AJHS
Asian Journal of Home Science
Volume 13 | Issue 1 | June, 2018 | 352-356

DOI: 10.15740/HAS/AJHS/13.1/352-356
e ISSN-0976-8351 ■ Visit us: *www.researchjournal.co.in*

Research Paper

Comfort properties of cotton, acrylic and polypropylene/ nettle union fabrics

■ Neha Garg, Harinder Kaur Saggu **and** Kanwaljit Kaur Brar

Received: 15.11.2017; **Revised:** 24.04.2018; **Accepted:** 11.05.2018

■ **ABSTRACT :** The textile industry for designing and producing new textiles from time to time. The efforts were taken to develop Eco-friendly and biodegradable fibres to control non-polluting environment. Nettle plant have been used as food, fodder and raw material in cosmetics, medicines, industry and bio-dynamic agriculture. Many experiments have been conducted not only in developing commercial textiles using nettle, but also in the growth and propagation of the crop in the most sustainable manner. The nettle union fabrics were constructed to study the properties of fabric. To construct nettle union fabric, the nettle yarn was used as weft with cotton, acrylic and polypropylene yarn as warp. In the study, the fabrics were prepared with three different weave (plain, twill and basket weave). Union fabric was much cheaper in cost compared to pure nettle fabric. Those woven fabrics were tested for physical and mechanical properties analyzed. Further, data were evaluated to find out the influence of physical and mechanical properties.

■ **KEY WORDS:** Nettle union fabric, Cotton, Acrylic, Polypropylene, Physical, Mechanical properties.

■ **HOW TO CITE THIS PAPER :** Garg, Neha, Saggu, Harinder Kaur and Brar, Kanwaljit Kaur (2018). Comfort properties of cotton, acrylic and polypropylene/nettle union fabrics. *Asian J. Home Sci.*, **13** (1) : 352-356, **DOI: 10.15740/HAS/AJHS/13.1/352-356.**

See end of the paper for authors' affiliations

Neha Garg
Department of Apparel and Textile Science, College of Home Science, Punjab Agricultural University, Ludhiana (Punjab) India

Nettles have long history of varied applications in different parts of the world. Cloth discovered from a Bronze Age tomb at Voldtofte, Denmark was made of fibre from the common nettle. Some archaeological remains from Britain also confirm that nettle was used for cloth manufacturing in the Neolithic times. The use of bast fibres from nettle stalks was documented by Nestorius in AD 900. Nettle fibre was widely used by many groups of American Indians for thousands of years as a source of fibre for bowstrings, fishing nets and lines, snares and cordages. Coastal Indians used nettles for making a variety of fishing nets. Some even say that the word 'net' has been derived from nettle only. There are evidences which state that the tribes were detaching fibres and spinning them into strong string by using a spindle, or rolling the fibre on the naked thigh with the palm. The Indians discovered that a part of the plant as formidable as the nettle could be cut, spilt, dried, beaten, shredded and spun in to a fine two strand strings of unusually good strength. There are accounts testifying the use of nettle fibre for weaving ceremonial cloth by many ancient tribes in America (Barakoti and Shrestha, 2000). The process followed by a company in development of nettle fibre and yarns. In the beginning they collected nettle yarns from villagers, where they make the yarns for themselves. There were

Table A : Instruments used for fabric testing

Name of equipments	Make	Purpose	Test method
Electronic balance 200B	Ramp tmpex; New Delhi	Weight per unit area of fabric (GSM)	IS 1964-1970
Tensile Strength Tester	SDL Atlas; UK	Tensile Strength	IS 1969-1985
Thickness Tester	Prolific Engineers; Noida	Fabric Thickness	IS 7702-1985
Martindale Abrasion Tester	SDL Atlas; UK	Flat Abrasion Resistance Test	IS 12673- 1999

too many waste threads in the village and the company collected that thread and started to supply them for carpets. But this thread was not exportable. The company started searching for good yarn and fibre and it succeeded in making a good quality yarn in 2009 (Mahapatra, 2012). The study was aimed at following objective:

– Preparation of nettle union fabrics in different weaves using selected yarns with cost calculation.

– To analysis the physical mechanical properties of union fabric.

■ RESEARCH METHODS

Cotton, acrylic and polypropylene yarns were approved for nettle union fabric by the members of advisory committee. Cotton yarn of 2/20 and 2/24, acrylic yarn of 2/24 and 2/32 and polypropylene yarn of 2/120 counts were procured from Ludhiana city (Punjab). Single ply polypropylene yarn was procured from Bhiwadi city (Haryana) and nettle 6 Nm yarn was procured from Chamoli (Uttarakhand). For creation of three different types of textiles textures, plain, basket (variation of plain weave) and twill weaves were selected. A total of eighteen samples using nettle yarn with other three selected yarns *viz.*, cotton, acrylic and polypropylene each in two different count (given above) were prepared by using selected weaves. Cost of nettle union fabrics was calculated per meter fabric. It included all operation yarn, warping, weaving and finishing were included.

Developed fabrics were studied for physical and mechanical properties to analyse their suitability for product development. The physical properties studied were fabric weight, fabric thickness and dimensional stability. The mechanical properties analyzed were tensile strength and abrasion resistance.

■ RESEARCH FINDINGS AND DISCUSSION

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

Details of developed union fabrics :

Total eighteen samples of union fabrics were developed using above given yarns and weaves. Cotton (2/20)/nettle (6Nm) was woven in plain (EPI=35, PPI=22), twill (EPI=48, PPI= 26) and basket (EPI=51, PPI=24) weaves. Samples in plain (EPI=39, PPI=26), twill (EPI=35, PPI=20) and basket (EPI=40, PPI=28) weaves were also woven using cotton (2/24)/nettle (6 Nm). Besides, union samples in the selected plain (EPI=40, PPI=27), twill (EPI=42, PPI=26), basket (EPI=31, PPI=25) weaves were also woven using acrylic (2/24)/nettle (6Nm). Acrylic (2/32)/nettle (6Nm) union fabric was woven in plain (EPI=36, PPI=27), twill (EPI=65, PPI=34), basket (EPI=36, PPI=29) weaves. Samples in plain (EPI=21, PPI=13), twill (EPI=28, PPI=20), basket (EPI=30, PPI=16) weaves were also woven using polypropylene (2/120)/nettle (6Nm). Besides, union sample in selected plain (EPI=39, PPI=28), twill (EPI=38, PPI=36), basket (EPI=31, PPI=37) weaves were also woven using polypropylene (single ply)/nettle (6Nm).

Cost estimation of union fabrics :

The data depicted that the cost of pure nettle yarn was Rs. 750 per kg whereas the cost of cotton and acrylic was Rs. 180 per kg each. Cost of polypropylene was little higher than cotton and acrylic, *i.e.* Rs. 200 per kg. Thus, development of union fabrics using these yarns for warping could provide considerable cost benefit. For weaving one meter pure nettle fabric (6Nm/6Nm) with 32 inches width, 700 g nettle yarn was needed for the prevalent textures. On the contrary, for one meter union fabric cotton (2/20)/nettle (6Nm) with 28.5 inches width, 280 g cotton and 250 g nettle were required, for and cotton (2/24)/nettle (6Nm) 300 g cotton and 250 g nettle were required, followed by acrylic (2/24)/nettle (6Nm) and acrylic (2/32)/nettle (6Nm) with same width, 300 g acrylic and 250 g nettle were required. For polypropylene (single ply)/nettle (6Nm) and polypropylene (2/120)/nettle (6Nm), 370 g polypropylene and 250 g nettle were required for each sample. Calculated cost of warping, weaving and finishing of fabric was Rs. 400. Total cost of one meter pure nettle fabric was Rs. 900 and for cotton (2/20)/nettle (6Nm) was Rs. 638, cotton (2/24)/ nettle (6Nm) was Rs. 647, Acrylic (2/24)/nettle (6Nm) and acrylic (2/32)/nettle (6Nm) was Rs. 647 and polypropylene (single ply)/nettle (6Nm), polypropylene (2/120)/nettle (6Nm) was Rs. 663 (Table 1). It is evident that the union fabric was much cheaper in cost compared to pure nettle fabric.

Woven fabrics were physically and mechanically analyzed. The physical properties such as fabric thickness, fabric weight and dimensional stability and mechanical properties such as abrasion resistance and breaking strength were studied (Source: NITRA, 2015).

Physical/mechanical properties of developed union fabrics prepared with cotton yarn (2/20, 2/24 count), acrylic yarn (2/24, 2/32 count) and polypropylene yarn (2/120, single ply count) in warp wise direction with the other yarns like nettle yarn of 6 Nm in the weft wise direction.

Fabric weight and thickness :

The findings depicted in Table 2 revealed that fabric weight of CN_6 was 355.95 g/m^2, AN_5 was 393.3 g/m^2 and PN_3 was 393.15 g/m^2. The weight of sample AN_5 was considerably more than other fabrics. It was observed that fabric thickness of CN_3 was 1.81 mm, AN_5 was 1.91 mm and PN_6 fabric was 1.935 mm which was higher than the other union fabrics. It was concluded that fabrics with higher fabric weight and thickness were good for making home textile products *viz.*, rug, table runner and cushion cover because these would retain shape well and, resist slippage and folds in use.

Dimensional stability :

It was depicted from the Table 2 that AN_6 and PN_6 were more dimensionally stable in warp direction as compared to CN_3. The mean value of shrinkage of CN_3

Table 1 : Union fabric costing

Union fabrics		Nettle Yarn required per meter fabric (g)	Cost of Nettle yarn used (Rs.)	Yarn required per meter fabric (g)	Cost of yarn used (Rs.)	Warping cost per meter (Rs.)	Weaving cost per meter (Rs.)	Finishing cost per meter (Rs.)	Cost of fabric per meter (Rs.)
Pure nettle fabric	(6Nm)/(6Nm)	700	500	-	-	100	200	100	900
Cotton/Nettle	(2/20)/(6Nm)	250	188	280	50	100	200	100	638
	(2/24)/(6Nm)	250	188	300	59	100	200	100	647
Acrylic/Nettle	(2/24)/ (6Nm)	250	188	300	59	100	200	100	647
	(2/32)/ (6Nm)	250	188	300	59	100	200	100	647
Polypropylene/	(single ply)/ (6Nm)	250	188	370	75	100	200	100	663
Nettle	(2/120)/ (6Nm)	250	188	370	75	100	200	100	663

Table 2 : Effect of yarn count on physical properties of union fabrics

Physical parameters	Union fabric codes																	
	CN_1	CN_2	CN_3	CN_4	CN_5	CN_6	AN_1	AN_2	AN_3	AN_4	AN_5	AN_6	PN_1	PN_2	PN_3	PN_4	PN_5	PN_6
Fabric weight (g/m^2)	286.5	298.55	335.35	286.7	283.45	355.95	297.05	331.65	330	306.7	393.3	350.65	301.1	368.9	393.15	363.8	342.9	365.8
Fabric thickness (mm)	1.395	1.645	1.81	1.26	1.53	1.755	1.685	1.47	1.735	1.275	1.91	1.855	1.19	1.775	1.875	1.85	1.78	1.935
Shrinkage (%)																		
Warp	(-)4.1	(-)3.1	(-)1.0	(-)2.0	(-)2.3	(-)0.2	(+)0.4	(-)1.3	(+)0.6	(-)1.2	(-)1.8	(+)0.3	(+)1.9	(+)1.6	(+)0.6	(-)1.3	(-)2.8	(-)0.5
Weft	(-)1.2	(-)1.7	(-)1.7	(-)1.1	(-)2.1	(-)4.2	(-)0.3	(-)4.1	(-)4.1	(-)0.4	(-)1.1	(-)3.1	(-)2.7	(-)2.2	(-)4.1	(-)2.1	(-)0.4	(-)3.5

*=[2/20x6= Plain (CN_1), Twill (CN_2), Basket (CN_3), 2/24x6= Plain (CN_4), Twill (CN_5), Basket (CN_6)]
*=[2/24x6= Plain (AN_1), Twill (AN_2), Basket (AN_3), 32/2x6= Plain (AN_4), Twill (AN_5), Basket (AN_6)]
*= [single plyx6= Plain (PN_1), Twill (PN_2), Basket (PN_3), 2/120x6= Plain (PN_4), Twill (PN_5), Basket (PN_6)]

Table 3 : Effect of yarn count on mechanical properties of union fabrics

Mechanical parameters	Union fabric codes																	
	CN_1	CN_2	CN_3	CN_4	CN_5	CN_6	AN_1	AN_2	AN_3	AN_4	AN_5	AN_6	PN_1	PN_2	PN_3	PN_4	PN_5	PN_6
Breaking Strength (kg/sq.cm)																		
Warp	310.97	266.7	295.3	323.9	346.9	409.5	337.2	356.6	246.7	424.7	419.9	388.3	182.5	215.5	158.42	431.7	435.4	450.9
Weft	298.5	410.2	353.5	279.6	212.2	248.9	345	427.8	409.3	408.4	421.2	348.5	2158.1	3033.2	2087.8	545.9	615.6	567.7
Abrasion resistance (cycles)	1092	1060	1173	1242	1061	1311	1063	1704	869	1235	1204	1100	2683	1722	1115	1539	1205	1322

*= [2/20x6= Plain (CN_1), Twill (CN_2), Basket (CN_3), 2/24x6= Plain (CN_4), Twill (CN_5), Basket (CN_6)]
*=[2/24x6= Plain (AN_1), Twill (AN_2), Basket (AN_3), 32/2x6= Plain (AN_4), Twill (AN_5), Basket (AN_6)]
*= [single plyx6= Plain (PN_1), Twill (PN_2), Basket (PN_3), 2/120x6= Plain (PN_4), Twill (PN_5), Basket (PN_6)]

fabric was (-) 1.0 whereas for AN_6 fabrics, mean value of shrinkage was (+) 0.3 and for PN_6 fabrics mean value of shrinkage was (-) 0.5. Mean value of CN_4 was (-) 1.1, mean value of AN_1 was (-) 0.3 and mean value of PN_5 was (-) 0.4. The reason for better dimensional stability of AN_6, PN_6 fabric was more due to compact yarn and fabric structure in which less space was left for shrinkage. Less shrinkage was considered good for fitted textile products like jacket, and cushion cover.

Breaking strength :

It was observed from the Table 3 that PN_6 exhibited more breaking strength in comparison to CN_6 and AN_4 for the warp direction. In terms of warp direction, the mean value for PN_6 was 450.9 kg/sqcm whereas for CN_6 fabric was 409.5 kg/sqcm and for AN_4 fabric breaking strength was 424.7 kg/sqcm. Similarly, in weft direction also the higher mean value of PN_2 as compared to CN_2 and AN_2 resulted in higher breaking strength. It was considered good for textile products like jacket, stole, carry bag, cushion cover, rug, table runner etc.

Abrasion resistance :

The abrasion for CN_6 was persisted at 1311 cycles and AN_2 fabric persisted 1704 cycles whereas for PN_1 the abrasion was noted with the value 2683 cycles. The results depicted that the CN_6, AN_2 exhibited more abrasion resistance as compared to PN_1 (Table 3). It was considered good for textile products for personal use like jacket, rug, stole etc. and found to be durable. Due to it had non-pilling quality.

The difference in the yarn count of the developed union fabrics led to difference in fabric weight, fabric thickness, shrinkage in warp direction, breaking strength in warp as well as weft direction and abrasion resistance. AN_5, PN_6 was having more fabric weight and thickness compared to other fabrics. Dimensional stability of AN_6 was good. PN_6 fabric was more compact due to yarn and fabric structure in which less space was left for shrinkage. PN_2 was having higher breaking strength in weft direction.

Bordros and Baley (2008) also found that nettle fibres have very good tensile properties and could also be suitable as reinforcing components in composite materials.

Conclusion:

Cost of one meter pure nettle fabric was Rs. 900 and for cotton (2/20)/nettle (6Nm) was Rs. 638, cotton (2/24)/nettle (6Nm) was Rs. 647, Acrylic (2/24)/nettle (6Nm) and acrylic (2/32)/nettle (6Nm) was Rs. 647 and polypropylene (single ply)/nettle (6Nm), polypropylene (2/120)/nettle (6Nm) was Rs. 663. It is evident that the union fabric was much cheaper in cost compared to pure nettle fabric. Fabric weight of cotton/nettle union fabric (CN_6) was 355.95 g/m^2, acrylic/nettle union fabric (AN_5) was 393.3 g/m^2 and polypropylene/nettle (PN_3) was 393.15 g/m^2, respectively. Fabric thickness of PN_6 fabric was 1.935 mm which was higher than the other union fabrics. It was concluded that fabrics with higher fabric weight and thickness were good for making home textile products *viz*., rug, table runner and cushion cover because these would retain shape well, and resist slippage and folds in use. Dimensional stability of AN_6, PN_6 fabric was more due to compact yarn and fabric structure in which less space was left for shrinkage. Less shrinkage was considered good for fitted textile products like jacket, and cushion cover. CN_6 and AN_4 fabrics were found to be more durable as the breaking strength compared to PN_6 was considered good for textile products like jacket, stole, carry bag, cushion cover, rug and table runner. Fabric such as CN_6 and AN_2 exhibited more abrasion resistance compared to PN_1 and considered good for textile products for personal use like jacket, rug and stole and found to be durable. It had non-pilling quality.

Authors' affiliations:

Harinder Kaur Saggu and Kanwaljit Kaur Brar, Department of Apparel and Textile Science, College of Home Science, Punjab Agricultural University, Ludhiana (Punjab) India

■ REFERENCES

Bodros, E. and Baley, C. (2008). Study the tensile properties of stinging nettle fibres (*Uritica diocia*). *J. Composite Sci. Tech.,* **62** : 2143-2145

Barakoti, T.P. and Shrestha, K.P. (2000). Commerical utilization of *Allo* (*Girardinia diversifolia*) by the Rais of Sankhuwasabha for income generation. *J. Banko. Janakari,* **18**:18-24.

Mahapatra (2012). Processing of Himalayan nettle fibre in textile industries. *J. Colourage*, **158** : 50-52.

NITRA (2015). Northern India Textile Research Association *www.nitratextile.org* (retrieved on August 27, 2015).

UBFDB (2011). *Himalayan Nettle.* Uttarakhand Bamboo and Fibre Development Board. Uttarakhand, India.

★★★★★ 13th Year of Excellence ★★★★★