Cotton Insights Newsletter

A service provided by Windstar, Inc. affiliated gins.

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Introduction to Deep Dive into Fiber Quality Series – Color Grade

Most growers have questions about cotton classing, the results and how this all relates to the Commodity Credit Corporation (CCC) Loan chart. A series of newsletters entitled Deep Dive into Fiber Quality will be generated which will provide a greater understanding of this complex issue for the fiber properties and classing results that impact Loan rate. We will provide an in-depth discussion of various fiber quality components and factors which affect them over the next several newsletters.

Classing is the very beginning of this process, and is performed on a fiber sample taken after each bale is released from the press just before bagging. This sample is identified by a bar coded Permanent Bale Identification (PBI) tag, which corresponds with the PBI on the actual bale. For our gin territory, the Lubbock USDA-Agricultural Marketing Service (AMS) Classing Office is the location where our cotton is classed.

Classing has changed considerably over the past few decades with the advent of high-volume instrument (HVI) testing machines and reduced reliance on the human eye for various fiber quality components. All classing offices are "conditioned" and required to maintain specific humidity and temperature conditions in order to provide more precise and consistent fiber quality evaluations. These conditions include 70 degrees F plus or minus 1 degree, and 65% relative humidity plus or minus 2%. If these environmental conditions cannot be sustained, classing is not performed. Samples are equilibrated to these conditions, and must have a moisture content between 6.75 and 8.25% (dry-weight basis).

Fiber properties are exclusively measured by HVI, but other visual evaluations (knowns as classer's call) are still performed by the individual classer. The classer's call observations require a trained eye to properly identify and evaluate these additional components and when combined with the HVI data, these collectively are a representation of a cotton bale's overall quality. Currently, the following are included in a USDA-AMS classing result for a cotton bale:

- Fiber length, measured in 100ths inch, converted to staple in 32nds inch

- Length uniformity, reported as %

- Fiber strength, reported as grams/tex

- Micronaire, a unitless measure

- Color grade

- Trash, reported as percent area

- Leaf grade, reported as 1 to 8

- Extraneous matter, which is anything other than fiber or leaf

Color Grade

Color grade has been determined since 1993 using the HVI colorimeter readings of reflectance (Rd), measured in percent, and yellowness (+b), also measured in percent. The HVI colorimeter is basically a camera that is used to scan the fiber sample, with standard samples used for its calibration. Rd indicates the grayness (how light or dark) and +b measures the yellowness in the sample. Based on the HVI Color Diagram for American Upland Cotton, Effective July 1, 2008, the Rd scale ranges from about 40 to 90%, whereas the +b component ranges from about 4 to 18%. Higher Rd values indicate reduced grayness (higher quality) and higher +b values indicate greater yellowness (lower quality). Although colorimeters are used to determine color grade, USDA-AMS maintains color grade physical standards, and calibration standards for their HVI machines. There are 25 color grades and 5 below grade color classifications.

Official Color Grades of Upland Cotton
(Effective in 1993)

Decreasing quality →

Decreasing quality ↓

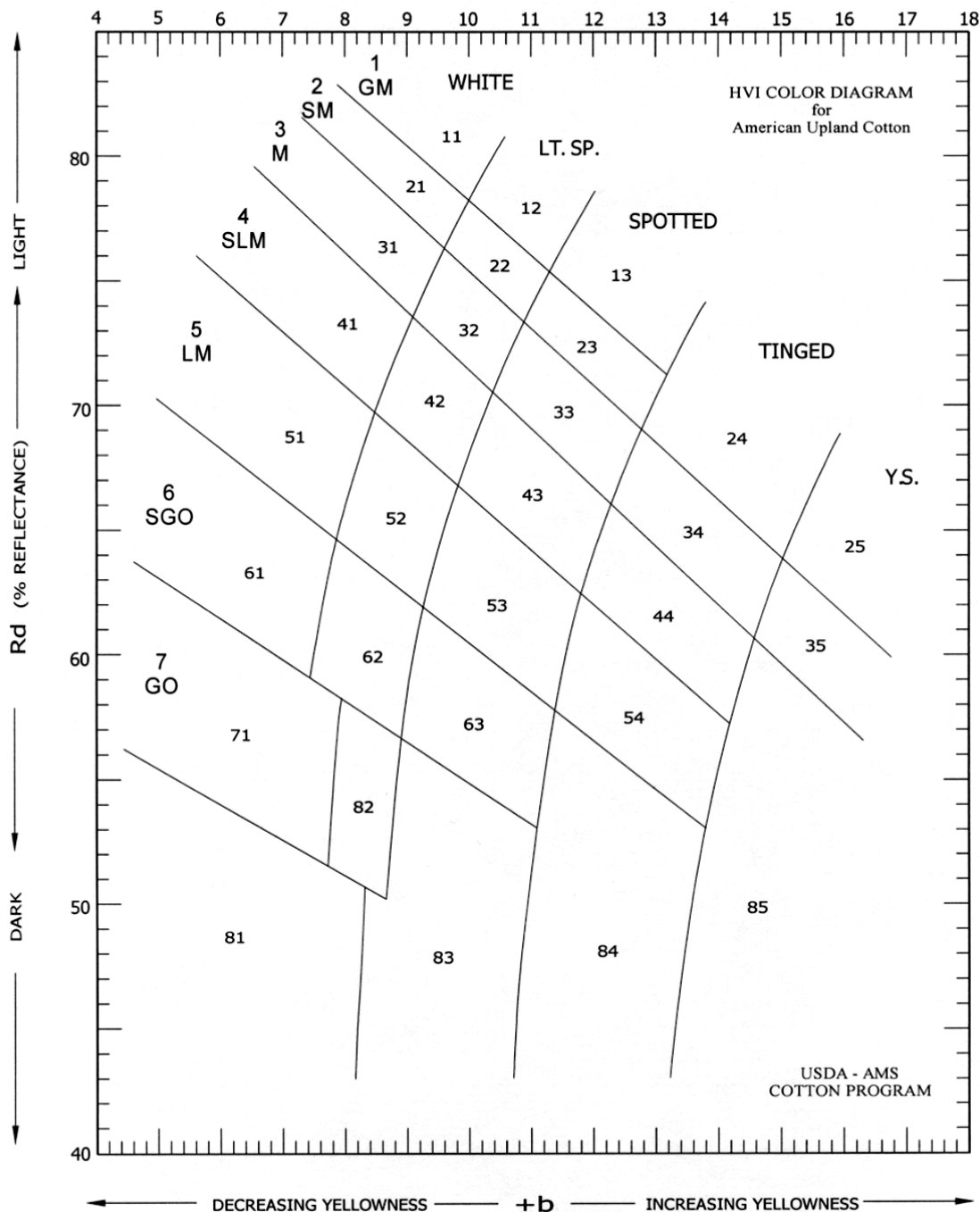|	White	Light Spotted	Spotted	Tinged	Yellow Stained
Good Middling	11-1*	12	13	--	--
Strict Middling	21-2*	22	23**	24	25
Middling	31-3*	32	33**	34**	35
Strict Low Middling	41-4*	42	43**	44**	--
Low Middling	51-5*	52	53**	54**	--
Strict Good Ordinary	61-6*	62	63**	--	--
Good Ordinary	71-7*	--	--	--	--
Below Grade	81	82	83	84	85

* Physical standards for both color grade and leaf grade.
** Physical standards for color grade only.
All others are descriptive.

The relationship between Rd, +b and corresponding color grades is presented below. The +b values are plotted on the X axis of the graph, a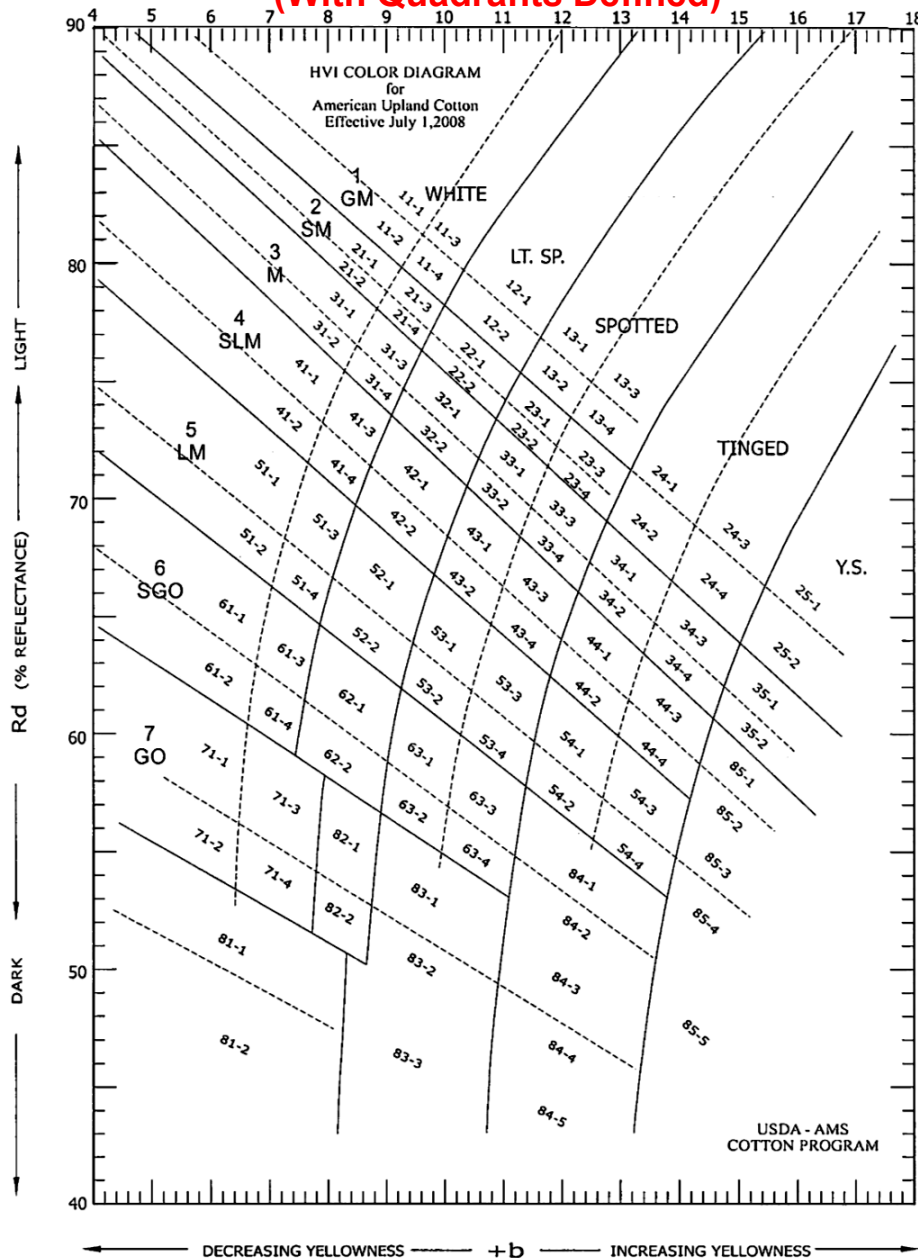nd the Rd values are plotted on the Y axis. **Note that this first diagram does not include Quadrant, but the second one does.**

OFFICIAL COLOR GRADES FOR AMERICAN UPLAND COTTON
(Without Quadrants Defined)

HVI COLOR DIAGRAM
for
American Upland Cotton

Rd (% REFLECTANCE)

LIGHT — DARK

1 GM · 2 SM · 3 M · 4 SLM · 5 LM · 6 SGO · 7 GO

WHITE · LT. SP. · SPOTTED · TINGED · Y.S.

11, 12, 13, 21, 22, 23, 24, 25, 31, 32, 33, 34, 35, 41, 42, 43, 44, 51, 52, 53, 54, 61, 62, 63, 71, 81, 82, 83, 84, 85

DECREASING YELLOWNESS ← +b → INCREASING YELLOWNESS
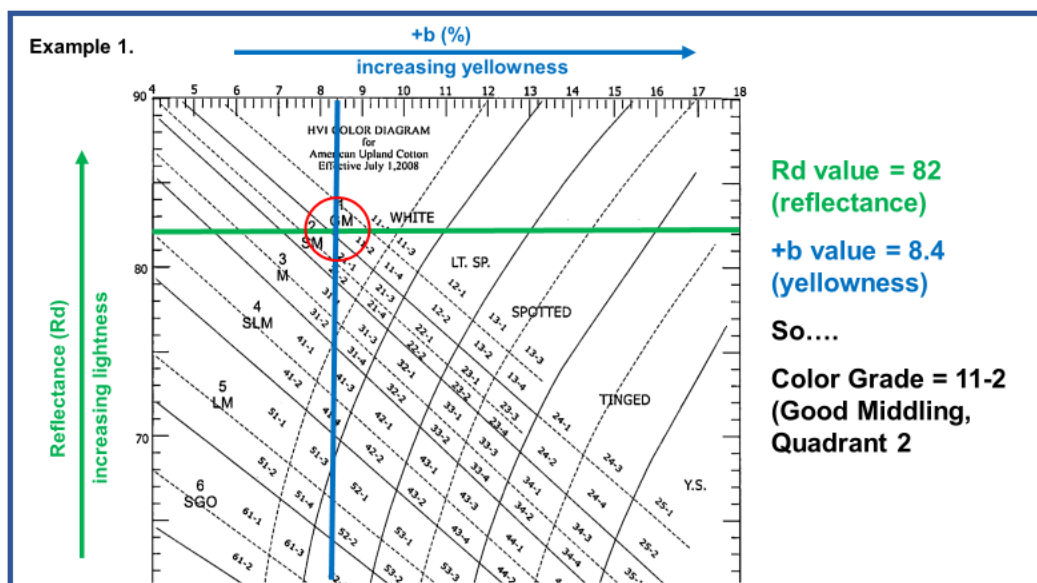
USDA - AMS
COTTON PROGRAM

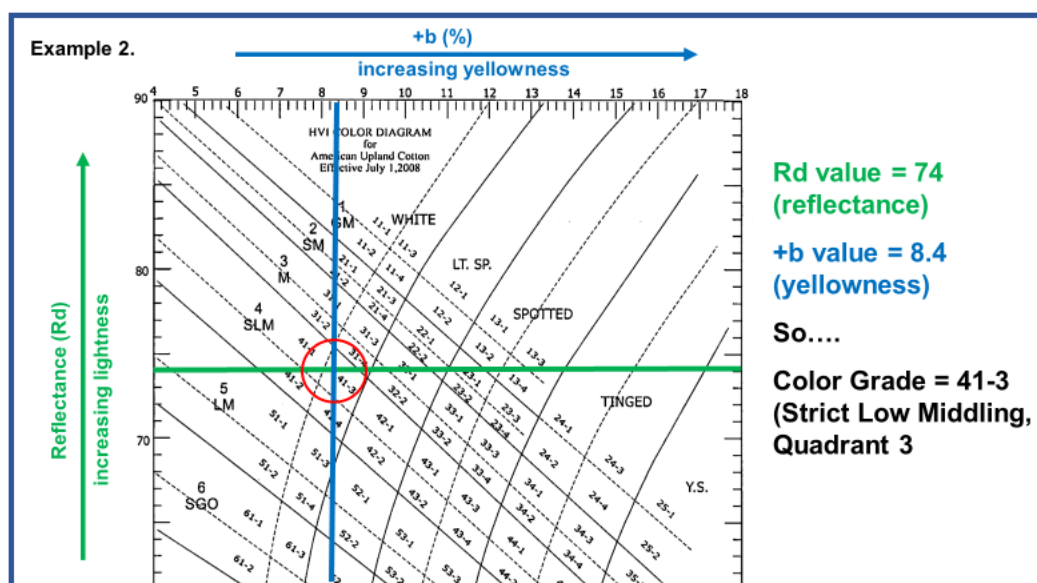# HVI COLOR GRADES FOR AMERICAN UPLAND COTTON
(With Quadrants Defined)

The HVI Color Diagram for American Upland cotton is used to determine the overall color grade, and factors in both reflectance (Rd, %) and yellowness (+b, %). Values for these two components of color are essentially plotted on the chart, and the point at which these values intersect determines the color grade and the associated quadrant or subdivision. Some color grades only have two quadrants whereas others have four. Some observers confuse the color grade quadrant with leaf grade, so be aware of that.

Changes in either Rd or +b can significantly alter the ultimate color grade assigned and quadrant. For examples of this see the three charts below.

- Example 1 below shows the intersection of an Rd value of 82 and a +b value of 8.4 which results in a color grade 11 in quadrant 2.

Example 1.

HVI COLOR DIAGRAM for American Upland Cotton Effective July 1,2008

Rd value = 82 (reflectance)

+b value = 8.4 (yellowness)

So....

Color Grade = 11-2 (Good Middling, Quadrant 2

- Example 2 below shows the intersection of an Rd value of 74 and a +b value of 8.4 which results in a color grade of 41 in quadrant 3. This example has the same +b value (8.4) as Example 1 above, and shows the impact of increased grayness (lower reflectance) in the fiber sample.

Example 2.

HVI COLOR DIAGRAM for American Upland Cotton Effective July 1,2008

Rd value = 74 (reflectance)

+b value = 8.4 (yellowness)

So....

Color Grade = 41-3 (Strict Low Middling, Quadrant 3

- Example 3 below shows the intersection of an Rd value of 74 and a +b value of 14.2 which results in a color grade of 24 in quadrant 1. This example has the same Rd (74) as Example 2 above, and shows the impact of increased yellowness (higher +b) in the fiber sample.
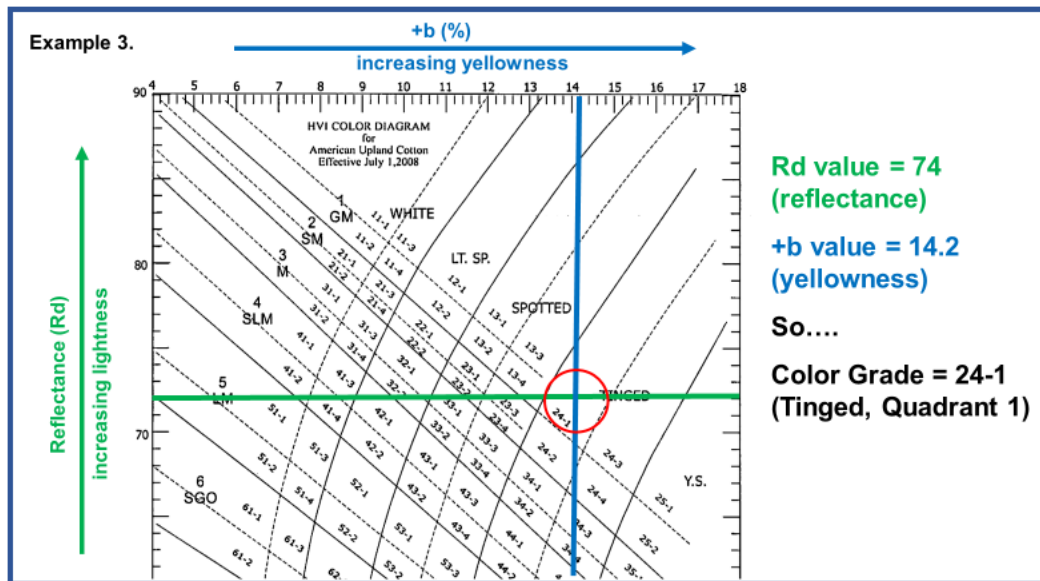
- Cotton fields can be exposed to plant, environmental, harvesting and module storage conditions which can affect color components as measured by the HVI colorimeter. Typically, color grade quality is reduced the longer the cotton sits in the field. Collectively these conditions are called "weathering" and in general the longer cotton bolls remain unharvested, the lower the color grades tend to be. There is an old saying that states "a cotton boll's quality is never higher than the day it opens." However, some slight color grade improvements may be encountered in some situations if proper environmental conditions exist which can improve the fiber color above an initial lower grade. An example of this might be where cotton could be lightly stained while in the field, and a timely rainfall event and bright sunshine might slightly improve color.

- Weathering generally arises from the exposure of open bolls to warm temperatures and rainfall may result in degradation of the fiber surface by various microorganisms. Modules constructed with excessively moist bur cotton can also be discolored by microbial degradation during "heating" of the module. This likely to reduce reflectance (increase grayness). Other factors may include lint staining arising from plant material and can be caused by freezing conditions on unopened bolls, or by excessive insect damage. High moisture modules can also drive staining arising from plant material such as leaves, burs, etc. These conditions tend to increase yellowness (+b), which results in lower quality grades.

- For an excellent explanation of the US classing system, click on the Cotton Incorporated link below: https://www.cottoninc.com/wp-content/uploads/2017/02/Classification-of-Cotton.pdf

- For a companion document from USDA-AMS that discusses classing data, click on the link below: https://www.ams.usda.gov/sites/default/files/media/Cotton%20DB%20Understanding%20the%20Data.pdf