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EFFECT OF ARTIFICIAL DRYING SEED COTTON BEFORE GINNING ON CERTAIN
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WASHINGTON, D. C.

EFFECT OF ARTIFICIALLY DRYING SEED COTTON BEFORE GINNING ON CERTAIN QUALITY ELEMENTS OF THE LINT AND SEED AND ON THE OPERATION ON THE GIN STAND[1]

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CONTENTS

	Page
Introduction	1
Purposes of study	3
Cottons, equipment, and methods used	4
Seed cottons	4
Drying equipment and gin machinery	8
Methods	9
Results and discussion	16
Moisture in seed cotton as related to preparation of ginned lint	17
Weight of seed cotton and of ginned lint as affected by artificial drying	19
Quality of ginned lint as affected by artificially drying seed cotton	25
Monetary value of ginned lint as affected by artificially drying seed cotton	43
Results and discussion—Continued.	
Germination and weight of cottonseed as affected by artificially drying seed cotton	48
Certain mechanical elements of ginning as affected by artificially drying seed cotton	49
Other advantages of artificially drying green, damp, or wet seed cotton	51
Summary	52
Literature cited	55
Appendix	57
Basic tables showing absolute values of paired undried and dried samples	57

INTRODUCTION

Present practices in harvesting and ginning the American cotton crop are generally different from those followed only a few years ago and are decidedly different from practices followed in the early years of commercial cotton production in the United States.

Before the saw gin was invented and patented in 1794, the cotton fibers were pulled from the seed by laborious methods on the farm; in fact, the separation of the fibers from the seed was considered as much a part of the initial production as were the growing and the harvesting of the crop. Between 1794 and 1820 many of the first saw gins were established on farms and plantations throughout the country, and the separation of the fibers from the seed, now known as "ginning", continued to be a farm operation.

[1] The fiber quality aspects of this study are a part of the program of work of the Cotton Utility and Standards Research Section under the leadership of R. W. Webb. Credit is due T. L. W. Bailey, Jr., assistant cotton technologist, for valuable aid in the preparation of the manuscript.

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As growers devoted more and more time and thought to problems of production, outside capital found an opportunity in the business of ginning. In this way the growing and the ginning of cotton have become two distinct but closely related forms of enterprise.

It has frequently been alleged that considerable damage to lint cotton has resulted from improper ginning. Although any damage that might have occurred may be attributed in part to this factor, a large proportion is due to the manner in which the cotton is harvested. For example, each year many of the gins are required to handle varying quantities of seed cotton that have not been carefully picked and that possess a moisture condition which is unsuitable for proper ginning.

Moisture in seed cotton is one of the most important factors affecting the operation of a cotton gin and the quality of the ginned lint. It is generally understood that lint cotton of inferior preparation is frequently the result of ginning seed cotton that has not been properly conditioned, early cotton that is "green-sappy", or cotton that is damp, dew-laden, or rain-soaked. Commercial gins are forced to handle appreciable quantities of such seed cotton, with the unavoidable result of inferior preparation in the lint and a consequent reduction of spinning and monetary values (*5*)[2].

The importance of the moisture problem in relation to the ginning of the American cotton crop is, for example [3], indicated by estimates which show that in the ginning season of 1931, a period of relatively little rainfall, about a half million bales, or 24 percent, of all cotton $1\frac{1}{16}$ inches staple and longer and more than 1 million bales, or 8 percent, of cotton shorter than $1\frac{1}{16}$ inches staple were ginned while too green or damp for the best ginning results. In 1932, a year in which rainfall was heavier in the ginning months, these figures amounted to over half a million bales, or 35 percent, for cotton of the longer staples and over 2 million bales, or 20 percent, for the shorter staple cotton. It is of interest to observe that, in the 10 years next preceding 1933, weather conditions in the ginning months resembled those in 1932 in more seasons than they did the conditions in 1931.

Moisture in seed cotton varies not only from year to year for the Cotton Belt as a whole but also from section to section and from time to time within a given season. In 1932, the moisture problem was most acute in the States east of the Mississippi River and in the Delta sections bordering on the west. For example, the quantity of the longer staple cotton which was too damp for best ginning amounted to as much as 40 percent for Mississippi and as low as 4 percent for Arizona; the shorter staple cotton of such condition approximated more than 40 percent in Georgia and only about 3 percent in Oklahoma.

Besides the rainfall that occurs during the ginning season, other factors contribute to the importance of the moisture problem in cotton. Picking is often started early in the day before the dew on the cotton has disappeared. An appreciable quantity of the cotton picked each day, therefore, may be damp or wet. Cotton that is

[2] Italic numbers in parentheses refer to Literature Cited, p. 56.

[3] Preliminary surveys bearing on the moisture problem of cotton, as related to ginning, were made during the ginning seasons of 1931 and 1932. Lint samples were collected periodically throughout the Cotton Belt: they were subjected to moisture determinations and the findings were related to available rainfall data. On the basis of these data, of the findings here reported, and of information reported by the Bureau of Agricultural Economics for the production of American cotton during the corresponding seasons, an estimate has been made of the quantity of cotton that possessed too high moisture content for proper ginning for each of the two seasons.

picked so soon after opening that its "greenness" has not had opportunity to dry out by exposure to sunlight or dry winds, is often too damp for proper ginning. Stalks of rank growth sometimes prevent green, dew-laden, damp, or wet cotton from receiving sufficient exposure to sunlight for drying prior to picking. Cotton pickers, employed and paid on the basis of gross weight picked, are inclined to include in their pickings many of the greener, heavier locks.

Most cotton farms are without suitable facilities for drying or storing cotton that has been picked too green or damp for best ginning results. Improved highways and modern means of transportation encourage the delivery of seed cotton at the gin very soon after it is harvested. These factors, together with the necessity for prompt repayment of crop loans and the need of cash to meet current outlays for picking, have encouraged ginning immediately after harvesting, regardless of the moisture content of the seed cotton or of other conditions which may make the cotton unsuitable for proper ginning. As a result of these conditions it appears that the difficulties encountered by both growers and ginners are increasing in number and degree from season to season.

The United States Department of Agriculture, realizing the need for and the benefits that would accrue to cotton growers from the development of methods and equipment for artificially drying seed cotton, began an intensive study of the subject in 1926. Information on the rate of ginning and on the moisture condition most conducive to good ginning was obtained in Louisiana, Mississippi, Arkansas, and other cotton-growing States where the problem appeared to be acute. Many drying tests were made in 1926, 1927, and 1928 by engineers of the Bureau of Agricultural Engineering (formerly the Division of Agricultural Engineering in the Bureau of Public Roads). During this period several small drying units were tested, and three full-sized cotton-drying outfits of different designs were constructed and tested at a regular four-stand gin. Simultaneously, the Bureau of Agricultural Economics developed methods of fiber analysis in connection with the cotton standardization work in its Division of Cotton Marketing. These developments laid the foundation for many of the experimental and statistical methods that are being employed in the cotton-ginning investigations.

In 1930 Congress authorized an investigation of cotton ginning [4] and made an appropriation to begin the studies. A cotton-ginning laboratory was constructed at Stoneville, Miss., facilities for fiber analyses were made available, and the investigations were rapidly put under way.

PURPOSES OF STUDY

The objectives of this study were: (1) To show the relationship between the moisture content of seed cottons (undried) and some of the quality elements of ginned lint, (2) to determine the extent to which artificial drying, within a specified range of temperatures, reduces the quantity of moisture in seed cottons of different moisture contents and in the resulting ginned lint, (3) to show the comparative effects on certain quality elements of ginned lint and cottonseed,

[4] (46 Stat. 248.)

and on the mechanical operation of the gin machinery, produced by ginning seed cottons of different moisture contents without conditioning, and portions of the same seed cottons after artificially drying at varying temperatures, and (4) to determine the proper drying temperatures for seed cottons of different moisture content.

COTTONS, EQUIPMENT, AND METHODS USED

SEED COTTONS

The seed cottons used in this study are listed in table 1. An identification number is assigned to each cotton, as shown, and the cottons will be referred to hereafter by their respective numbers.

TABLE 1.—*A partial description of seed cottons used in tests and some evaluations for their seed, fiber, and ginned lint, 1931–33*

Crop year and lot	Variety	Place of growth	Harvesting		Moisture content as determined by oven tests	Laboratory determinations [1]					Classer's appraisals	
			Date	Stage		Weight of 100 seeds	Weight of lint from 100 seeds	Proportion of lint	Upper quartile fiber length [2]	Variability of fiber length [2]	Staple length [3]	Grade [4]
1931					*Percent*	*Grams*	*Grams*	*Percent*	*Inches*	*Percent*	*Inches*	
No. 35	Delfos 6106	Burdette, Miss.	Sept. 4	First	19.4	12.785	5.568	30.3	1.386	57.7	1 7/32	S. M., B.—
No. 36	Missdel No. 4	Stoneville, Miss.	Sept. 8–9	do	18.8	13.126	5.875	30.9	1.318	61.6	1 3/16	S. M., C.
No. 39	Wilds No. 2	Trail Lake, Miss.	Sept. 9	do	16.5	15.404	6.532	29.8	1.409	58.7	1 9/32	G. M., B.—
No. 40	Missdel No. 3	Stoneville, Miss.	Sept. 14–15	do	11.9	14.453	6.492	31.0	1.415	55.5	1 9/32	G. M., B.
No. 41	Dixie Triumph	Baton Rouge, La.	do	do	17.3	13,211	6.737	33.8	1.000	48.1	29/32	M.
No. 46	Cook 588	Auburn, Ala.	Sept. 21–23	do	10.5	11.298	6.551	36.7	.998	63.2	7/8	S. M., Sp.
No. 47	Mexican strain 58	Raleigh, N. C.	Sept. 20–30	Second	26.4	11.804	6.352	35.0	1.202	44.7	1 1/32	M., Sp.
No. 48	Missdel No. 1	Stoneville, Miss.	Sept. 28	First	7.8	14.206	6.345	30.9	1.347	55.0	1 5/32	G. M., B.
No. 51	Missdel No. 3	do	Sept. 29–30	do	7.2	13.500	5.479	28.9	1.329	44.8	1 7/32	G. M., B.+
No. 53	D. P. L. 8	Scott, Miss.	Oct. 1	do	7.2	12.058	6.541	35.2	1.043	58.5	1 1/32	M.
No. 54	Wilds No. 3	Panther Burn, Miss.	Sept. 28–30	do	6.8	13.539	5.555	29.1	1.360	66.0	1 7/32	G. M., B.
No. 56	Deltatype Webber	Long Switch, Miss.	Oct. 3–5	do	10.2	14.032	5.657	28.7	1.383	55.5	1 1/4	S. M., B.
No. 58	D. P. L. 4–8	Jackson, Tenn.	Sept. 30	do	11.3	12.121	6.938	36.4	1.170	61.5	1 1/16	S. M.
No. 59	Delfos 719	Stoneville, Miss.	Oct. 8–9	do	7.8	14.031	5.951	29.8	1.286	74.5	1 3/32	M.
No. 60	Missdel No. 1	McCarley, Miss.	Week Oct. 5	do	10.7	11.672	5.908	33.6	1.263	63.5	1 5/32	M., B.
No. 62	do	Walls, Miss.	Oct. 13	do	7.5	12.240	5.941	31.0	1.256	67.0	1 1/8	S. M., B.
No. 65	Missdel No. 4	Stoneville, Miss.	Oct. 15–16	Second	22.3	12.545	6.245	33.2	1.117	53.7	1 1/32	L. M.
No. 78	Missdel No. 1	do	Nov. 23–30	do	15.0	13.427	6.955	34.1	1.285	65.0	1 3/32	L. M.
1932												
No. 101	Kasch	Edroy, Tex.	Aug. 3	First	7.9	11.619	7.051	37.8	1.000	77.5	1	G. M.
No. 103	Missdel No. 4	Winterville, Miss.	Aug. 16	do	13.5	10.894	6.257	36.5	1.278	63.2	1 5/32	G. M., B.—
No. 104	Delfos 531	Stoneville, Miss.	Aug. 16–17	do	13.7	11.228	5.155	31.5	1.241	90.6	1 5/32	G. M., C.+
No. 105	do	do	Aug. 22	do	16.4	11.942	5.217	30.4	1.307	68.1	1 3/16	S. M., C.
No. 106	do	Greenville, Miss.	Aug. 23	do	12.5	13.555	5.914	30.4	1.362	64.6	1 3/16	S. M., B.
No. 107	Missdel No. 3	Stoneville, Miss.	Aug. 30	do	14.6	13.340	5.229	28.2	1.290	50.0	1 5/32	S. M., C.+
No. 108	Missdel No. 4	do	Aug. 31	do	13.7	11.198	5.052	31.1	1.207	85.0	1 5/32	M., B.—
No. 109	Mebane	Lockhart, Tex.	Aug. 29–30	do	12.4	10.661	7.538	41.4	.987	65.7	31/32	M.
No. 112	Acala	Blytheville, Ark.	Sept. 1	do	15.0	9.983	4.941	33.1	1.031	65.3	1 1/32	M.
No. 113	Delfos 531	Stoneville, Miss.	Sept. 6	Second	16.2	10.438	4.670	30.9	1.259	74.5	1 5/32	S. L. M., C.
No. 114	Missdel No. 4	Winterville, Miss.	Sept. 7	do	13.4	12.541	5.499	30.5	1.138	58.2	1 3/32	S. L. M.
No. 115	Stoneville No. 2	Griffin, Ga.	Sept. 5–6	First	11.7	9.888	5.860	37.2	1.079	64.4	1 1/32	M.
No. 116	Cook 588	Auburn, Ala.	Sept. 2–3	do	14.4	11.492	6.722	36.9	.947	63.5	7/8	S. M.
No. 118	Delfos 531	Stoneville, Miss.	Sept. 12–13	Second	9.6	11.333	4.882	30.1	1.285	68.2	1 3/16	M., C.+
No. 119	D. P. L. 4–8	Baton Rouge, La.	Sept. 5–10	First	12.5	11.343	6.432	36.2	1.115	72.2	1 1/16	S. M.
No. 120	do	Belle Mina, Ala.	Sept. 3–11	do	14.4	10.284	6.089	37.2	1.045	55.3	31/32	S. M.
No. 121	Missdel No. 3	Stoneville, Miss.	Sept. 15–16	Second	13.4	13.589	5.328	28.2	1.321	67.7	1 3/16	M., C.+
No. 122	Acala No. 5	Jackson, Tenn.	do	First	14.6	12.864	5.355	29.4	1.138	68.6	1 1/16	S. M.

See footnotes on p. 6.

TABLE 1.—*A partial description of seed cottons used in tests and some evaluations for their seed, fiber, and ginned lint, 1931–33*—Continued

Crop year and lot	Variety	Place of growth	Harvesting		Moisture content as determined by oven tests	Laboratory determinations [1]					Classer's appraisals	
			Date	Stage		Weight of 100 seeds	Weight of lint from 100 seeds	Proportion of lint	Upper quartile fiber length [2]	Variability of fiber length	Staple length [3]	Grade [4]
					Percent	*Grams*	*Grams*	*Percent*	*Inches*	*Percent*	*Inches*	
No. 123	Delfos 531	Greenville, Miss	Sept. 16	Second	10.5	13.099	5.337	28.9	1.307	85.5	1 7/32	M., B.–
No. 126	do	Stoneville, Miss	Sept. 23–24	Third	11.2	10.961	4.669	29.9	1.237	76.4	1 5/32	M., B.
No. 131	D. P. L. 4–8	Belle Mina, Ala	Sept. 25	Second	16.2	10.205	5.787	36.2	1.038	54.9	15/16	M., Sp.
No. 133	Harper Certified	Britton, Tex	Oct. 1	First	13.7	12.263	7.058	36.5	.975	56.4	31/32	M.
No. 134	Delfos 531	Stoneville, Miss	Oct. 6–7	Third	10.3	10.651	4.634	30.3	1.233	85.4	1 1/8	S. L. M., B.
No. 137	Acala	Jackson, Tenn	Oct. 3–5	Second	13.3	11.602	5.948	33.9	1.214	65.3	1 3/32	M.
No. 139	D. P. L. 4–8	Baton Rouge, La	Oct. 10	do	12.7	10.767	6.485	37.6	1.128	68.6	1 1/16	M., Sp.
No. 141	Delfos 531	Greenville, Miss	Oct. 18–19	Third	12.3	11.303	5.476	32.6	1.398	54.7	1 5/32	M., C.+
No. 142	D. P. L. 4–8	Belle Mina, Ala	Oct. 20	do	11.6	11.129	6.201	35.8	1.149	60.8	1 1/32	S. M.
No. 144	Delfos 531	Stoneville, Miss	Oct. 24–25	do	11.4	11.532	5.676	33.0	1.326	74.4	1 1/8	L. M., B.
No. 145	Harper Certified	Britton, Tex	Oct. 24	Second	9.0	12.622	7.449	37.1	.957	52.4	31/32	S. M.
1933												
No. 201	Kasch	Edroy, Tex	Aug. 10–11	First	18.6	12.893	7.771	37.6	1.026	75.8	1 1/32	S. L. M.
No. 202	Delfos 531	Greenville, Miss	Aug. 15–16	do	17.5	10.827	5.057	35.9	1.232	92.4	1 3/16	S. M., C.
No. 203	Cook 307	Prattville, Ala	Aug. 15	do	16.1	12.357	6.918	35.9	1.043	73.4	31/32	G. M., Sp.
No. 204	Delfos 89	Stoneville, Miss	Aug. 22–23	do	14.2	11.718	5.680	32.6	1,298	80.4	1 1/4	S. M., C.
No. 205	Deltatype Webber strain 9.	Leland, Miss	Aug. 15	do	16.2	12.555	6.280	31.7	1.349	72.7	1 1/4	S. M., C.
No. 206	Kasch	Edroy, Tex	Aug. 24	Second	10.8	12.960	7.144	35.5	1.035	63.0	1	M.
No. 209	D. P. L. 11	Scott, Miss	Aug. 28–29	First	12.4	10.760	7.197	40.1	1.195	74.1	1 1/8	S. M., B.
No. 210	D. P. L. 10	do	Aug. 29	do	15.8	12.349	6.851	35.7	1.160	78.0	1 3/32	S. M.
No. 211	Missdel No. 4	Stoneville, Miss	do	do	24.6	12.072	6.363	34.5	1.279	74.3	1 5/32	M., B.+
No. 214	Delfos 531	Greenville, Miss	Sept. 4–5	Second	12.6	11.129	5.857	34.5	1.234	93.6	1 5/32	M., C.
No. 215	Missdel No. 3	Australia Island, La	Sept. 5	First	11.9	13.971	6.845	32.9	1.297	77.2	1 3/16	S. M., B.
No. 217	Stoneville 2–A	Magenta, Miss	Sept. 7	do	20.2	11.782	6.205	34.5	1.241	81.9	1 3/32	S. L. M.
No. 218	Coker No. 5	Clemson College, S. C.	Sept. 2–4	do	18.2	11.615	7.319	38.7	1.125	67.9	1 1/16	M., Sp.
No. 219	Missdel No. 3	Stoneville, Miss	Sept. 6	do	14.6	12.857	6.322	33.0	1.343	63.2	1 1/4	M., D.+
No. 220	Cook 307	Prattville, Ala	Sept. 7	Second	17.1	11.050	6.250	36.1	1.005	68.9	7/8	S. M.
No. 221	Wilson type	Wilson, Ark	Sept. 8	First	24.4	11.710	6.105	34.3	.993	67.1	31/32	L. M.
No. 223	Kasch	Edroy, Tex	Sept. 8–9	Third	11.9	11.224	6.643	37.2	1.018	70.6	15/16	S. L. M.
No. 226	Delfos 9252	Stoneville, Miss	Sept. 19	First	11.8	12.845	6.480	33.5	1.343	68.4	1 7/32	S. M., B.
No. 227	Delfos 719	Magenta, Miss	Sept. 21	do	11.9	12.997	7.262	35.8	1.154	64.8	1 1/8	S. M., B.
No. 228	Cook 307	Prattville, Ala	Sept. 18	Third	7.9	10.203	6.750	39.8	.974	72.7	7/8	S. M.
No. 229	Stoneville No. 4	Stoneville, Miss	Sept. 27	First	13.5	14.469	8.226	36.2	1.185	79.3	1 3/32	S. M.
No. 243	Delfos 531	Greenville, Miss	Nov. 1	Third	10.3	11.084	5.844	34.5	1.274	73.3	1 3/32	S. L. M.

[1] Lint hand-pulled from seed.
[2] See Quality Determinations, p. 11.
[3] Longest sample of ginned lint sample from each lot of cotton used in these tests.
[4] Grade of sample from the undried portion of the seed cotton ginned with a loose seed roll.

The seed cottons were obtained from nine States in the Cotton Belt. Southern agricultural experiment stations supplied 20 of the 69 cottons used; cotton breeders, and the increase parties who grow purebred seed for them, 24; and large plantation owners supplied 25. The cottons were selected to represent pure varieties of uniform types of American upland cotton with the special purpose of obtaining cottons of wide ranges in moisture content and length of staple. After the cottons were ginned, the staple lengths of all the samples from each cotton were determined and the staple length shown for each seed cotton in table 1 is that of the longest sample obtained. The grade was also determined, and the grade shown for each seed cotton is that for the sample obtained with the undried seed cotton using the loose seed roll.

All picking and handling of the selected cottons were performed under the supervision of or in accordance with instructions from a representative of the ginning laboratory. Promptly, or shortly after the time of harvesting, each lot of cotton not obtained locally with the exception of cotton no. 47, was transported by motor truck to the ginning laboratory. While being trucked to the laboratory, the seed cotton was covered with a tarpaulin and the top layer of cotton was sacked in canvas bags in an effort to hold to a minimum the moisture changes that might occur in transit. Cotton no. 47 was shipped by freight and soon after arrival was wet down by rain. Cotton no. 65, obtained locally, was also wet down by rain.

Since the moisture content and staple length of cotton so definitely affect ginning, summaries and cross classifications of these characteristics of the seed cottons are shown in table 2 for each year and for total of the 3 years. On the whole, there is a more-or-less even distribution of these conditions over a relatively wide range.

TABLE 2.—*Distribution by moisture content and staple length groups, of seed cottons used in the tests, from the crops of 1931, 1932, and 1933*

Year and moisture-content group (percent)	Staple-length group				
	All lengths	7/8 to 31/32 inches	1 to 1 3/32 inches	1 1/8 to 1 7/32 inches	1 1/4 inches and longer
	Number	*Number*	*Number*	*Number*	*Number*
1931:					
16.0 and above	6	1	2	2	1
12.0 to 15.9	1	----------	1	----------	----------
8.0 to 11.9	5	1	1	1	2
Below 8.0	6	----------	2	4	----------
All groups	18	2	6	7	3
1932:					
16.0 and above	3	1	----------	2	----------
12.0 to 15.9	17	4	6	7	----------
8.0 to 11.9	8	1	2	5	----------
Below 8.0	1	----------	1	----------	----------
All groups	29	6	9	14	----------
1933:					
16.0 and above	9	3	3	2	1
12.0 to 15.9	6	----------	2	2	2
8.0 to 11.9	6	1	2	3	----------
Below 8.0	1	1	----------	----------	----------
All groups	22	5	7	7	3
All years:					
16.0 and above	18	5	5	6	2
12.0 to 15.9	24	4	9	9	2
8.0 to 11.9	19	3	5	9	2
Below 8.0	8	1	3	4	----------
All groups	69	13	22	28	6

DRYING EQUIPMENT AND GIN MACHINERY

VERTICAL SEED-COTTON DRIER

The drying unit used in these experiments was of the vertical design, developed and built by the ginning laboratory at Stoneville, Miss. It employed the seed-cotton-drying process previously developed by the Department of Agriculture (*2*). Figure 1 shows a diagrammatic

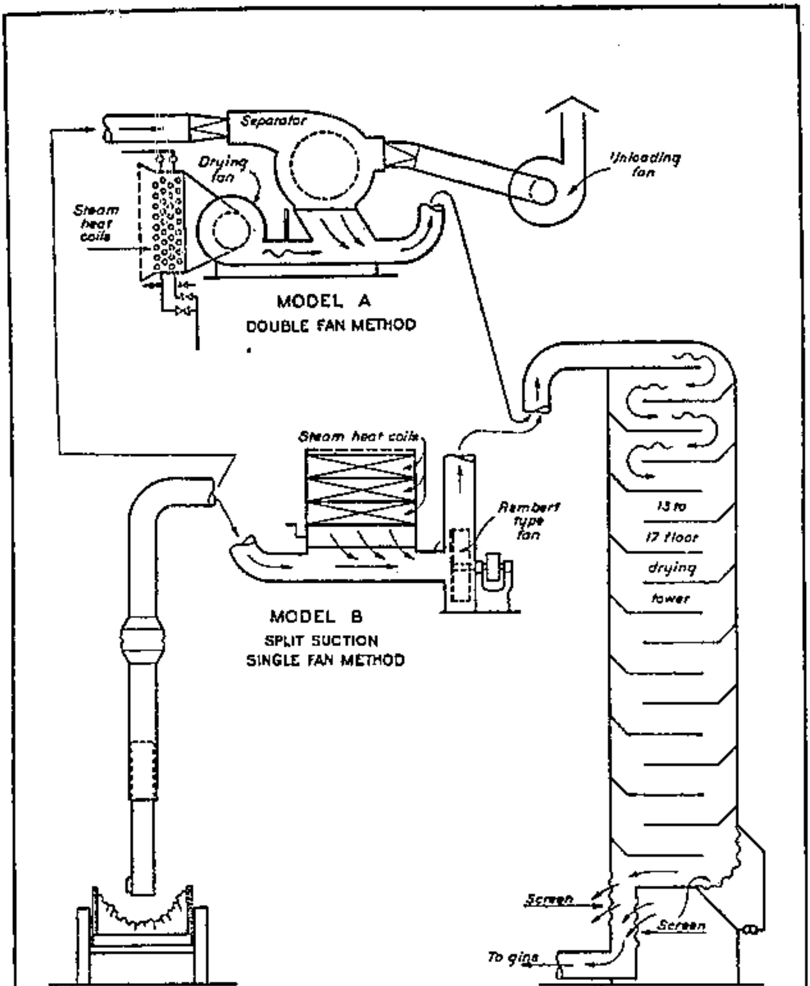

FIGURE 1.—THE VERTICAL SEED COTTON DRIER DEVELOPED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE.

Model A is the principal and model B is an alternate method of feeding.

sectional view of this vertical seed-cotton drier and indicates the route of the cotton through the unit.

The double-fan type of installation, model A, used in the tests here reported employed the following items of equipment: (1) One no. 30

18-blade unloading fan operating at 2,000 revolutions per minute; (2) one stationary-screen separator, 45 inches wide; (3) one no. 35 18-blade hot-blast or drying fan operating at 1,800 revolutions per minute and delivering an average hot-blast volume of 4,150 cubic feet per minute from and at a temperature of 70° F.; (4) three 2-row sections of 1-inch fin-type copper-tubing coils with 2-inch globe valve for each section; and (5) one 30-horsepower vertical gas-fired steam boiler operating at 100 pounds gage.

The period of exposure of the cotton in the drier is about 15 seconds.

GIN MACHINERY

The gin stands used were 70-saw double-rib huller of brush and air-blast types, each of which was operated in combination with its associated big-drum feeder. Unit condensers, from which the ginned lint samples were taken, were used in connection with each gin stand. Either a stationary-screen separator or a revolving-screen separator was used to remove the seed cotton from the conveying air current, and from the separator it was distributed to the feeder.

METHODS

GINNING PROCEDURE

Upon arrival at the ginning laboratory, every lot of seed cotton was carefully composited by hand when unloaded, and thoroughly mixed in an effort to insure a uniform distribution of moisture as well as other characteristics. Small samples of seed cotton were selected at random throughout the mass of each cotton, they were placed immediately in 6 to 8 airtight tin containers, and were reserved for moisture determinations. In the light of the relatively small variability in results obtained, this method of sampling is considered reliable. An additional representative sample, weighing approximately 3 pounds, was reserved for other purposes. The remaining seed cotton was then divided into lots of known weight in conformity with the requirements of the tests.

Different lots of each of the various cottons that were employed in drying tests were dried once in the double-fan vertical drier (fig. 1, model A) at 1, 2, or 3 of the drier temperatures of 150°, 170°, 185°, 200°, 210°, 220°, 230°, and 250° F. A single section of the blast heater generally afforded sufficient heat for maintaining 150° at the inlet of the drier; two sections were used for ranges between 150° and 200° and three sections were necessary for tests between 200° and 250°. Samples of seed cotton, after drying, were taken in the manner described for the undried material.

Portions of some of these cottons were sun-dried, and portions of some were stored and turned by hand periodically in an effort to dry them and to provide information on some of the more common methods of conditioning for comparison with effects of artificial drying. In these tests the portions of the seed cottons that were sun-dried were spread in layers of 4 to 8 inches on tarpaulins and exposed to the direct rays of the sun from 2 to 4 days. The stored lots were spread in layers about a foot in depth on the floor of a sheet-iron building and were turned by hand 2 or 3 times each day during the storage period of a week or more, depending on the prevailing weather conditions.

Equal quantities of the unconditioned and conditioned lots were conveyed by air through either a stationary-screen separator or a revolving-screen separator, before being delivered to the gin stands. The two types of separators employed the same fan and had the same function. Since no significant difference was found in quality elements between numerous lint samples from the same cottons handled by the two separators, cottons run through each of the two types were therefore combined in the statistical analyses later described. The separators were operated at a constant speed.

Portions of all the seed cottons were ginned on a brush-type double-rib huller gin after being handled by the big-drum cleaning feeder ordinarily used with each gin. Portions of many of the cottons were similarly ginned on an air-blast-type gin. Since for the purpose of this report the gin stand is considered only as a means for providing ginned lint on which to study the effect of artificial drying, and since it was observed that the effects of drying seed cotton were similar when ginned on either type of gin, the results shown in this report relate only to the brush-type gin.

The effects of seed-roll density were so pronounced that every test was made with both loose and tight seed rolls. In the absence of a satisfactory mechanical indicator, the seed-roll densities were maintained as uniformly as possible, by regulation of the rate of feed commensurate with the desired density. That is, the gin operator by observation of a combination of the height and density of the seed roll and by the "feel" of the roll, regulated the rate of feed to maintain a uniform loose seed roll or a uniform tight seed roll as desired.

The gin saws were run at or near the speed recommended by the manufacturer, and were maintained at these speeds by the use of variable speed controls. The gin stands and other auxiliary ginning machinery employed in these experiments were new equipment and were maintained in proper adjustment and repair.

Weights were obtained of foreign matter removed during the ginning process on all lots, and of ginned lint and seed on selected lots. Power readings were taken from the saw shafts in ginning certain of the lots from the 1933 crop. Drier temperatures were maintained by manual control of a valve on the steam line to each blast heater.

Portions of many of the cottons were handled by different types of cleaners and extractors, and were ginned at or near the manufacturers' recommended saw speed. Some of these were also ginned at different saw speeds. The effects of these various machinery set-ups and speeds, however, are beyond the scope of this bulletin.

During each test, after the desired conditions had been acquired and maintained for a short period of time, a representative sample of ginned lint, weighing approximately 2 pounds, was taken at the condenser for the purpose of fiber analyses and classification. The results of fiber analyses and classification studies made on a series of samples taken from each of several hundred tests confirm the representative nature and reliability of this method of sampling. Additional samples were taken simultaneously at the condenser and were placed in airtight tin containers for use in determining the moisture content of the ginned lint. Repeated moisture tests have revealed that this procedure of sampling is sufficiently accurate for the purpose of the study.

From some of the cottons, representative samples of cottonseed were collected at the outlet of the seed conveyor, during the time the desired ginning test conditions prevailed; a portion was placed in airtight containers for moisture tests and the remaining portion was reserved for other analyses. Numerous moisture tests taken in this manner indicated that the sampling error was insignificant.

QUALITY AND MOISTURE DETERMINATIONS

The samples of seed cotton and ginned lint reserved during the ginning tests were subjected, in the Stoneville and Washington fiber laboratories, to careful analyses involving measurement and evaluations of the elements of quality which are now measurable (*3, 4, 14*).

Moisture determinations were made on samples of each of the seed cottons reserved prior to the ginning tests, and on samples of seed cotton, cottonseed, and ginned lint selected during the ginning test. These moisture determinations, with the exception of those made on cottonseed, were made in drying ovens according to the method for textile materials as recommended by the American Society for Testing Materials (*1*). The moisture content of the cottonseed was ascertained to a fair degree of accuracy by boiling a 50-g. sample in xylene for a period of about 30 minutes, during which all of the free water was distilled out and caught in a graduated distillation trap [5] (*16*). The water reading was then converted into terms of moisture percentage. In all cases, the moisture percentage is expressed in terms of moisture content; that is, as percentage of the original weight of the sample.

Color measurements were made by means of a disk colorimeter developed in the Washington fiber laboratory of the Bureau of Agricultural Economics [6] (*10, 11, 12*).

The color of an adequate area of the sample is matched against the composite color of a standard series of disks used on this instrument. The readings obtained are converted into the color attributes recognized by the normal eye, and by which any color may be specified. Brilliance, that attribute which is a measure of the light-to-dark quality of color, is the chief color measurement used to study the samples of ginned lint, since the main color improvement to be made by methods of ginning is that of brightening the lint samples. Chroma refers to the depth of color, that is, to the creaminess, stain, etc. of the cotton.

Length-distribution studies were made in the fiber-array laboratories. The samples from the seed cottons employed in the ginning tests were conditioned and the fibers from 4 samples of 25 seeds, each selected at random from each seed cotton, were carefully "butterflied" and removed by hand.[7] The total weight of the lint and of the

[5] This method provided results sufficiently accurate for this study and was practicable because of its rapidity.

[6] NICKERSON, D. APPLICATION OF COLOR MEASUREMENTS IN THE GRADING OF AGRICULTURAL PRODUCTS, A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 36 pp. 1932. [Mimeographed.]

[7] The operations involved in making the fiber arrays and in the tests for lint index and lint percentage were performed in a laboratory having a standard condition of the atmosphere, namely, 65 percent relative humidity and 70° F. temperature.

seed from these samples was determined to provide a lint index and lint percentage (*9*). Using the method developed in the Washington fiber laboratory of the Bureau of Agricultural Economics, arrays were made of the lint from 3 of the 25 seed samples and usually 3 arrays were made of selected ginned-lint samples [8] (*17*). The distribution of fiber length in each array was determined by weighing groups of fibers representing each length interval of measurement on a microtorsion balance. Averages of the data from the three arrays were made and the upper quartile [9] length was calculated and used as a basis of determining the effects of the various methods of conditioning and ginning on fiber length. The fiber-length variability was determined from the middle 80 percent of the cumulative weight percentage of the fibers in the length array. This was calculated by subtracting the length at the 90- from that of the 10-percent point, dividing the result by the length at the 50-percent point, and multiplying by 100 to convert to percentage. This calculation provides an index for comparing the effects of the different methods of ginning on the uniformity of fiber lengths.

Strength tests were made in the Washington fiber laboratories on especially selected samples from the ginning tests by a revision of the method and apparatus developed by Chandler in that laboratory.[10] A bundle of fibers was combed, wrapped, and subsequently broken in a textile-testing machine. The machine breaks thus obtained were corrected and expressed as strength in pounds per square inch of cross-sectional area of the bundle of fibers.

The ginned-lint samples obtained from the ginning tests were classed by Government classers according to the official cotton standards (*13*). During the 1932 and 1933 seasons one classer was assigned to the ginning laboratory, and he made the classifications with much care, making not only an initial classification but also a comparative class of the samples within each series of samples representing a particular cotton.

In the classification of the samples, grade and its separate factors of color and leaf were recorded for each sample. Table 3 shows the code indices assigned to grade and to two of its components—color and leaf. These indices correspond to the numerical designations of the white grades according to the universal cotton standards for grade.

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[8] WEBB, R. W. PROBLEMS AND RESEARCH METHODS IN COTTON GINNING. A PRELIMINARY REPORT U. S. Dept. Agr., Bur. Agr. Econ. 12 pp., illus. 1929. [Mimeographed.]

[9] The upper quartile length is the length of the fibers at the 25-percent point on the length-cumulative weight percent curve beginning with the longest fibers.

[10] CHANDLER, E. E. A NEW METHOD FOR DETERMINING THE STRENGTH OF COTTON. A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ. 16 pp. 1926. [Mimeographed.] The method actually used has been improved by others in this Bureau's laboratories.

TABLE 3.—*Schedule for cotton classer's grade and for the grade factors of color and leaf based on the universal standards for white grades*

Universal standards equivalent	Code index	Class limits[1]	Grade and grade-factor designation
Middling Fair	1	0.50–0.82	M. F.+
		.83–1.16	M. F.
		1.17–1.49	M. F.–
Strict Good Middling	2	1.50–1.82	S. G. M.+
		1.83–2.16	S. G. M.
		2.17–2.49	S. G. M.–
Good Middling	3	2.50–2.82	G. M.+
		2.83–3.16	G. M.
		3.17–3.49	G. M.–
Strict Middling	4	3.50–3.82	S. M.+
		3.83–4.16	S. M.
		4.17–4.49	S. M.–
Middling	5	4.50–4.82	M.+
		4.83–5.16	M.
		5.17–5.49	M.–
Strict Low Middling	6	5.50–5.82	S. L. M.+
		5.83–6.16	S. L. M.
		6.17–6.49	S. L. M.–
Low Middling	7	6.50–6.82	L. M.+
		6.83–7.16	L. M.
		7.17–7.49	L. M.–
Strict Good Ordinary	8	7.50–7.82	S. G. O.+
		7.83–8.16	S. G. O.
		8.17–8.49	S. G. O.–
Good Ordinary	9	8.50–8.82	G. O.+
		8.83–9.16	G. O.
		9.17–9.49	G. O.–

[1] For use in conversion of code indices into designations of grade and its component factors color and leaf

Preparation of cotton 1⅛ inches or longer in staple was designated according to the tentative standards for preparation of American upland cotton of 1⅛ inches and longer staple, namely, A, B, and C, for Strict Middling, Middling, and Strict Low Middling grades [11] (*13*). Each preparation designation was further divided into three equal steps, making possible the designation of nine degrees of preparation. The nine steps were indicated by attaching a plus or minus sign to the letter designation. Preparation of cotton shorter than 1⅛ inches was compared with that of the white grades to which it most nearly corresponded. Additional descriptive preparation steps were used for cotton of both length categories, ranging from below the lowest of these steps, through "gin cut." Table 4 is a code of preparation indices for cotton 1⅛ inches and longer and for cotton shorter than 1⅛ inches, respectively, and shows what may be considered as generally comparable steps in the two length groups.

[11] For detailed discussion of these standards see the following: UNITED STATES DEPARTMENT OF AGRICULTURE, BUREAU OF AGRICULTURAL ECONOMICS. HANDBOOK FOR LICENSED CLASSIFIERS (U. S. COTTON STANDARDS ACT). 30 pp. Revised, 1931. [Mimeographed.]

TABLE 4.—*Schedule for cotton classer's designation of preparation*

Designation		Code index	Class limits [1]
Cottons 1⅛ inches and longer	Cottons shorter than 1⅛ inches		
A+	Middling Fair	1	0.50– 1.49
A	Strict Good Middling	2	1.50– 2.49
A–	Good Middling	3	2.50– 3.49
B+	Strict Middling	4	3.50– 4.49
B	Middling	5	4.50– 5.49
B–	Strict Low Middling	6	5.50– 6.49
C+	Low Middling	7	6.50– 7.49
C	Strict Good Ordinary	8	7.50– 8.49
C–	Good Ordinary	9	8.50– 9.49
D+	Ordinary	10	9.50–10.49
D	Inferior	11	10.50–11.49
D–	"Dogs"	12	11.50–12.49
Gin cut	Gin cut	13	12.50–13.49

[1] Used in conversion of code indices into letter designations.

Staple was classed against the official cotton standards for length. Table 5 is a schedule of the codes used in converting the fractional designation to decimal inches.

TABLE 5.—*Schedule for cotton classer's designation of staple length*

Fraction	Decimal	Class limit decimals [1]	Fraction	Decimal	Class limit decimals [1]
	Inches	*Inches*		*Inches*	*Inches*
13/16 inch		0.8073–0.8177	1 1/16– inches		1.0469–1.0572
13/16+ inch	0.812	.8178– .8281	1 1/16 inches	1.062	1.0573–1.0677
27/32– inch		.8282– .8385	1 1/16+ inches		1.0678–1.0781
27/32 inch	.844	.8380– .8489	1 3/32– inches		1.0782–1.0885
27/32+ inch		.8490– .8593	1 3/32 inch	1.094	1.0886–1.0989
7/8– inch		.8594– .8697	1 3/32+ inches		1.0990–1.1093
7/8 inch	.8750	.8698– .8802	1 1/8– inches		1.1094–1.1197
7/8+ inch		.8803– .8906	1 1/8 inches	1.125	1.1198–1.1302
29/32– inch		.8907– .9010	1 1/8+ inches		1.1303–1.1406
29/32 inch	.906	.9011– .9114	1 5/32– inches		1.1407–1.1510
29/32+ inch		.9115– .9218	1 5/32 inches	1.156	1.1511–1.1614
15/16– inch		.9219– .9322	1 5/32+ inches		1.1615–1.1718
15/16 inch	.938	.9323– .9427	1 3/16– inches		1.1719–1.1822
15/16+ inch		.9428– .9531	1 3/16 inches	1.188	1.1823–1.1927
31/32– inch		.9532– .9635	1 3/16+ inches		1.1928–1.2031
31/32 inch	.969	.9636– .9739	1 7/32– inches		1.2032–1.2135
31/32+ inch		.9740– .9843	1 7/32 inches	1.219	1.2136–1.2239
1– inch		.9844– .9947	1 7/32+ inches		1.2240–1.2343
1 inch	1.000	.9948–1.0052	1 1/4– inches		1.2344–1.2447
1+ inch		1.0053–1.0156	1 1/4 inches	1.250	1.2448–1.2552
1 1/32– inches		1.0157–1.0260	1 1/4+ inches		1.2553–1.2656
1 1/32 inches	1.031	1.0261–1.0364	1 9/32– inches		1.2657–1.2760
1 1/32+ inches		1.0365–1.0468	1 9/32 inches	1.281	1.2761–1.2864
			1 9/32+ inches		1.2865–1.2968

[1] Used in conversion of code indices into fractional length designations.

STATISTICAL ANALYSES

The data for the seed cottons employed in the drying tests were grouped according to temperature ranges of the hot air at the inlet of the drier, to which the seed cotton was subjected. The data for the cottons dried at each temperature range were subdivided on the basis of staple length, then by moisture content, and finally by density of seed roll.

The drier temperature groupings used are as follows: (1) 150° F., (2) 170° to 200°, (3) 210° to 230°, and (4) 250°. Two staple-length groups—1⅛ inches and longer, and shorter than 1⅛ inches—were used.

The moisture-content groupings selected were: (1) 16 percent and above, (2) 12 to 15.9 percent, (3) 8 to 11.9 percent, and (4) below 8 percent. The two degrees of seed-roll density employed were loose and tight.

The average moisture content of the seed cotton and of the ginned lint, and the average of each quality element of ginned lint was then calculated for both undried and dried samples from portions of the same seed cottons. These paired averages of undried and dried samples are shown in the appendix (tables 22 to 25) by the four drier-temperature ranges used.

The average grade for cottons 1⅛ inches and longer was obtained by adding together the numerical value of the two grade factors, color and leaf, dividing the sum by twice the number of samples in the lot, and attaching to this average the corresponding average of preparation expressed in letter designation. The average grade for cottons shorter than 1⅛ inches was obtained by adding together the numerical values of color, leaf, and preparation, and dividing this sum by three times the number of samples in the lot. This procedure was followed, instead of averaging the grade of the individual samples as designated by the classer, in order to preserve in this final average the minute effects of conditioning or drying on either of the grade components. This method of calculating an average grade assumes equal steps between the several grades. It is realized that the steps between grades are not equal but no other method of averaging seemed so practical. To facilitate the averaging of samples classed as spotted, the spotted designation was replaced by reducing the color factor one full step, thus making the resulting grade more nearly equivalent to the white standard. The leaf designation was used as indicated.

Staple length was designated in intervals of one thirty-second of an inch and converted into decimal values for averaging. The final average staple length of a group of samples was converted from the code or decimal value to a fractional value and expressed in the nearest thirty-second inch group with a plus or minus sign, by the use of the schedule shown in table 5.

Since the same seed cottons do not appear in each moisture grouping, and since portions of the same cottons were not always dried at each of the temperature ranges, the differences between paired averages of each moisture group, and at each drying temperature, were used instead of the absolute values to determine the influence of artificial drying on the moisture content of the seed cotton and ginned lint, and on the quality of the ginned lint. Differences between undried and dried samples were calculated from the paired values in tables 22 to 25 and are shown for seed-cotton and lint-moisture content, and for each quality element in tables 7 to 16 by the 2 staple-length groups, 2 seed-roll densities, 4 drier-temperature ranges, and 4 moisture-content groups. Although many of these differences are of small magnitude, most of them were found to be statistically significant. The fact that consistent tendencies are shown in repeated tests is in itself an indication of significance. Since portions of the same seed cottons always entered into averages that are compared, all of the results are based on paired observations.

As a direct result of this pairing of the seed cottons, a high correlation naturally existed between the two single lint samples of each pair entering into the averages. This element of correlation between the paired observations makes the apparent small differences between some of the averages all the more significant. The degree of significance of the mean differences was determined by the use of Student's method and probability table for ascertaining the significance of the difference between paired observations (8).

Scatter diagrams of the individual differences between paired samples of lint ginned from portions of the same seed cottons are presented for each of the quality elements considered and for moisture content. The data shown as averages in tables 6 to 16 are plotted as individual differences in figures 2 to 12, respectively.

RESULTS AND DISCUSSION

Before describing the experiments and presenting the results of studies, it seems appropriate to point out the primary conditions that have been recognized as variables affecting the quality of the ginned lint and have been controlled or measured, and to mention the secondary conditions, both those that were held constant and those not controlled.

Moisture content of the seed cotton, length of staple, and temperature of the air in the vertical drier in their separate and combined influences are the primary conditions of experimentation considered in this analysis.

Recognized and controlled secondary conditions may be generally described as the ginning process. These include seed-roll density, type and complexity of the cleaning and extracting machines, fineness and shape of saw teeth, speed of saws, etc. With the exception of seed-roll density, the effect of each of these conditions was eliminated by the use of a constant set-up throughout the experiments. In this presentation the other conditions have been held constant, and no attempt is here made to measure their influence.

Secondary conditions that were not controlled may be grouped generally as variety and quality of the seed cotton, and weather conditions. Seed cotton has such variables as length variability; strength and type of fiber; shape, weight, and fuzziness of the seed; tenacity of attachment of the fibers to the seed; and quantity and type of foreign matter in the seed cotton. Weather conditions refer to the prevailing relative humidity and temperature at the time each test was made. It is recognized that these factors are not unimportant, but any effect exerted by them would tend to be overcome in averaging the quality elements of several cottons. Sufficient cottons were not available to permit consideration of a wide range of these secondary conditions under narrow limits of primary conditions. However, some of the irregularities of the results presented in the subsequent tables are due, no doubt, to inherent differences in the seed cottons that were not completely eliminated.

Had adequate conditioning facilities been available at the laboratory to vary the moisture content of separate portions of the same seed cottons, certain irregularities due to inherent characteristics of the seed cotton would have been eliminated. However, since these facilities for conditioning large quantities of seed cotton were not available, it was necessary to use different seed cottons in each moisture-content group. In certain respects, this arrangement is very desirable in the beginning, inasmuch as it affords an opportunity to study these practical problems under natural conditions; that is to say, the removal of moisture from, or the addition of moisture to, seed cotton by artificial conditioning alone would not have represented the range of natural and practical conditions of the seed cotton involved in this ginning problem.

If seed cottons of only a relatively high moisture content (16 percent or more) had been employed, the adjustment of the moisture content of aliquot portions to successively lower percentages would have required drying at successively higher drying temperatures, or for longer periods, or both. Obviously such a method of procedure would introduce other variables and effects.

On the other hand, if seed cottons of only a relatively low moisture content (below 8 percent) had been used the adjustment of the moisture content of aliquot portions to successively higher percentages would have necessitated the addition of water in some form. It would have been practically impossible to have added moisture uniformly to all of the seed cotton in a given portion without continued handling. This additional handling would have added variables to the ginning results that could not properly be attributed to the moisture content.

It also would have been difficult if not impossible to have obtained seed cotton having a moisture content equivalent to that of very "green" cotton had either the very wet or very dry cottons been used, and the moisture content of different portions of each cotton adjusted artificially to the desired moisture percentage.

It is believed, therefore, that the use of different seed cottons in each moisture group offers the best possibility at present of obtaining results of the most practical application. As regards the temperature phases, portions of the same seed cottons were not dried at all of the drying temperatures reported in these tests because sufficient quantities of every seed cotton were not available to make these and other ginning tests. However, portions of the same seed cotton were dried at three of the temperatures in a number of instances. Where it was possible for different portions of each of several cottons to be dried at three temperatures, the laboratory and classing results obtained for such cottons, or those considered in connection with table 19, were substantially the same as the results shown by the difference tables 7 to 16 for the tests in which portions of each cotton were not always dried at each of the temperature groups shown.

MOISTURE IN SEED COTTON AS RELATED TO PREPARATION OF GINNED LINT

Moisture in seed cotton affects the quality of ginned lint primarily in a single grade element—preparation. Preparation (*3; 13, p. 11*) of ginned lint is by definition a function of the ginning process rather than an inherent quality of the seed cotton, although the characteristics and properties of the seed cotton play an important part. It seems desirable, therefore, that the relationship of moisture in seed

38731°—36——3

cotton to the preparation of ginned lint be pointed out before the results of the drying tests are presented.

The data for the undried portions of the 63 seed cottons used in the drying tests were divided into 2 staple lengths, and 4 moisture groups, as previously explained. The average moisture content of the seed cottons, and the average moisture content and preparation of the ginned-lint samples were then calculated for both loose and tight seed-roll ginnings for the number of cottons appearing in each moisture group. The results are given in table 6 and figure 2.

TABLE 6.—*Relationship of the average moisture content of undried seed cottons and the average preparation of the ginned lint samples*

COTTONS 1⅛ INCHES AND LONGER

Seed cotton			Seed-roll density	Ginned lint		
Moisture content (percent)	Lot	Moisture content at time of ginning		Moisture content after ginning	Preparation	
		Percent		*Percent*	*Code index*	*Designation*
16.0 and above	Nos. 35, 36, 39, 105, 113, 202, 205, 211.	18.2	Loose	11.0	7.8	C.
			Tight	11.2	8.5	C.—
12.0 to 15.9	Nos. 104, 107, 108, 121, 204, 209, 219.	13.8	Loose	9.5	7.1	C.+
			Tight	9.6	8.1	C.
8.0 to 11.9	Nos. 40, 56, 60, 118, 123, 126, 134, 144, 215, 226, 227.	11.0	Loose	7.6	5.5	B.—
			Tight	7.5	6.6	C.+
Below 8.0	Nos. 48, 51, 54, 62	7.3	Loose	5.9	5.5	B.—
			Tight	5.9	5.5	B.—

COTTONS SHORTER THAN 1⅛ INCHES

Seed cotton			Seed-roll density	Ginned lint		
16.0 and above	Nos. 41, 47, 65, 131, 203, 217, 218, 220, 221.	19.8	Loose	12.6	6.9	L. M.
			Tight	12.9	8.0	S. G. O.
12.0 to 15.9	Nos. 78, 109, 112, 116, 119, 120, 122, 133, 137, 139, 210, 229.	13.9	Loose	9.0	6.0	S. L. M.
			Tight	9.3	7.2	L. M.
8.0 to 11.9	Nos. 46, 58, 115, 142, 145, 206, 223, 243.	10.9	Loose	7.7	5.1	M.
			Tight	7.8	5.9	S. L. M.
Below 8.0	Nos. 53, 59, 101, 228	7.7	Loose	5.6	4.5	M.
			Tight	6.2	6.0	S. L. M.

It is noted that relatively low ginning preparation is associated with seed cottons of the highest moisture content and that on the whole the preparation is better for the cottons of each succeeding lower moisture group. This tendency is shown by cottons of each staple-length group ginned with either seed-roll density. The loose seed-roll samples on the average are higher in preparation than the tight seed-roll samples for the cotton of every moisture group except the lowest with the longer staple cotton. This indicates that a faster rate of feed is possible as lower moisture-content cottons are ginned.

The preparation of the longer staple cottons is generally lower than that of the shorter staple cottons in corresponding moisture-content groups, showing that the unfavorable effect of moisture in the seed cotton tends to be more pronounced for the longer than for the shorter staple cottons. For example, the preparation of ginned lint that was obtained for the shorter staple cottons averaging 19.8 percent moisture in the seed cotton was similar to that for the longer staple cottons averaging 13.8 percent moisture.

There is a closer relationship between the moisture content of the ginned lint and preparation than between the moisture of the seed cotton and preparation. However, the cottons have been grouped in table 6, and in subsequent tables, on the basis of moisture content in the seed cotton because, from the practical standpoint, the determination of moisture in the lint could not be made prior to ginning.

The purpose, then, of artificially drying seed cotton is to lower the moisture content, especially of the fibers, in order that smoother and more efficient ginning and a better preparation of sample will be obtained.

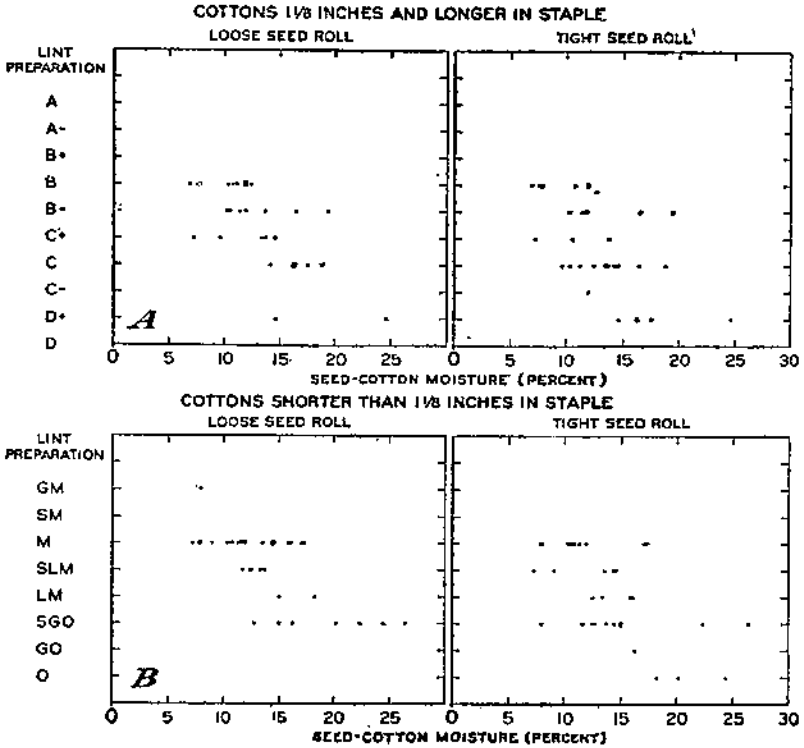


FIGURE 2.—PREPARATION OF INDIVIDUAL GINNED-LINT SAMPLES AS RELATED TO THE MOISTURE CONTENT OF THE SEED COTTON AT TIME OF GINNING.

Relatively low preparation of ginned lint is usually associated with seed cotton of high moisture content

WEIGHT OF SEED COTTON AND OF GINNED LINT AS AFFECTED BY ARTIFICIAL DRYING

MOISTURE REMOVED FROM SEED COTTON

The quantity of moisture removed from seed cottons of different moisture-content groups by drying at different temperatures is shown in table 7 and figure 3. Since two portions of each lot of undried and dried seed cottons were ginned with loose and with tight seed rolls consecutively, the moisture content of the two portions of seed cotton ginned with the two respective seed-roll densities were identical. Moisture determinations, therefore, were made and reported for only one portion.

TABLE 7.—*Moisture content of seed cotton: Average pounds of moisture per 100 pounds of seed cotton, and average of the differences[1] between undried and dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	150° F.		170° to 200° F.		210° to 230° F.		250° F.	
	Before drying	Removed by drying	Before drying	Removed by drying	Before drying	Removed by drying	Before drying	Removed by drying
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
16.0 and above	18.3	2.9	18.6	3.2	19.1	3.7	16.4	2.9
12.0 to 15.9	14.0	1.8	14.0	2.2	13.7	3.2	14.0	3.0
8.0 to 11.9	10.8	1.1	10.7	2.2	11.6	1.4	10.5	2.1
Below 8.0			7.5	1.1	7.3	1.9		

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	150° F. Before drying	150° F. Removed by drying	170° to 200° F. Before drying	170° to 200° F. Removed by drying	210° to 230° F. Before drying	210° to 230° F. Removed by drying	250° F. Before drying	250° F. Removed by drying
16.0 and above	19.2	3.4	20.3	3.4	20.5	3.7	16.2	4.6
12.0 to 15.9	13.6	1.5	13.6	2.1	14.7	2.7	13.7	2.6
8.0 to 11.9	10.9	1.1	10.8	1.7	10.0	2.4	10.8	1.8
Below 8.0	7.9	.3			7.5	.9		

[1] See tables 22 to 25 for paired values from which these differences were calculated.

In general, for each drying-temperature range, the amount of moisture removed from seed cotton by artificial drying increased with each succeeding higher moisture-content group. Part of the discrepancies to this relationship observable in table 7 are due to the fact that it was not possible to obtain seed cottons with the same moisture content before drying. Although several exceptions are noted, particularly at the highest temperature or 250° F., there was a tendency for each higher temperature to remove more moisture from cottons of the same moisture-content group. The differences in the effect of drying at different temperatures, however, on cotton of the same moisture group were much less pronounced than those of drying at any one temperature when cottons of different moisture content were employed. That is, varying the temperature from 150° to 250° for cottons of the same moisture content, resulted in much smaller differences in the quantities of moisture removed, than was observed upon drying at a given temperature seed cottons that varied in moisture content from less than 8 to 16 percent or more.

Moisture removed by drying the seed cotton at 150° F. varied from an average of about 1 pound per 100 pounds of seed cotton for cotton having a moisture content of less than 12 percent, to about 3 pounds for cotton having 16 percent or more moisture. At 210° to 230° drying temperature the average amount of moisture removed varied, on the average, from about 2 pounds for cotton having less than 12 percent moisture to almost 4 pounds for cotton having 16 percent or more. Little if any additional moisture was removed by drying the longer seed cotton at 250°, over that removed by drying at 210° to 230°. This is to be explained, in part, by the fact that the relative humidity of the hot air in the drying tower is very slightly less with a temperature of 250° than with a temperature of 210° to 230°. The capacity of this air to absorb moisture is, therefore (within practical limitations which must prevent condensation inside the drier) only slightly greater. Another possible reason is that all of the free moisture volatilizes at a drying temperature below the boiling point of water, and drying at a higher temperature does not have an opportunity to remove any appreciable amount of internal moisture during the brief period of exposure within the vertical drier.

The amount of moisture removed from a given lot of seed cotton by artificial drying is no doubt influenced both by the inherent characteristics of the seed cotton and by the nature of the moisture in the cotton. Moisture occurs in the fibers and seed and on their exterior surfaces, and it is reasonable to expect that their ratios will show considerable variation. That is, seed cotton when damp or wet from rain or dew will have excess moisture largely on the exterior; whereas seed cotton exposed to continued damp or rainy weather and its

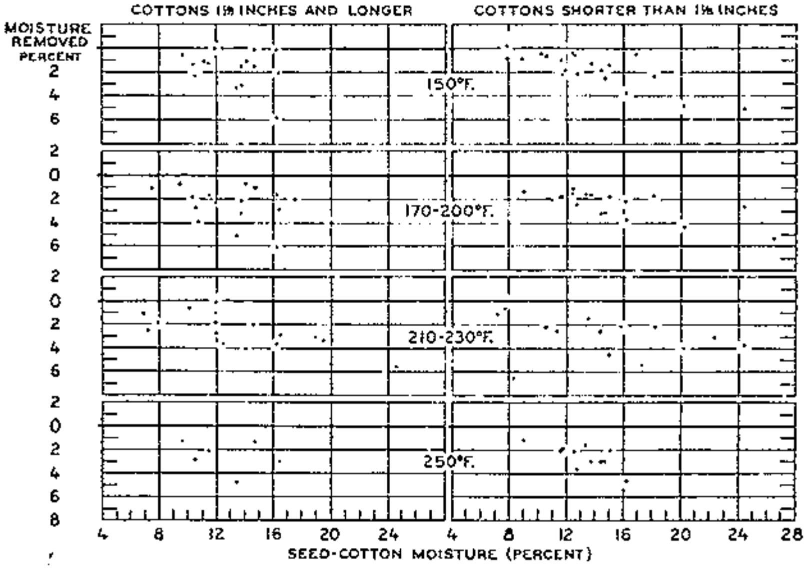


FIGURE 3.—DIFFERENCES IN THE MOISTURE CONTENT OF UNDRIED AND DRIED PORTIONS OF THE SAME SEED COTTONS.

Within the limits employed, the amount of moisture removed by drying tends to increase with increase in the moisture content of the seed cotton and with increase in the drying temperature.

attendant high relative humidity, or cotton recently picked from stalks of rank growth or heavy foliage, will have a relatively high moisture content within the seed and fiber substance. In the light of such considerations, it is evident, that, from a ginning standpoint, the absolute amount of moisture removed is, to some extent, of more significance than the relative amount.

MOISTURE REMOVED FROM THE LINT

Artificial drying is more effective in removing moisture from cotton fibers (table 8 and fig. 4) than is indicated by the amount of moisture removed from seed cotton. Since the fibers (through their dimensions, relatively great surface exposures, and nature) are much more susceptible to drying than are the seeds, most of the moisture removed from seed cotton, during the short period of exposure in the drier, comes from the lint rather than from the seed. Moreover, the seeds comprise about two-thirds of the weight of seed cotton, and the usual moisture content of cottonseed is higher than that of lint. Results from moisture tests of seed cotton, and especially if the seed cotton has been artificially dried, do not necessarily indicate, therefore, the ginning condition of the fibers. Finally, the moisture content of the seeds is considerably less important from a ginning standpoint than is the moisture content of the fibers, unless the seeds are so wet that they are soft or mushy.

TABLE 8.—*Moisture content of ginned lint: Average of the differences*[1] *in pounds of moisture per 100 pounds of lint between lint ginned from undried and from dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
16.0 and above	2.8	4.5	3.5	4.2	2.5	2.9	3.9	2.4
12.0 to 15.9	2.5	3.1	3.1	3.6	2.1	3.3	3.0	3.6
8.0 to 11.9	1.4	2.1	2.2	2.0	1.7	2.3	2.2	1.9
Below 8.0	----------	1.8	2.4	----------	----------	2.1	2.0	----------

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	Loose seed roll: 150° F.	Loose: 170° to 200° F.	Loose: 210° to 230° F.	Loose: 250° F.	Tight seed roll: 150° F.	Tight: 170° to 200° F.	Tight: 210° to 230° F.	Tight: 250° F.
16.0 and above	4.3	4.4	5.9	5.5	4.2	5.0	5.4	5.2
12.0 to 15.9	2.1	2.9	3.1	3.8	2.3	3.2	3.0	4.0
8.0 to 11.9	1.5	3.0	1.9	2.9	1.6	2.8	1.6	3.3
Below 8.0	.4	----------	1.1	----------	1.5	----------	1.7	----------

[1] See 10–6, tables 22 to 25 for paired values from which these differences were calculated.

It was found in general that the absolute amount of moisture removed from the fibers at each drying-temperature range was greater for cottons of successively higher moisture-content groups and that the tendency of increasing the drying temperature on seed cottons of the same moisture content was to increase the amount of moisture removed.

With the shorter staple cottons the absolute amount of moisture removed from 100 pounds of lint by drying at a temperature of 150° F., varied from an average of about 1.5 pounds, for seed cotton having 8 to 11.9 percent, to more than 4 pounds for seed cotton having 16 percent or more. By drying at a temperature of 250°, such moisture removals ranged from about 3 pounds to more than 5 pounds. The amount of moisture removed from the lint of the longer staple cottons, showed a similar tendency with respect to cottons with moisture content of less than 12 percent.

With the cottons having 16 percent or more moisture, smaller proportions of moisture were removed from the lint of the longer staple cottons than from the lint of the shorter staple cottons. However, this apparently greater reduction in the moisture content of the ginned lint of the shorter staple cotton is due, in a large measure, to the fact that the average moisture content of the shorter staple cottons, before drying, was considerably higher than that of the longer staple cottons.

Except for the short cotton of this high-moisture-content group, the moisture remaining in the lint ginned from all cottons having a moisture content above 12 percent was approximately 7 percent after drying at a temperature of 150° F. (table 22). Higher drying temperatures reduced the moisture content of the ginned lint below this figure in many cases, particularly the high drying temperature of 250°. Moreover, the moisture content of lint ginned from seed cotton having a moisture content of less than 12 percent was reduced below

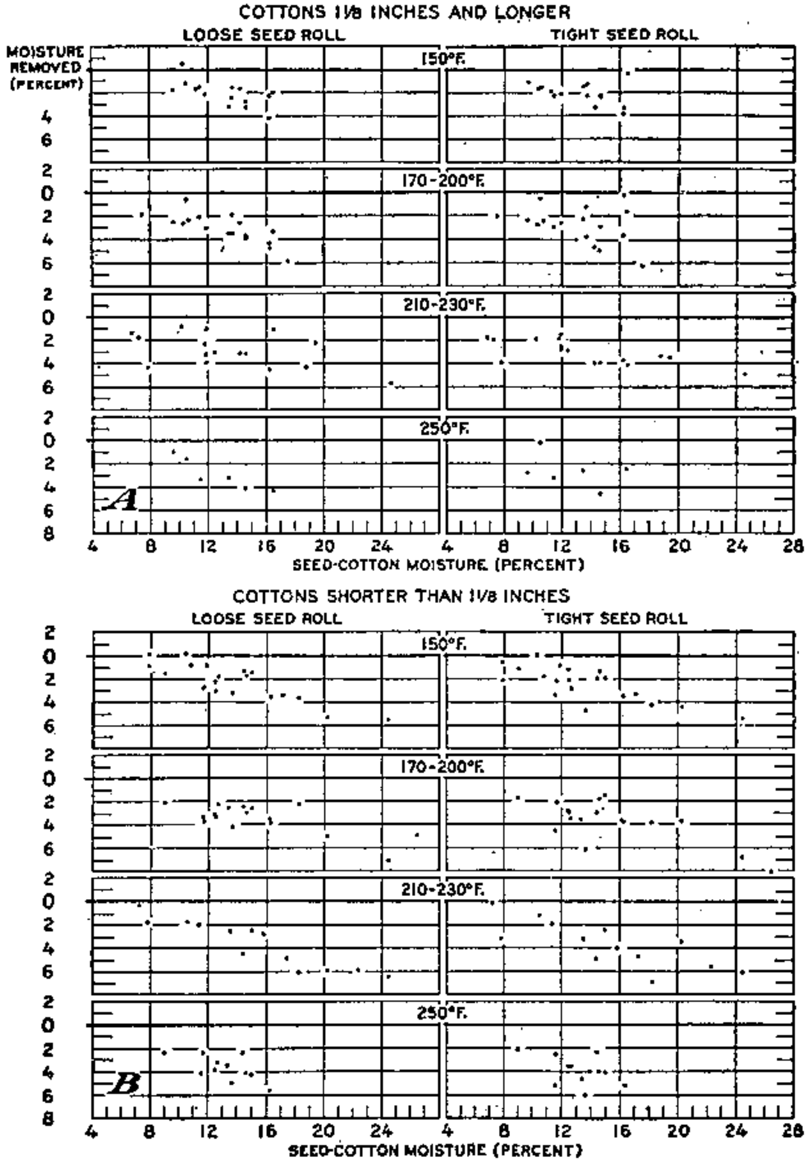


FIGURE 4.—DIFFERENCES IN THE MOISTURE CONTENT OF LINT GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

The amount of moisture removed from the lint tends to increase as seed cottons of successively higher moisture content were dried.

7 percent or in some instances as low as about 5 percent by drying even at the lowest temperature. Also, as higher drying temperatures were used, still further reductions were shown.

The amount of moisture removed from the lint by drying the seed cotton is important from the standpoint of value, since all cotton is sold on the basis of weight. If a drying temperature is used that is higher than that required to dry satisfactorily a given cotton, the weight of the lint will be unnecessarily reduced by the amount that the moisture content of the lint is lowered below the usual moisture content of cotton picked and ginned under normal weather conditions. There are no official standards for moisture content in American cotton, but generally accepted trade practice recognizes a moisture regain of about 8.5 percent as the usual allowable moisture in raw cotton (*7*). A regain of 8.5 percent is the equivalent of 7.8 percent moisture content. Therefore, if the moisture content of lint is not reduced below 7.8 percent by artificial drying, the loss in weight from the standpoint of the marketing system cannot be said to be an economic loss. However, if only a relatively few growers dried their cotton before ginning, they would probably be penalized by the amount of the loss in weight. By reference to tables 22 to 25, it will be seen that seed cottons having a moisture content of 8 to 11.9 percent will generally produce, when ginned without drying, lint having a moisture content of 7 to 8 percent.

Under present marketing practices in the United States, excess moisture in baled cotton is allowed for by dockage at the time of the original purchase of the cotton, in order to compensate for probable loss in weight as the cotton dries out in storage or in transit (*6*), *page 100*. However, at present, individual bales that are dried receive the same treatment.

In order to study the effect of artificial drying on the weight of a bale of cotton of standard size, a 3,000-pound lot of seed cotton, having a moisture content of 14.6 percent, was divided into two equal portions. One portion was ginned without drying, and the other after drying in the double-fan vertical drier at 220° F. After being ginned and baled on September 9, 1933, the two bales were stored at Leland, Miss., in a commercial compress having a roof, a concrete floor, and two open sides. The bales were wrapped with jute bagging.

The moisture content of the undried bale of lint at the time of ginning was 10.9 percent, and that of the dried, 7.8 percent. The bales were taken to the compress immediately after ginning; they weighed 441 and 425 pounds, respectively, on arrival. They were reweighed each week for a period of 35 weeks. During the first 10 weeks the bale ginned from the undried seed cotton lost 12 pounds, whereas the weight of the bale ginned from the dried seed cotton changed only slightly. After the twelfth week the undried bale remained almost constant in weight while the dried bale gained, until at the end of the eighteenth week the dried bale weighed only 3 pounds less than the undried bale. This relationship remained practically constant throughout the remainder of the test.

Moisture tests made after 35 weeks of storage revealed that the undried lint contained 8.6 percent of moisture and the dried 7.6 percent. This test shows that because of the evaporation of excess moisture, the undried bale lost weight whereas the bale from dried seed cotton, which was of approximately usual moisture content at the time of ginning, did not undergo any appreciable change in weight; and that after a sufficient period of storage there is no material difference in weight of dried and undried bales.

QUALITY OF GINNED LINT AS AFFECTED BY ARTIFICIALLY DRYING SEED COTTON

GRADE

In presenting the effects of artificially drying the seed cotton before ginning, on the grade of ginned lint three methods are used. They are: (1) the presentation of classing data to show the effects on preparation, color, and leaf classed first as separate factors of grade and then averaged to obtain the net effect on the grade; (2) the presentation of laboratory measurements of the brilliance of paired samples ginned from undried and dried portions of the same seed cotton; and (3) the use of photographic illustrations of samples ginned from equal portions of the same seed cotton, one portion of which was ginned without drying and the other after drying.

PREPARATION

The quality element most noticeably benefited by drying the seed cotton before ginning is preparation, or smoothness of ginning. The improvement in preparation is closely related to the amount of moisture removed from the seed cotton, and more particularly to that removed from the fibers. The average differences in preparation of lint ginned from undried and dried portions of the same seed cottons are shown in table 9. Differences between undried and dried samples of individual cottons are shown graphically in figure 5. It has been noted that, with seed cottons of successively higher moisture content, greater quantities of moisture were removed from the lint by the drying process. These effects are highly related to preparation improvements That is, the beneficial effects on preparation of drying at either temperature range increased generally as seed cottons of each succeeding higher moisture group was dried and larger amounts of moisture were removed. The preparation improvements with the longer cottons having 12 percent or more moisture are similar to those with the shorter cottons having 16 percent or more moisture. However, the preparation enhancements with the shorter cottons having 12 to 15.9 percent moisture are usually higher than those of the longer cottons having 8 to 11.9 percent moisture.

TABLE 9.—*Preparation of ginned lint: Average of the differences*[1] *between the classer's designation of preparation of lint ginned from undried and from dried portions of the same seed cotton*

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Code points[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]
COTTON 1 1/8 INCHES AND LONGER								
16.0 and above	2.0	2.5	2.0	2.0	2.3	2.5	1.2	0.0
12.0 to 15.9	2.5	2.5	2.7	2.0	1.4	1.9	2.0	2.0
8.0 to 11.9	.6	.6	.4	1.0	.3	1.0	1.0	.7
Below 8.0	----------	.0	.7	----------	----------	.0	.7	----------
COTTON SHORTER THAN 1 1/8 INCHES								
16.0 and above	2.0	2.0	2.0	3.0	1.8	2.7	2.2	3.0
12.0 to 15.9	1.1	1.2	.8	1.4	1.7	1.9	.6	1.7
8.0 to 11.9	.2	.3	.0	.3	.7	1.3	.0	1.8
Below 8.0	.5	----------	.0	----------	1.5	----------	−1.0	----------

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (—) indicates lower quality of lint from standpoint of preparation as a result of drying the seed cotton before ginning.

[2] 1.0 point = 1 preparation step. See table 4.

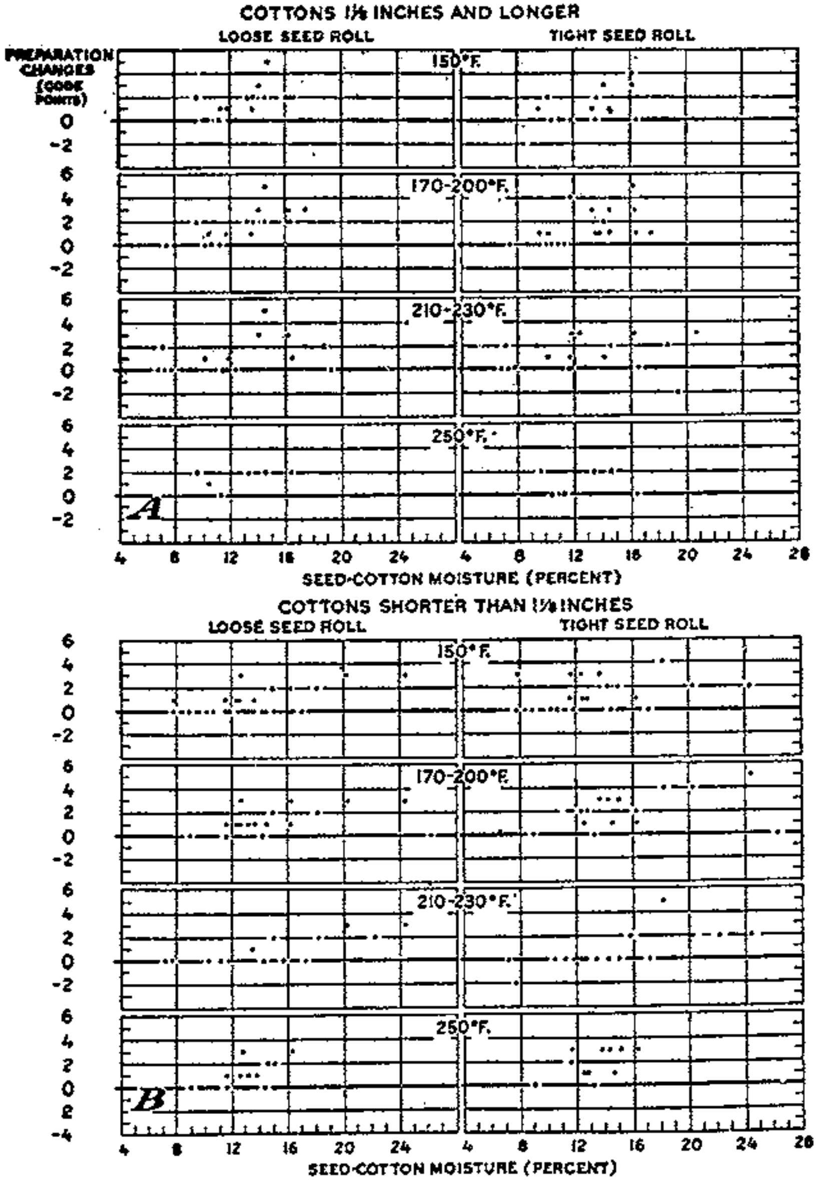


FIGURE 5.—DIFFERENCES IN PREPARATION, AS OBSERVED BY THE CLASSER, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

Within the limits employed, preparation improvements as a result of drying are more pronounced as the moisture content of the seed cotton increases.

The changes in preparation as a result of drying the longer staple cottons of the 8 to 11.9 percent moisture group were still favorable to drying; but with the shorter cottons of this moisture group, the improvements, in general, were small, particularly when the loose seed roll was used in ginning. The effects on preparation produced by drying cottons of a moisture content below 8 percent were so small and inconsistent for both long- and short-staple cottons, and even detrimental in some instances, as to suggest that cotton of this moisture content should not be artificially dried.

Increasing the drying temperature above 150° F. for seed cottons of either moisture group resulted in only small additional benefits to preparation at the 170°–200° temperature range. Little or no further benefit was realized by drying at 210° to 230° or 250°. It would appear therefore, that the drying temperature range of 170° to 200° removed enough moisture to put the seed cotton in the optimum ginning condition, and that any additional moisture removed by higher drying temperatures was not reflected in further preparation improvement.

Greater improvements in preparation of ginned lint were obtained generally, as a result of drying, for the longer staple cottons than for the shorter cottons. The apparent exception to this tendency, as shown by the data reported for seed cottons in the 16-percent-and-above moisture group is explained, in part at least, by the fact that the moisture content of the longer staple cottons averaged considerably less than that of the shorter staple cottons of the same moisture group (table 7). The average moisture content of the longer staple cottons in the 16-percent-and-above moisture group was only slightly above 16 percent for either group of cottons, except for those dried at 210° to 230° F., and only a little more than 2 percent greater than the average of the seed cottons in the 12 to 15.9 percent moisture group. Probably this explains why the preparation of the lint ginned from the undried longer staple cottons in the 16-percent-and-above moisture group was only slightly lower than that ginned from the cottons in the 12 to 15.9 percent moisture group. This in turn explains why the improvement in preparation as a result of drying was no greater for the lint ginned from the seed cottons of the 16-percent-and-above moisture group than that of the lint ginned from the cottons in the 12 to 15.9 percent moisture group.

When portions of these same longer staple seed cottons were dried before ginning, the preparation of lint ginned from seed cotton of the 8 to 11.9 percent moisture group and that ginned from cotton in the 12 to 15.9 percent group was practically the same, and was only slightly different from that ginned from seed cottons in the 16-percent-and-above moisture group (tables 22 to 25). The improvements in preparation therefore, as a result of drying the longer staple cottons, were not any more pronounced for seed cottons having 16-percent-or-more moisture than for cottons of the next lower moisture group. However, had the seed cotton in this moisture group averaged about 18 percent, or 4 percent above that of the cottons in the next lower moisture group, as did the shorter staple cottons, it would seem reasonable to expect that the improvement in preparation as a result of drying would have been more for cottons in the 16-percent-and-above moisture group than for those of the next lower group.

The preparation of lint of the shorter staple cottons, ginned after drying, was practically identical for cotton of each moisture group, dried at either temperature range, while the preparation of the lint from the undried cotton was lower for each succeeding higher moisture group. The differences in preparation, then, between corresponding groups of undried and dried cottons were increasingly greater as cottons of each succeeding higher moisture group were compared.

TABLE 10.—*Color of ginned lint: Average of the differences*[1] *between the classer's designation of color of lint ginned from undried and from dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Code points[2]	*Code points*[1]	*Code points*[1]	*Code points*[1]	*Code points*[1]	*Code points*[1]	*Code points*[1]	*Code points*[1]
16.0 and above	0.4	0.3	0.2	0.0	0.4	0.3	0.2	0.0
12.0 to 15.9	.0	.1	.0	.5	0.	.1	.0	.0
8.0 to 11.9	.2	.0	.4	.0	.2	.0	.0	−.3
Below 8.0		.0	.0			1.0	.0	

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	Loose 150° F.	Loose 170° to 200° F.	Loose 210° to 230° F.	Loose 250° F.	Tight 150° F.	Tight 170° to 200° F.	Tight 210° to 230° F.	Tight 250° F.
16.0 and above	0.4	0.7	0.8	0.0	0.4	0.7	0.8	0.0
12.0 to 15.9	−.2	.0	.0	.0	.0	.2	.0	.3
8.0 to 11.9	.0	.0	.0	.0	.0	.0	.0	.0
Below 8.0	.0		.5		.5		.5	

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (−) indicates lower quality of lint from standpoint of color as a result of drying the seed cotton before ginning.
[2] 1.0 point=1 color step. See table 3.

COLOR

The averages of the differences in the grade factor of color, as observed by the classer, between the lint ginned from undried and from dried portions of the same seed cottons are shown in table 10. Differences between undried and dried samples of individual cottons are shown graphically in figure 6. Although the classer did not find a difference between the color of lint ginned from undried and dried cottons for most of the tests made, such changes as were observed showed an improvement in color for the dried portions. There appears to be a slight tendency for the color to improve when cottons of the higher moisture content were dried. This was observed to be especially true when the color of the lint ginned from the undried portions was sufficiently low to offer an opportunity for brightening as a result of proper drying and ginning procedure. That is, low-grade cotton, having a correspondingly dull color, would be more likely to be improved by drying than would relatively high-grade cotton.

Brighter color of the lint as a result of drying the seed cotton could result from several influences, either singly or in combination. Smoother preparation would tend to cause the lint ginned from the dried cotton to appear brighter, in that the shadows would be less in evidence than in samples with rougher preparation. The "fluffing" of individual locks in the zigzag course of the seed cotton through the drying tower might tend to cause the lint to have a brighter appearance.

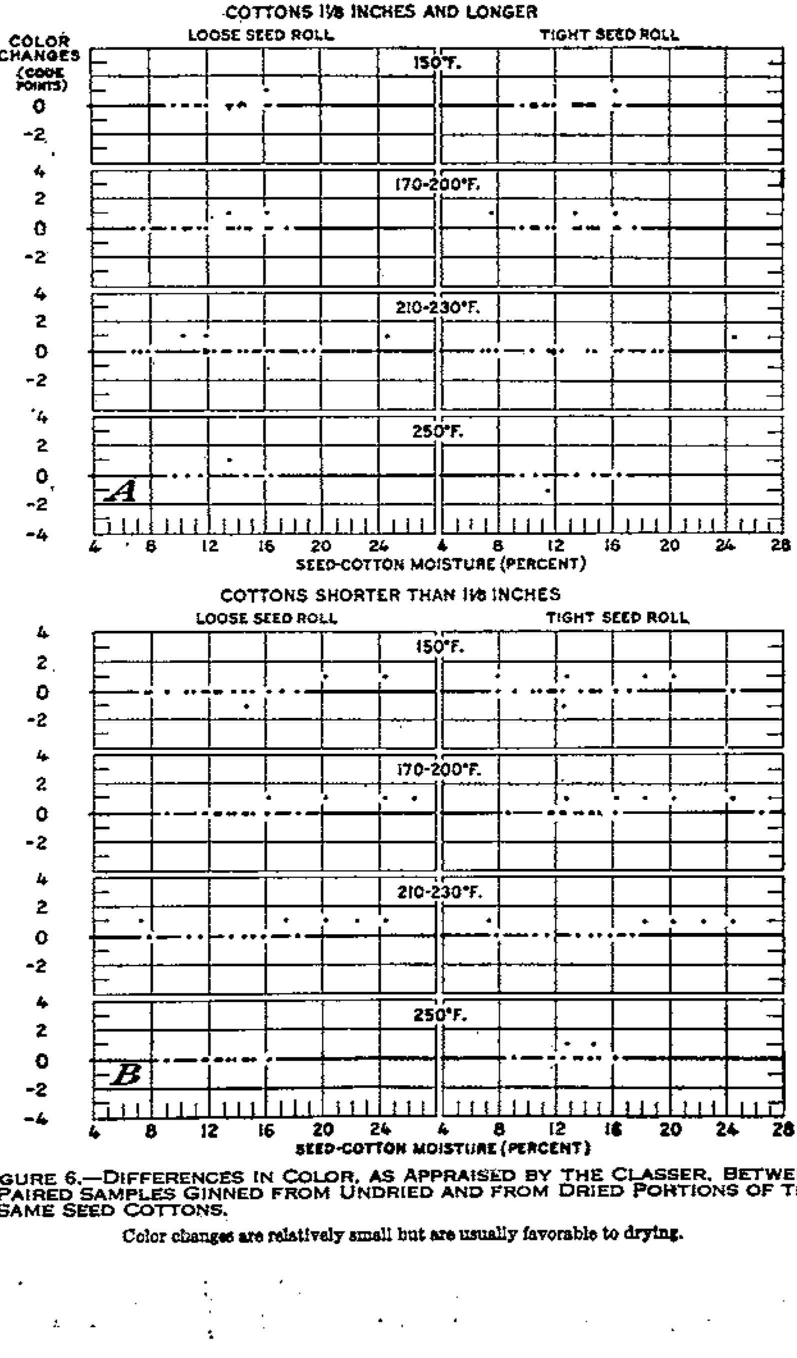


FIGURE 6.—DIFFERENCES IN COLOR, AS APPRAISED BY THE CLASSER, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

Color changes are relatively small but are usually favorable to drying.

Also, to the extent that the dried seed cotton would respond more readily than the wet seed cotton to the cleaning machinery, the lint would appear brighter. However, no definite improvement in leaf content was noted by the classer in this study as a result of drying the seed cotton.

LEAF

The average differences in the grade factor of leaf content, as observed by the classer, between lint ginned from undried and from dried portions of the same cottons are shown in table 11. Differences for individual cottons are shown graphically in figure 7. Obviously, improvement in the leaf designation refers to a reduced quantity of leaf or other foreign matter in the lint.

TABLE 11.—*Leaf content of ginned lint: Average of the differences*[1] *between the classer's designation of leaf content of lint ginned from undried and from dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Code points[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]
16.0 and above	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
12.0 to 15.9	.0	.1	.0	.5	.0	.1	.0	.0
8.0 to 11.9	.0	.2	.2	.3	.0	.2	−.2	.0
Below 8.0	----------	.0	−.7	----------	----------	1.0	.0	----------

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	Loose 150° F.	Loose 170° to 200° F.	Loose 210° to 230° F.	Loose 250° F.	Tight 150° F.	Tight 170° to 200° F.	Tight 210° to 230° F.	Tight 250° F.
16.0 and above	0.4	0.3	0.8	0.0	0.2	0.5	0.6	0.0
12.0 to 15.9	−.1	−.1	.0	−.1	.3	.3	.0	.4
8.0 to 11.9	.1	.0	.0	.0	.0	.0	.0	.0
Below 8.0	.0	----------	1.0	----------	.5	----------	.5	----------

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (−) indicates lower quality of lint from standpoint of leaf as a result of drying the seed cotton before ginning.
[2] 1.0 point = 1 leaf step. See table 3.

Artificially drying the seed cotton did not appear to affect the leaf content of lint consistently and generally caused very few changes, except, possibly, in the case of short cottons of highest moisture content. In some cases the effects were in favor of drying, but in others the opposite effects were noted.

A classer's concept of leaf is influenced not only by the quantity of leaf or foreign matter, but also by the size of the leaf particles (*13*). Large particles of leaf are less objectionable than smaller particles. To the extent that artificial drying causes the ginning process to break up the leaf particles without increasing the quantity removed, it tends to cause the quality of dried samples to be lower than that of the undried. This may account for the failure of the classer to observe any definite improvement in the leaf quality as a result of the drying treatments.

The quantity of leaf removed from the shorter staple cottons of highest moisture content, as a result of drying, appeared to be slightly greater than for cottons of this same staple group but of lower mois-

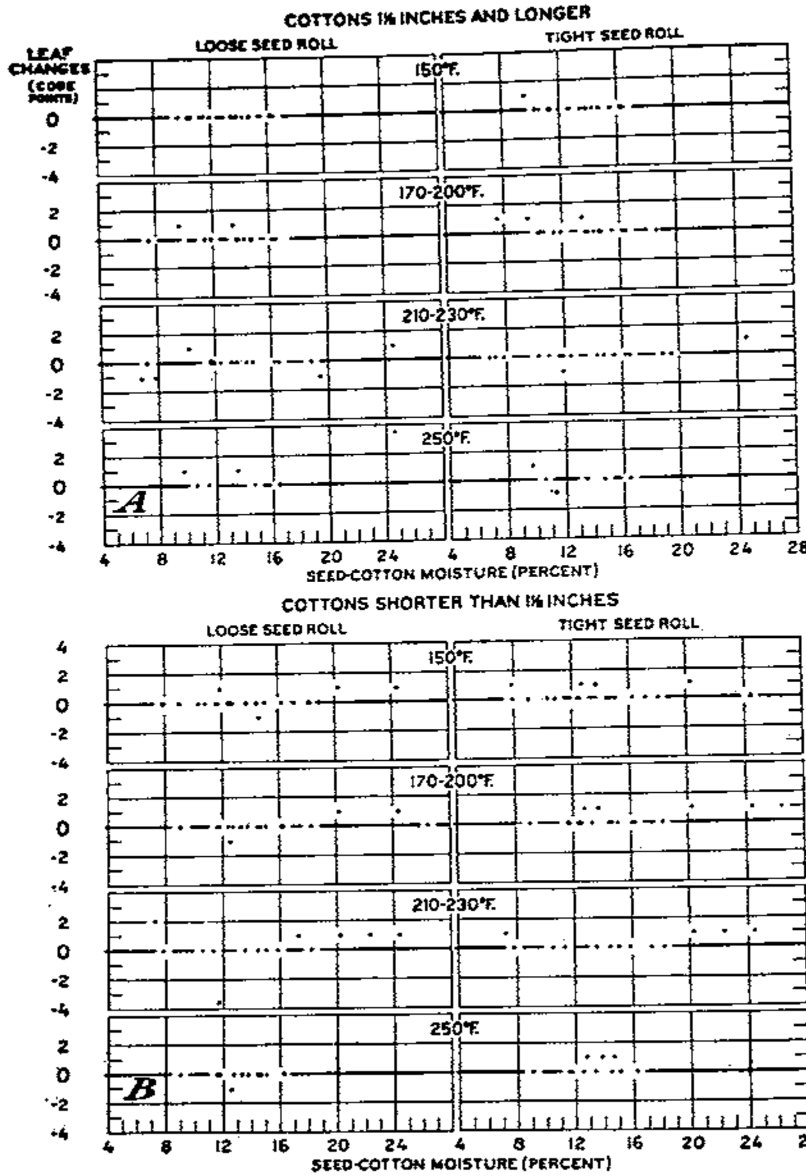


FIGURE 7.—DIFFERENCES IN LEAF, AS OBSERVED BY THE CLASSER, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

Leaf changes are relatively few and slight but are favorable to the dried samples in a majority of the cases.

ture content. For the longer staple cottons, this tendency was not in evidence. It is possible that the long-staple cottons offer more resistance to the removal of leaf than do the shorter cottons, in that the longer fibers because of their length and fineness cling more tenaciously to the leaf particles. Although the cleaning action of the drier, the separator, and the cleaning feeder might break up the leaf particles as a result of drying, these finer particles would still remain in the lint of the longer cottons and contribute to a lower quality more than would the larger leaf particles.

TOTAL GRADE EFFECTS—CLASSEE'S DESIGNATION

The influences of drying seed cottons on grade of ginned lint, as averaged from the classer's designations of the grade factors of color, leaf, and preparation, are shown in table 12 and figure 8. The averages representing differences in grade between undried and dried lint shown in the table and in the figure were obtained by averaging the differences for color, leaf, and preparation shown in tables 9, 10, and 11, and in figures 5, 6, and 7, respectively. Since drying the seed cotton raised the preparation of the ginned lint much more than the color or leaf, these improvements in grade are largely reflections of better preparation.

TABLE 12.—*Grade of ginned lint: Average of the differences*[1] *between the classer's designation of grade of lint ginned from undried and dried portions of the same seed cotton (by staple length, moisture content of seed cotton, seed-roll density, and drying temperature)*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Code points[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]	*Code points*[2]
16.0 and above	0.8	0.9	0.7	0.7	0.9	0.9	0.5	0.0
12.0 to 15.9	.8	.9	.9	1.0	.5	.7	.7	.7
8.0 to 11.9	.3	.3	.3	.4	.2	.4	.3	.1
Below 8.0	----------	.0	.0	----------	----------	.7	.2	----------
COTTON SHORTER THAN 1⅛ INCHES								
16.0 and above	0.0	1.0	1.2	1.0	0.8	1.3	1.2	1.0
12.0 to 15.9	.3	.4	.2	.4	.7	.7	.2	.8
8.0 to 11.9	.1	.1	.0	.1	.2	.4	.0	.5
Below 8.0	.2	----------	.5	----------	.8	----------	.0	----------

[1] See tables 22 to 25 for paired values from which these differences were calculated.
[2] 1.0=1 grade step. See table 3.

In general, the average improvement in the grade of the ginned lint as a result of drying the seed cotton increased with seed cottons of each successively higher moisture content. The changes in grade were small for the two groups of cotton of low moisture content; and they approximated one grade, on the average, for long- and short-staple cottons, respectively, having 16 percent or more moisture. For cottons having a moisture content 12 to 15.9 percent, the improvements in grade as a result of drying were about 0.8 and 0.5 for the long- and short-staple groups respectively. Some of the

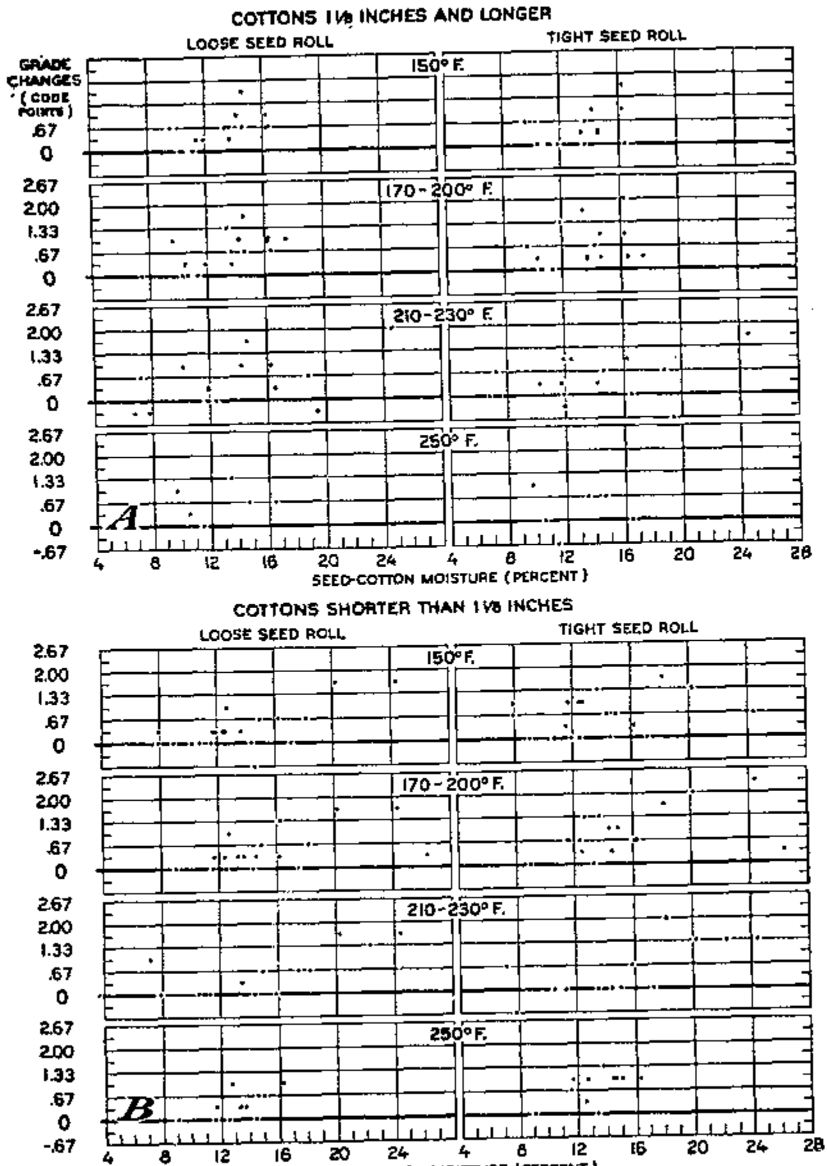


FIGURE 8.—DIFFERENCES IN GRADE, AS OBSERVED BY THE CLASSER, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

Grade improvements are due principally to better preparation. Within the limits employed, they generally were increasingly greater as seed cottons of successively higher moisture content were dried.

cottons were so wet that drying at the temperatures employed caused grade improvements amounting to as much as two full grades.

Practically as much improvement was obtained for cottons of the different moisture groups by drying at 150° F. as at any of the higher temperatures used. Some slight grade benefits over those realized at 150° resulted from drying the cottons of the two higher moisture-content groups at the temperature range of 170° to 200°. This was due, no doubt, to the greater amount of moisture removed by drying at the higher temperature, which resulted in an improvement in one or more of the grade factors, but principally preparation. However, drying at 210° to 230° did not result in any increased grade benefits over those realized at 170° to 200° temperature range, as the additional moisture removed was not enough to cause further improvement in preparation. Generally, the grade improvements as a result of drying at 250° were less than those observed at some of the lower drying temperatures, even though the amount of moisture removed from the lint was greater in some cases than that removed by lower temperatures. It was observed by the classer in some instances that the lint ginned from seed cotton dried at 250° had a dull and spongy appearance.

With the exception of cottons in the moisture group of 16 percent and above, an exception which undoubtedly is more apparent than real, the grade of lint ginned from long-staple cotton benefited more than that from the short-staple cotton by drying the seed cotton before ginning. As previously explained, the reason the longer staple cotton of the 16-percent-and-above moisture group showed less improvement than the shorter cotton in this grouping is traceable to the difference in the average moisture content of the seed cotton, and to the original grade of the cotton in the two length groups. In this moisture group the shorter staple cotton averaged considerably higher in moisture content than the longer staple cotton, while color and leaf of the lint ginned from the undried portions of the shorter cotton was somewhat lower than these qualities in the longer cotton. The shorter cotton therefore had a greater opportunity for improvement. That is, the higher moisture content of the short cotton caused the lint obtained without drying to be relatively lower in preparation than that obtained after drying, and in addition, the low quality of color and leaf in the short cotton could be more easily improved by drying than could these qualities which were already high in the longer cotton. As a rule, long-staple cotton that is ginned without drying is much more susceptible to gin damage than short-staple cotton, especially in the case of seed cotton containing excessive moisture.

TOTAL GRADE EFFECTS—LABORATORY DETERMINATIONS

The beneficial effects on grade of drying seed cotton were also indicated by laboratory determinations of brilliance, a measure of the light-to-dark appearance of the samples that is highly correlated with grade.[12] As shown in table 13 and figure 9 the improvements in this factor were generally more noticeable for the cottons of higher moisture content. Higher brilliance of dried samples as compared with

[12] The correlation is high since brilliance measurements are affected by the three grade factors, that is, by the greater or smaller number of shadows which accompany different degrees of preparation, by the color of the lint itself, and by the quantity of leaf.

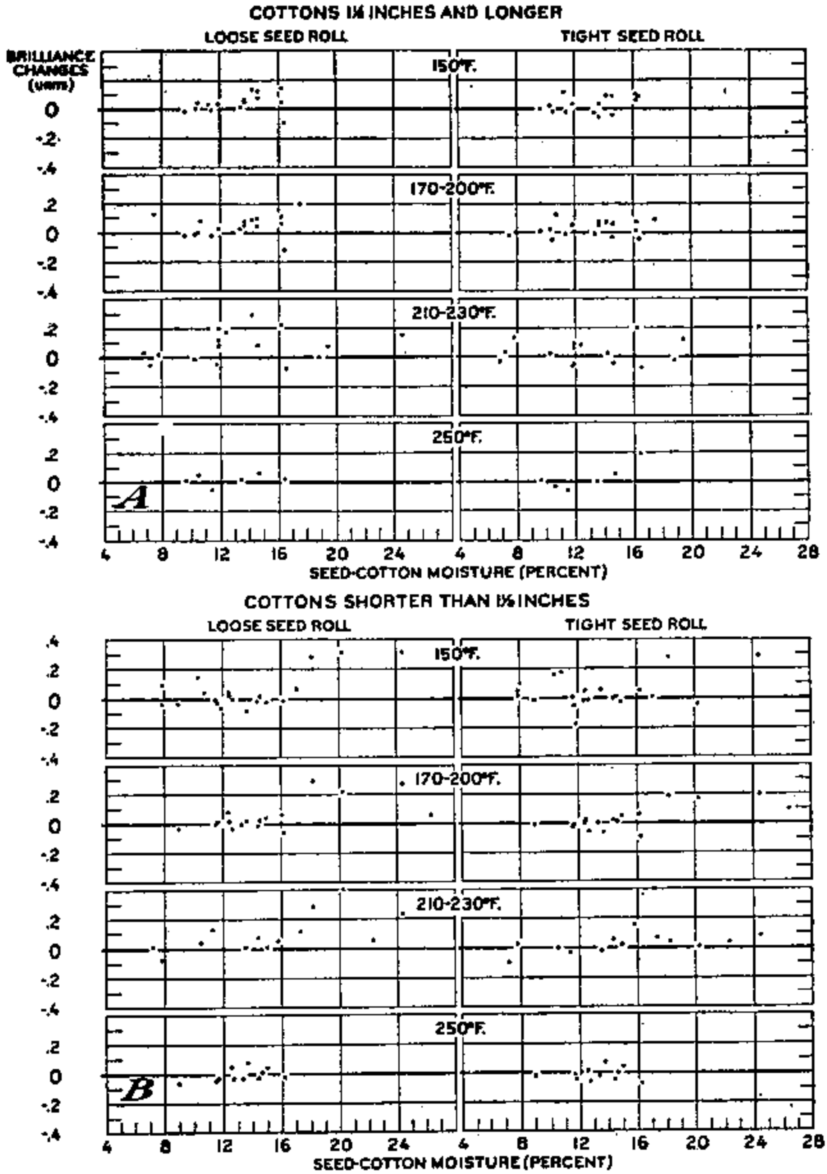


FIGURE 9.—DIFFERENCES IN BRILLIANCE, AS MEASURED IN THE LABORATORY, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND DRIED PORTIONS OF THE SAME SEED COTTONS.

Brilliance changes, as measured in the laboratory, are highly correlated with the grade changes observed by the classer, showing some tendency to be greater as cottons of successively higher moisture content were dried.

undried samples results from the smoother preparation and reduced quantity of leaf or other foreign matter of the dried samples, both of which brighten the appearance of the lint.

TABLE 13.—*Brilliance of ginned samples: Average of the differences*[1] *between laboratory measurements of brilliance of samples ginned from undried and dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Units[2]	*Units*[2]	*Units*[2]	*Units*[2]	*Units*[2]	*Units*[2]	*Units*[2]	*Units*[2]
16.0 and above	0.03	0.06	0.07	0.02	0.08	0.03	0.09	0.19
12.0 to 15.9	.08	.07	.18	.04	.01	.03	.02	.02
8.0 to 11.9	.01	.01	.06	.00	.02	.02	.01	−.03
Below 8.0		.13	.00			−.02	.05	

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	Loose 150° F.	Loose 170° to 200° F.	Loose 210° to 230° F.	Loose 250° F.	Tight 150° F.	Tight 170° to 200° F.	Tight 210° to 230° F.	Tight 250° F.
16.0 and above	0.19	0.14	0.22	−0.02	0.17	0.10	0.04	−0.07
12.0 to 15.9	.00	.01	.03	.01	.02	.00	.05	.00
8.0 to 11.9	.01	−.01	.09	−.04	.02	−.01	−.01	−.02
Below 8.0	.02		−.03		.04		−.03	

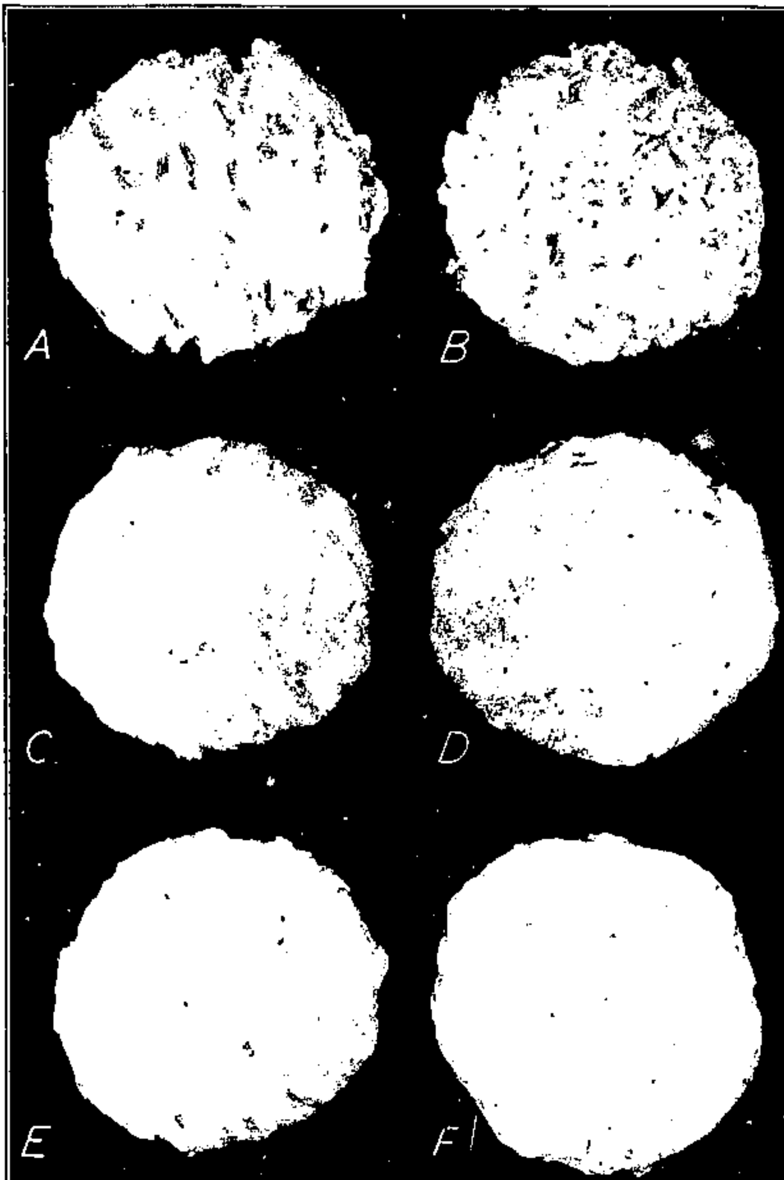
[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (−) indicates lower quality of lint from standpoint of brilliance as a result of drying the seed cotton before ginning.
[2] Brilliance readings of cotton samples range from approximately 7.0 to 9.0 on a scale which extends in equal steps from 0, which is black, to 10, which is white.

There appeared to be a tendency for the enhancements in brilliance of the samples to be more pronounced as temperatures up to 210° to 230° F. were used, but the use of the excessive temperature of 250°, in many cases, gave less improvement in brilliance than did lower temperatures. The brilliance was even less for some samples dried at 250° than for corresponding undried samples, indicating a deadening or dulling of the color in samples that are subjected to drying temperatures relatively high in comparison to the amount of moisture in the seed cotton.

TOTAL GRADE EFFECTS—PHOTOGRAPHIC ILLUSTRATIONS

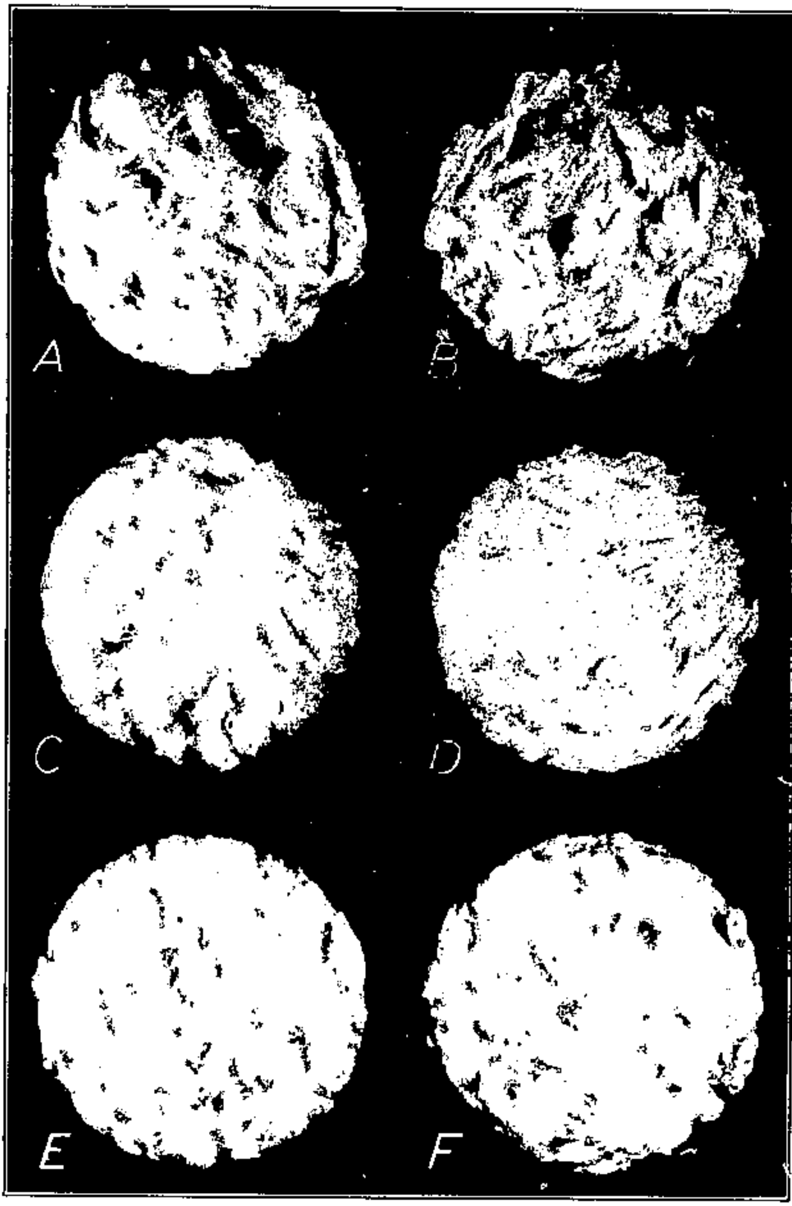
Photographic illustrations of the improvements in grade, to which reference has been made, are shown by plates 1 to 3. As already stated, these grade improvements are largely due to better preparation of the lint ginned from the dried portion of the seed cottons.

In plate 1, samples are shown that had been ginned with and without drying from a long-staple cotton having a moisture content of 16.2 percent before drying. As a result of drying, substantial improvements are shown in preparation and in color and leaf. Increasing improvement in the appearance of the samples is shown for each higher drying temperature used. The difference in preparation between samples ginned with loose and tight seed roll are much greater for the undried portions than for samples ginned from the dried portions. As pointed out previously, drying damp or wet seed cotton before ginning permits the use of a faster rate of feed without material damage to the quality of the lint.



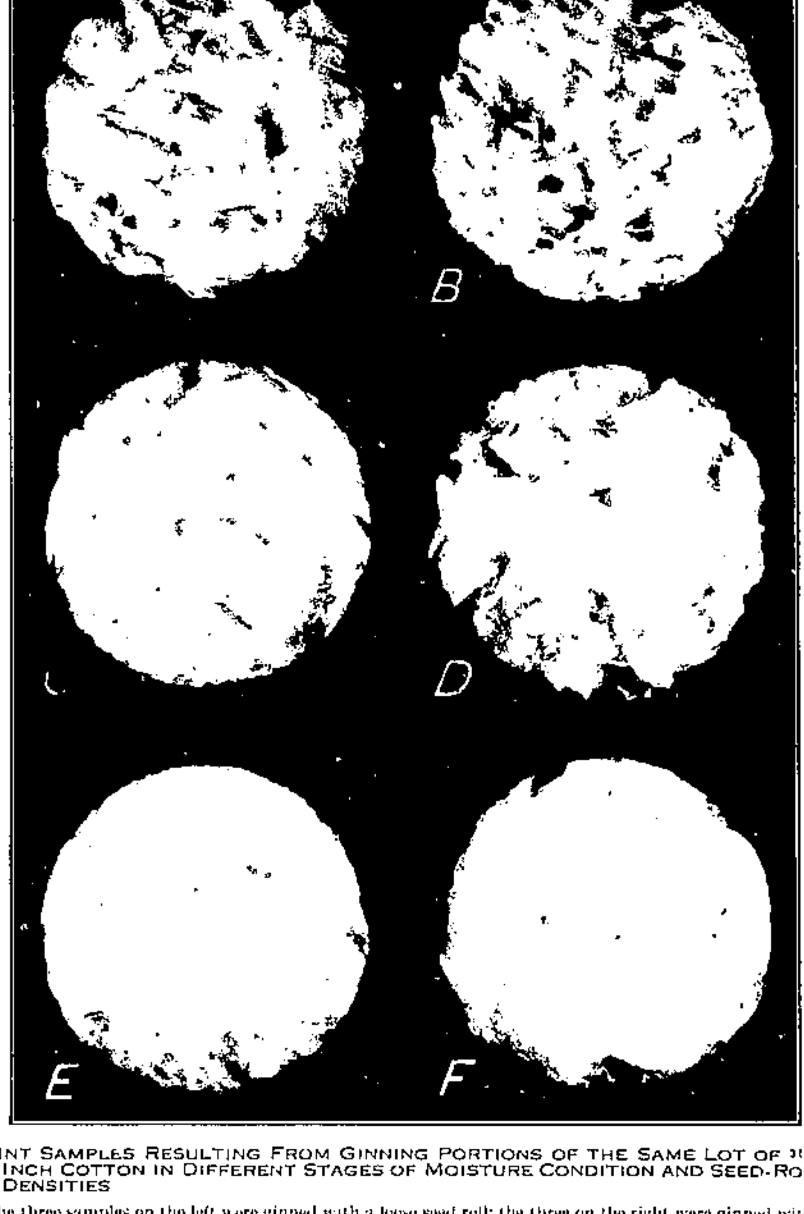
LINT SAMPLES RESULTING FROM GINNING PORTIONS OF THE SAME LOT OF 1$\frac{3}{32}$-INCH COTTON IN DIFFERENT STAGES OF MOISTURE CONDITION AND SEED-ROLL DENSITIES

The three samples on the left were ginned with a loose seed roll; the three on the right were ginned with a tight seed roll. *A* and *B* were ginned in a damp condition, *C* and *D* after drying in vertical drier at 150° F., and *E* and *F* after drying in vertical drier at 200° F. Note the substantial improvements caused by drying. Samples ginned with a loose seed roll (*A*, *C*, *E*) are regularly better than those ginned with a tight seed roll (*B*, *D*, *F*), the difference being particularly marked in the case of the undried samples (*A* compared with *B*). Drying reduces the relative degree of damage from this cause but does not eliminate it. (Mississippi Delfos 531 mid-season damp cotton, crop 1932, ginned on a brush gin at a saw speed of 500 r. p. m., after handling by a stationary screen separator, 66 r. p. m.)



LINT SAMPLES RESULTING FROM GINNING PORTIONS OF THE SAME LOT OF $1\frac{1}{16}$-INCH COTTON IN DIFFERENT STAGES OF MOISTURE CONDITION AND SEED-ROLL DENSITIES.

The three samples on the left were ginned with a loose seed roll; the three on the right were ginned with a tight seed roll. *A* and *B* were ginned in green and damp condition, *C* and *D* after drying in vertical drier at 150° F., and *E* and *F* after drying in vertical drier at 185° F. Note that the drier samples are superior in grade to the green and damp samples. Samples ginned with a loose seed roll are consistently better than those ginned with a tight seed roll, the damage caused by tight seed roll on undried sample (*B*) being greater than that caused by a loose roll on a green and damp sample (*A*). Drying reduces the relative degree of damage from this cause but does not eliminate it. (South Carolina Coker Cleveland No. 5, first picking green and damp cotton, crop 1933, ginned on a brush gin at a saw speed of 500 r. p. m.)



LINT SAMPLES RESULTING FROM GINNING PORTIONS OF THE SAME LOT OF 31/32-INCH COTTON IN DIFFERENT STAGES OF MOISTURE CONDITION AND SEED-ROLL DENSITIES

The three samples on the left were ginned with a loose seed roll; the three on the right were ginned with a tight seed roll. *A* and *B* were ginned in green and damp condition, *C* and *D* after drying in vertical drier at 150° F., and *E* and *F* after drying in vertical drier at 185° F. The drier caused substantial grade improvements on cottons ginned with a loose seed roll (*A*, *C*, *E*), such samples being consistently better than for the tight seed roll samples (*B*, *D*, *F*). (Arkansas Wilson type, first picking green and damp cotton, crop 1933, ginned on a brush gin at a saw speed of 500 r. p. m.

Referring to plate 2, the samples ginned with and without drying are from a shorter staple cotton having an initial moisture content of 18.2 percent. The samples from portions of the artificially dried seed cotton are substantially higher in grade than those ginned from the undried seed cotton. The grade of all of the dried samples are similar regardless of seed-roll density used, indicating again that from the standpoint of grade preservation a faster rate of feed may be used when the cotton is dry.

Dried and undried samples from a short-staple cotton having a moisture content of 24.4 percent are shown in plate 3. When the tight seed roll was used in ginning, the samples ginned from the portion of the seed cotton dried at 185° F. was more than two grades higher than that ginned from the undried portion. Similar difference for the portions ginned with the loose seed roll amounted to more than one grade.

STAPLE

Classer's Designation of Staple Length

The effect of drying seed cotton on the staple length of ginned lint, as observed by the classer, is shown in table 14 and figure 10, by moisture content of the seed cotton, and drying temperature.

Table 14.—*Staple length of ginned lint: Average of the differences*[1] *between the classer's designation of staple length of lint ginned from undried and dried portions of the same seed cotton.*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Inches[1]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]
16.0 and above	0.000	−0.016	−0.019	−0.032	0.021	0.000	−0.006	−0.032
12.0 to 15.9	−.011	−.011	−.020	.000	−.015	.000	−.020	.000
8.0 to 11.9	−.006	−.015	−.018	−.021	.005	−.015	−.031	−.032
Below 8.0	----------	.000	−.042	----------	----------	.000	.010	----------

COTTON SHORTER THAN 1⅛ INCHES

Moisture content of seed cotton (percent)	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
16.0 and above	0.000	−0.005	0.006	0.000	0.000	0.000	−0.019	0.000
12.0 to 15.9	−.004	−.020	−.010	−.026	−.009	−.016	−.016	−.031
8.0 to 11.9	−.005	−.031	.000	−.041	−.010	−.041	.000	−.041
Below 8.0	.000	----------	−.003	----------	−.016	----------	−.003	----------

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (−) indicates lower quality of lint from standpoint of staple length as a result of drying the seed cotton before ginning.
[2] 0.031 = 1/32 inch.

The lint from seed cottons having 16 percent or more moisture was shown by "classing" to be equally long from the portions ginned after drying at 150° F. and from the portions ginned without drying. The lint ginned from portions of seed cottons having less than 16 percent moisture was shown by classing to be only slightly shorter as a result of drying. These reductions in staple length, however, were relatively unimportant when compared with the substantially higher grades for the same ginned lint as a result of such drying.

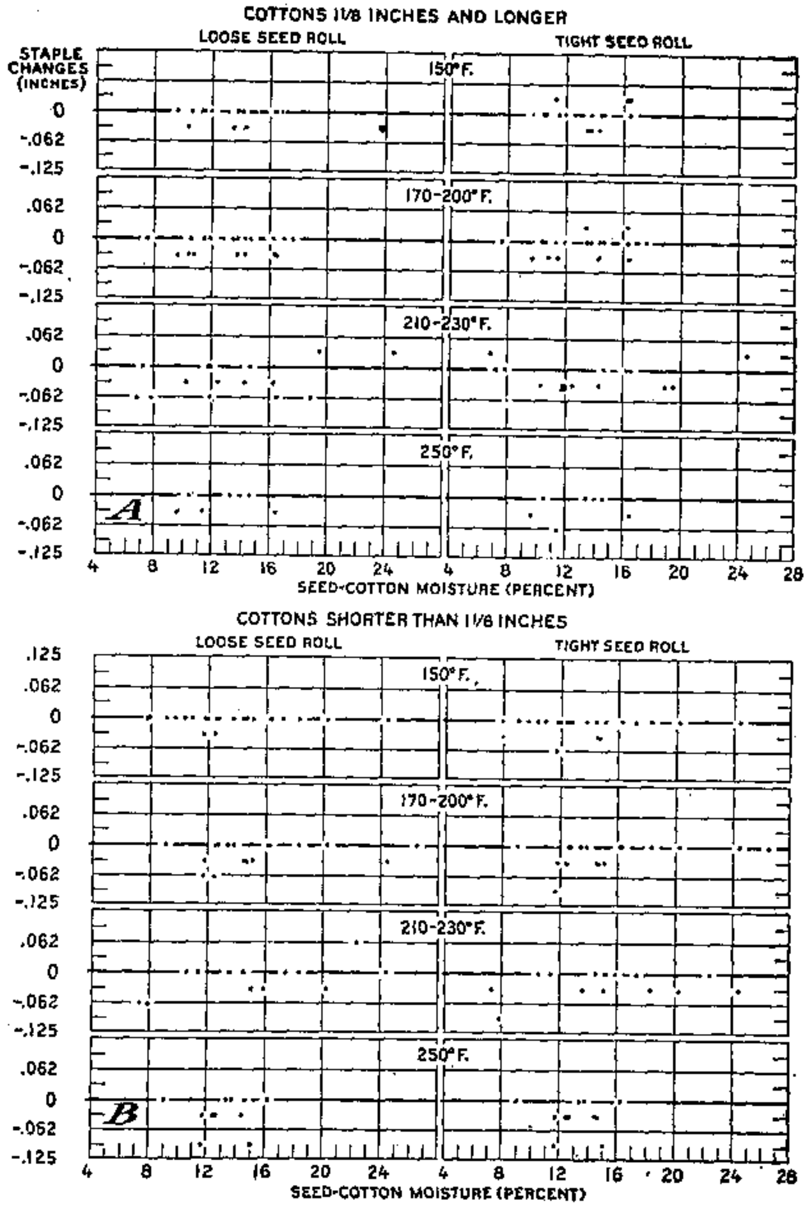


FIGURE 10.—DIFFERENCES IN STAPLE LENGTH, AS OBSERVED BY THE CLASSER, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

The staple length, in general, was preserved by drying the seed cotton at a temperature of 150° F., and showed a tendency to be classed increasingly shorter as the drying temperatures were increased above 150°.

Generally, the difference in classification of staple length unfavorable to the dried cotton tended to become more pronounced for seed cottons of any moisture group as higher drying temperatures were used.

The difference in length of lint ginned from undried and from dried portions of the same seed cottons having 16 percent or more moisture and dried at 170° to 200° F. was not appreciable. However, the unfavorable effects on staple length due to drying at this range of temperature tended to increase slightly with cottons of lower moisture content. With the longer staple cottons having a moisture content between 8 to 11.9 percent, the dried cotton was classed shorter than the undried by an average of one sixty-fourth of an inch, but the shorter staple cotton of this moisture group showed changes in average length designations, attributable to drying, that amounted to one thirty-second of an inch for samples ginned from a loose seed roll and even shorter for cottons ginned with a tight seed roll.

Drying the seed cotton at temperatures above 200° F. was accompanied on the average by lower staple-length designations. Drying short-staple cottons having less than 8 percent moisture, at 210° to 230°, was accompanied by staple-length classifications shorter on the average by one sixteenth of an inch. Drying both long- and short-staple cotton of the 8 to 11.9 percent moisture group at 250° was associated with a shorter staple length classification of one thirty-second of an inch or more.

LABORATORY MEASUREMENT OF FIBER LENGTH

The results from fiber-length arrays of ginned lint show effects of drying (table 15 and fig. 11) in line with those observed by the classer for staple length. On the average, drying the seed cottons having 16 percent or more moisture at 150° F. did not reduce the upper quartile fiber length. The upper quartile fiber length from seed cottons having less than 16 percent moisture was only slightly shortened on the average. In general, at any one temperature range used, there seemed to be a tendency for the differences in the upper quartile fiber length to be somewhat more pronounced as cottons of each lower moisture group were dried.

TABLE 15.—*Fiber length of ginned lint: Average of the differences*[1] *between the upper quartile fiber length as determined in the laboratory, of lint ginned from undried and dried portions of the same seed cotton*

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
COTTON 1⅛ INCHES AND LONGER								
	Inches[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]	*Inches*[2]
16.0 and above	0.017	−0.005	−0.010	−0.021	0.013	0.006	−0.011	0.007
12.0 to 15.9	−.001	−.010	−.018	.008	.003	−.005	−.020	−.009
8.0 to 11.9	−.007	−.019	−.027	−.027	−.006	−.030	−.018	−.028
Below 8.0		−.020	.006			−.009	−.023	
COTTON SHORTER THAN 1⅛ INCHES								
16.0 and above	0.005	−0.011	0.003	−0.023	0.007	−0.008	−0.009	−0.018
12.0 to 15.9	−.004	−.010	−.025	−.011	−.004	−.021	−.019	−.007
8.0 to 11.9	−.013	−.010	.021	−.017	−.011	−.003	.011	−.004
Below 8.0	.011		−.022		.036		−.010	

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (—) indicates lower quality of lint from standpoint of fiber length as a result of drying the seed cotton before ginning.
[2] 0.031 = 1/32 inch.

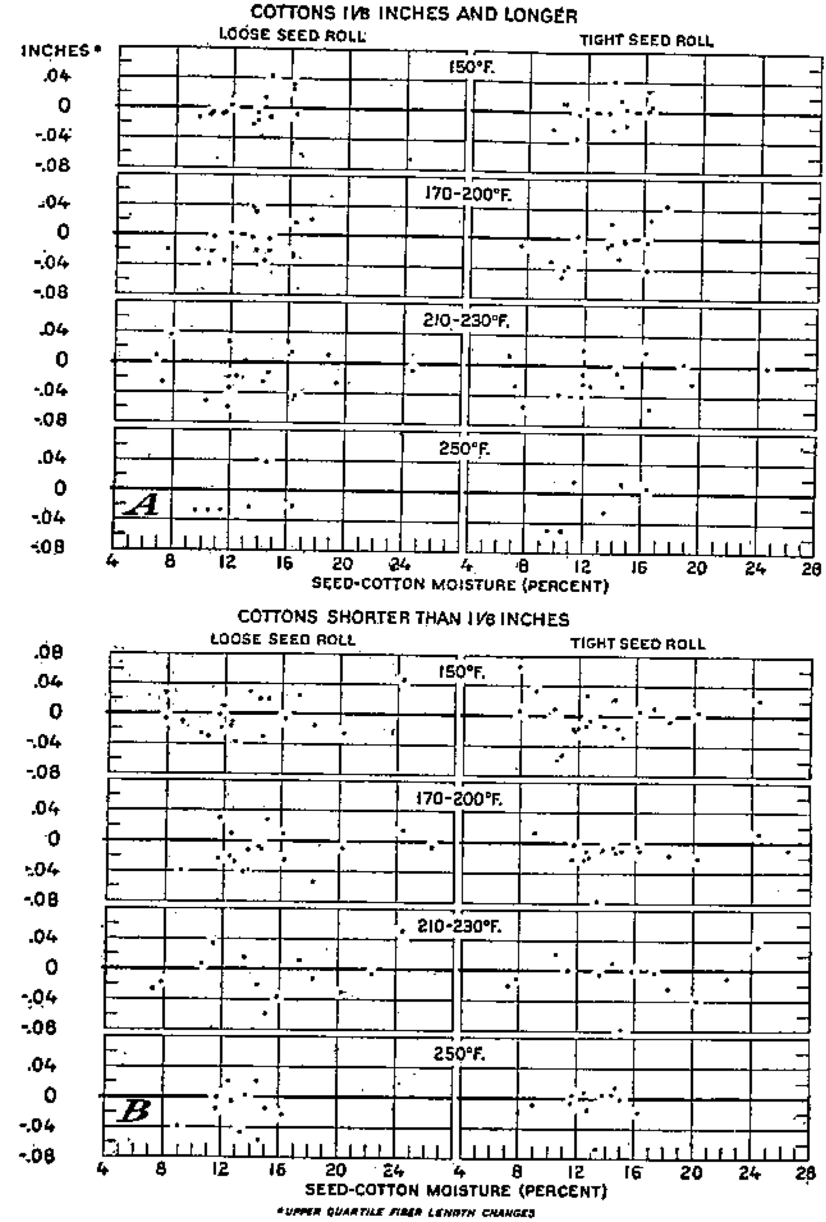


FIGURE 11.—DIFFERENCES IN UPPER QUARTILE FIBER LENGTH, AS MEASURED IN THE LABORATORY, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

From the standpoint of affecting fiber length, the drying temperature of 150° F. appears to be the most favorable of the temperatures employed.

VARIABILITY OF FIBER LENGTH

In general, length variability was not materially increased by drying conditions that preserved fiber length (table 16 and fig. 12). However, on the average, there appeared to be a tendency for the variability to increase with increasingly higher temperatures and with cottons of successively lower moisture-content.

TABLE 16.—*Variability of fiber length: Average of the differences [1] between fiber length variability as determined in the laboratory of lint ginned from undried and dried portions of the same seed cotton*

COTTON 1⅛ INCHES AND LONGER

Moisture content of seed cotton (percent)	Loose seed roll				Tight seed roll			
	150° F.	170° to 200° F.	210° to 230° F.	250° F.	150° F.	170° to 200° F.	210° to 230° F.	250° F.
	Percent [2]	*Percent* [2]	*Percent* [2]	*Percent* [2]	*Percent* [2]	*Percent* [2]	*Percent* [2]	*Percent* [2]
16.0 and above	1.7	−0.4	−0.8	3.6	0.1	8.0	0.7	19.8
12.0 to 15.9	−1.4	1.3	−.2	4.8	4.6	7.4	8.1	13.4
8.0 to 11.9	2.5	4.4	6.1	6.8	3.5	8.7	8.1	7.3
Below 8.0		15.7	−1.5			8.4	17.3	
COTTON SHORTER THAN 1⅛ INCHES								
16.0 and above	−7.0	−4.9	−3.9	−0.3	1.6	6.5	5.1	7.3
12.0 to 15.9	4.4	5.9	.4	11.6	3.2	6.1	2.5	3.2
8.0 to 11.9	10.6	7.1	7.7	18.9	−2.0	1.9	1.2	.9
Below 8.0	9.4		3.0		3.9		15.5	

[1] See tables 22 to 25 for paired values from which these differences were calculated. Minus sign (−) indicates less variability of fiber length of the lint as a result of drying the seed cotton before ginning.
[2] Length at 10-percent point on cumulative array minus length at 90-percent point, divided by length at 50-percent point, times 100.

FIBER STRENGTH

Strength tests were made on the ginned lint from 12 seed cottons (table 17). For each of the 12 cottons, 10 breaks were made on samples of lint from the portions ginned (1) without drying, (2) after drying at 200° F., and (3) after drying twice at 250°. The results are shown as averages, in table 17, grouped by staple length into 1⅛ inches and longer, and shorter than 1⅛ inches, and each length group subdivided into two groups on the basis of moisture content of the undried seed cottons.

TABLE 17.—*Effect of artificially drying seed cottons, on the average breaking strength of ginned fibers, by staple length, moisture content, and drying temperature*

COTTONS 1⅛ INCHES AND LONGER

Moisture content range (percent)	Lot	Seed cotton: Treatment	Seed cotton: Moisture content (average)	Breaking strength per square inch
			Percent	*1,000 pounds*
13.4 to 16.4	Nos. 103, 105, 114	Undried	14.4	76.8
		Dried once at 200° F	11.2	76.8
		Dried twice at 250° F	9.2	74.5
9.6 to 12.5	Nos. 100, 118, 123, 141	Undried	11.2	75.6
		Dried once at 200° F	9.5	77.3
		Dried twice at 250° F	8.8	74.1
COTTONS SHORTER THAN 1⅛ INCHES				
14.4 to 16.2	Nos. 112, 120, 131	Undried	15.2	78.7
		Dried once at 200° F	12.3	79.5
		Dried twice at 250° F	11.1	76.1
11.6 to 11.7	Nos. 115, 142	Undried	11.6	78.2
		Dried once at 200° F	9.9	80.8
		Dried twice at 250° F	8.7	78.6

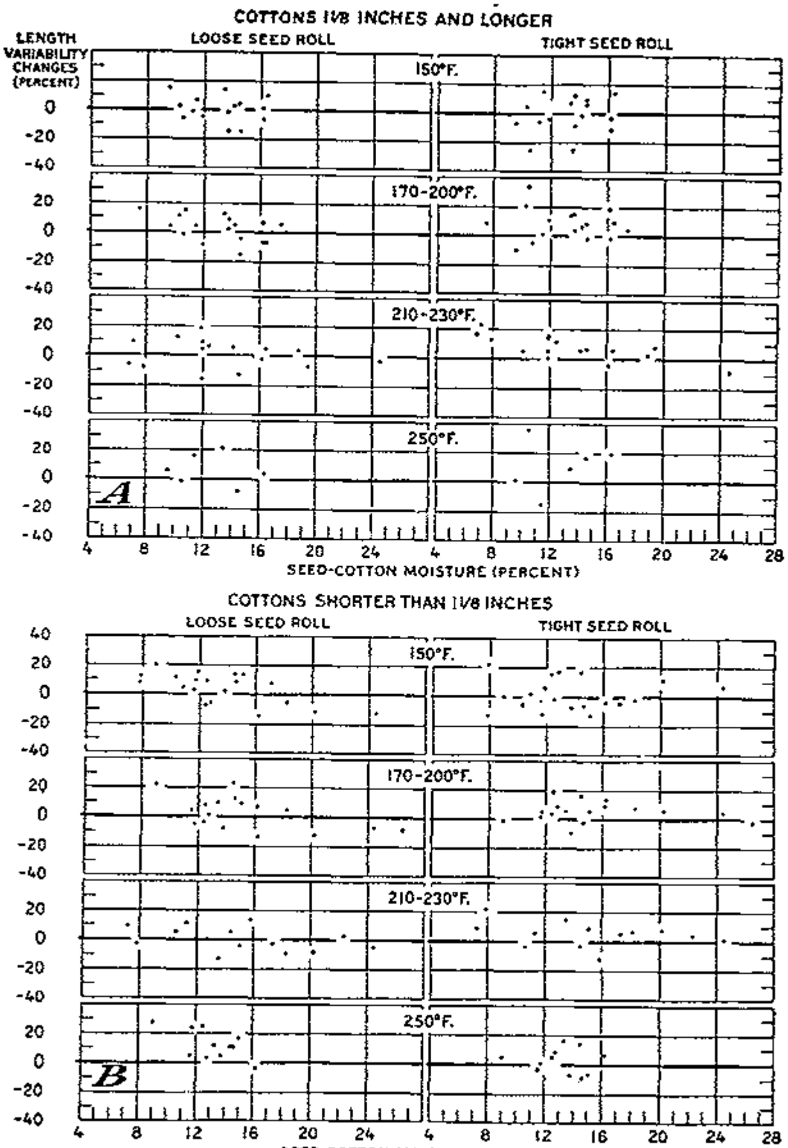


FIGURE 12.—DIFFERENCES IN LENGTH VARIABILITY, AS MEASURED IN THE LABORATORY, BETWEEN PAIRED SAMPLES GINNED FROM UNDRIED AND FROM DRIED PORTIONS OF THE SAME SEED COTTONS.

Fiber-length variability tends to show some increases as the higher temperatures are used in *drying*, particularly with the low-moisture-content cottons.

Drying the seed cotton in the vertical drier at 200° F. temperature did not impair the breaking strength of the fibers; in fact, with the lower moisture content cottons of each length group, the strength figures are slightly larger for the dried samples than for the undried ones. With both the long and the short cottons of the high moisture content group, the average breaking strength of the dried samples was not significantly different from that of the undried samples.

In the portions of these seed cottons routed through the drier twice in succession at a temperature of 250° F., there appears to be a slight weakening of the fibers.

MONETARY VALUE OF GINNED LINT AS AFFECTED BY ARTIFICIALLY DRYING SEED COTTON

The final and net result of any method of conditioning or ginning seed cotton must necessarily be evaluated by the effect of such processes on the spinning utility or monetary value of the lint over and above the cost of the conditioning. Preliminary tests and observations of commercial installations indicate that the operating cost of drying seed cotton amounts to from 20 to 50 cents per bale. Inasmuch as spinning tests on lint ginned from portions of the cottons used in the foregoing test are not yet available, an attempt has been made to evaluate the lint ginned from portions of several seed cottons using the average commercial prices for cotton of the various grades and staple lengths prevailing at Memphis, Tenn., during the season of 1932–33 (table 18). It is recognized that the effect on the value of the ginned lint of drying seed cotton will vary from year to year with changes in the premiums and discounts for grade and staple.

TABLE 18.—*Approximate average price per pound of cotton of specified white grades and staple lengths prevailing at Memphis, Tenn., season 1932–33*

Staple length	Price per pound for indicated grade						
	Good Middling No. 3	Strict Middling No. 4	Middling No. 5	Strict Low Middling No. 6	Low Middling No. 7	Strict Good Ordinary No. 8	Good Ordinary No. 9
	Cents	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*	*Cents*
29/32 inch	7.44	7.34	7.09	6.84	6.34	5.79	5.29
15/16 inch	7.49	7.39	7.14	6.89	6.39	5.89	5.39
31/32 inch	7.59	7.49	7.24	6.99	6.54	5.89	5.39
1 inch	7.79	7.64	7.30	7.14	6.54	5.89	5.39
1 1/32 inches	8.14	7.04	7.59	7.24	6.64	5.89	5.64
1 1/16 inches	8.34	8.09	7.09	7.29	6.69	5.89	5.64
1 3/32 inches	8.54	8.24	7.79	7.34	6.79	5.89	5.64
1 1/8 inches	9.14	8.74	7.89	7.39	6.84	5.89	5.64
1 5/32 inches	9.64	9.14	7.99	7.39	6.89	5.89	5.64
1 3/16 inches	10.39	10.14	8.89	7.64	6.89	5.89	5.64
1 7/32 inches	11.64	11.14	9.64	8.14	7.14	5.89	5.64
1 1/4 inches	13.39	12.04	11.14	8.39	7.39	5.89	5.64

The value of the lint from a given quantity of seed cotton depends on the percentage of lint obtained in the ginning process as well as the quality. Damp or wet seed cotton that is sun-dried, or artificially dried, or stored, will obviously have less weight in the fibers to the extent that moisture is removed from the fibers. This loss in weight may also be increased by the fact that more trash or foreign matter may be removed when the seed cotton is passed through the drier, owing to a removal of trash by the drying apparatus and to a better action of cleaners, extractors, and other trash-removing processes. Although these losses may be compensated for in part by a larger percentage of lint removed from the seed when drier cotton is ginned, if there is to be any substantial increase in value of the bale some of the factors of quality will have to be improved. To the extent that the net improvement in quality, as reflected in the price, more than offsets the loss in weight, the value of a bale of cotton will be increased by drying. This holds true even though it is assumed that no dockage in price will be made for damp or wet cotton.

Although it is realized that bales of extremely high moisture content are occasionally sold in local markets without any dockage in grade, staple, or price, it is also known that allowance is made in the average price for cotton-growing areas from which cotton containing excessive moisture is consistently shipped. Moreover, dockage in weight by some weighers is not an uncommon practice when a considerable number of bales of excessively high moisture content are received from a locality. This is particularly true when heavy rains prevail or when cotton is picked and ginned in a green or wet condition (*6*). Any such reduction in the basis and dockage in weight is in addition to the lowering of quality and the resulting price, from ginning seed cotton containing excessive moisture. To the extent that central-market premiums are paid for quality in cotton, and allowance is made for excessive moisture, the value of the lint in a given quantity of seed cotton is considerably enhanced by artificial drying.

To study the effect of different drying temperatures on the value of the ginned lint as related to moisture content and staple length of the seed cotton, 23 seed cottons from the crops of 1932 and 1933, on which turn-out of lint was available, ginned on the brush-type gin, were grouped by staple length of the ginned lint into cotton 1⅛ to 1¼ inches and cottons $^{15}/_{16}$ to $1\frac{3}{32}$ inches, and were subdivided into damp or wet cotton, or seed cotton having a moisture content above 12 percent, and normal, or seed cotton having a moisture content between 8 and 12 percent.

The weight of the bale was determined for each group by applying the average percentage of lint of the several cottons in each group to 1,500 pounds of seed cotton, and adding 22 pounds for bagging and ties.

The average grade and the average staple length, which were computed in accordance with the methods previously described, were converted into price by interpolating the price difference between the grade indicated by the whole number and the next lower grade in proportion to the decimal part of the number, and interpolating between the staple length in thirty-seconds of an inch indicated by the whole number and the next longer thirty-second inch length in proportion to the decimal part of the number. For example, a sample having an average of 4.40 for grade and 32.60 for staple length was discounted 40 percent of the difference between Strict Middling and Middling on 1-inch cotton, and increased by 60 percent of the premium of $1\frac{1}{32}$-inch staple over 1-inch staple on Strict Middling cotton, and the net result added algebraically to the price for Strict Middling 1-inch cotton.

Table 19 and figure 13 show the effect of drying at different temperatures on the value of the lint from 1,500 pounds of seed cotton, as well as the effect on the weight of the lint, the grade or value class, the staple length, and the resultant price.

TABLE 19.—*The effect of artificially drying 1,500 pounds of seed cotton on the average value of the ginned lint*

Lot	Method of conditioning	Loose seed roll					Tight seed roll				
		Grade	Staple length	Price per pound [1]	Weight of bale	Value per bale	Grade	Staple length	Price per pound [1]	Weight of bale	Value per bale
		Index	*1/32 in.*	*Cents*	*Pounds*	*Dollars*	*Index*	*1/32 in.*	*Cents*	*Pounds*	*Dollars*
MOISTURE CONTENT OF SEED COTTON 12.27 TO 16.42 PERCENT (AVERAGE 14 PERCENT); STAPLE LENGTH 1⅛ TO 1¼ INCHES											
Nos. 103, 105, 106, 141, 204, 205, 209, 219	Undried	5.12	38.38	9.02	448	40.41	5.71	38.00	8.00	454	36.32
	Dried, 150° F	4.54	38.38	9.75	448	43.68	5.17	38.00	8.68	442	38.36
	Dried, 185° to 200° F	4.50	37.88	9.36	446	41.74	5.04	37.88	8.76	439	38.45
	Dried, 220° to 250° F	4.46	37.50	9.11	444	40.45	5.08	37.50	8.39	442	37.08
MOISTURE CONTENT OF SEED COTTON 9.63 TO 11.76 PERCENT (AVERAGE 10.8 PERCENT); STAPLE LENGTH 1⅛ TO 1¼ INCHES											
Nos. 118, 123, 144, 226	Undried	5.57	37.75	7.83	427	33.43	5.83	37.75	7.67	419	32.14
	Dried, 150° F	5.25	37.75	8.52	431	36.72	5.57	37.75	7.84	424	33.24
	Dried, 185° to 200° F	5.25	37.50	8.29	430	35.65	5.58	37.25	7.70	418	32.19
	Dried, 220° to 250° F	5.25	37.25	8.06	424	34.17	5.67	36.75	7.63	418	31.89
MOISTURE CONTENT OF SEED COTTON 12.47 TO 20.17 PERCENT (AVERAGE 15 PERCENT); STAPLE LENGTH 15/16 TO 1 3/32 INCHES											
Nos. 112, 119, 120, 133, 139, 217, 228, 229	Undried	4.96	33.12	7.62	472	35.97	5.71	33.12	7.35	480	35.28
	Dried, 150° F	4.37	33.12	7.83	468	36.64	4.83	33.00	7.65	470	35.96
	Dried, 185° to 200° F	4.42	32.88	7.80	466	36.35	4.58	32.75	7.64	466	35.60
	Dried, 220° to 250° F	4.37	32.25	7.62	462	35.20	4.71	32.00	7.46	466	34.76
MOISTURE CONTENT OF SEED COTTON 9.02 TO 11.70 PERCENT (AVERAGE 10.8 PERCENT); STAPLE LENGTH 15/16 TO 1 3/32 INCHES											
Nos. 115, 142, 145	Undried	4.44	32.33	7.63	523	39.90	5.33	32.33	7.37	527	38.84
	Dried, 150° F	4.33	32.00	7.56	516	39.01	4.89	31.67	7.36	517	38.05
	Dried, 185° to 200° F	4.33	31.33	7.46	522	38.94	4.89	31.00	7.26	512	37.17
	Dried, 220° to 250° F	4.33	31.00	7.41	520	38.53	4.78	31.00	7.30	518	37.81

[1] Calculated from data in table 18.

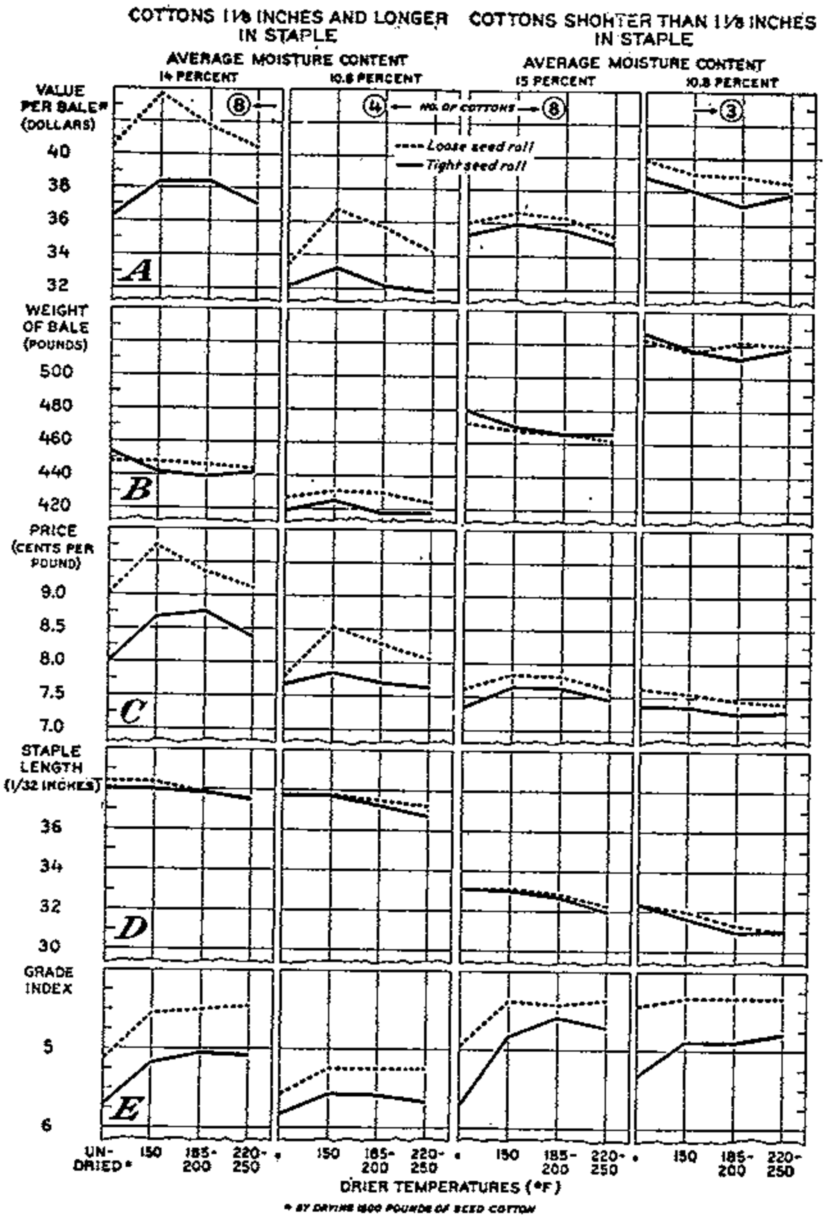


FIGURE 13.—VALUE OF GINNED LINT AS AFFECTED BY DRYING 1,500 POUNDS OF SEED COTTONS.

The maximum value per bale, for cottons that need drying, is obtained when the seed cotton is dried at a temperature of 150° F. and is ginned with a loose seed roll.

Employing a loose seed roll, the greatest increase in value owing to drying, as shown by these data, is at the temperature of 150° F., for the longer cottons in both high- and low-moisture-content groups and for the shorter cotton in high-moisture-content group. The average increases in value because of drying at this temperature amounted to $3.27 per bale, or 8 percent, with the longer staple cottons of the high-moisture-content group, to $3.29, or almost 9 percent, with the longer staple cottons of the lower moisture-content group, and 67 cents, or almost 2 percent, with the shorter staple cottons of the higher moisture-content group. The value of the shorter staple cotton of the lower moisture content was decreased by drying. The value of the all dried material was successively decreased as high drying temperatures were used.

When using a tight seed roll in ginning the higher moisture-content cottons, the increase in value caused by drying the longer cottons was about $2 at either of the temperatures of 150° or 185° to 200° F.; and the increases with the shorter staple cottons were 68 cents at the temperature of 150° and 32 cents at the 185° to 200° range. The higher moisture groups of the longer staple cottons still showed a gain in value when dried at a temperature range of 220° to 250°, but the low-moisture group showed a loss of 25 cents per bale when dried at this temperature range. The high-moisture-content group of the shorter staple cottons showed a loss only when dried at the 220° to 250° range, but the low-moisture-content group showed a loss in value due to drying at each temperature.

A comparison of the value of the lint ginned with a loose seed roll from portions of the higher moisture-content cottons dried at a temperature of 150° F. with that of the lint ginned with a tight seed roll from portions of the corresponding undried cottons showed combined increases in value in favor of drying and the loose seed roll amounting, on the average, to $7.36 per bale, or 20 percent, for the longer staple cotton and $1.36, or 4 percent, per bale for the shorter staple cotton. Therefore, very substantial gains in the value of lint may be obtained for longer staple cotton and some gains for short-staple cotton by artificially drying damp or wet seed cotton and ginning with a loose roll, or slow rate of feed, instead of ginning in a natural condition with a tight seed roll, or fast rate of feed, which is a more or less common commercial practice. It is reasonable to expect, moreover, that if gin equipment in a poor state of repair or adjustment had been used, the benefits of drying would have been even greater than those demonstrated by the figures presented.

The increases in value shown as a result of drying are due principally to improvements in preparation which are reflected in higher grades. The increases in grade obtained by drying at a temperature of 150° F. more than offset any loss in weight due to removal of moisture.

The staple-length classifications were not materially shorter when dried at 150° F., but progressively higher temperatures showed a trend toward increasingly shorter classifications for staple length, amounting in some cases to slightly more than one thirty-second of an inch at the 220° to 250° temperature group.

The price, based on grade and staple, of the cotton dried at one or more of the drying temperatures was higher than that for the undried cotton in all groups except the short-staple low-moisture-content cottons. The cotton dried at the lowest drying temperature generally commanded the highest price. Further increases in temperature tended to give lint of lower price, even going below the price of undried cotton in a few instances.

The weight of the bale, or percentage of lint, was higher for the undried cotton than for the corresponding cotton dried at each drying temperature, except in the case of the first two temperatures on the low-moisture groups of the longer staple-length cottons ginned with the loose seed roll and the first temperature on the same cottons ginned with the tight seed roll. However, the difference in the weight of lint in each of these instances was small.

GERMINATION AND WEIGHT OF COTTONSEED AS AFFECTED BY ARTIFICIALLY DRYING SEED COTTON

To show how drying seed cotton in the drier affected the germination of the seed ginned from several cottons employed in such conditioning experiments, tests [13] were made on select samples of seed according to a standard method of procedure. The average results for seed from 7 cottons ginned without drying and with drying in the vertical drier at three temperature groups—150°, 185° to 200°, and 220° to 250° F.—are shown in table 20, together with those for seed from 3 cottons ginned without drying, and with drying twice in this drier at the excessive temperature of 250°.

TABLE 20.—*Germination of cottonseed as affected by artificially drying seed cotton*

Lot	Method of conditioning the seed cotton	Moisture content		Germination of cottonseed
		Seed cotton at time of ginning	Cottonseed after ginning	
		Percent	*Percent*	*Percent*
Nos. 105, 112, 115, 118, 204, 218, 227	Undried	13.9	12.8	76.6
	Dried at 150° F.	12.1	12.0	74.6
	Dried at 185° to 200° F.	12.3	11.7	80.2
	Dried at 220° to 250° F.	11.4	11.1	80.2
Nos. 105, 112, 115	Undried	14.4	12.2	69.7
	Dried twice at 250° F.	10.7	10.1	75.1

GERMINATION

With one exception the germination of cottonseed was not reduced by artificially drying the seed cotton before ginning. In fact, drying the seed cotton by the various methods increased the germination percentage of the seed in every instance except that of drying at 150° F. in which case the reduction was very slight. This exception is no doubt due to chance errors of sampling, since higher drying temperatures increased the germination percentage.

[13] The germination tests were made through the courtesy of Edgar Brown, in charge, Division of Seed Investigations, Bureau of Plant Industry.

Reducing the moisture content of seed cotton within limits before ginning is, therefore a favorable practice not only from the standpoint of improvement in quality of lint, as previously shown, but also from the standpoint of increasing the germination percentage of the resultant cottonseed (*15*). Similar tests made by sun-drying and storing the seed cotton also increased the percentage germination of the cottonseed. In addition, it is obvious that artificial drying would simplify, in many instances, certain problems in connection with the storage of cottonseed for both planting and oil-mill purposes. From a milling standpoint, the grade of the cottonseed would be raised by reducing the moisture content.

WEIGHT

The use of the vertical drier with 7 seed cottons reduced the proportionate amount of moisture in the cottonseed about 6 percent with the 150° F. temperature, almost 9 percent with the 185° to 200° temperature, slightly more than 13 percent with the 220° to 250° temperature, and more than 17 percent when 3 seed cottons were passed through the drier twice at a temperature of 250°.

These reductions in weight do not necessarily mean reduced value of the seed, as it is reasonable to believe that the excess moisture in green, damp, or wet seed would result in a lower basic price than it would be if all cottonseed were dried.

The reduction in the moisture content of the seed, due to artificially drying the seed cotton, was less for every drying temperature used, than for similar tests made by sun-drying or storing the seed cotton before ginning.

To the extent that cottonseed is sold on the basis of grade, either by the farmer directly or through the ginner indirectly, the value of a given quantity will be increased by artificially drying any seed cotton that needs such conditioning.

CERTAIN MECHANICAL ELEMENTS OF GINNING AS AFFECTED BY ARTIFICIALLY DRYING SEED COTTON

In addition to the effects on the quality of the product from drying seed cotton in the vertical drier, some of the mechanical processes in ginning are also materially influenced. Available data on power requirements, ginning time, and lint turn-out of a 70-saw brush gin (table 21) for 18 different seed cottons were grouped according to 2 moisture contents, and 2 staple lengths. The staple-length groupings, as in other tables, were 1⅛ inches and longer, and shorter than 1⅛ inches. The moisture content of the wetter cottons averaged 15.0 percent for the longer cottons and 16.8 percent for the shorter cottons. The moisture content of the lower moisture content cottons averaged 12.2 percent and 11.7 percent for the longer and shorter cottons, respectively. A portion of the high-moisture-content cottons of each length group was artificially dried at 185° to 200° F., and a portion of the low-moisture-content cottons dried at 150°. The results, arranged by both loose and tight seed rolls, were averaged and are shown in table 21.

TABLE 21.—*Effects of artificially drying seed cotton on certain mechanical features of the ginning processes*

Lot	Seed cotton: Treatment	Seed cotton: Moisture content at time of ginning	Seed-roll density	Moisture content of lint	Power requirements [1]	Time required to gin 100 pounds of seed cotton [1]	Energy consumed per 100 pounds of seed cotton ginned [1]	Lint turnout per 100 pounds of seed cotton
DRIER TEMPERATURE, 185° TO 200° F., COTTONS 1⅛ INCHES AND LONGER								
		Percent		*Percent*	*Horsepower*	*Minutes*	*Kilowatt hours*	*Pounds*
Nos. 202, 204, 205, 209, 219.	Undried	15.0	Loose	11.0	9.7	3.7	0.45	29.8
	Dried	13.5	do	7.2	8.6	3.8	.41	29.0
	Undried	15.0	Tight	11.3	15.5	2.5	.48	29.9
	Dried	13.5	do	7.3	13.6	2.5	.42	28.9
DRIER TEMPERATURE, 185° TO 200° F., COTTONS SHORTER THAN 1⅛ INCHES								
Nos. 203, 210, 217, 218, 229.	Undried	16.8	Loose	11.0	9.1	4.1	0.46	29.9
	Dried	14.8	do	7.8	7.9	4.2	.41	28.6
	Undried	16.8	Tight	11.5	16.0	2.6	.52	30.2
	Dried	14.8	do	8.2	12.1	2.9	.44	29.1
DRIER TEMPERATURE, 150° F., COTTONS 1⅛ INCHES AND LONGER								
Nos. 209, 214, 226, 227.	Undried	12.2	Loose	8.6	9.2	4.1	0.47	29.6
	Dried	10.6	do	8.2	8.7	4.4	.48	30.0
	Undried	12.2	Tight	8.4	13.2	2.8	.46	29.2
	Dried	10.6	do	6.7	12.6	2.9	.45	29.5
DRIER TEMPERATURE, 150° F., COTTONS SHORTER THAN 1⅛ INCHES								
Nos. 206, 223, 229, 243.	Undried	11.7	Loose	8.0	8.6	4.9	0.52	31.2
	Dried	10.6	do	6.8	8.8	4.3	.53	31.6
	Undried	11.7	Tight	8.3	12.5	3.3	.51	31.6
	Dried	10.6	do	6.7	12.0	3.5	.56	30.4

[1] Includes feeder, gin saws, and brush.

The power requirements for operating a gin stand have been found to be considerably less for ginning damp or wet seed cottons that have been dried than for ginning such cottons without drying. With a given seed-roll density, however, the time for ginning a given quantity of cotton was slightly increased. This increase in ginning time prevents the reduction in energy consumed from being so great as would be the case if the ginning times were equal. Even so, the artificial drying caused the amount of energy consumed in ginning 100 pounds of long-staple cotton, having a high moisture content, to be reduced from 0.45 to 0.41 kilowatt hour when a loose seed roll was used, and from 0.48 to 0.42 kilowatt hour when a tight seed roll was used. This amounts to a reduction in the amount of energy consumed in ginning in favor of the dried cotton of about 9 percent for the slow rate of feed and 12 percent for the fast rate of feed. Similar reductions in energy consumed in ginning portions of the high-moisture-content short-staple cottons, after drying, amounted to more than 10 percent for the loose-roll ginning and 15 percent for the tight-roll ginning. The greater reduction in power consumed for the shorter, as compared with that for the longer staple cotton, was perhaps a result of the average moisture content of the former (16.8 percent) being higher than that of the latter (15.0 percent), rather than due to differences in staple length and seed-cotton characteristics for the two groups of cottons.

With one exception, drying the seed cottons of lower moisture content (11.7 to 12.2 percent), caused the energy consumed to be slightly increased in ginning both the long- and short-staple cottons. It is of interest that, for seed cottons of this range of moisture content, the drying reduced to some extent the horsepower requirements. However, the additional time generally required to gin 100 pounds of this seed cotton resulted in consumption of slightly more energy in ginning the dried lots.

Even though drying the seed cotton did not make any pronounced difference in the amount of energy consumed, the decrease in power requirements for ginning damp or wet seed cotton after drying is important from the standpoint of the load capacity of the power unit being used or installed. For example, drying the seed cotton at 185° to 200° F. reduced the power requirements for ginning the long-staple high-moisture-content cotton about 1 horsepower with the loose seed roll and about 2 horsepower with the tight seed roll. This would mean approximately 5- and 10-horsepower reductions, respectively, in the size of the power unit required for a 5- to 70-saw gin plant or over a 10-percent reduction in each case.

The time required to gin 100 pounds of seed cotton of the various groupings was not in general noticeably changed by drying. The removal of moisture from the fiber by drying accounts in some cases for a lowering of the lint turn-out, particularly with the cottons having higher moisture content. In the other cases, the seed were better cleaned of their fiber and the turn-out was increased.

The ginning capacity may be somewhat increased by the use of the drier, in that a more rapid rate of feed without damage to the quality of the lint is possible with dry than with wet cotton. That is, by drying damp seed cotton it is possible to gin with a slightly tighter seed roll and still obtain a preparation as good as may be attained by ginning the cotton in a damp or wet condition and running with a much looser roll. Although the time required to gin a given quantity of seed cotton with the same seed-roll density is slightly increased owing to the fluffiness of the lint when the cotton is dried, this factor of time may be overcome, without damage to the quality elements of the lint, by a reasonable increase in the rate of feed.

OTHER ADVANTAGES OF ARTIFICIALLY DRYING GREEN, DAMP, OR WET SEED COTTON

It should be pointed out, in connection with the use of a drier, that ginning may be continued during damp or rainy weather without interruptions from mechanical difficulties, such as chockages and breakdowns, that so often arise in handling damp or wet seed cotton. When damp seed cotton requires cleaning, drying will facilitate that process by more economical operation of the cleaning equipment and by increasing its efficiency, since the removal of trash in the seed cotton is relatively easier when the cotton and foreign matter are comparatively dry.

Other indirect benefits of artificially drying damp or wet seed cottons are related particularly to the picking or harvesting activities under certain conditions. For example, by having a means for drying available at the gin, picking can be continued during damp weather and can begin sooner than otherwise would be desirable in fields having a rank growth or heavy foliage. Since potential quality in cotton deteriorates rapidly [14] when it is necessary, because of weather conditions, to allow open bolls to remain in the field unpicked, facilities for drying cotton picked during such unfavorable conditions can prevent an appreciable loss in quality to the crop that otherwise would be unavoidable.

Even when weather conditions are favorable for naturally drying seed cotton on the farm, the facilities and labor for such a procedure are costly items. It has been observed that under present farm organization, it is generally impracticable and expensive to dry seed cotton satisfactorily on the farm by sun-drying or storing it. On the other hand, observations made of commercial drying installations have shown that the operating cost per bale with the vertical drier amounted only to from 20 to 50 cents per bale. Artificial drying with such installations, therefore, promises to be one of the most practical and economical means for properly handling damp or wet seed cotton. Furthermore, the preliminary tests employing various farm methods of conditioning as previously described gave results which indicate that the quality benefits obtained with artificial drying when conducted in accordance with the recommended procedure compare favorably with those obtained by sun-drying and storing seed cotton.

SUMMARY

Excess moisture in seed cotton has long been recognized as one of the most important of the many problems involved in cotton ginning. More recently, data have become available which confirm the seriousness of this problem. For example, an estimate made for the ginning season of 1932, a season not considered unusual with respect to weather conditions, indicated that approximately one-third of the cotton 1$\frac{1}{16}$ inches and longer in staple length, and about one-fifth of the cotton shorter than 1$\frac{1}{16}$ inches, was more or less damaged in the ginning process as a result of too much moisture in the seed cotton.

A vertical drier (*2*) for artificially drying damp or wet seed cottons has been recently developed in an effort to provide means for reducing the damage attributed to this cause.

Using 69 American upland cottons selected from the 1931, 1932, and 1933 crops to represent a wide range of seed-cotton characteristics, and employing the vertical drier, a series of studies was conducted with a view of determining (1) the relationships and the interrelationships between the moisture content of seed cotton, the resulting quality of ginned lint, the amount of moisture that may be removed by artificial drying without reduction of fiber quality, and the desirable mechanical operation of the gin stand when handling cottons of different moisture content, and (2) the proper drying temperatures for cottons of different moisture content. The seed

[14] NICKERSON, D., STUDIES OF COLOR IN RAW COTTON. A PRELIMINARY REPORT. U. S. Dept. Agr., Bur. Agr. Econ., 22 pp., 1933. [Mimeographed.]

cottons were obtained from nine States including and extending from Georgia and the Carolinas to Texas. They varied in moisture content, from 6.8 to 26.4 percent; in staple length, from ⅞ inch to 1⅜ inches; and they varied widely in other characteristics.

Portions of the seed cottons, dried and undried, were ginned on new and properly adjusted brush and air-blast types of gins at constant saw speeds and with loose and tight seed-roll densities (slow and fast rates of feed, respectively). However, since the effects of drying were observed to be similar for the two types of gins, only the results for the brush type gin are presented in this bulletin.

Engineering observations and records were made during the tests on ginning operation and time, power requirements and energy consumption, and weight of products. Samples reserved from various stages were analyzed for moisture content, fiber-length array, color, strength, and germination. The lint samples from each test were classed for staple length, and for grade and its several factors—color, leaf, and preparation.

The paired differences between undried and dried samples for each of the quality elements were grouped and were averaged by 2 staple-length groups, long and short by 4 moisture-content groups, and by 4 drying-temperature groups. Other groupings were made for special purposes.

The amount of moisture removed from seed cottons by drying at a temperature of 150° F. increased with increase in moisture content on the average from 1 pound per 100 pounds of seed cotton for those with less than 12 percent moisture to 3 pounds for those having 16 percent or more. The amount of moisture removed at the higher temperatures was only slightly greater than that at 150°, presumably due to the relatively short period of exposure in the drier (15 seconds) and to the fact that the relative humidity of the air heated to the higher temperatures is not appreciably lower than that at 150°.

The greater part of the drying action on seed cotton is confined to the fibers. The amount of moisture removed from lint per 100 pounds by drying at 150° F. ranged from an average of 1.5 pounds for seed cottons below 12 percent in moisture to an average of 4 pounds for those having 16 percent or more, and increased slightly with higher drying temperatures.

The moisture content of seed cotton has a pronounced effect on the smoothness with which it is possible to gin the lint, successively lower preparation being associated with increases in moisture content. The unfavorable effects of ginning cottons with excess moisture are intensified as the staple length of the cotton is increased and as the seed-roll density is changed from loose to tight.

Average grade improvements, or the combined influence of generally smoother preparation and occasionally brighter color and reduced leaf, as a result of artificial drying, were more pronounced for the longer than for the shorter cottons. Drying at a temperature of 150° F. showed grade benefits ranging, on the average, from about one grade for either length group having 16 percent or more moisture, to approximately one-third of a grade for the longer cottons having 8 to 11.9 percent and the shorter cottons having 12 to 15.9 percent moisture. Cottons having a moisture content below these respective limits did not show enough grade improvements to justify drying.

Staple length, on the average, was preserved when the seed cotton was dried at 150° F., but higher drying temperatures were, in general, accompanied by ginned lint with slightly shorter staple length as shown by classification and with increased variability of fiber length. In many cases, drying temperatures above 200° were associated with shortening of staple to an extent of one thirty-second to one-sixteenth of an inch.

Average fiber strength was not weakened by drying the tested seed cottons at temperatures up to 200° F, but there appeared to be a slight weakening of the fibers when the material was dried twice in succession at 250°.

The temperature of the hot air at the inlet of the drier should not greatly exceed 150° F., except for very wet cotton and then should seldom, if ever, exceed 200°. The critical temperature is reached sooner with short-staple or lower moisture-content than with long-staple or higher moisture-content cottons respectively.

Based on average grade and staple premiums and discounts at Memphis, Tenn., for the 1932–33 season (table 18), drying long-staple cottons of relatively high moisture, averaging 14 percent, increased the average monetary value per bale about $3, or 8 percent, when ginning with a loose seed roll, and $2, or 6 percent, with a tight roll. Drying and ginning with a loose roll increased the average value of the same cottons approximately $7, or 20 percent, as compared with that for corresponding portions ginned damp or wet with a tight seed roll. This latter practice is frequently customary in commercial ginning plants. Tables show that long-staple cottons, having an average of 10.8 percent moisture, showed increases in value from drying of over $3, or 10 percent, when ginned with a loose seed roll, and $1, or 3 percent, with a tight roll. Ginning portions with a loose seed roll after drying gave an increase in value of over $4, or 14 percent, as compared with the value of the cotton obtained with a tight seed roll without drying.

With short-staple cottons of relatively high moisture, averaging 15 percent, the average monetary value per bale was increased 67 cents, or almost 2 percent, by drying when ginned with a 'oose seed roll, and 68 cents, or 2 percent, with a tight roll. The value of these cottons dried and ginned with a loose seed roll was higher by almost $1.50, or 4 percent, than that obtained when portions were ginned damp or wet with a tight seed roll. Shorter staple cottons, averaging 10.8 percent in moisture, showed decreases in monetary value with drying.

Although the actual differences in the weight of bales due to drying are not permanent, the loss in weight of the material has been considered in the calculations showing changes in monetary value as a result of drying seed cotton. The results obtained from a storage test at Leland, Miss., have shown that under those conditions, the bale of undried (damp) material rapidly lost weight; that the dried material gained slightly, and that, at the end of 10 weeks, the bales differed in weight by only 4 pounds. Obviously, a consideration of any subsequent loss in weight of the undried bales and gain in weight of the dried bales during storage would have increased slightly the benefits in monetary value reported herein for artificial drying of damp or wet seed cotton.

The beneficial effects of artificial drying, as shown by the differences between paired samples, are considered as being probably of smaller magnitude than would have resulted had machinery been used in these experiments that was more or less worn out or obsolete, or inadequately repaired, or improperly operated.

The percentage germination of seed from portions of seed cotton dried at test temperatures was not reduced by drying; on the contrary, the dried portions show germination of slightly higher percentages.

Facilities for artificial drying at the gin permit cotton picking to be continued during damp seasons, and in fields of heavy foliage sooner than otherwise would be desirable. An opportunity is afforded by this means to handle cotton which heretofore has been left unpicked because of inadequate means for conditioning and ginning.

Artificial drying of green, damp, or wet seed cotton enables continuous operation of the gin without loss of time due to chokages or break-downs, allows a reasonable increase in ginning capacity at no loss of quality to the product, and affords a slight reduction in power requirement.

The vertical drier offers satisfactory ginning volume and maximum safety to both the product and the ginning plant, and the results thus far obtained with it compare favorably with those generally attributed to sun-drying and storing. In the light of present-day farm organization, this drier added to gin equipment gives promise of being one of the most practical and economical means for drying seed cotton. Observations made of commercial drying installations show that the operating cost of drying seed cotton amounts to only 20 to 50 cents per bale.

It seems reasonable to expect that, when comparable operating conditions are employed, other designs of driers will give results generally in line with those presented herein for the vertical drier.

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APPENDIX

BASIC TABLES SHOWING ABSOLUTE VALUES OF PAIRED UNDRIED AND DRIED SAMPLES

The influence of artificially drying seed cotton on the quality of lint is shown in tables 22 to 25 by the use of paired data. That is, each quality element was determined for the lint ginned from equal portions of the same seed cotton; one portion of which was ginned without drying and the other portion ginned immediately after drying. A part of each of these portions of seed cotton was ginned with a loose seed roll and a part with a tight seed roll. The results, therefore, are paired data as between samples ginned with loose and tight seed roll as well as between samples ginned from undried and dried seed cottons.

The data were classified into four tables on the basis of the temperature range at which a portion of each seed cotton was dried. The data for each seed cotton were then subdivided as follows: Staple length of the ginned lint, moisture content of the undried seed cotton, and seed-roll density used in ginning. The averages showing the moisture content of the seed cotton and of the ginned lint, and the averages for the quality elements were then calculated for both undried and dried samples for the number of cottons appearing in each group.

The drier temperature groupings used are as follows: (1) 150° F., (2) 170° to 200°, (3) 210° to 230°, and (4) 250°, and the results of drying seed cottons at each of these respective temperature ranges are shown in tables 22 to 25. The temperature range is that of the hot air at the inlet of the vertical drier. Two staple-length groups—1⅛ inches and longer, and shorter than 1⅛ inches—were used. The moisture-content groupings selected were: (1) 16 percent and above, (2) 12 to 15.9, (3) 8 to 11.9, and (4) below 8 percent.

The lots of seed cotton were grouped for moisture content according to oven tests of the amount of moisture in each before drying in order to ascertain the amount of moisture removed by the different temperatures. The moisture content was considered to be accurately measured in that repeated tests made on several divisions of each sample of seed cotton showed that the variability was usually below 10 percent. The moisture content of the ginned lint was also determined by oven tests and successive tests on different units of a single sample showed even less variation than was found in seed-cotton tests.

In connection with these tables, the averages for the various quality elements, except those for preparation, in one moisture group of cottons should not be compared with corresponding averages for another moisture-content group on either the longer or shorter staple-length cottons, and averages for corresponding moisture groups of the longer and shorter cottons should not be compared, because the inherent qualities of the cottons, in many instances, are not the same. That preparation is a function of ginning, as influenced by the moisture content of the seed cotton and by the staple length, and that other factors are of minor consideration, make it possible to compare the one element, preparation, from various angles.

The data are arranged in tables 22 to 25 with the quality of the paired undried and dried samples in alternate lines. The differences between these paired values have been shown in tables 7 to 16, in the text of the bulletin, and have served as the principal basis of discussion and conclusions with respect to the cotton-quality phases.

TABLE 22.—*Average effects of artificially drying seed cotton at 150° F. on certain lint-quality elements*

COTTONS 1 1/8 INCHES AND LONGER

Seed cotton: Moisture content (percent)	Seed cotton: Lot	Seed cotton: Treatment	Seed cotton: Moisture content at time of ginning	Seed-roll density	Condition and quality of ginned lint: Moisture content after ginning	Laboratory measurement: Brilliance[1]	Laboratory measurement: Chroma	Laboratory measurement: Upper quartile fiber length	Laboratory measurement: Variability of fiber length	Classer's designation: Color	Classer's designation: Leaf	Classer's designation: Preparation	Classer's designation: Grade (color, leaf, and preparation)	Classer's designation: Staple length
			Percent		*Percent*	*Units*	*Units*	*Inches*	*Percent*	*Code index*	*Code index*	*Code index*		*Inches*
16.0 and above	Nos. 105, 113, 205	Undried	16.3	Loose	10.1	8.53	1.89	1.243	92.7	4.7	4.3	8.0	M.+C.	1 3/16+
		Dried	13.4	do	7.3	8.56	1.88	1.260	94.4	4.3	4.3	6.0	S. M.–B–	1 3/16+
		Undried	16.3	Tight	9.5	8.46	1.90	1.246	89.9	4.7	4.3	9.3	M.+C.–	1 3/16–
		Dried	13.4	do	7.0	8.54	1.93	1.259	90.0	4.3	4.3	7.0	S. M.–C+	1 3/16+
12.0 to 15.9	Nos. 107, 121, 104, 219, 204, 108.	Undried	14.0	Loose	9.5	8.62	1.84	1.250	86.2	4.3	4.3	7.5	S. M.–C.	1 3/16
		Dried	12.2	do	7.0	8.70	1.76	1.249	84.8	4.3	4.3	5.0	S. M.–B.	1 3/16–
		Undried	14.0	Tight	9.6	8.64	1.81	1.241	82.6	4.3	4.3	8.2	S. M.–C.	1 3/16–
		Dried	12.2	do	7.5	8.65	1.80	1.244	87.2	4.3	4.3	6.8	S. M.–C.+	1 5/32+
8.0 to 11.9	Nos. 118, 123, 134, 144, 126, 215.	Undried	10.8	Loose	7.8	8.42	1.74	1.241	100.1	5.5	5.3	5.8	M.–B.–	1 5/32+
		Dried	9.7	do	6.4	8.43	1.73	1.234	102.6	5.3	5.3	5.2	M.–B.	1 5/32
		Undried	10.8	Tight	7.5	8.39	1.75	1.237	94.2	5.5	5.3	7.5	M.–C.	1 5/32–
		Dried	9.7	do	5.8	8.41	1.74	1.231	97.7	5.3	5.3	7.2	M.–C.+	1 5/32
Below 8.0		Undried		Loose										
		Dried		do										
		Undried		Tight										
		Dried		do										

COTTONS SHORTER THAN 1 1/8 INCHES

Seed cotton: Moisture content (percent)	Seed cotton: Lot	Seed cotton: Treatment	Seed cotton: Moisture content at time of ginning	Seed-roll density	Condition and quality of ginned lint: Moisture content after ginning	Laboratory measurement: Brilliance[1]	Laboratory measurement: Chroma	Laboratory measurement: Upper quartile fiber length	Laboratory measurement: Variability of fiber length	Classer's designation: Color	Classer's designation: Leaf	Classer's designation: Preparation	Classer's designation: Grade (color, leaf, and preparation)	Classer's designation: Staple length
16.0 and above	Nos. 131, 217, 218, 220, 221.	Undried	19.2	Loose	13.3	8.54	2.13	1.037	84.8	5.0	4.6	7.2	S. L. M.+	1–
		Dried	15.8	do	9.0	8.73	2.03	1.042	77.8	4.6	4.2	5.2	M.+	1–
		Undried	19.2	Tight	13.3	8.51	2.15	1.038	74.7	5.2	4.6	8.8	S. L. M.–	1–
		Dried	15.8	do	9.1	8.68	2.09	1.045	76.3	4.8	4.4	7.0	M.–	1–
12.0 to 15.9	Nos. 109, 112, 119, 120, 122, 133, 139.	Undried	13.6	Loose	8.9	8.50	1.90	1.012	78.8	4.1	3.9	6.1	M.+	1+
		Dried	12.1	do	6.8	8.50	1.89	1.008	83.2	4.3	4.0	5.0	S. M.–	1+
		Undried	13.6	Tight	9.0	8.50	1.90	1.006	82.8	4.4	4.4	7.6	S. L. M.+	1+
		Dried	12.1	do	6.7	8.52	1.90	1.002	86.0	4.4	4.1	5.9	M.+	1
.0 to 11.9	Nos. 115, 142, 145, 206, 223, 243.	Undried	10.9	Loose	8.0	8.55	1.93	1.053	78.5	4.8	4.8	5.2	M.	1+
		Dried	9.8	do	6.5	8.56	2.00	1.040	89.1	4.8	4.7	5.0	M.+	1
		Undried	10.9	Tight	8.1	8.52	1.95	1.050	85.0	5.0	5.0	6.2	M.–	1+
		Dried	9.8	do	6.5	8.54	1.93	1.039	83.0	5.0	5.0	5.5	M.–	1
Below 8.0	Nos. 101, 228	Undried	7.9	Loose	5.4	8.68	2.03	.935	84.0	3.5	3.5	4.0	S. M.+	15/16
		Dried	7.6	do	5.0	8.70	2.07	.946	93.4	3.5	3.5	3.5	S. M.+	15/16
		Undried	7.9	Tight	6.4	8.62	1.98	.918	87.9	4.0	4.0	6.5	M.+	15/16
		Dried	7.6	do	4.9	8.66	2.07	.954	91.8	3.5	3.5	5.0	S. M.	15/16–

[1] Brilliance readings are made on the entire surface of cotton samples and range from approximately 7.0 to 9.0 on a scale which extends in equal steps from 0, which is black, to 10, which is white.

TABLE 23.—*Average effects of artificially drying seed cotton at 170° to 200° F., on certain lint-quality elements*

COTTONS 1 1/8 INCHES AND LONGER

Seed cotton					Condition and quality of ginned lint with respect to—									
						Laboratory measurements				Classer's designation				
Moisture content (percent)	Lot	Treatment	Moisture content at time of ginning	Seed-roll density	Moisture content after ginning	Brilliance[1]	Chroma	Upper quartile fiber length	Variability of fiber length	Color	Leaf	Preparation	Grade (color, leaf, and prepartaion)	Staple length
			Percent		*Percent*	*Units*	*Units*	*Inches*	*Percent*	*Code index*	*Code index*	*Code index*		*Inches*
16.0 and above	Nos. 105, 205, 113, 202	Undried	16.6	Loose	10.9	8.60	1.90	1.231	91.4	4.5	4.2	8.0	S. M.—C.	1 3/16+
		Dried	13.4	do	6.4	8.66	1.89	1.226	91.0	4.2	4.2	5.5	S. M.—B.—	1 3/16—
		Undried	16.6	Tight	10.6	8.54	1.91	1.241	87.4	4.5	4.2	9.5	S. M.—D.+	1 3/16—
		Dried	13.4	do	7.7	8.57	1.94	1.247	95.4	4.2	4.2	7.0	S. M.—C.+	1 3/16—
12.0 to 15.9	Nos. 104, 107, 108, 121, 204, 219.	Undried	14.0	Loose	9.5	8.62	1.84	1.250	86.2	4.3	4.3	7.5	S. M.—C.	1 3/16
		Dried	11.8	do	6.4	8.69	1.75	1.240	87.5	4.2	4.2	5.0	S. M.—B.	1 3/16—
		Undried	14.0	Tight	9.6	8.64	1.81	1.241	82.6	4.3	4.3	8.2	S. M.—C.	1 3/16—
		Dried	11.8	do	6.3	8.67	1.82	1.236	90.0	4.2	4.2	6.3	S. M.—B.—	1 3/16—
8.0 to 11.9	Nos. 60, 118, 123, 134, 144, 215.	Undried	10.7	Loose	7.3	8.46	1.75	1.216	99.5	5.3	5.5	5.5	M.—B.—	1 5/32
		Dried	8.5	do	5.2	8.47	1.73	1.197	103.9	5.3	5.3	5.2	M.—B.	1 5/32—
		Undried	10.7	Tight	7.2	8.44	1.75	1.224	94.7	5.3	5.5	7.2	M.—C.+	1 5/32—
		Dried	8.5	do	4.9	8.46	1.72	1.194	103.4	5.3	5.3	6.2	M.—B.—	1 1/8+
Below 8.0	No. 62	Undried	7.5	Loose	6.2	8.67	1.71	1.218	84.4	4.0	4.0	5.0	S. M. B.	1 1/8
		Dried	6.4	do	4.4	8.80	1.54	1.198	100.1	4.0	4.0	5.0	S. M. B.	1 1/8
		Undried	7.5	Tight	6.5	8.74	1.71	1.194	85.8	5.0	5.0	5.0	M. B.	1 1/8
		Dried	6.4	do	4.4	8.72	1.54	1.185	94.2	4.0	4.0	5.0	S. M. B.	1 1/8
COTTON SHORTER THAN 1 1/8 INCHES														
16.0 and above	Nos. 47, 131, 203, 217, 218, 221.	Undried	20.3	Loose	12.9	8.46	2.13	1.059	79.5	5.2	4.3	7.3	S. L. M.+	1+
		Dried	16.9	do	8.5	8.60	2.08	1.048	74.6	4.5	4.0	5.3	M.+	1
		Undried	20.3	Tight	13.5	8.46	2.16	1.064	71.2	5.2	4.5	9.0	S. L. M.—	1+
		Dried	16.9	do	8.5	8.56	2.14	1.056	77.7	4.5	4.0	6.3	M.	1+
12.0 to 15.9	Nos. 109, 112, 119, 120, 122, 133, 137, 139.	Undried	13.6	Loose	8.8	8.51	1.88	1.027	80.7	4.1	3.9	6.1	M.+	1 1/32—
		Dried	11.5	do	5.9	8.52	1.87	1.017	86.6	4.1	4.0	4.9	S. M.—	1
		Undried	13.6	Tight	9.1	8.50	1.88	1.027	82.8	4.4	4.4	7.5	M.—	1 1/32—
		Dried	11.5	do	5.9	8.50	1.88	1.006	88.9	4.2	4.1	5.6	M.+	1
8.0 to 11.9	Nos. 115, 142, 145	Undried	10.8	Loose	8.2	8.58	1.89	1.020	73.7	4.0	4.0	5.3	S. M.—	1+
		Dried	9.1	do	5.2	8.57	1.90	1.010	80.8	4.0	4.0	5.0	S. M.—	31/32+
		Undried	10.8	Tight	8.3	8.56	1.89	1.009	80.1	4.3	4.3	7.3	M.—	1+
		Dried	9.1	do	5.5	8.55	1.90	1.006	82.0	4.3	4.3	6.0	M.	31/32
Below 8.0		Undried		Loose										
		Dried		do										
		Undried		Tight										
		Dried		do										

[1] Brilliance readings are made on the entire surface of cotton samples and range from approximately 7.0 to 9.0 on a scale which extends in equal steps from 0, which is black, to 10, which is white.

TABLE 24.—*Average effects of artificially drying seed cotton at 210° to 230° F., on certain lint quality elements*

COTTONS 1 1/8 INCHES AND LONGER

Seed cotton: Moisture content (percent)	Seed cotton: Lot	Seed cotton: Treatment	Seed cotton: Moisture content at time of ginning	Seed-roll density	Lint: Moisture content after ginning	Laboratory measurement: Brilliance [1]	Laboratory measurement: Chroma	Laboratory measurement: Upper quartile fiber length	Laboratory measurement: Variability of fiber length	Classer's designation: Color	Classer's designation: Leaf	Classer's designation: Preparation	Classer's designation: Grade (color, leaf, and preparation)	Classer's designation: Staple length
			Percent		*Percent*	*Units*	*Units*	*Inches*	*Percent*	*Code Index*	*Code Index*	*Code Index*		*Inches*
16.0 and over	Nos. 35, 36, 39, 205, 211	Undried	19.1	Loose	11.0	8.61	2.01	1.325	86.3	4.0	4.0	7.6	S. M.—C.	1 3/16+
		Dried	15.4	do	7.5	8.68	1.94	1.315	85.5	3.8	4.0	5.6	S. M.—B.—	1 3/16—
		Undried	19.1	Tight	11.7	8.56	2.00	1.323	83.3	4.2	4.2	8.0	S. M.—C.	1 3/16—
		Dried	15.4	do	7.8	8.65	1.96	1.312	84.0	4.0	4.0	6.8	S. M.—C.+	1 3/16—
12.0 to 15.9	Nos. 204, 209, 219	Undried	13.7	Loose	10.0	8.72	1.79	1.279	81.7	4.3	4.3	7.7	S. M.—C.	1 7/32—
		Dried	10.5	do	6.9	8.90	1.65	1.261	81.5	4.3	4.3	5.0	S. M.—B.	1 3/16
		Undried	13.7	Tight	10.2	8.73	1.76	1.268	82.4	4.3	4.3	8.7	S. M.—C.—	1 7/32—
		Dried	10.5	do	6.6	8.75	1.70	1.248	90.5	4.3	4.3	6.7	S. M.—C.	1 3/16
8.0 to 11.9	Nos. 40, 56, 215, 226, 227	Undried	11.6	Loose	8.0	8.74	1.73	1.297	85.3	3.8	3.6	5.4	S. M.+B.	1 7/32—
		Dried	10.2	do	5.8	8.80	1.69	1.270	91.4	3.4	3.4	5.0	G. M.—B.	1 3/16
		Undried	11.6	Tight	8.0	8.76	1.70	1.286	83.8	3.8	3.6	6.2	S. M.+B.—	1 3/16+
		Dried	10.2	do	5.8	8.77	1.73	1.268	91.9	3.8	3.8	5.2	S. M.+B.	1 5/32+
Below 8.0	Nos. 48, 51, 54	Undried	7.3	Loose	5.8	8.64	1.81	1.287	91.9	3.0	3.0	4.7	G. M. B.—	1 3/16—
		Dried	5.4	do	3.4	8.64	1.81	1.293	90.4	3.0	3.7	4.0	G. M.—B.—	1 1/8+
		Undried	7.3	Tight	5.7	8.60	1.81	1.296	80.6	3.3	3.7	4.7	S. M.+B.	1 5/32
		Dried	5.4	do	3.1	8.65	1.81	1.273	97.9	3.3	3.7	4.0	S. M.+B.	1 5/32+
COTTONS SHORTER THAN 1 1/8 INCHES														
16.0 and over	Nos. 41, 65, 217, 218, 221	Undried	20.5	Loose	13.4	8.37	2.06	1.093	77.7	5.4	5.2	7.2	S. L. M.	1—
		Dried	16.8	do	7.5	8.59	2.01	1.096	73.8	4.6	4.4	5.2	M.+	1
		Undried	20.5	Tight	13.4	8.38	2.06	1.089	72.5	5.6	5.0	8.6	S. L. M.—	1
		Dried	16.8	do	8.0	8.42	2.01	1.080	77.6	4.8	4.4	6.4	M.	31/32+
12.0 to 15.9	Nos. 78, 116, 210, 229	Undried	14.7	Loose	9.6	8.47	1.79	1.106	83.6	4.5	4.5	5.8	M.	1 1/32+
		Dried	12.0	do	6.5	8.50	1.82	1.081	84.0	4.5	4.5	5.0	M.+	1 1/32—
		Undried	14.7	Tight	9.8	8.43	1.83	1.095	81.9	4.8	4.8	6.8	M.—	1 1/32
		Dried	12.0	do	6.2	8.48	1.83	1.076	84.4	4.8	4.8	6.2	M.—	1+
8.0 to 11.9	Nos. 46, 58	Undried	10.9	Loose	6.9	8.51	1.76	.970	65.3	4.5	4.0	5.0	S. M.—	31/32
		Dried	8.5	do	5.0	8.60	1.82	.991	73.0	4.5	4.0	5.0	S. M.—	31/32
		Undried	10.9	Tight	6.7	8.54	1.77	.979	70.8	4.5	4.0	5.0	M.+	15/16+
		Dried	8.5	do	5.1	8.53	1.81	.990	72.0	4.5	4.0	5.0	M.+	15/16+
Below 8.0	Nos. 53, 59	Undried	7.5	Loose	5.8	8.61	1.82	1.098	89.0	4.5	5.0	5.0	M.+	1 1/16—
		Dried	6.6	do	4.7	8.55	1.85	1.076	92.0	4.0	4.0	5.0	S. M.—	31/32+
		Undried	7.5	Tight	6.1	8.62	1.81	1.084	83.8	4.5	4.5	5.5	M.+	1 1/16—
		Dried	6.6	do	4.4	8.59	1.85	1.068	99.3	4.0	4.0	6.5	M.—	31/32+

[1] Brilliance readings are made on the entire surface of cotton samples and range from approximately 7.0 to 9.0 on a scale which extends in equal steps from 0, which is black, to 10, which is white.

TABLE 25.—*Average effects of artificially drying seed cotton at 250° F., on certain lint quality elements*

COTTONS 1 1/8 INCHES AND LONGER

Seed cotton					Condition and quality of ginned lint with respect to—									
						Laboratory measurements				Classer's designation				
Moisture content (percent)	Lot	Treatment	Moisture content at time of ginning	Seed-roll density	Moisture content after ginning	Brilliance[1]	Chroma	Upper quartile fiber length	Variability of fiber length	Color	Leaf	Preparation	Grade (color, leaf, and preparation)	Staple length
			Percent		*Percent*	*Units*	*Units*	*Inches*	*Percent*	*Code index*	*Code index*	*Code index*		*Inches*
16.0 and over	No. 105	Undried	16.4	Loose	9.6	8.60	1.80	1.201	92.4	4.0	4.0	8.0	S. M. C.	1 3/16
		Dried	13.5	do	5.4	8.62	1.84	1.180	96.0	4.0	4.0	6.0	S. M. B.−	1 5/32
		Undried	16.4	Tight	8.4	8.43	1.82	1.199	88.1	4.0	4.0	8.0	S. M. C.	1 3/16
		Dried	13.5	do	6.0	8.62	1.82	1.206	107.9	4.0	4.0	8.0	S. M. C.	1 5/32
12.0 to 15.99	Nos. 107, 121	Undried	14.0	Loose	9.0	8.60	1.77	1.246	84.4	4.5	4.5	7.0	M.+C.+	1 3/16−
		Dried	11.0	do	5.4	8.64	1.76	1.254	89.2	4.0	4.0	5.0	S. M. B.+	1 3/16−
		Undried	14.0	Tight	8.9	8.60	1.77	1.248	72.6	4.5	4.5	8.0	M.+C.	1 5/32
		Dried	11.0	do	5.3	8.62	1.78	1.242	86.0	4.5	4.5	6.0	M.+B.−	1 5/32
8.0 to 11.9	Nos. 118, 123, 144	Undried	10.5	Loose	6.8	8.39	1.75	1.218	103.5	5.7	6.0	6.3	S. L. M.+B.−	1 5/32+
		Dried	8.4	do	4.8	8.39	1.75	1.191	110.3	5.7	5.7	5.3	S. L. M.+B.	1 5/32−
		Undried	10.5	Tight	6.8	8.38	1.76	1.214	103.8	5.7	6.0	7.0	S. L. M.+C.+	1 5/32+
		Dried	8.4	do	4.9	8.35	1.75	1.186	111.1	6.0	6.0	6.3	S. L. M. B.−	1 1/8+
Below 8.0		Undried		Loose										
		Dried		do										
		Undried		Tight										
		Dried		do										
COTTONS SHORTER THAN 1 1/8 INCHES														
16.0 and over	No. 131	Undried	16.2	Loose	11.3	8.53	1.98	1.017	91.4	5.0	4.0	8.0	S. L. M.+	15/16
		Dried	11.6	do	5.8	8.51	2.13	.994	91.1	5.0	4.0	5.0	M.+	15/16
		Undried	16.2	Tight	11.6	8.52	1.98	.999	76.2	5.0	4.0	9.0	S. L. M.	15/16
		Dried	11.6	do	6.4	8.45	2.15	.981	83.5	5.0	4.0	6.0	M.	15/16
12.0 to 15.9	Nos. 112, 119, 120, 122, 133, 137, 139	Undried	13.7	Loose	8.7	8.54	1.83	1.037	78.6	4.1	3.9	6.1	M.+	1 1/32
		Dried	11.1	do	4.9	8.55	1.85	1.026	90.2	4.1	4.0	4.7	S. M.−	1
		Undried	13.7	Tight	9.1	8.52	1.83	1.037	81.1	4.4	4.4	7.4	M.−	1 1/32
		Dried	11.1	do	5.1	8.52	1.84	1.030	84.3	4.1	4.0	5.7	M.+	1
8.0 to 11.9	Nos. 115, 142, 145	Undried	10.8	Loose	8.2	8.58	1.89	1.020	73.7	4.0	4.0	5.3	S. M.−	1+
		Dried	9.0	do	5.3	8.54	1.90	1.003	92.6	4.0	4.0	5.0	S. M.−	31/32
		Undried	10.8	Tight	8.3	8.56	1.89	1.009	80.1	4.3	4.3	7.3	M.−	1+
		Dried	9.0	do	5.0	8.54	1.90	1.005	81.0	4.3	4.3	5.7	M.+	31/32
Below 8.0		Undried		Loose										
		Dried		do										
		Undried		Tight										
		Dried		do										

[1] Brilliance readings are made on the entire surface of cotton samples and range from approximately 7.0 to 9.0 on a scale which extends in equal steps from 0, which is black to 10, which is white.

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