MANUAL COLOR & LEAF VS. HVI VALUES ECONOMIC ADVANTAGE TO THE GROWER OF HVI COLOR

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Abstract

One of the most economically important improvements in cotton production and processing will be an increased and acute interest by grower's and ginner's in the raw material requirements of textile manufactures. We must learn what is important to the spinner, what impact we have on those spinner important fiber properties, and what we can do to improve the cotton delivered to the textile mill.

In preparation for this talk, I polled several leading textile manufacturers about what is important to them in terms of color and leaf. This research revealed that color is much more important to the spinner than leaf, by a ratio of about 4 to 1. Of the two components of color, +b is the most important by a ratio of about 7 to 3. All of the mills I surveyed use Cotton Inc.'s Engineered Fiber Selection Software to determine their mix of cotton bales to spin, and as many as 90% of all US mills use the HVI data when selecting their laydowns.

Growers on the other hand rely on the manual class to determine the color value of their cotton.

Introduction

This talk compares the USDA-AMS HVI color and leaf measurements to the color and leaf grades called by the classer on the 111,000 Servico bales ginned in 1994, '95, and '96, and an additional 280,000 bales ginned in 1994 from other gins with an incidence of bales in excess of 5% called for the extraneous matter known as "Preparation."

Discussion

Figure 1 Each dot represents a group of bales Servico produced in 1994 that were called 31 by the classer, but something else by the HVI. The area labeled 31 is blank because only those bales on which the HVI disagreed with the person classing the cotton are indicated. The more dense populations of deviant bales are indicated by differing shades of yellow.
The graph is the Nickerson-Hunter color chart, which is used by the U.S. cotton industry to correlate HVI color measurements to the hand classer's color call.

The vertical axis represents the cotton's reflectance or Rd, and the higher it is the better. The horizontal axis is the yellowness or +b, and generally the lower it is the better. In other words, generally the higher and to the left on the graph the better the color. Though this is not a hard and fast rule, it is the rule in all but a very few applications.

The red lines represent the boundaries of the different manual classer's grades as they fall on the color chart, and the numbers 31 through 52 are the classer's grade.

Note that on this graph the bales on which the HVI differed are pretty evenly scattered around the 31. This is the relationship you would hope to find.

It's no coincidence that this is the case. Where the classer's color grade falls on the chart was backed in to years ago by USDA-AMS.

Figure 2 Still a pretty good distribution.

Figure 3 Again a good distribution.

Figure 4 This graph is from the 1994 data collected by the Stoneville Gin Lab. This also indicates the hand class has hit the HVI target.

Figure 5 Notice that this is not a good distribution relationship. Almost all the bales HVI disagreed with are whiter (+b) and brighter (Rd) than the classer's call. In other words, the HVI measured the color as something better than the classer called it.

Figure 6 Again we see a similar disparity, though not as pronounced as in 1994. Still the vast majority of those bales with different HVI values were measured as whiter, and especially as influenced by +b, the more important spinner value by a margin of 7:3.

Figure 7 Again we see the same bias by the classer toward calling more color than is measured by HVI.

Figure 8 This is the Stoneville data on 330,000 bales, and the same bias is evident.

Figure 9 Here you see the yellow color which means there were considerably more bales in those ranges than in the white areas. Again this shows that the HVI is measuring a better reflectance, and more importantly a better +b.

Figure 10 Here we see a pretty good distribution around the 41 range of values.

Figure 11 Servico's 1996 bales, and again the manual class bias is against the grower.

Figure 12 This is the 1994 data collected by Stoneville.

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Figure 13 On the 42's the classer's call was very biased. Again the darker yellow represents a significantly denser concentration of differing HVI values, and they are practically all better than what the classer called them.

Figure 14 Again this points out the same relationship, and strongly indicates that the manual classer is calling bales with premium Rd and +b values as being off color.

Figure 15 The same bias is evident in 1996.

Figure 16 The Stoneville data for 42's further substantiates the classer bias.

Though I will not present the 51's and 52's, the same bias is evident.

Figure 17 In terms of dollars and cents, had Servico's customers sold their 102,403 1994,'95 & '96 non-prep bales based on the HVI color measurements, they would have received an additional $2.93 per bale, or $300,170.00.

Figure 18 This graph plots all the 1995 classer grade 31's. Each bar represents the number of bales (vertical axis) of a certain HVI +b value. Remember that +b is more important than Rd.

The yellow bars are the bales that are within the +b values for 31's. Remember the earlier scatter graph that showed almost perfect centering of the 31's on the Nickerson-Hunter color chart. This graph also indicates a very good correlation between HVI and classer.

Figure 19 The focus of this graph is on the blue bars, which are the bales that were called something different by HVI. Over half of all the bales called 32 by the classer were measured differently by HVI, and almost 100% of these deviant bales were better than called.

Figure 20 The yellow bars are bales that correlate. This is obviously a very good relationship.

Figure 21 Over 1/3 of the bales discounted to the grower as 42's were white as measured by HVI. And though I took the slide out, ¼ of the 52's were spun as white cotton if delivered to one of the 90% of U.S. textile mills using HVI measurements to determine their mix.

Figure 22 Which method of valuing cotton is best?

Consider the scatter graphs and bar graphs, and the fact that the majority of the mills in the U.S. use HVI color data to determine their processing mix.

HVI is a fixed target that measures reflectance and yellowness the same from day to day, instrument to instrument, and year to year.

HVI better expresses the empirical color values that relate to the processing performance of the cotton.

Therefore, HVI is of more value to the spinner than the hand class.

However, for the same reasons and because the manual class is a subjectively determined moving target, easily biased by many variables, the manual class is of more value to the merchant.

Figure 23 Growers and ginners would obviously be better off with HVI for all of the above reasons. Now we'll switch briefly to trash.

Figure 24 Leaf is of much less importance than color. HVI trash measurements are reported as a % of the total area measured. The HVI measures to two decimals, but the classing office rounds the measurement reported to us to only one decimal. Because of this rounding error, any study using classing office data is of limited value. A study should be conducted using % area measurements carried to two decimal places, and in the future the classing office should report the measurements with the greater two decimal resolution.

Figure 25 This chart compares the classer's leaf call in the left column to the HVI % area. The second column is the conversion printed by the classing office, but is from data gathered prior to 1993. The third column is from Stoneville's 330,000 bales of 1994 data, and the fourth column is from the 111,000 bales of Servico data.

The classing office's old pre-1993 conversion table is obviously out of date and not a fair representation of what the HVI measurements convert to. If HVI % area is used to determine grower value, the conversion to $ value should be based on more recent data, gathered from the latest generation of measuring instruments.

Figure 26 Why is there a significant difference in the classer's color call and that measured by the HVI camera? Some will say that the camera is just not good enough to pick up certain color, and therefore should not be used for the grower color discount determination. Why then do the vast majority of U.S. textile mills rely on HVI color if the measurements made are not more useful than the classer's color call? We should listen to our ultimate customer, the spinner.

I am convinced that the cause of the classer's color bias may be found in a relationship discovered while studying Servico's data as it relates to the extraneous matter known as "preparation."

In 1994 Servico installed and is helping to develop a computerized process control system that uses on line moisture and HVI color and trash measurements to control

the amount and type of cleaning and heat the cotton is exposed to. When the system reduces the amount of lint cleaning and or heat, Servico's incidence of bales reduced for the extraneous matter "preparation" increases.

An industry accepted misnomer, "preparation" is a degree of roughness, not an extraneous matter. It has no mass, nor shape. It can not be measured or by any method known quantified and its impact on the spinner if any is not determined. Preparation is at best a subjectively determined characteristic that costs the grower over $20 per bale.

In this study it was found that HVI color differed with the classer more dramatically on prep bales than the non-prep bales. This fact is a clue to the color bias mystery.

Figure 27 An earlier slide showed that the classer called discount for color was $2.93 per bale more than that measured by HVI. On the prep bales, the manual color discount was $6.75 per bale more than HVI.

Figure 28 The actual cost to the grower for bales called "preppy" is $27.50 when both the prep and color discounts are taken into account.

Figure 29 But how does a discussion of roughness answer the question about why the classer is biased to calling more color and why was the manual color bias twice as bad on "prep" bales as on the smoother cotton?

The answer may be found by examining a process used by some textile mills called combing. Combing the cotton adds value by making the product manufactured appear smoother and more lustrous to the consumer. But what effect does combing have on the important +b value?

At the gin level, combing takes place with lint cleaning. The more lint cleaners used the smoother, more lustrous the sample appears to the classer. But multiple lint cleaning does not improve the important +b value?

The classer's eyes see a fluffy sample of cotton with little valleys and hills, under imperfect light, with contrasting borders, and in three dimensions.

The HVI color meter sees the same sample in a compressed, relatively smooth condition, with flatter valleys and hills, under laboratory lighting, in only two dimensions with no contrasting borders to bias the measurement.

At the other end of the smoothness-roughness scale from combed cotton is cotton that has received little or no lint cleaning and drying. This sample appears rough enough to be called a "prep" bale. Just as all un-combed cotton will have some degree of roughness because it is prepared to varying degrees, all minimally gin processed cotton will have some degree of gin roughness. I contend that the classer will see the resulting shadows as more color or less brightness which results in his color bias.

Summary

Figure 30 The majority of the classer's color bias may be explained by the varying degrees of smoothness, and has nothing to do with the spinner's requirements, or any quantifiable color characteristic.

Figure 31 In conclusion and for all the reasons presented, the HVI color measurements should be used to value cotton. This will be a more consistent and fair valuation, and will also effect gin process changes by encouraging reduced lint cleaning and drying, resulting in less fiber damage.

The current discounts for prep and the classer's color bias resulting from greater degrees of sample roughness encourage excessive gin processing, and fiber damage, and are of negative benefit to the grower and spinner.
Using the HVI color measurements for cotton valuation at the grower level will benefit the grower, ginner and mill.

Thank you

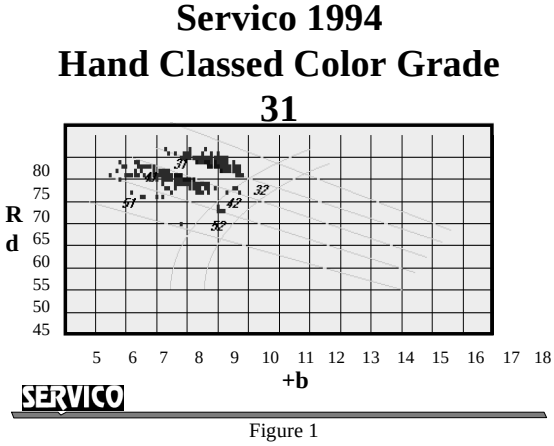

Figure 1

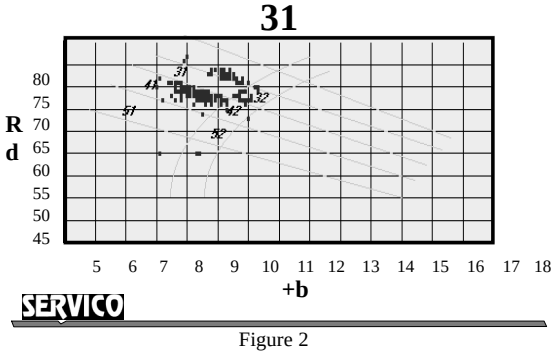

Figure 2

Servico 1996
Hand Classed Color Grade
31

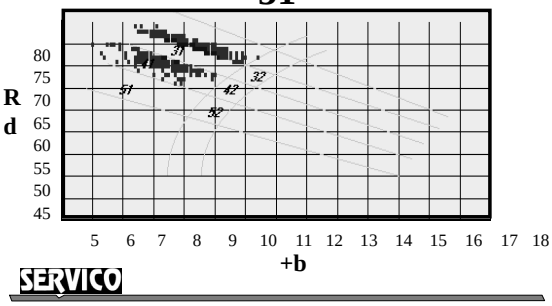

Figure 3

Servico 1995
Hand Classed Color Grade
32

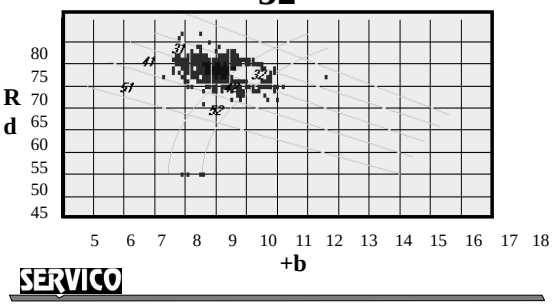

Figure 6

U.S.D.A. ARS
Hand Classed Color Grade
31

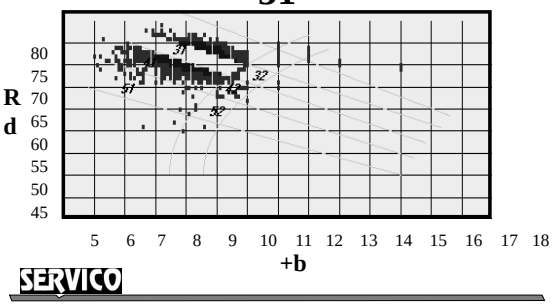

Figure 4

Servico 1996
Hand Classed Color Grade
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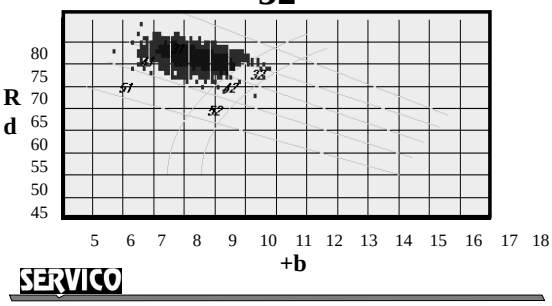

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Servico 1994
Hand Classed Color Grade
32

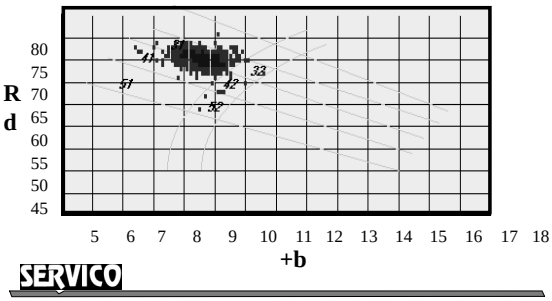
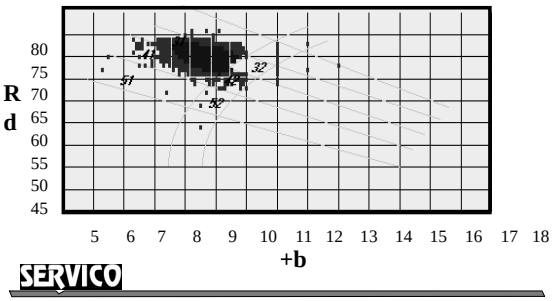


Figure 5

U.S.D.A. ARS
Hand Classed Color Grade
32



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Servico 1994
Hand Classed Color Grade
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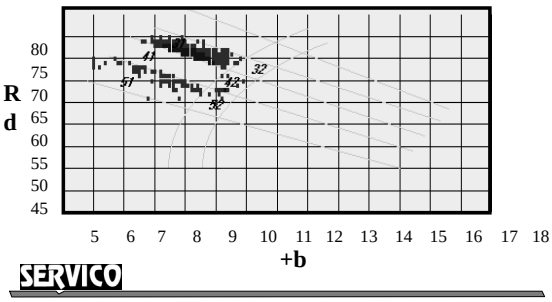

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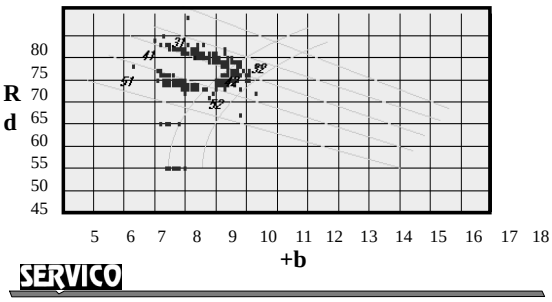

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Hand Classed Color Grade
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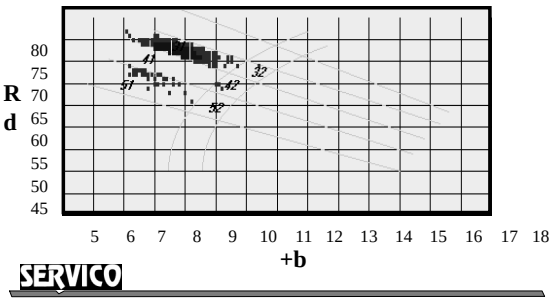

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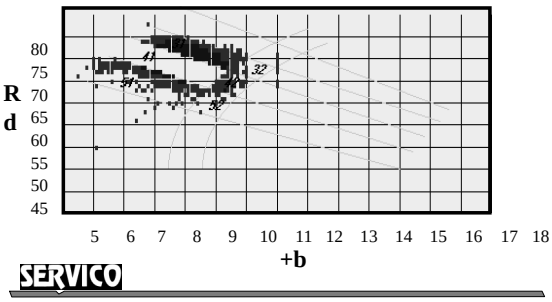
U.S.D.A. ARS
Hand Classed Color Grade
41



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Servico 1994
Hand Classed Color Grade
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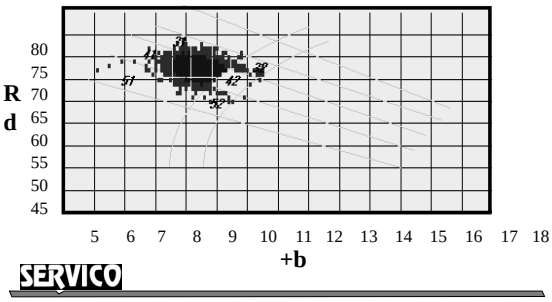

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Hand Classed Color Grade
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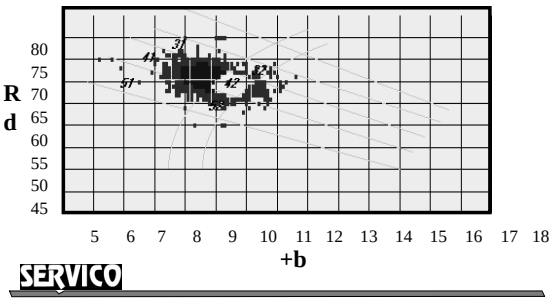

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Servico 1996
Hand Classed Color Grade 42

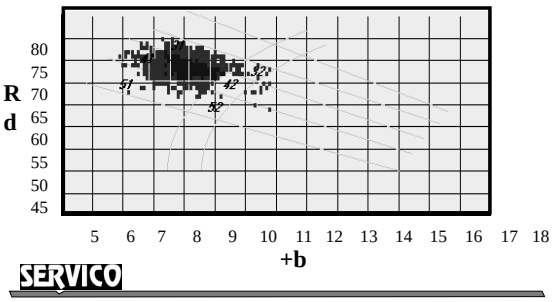

Figure 15

U.S.D.A. ARS
Hand Classed Color Grade 42

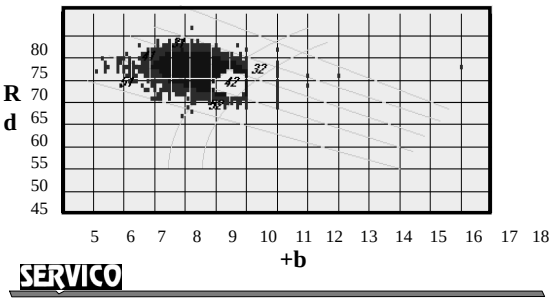

Figure 16

$ Difference Manual Color vs HVI Color

- Non-Prep Bales 94 - 96 crop years

- Per pound Difference 59 points less per hand class
- Times 500 lbs $ 2.93 per bale
- Times 102,403 bales $ 300,169.80 total gin output

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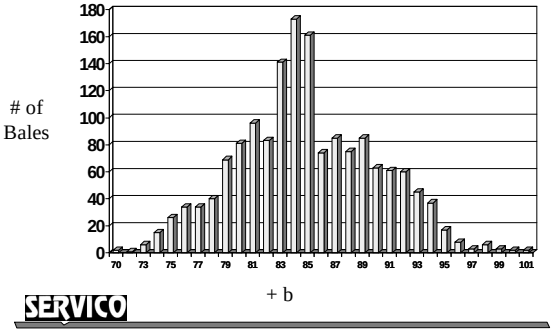
Figure 17

1995 Hand Classed Color Grade 31's



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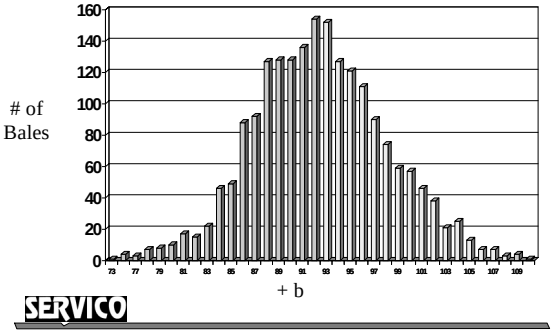
1995 Hand Classed Color Grade 32's



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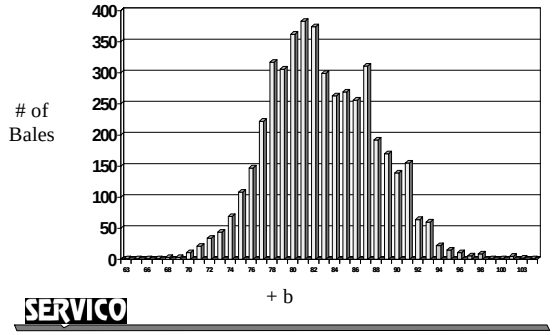
1995 Hand Classed Color Grade 41's



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1995 Hand Classed Color Grade 42's

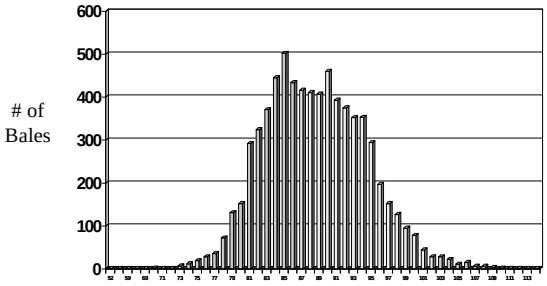

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Figure 21

Trash

Relationship of Trash Measurement to Classer's Leaf Grade

Classer's Leaf Grade	USDA pre-1993	HVI Trash % Area USDA ARS	Servico 94-96 Avg.
1	0.08	0.15	0.22
2	0.12	0.23	0.33
3	0.18	0.37	0.45
4	0.34	0.53	0.60
5	0.55	0.72	0.58
6	0.86	0.90	NA
7	1.56	0.98	NA

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Figure 25

Prep's Impact on Color

Bias Hand Classing

- Average Manual Grade Discount .0268
- Average HVI Grade Discount .0133
- Difference .0135
- Difference per bale $ 6.75

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Figure 27

Prep's Impact on Grower's Price

- Prep Discount $ 20.75 per bale
- Color Difference $ 6.75 per bale
- Total Discount $ 27.50 per bale

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Figure 28