



**SUITABILITY ASSESSMENT OF DESIGNED FUNCTIONAL CLOTHING TO MITIGATE OCCUPATIONAL HAZARDS DURING THRESHING**

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**Abstract**

The present paper is outcome of the research work under taken in All India Coordinated 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 male and female farm workers. Two aprons and two masks for male farm workers and one apron and two mask for female farm 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 male and female farm workers.

**Key words:** Functional clothing, Threshing, Face Mask, Occupational Hazards

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Agriculture provides the principal means of livelihood for over 58.4% of India's population. Agriculture workers face many occupational hazards while performing different activities. After cutting crop, farmers hire the thresher and work continuously day and night to complete the threshing process. Farmers are exposed to high levels of organic dust during threshing of crops leading to many health hazards. Common health hazards observed during threshing activity were: itching, eye irritation dry skin, rashes, cracks, pimples, nausea, headache, vomiting and breathing related problems like sneezing, running nose, breathlessness etc and in long run may affect the brain, lungs, heart, liver, blood and other organs. To mitigate occupational health hazards, Protective clothing developed for Pesticide applicators were found to be suitable and acceptable by the farm workers. But there is few more agriculture activity like threshing activity for which protective clothing needs to be developed. In the present research work protective clothing /functional clothing and accessories were designed developed and field tested for its suitability among male and female farm workers.

**Methodology** In the present study the problems encountered by the farm workers during threshing 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 in AICRP selected villages. The designed and developed clothing and accessories were given for wear trial for three days during threshing period. For the purpose 30 farm workers 15 male and 15 female doing maize threshing in the month of Oct.Nov.2013 were selected purposively. To measure the response three point rating scale was developed weighted mean score (WMS) for male and female farm workers 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.

### **Protective / functional clothing designed for male and female farm workers were**

#### **Male farm workers**

- Apron with hood and full sleeves with elasticized cuffs
- Apron without hood and full sleeves with elasticized cuffs
- Pleated mask / beak mask
- Gloves

#### **Female farm workers:**

- Apron with full sleeves preferably elasticized cuffs
- Hood mask/Scarf mask
- Gloves

### Specification of the fabrics used for mask and apron

Physical properties	Fabric for aprons		Fabric for masks
	Blend (45% cotton and 55% polyester)	Cotton (100%)	Cambric (100% Cotton)
Texture	Soft and smooth	Soft and smooth	Soft and smooth
Yarn count	85×72	84×73	78×69
Weight	95g/m <sup>2</sup>	125g/m <sup>2</sup>	79g/m <sup>2</sup>
Thickness	24mm	27mm	23mm

Apron and mask were designed and developed, while the goggles were purchased by the local market. Respondents were also asked to wear the sports shoes during threshing.



Fig. 1 Developed protective clothing/accessories of farm workers



### Problem encountered during threshing

**Table 1 Problem encountered while threshing**

**N-30**

S.no.	Categories	F	%	
1	Running nose	12	40.0	
2	Soiling of	Hair	16	53.33
		Face	14	46.67
		Hand	13	43.33
		Feet	16	53.33
3	Cut in hand/arms	6	20.0	
4	Cut in other body parts	5	16.67	
5	Itching/irrigation in hands and other body parts	6	20.0	
6	Breathlessness	3	9.99	
7	Allergic bronchitis	1	3.33	

The table 1 clearly reveals that the major problems faced by the respondents during the threshing were related to soiling of hairs face, hand and feet followed by running nose (40%). Equal per cent of the respondents also faced the Itching/irrigation in hands and other body parts as well as cuts in hands and arms (20%). During thrashing dust particles, dried leaves of grain plants, husk and noise of thresher machine were generating problems. Enquiry about the protective measures taken during threshing was also made and it was revealed that male workers were using the scarf or pieces of old cloth to protect hairs from dust in the environment.

### Suitability assessment of developed protective clothing/accessories of male farm workers

Data in table clearly reveals that Apron 1 was found highly suitable as of it protects neck and arms from husk/dust (80 and 100%) and found comfortable to wear, position of pocket and flap on pocket prevents accumulation of husk/ dust inside the pocket (73.3%). Similarly shape and size of pocket was also found highly suitable by 60 per cent respondents. Slightly more than one quarter of respondents found it comfortable, shape, size, position of pocket and flap on pocket was found suitable by 26.7%. Only 13.3 per cent respondents found shape and size of pocket somewhat suitable. On the basis of WMS calculated for each parameters Apron-1 fall

under the category of highly suitable with WMS ranging from 2.7 to 3.0, overall WMS of apron 1 was 2.72.

Critical review of data of Apron-2 in table clearly indicates that all the construction features were found highly suitable while protect head from husk/ dust was under the category of suitable as no hood was attached with apron. So it does not prevent much husk or dust from accumulating on the head. While rest of scores were nearly similar to that Apron-1.

**Table 2 Suitability assessment of developed protective clothing/accessories of male farm workers**

**n=15**

Functional features of garments	Characteristics of functional features	Highly suitable 3	Suitable 2	Somewhat suitable 1	WMS	Over all WMS
Apron 1 Apron with hood Elasticized cuff (elastic in two row)and Patch pocket with flap	Protects neck from husk/ dust	12 (80)	3 (20)	-	2.8	2.72
	Protects arms from husk/ dust	15 (100)	-	-	3.0	
	Comfortable	11 (73.3)	4 (26.7)	-	2.7	
	Position of pocket	11 (73.3)	4 (26.7)	-	2.7	
	Shape and size of pocket	9 (60)	4 (26.7)	2 (13.3)	2.4	
	Flap prevents accumulation of husk/dust in side pocket	11 (73.3)	4 (26.7)	-	2.7	
Apron 2 Apron with polo collar Elasticized cuffs(elastic in one row) and Patch pocket with flap	Protects head from husk/ dust	-	13 (86.7)	2 (13.3)	1.86	2.5
	Protects arms from husk/ dust	12 (80)	3 (20)	-	2.8	
	Comfortable	11 (73.3)	2	2 (13.3)	2.7	
	Position of pocket	11 (73.3)	4 (26.7)	-	2.7	
	Shape and size of pocket	9 (60)	4 (26.7)	2 (13.3)	2.4	
	Flap prevents accumulation of husk/dust in side pocket	11 (73.3)	4 (26.7)	-	2.7	
Mask Beak mask	Easy to put on	10 (66.7)	4 (26.7)	1 (6.7)	2.6	2.53
	Easy to remove	10 (66.7)	4 (26.7)	1 (6.7)	2.6	

	Coverage of face	9 (60)	4 (26.7)	2 (13.3)	2.46	
	Easy to breathe	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
	Shape of mask	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
	Elastic at sides of mask comfortable during wear	9 (60)	4 (26.7)	2 (13.3)	2.46	
Pleated mask	Easy to wear	12 (80)	3 (20)	-	2.8	2.73
	Easy to remove	12 (80)	3 (20)	-	2.8	
	Coverage of face	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
	Easy to breathe	11 (73.3)	4 (26.7)	-	2.7	
	Shape of mask	12 (80)	3 (20)	-	2.8	
	Elastic at sides of mask comfortable during wear	11 (73.3)	4 (26.7)	-	2.7	
ii) Goggles/plain glasses	Protects eyes from husk/dust	11 (73.3)	4 (26.7)	-	2.7	2.7
Gloves/ Mittens	Prevents irritation and itching on hand	9 (60)	4 (26.7)	2 (13.3)	2.46	2.46
	Protects hands from cuts and sore	9 (60)	4 (26.7)	2 (13.3)	2.46	

Data related to beak mask and pleated mask clearly reveals that pleated mask was found highly suitable as compare to beak mask with overall WMS of 2.73. Pleated mask was found highly suitable due to its shape, coverage on face, easy to put on and put off. Respondents also told that goggles with plain glass also protect their eyes from husk and gloves prevent the irritation and itching on hand and protect hands from cuts and sores.

### Suitability assessment of developed protective clothing for female

Apron developed for female farm workers was without hood, with Chinese collar, full sleeve with elasticized cuffs, patch pocket with flaps and belt at the waist. Good number of the respondents found it highly suitable, 20 to 26.7 per cent found it suitable while only 6.7 – 13.3 percent judged it as somewhat suitable. The overall weighted mean score was 2.48 which indicate that it was found highly suitable. Critical review of the date reveals that hood mask was more preferred as compare to the scarf mask reason as reported by the respondents were easy to put-on and remove the hood. While in case of scarf mask designs was rated as slightly

complicated. Respondents also told that goggles with plain glass also protect their eyes from husk and gloves prevent the irritation and itching on hand and protect hands from cuts and sores.

**Table 3 Suitability assessment of developed protective clothing/accessories of female farm workers**  
n=15

Functional features of garments	Characteristics of functional features	Highly suitable 3	Suitable 2	Somewhat suitable 1	WMS	Over all WMS
Apron						
Chinese collar	Protects neck from husk/ dust	11 (73.3)	3 (20)	1 (6.7)	2.6	2.48
Elasticized cuffs	Protects arms from husk/ dust	10 (66.7)	3 (20)	2 (13.3)	2.5	
Size of elasticized cuff	Comfortable	10 (66.7)	3 (20)	2 (13.3)	2.5	
Patch pocket with flap	Position of pocket	9 (60)	4 (26.7)	2 (13.3)	2.46	
	Shape and size of pocket	9 (60)	4 (26.7)	2 (13.3)	2.46	
	Flap prevents accumulation of husk/dust in side pocket	9 (60)	4 (26.7)	2 (13.3)	2.46	
Belt at waist	Prevents hindrance of clothing while working	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
Hood mask						
Head cover of hosiery fabric	Protects head from husk/ dust	15 (100)	-	-	3.0	2.69
	Protects neck from husk/ dust	10 (66.7)	5 (33.3)	-	2.6	
Mask of fine cotton fabric	Protects from inhalation of husk/ dust	11 (73.3)	4 (26.7)	-	2.7	
	Height of mask	11 (73.3)	4 (26.7)	-	2.7	
	Width of mask	9 (60)	6 (40)	-	2.6	
	Comfortable	10 (66.7)	5 (33.3)	-	2.6	
Overall hood mask	Easy to wear	11 (73.3)	4 (26.7)	-	2.7	
	Easy to remove	11 (73.3)	4 (26.7)	-	2.7	
	Comfortable	9 (60)	6 (40)	-	2.6	

Scarf mask						
Head cover of voile fabric	Protects head & neck from husk/ dust	10 (66.7)	4 (26.7)	1 (6.7)	2.6	2.59
Mask of double layer voile fabric	Protects from husk/ dust inhalation	11 (73.3)	4 (26.7)	-	2.7	
Elastic at nose and forehead in the mask	Keep mask in position	11 (73.3)	4 (26.7)	-	2.7	
	Comfortable	9 (60)	4 (26.7)	2 (13.3)	2.46	
Shape of mask	Height of mask	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
	Width of mask	11 (73.3)	4 (26.7)	-	2.7	
Size of head cover	Appropriate	11 (73.3)	4 (26.7)	-	2.7	
Strap for knotting	Easy to tie knot	10 (66.7)	4 (26.7)	1 (6.7)	2.6	
	Easy to open knot	9 (60)	4 (26.7)	2 (13.3)	2.46	
Overall scarf mask	Easy to wear	11 (73.3)	4 (26.7)	-	2.7	
	Easy to remove	9 (60)	4 (26.7)	2 (13.3)	2.46	

Both the male and female workers also reported that that functional clothing developed for threshing period did not create problem during activity and flow of work is not affected by wearing the functional clothing and accessories. The respondents were found eager to adopt these functional clothing and accessories.

**Conclusion** It can be concluded on the basis of the study that among two aprons designed for male farm workers apron with hood was found more suitable as compared to apron without hood. Both the developed mask was liked by the respondents but pleated mask was found more suitable as compared to beak mask due to its shape. Similarly female farm workers found apron highly suitable and among two different mask hood masks was more preferred than scarf mask due to simplicity to put on and put off the mask. On the basis of WMS all the developed clothing and accessories were under the category of highly suitable.

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