TECHNICAL BULLETIN

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FQR 1003

EXPLANATION OF THE USDA COLOR DIAGRAM FOR AMERICAN UPLAND COTTON

INTRODUCTION

The USDA, under the statutory authority of the Smith-Doxey Act, employs various standards for the classing of upland cotton. These standards include several factors, such as staple length, micronaire and grade. In 1953, the USDA issued the Color Diagram as a universal standard for the grading of upland cotton. This diagram divides the range of cotton color into specific color grade sections. It was revised in 1960 to include a separate section for light spotted cottons.

COTTON COLOR

Upland cotton, after opening normally in the field, is white in color. Exposure to various environmental conditions can cause the natural white color to change. The action of the microorganisms and weather exposure can cause the color to become duller and more gray. The effect of severe weather, unusual moisture conditions, and contamination by soil, bacteria, and insects may cause the cotton to become more yellow and, in some cases, spotted.

Also, color may be introduced by harvesting, ginning, or other processing equipment when contamination from the equipment or the cotton plant itself occurs. This would include such things as oil, grease, or green leaves from the plant.

Regardless of its source, differences from the normal white color represent variations in quality. This is accounted for in the classing system by the assignment of a descriptive grade for the yellowness and grayness of the sample. Yellowness is classified according to white, light spotted, spotted, tinged, and yellow stained. The degree of grayness or darkening of the sample is used to assign the descriptive grades such as strict middling, middling, or strict low middling. Other factors such as preparation, visible trash, and condition are also considered. The USDA records this information in the data fields Extraneous Matter, Leaf Grade, and Remarks respectively.

COLOR DIAGRAM

The diagram, as shown in Figure 1, is in the form of a representation of color space. The three attributes of color are value (light/dark), chroma (brightness or saturation), and hue (color family -- red, green, blue, orange, yellow, gray). The Color Diagram is based on the Munsell System in which colors are classified into families by numerical notation. As shown in Figure 2, the entire USDA chart corresponds to a slice of this Munsell color space in the yellow color family "10YR". The horizontal axis of the diagram represents increasing yellowness to the right by the quantity "b". The higher values of "b" represent brighter and more saturated yellows, and the lower values represent duller, grayer, and less saturated yellows. The vertical axis represents the total lightness and darkness (value) of the sample. This is represented numerically by the reflectance of the sample "R_d". The areas to the top of the scale have higher reflectance and appear lighter. Typically, the values of "b" range from 4 to 18, and the values of "R_d" range from 40 to 85% reflectance.

THE DIVIDING LINES

The chart is mapped into small segments by a series of roughly parallel vertical and horizontal curves. These curves are the dividing lines between the various USDA "color grades". Their locations are defined by grading protocol of the USDA. The areas between these lines have both the numerical and letter designations of the USDA grades. These are the color grades only and would be modified in the final grade by the classer's assessment of other factors such as visible trash, preparation, and condition. There are seven curves that are roughly horizontal, actually sloping down to the right. All cotton above the top curve would have the "GM" color classification. This would be the numerical grades 11, 12, 13, etc. The fourth curve separates the "SLM" and "LM" areas in a similar manner. The roughly vertical curves, actually sloping upward to the right, separate the classification areas of white, light spotted, spotted, tinged, and yellow stained.

Explanation of White Grades

GM = Good Middling
LM = Low Middling
SM = Strict Middling
SGO = Strict Good Ordinary
M = Middling
GO = Good Ordinary
SLM = Strict Low Middling

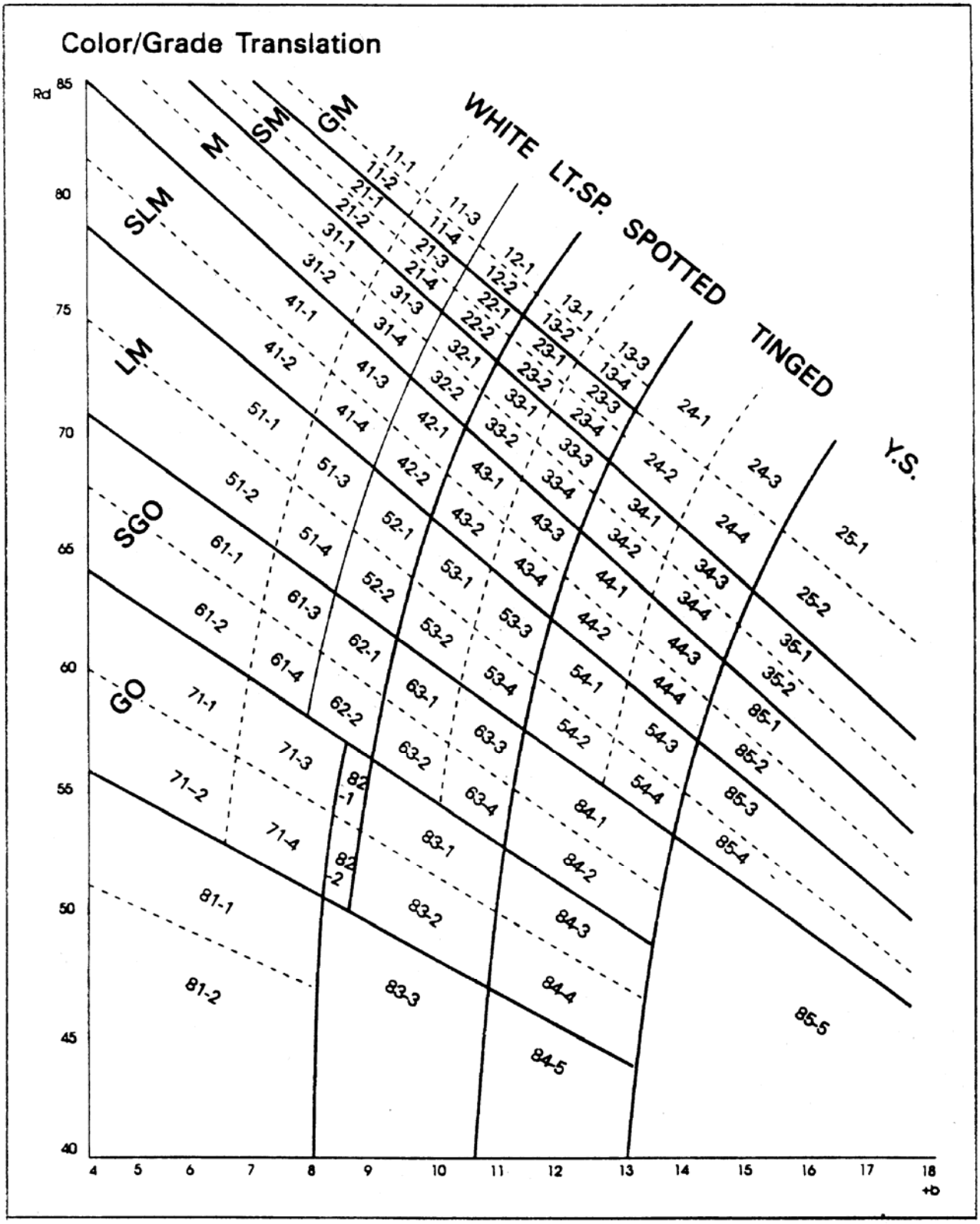
Color/Grade Translation
Rd
WHITE
LT.SP.
SPOTTED
TINGED
Y.S.
GM
SM
M
SLM
LM
SGO
GO
+b

Figure 1

RESEARCH AND TECHNICAL SERVICES

Cotton Incorporated is a research and promotion company representing cotton worldwide. Through research and technical services, our company has the capability to develop, evaluate, and then commercialize the latest technology to benefit cotton.

- Agricultural research leads to improved agronomic practices, pest control, and fiber variants with properties required by the most modern textile processes and consumer preferences. Ginning development provides efficient and effective machines for preservation of fiber characteristics. Cottonseed value is enhanced with biotechnology research to improve nutritional qualities and expand the animal food market.

- Research in fiber quality leads to improved fiber testing methodology and seasonal fiber analyses to bring better value both to growers and then mill customers.

- Computerized fiber management techniques result from in-depth fiber processing research.

- Product Development and Implementation operates programs leading to the commercialization of new finishes and improved energy and water conserving dyeing and finishing systems. New cotton fabrics are engineered -- wovens, circular knits, warp knits, and nonwovens -- that meet today's standards for performance.

- Technology Implementation provides comprehensive and customized professional assistance to the cotton industry and its customers -- textile mills and manufacturers.

- A fiber-to-yarn pilot spinning center allows full exploration of alternative methods of producing yarn for various products from cotton with specific fiber profiles.

- The Company operates its own dyeing and finishing laboratory, knitting laboratory, and a laboratory for physical testing of yarn, fabric, and fiber properties including High Volume Instrument testing capable of measuring micronaire, staple length, strength, uniformity, color, and trash content.

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