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EFFECT OF BLEND RATIO ON YARN EVENNESS OF THE UAS SHEEP BREED WOOL AND ITS BLENDS

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ABSTRACT

Wool is natural protein fibre which is highly extensible, flexible and resilient in nature. The natural crimp and resilience of wool fibres help to maintain high loft and thermal insulation of fabrics. UAS sheep breed, a product of crossing Southdown, Bannur and Deccani breeds developed at University of Agricultural Sciences (UAS), Dharwad was selected for the study. The UAS breed wool has very low tensile strength and elongation, to enhance the optimum utilization and improve the properties of UAS sheep breed fleece was blended with other synthetic and natural fibres. The scoured and pre-carded UAS sheep breed fleece was blended with acrylic, r-PET and jute fibres in varied proportions *viz.*, 70/30, 60/40 and 50/50through sandwich/stack blending technique. The blended fibres were subjected to woolen carding system and spun on hand charaka and friction machine. Control and nine blended yarns were subjected to Uster evenness tester to assess the total yarn imperfections. The results revealed that among the test samples, both hand spun and friction spun wool/ jute blends in varied proportions exhibited significantly less unevenness percentage, thin places, thick places than the r-PET and acrylic.

KEYWORDS: Neps, Thick Places, Thin Places, Total Yarn Imperfections, UAS Sheep Breed Wool and Unevenness Percentage

INTRODUCTION

Figure 1: UAS sheep breed

Wool is highly valued for a wide range of properties which can absorb upto 30 % moisture to its own weight without feeling wet. Although not a very strong fibre, wool is highly extensible, flexible and resilient. These properties makes the wool fabrics better handle, drape and fashion style (Johnson and Russell, 2008).University of Agricultural Sciences (UAS) sheep breed wool developed by the UAS, Dharwad is shorter and coarser fibre. In the local area, the UAS sheep breed (Figure 1) is mainly reared for the purpose of meat and from each sheep 300 - 400 g of fleece is generated by every clipping per year. This type of wool is lacking proper value addition due to shorter, coarser and lower strength. The UAS sheep fleece can be improved through blending with other stronger natural and manmade fibers.

Blending is a way of value addition in the utilization of coarse varieties of wool available in the country. There is a need to develop diversified products from coarser grade wool and innovative blending processes that will make possible usage of coarser varieties like blankets, shawls, furnishing and to enrich the properties such as strength, appearance, comfort etc. (Sharma and Goel, 2003). Blending coarse grade wool with other fibres commercially reduces the total costs of production, improve the performance properties and create market demand (Johnson and Russell, 2008). Hence an attempt was made to improve and enhance the utilization of UAS sheep breed wool by blending with acrylic, r-PET and jute fibres.

A yarn with more imperfections results into faulty appearance of the fabrics usually when the fabric is dyed or finished. Functional properties such as abrasion, pill-resistance, soil retention, drape, absorbency, reflectance or luster may also be directly influenced by yarn evenness (Samanta, 2014).Yarn evenness is defined as the variation in weight per unit length of the yarn or as the variation in its thickness (Saville, 2004). Imperfections can be defined as the total number of neps, thick and thin places in a given length of yarn (Ochola et al. 2012).Yarn imperfection is an important yarn parameter which affects yarn and fabric processing which gives overall quality parameter.

Thus, the yarn evenness is important property which contributes overall appearance of the products, hence the research is designed (Fig 2) on effect of blend ratio on yarn evenness of the hand spun and friction spun pure UAS sheep breed wool and blended yarns.

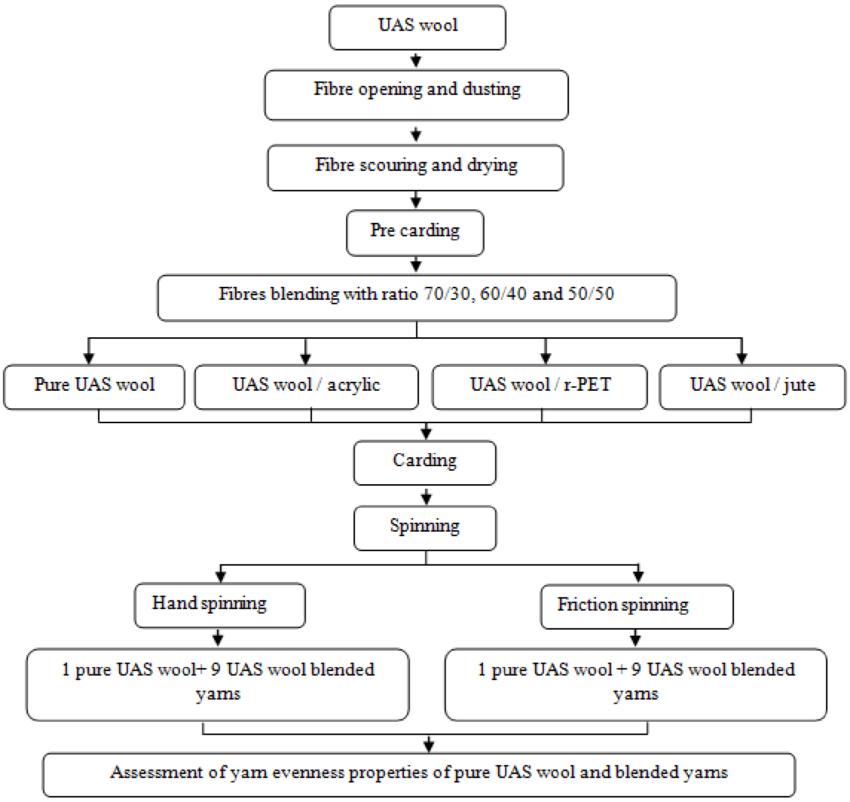

Figure 2: Research Design

METHODOLOGY

UAS (University of Agricultural Sciences) sheep breed wool fibres were collected from the Department of Animal Sciences, UAS, Dharwad. Theacrylic, recycled polyethylene terephthalate (r-PET) and jute fibres were procured from Wool Research Association (WRA), Thane, Mumbai. The properties of selected fibres, *viz.*, fibre length (mm), fibre diameter (micron), fibre tenacity (gm/denier) and fibre elongation (%) are shown in the Table 1.

UAS sheep breed wool fleece was shorn with electrically operated wool shearing machine (Figure 3). The fleece was fed to fibre opener for opening and dusting of the fibres (Figure 4). Scouring was carried out in two-bowl scouring machine(Figure 5) with 3 % sodium carbonate and 2 % non ionic detergent keeping 1:40 MLR at 50^0Ccarried out at Wool Development and Research Centre, Ranebennur, Haveri district, Karnataka. The wool fibres were fed into the pre-carding machine (Figure 6), where the initial straightening and the separation of short staple fibres takes place.

Figure 3: Shearing Of UAS Sheep Breed Wool Fleece Wool Fleece

Figure 4: Opening and Dusting of UAS Sheep Breed Wool

Figure 5: Two Bowl Scouring of UAS Sheep Breed Wool Fibres

Figure 6: Pre-Carding of UAS Wool Fibres

The pre-carded UAS sheep breed wool fibres were blended with acrylic, r-PET and jute fibres in varied proportions *viz.*, 70/30, 60/40 and 50/50 by adopting sandwich blending technique. The pure and blended fibres were processed in woolen carding system (Figure 7). The pure and blended slivers were spun on hand charaka (Figure 8) at Medleri, Ranebennur taluk, Haveri district, Karnataka and friction machine (Figure 9) at Wool Research Association (WRA), Thane, Mumbai. The developed pure and blended yarns were subjected to yarn evenness test (Figure 10) using Uster Tester 4-SE at Gadag Co-operative Textile mill Ltd, Hulkoti. The statistical tool one-way ANOVA was used to draw valid conclusions.

Figure 7: Feeding UAS Sheep Breed Wool Blended Fibres in to the Woolen Card

Figure 8: Hand Spinning of UAS Sheep Breed Wool Blended Yarns in Hand Charaka

Figure 9: Friction Spinning of UAS Sheep Breed Wool Blended Yarns

Figure 10: Yarn Evenness Testing of the Pure UAS Sheep Breed Wool and Blended Yarns

RESULTS AND DISCUSSIONS

The yarn evenness is assessed in terms of thick places/ km (+50%), thin places/ km(-50%), neps/ km (+200%) and unevenness percentage. The product ant of all these factors gives total yarn imperfections of the yarn.

Table 2 showed yarn evenness of the pure UAS sheep breed wool and blended yarns. In general, the unevenness percentage, number of thick, thin places and neps of the pure hand spun wool yarns were found to be significantly lower than the blended samples.

Unevenness Percentage (U%)

The hand spun yarn unevenness percentage (U%) gives an overall number for yarn irregularities (Table 2). Pure UAS sheep breed wool yarn possessed relatively even yarn with unevenness percentage (25.60) compared to UAS sheep breed wool blended yarns. Among the yarn samples, the unevenness percentage was found to be highest in wool/ acrylic blended yarn, 39.30 % (60/40) which may due to the waviness present in acrylic leading to difficulty in fibre opening process resulting into bulkier and more yarn evenness.

Evenness results of the friction spun UAS sheep breed wool and blended yarns are presented in Table 3. The results depicted that wool/ acrylic blended yarns have high unevenness percentage than wool/ r-PET and wool/ jute blends. 70/30 and 60/40 blends of wool/ acrylic exhibited significantly higher U% than control. Among the wool/ acrylic blended yarns, the highest value of unevenness percentage belongs to 70/30 (28.20) followed by 60/40 (25.40) and 50/50 (23.60). The unevenness of wool/ r-PET blends was found to be less significant than the control. Wool/ r-PET (70/30) possessed greater unevenness percentage (24.40) compared to 60/40 (23.90) and 50/50 (19.70) indicating that yarn was more uneven.

However in the wool/ jute blends, the 70/30 blend ratio (21.50) attained higher unevenness percentage than the 60/40 (21.20) and 50/50 (13.30) resulting that the wool/ jute blended yarns were more even with significantly less U% than control.

The friction spun pure UAS sheep breed wool sample possessed lesser unevenness percentage (24.50) compared to wool/ acrylic blends whereas the unevenness percentage of pure UAS sheep breed wool was on par with wool/ jute indicating more even yarn (Table 3).Among the pure UAS sheep breed wool and blended yarns, the U% was relatively high in case of wool/ acrylic yarns due to waviness and bulkier wool/ acrylic that creates several problems *viz.*, excessive variation in fibre fineness and fibre length, improper mixture and fibres distribution during carding and gilling.

Thick Places/ km(+50%)

A thick place is the region where the cross-sectional size is bigger by 50% of the average size (Ratnam et al. 1994).Thick places in the yarn appeared due to presence of large amount of trash, low micronaire with high level of immaturity, excessive fibre entanglements leading to formation of thick places in the yarn.

Table 2 depicts the thick places/ km (+50%) of the hand spun UAS sheep breed wool and blended yarns. Among all the blends, wool/ r-PET blends exhibited higher number of thick places than wool/ acrylic and wool/ jute blends. Higher numbers of thick places were noticed in the wool/ r-PET 50/50 (4975.30) blended yarn due to variation in fineness*i.e.*, finer r-PET (12.61 µ) and coarser wool (30.54 µ). And also due to high twisting force and low fibre movement leads to formation of thick places. These findings are in line with Ochola *et al.* (2012).In the wool/ r-PET blends, as the percentage of r-PET increased in the blend ratio, the number of thick places also increased.

Table 3 highlighted the thick places/ km (+50%) of the friction spun UAS sheep breed wool and blended yarns. Irrespective of fibre content and blend ratio, the thick places in the yarn were found to be more in wool/ r-PET blends (70/30-3660.00) followed by wool/ acrylic (70/30-3437.00), control sample (3193.00) and wool/ acrylic blends (60/40-2744.30).

With respect to fibre content and blend ratio, the 70/30 blend ratio of wool/ r-PET (3660.00) showed maximum number of thick places followed by 60/40 (1080.70) and 50/50 (900.30) respectively. The thick places reduced with the increase of r-PET content in the blend ratio.

However in the friction spun wool/ acrylic blends, significantly higher number of thick places were seen in the 70/30 blends (3437.00) followed by 60/40 (2744.30) and 50/50 (2431.30). A trend of decrease in number of thick places with the increase in acrylic proportion in the blend was observed. In the UAS sheep breed wool/ jute blends the 60/40 blended yarns possessed more number of thick places (2060.00) than 70/30 (1639.00) and 50/50 (173.30).More amounts of thick places formed in the wool/ r-PET friction spun blends may be because of heterogeneous fibre fineness (r-PET-12.61µ and wool-30.54µ, Table 1).

Thin Places/ km (-50%)

A thin place is the region where the cross-sectional size is smaller by 50% of the average size (Ratnam *et al.* 1994).

Hand spun pure UAS sheep breed wool (Table 2) performed very less number of thin places (2262.30) compared to its blended yarns. Highest numbers of thin places were found in the wool/ acrylic blends. Wool/ acrylic yarn (60/40) exhibited maximum number of thin places (10369.70) than other blends which may be due to lack of homogeneity in the fibre fineness of the constituent fibres in the wool/ acrylic blends (Wool- 30.54, acrylic-11.81, Table 1).

Table 3 indicated the thin places/ km(+50%) of the friction spun pure UAS sheep breed wool and blended yarns. The pure UAS sheep breed wool yarn attained significantly more number of thin places (4526.70) than the other blends. The wool/ r-PET blended yarn of 60/40 (4617.70) and 70/30 (4505.00) showed higher thin places than the 50/50 (3723.30). Among the wool/ acrylic blended yarns, 70/30 blend ratio achieved greater number of thin places (4385.70) followed by 60/40 (4008.70) and 50/50 (2763.30). However, more evenness resulted in the wool/ jute blends. The wool/ jute blended yarn of 60/40 (2716.00) exhibited more number of thin places compared to 70/30 (1437.70) and 50/50 (275.30).

From the above results it can be stated that, with the increase in r-PET, acrylic and jute fibres in the blend mixture, there was decrease in number of thick places.

Friction spun blended yarn of wool/ r-PET accounted higher number of thick and thin places, total imperfections compared to other test samples due to variations in the fibre properties (length and fineness) leading to poor blending and carding which yielded greater total yarn imperfections.

Neps/km (+200%)

Neps are small knot like aggregates of entangled fibres. High incidence of neps is responsible for poor appearance and appeal characteristics of yarns and fabrics, formation of spotty and streaky materials during dyeing and printing, end breaks during winding, warping, weaving and knitting and lower price realization (Ratnam *et al.* 1994).

Hand spun wool/ acrylic (60/40) blended yarn registered more number of neps as compared to other test samples. This increase in the neps may be because of combined effect of coarser wool and finer acrylic fibre with lower flexural rigidity making the acrylic fibres easy to curl leading to formation of more number of neps after releasing from the high stress during yarn spinning. These results are in configuration with the results reported earlier by Samanta (2014).Whereas, less number of neps were noticed in the wool/ jute blends of 60/40 ratio (164.4) due to the lower linear density of the yarn. The coarser yarn showed lesser number of neps than the finer yarns. Ochola *et al.* (2012) also stated that the linear density has influence on the number of neps which implies that coarser yarn results lesser neps than the finer yarns.

Neps/ km (+200%) of the friction spun pure UAS sheep breed wool and blended yarns are shown in the Table 3. Among the friction spun pure UAS sheep breed wool and wool blends, significantly higher number of neps were formed in the wool/ r-PET blended yarns of ratio 70/30 (8480.00) than 60/40 (8132.00) and 50/50 (6327.30). Whereas the wool/ jute (70/30) blends possessed higher number of neps (3044.70) than the 50/50 (455.00) and 60/40 blend ratio (452.70). In wool/ acrylic blends, neps were found to be significantly less than the control. In case of wool/ acrylic blends, the 70/30 blended yarn exhibited maximum neps (2674.70) followed by the 50/50 (2674.30) and 60/40 (2076.00).

Total Imperfections

The total imperfections are the resultant of the evenness properties. These are the larger short-term deviations from the mean thickness and they comprise thin places, thick places and neps (Saville, 2004).

Among the hand spun UAS sheep breed wool blends, total imperfection rate was found to be exorbitantly high in the wool/ acrylic blends *i.e.*, 60/40 (18339.70), 70/30 (13221.70) and 50/50 (8242.10). Results indicated that yarn becomes more uneven than the wool/ r-PET and wool/ jute blends. Further in the wool/ r-PET (r-PET) blended yarns, as the wool percentage decreases and r-PET proportion increases total imperfections rate were also more *i.e.*, 50/50 (13850.70), 60/40 (11323.30) and 70/30 (7669.10) respectively. However, least unevenness percentage was found in wool/ jute blends (2480.00) followed by thick and thin places (952.00 and 2415.30), neps (202.20) and total imperfections (3677.10) indicating more even yarn. This may be because of higher flexural rigidity of jute fibres which makes it stiffer than the wool and significantly reduces the chance of entanglement during fibre separation process leading to more even yarns.

Table 3 implies the total imperfections of the friction spun pure UAS sheep breed wool and blended yarns. The total imperfections of the control sample (14926.00) were found to be highly significant than the blended yarns which highlights uneven yarn. In the friction spun pure and blended yarns, the more imperfections were seen in the wool/ r-PET blends. As the percentage of r-PET increases in the blend, the yarns become more even (70/30- 16645.00, 60/40-13830.30 and 50/50- 10951.00).Further, the wool/ acrylic blends had relatively lesser total imperfections and resultant yarn was uneven *i.e.,* 10497.30 (70/30), 8829.00 (60/40) and 7869.00 (50/50). A blended yarn becomes even, as the acrylic content increases in the blend. However, the wool/ jute blends exhibited more even yarn with less number of imperfections and trend of decrease in imperfections as the jute fibre increased in the blends *i.e.*, 70/30 (6121.30), 60/40 (5229.00) and 50/50 (903.70) respectively.

Table 1: Fibre properties

Sl. No.	Test parameters	Wool	r-PET	Acrylic	Jute
1	Fibre diameter (micron)	30.54	12.61	11.81	39.65
2	Fibre length (mm)	45.00	60.00	60.00	75.00
3	Fibre tenacity (gm/denier)	3.88	3.73	5.97	4.11
4	Fibre elongation (%)	30.00	13.23	18.62	2.27

Table 2: Effect of Blend Ratio on Yarn Evenness of the Hand Spun Pure UAS Sheep Breed Wool and Blended Yarns

Sl. No.	Fibres	Blend Ratios	Yarn Evenness				
			U%	Thick Places	Thin Places	Neps 200/km	Total Imperfections
1	UAS sheep breed wool	100	25.60	1854.30	2262.30	195.10	4311.80
2	UAS sheep breed wool/ acrylic	70/30	35.20*	4595.30*	6697.70*	1928.70*	13221.70*
		60/40	39.30*	4314.70*	10369.70*	3655.30*	18339.70*
		50/50	27.60*	2835.70*	4835.30*	571.10*	8242.10*
3	UAS sheep breed wool /r-PET	70/30	28.10*	2693.70*	4524.30*	451.10*	7669.10*
		60/40	31.80*	4755.70*	5757.70*	810.00*	11323.30*
		50/50	36.70*	4975.30*	7300.30*	1580.00*	13855.70*
4	UAS sheep breed wool/ jute	70/30	24.80*	1915.70NS	2677.70*	202.20NS	4795.50*
		60/40	25.80*	2013.70*	3173.30*	164.40NS	5351.40*
		50/50	25.00*	952.00*	2415.30*	309.80*	3677.10*
SEm±			**0.677**	**213.584**	**249.229**	**170.352**	**573.601**
CV%			**3.912**	**11.970**	**8.631**	**347.845**	**11.082**

***Significant at 5 per cent**
NS – Not significant

Table 3: Effect of Blend Ratio on Yarn Evenness of the Friction Spun Pure UAS Sheep Breed Wool and Blended Yarns

Sl. No.	Fibres	Blend Ratios	Yarn Evenness				
			U%	Thick Places	Thin Places	Neps 200/km	Total Imperfections
1	UAS sheep breed wool	100	24.50	3193.00	4526.70	7206.30	14926.00
2	UAS sheep breed wool/ acrylic	70/30	28.20*	3437.00*	4385.70*	2674.70*	10497.30*
		60/40	25.40*	2744.30*	4008.70*	2076.00*	8829.00*
		50/50	23.60*	2431.30*	2763.30*	2674.30*	7869.00*
3	UAS sheep breed wool /r-PET	70/30	24.40NS	3660.00*	4505.00NS	8480.00*	16645.00*
		60/40	23.90*	1080.70*	4617.70*	8132.00*	13830.30*
		50/50	19.70*	900.30*	3723.30*	6327.30*	10951.00*
4	UAS sheep breed wool/ jute	70/30	21.50*	1639.00*	1437.70*	3044.70*	6121.30*
		60/40	21.20*	2060.30*	2716.00*	452.70*	5229.00*
		50/50	13.30*	173.30*	275.30*	455.00*	903.70*
SEm±			**0.327**	**21.503**	**70.358**	**14.230**	**69.147**
CV%			**2.512**	**1.747**	**3.697**	**0.593**	**1.254**

***Significant at 5 per cent**
NS – Not significant

CONCLUSIONS

The hand spun wool/ acrylic (60/40) yarn exhibited greater percentage of unevenness, thin places, neps and total imperfections. Whereas, wool/ r-PET (50/50) blended yarn showed greater number of thick places. Pure UAS sheep breed wool yarn was even compared to blended yarns. Wool/ jute blends explored even yarns compared to wool/ acrylic and wool/ r-PET blended yarns. The friction spun pure wool yarn exhibited more number of thin places compared to other blended yarns. Whereas, the wool/ acrylic (70/30) blends possessed higher percentage of unevenness and wool/ r-PET (70/30) blends resulted greater number of thick places, neps and total imperfections. The wool/ jute blends of hand spun and friction spun exhibited more even yarns with less number of total imperfections.

The friction spun pure UAS sheep breed wool and blended yarns were found to be more even than the hand spun yarns with less number of total imperfections. With respect to fibre content and blend ratio, 50/50 blend ratio was found to be more even. Hence, the weavers can go for the friction spinning and use the yarns as weft for production of shawls, kamblis etc.

In general friction spun blended yarns exhibited better yarn properties than the hand spun blended yarns. Among fibre content, UAS wool/ jute blended yarn showed more even and suitable as weft for production variegated union fabrics. Further, hand spun yarns can be used for kambli making.

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REFERENCES

1. Johnson N A & Russell I M, *Advances in wool technology* (Woodhead publishing in Textiles, India), 2008, 284.
2. Ratnam T V, Seshan K N, Chellamani K P & Karthikeyan S, *Quality control in spinning* (The South India Textile Research Association, Coimbatore),1994, 163.
3. Samanta A K, *Indian J. Fibre Text*, 39 (2014) 89.
4. Saville B P,*Physical testing of textiles* (Woodhead Publishing Ltd., England), 2004, 94-96.
5. Sharma A & Goel A, *Synthetic fibres,*32 (2003)12.
6. Ochola J, Kisato J, Kinuthia L, Mwasiagi J & Waithaka A, *Asian J. Tex,* 2 (2012) 32.