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CONTROL OF LAP AND CARD SLIVER EVENNESS AND CARD WEB NEPS WITH MECHANICAL VARIABLES AT SCUTCHER

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Different setting points of scutcher i.e. feed roller to krischner beater, krischner beater to stripping rail and grid bar gauges were changed and their effect on lap evenness, card sliver evenness, and card sliver neps was observed. It was noted that feed roller to krischner beater and krischner beater to stripping rail for evenness and all the setting points for sliver neps showed highly significant differences in the mean values for different settings.

Key words: lap evenness, scutcher settings, sliver evenness

INTRODUCTION

Cotton delivered by the opening machinery to the scutcher is well opened and usually arrives in the form of large tufts. Scutching is a process of cleaning by striking the cotton from a pair of rolls to a rapidly revolving beater after which it is formed into a continuous sheet of small tufts of cotton, held together by compression. The objectives of the scutching operation are: first, to continue the opening of the cotton even further than has already been done; second, to clean the cotton of more of the heavier dirt and undesirable short fibres; third, to form this cleaned cotton into a continuous sheet called a "Lap"; and fourth to make this lap as uniform as possible. The scutcher section may be classified as: feed unit, beater section, screen section and lap head. With improvements in trash extraction at earlier stages of processing, the extraction of trash at scutcher has been of less importance than making a uniform well textured lap.

Khan (1972) found that regularity of sliver is dependent upon the uniformity of scutcher lap. Shrigley (1973) reported that incorrect setting of stripping rail is detrimental to lap regularity. Ratnam and Seshan (1987) mentioned that the short term variation in card sliver contributes 3.2% of the total, provided the sliver is regular. Variation introduced by cards together with the variation in blow room, a major part of this variation, can be attributed to blow room. Almashouley (1988), reported that inadequate settings and inadequate feedings are the sources of variation in weight per yard of lap. Alan and Alexander (1988) pointed out that processing of fibres tends to produce neps through a stress build up/sudden release mechanism which induced buckling along the fibre length. Ali (1998) reported that calender rolls pressure. kirschner beater gauges and kirschner beater speed mainly influenced the lap weight variation. He also recommended that CV of meter to meter lap weight be strictly controlled and maintained at level less than 2%. Anonymous (1999) recommended that distance between stripping rail and the kirschner beater should be 2mm. In case. distance between rail and beater is greater, this will badly influence flow of material and cause soft lap. Robert et at. (2000) observed that considerable amounts of short fibre content. created in production and processing, are removed in the combing process. This study was undertaken to determine the effect of different setting points of scutcher on lap and card sliver evenness and card sliver neps.

MATERIALS AND METHODS

Lint cotton samples of Punjab American cotton variety MNH-93 were collected from the running material at M/S Nishat Mills Ltd., Faisalabad. The raw cotton samples were subjected to following physical tests:

Spinning Procedure: The samples were processed at Ohara Hergath blow room line (Model 1988) with the following changes at scutcher in blow room.

i. Feed roller to kirschner beater gauge: F_1 =3 mm, F_2=5 mm, F_3= 7 mm
ii. Kirschner beater to stripping rail gauge: S_1=2 mm. S_2=3 mm, S_3=4 mm
iii. Kirschner beater grid bar gauge: G_1=5 mm, G_2= 7 mm, G_3= 9 mm

After every change at scuther, the samples from laps were collected and tested for the basic fibre characteristics along with the following lap quality evaluation tests:

Lap Evenness: This is yard to yard weight variation of lap and was determined by cutting it into one yard pieces then weighing each piece in grams on the weighing scale and in this way the coefficient of variation was calculated.

Sliver Evenness: Sliver evenness (U%) was determined on Uster Tester-III according to the procedure supplied by the manufacturer, M/S Zellweger Ltd. (1995b). Uster Tester speed was set at 25 meter per minute for each test.

Card Web Neps: Neps were counted by AFIS-N according to the instructions laid down in its operational manual supplied by M/S Zellweger Ltd. (1992), Switzerland.

Three factor factorial completely randomized design was applied for testing differences among various quality characters evaluated in this study. Duncan's multiple range test was applied for individual comparison of means among various quality characteristics as suggested by Steel and Torrie (1980). The data were subjected to statistical manipulation on computer employing M-Stat computer programme designed by Freed (1992).

RESULTS AND DISCUSSION

Lap Evenness :The results pertaining to lap evenness are shown in Table I. This Table shows that the effect of feed roller to beater gauges, beater to stripping rail gauges and interaction F x S generate highly significant differences among mean values. The results in respect of SxG interaction also showed significant differences, while the effect of rest of gauge and interactions on lap evenness was non-significant. .

The individual mean values of lap evenness recorded the best value as 0.80% at F_2 followed by 0.87 and 0.93% for F_3 and F_1 respectively while these gauges significantly differed in their mean values. Above results show that the setting F_2 gives minimum lap. Similar views are given by Almashouley (1988), who reported that inadequate settings and inadequate feedings are the sources of variation in weight per yard of lap, while Ali (1998) reported that ealender rolls pressure, kirschner beater gauges and kirschner beater speed mainly influenced the lap weight variation. He also recommended that CV of meter to meter lap weight be strictly controlled and maintained at level less than 2%.

The comparison of individual means for beater to stripping rail gauges recorded the best value of 0.65% CV for SI followed by 0.85 and 1.10 % S2 and S3 respectively and recorded significant differences between the individual means. These results coincide with those of Anonymous (1999) which recommended that distance between stripping rail and the kirschner beater should be 2mm. In case, distance between rail and beater is greater, this will badly influence flow of material and cause soft lap. Likewise Shrigley (1973) reported that incorrect setting of stripping rail is detrimental to lap regularity. In case of grid bar gauges, the order for grid bar settings G_3, G_2 and G I was recorded as 0.85. 0.87 and 0.88 % respectively. These results indicated that the means of grid bar gauges recorded non-significant differences with respect to individual means.

Sliver Evenness: The results pertaining to the sliver evenness are given in Table 2. This Table showed that the effect of feed roll to beater gauges, beater to stripping rail gauges and interaction F x S was highly significant.. However, grid bar gauges and remaining interactioris were found to have non-significant effect.. The individual mean values for sliver evenness between feed roller to beater gauges were recorded as 3.88, 4.12 and 4.28 % for F_2, F_3 and F_1 respectively. Present results indicated significant differences among the individual means. These results are in line with those of Khan (1972) who found that regularity of sliver is dependent upon the uniformity of scutcher lap, while Ratnam and Seshan (1987) stated that the short term variation in card sliver contributed 3.2% of the total, provided the sliver is regular.. Variation introduced by cards is in addition to the major variation caused in blow room.

The comparison of individual mean values for beater to stripping rail gauges is shown in Table I. The best value of sliver evenness (3.31%) for SI was followed by S2 and S3 with respective means of 4.17 and 4.80%. These values showed significant differences among individual means indicating that the close gauge SI gave the best results for lap uniformity than for sliver uniformity, since the variation in lap leads to the variation in card sliver.. These results get support from Merill (1960) who recommended that the stripping rail must be close enough to beater.. Shrigley (1973) reported that incorrect setting of stripping rail is detrimental to lap regularity. Khan (1972) found that regularity of sliver is dependent upon the uniformity of scutcher lap.

Comparison of individual means for grid bar gauges are shown in Table 2a. The individual mean values for grid bar gauges were 4.05, 4.10 and 4.13 % for G", G_1 and G_2 respectively, indicating that there was no effect of grid bar gauges on the regularity of card sliver..

Card **Web** Neps: The results pertaining to card web neps for different settings at scutcher in blow room are shown in Table 3. The results revealed that the effect of feed roller to beater gauges, beater to stripping rail gauges. grid bar gauges and interactions F x Sand S x G are highly significant, while interactions F x G and F x S x G differed significantly.

Duncan's multiple range test for comparison of individual means of card web neps for feed roller to beater gauges are shown in Table 1. The minimum web neps are recorded at F_2 followed by F_3 and F_1 with their respective means as 80.17, 88.03 and 94.08 neps per gram. These results indicated that close gauge produced more fibre breakage and neps. Similar were the findings of Wegener (1980) who reported that neps originated from growth, harvesting, ginning, and processing and are often formed form fibre breakage. causing the fibre to coil itself, thus involving other fibres in its recoiling and producing entanglements. Similarly, Dever et at (1988) observed that neps are formed by increased aggressive cleaning. However. Alon and Alexander (1978) pointed out that processing of fibres tends to produce neps through a stress build up/sudden release mechanism which induces buckling along the fibre length.

The comparison of individual means for beater to stripping rail, gauges generated the minimum number of neps for SI followed by S2 and S3 as 69.69,88.94 and 103.65 neps per gram respectively. However, the individual means significantly differed from each other.. These findings are supported by Shrigley (1973) who found that the stripping rail setting is the most important, since a setting that is too wide may permit the cotton to pass around with the beater instead of being discharged, thereby creating neps and flocking, whereas Stead man (1997) reported that neps seldom appear in boil, but every processing stage has the potential to be susceptible to fibre aggregation. When properly managed, both carding and combing can remove more neps than generated.

In case of grid bar gauges, the minimum number of neps was recorded at G_3 followed by G_2 and G I with their respective mean values as 85.11, 87.36 and 89.81 neps per gram. indicating significant differences between the individual means. More opening of grid bars generates more cleaning and less neps. Sheikh (1997) reported that an increase in seed, trash particles in cotton is associated with higher nep content.. Herbert et at (1986) observed that three types of neps are present in cotton: i) entanglement with seed coat fragment, ii) entanglement with trash, and iii) non-fibrous material entanglement, while Harrison and Barge/on (1986) observed that neps are important in determining the quality of final product of cotton fabrics. Fibre characteristics and processing conditions are two factors that affect the nep formation.

Conclusion: The study showed that too wide stripping rail setting with the beater may permit the cotton to pass round and round with the beater instead of being discharged which damages the fibres and generates neps, thus the rail must be close enough for proper functioning.

Table 1. Analysis of variance for lap evenness, sliver evenness and card web neps

Source	D.F.	Prob.	Prob.	Prob.
F	2	0.0000**	0.0000**	0.0000**
S	2	0.0000**	0.0000**	0.0000**
G	2	0.0645'J~		0.0000**
FxS	4	0.014*	0.0082N~	0.0000**
FxG	4		0.3290N~	0.0134*
SxG	4	0.0488^{NS}	0.0644N~	0.0046**
FxSxG	8		0.0937^{NS}	0.0170*
Error	81			
Total	107			

**= Highly significant; * = significant; NS= non-significant.

Table la. Comparison of individual means oflap evenness

Feed roller 10 beater gauge	Mean	Beater to stripping rail group	Mean	Grid bar gauges	Mean
1'1	0.93 a	SI	0.65 c	G_1	0.88
F2	0.80 c	S2	0.85 b	G2	0.87
1',	0.87 h	S,	1.10 a	G_3	0.85

Any two means sharing a letter do not differ significantly at P = 0.05.

Table Ib. Comparison of individual means of sliver evenness

Feed roller to beater gauge	Mean	Beater to stripping rail group	Mean	Grid bar gauges,	Mean
F_j	4.28 a	SI	3.31 c	GI	4.10
F2	3.88 c	S2	4.17 b	Gz	4.13
F_3	4.12 b	S3	4.80 a	G3	4.05

Any two means sharing a letter do not differ significantly at P = 0.05.

Table 1c. Comparison of individual means of card web neps

Feed roller to beater gauge	Mean	Beater to stripping rail group	Mean	Grid bar gauges	Mean
1'1	94.08 a	Sl	69.69 c	GI	89.81 a
1'2	80.17 c	S2	88.94 b	G2	87.36 b
1'3	88.03 b	SJ	103.65 a	G_3	85.11 c

Any two means sharing a letter do not differ significantly at P=0.05.

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concentration of a carbon source was 1% (w/v). The isolates were streaked on plates in triplicate and the presence or absence of their growth was observed after 3-5 days.

RESULTS AND DISCUSSION

The average nodule number formed by alfalfa plants in different treatments inoculated with Rhizobial strains indicated significant differences among themselves (Table I). The maximum number of nodules per plant was recorded for alfalfa plants inoculated with MS-I. It was significantly higher than with all other treatments inoculated with local Rhizobial strains but at par with those receiving TAL-1373 (exotic strain) inoculation. In alfalfa plants receiving MS-2, MS-3, and MS-4 inoculation, average number of nodules per plant was significantly less than that of TAL-1373 and was recorded as 4, 5, and 3 respectively. Nevertheless, alfalfa plants in the control (un inoculated) treatment did not cause nodulation. Nelson (1987) inoculated pea plants with isolates of high and low effectiveness which resulted in significantly different number of nodules per plant.

Among the treatments involving inoculation with local strains, the maximum fresh weight (5.6 mg) of nodules per plant, significantly higher than those of all other treatments was recorded for MS-I. Fresh weight of nodules per plant in MS-2, MS-3 and MS-4 inoculated plants differing non-significantly from each other was recorded as 2.63, 2.83 and 2.67 mg respectively. However, in all local Rhizobial strain inoculated plants, fresh nodule weight per plant was significantly less than that of TAL-1373 (exotic strain).

Nodule dry weight per plant ranged from 1.17 mg (MS-2) to 3.53 mg (MS-I). However, the differences between the nodule dry weights of MS-2 and MS-3 were non-significant. Similarly, nodule dry weight in MS-3 and MS-4 inoculated alfalfa plants also differed non-significantly.

Nitrogenase activity of alfalfa nodules ranged from 1.69 nmole C_2H_4 h^{-1} (MS-3) to 2.83 nmole C_2H_4 h^{-1} per plant. The maximum nitrogenase activity in MS-I inoculated alfalfa strains was, however, at par with those inoculated with MS-4 and TAL- 1373. The intermediate position for nitrogenase activity, significantly higher than that of MS-3 (minimum value), was recorded for MS-2 inoculated alfalfa plants. Similar results have been reported by Nelson (1987). Specific nitrogenase activity of alfalfa plants varied from 266 nmole C_2H_4 h^{-1} g^{-1} (MS-I) to 673 nmole C_2H_4 h^{-1} g^{-1} dry weight (MS-4) of nodules. In MS-2, MS-3 and MS-4 inoculated alfalfa plant nodules, specific nitrogenase activity was significantly higher than that observed for TAL-1373 and the differences among themselves were also significant. Nonetheless, in MS-I treated plants specific nitrogenase activity was significantly less than that of TAL-1373. These findings have been supported by Ahmadi and Yazdi (1994) and Roomi et al. (1994).

Isolates varied greatly in the utilization of different carbon sources (Table 2). The indigenous Rhizobial strains MS-l and the exotic strain TAL-1373 showed full growth in

Table I. Effect of Rhizobial inoculation on growth, nodulation and N_2 fixation in alfalfa plants

Strains	No.of nodules/ plant	Fresh weight of nodules/ plant (mg)	Dry weight of nodules/ plant (mg)	ARA nmoles $C_2H_4h^{-1}$	ARA nmole $C_2H_4h^{-1}$ g^{-1} dry weight of nodules
MS-l	8 a*	5.60 b	3.53 a	2.83 a	266 e
MS-2	4 bc	2.63 c	1.17 d	2.26 b	646 b
MS-3	5 b	2.83 c	1.33 cd	1.69 c	424 c
MS-4	3 c	2.67 c	1.40 c	2.83 a	673 a
TAL-1373	8 a	6.00 a	3.13 b	2.83 a	300 d
Control (un-inoculated)	0	0	0	0	0

*: Treatment means sharing the same letters differ non-significantly.

Table 2. Utilization of various carbon sources by different Rhizobial strains isolated from alfalfa plants

Strains	A	Gal	Glu	Mal	Man	R	S	X	Mol
MS-I	+++	+++	+++	+++	+++	+++	+++	+++	+++
MS-2	+	+	+	+++	+++	+++	+	+	+++
MS-3	+++	+++	+++	+++	+++	+++	+	+++	+++
MS-4	+	+	++	+++	+++	+++	+	+	+++
TAL-1373	+++	+++	+++	+++	+++	+++	+++	+++	+++

A: arabinose; Gal: galactose; Glu: glucose; Mal: maltose; Man: mannitol; R: raffinose; S: sucrose; X: xylose; Mol: molasses; +: poor growth; ++: moderate growth; +++: excellent growth.

response to all. carbon sources tested in this study. MS-3 also showed excellent growth for all carbon sources except sucrose. However, MS-2 and MS-4 behaved alike and showed excellent growth in maltose, mannitol, raffinose and molasses. In glucose, MS-4 showed moderate growth while for carbon sources i.e. arabinose, galactose, sucrose and xylose both MS-2 as well as MS-4 exhibited poor growth. During a similar study, Sadowsky et al. (1983) and Anand and Dogra (1991) observed that fast growing Rhizobial strains utilized a wider variety of carbohydrates than the slowly growing strains. ~Hafeez et al. (1993) and Moawad and Bahlool (1993) also utilized different carbon resources as a helpful tool to characterize the isolates.

Although the Rhizobial strains isolated from alfalfa plants varied greatly in their nodulation, nitrogenase activity and utilization of different carbon sources, yet some of them were found almost efficient in terms of these characteristics as the exotic strain TAL-1373. Further exploration and characterization of efficient Rhizobial strains for practical use and introduction in different agro-ecosysterns is still desired.

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