THE SOLUTIONS FOR CONTROLLING FABRIC BARRE'

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Abstract

The current expansion of the worldwide market for cotton has opened up many possibilities for the spinning mill. Spinning mills now have many options in the raw materials they purchase for producing yarn. This expansion in the availability of raw material has helped in reducing costs and improving yarn quality and spinning efficiency. Unfortunately this situation has also presented some new challenges for the spinning managers and cotton buyers. Traditionally purchased cottons had well established seed varieties and growing regions. This meant that with an average control of micronaire they had few problems with the dying and finishing of cotton fabrics.

Over the past two years we have seen a rapid increase of the problems with dying and fabric finishing. This is especially evident in the claims and rejects of 100% cotton knitted fabrics for barre'. Claims and rejects can easily wipe out any savings in raw material costs obtained by purchasing cotton from several international sources. Figure 1 is a classic example of the problems related to mixing cottons of similar micronaire but from different growing regions and seed varieties. Many spinning mills are under the impression that all upland seed varieties mature the same as related to the micronaire. Unfortunately what they discover is that cottons with similar micronaire that have different growing regions and seed varieties dye differently.

Controlling some of the basic fiber properties can give the spinning mill the information necessary to reduce and or eliminate the recurring problems of barre'. Mill experience and trials have given us the necessary information to set up guidelines for controlling the fiber properties that influence the dyability of cotton yarns in knitted fabrics. There are several mechanical causes of fabric barre' that are associated with the spinning and sliver preparation processes in the spinning mill. Figure 2 highlights the major causes of barre' showing the major influence is from the fiber. While mechanical differences and variations in yarn count, twist and hairiness can also be a cause of the barre' effect the single largest cause lies in the variation in fiber properties. Figure 3 shows the fiber properties that have an major influence in the causes of barre'. Micronaire, maturity/fineness and fluorescence all play a major roll in the consistent dying and finishing of knitted fabric.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 1:738-742 (1997)
National Cotton Council, Memphis TN

Micronaire

Most mills have learned over the years that they need to control the average of the micronaire in the bale laydown. Most mills have some type of system to catagorize cotton bales into groups in an effort to control the average micronaire. This system is then used when selecting the bales from the warehouse. While controlling the average micronaire is a good first step many times this is not enough control to eliminate the barre' effect, especially in knitted fabric. Figure 4 shows the causes and controls necessary for eliminating dying problems as they relate to micronaire. The additional control of the variation or CV% of the micronaire must be added to the overall control of the average in each laydown.

It is also necessary to change the average of the laydown over time so that all bales in the warehouse can be processed. The change in average micronaire in the laydown must be changed slowly over time as shown in figure 5. The maximum bale to bale variation within the mix should be 12%. A variation of micronaire higher than 12% will very likely cause a barre' effect in the fabric. Figure 6 is an example of a 24 bale laydown that does not meet the 12% variation guidelines.

Maturity And Fineness

Micronaire is an indication of the maturity in cotton fiber, although it is not a direct measurement of the fiber maturity. Micronaire can be used successfully to control barre' if the cotton being processed is from the same seed variety. If cottons from several varieties or growing areas are being blended together, then additional testing and maturity information may be necessary. Figure 7 highlights the causes of barre' that is typically a result of changes in cotton maturity.

An example of fabrics made of yarn produced from three (3) different bales of cotton is shown in figure 8. The cottons all had the same micronaire (4.2) but, as can be seen, the dye uptake on the individual yarns were very different. Figure 8 is a good example of how cotton fiber maturity (not micronaire) can cause a barre' effect in fabric. These bales of cotton were tested on the HVI instrument and the yarn was tested on the Uster Evenness tester. These results are shown in figures 9 and 10, it is not possible to determine any significant differences between these three cottons that would cause a problem in dying and finishing. The cottons are also tested on the new AFIS Length and Maturity to determine is any differences could be found. The results from the AFIS Maturity module is shown in figure 11. The AFIS Maturity module is a single fiber measurement of individual fiber maturity. The individual fiber maturity information gives a distribution of fiber maturity as well as the average fiber maturity. The distribution enables us to identify the very immature fibers

and it is described by the Immature Fiber Content (IFC%). Figure 11 clearly shows a considerable difference of the three bales in the IFC%.

Maturity differences in cotton can also cause defects in fabric such as white speck neps. Fabric in figure 12 was knitted from yarn produced from three different cottons having similar micronaire values. There was a significant difference in the amount of white specks in the three fabric samples. The three cottons were tested on the AFIS Maturity module and the results are given in figure 13. The differences in the AFIS IFC% correlates visually to the amount of white specks in the three fabrics. Interesting is that the overall average maturity ratio for the three cottons was very similar, giving no indication of a potential problem of white speck neps.

Variation of Maturity in Sliver

There is a possibility to optimize the carding process to make sure all cards remove as much of the immature fiber as possible. Figure 14 shows the results from testing a line of cards all fed from the same bale laydown. It is interesting that while the card mats all show very similar results the card slivers show quite some variation. The possibility of the influence of carding on the maturity of the sliver was investigated further using the AFIS Maturity module. Several individual cards were analyzed and it was apparent that there was a large variation in the amount of immature fibers removed by the cards. This initial trial indicates that it is possible to change the mechanical setup of a card to influence the removal of immature cotton fibers. These results are shown in figure 15.

Fluorescence

Another major cause of fabric barre' is a change in the cotton fiber fluorescence. Fluorescence can be measured by the Uster Fiberglow, which measures the ultraviolet light that is reflected from the cotton sample. Fluorescence (UV) is not cotton color, but the effect of sunlight on the structure of the fibers. The specific causes of barre' as it relates to fluorescence are shown in figure 16. Bale laydowns should be controlled using similar techniques that is used for micronaire. These solutions for controlling fluorescence are given in figure 17. Examples of controlling the UV reading within the bale mix and between the mixes is shown in figures 18 and 19. The variation within a single mix should be a maximum of +/- 5 points. The average UV reading of the mix should not change more than +/- 1 point from mix to mix.

There is a normal change in the UV readings from crop year to crop year. This is due to seasonal changes as well as the difference in UV from cotton stored in a warehouse for 9 - 12 months. Blending old crop and new crop must be done carefully to reduce the chance of creating fabric barre'. Typically each year the new cotton crop will have a different UV average and range depending on the weather at the time of harvest.

Conclusions

At least 70% of the causes of fabric barre' are due to variations in fiber properties. There are specific solutions available for spinning mills to control the key fiber properties that affect the dying and finishing of cotton fabrics. Individual bale measurements of micronaire, maturity and fluorescence will help the spinning mill to control all aspects of fiber barre' problems. The exact solution will depend greatly on the specifics of end product, spinning system and raw materials used by individual mills. Application guidelines are available for use in selecting bales for mixes and storing bales in the warehouse. Instruments and software programs are available to help the spinning mill monitor and control these specific fiber properties.

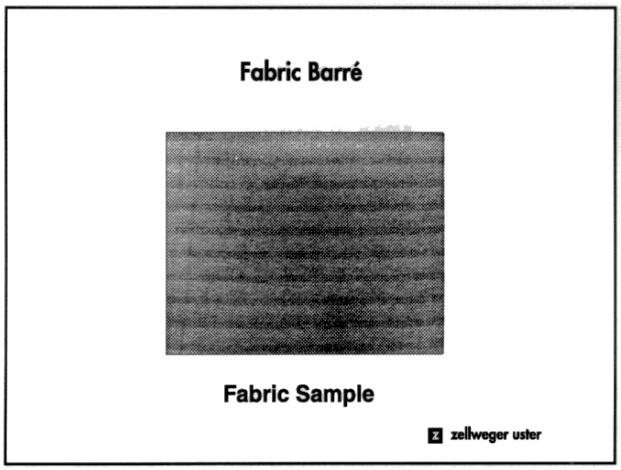
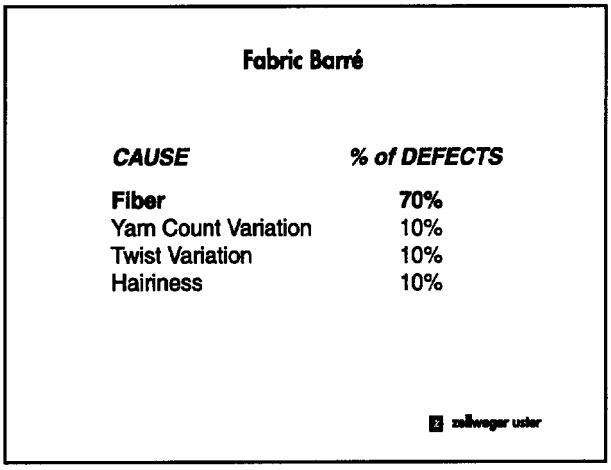


Figure 1.



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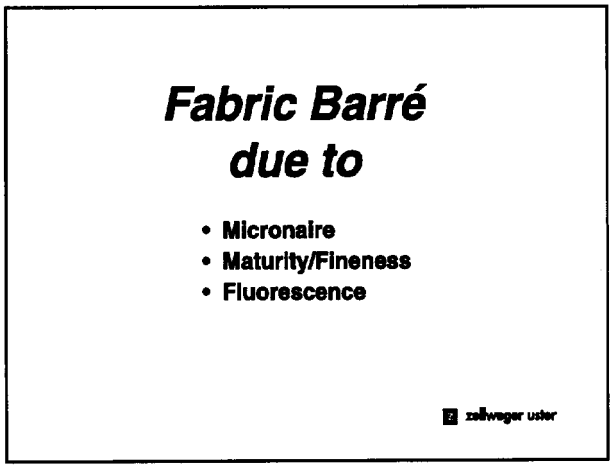

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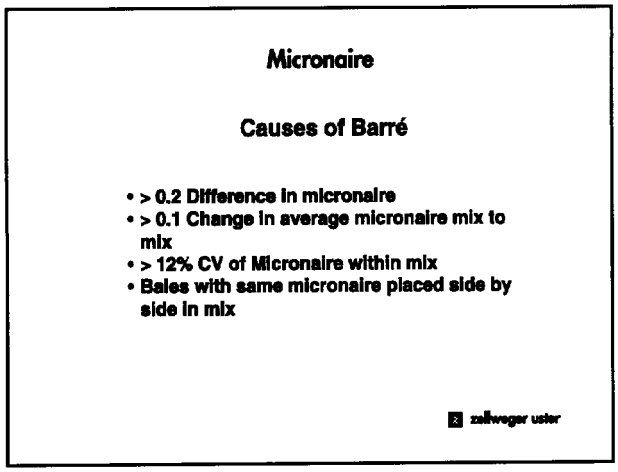

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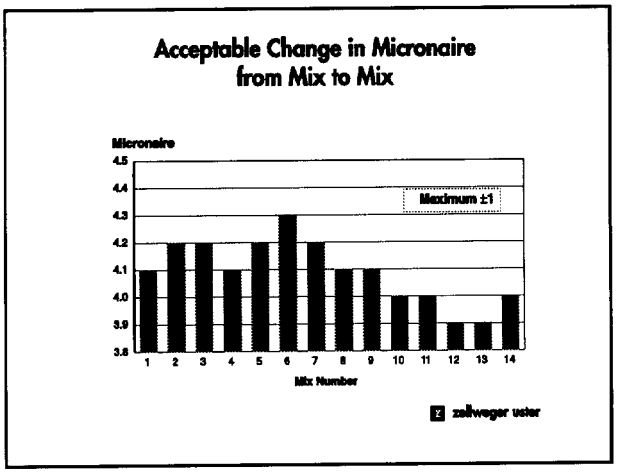

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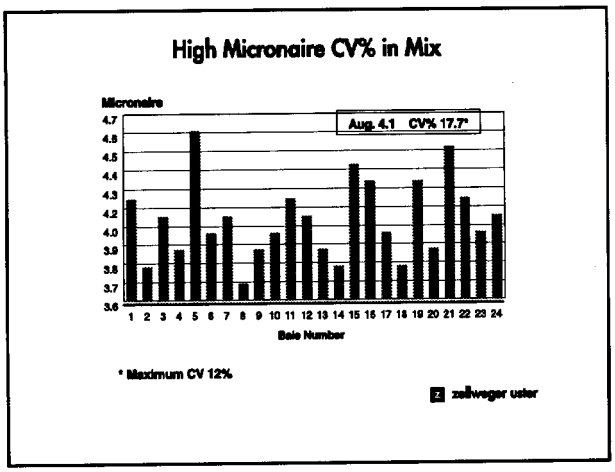

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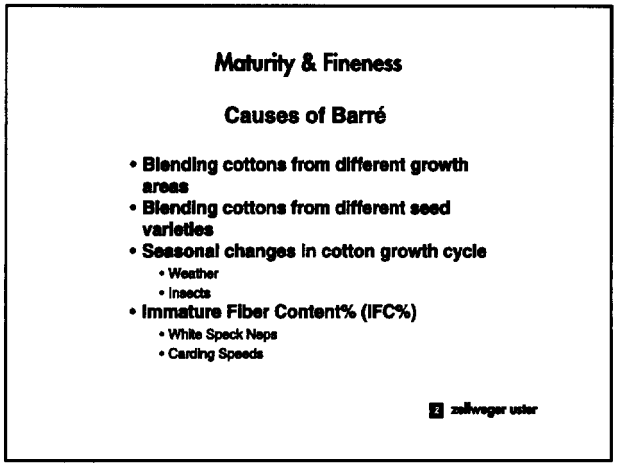

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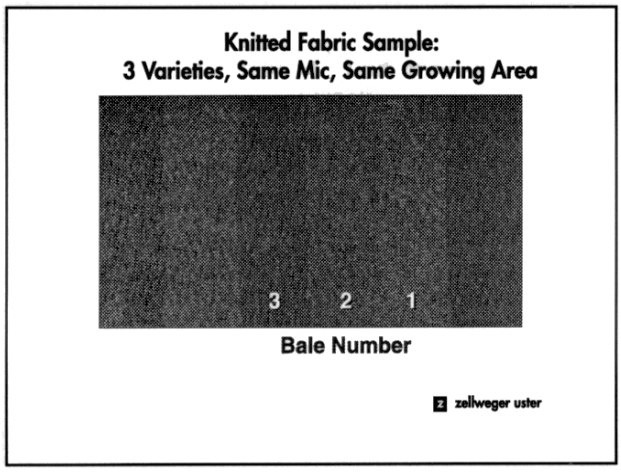

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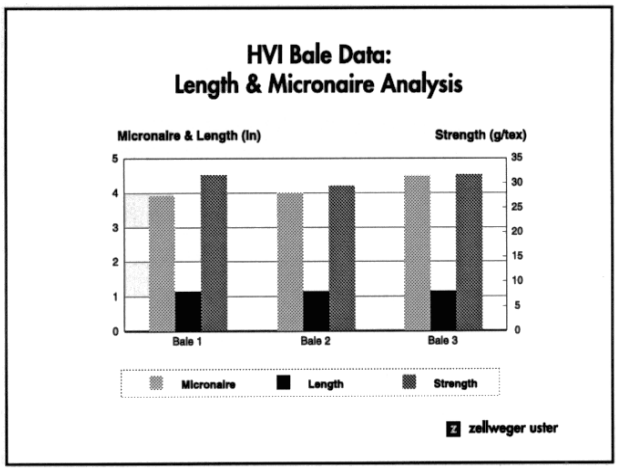

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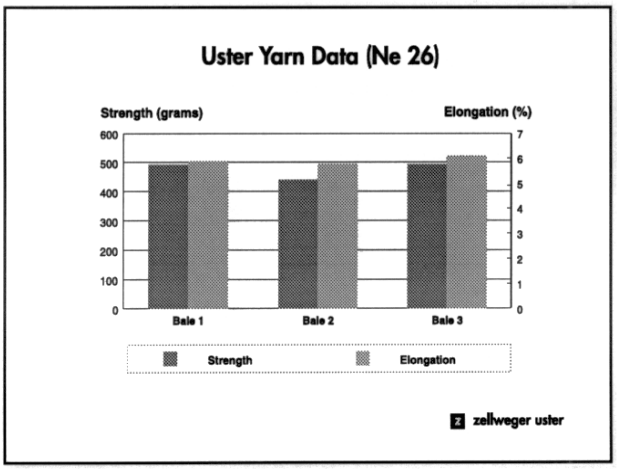

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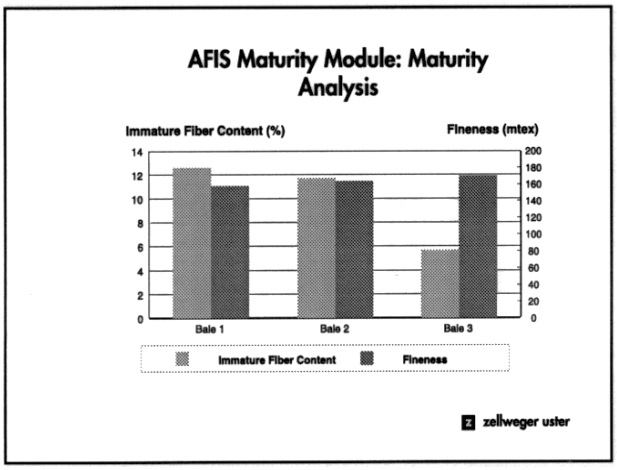

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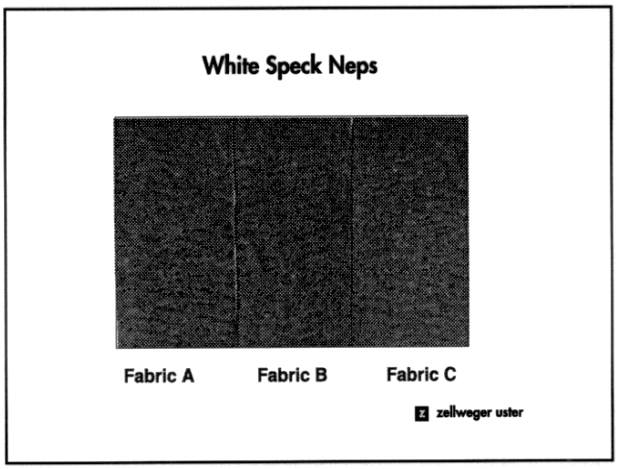

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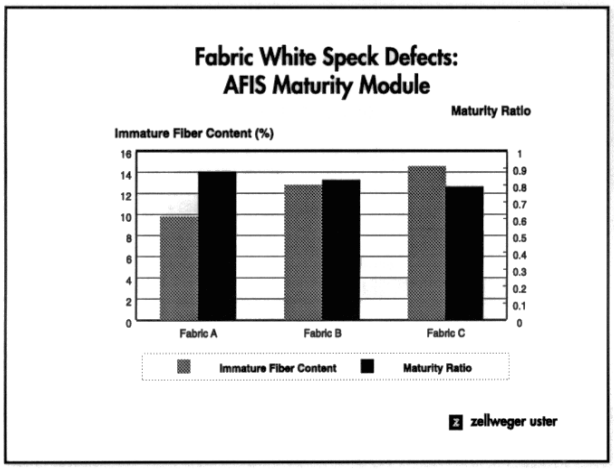

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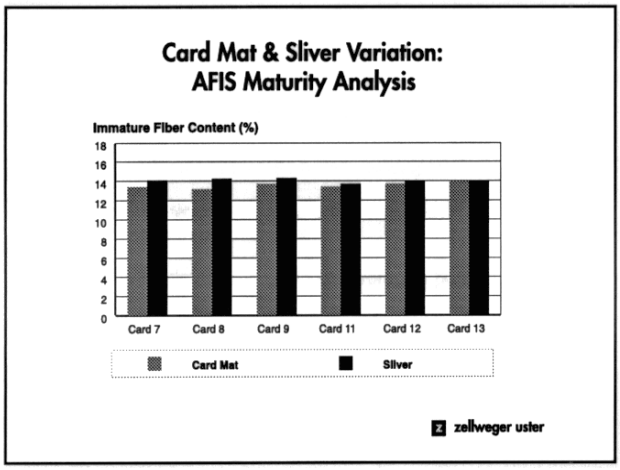

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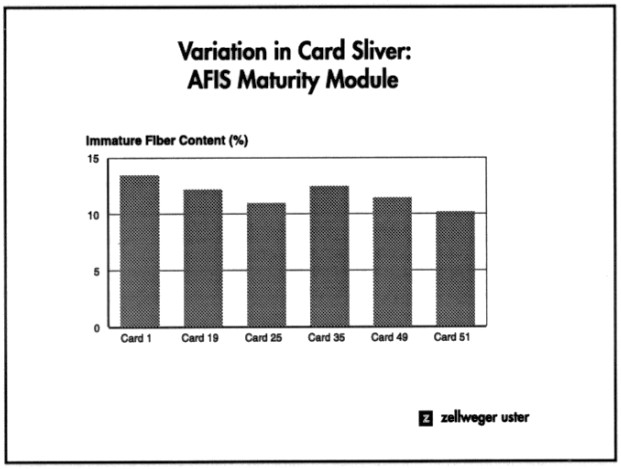

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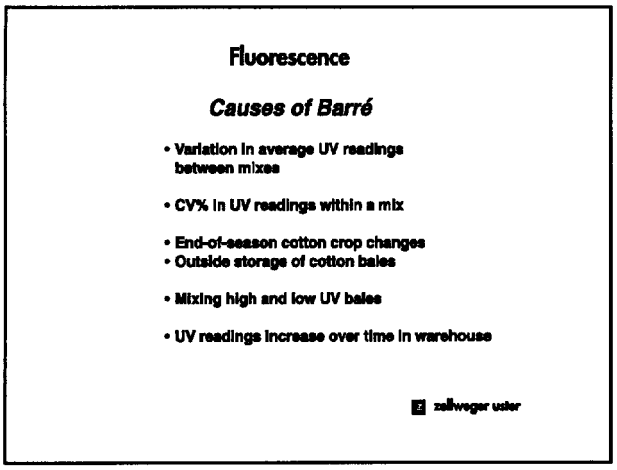

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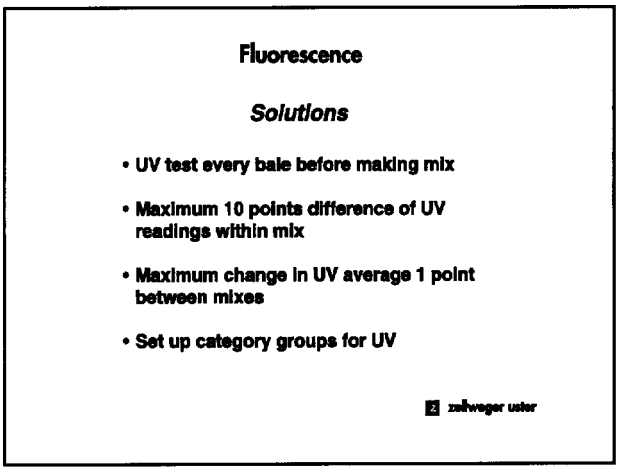

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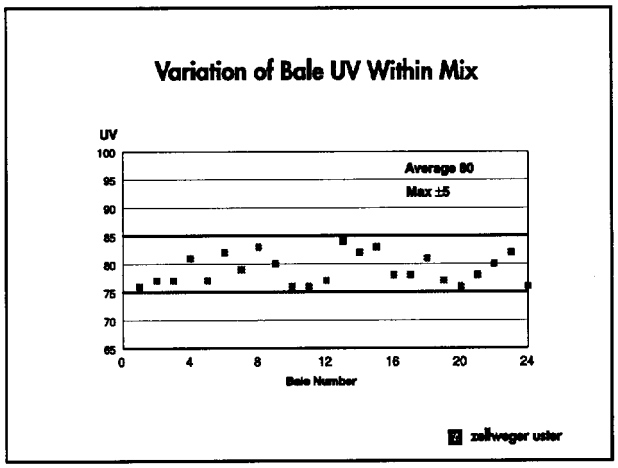

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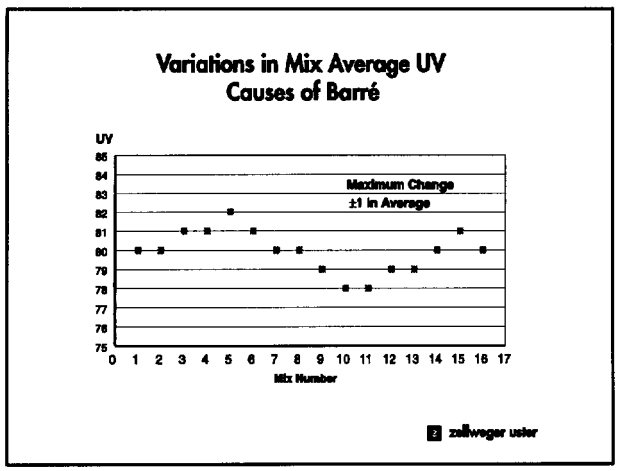

Figure 19.