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FIELD ENVIRONMENT MAY AFFECT COTTON QUALITY

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The overall quality of cottonseed produced in Mississippi has been unsatisfactory for the past several years. Viability of the majority of cottonseed used for planting purposes since 1957 has averaged between 60 and 70 percent, with many lots going as low as 40 percent. This has necessitated lowering of certification standards and temporary alteration of state laws to meet the demands for planting seed.

Considerable interest has been expressed by farmers and seedsmen in a research program to investigate the causes of this deterioration in cottonseed quality. This is the object of a current cooperative research project of the Mississippi Agricultural Experiment Station and the U. S. Department of Agriculture

Field experiments were conducted at the Delta Branch Experiment Station, Stoneville, in 1960, to determine the effects of preharvest environment, from time of boll opening until picking, upon cottonseed and lint quality. The first step was to measure the effects of temperature and humidity on seed and lint deterioration. In order to establish plant microclimates of differing humidities, three levels of nitrogen fertility and two levels of irrigation were used.

Blossoms were tagged at three dates to give a large sample of like age bolls at the bottom of the plant, middle of the plant, and top of the plant. These bolls were harvested at three dates: 1 week, 3 weeks, and 6 weeks after opening. Recording hygrothermographs were placed in the plots to give a continuing microclimate record of temperature and relative humidity.

Although the levels of nitrogen fertility and irrigation have some effect on the temperature and humidity in the boll microclimate, the position of the boll on the plant and the length of exposure after opening had a greater effect.

Several measurements were made to determine the quality of the seed and lint. Viability, vigor, and emergence under field conditions were determined on the seed by the Mississippi Seed Technology Laboratory. Fiber color, fiber strength, upper half mean fiber length, and mean fiber length were determined by the Clemson Cotton Laboratory.

Table 1 lists means of the various measurements taken. It was found that field exposure of 3 and 6 weeks caused a significant loss in seed quality over that exposed for 1 week. Also, significant losses in seed quality occurred in bolls at the bottom and middle portions of the plant when compared with those in the top of the plant.

The degree of lint quality deterioration in nearly all cases paralleled that of seed quality deterioration. It was found that fiber strength was significantly reduced when bolls were exposed from 3 to 6 weeks before they were harvested. Also, in irrigated cotton, fiber strength was significantly less for the bottom crop than for the middle or top crop. Fiber upper half mean length was significantly reduced by field exposure of 3 to 6 weeks in plots which received a high rate of fertilizer (135 pounds N per acre). The length of the fibers from the bottom crop was significantly lower than that of the fibers from the middle and top crop. As shown in table 1, the best fiber color was realized when the open bolls were exposed only 1 week. It also appears that the higher the boll on the stalk, the better the fiber color.

It is evident that if one is to realize maximum fiber length, strength, and color, and overall seed quality, he should

[1]The work described is part of a cooperative project of the Seed Technology Laboratory, State College, and the Delta Branch Experiment Station, Stoneville. It is part of a Mississippi Agricultural Experiment Station project and of a contributing project to Regional Cotton Mechanization Project S-2.

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Table 1. Averages of seed and lint quality measurements from test conduc ted in 1960.

Variables	Seed measurements: Viability	Seed measurements: Vigor[1]	Seed measurements: Field emergence	Lint measurements: Fiber color[2]	Lint measurements: Fiber strength	Lint measurements: Upper half mean fiber length	Lint measurements: Mean fiber length	Temperature-humidity index[3]
	Percent		Percent		Gms/tex	Inches	Inches	
Field exposure after boll opening								
1 week	78.99	28.72	28.25	93.6	23.19	1.06	.76	149.0
3 weeks	64.64	24.58	23.42	90.0	21.83	1.03	.73	378.1
6 weeks	54.11	21.86	19.70	87.2	22.13	1.04	.75	637.8
Boll position on plant								
Top	82.10	31.54	36.53	92.2	22.49	1.05	.76	264.8
Middle	64.32	25.27	21.73	90.6	22.44	1.05	.75	423.5
Bottom	51.32	18.34	13.11	87.9	22.23	1.03	.73	476.5

[1]A vigor index based upon rate of germination.
[2]Measured as percentage of value of 1-inch white Middling grade.
[3]Number of hours exposure to temperature plus relative humidity over 140.

(over)

harvest as soon after the boll opens as possible.

Correlations were made of the various quality measurements with the temperature-humidity index. With the exception of fiber strength and mean fiber length, these correlations were all highly significant.

Although this particular set of data indicates that the greatest amount of deterioration occurred in those bolls located on the bottom and middle portions of the plant, this may not necessarily hold true for every season. In the 1960 season, the highest combination of temperature and humidity occurred while the bottom and middle bolls were opening, and had decreased by the time the top bolls opened. In another season, the highest temperature and humidity might occur at some other time, in which case the portion of the crop exposed at that time would be damaged most.

It is important to remember that the deterioration which occurred was caused by exposure to high temperature and humidity. Nitrogen and irrigation levels, boll positions, and dates of harvest are secondary factors which controlled the intensity of the temperature and humidity to which the bolls were exposed. In seasons when the temperature and humidity is lower than the 1960 season, less deterioration may be expected.

Several factors are evidently contributing to the present lowered quality of seed and lint produced in Mississippi. Last year over 50 percent of the cotton produced in the Mississippi Delta was picked by machine. In many fields, only one picking was made — after all the bolls were open. The lower bolls may have been open for as long as 2 months before being picked. This prolonged exposure undoubtedly lowers the quality of the seed as well as the lint. Modern cultural practices, including high plant populations, high fertility levels, and irrigation, all contribute to higher humidity in the microclimate surrounding the lower bolls. This will tend to lower the quality of the seed and lint.

Practices which would minimize the length of exposure of open bolls to high temperature and humidity would be expected to improve quality. This might be accomplished by lowering the humidity in the boll microclimate and also by picking as soon after boll opening as possible.

Research is in progress on various means of improving the quality of Mississippi's cotton lint and seed. These efforts are being directed toward reducing humidity in the boll microclimate by various cultural practices and toward effecting means of earlier machine harvesting. Work is also being done in the laboratory to clarify the effects of specific humidity and temperature levels upon cotton deterioration.

Table 2. Correlation coefficients comparing seed and lint quality measurements and temperature-humidity index.

Factors compared	r
Viability/temperature-humidity index	—.816**
Vigor/temperature-humidity index	—.717**
Field emergence/temperature-humidity index	—.674**
Fiber color/temperature-humidity index	.726**
Fiber strength/temperature-humidity index	—.321*
Upper half mean fiber length/temperature-humidity index	—.396**
Mean fiber length/temperature-humidity index	—.233
Vigor/field emergence	.866**

*Indicates significance at the 5 percent level.
**Indicates significance at the 1 percent level.