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NEW GINNING TECHNIQUES FOR IMPROVING FIBER QUALITY Ginning is a process for removing cotton fiber from the seed. The fiber is used in textile manufacturing while the seed is processed through a crushing mill to extract oil from it. This is used in cooking, after the gossypol has been removed. (Gossypol is a phenolic pigment, $C_{30}H_{30}O_8$, present in most cottonseed. It is toxic to some animals, including humans. It is removed by the oil recovery process, but remains in cottonseed meal. Some varieties of cotton do not contain gossypol. These are referred to as "glandless" cottons.) Linters, the very short fibers remaining on the seed after ginning are a pure base of alpha-cellulose, and when removed can be used for a number of products including plastics, explosives, and in the past the manufacture of rayon. Additionally, the body of the seed is high in protein and can be used in a variety of foods, once again after it has been purified.

Over the years, there have been many questions about ginning, these often coming from textile manufacturers. Suggestions have been made that too much ginning damages the fiber, reduces its length, lowers its length uniformity, and creates a high percentage of short fibers. As producers have gone to more productive harvesting methods, the amount of trash arriving at the gin with the cotton has increased. This in turn has led to the use of machines called lint cleaners, which remove leaf particles, stems and other foreign material from the fiber after ginning. While a certain amount of cleaning is necessary, care is taken not to over-work the fiber. We have evaluated cottons coming from varying amounts of cleaning and have noted the fiber properties and spinning performance. We do not intend to report on that at this time, but will simply comment that it would seem very difficult to gin cotton that will satsify everyone involved with it.

In the annual report on research conducted for the Natural Fibers and Food Protein Commission of Texas (NFFPC) in 1987, we prepared a review of a study of the fiber properties and spinning performance from cottons that had been ginned by three different methods. These were conventional saw ginning, selective ginning, and residual ginning. Selective ginning is reported to be an experimental process designed to remove only the longer fibers from the seed. Residual ginning is a second passage through the saw gin to remove the remaining fibers having textile quality. This method was developed by L. H. Wilkes, agricultural engineer at the Texas A&M Experiment Station, College Station, Texas, in cooperation with Cotton Incorporated. Dr. Wilkes, Dr. K. E. Watkins, and Dr. W. F. Lalor, director of agricultural research for Cotton Incorporated, reported on this development at the Beltwide Cotton Production Research Conference in Dallas, Texas on January 4, 1987.

An evaluation of the fiber coming from the three ginning procedures was conducted at the International Center for Textile Research and Development. Seed cotton from California was supplied to Texas A&M's Agricultural Engineering Department at College Station where it was all processed through the same sequence of cleaning machinery before ginning. Afterward, a small quantity was saw-ginned and given one lint cleaning treatment. This was done simply to provide enough fiber for testing. The remaining seed cotton was passed through the selective ginning process, removing 51.4% of the fiber which was then passed through a single lint cleaner. After selective ginning, the same seed cotton was carried through a standard saw gin and a single lint cleaner to give the cotton referred to as residual lint in this report. Therefore, the study involved: (1) cotton that had been removed from the seed by standard saw ginning; (2) other fiber obtained by selective ginning; and (3) the final fiber coming from residual ginning.

The three lots were tested by individual instruments such as the Stelometer, Fibrograph, Fibronaire, Shirley Analyzer, and the Pressley Tester. Additionally, the Peyer AL-101, the IIC/Shirley Fineness/Maturity Tester, and the Motion Control HVI system were used for further evaluation. Table I gives the average values of the testing by the various instruments. As might be expected, residual ginning gave the shortest length, the lowest length uniformity, and the highest percentage of short fibers. It is interesting to note that the micronaire and fineness values for the selective-ginned cotton were lower than those of the

TABLE I: FIBER PROPERTIES

Property	Gin Treatment		
	Saw-Ginned	Selective	Residual
Individual Instruments			
Tenacity (g/tex) (g/tex)	32.37	34.01	32.87
Elongation (%)	5.14	5.11	4.83
2.5% Span Length (in)	1.168	1.164	1.119
Uniformity Ratio (%)	48.1	48.3	47.2
Short Fiber Content (%)	0.83	0.74	2.04
Micronaire Value	4.06	3.80	4.48
Non-Lint Content (%)	2.45	3.18	2.19
Pressley Strength (MPSI)	112	112	115
Peyer AL-101			
Upper Quartile Length (in)	1.157	1.207	1.123
Mean Length (in)	0.950	1.017	0.893
CV% of Length	29.1	25.9	33.6
Short Fiber Content (%)	8.2	5.1	13.6
IIC/Shirley F/MT			
Micronaire Value	4.13	3.90	4.43
Maturity (%)	88.3	87.5	94.0
Fineness in Millitex	154	146	158
Standard Fineness (mtex)	145	146	144
HVI Data			
Strength (g/tex)	31.0	32.0	29.7
Elongation (%)	4.23	4.17	4.13
Length (in)	1.140	1.153	1.103
Length Uniformity (%)	84	83	82.7
Micronaire	4.0	3.8	4.3
Leaf	2	2	2
Reflectance, R_d (%)	79	78	78
Yellowness, +b	7.6	7.3	7.9

TABLE II: ROTOR SPINNING TRIAL RESULTS

SLIVER	45 gr/yd Finisher Drawframe		
Machine	Schlafhorst Autocoro		
Nominal Yarn No. (N_e)	30		
Rotor Type	G 33		
Rotor Speed (rpm)	90,000		
Opening Roller Type	OB20		
Opening Roller Speed (rpm)	7,000		
Draft	163.9		
Twist Multiplier (α_e)	4.30		
Yarn Speed (yd/min)	106		
Navel	KN4 + O/TS		
Ambient Conditions	75°F/55% RH		
Duration (Total km. yarn)	314.3	314.4	10.0
GIN TREATMENT	Saw-Ginned	Selective	Residual
YARN PROPERTIES			
Skein Test:			
Yarn Number (N_e)	30.23	30.49	30.47
CV% of Count	1.0	1.1	1.2
Count-Strength-Product	2485	2454	2243
CV% of CSP	2.5	2.3	2.5
Single Yarn Tensile Test:			
Tenacity (g/tex)	16.35	16.59	14.97
Mean Strength (g)	319	321	290
CV% of Strength	7.5	8.7	9.4
Elongation (%)	5.72	5.91	5.54
CV% of Elongation	6.4	6.8	7.0
Spec. Work Rupture (g/tex)	0.443	0.466	0.397
CV% of Work of Rupture	12.1	13.4	14.3
Initial Modulus (g/tex)	238	224	215
Uster Evenness Test:			
Non-Uniformity (CV%)	16.25	16.62	16.93
Thin Places/1,000 yds	86	82	97
Thick Places/1,000 yds	214	335	316
Neps/1,000 yds	597	973	881
Hairs/100 yds	342	374	322
PERFORMANCE			
Number of Breaks	47	52	22
Break Rate/1,000 km	150	165	2200
Break Rate/1,000 R.hr	870	963	XS

other two cottons. Another point that attracted our attention was that while the strength of all three lots was quite good, the Stelometer gave a higher reading than the HVI equipment. In most of our testing we have found the opposite to be true.

After the fiber was tested at the International Center, it was processed through carding and two processes of drawing prior to rotor spinning. Data developed from the spinning portion of this program are presented in Table II. It will be seen that although selective ginning gave a slightly longer fiber with a lower percentage of short fibers, neither spinning performance nor yarn quality was really improved. Both the saw-ginned and selective-ginned cottons spun better with fewer ends down than the residual lint. The strengths of these two were approximately the same, the count-strength-product was slightly better for the saw-ginned cotton, while the single-strand tenacity was marginally higher for the selective-ginned fiber. The Uster uniformity measurement was slightly better for the saw-ginned cotton.

TABLE III: BREAK RATE ANALYSIS

GIN TREATMENT	Saw-Ginned	Selective	Residual
Total Rotor hours	54.0	54.0	1.7
Total Length spun (km)	314.3	314.3	10.0
Sliver Breaks	0	0	0
Trash-related:			
Bark	0	3	0
Seed coat	28	35	17
Trash	2	1	0
Entanglement-related:			
Nep	2	1	0
Slub	6	4	1
Unknown	6	6	4
Uninspected	2	1	0
Mechanical	0	0	0
Foreign matter	1	1	0
Total Sliver	0	0	0
Total Trash	30	39	17
Total Entanglement	8	5	1
Total Unknown, Uninspected	8	7	4
Other	1	1	0
Spinning: Total	46	51	18
Breaks per K.R.hr.	852	844	XS
Breaks per Mm	146	162	1800
Overall: Total	47	52	22
Breaks per K.R.hr.	870	963	XS
Breaks per Mm	150	165	2200

Table III shows the break-rate analyses for the three cottons. The saw-ginned and selective-ginned cottons were spun for 54 rotor hours, but the residual-ginned fiber had such an excessive number of breaks that the spinning time was only sufficient to give yarn for testing. It is interesting to note that the selective-ginned cotton had the greatest number of yarn breaks due to seed coat fragments. The limited amount of spinning for the residual lint cannot be used for comparison, but still there seemed to be more seed coat fragments in the selective-ginned cotton than in the saw-ginned fiber.

Conclusions drawn from our investigation were as follows:

1. In general, the fiber obtained from selective ginning was longer but lower in fineness and micronaire values than either the conventional saw-ginned lint or that coming from residual ginning.
2. The fiber resulting from residual ginning was shorter with lower uniformity and a higher micronaire value than either of the other two cottons.
3. The short fiber content in the saw-ginned and residual-ginned cottons was higher than that obtained from selective ginning.
4. There was some improvement in the quality of the cotton obtained by selective ginning, but this seemed to be marginal at best.
5. Selective ginning apparently did not reduce the number of seed coat fragments which would produce interruptions at spinning.
6. Selective ginning did not improve spinning performance or yarn quality as expected, and, in fact, offered little improvement over the saw-ginned sample of the same variety.

While we feel the results reported here are indicative of the cotton fiber quality coming from experimental selective ginning, we understand that additional research is in progress. We were told, since beginning preparation of this article, that a similar investigation is underway at a location in the mid south. It will be interesting to learn of advancements in this type of ginning that will improve fiber quality and spinning performance.

Our study of the three ginning procedures was sponsored by the Natural Fibers and Food Protein Commission of Texas. The cotton used in this program was donated by Dr. H. B. Cooper, cotton breeder from Bakersfield, California. As noted earlier, ginning was performed at Texas A&M University. The research at the International Center was supervised by John B. Price, assistant director.

COMMUNICATION CHANGES It has always been our desire to maintain the best communication possible with our many friends around the world. We have done this by postal service, telephone, telex and telefacsimile, and as far as we know, we have been able to provide good service to all locations.

We have used a telex system for some time and our telefacsimile unit was installed last year when we moved to our present facility. Since the FAX has been in service, our telex communications have all but stopped. As we try to keep our expenditures as low as possible, we have decided to terminate telex service directly into our offices.

We still may be contacted by telex by using the Texas Tech Book Store telex system. Any telex communication will be forwarded to us. Many of our friends have used this in the past. That telex number is 744451 and the answerback is TX BK ST LBK.

Please note that our telephone and telefacsimile numbers remain the same as they have been. These are:

Telephone: 806/747-3790
Telefacsimile: 806-747-3796

And, to repeat, the Texas Tech Book Store telex number: 744451 (TX BK ST LBK).

VISITORS Visitors to the International Center for Textile Research and Development during June included Kurt Stirnemann and Urs Meyer, Machinenfabrik Rieter AG, Winterthur, Switzerland; Dan Stokes, Rieter Corporation, Spartanburg, SC; Franco Tavasani, American Savio Cororation, Charlotte, NC; Helmut Deussen and Mike Rodriguez, American Schlafhorst Co., Charlotte, NC; Robert L. Hale, Joe Don Long and Autry Moore, ACG Textile Division, Littlefield, TX; Lynn McDonald, Stoneville Pedigreed Seed Co., Stoneville, MS; Charles Peyton Rushing, Houston, TX; Kenneth Taylor, Rovetex AG, Zug, Switzerland; James Calvin Pigg, Southwest Farm Press, Dallas, TX; Mark E. Carr and Robert Sallavanti, Gentex Corporation, Carbondale, PA; Stephen R. Oakley, California Planting Cotton Seed Distributors, Shafter, CA; R. M. Gasela, Zimbabwe Cotton Marketing Board, Harare, Zimbabwe; Lu Huotian, Nandong Textile Institute, Nandong, People's Republic of China; and Wang Shichao, Jinan, Shandong, PRC.

In addition to these, fifty-three members of 4-H clubs in counties near Lubbock and twenty students from area high schools came to the Center for tours.

MORE VISITORS A group of textile executives from West Germany came to the Center on June 16 for a visit and tour. Members of the group included Alfons Hols, Weberei Burghardt Vossen, Gutersloh; Hubert Jany, Spinnerei Vossen-Frottier, Jenersdorf; Manfred Kroger, Borghorster Warpspinnerei, Steinfurt; Rudolph Mueller, Schlikker & Sohne, Schuttorf; Joachim Steinhilber, BSU Textil AG, Lichtenstein/Wuertt; and Heinz Verwohlt, Christian Dierig GmbH, Augsburg. They were accompanied by Peter Scott, Cotton Council International, London, England; and David B. Collins, CCI, Washington, DC.

Coming to the Center the following week for a short course in cotton technology were four visitors from Iraq. They were Ms. Ebtesam Abid Ali, Dewaniya State Cotton Textile Establishment, Kadisiya; Adel Ibrahim Mohamad, State Establishment for Cotton Industries, Baghdad; and Hashim Abid Mohamad, Mosul Textile Factory, Mosul.

We were pleased to have these visitors at the Center.