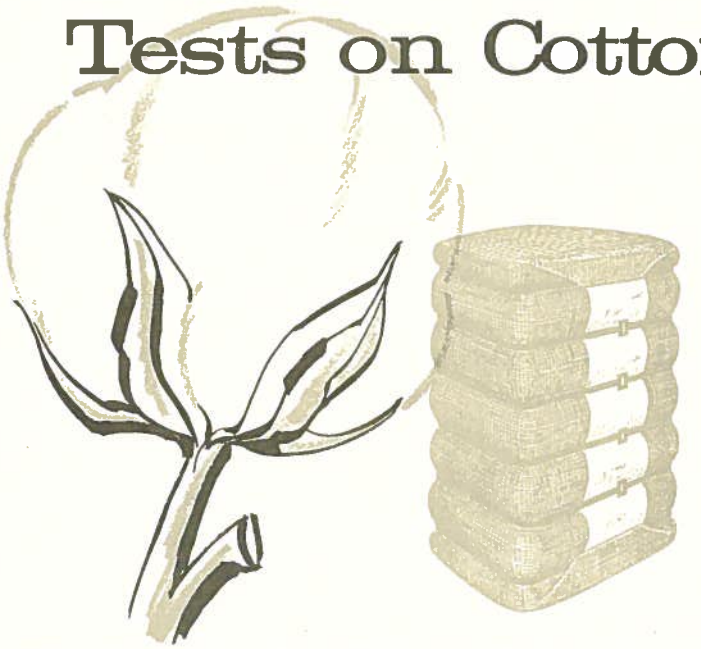
. Cotton - Testing

Cost of Performing Fiber Strength Tests on Cotton



(North Carolina. State university
Dept. of agricultural economics)

Cost of Performing Fiber Strength Tests on Cotton

R. Charles Brooks
Extension Economist, Cotton Marketing

Miscellaneous Publication No. 18
Department of Agricultural Economics
North Carolina State University

May 1965

Cost of Performing Fiber Strength Tests on Cotton

COST OF PERFORMING FIBER STRENGTH TESTS ON COTTON

R. Charles Brooks[1]

Introduction

For some time the cotton industry has recognized the importance of fiber strength as a determinant of cotton quality. Knowledge of fiber strength is being used more and more by the trade in making purchases and sales decisions. As early as 1956-57, fiber strength information was available on 1.2 million bales or 13 percent of the open market cotton bought by shippers.[2] Fiber strength was included in contracts for about 10 percent of the cotton bought by mills from shippers.[3]

Yarn strength is highly correlated with the strength of raw cotton from which it was processed. In addition, cotton with high strength usually gives less trouble in the manufacturing process. Knowledge of fiber strength for individual bales is an important aid to textile mills in the mixing and blending of raw cotton aimed at achieving a specified quality of finished material. In turn, knowledge of fiber strength is needed by merchants and shippers in order that they may supply mills with cotton of specified strength. With fiber strength information in addition to grade, staple, and fiber fineness, bales may be routed more directly from gin to textile mill.

Marketing firms, whether they be independent merchants, cooperatives, or textile mills, may perform fiber strength tests themselves or have the

---

[1]Extension Economist, Department of Agricultural Economics, North Carolina State University, May, 1965. Prepared in cooperatipn with the Cotton Division, Consumer and Marketing Service, U. S. Department of Agriculture.

[2]Use of Cotton Fiber Tests in Marketing Cotton, Southern Cooperative Series Bulletin 72, March, 1960, p. 10.

[3]Ibid., p. 14.

service performed by commercial laboratories. The major purpose of this publication is to provide information on the investment and operating costs of fiber strength testing equipment. A related purpose is to provide a method for marketing firms to evaluate better their individual situations and adopt the most economical method of obtaining fiber strength measurements, whether it be from using custom testing or establishing individual testing facilities.

Nature of Fiber Strength Tests

Fiber strength tests are generally of two types--zero gauge and 1/8-inch gauge. The zero gauge reading has been used longer and is more familiar to the industry; whereas, ". . . comparative tests have shown that the results of 1/8-inch gauge tests are more highly correlated with yarn strength than the results of zero gauge tests."[1]

Fiber strength tests are made by hand combing cotton fibers to form a flat ribbon of parallel fibers about one-fourth inch wide. These fibers are placed in a set of breaking clamps, cut to a definite length, broken in the tester and then weighed. A 1/8-inch spacer is placed between the breaking clamps to differentiate the 1/8-inch gauge from the zero gauge test.

Measurements for zero gauge results are usually given in thousands of pounds per square inch and 1/8-inch gauge results are usually given in grams per tex.[2]

---

[1] Annual Cotton Quality Survey, Washington: U. S. Department of Agriculture, Consumer and Marketing Service, Agricultural Information Bulletin No. 294, March, 1965, p. 102.

[2] A tex unit is equal to the weight in grams of 1,000 meters of the material.

Results of fiber strength tests are generally interpreted as follows:

Designation	Zero gauge (thousand pounds per square inch)	1/8-inch gauge (grams per tex)
Very low strength	Below 70	Below 19
Low strength	70 to 76	19 to 20
Average strength	77 to 83	21 to 23
High strength	84 to 90	24 to 25
Very high strength	Above 90	Above 25

Investment Costs

It was assumed that marketing firms have adequate space for establishing a fiber testing facility within their existing operation. That is, the laboratory space was already available but would need to be equipped with temperature and humidity controls and testing instruments. No distinction was made in the equipment cost or rate of work in performing zero gauge and 1/8-inch gauge fiber strength measurements.

Investment requirements are given in Table 1. Temperature and humidity control costs are based on a three-ton cooling and humidifying unit to maintain a temperature of 70 degrees Farenheit plus or minus two degrees and a relative humidity of 65 percent plus or minus 2 percent for a room 12 feet by 18 feet by 8.5 feet. The cost of training a technician includes 400 dollars for fees charged by the American Textile Manufacturers Institute for a six-week training course at Clemson University, 300 dollars for room and board, and 400 dollars for salary during the six-week training period.

Table 1. Estimated investment requirements for performing fiber strength tests on cotton[a]

Item	Investment cost
	(dollars)
Air conditioning and humidity control	3,000
Tables, chairs, and miscellaneous items	150
Fiber strength tester, balance, and accessories	1,150
Training a technician	1,100
Total	5,400

[a]These costs are based on the assumption that the firm has adequate space for making fiber strength tests. Any building or remodeling cost would need to be added to the costs given in the table.

Cost of Performing Fiber Strength Tests

The estimated annual costs of performing fiber strength tests are given in Table 2. These costs are based on a one-technician operation for a period of one year. The largest single cost item was $4,800 for the technician's salary. The remaining items amounted to $1,284 per year.

The rate of work was assumed to be six samples per hour with two tests per sample and a work week of 40 hours. This is the same rate of work assumption used in two earlier studies.[1] As operators acquire skill in performing fiber strength tests, a rate of work of eight samples per hour might be more realistic in many situations. This would make the establishment of a fiber strength testing facility profitable at a lower volume than determined in the analysis to follow.

[1]J. F. Hudson and Wilbur Aguillard, Feasibility and Cost of a Cotton Fiber Testing Program in Louisiana, Research Report No. 326, Department of Agricultural Economics and Agribusiness, Louisiana State University, September 1963; and B. D. Raskopf, J. R. Fontana, C. S. Murphey, Cotton Fiber Testing by Shippers and Spinners, Bulletin 320, The University of Tennessee, October 1960.

Table 2. Estimated annual cost of performing fiber strength tests on cotton

Item	Dollars	
Annual fixed expense		
Technician's salary	4,800	
Depreciation[a]	507	
Interest on investment[b]	162	
Insurance[c]	86	
Taxes[d]	33	
Maintenance[e]	43	
Subtotal		5,631
Annual variable expense		
Electric power	292	
Supplies and calibration samples	75	
Repairs[f]	86	
Subtotal		453
TOTAL		6,084

[a]Based on expected life of 15 years for air conditioning and humidity control equipment, testing equipment, tables and chairs; 5 years for investment in training technician.

[b]Calculated at 6 percent of half the investment cost.

[c]Assumed to cost $2.00 per $100 of investment in equipment.

[d]Calculated at the rate of $3.00 per $100 of tax valuation with a tax valuation equal to one-half the average market value.

[e]Based on 1 percent of initial investment in equipment.

[f]Based on 2 percent of initial investment in equipment.

The estimated annual cost and cost per sample for various testing periods are given in Table 3 and are based on a rate of work of 240 samples per week. Data given in Part A of Table 3 are based on a fixed labor cost of $4,800 per year. The estimated cost per sample declined from $2.38 when operating 10 weeks per year to 50 cents per sample when operating time is increased to 50 weeks per year. It should be noted that the technician's salary was placed at $4,800 regardless of length of operating period and this factor contributed heavily to the cost per sample.

In Part B of Table 3, the labor cost was not fixed but was assumed to be available at $2.00 per hour. This situation may be used by firms able to obtain a trained technician on a part-time basis or having alternative uses for the technician's labor when not needed for fiber testing. In this situation, the cost was reduced to 71 cents per sample for a ten-week period of operation and declined to 44 cents per sample for a fifty-week operating period. It is likely that Part A will apply to most firms.

As an alternative to having their own fiber testing laboratory, cotton merchants and textile mills may obtain fiber strength measurements from private and public laboratories. The American Textile Manufacturers Institite maintains a laboratory and makes a charge of $ .75 per sample with two tests per sample for fiber strength tests. The custom charge fee, an assumed cost of five cents per sample for packaging and mailing cost, and the cost data given in Table 2 and Table 3 can be used to determine the volume of cotton necessary to equate testing costs. The formula for making this determination is given as follows:

$$\text{Break-even volume} = \frac{\text{Total annual overhead cost}}{\text{cost per sample from custom testing} - \text{variable cost per sample}}$$

$$= \frac{5631}{.80 - .0363}$$

$$= \frac{5631}{.7637}$$

$$= 7373 \text{ samples}$$

The variable cost per sample was obtained by dividing the annual variable expense in Table 2 by the potential volume from a full year's operation (453 ÷ 12,480 = .0363). A volume of 7,373 samples would require an operation of 30.7 weeks on the basis of six samples per hour and a work week of 40 hours. An annual volume larger than 7,373 samples would suggest a relatively lower testing cost by establishing a testing facility than using a custom laboratory with a fee of $ .75 per sample.

A fiber testing service is provided by the Consumer and Marketing Service of the U. S. Department of Agriculture. The U. S. Department of Agriculture charge for fiber strength testing is $1.00 per sample with two tests per sample. Increasing the custom fee from $ .75 to $1.00 and allowing five cents per sample for cost of packaging and mailing of samples would bring the break-even volume down to 5,555 samples. The operating period for this volume would be 23.1 weeks.

Conclusions

Fiber strength continues to increase in importance as a determinant of cotton quality. Marketing firms will be required to furnish fiber strength information at an early stage in the flow of cotton from the gins. Data used in this report are estimates and will vary from one location to another and will vary over time. Firms considering fiber strength testing will need to determine the cost for their individual situations.

Table 3. Estimated average cost of performing fiber strength tests by weeks of operation

Description	Weeks of operation				
	10	15	20	25	50
A. Labor cost fixed at $4,800 per year					
Number of samples[a]	2,400	3,600	4,800	6,000	12,000
Annual cost (dollars)	5,718	5,762	5,805	5,849	6,067
Cost per sample (dollars)	2.38	1.60	1.21	.97	.50
B. Labor available at $2.00 per hour					
Number of samples[a]	2,400	3,600	4,800	6,000	12,000
Annual cost, excluding labor (dollars)	918	962	1,005	1,049	1,267
Cost per sample (dollars)					
Labor	.33	.33	.33	.33	.33
Other	.38	.27	.21	.18	.11
	.71	.60	.54	.51	.44

[a]Based on six samples per hour with two tests per sample and a work week of 40 hours.

In choosing between custom testing and establishing individual testing facilities, there are monetary and non-monetary factors which firms should consider. This analysis was restricted to monetary factors and should be evaluated in relation to the non-monetary factors. There is an advantage in having tests performed by a third party since this should tend to reduce buyer-seller disputes. Second, commercial testing laboratories may be better able to maintain accuracy in testing and secure faster service when breakdowns occur. One of the principal disadvantages of using custom testing is the delay experienced in mailing samples and waiting for results.

Looking to the future, one thing appears certain--fiber strength testing will increase. The question becomes--which method is most appropriate for an individual firm to use--custom testing or to establish an individual testing facility.