Cotton Yield Components

H. Lewis\(^1\) and D.M. Oosterhuis\(^2\)

INTRODUCTION

Cotton is like most of the important field crops in that a major component of yield is the reproductive potential, or the number of seeds produced per unit of land surface. However, it differs from most of the other field crops, where seed yield is the prime determinant of economic yield, in that if no fiber or a reduced amount of fiber is produced on the seed surface, the lint yield may be severely reduced.

Cotton lint yield is probably best understood in terms of the components which make it up. Fiber or lint yield in cotton is determined by two major components, i.e., the number of seeds produced per acre and the weight of fiber produced on the seed. Cotton fibers are elongated epidermal cells of the outer integument of the seed coat. If there is no seed, there can be no fiber. The structure and dimensions of the fibers determine their quality.

COMPONENTS OF YIELD

Classically, the yield components of cotton in its simplest form consist of two main components: the number of bolls per unit area and the weight of the bolls. However, because the lint (fiber) is produced on the seed and is the main component of interest and harvested for profit, the components of yield can be further considered as number of seeds/acre multiplied by the weight of fiber/seed:

\[
\text{Lint yield} = [(\text{No. of Seeds/Acre})(\text{Weight of Fiber/Seed})]
\]

Cotton seed is still of commercial interest for oil and cattle feed, and the seed yield can be expressed as:

\[
\text{Seed Yield} = [(\text{No. of Seeds/Acre})(\text{Weight/Seed})]
\]

\(^1\)Retired plant breeder, Conway, Ark.
\(^2\)Distinguished professor, Department of Crop, Soil, and Environmental Sciences, University of Arkansas, Fayetteville.
The number of seeds per acre is determined by the number of plants per acre, the number of bolls per plant and the number of seeds per boll. This suggests that the number of seeds produced per acre is influenced to a high degree by management and environmental factors and to a lesser extent by genetic considerations.

\[
\text{Seeds per acre} = \left(\frac{\text{Plants}}{\text{Acre}}\right) \left(\frac{\text{Bolls}}{\text{Plant}}\right) \left(\frac{\text{Seeds}}{\text{Boll}}\right)
\]

The weight of fibers per seed is a function of the number of fibers per seed and the average weight per fiber.

\[
\text{Weight of fiber per seed} = \left(\frac{\text{Number of fibers per seed}}{\text{Average weight/fiber}}\right)
\]

From a cell physiology perspective, the number of fibers per seed is determined by the number of epidermal cells in the outer epidermis of the seed coat which initiate elongation and develop into lint fibers. Physically, the number of fibers per seed is a function of the weight of fiber per seed divided by the mean weight per fiber.

\[
\text{Number of Fibers/Seed} = \frac{\text{Weight of fiber per seed}}{\text{Mean weight per fiber}}
\]

The mean weight per fiber is a function of the mean length of the fibers on the seed multiplied by the mean linear density of the fibers.

\[
\text{Average weight per fiber} = \left(\frac{\text{Mean fiber length}}{\text{Mean linear density of fibers on the seed}}\right)
\]

Physiologically, the average weight per fiber is determined by the degree and extent of primary and secondary cell wall growth. Primary wall growth is equivalent to fiber elongation. As long as a plant cell is increasing in volume it is considered to be producing primary cell wall. After a plant cell stops increasing in volume but continues to increase in weight it has entered the secondary cell wall phase of growth. Secondary wall growth is equivalent to an increase in the linear density (micronaire tex, etc.) of the fiber or the thickness and, perhaps, the density of the secondary cell wall. Thus, the mean weight per fiber is a function, physiologically speaking, of both primary and secondary cell wall growth. This constitutes strong evidence that the weight of fiber per seed is heavily influenced by genetic considerations, especially in so far as the number of fibers per seed is concerned.

A relatively small increase in the weight of fiber per seed may have a highly significant impact on lint yield. For example, in the south central and southeastern U.S. cotton belt, the long term average number of seeds per acre produced is approximately 7 million. Thus, if the weight of fiber per seed were increased by only 5 milligrams, this could result in a yield increase of a little more than 75 pounds of lint per acre.
CONCLUSIONS

A knowledge of the components of yield of cotton is important in understanding how yield is produced and what influences yield and fiber quality. This description explains what makes up the main components of yield and provides an explanation of each component. Lint is produced on the seed and is the main component of interest and harvested for profit, and therefore the main components of yield are the number of seeds/acre multiplied by the weight of fiber/seed. However, the weight of fiber/seed and the number of fibers/seed, and the average weight per fiber are integral aspects of these components.