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Neps in cotton

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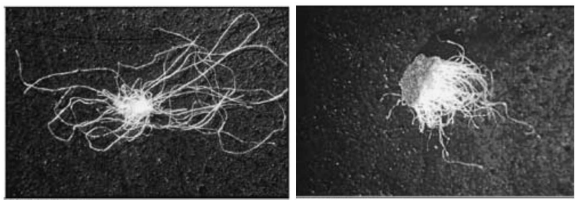
ABSTRACT: Neps and white specks are imperfections that severely decrease textile quality at the consumer level and, therefore, have immense economic consequences. Fibre properties, such as immaturity, staple length, fineness, and moisture content have been linked to the formation of neps. Variety, growing conditions, harvesting, ginning and processing contribute to the formation of neps. The goal should be to use HVI and AFIS data to recommend appropriate processing to improve yarn realization and fabric defects. When the ginner has fibre to process with a low micronaire for it's particular variety he should hold processing to a minimum. Nearly all range of cottons from 18-35mm are grown in India with maximum demand and cultivation is of *hirsutum* 28-30mm range. Roller gins are considered more suitable for ginning superior/medium long staple cotton. Different ginning systems were evaluated for neppiness in ginned cotton lint. AFIS results for fibre nep count in case of Indian double roller ginned cotton was found to be minimum around 150 with rotary knife ginning around 250 and for saw gins around 450. It was observed that ginning of conditioned seedcotton with 6 to 7 per cent moisture gives lowers nep count. Double roller gin is a gentle ginning technology where the fibre is separated by stretching method and fibre comes out in a blanket shape in straightened position, resulting in lower neps. Also, comparative trails shows that double roller gin gives higher fibre length leading to 2 per cent extra outturn, at the same time it retains natural luster of the cotton. This gin is usable for all type of cotton *i.e.* short staple not very light cottons, medium, long to extra long staples by simple adjustments of settings and retains maximum fibre length as well as natural fibre parameters.

Key words : Advanced fibre information system (AFIS), double roller gin, high volume instrument (HVI), maturity, micronaire, neps, white specks

Nep is a small knot of entangled fibres consisting either entirely of fibres (fibre nep) or of foreign matter (seed coat fragment) entangled with fibres (Fig. 1). Biological neps are typically associated with motes (malformed seed, unfertilized ovules, and dead seed), while in ginned cotton (cotton lint); they typically contain seed coat fragments (SCF). Mechanical neps are those that contain only fibres and have their origin in the manipulation of the fibres during processing. The last type is a shiny nep or white speck nep (Mehta and Combs, 1997) found on the surface of dyed fabrics, they appear as light or white spots and are seen only in the finished fabric. The formation of neps has been attributed to fibre properties such as immaturity, staple length, fineness and moisture content and to handling methods in production such as over or under beating the fibres in the carding or ginning operations (Mangialardi and Meredith, 1990). These entanglements of fibres are created during development, harvesting, ginning and yarn manufacturing phases of production (Jacobsen *et al.,* 2001). Neps can sneak up on mills. Because of low cellulose content of the undeveloped fibres, these clumps of fibres do not accept dye. Therefore, when a fabric is dyed, the mechanical and biological neps formed by immature fibres create undyed spots in the finished fabric. These undyed spots are known as white specks.



Fibre neps Seed coat neps

Fig. 1 Neps in cotton

Neps are not present in the closed cotton bolls. As soon as the cotton bolls open and the fibres blow up, dry, convolute and collapse some neps are formed. The causes for these growth neps are climatic influences, over watering, coalescence, maturity and pests. Harvesting methods also have an effect on nep formation. Hand picking gives the lowest number of neps. Cotton from first picking, produce yarn and fabric containing a lower number of the imperfections than cotton harvested in late season. This is attributed to the earlier harvest high in micronaire and more mature fibres than the later harvested cotton. Increase in impurities (*i.e.* trash) such as husk, leaf and stalk, and seed coat fragments, requires more cleaning points leading to more neps, fibre breakage, and short fibre content, decreased spinning performance and yarn and fabric quality. Neps are a very costly and sometimes rampant problem in the cotton industry. It only takes one part immature fibre per million mature fibres to ruin a fabric. Due to this problem, textile suffers monitory loss annually for the dye defects due to neps and lost product value.

Extensive research carried out during the last decade in the world more particularly in India as the cotton sector in India is progressing with high speed, significant technological advancement have taken place to improve the fundamentals of ginning to increase the outturn and to preserve the intrinsic quality of fibre obtaining the maximum length of fibre without breakage of seed, producing lint free of trash and contaminants at the lowest cost/unit ginned. The approach has been to make the process as gentle as possible and to reduce the harshness of saw gin, and to increase the productivity of roller gin. Saw gins are normally usable for upland cotton and not suitable for extra long cotton. This gin generates higher neps, reduced uniformity and increased fibre cuts. Rotobar gins are usable for long and extra long staple cotton and not usable for short staple cotton. Further, un ginned cotton goes with seed which can be partially recovered. This also causes significant seed cuts. These ginning systems were evaluated for neppiness in ginned cotton lint (Jacobsen *et al.,* 2001).

MATERIALS AND METHODS

Different ginning systems were evaluated for neppiness in ginned lint. For this Suraj and NH 615 cottons were ginned on double roller gin, rotobar gin and saw gin machines. HVI and AFIS test results were analysed for neppiness.

RESULTS AND DISCUSSION

AFIS data for fibre nep count in case of Indian double roller gin was found to be minimum around 150 with rotary knife fin value around 250 and saw gin around 450. Ginning conditioned cotton with 6 to 7 per cent moisture lowers fibre nep count. Double roller gin is a gentle ginning technology where the fibre is separated by stretching method and fibre comes out in a blanket shape in straightened position, resulting in lower neps. Also, comparative trail shows that double roller gin gives higher fibre length leading to 2 per cent extra outturn, at the same time it retains natural moisture and luster of the cotton. This gin is usable for all type of cotton *i.e.* short staple not very light cottons, long or extra long staple by simple adjustments of settings and retains maximum fibre length as well as natural fibre parameters.

The gin stand and saw cylinder lint cleaners are the major contributors to the formation of neps (Cantu *et al.,* 2007). All mechanical equipment should be monitored and kept in good repair with the recommended settings. Since fibre fineness and maturity are major factors in nepping, producers must plant cotton varieties that have good maturity (Boykin, 2008) in order to decrease the problem of neps. Nep defects are recognized only after dyeing.

Table 1. Nep studies for seedcotton with moisture percent less than 4 ginned on different ginning systems

Sr.No	Expt. with Suraj cotton	Fineness (m tex)	Maturity ratio (%)	Nep module test results			
				Fibre neps		Seed coat neps	
				Count/g	Mean size (µm)	Count/g	Mean size (µm)
1	S1	140	0.82	532	675	49	1,305
	S2	148	0.82	291	673	26	1,432
	S3	145	0.8	541	691	47	1,287
	Avg.	**144**	**0.81**	**455**	**680**	**41**	**1341**
2	DR1	151	0.84	147	629	22	1,317
	DR2	146	0.85	165	623	11	1,084
	DR3	142	0.84	157	619	28	1,374
	Avg.	**146**	**0.84**	**156**	**624**	**20**	**1258**
3	R1	147	0.84	212	664	28	1,133
	R2	124	0.76	345	649	36	1,256
	R3	149	0.86	196	662	26	1,144
	Avg.	**140**	**0.82**	**251**	**658**	**30**	**1178**

AFIS test report (ASTM D-5866:1995) of cotton lint ginned on Saw gin = S1, S2, S3; DR gin = DR1, DR2, DR3 and Rotobar gin = R1, R2, R3

Table 2A. Nep studies for ginning of moisture conditioned cotton on different ginning systems

Trail with NH 615	Fineness (m tex)	Maturity ratio (%)	Nep module test results			
			Fibre neps		Seed coat neps	
			Count/gm	Mean size(µm)	Count/gm	Mean size(µm)
Saw gin M 4	141	0.8	402	658	32	1255
DR gin M 4	154	0.83	99	641	13	1335
DR gin M 6	153	0.84	93	640	17	1349
Rotobar gin M 4	140	0.79	193	633	17	1242

Hence the goal should be to use HVI and AFIS data to recommend appropriate processing to improve productivity and minimize yarn and fabric defects. When the ginner has fibre to process with a low micronaire for it's particular variety he should hold processing to a minimum. Also, for pre cleaning such seed cotton recommended moisture in cotton is 5 per cent and cylinder cleaners should be used instead of saw type cleaners.

Table 2B. Experimental trail with Suraj cotton

Trail with Suraj	Fineness (m tex)	Maturity ratio (%)	Nep module test results			
			Fibre Neps		Seed coat neps	
			Count/gm	Mean size(µm)	Count/gm	Mean size(µm)
Saw gin M 4	128	0.8	477	675	23.8	1229
DR gin M 4	142	0.85	140	648	15.7	1298
DR gin M 6	132	0.81	131	662	14.7	1085
Rotobar gin M 4	118	0.78	274	647	26.5	1230

M= Moisture percent in cotton; Upper half mean length (UHML) of Suraj = 30 mm; Micronaire (MIC) = 3.2; UHML of NH 615 = 28 mm; MIC = 3.7

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