Protection from sun	3.6	0.70	4.8	0.42	4.7	0.67
3	Protection from pesticides	-	-	-	-	-	-
4	Suitability in activities	1.9	0.88	3.8	0.79	4.2	0.79
5	Hastens the process	2.2	0.63	3.3	0.67	3.4	0.52
	t-value	-	3.286*	3.586*			
IV	*Acceptability*						
1	Durability(no. of trails)						
a	0-5 trails	3.7	0.48	4.8	0.42	4.7	0.48
b	5-10 trails	3.1	0.57	4.0	0.47	4.6	0.52
c	10-20 trails	2.3	0.67	3.5	0.71	3.7	0.48
d	Entire crop period	1.7	0.48	2.8	0.42	3.0	0.47
2	Wash ability						
a	0 wash	3.8	0.42	4.8	0.42	4.7	0.48
b	1-2 wash	3.0	0.47	4.1	0.57	4.6	0.52
c	2-3 wash	2.4	0.70	3.7	0.48	3.7	0.48
d	More than 3 washes	1.6	0.52	2.9	0.57	3.1	0.32
3	Resistance to dust/soil	2.9	0.57	3.5	0.71	3.7	0.48
	t-value	-	13.098**	14.686**			

*Significant at 5% level ** Significant at 1% level

Acceptability

A glance at Table 3 showed the acceptability of the designed apron over the existing old shirt used by labourers engaged in ginning activity. Data revealed that the apron was more acceptable than old shirt due to its durability for 5-10 trails (4.9) and1-2 washes (4.8) and resistance to dust/soil (3.8).

Moreover, t- values showed that the use of designed apron was highly significant (16.463) than old shirt.

Headgear cum Mask

Suitability

Table 4 presents the data related to suitability, comfortability, functionality and acceptability of the designed headgear cum mask in ginning activities. Results revealed that headgear cum mask - II was more suitable than headgear cum mask - I and *saree pallu* due to its fabric (4.8), construction quality (4.6), appearance/style (4.5) and size (4.1).

The t - values explains that suitability of designed headgear cum mask - II (5.381) was highly significant than headgear cum mask - I and *saree pallu* for ginning activities.

Comfortability

It is evident from Table 4 that headgear cum mask - II was more comfortable than headgear cum mask - I and *saree pallu* because it is comfortable for 0-1 hrs of activity (4.9), covers the head and makes the wearer comfortable (4.7), comfortable due fabric used and easy donning and doffing (4.6) and proper fit / drapeability (4.1).

Statistically, it is proved that comfortability of designed headgear cum mask - II used by women labourers in ginning activity (8.369) was more significant than headgear cum mask - I and *saree pallu*.

Functionality

Table 4 further elucidates the functionality of the designed headgear cum mask over existing *saree pallu*. Data revealed that headgear cum mask - II used by labourers engaged in ginning activities found to be functional than headgear cum mask - I and *saree pallu* for the reason that it protects from accumulation of dust/dirt (4.8), protects from sun (4.7) and suitable for activity (4.2).

More over t - values showed that the designed headgear cum mask - II for ginning activity (3.586) was highly significant than headgear cum mask - I and *saree pallu*.

Acceptability

A glance at Table 4 enlighten the acceptability of designed headgear cum mask – II over headgear cum mask –I and existing *saree pallu* that headgear cum mask – II was more accepted by labourers than headgear cum – I and *saree pallu* because of its durability for 5-10 trails and 1-2 washes (4.7) and resistance to dust/soil (3.7).

It is observed from t - values that acceptability of headgear cum mask - II (14.689) and headgear cum mask - I (13.098) were highly acceptable than *saree pallu* used by women labourers engaged in ginning activity.

Overall Acceptability of the Functional Clothing for Ginning Mill Activities

Table 5 revealed the overall acceptability of functional clothing in ginning activity. Considering the suitability, comfortability, functionality and acceptability of designed functional clothing, apron (4.8) was highly accepted by women labourers than old shirt. Similarly acceptability of headgear cum mask - II (4.7) was found to be more than *saree pallu* used by women labourers engaged in ginning activity.

Table 5: Overall acceptability of functional clothing in ginning activity (N=30)

S. No.	*Clothing parameter*	*Mean*	*SD*
1	Upper garment –old shirt	3.3	0.82
2	Apron	4.8	0.42
3	Saree *pallu*	1.7	0.67
4	Headgear cum mask - I	4.2	0.63
5	Headgear cum mask - II	4.7	0.48

DISCUSSION

Suitability, comfortability, functionality and acceptability of apron in ginning activities was represented in Table 1. Designed apron was high-

ly suitable for ginning activities than old shirt due to its construction quality and style of the garment. Majority of women labourers opined that apron covers the body and comfort in performing ginning activity due to fabric used. Designed apron was more functional than existing clothes because it protects from accumulation of dust/dirt and other external materials. It was found that apron was greatly acceptable for the reason that durability of apron for 5-10 trails and wash ability for 5-10 washes. More over t - values showed that designed apron was highly significant over the old shirt (Fig.1).

In a study on "Protective clothing for male farm workers engaged in wheat threshing" by Punam et al. (2014) found that to mitigate health hazards faced by male farm workers during threshing, protective clothing such as apron - 1 with full sleeves along with cap and mask, apron - 2 with hood were designed and given for trails. Designed apron - 2 was highly suitable as compared apron - 1 with reference to face and neck coverage, comfortable and protection provided by fabric. Protective clothing were highly acceptable by the male farmers due to ease of wearing, easy to maintain and did not effect the work efficiency of the wearer.

It was evident from Table 4 that headgear cum mask - II was found to be more suitable than headgear cum mask - I and *saree pallu* because of its fabric used for mask, construction quality and style of the garment. Designed headgear cum mask - II was highly comfortable in performing ginning activities due to reasons that covers the head and face, easy donning and doffing and fabric used. Women labourers expressed that headgear cum mask - II was more functional than existing clothing as it protects from inhaling dust/dirt and other external materials. It was found that headgear cum mask - II was significantly acceptable over existing clothing due to its durability for 0-5 trails and wash ability for 1-2 washes. The t-values revealed that designed headgear cum mask - II was highly significant over headgear cum mask –I and *saree pallu* (Fig.1).

Fig.1. Wear trial of designed protective clothing
Source: Author

Gandhi et al. (2012) noticed that respondents reported respiratory problems, irritation in eyes, throat followed by nose which were mainly due to heat and organic dust in the surroundings. Protective masks viz beak-mask, face mask, hood mask and scarf mask were developed and tested its efficacy. Hood mask was highly acceptable as it showed lowest breathing resistance. Leakage of dust from sides and rate of sweating was medium. Hence, use of hood mask would be helpful to achieve the ergonomics objective of reducing health problems and improving performance.

A glance at Table 5 indicates that designed apron was found to be highly acceptable by women labourers followed by headgear cum mask - II to carry out ginning activities. However, these two garments were extremely preferred by women labourers than existing clothing.

Kale et al. (2016) found that the male and female workers of spinning mill reported the problems like breathlessness, sweating, uncomfortable to work, throat choking, uneasy to wear and fatigue due to the protective accessories provided to them in mill. Therefore, there is need to create awareness among labourers about protective clothing and benefits of clothing.

Although total prevention is not possible, but hazardous areas (noise/dust) can be prevented by proper aeration, putting exhaust fans, putting mask and ear plugs by workers in textile industry (Kumar et al. 2014). Along with that workers of the textile industry should be aware of the various occupational hazards in the industry and management should also take necessary steps like conducting medical camps for employees and dust control equipments can be setup in the industry to protect the workers from potential hazards (Babel and Tiwari 2013; Singh 2016).

CONCLUSION

Ginning sector acts as bridge between the farmer field and textile industry. Ginning stage of cotton plays a significant role in determining the quality of raw material for textile industry. Cotton industry workers are exposed to various hazards in the different departments of textile factories, especially in the ginning, spinning and weaving sections which play an important role in the high incidence of industrial health hazards. The results revealed that wear trials of the protective clothing such as apron and headgear cum mask - II were very much suitable for ginning activities. Apron is comfortable due to fabric used and in performing ginning activities than old shirt. Headgear cum mask protects from inhalation of dust as it covers the face and head. The comfortability of all the garments over the existing clothing practices were found to be statistically significant. Overall acceptability for apron was found to be higher followed by headgear cum mask - II. Hence it is necessary to educate the workers regarding health hazards caused due to ginning operations. Further there is a need to create awareness among the workers for usage of protective clothing and emphasize on benefits of protective clothing.

RECOMMENDATIONS

Protective clothing normally made from a mixture of innovative materials and functionality that a garment is expected to perform. The protective clothing that protects individuals who are exposed during work or that can facilitate body movements. The knowledge and usage of these clothing is very much essential for a healthy living. However the ergonomic studies on the work efficiency are very much essential.

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