FOCUS ON QUALITY – BREEDING THROUGH SPINNING: WHAT HAPPENED IN 1999? FIBER QUALITY IN ARIZONA

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Abstract

Cotton production systems are commonly oriented toward yield, which is recognized as a major ingredient of profitability. Lint quality is also a very important crop characteristic, and has been an increasingly important issue considering the following factors: textile mill requirements for fiber quality, the use of high volume instrument (HVI) testing, the occurrence of discounts due to unfavorable fiber characteristics, and depressed cotton markets. Arizona has traditionally enjoyed a reputation for the production of very high quality cotton fiber. However, in recent years, many Arizona farmers have expressed concerns over price discounts resulting from certain fiber characteristics such as micronaire (mike). High mike and inadequate staple length have emerged as fiber quality issues in some sectors with the 1999 crop.

Micronaire readings are a measure of fiber fineness and are related to maturity. In the HVI system, fiber micronaire is measured with an airflow meter by placing 10 grams of cotton fiber into a cylinder and compressing it to a constant volume and setting the air pressure at 10.0 psi. The rate of air flow through the cylinder is a measure of fiber fineness because coarser fibers have less surface area and air flows through these fibers more easily than fine fibers. Accordingly, coarse fibers have high mike readings and fine fibers have low mike readings. The optimum range for cotton micronaire is between 3.7 and 4.2. Cotton lint in this micronaire range can receive a premium price, particularly if fiber staple length is 33 or greater. Discounts begin for fiber having mike readings below 3.5 and above 4.9. The information in Table 1 shows the trends since 1988 in the percentages of the Arizona cotton crop that has had micronaire readings above 4.9. Thus far for the 1999 season, approximately 40% of the AZ crop has had mike values over 4.9. Obviously, an unsatisfactory situation and it is important to understand why this is happening and what can possibly be done about it with future crops.

Fiber fineness is a function of many factors, including the variety grown (genetics). However, fineness can also be influenced significantly by environmental, and therefore, management factors. Fiber development can be described in four general phases: **1) initiation, 2) elongation, 3) thickening (secondary wall development), and 4) desiccation or drying**. Fiber length is determined in the elongation phase, which commonly occurs about 21 days after flowering. Fiber elongation requires about 600 heat units (HU 86/55 ºF thresholds) to be completed, with no stress on the plant. If stresses occur (most commonly associated with water stress or potassium deficiency), fiber length can be reduced leading to shorter staple length.

At the end of the elongation phase the fibers are essentially hollow tubes with a circumference that has already been largely determined. With the initiation of the fiber thickening process, which can overlap elongation to some extent, a series of carbohydrate deposits are placed on the interior walls of the fiber. With increasing amounts of carbohydrate on the interior of the fiber, the micronaire value of the fiber increases. If fiber development is terminated prematurely, finer fibers, and low mike readings can result. On the other hand, if growth conditions are good, and the plant continues to actively produce new carbohydrates through photosynthesis, growth rings on the inside of the fiber continue to fill in the hollow internal space leading to more mature, coarser fibers, and higher mike readings. If new bolls are set on the plant, then they form the strongest points of carbohydrate demand (competing sinks), which can prevent the development of high micronaire fibers on older bolls. If new bolls are not being set, carbohydrates can be diverted to older, existing bolls causing an increase in micronaire.

In summary, the most common causes for high mike fiber are: 1) non-uniform boll setting, evidenced by gaps in fruiting on the plant and 2) late season growth that does not produce a sufficient number of bolls to either compete for carbohydrates or produce sufficient lower mike fiber to blend with the higher mike fiber and reduce overall mike readings. Thus, it is important to recognize that fiber micronaire is affected significantly by environment and management. Managing for optimum micronaire will therefore be an agronomic management issue in many cases. Each cotton field presents unique circumstances, but a review of these aspects of management may help identify problems with the current crop and help alleviate loss of profit associated with too high of a micronaire value.

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Table 1. Percentages of the Arizona cotton crop with micronaire readings greater than 4.9, 1988 to 20 December 1999.

Year	Percentage of AZ Crop Above 4.9 Micronaire
1988	16
1989	24
1990	22
1991	15
1992	12
1993	31
1994	33
1995	22
1996	39
1997	24
1998	34
1999*	40*

* As of 20 December 1999.