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Choosing Which Cotton Varieties to Grow[1]

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Many cotton producers in Oklahoma could greatly increase their lint yield and/or fiber quality by choosing to grow varieties better adapted to the state and to their particular growing conditions. With the same inputs of capital and labor, some cotton varieties provide a much greater return on the producers' investments than do others.

Cotton variety tests are conducted each year in Oklahoma to obtain the data necessary for producers to choose those varieties they should grow. The experiments include numerous commercially available varieties from throughout the Cotton Belt which have demonstrated superior performance in Oklahoma or have the potential to do so. (A partial exception is that because these tests are conducted on a fee basis, some varieties are not included as the companies who own or market them choose not to participate.) All experiments are conducted in as unbiased a manner as possible at several dryland and irrigated locations. Proper experimental designs are used with randomizations, replications, and statistical analyses of the yield data. Results from such tests are much more reliable than advertising, testimonials, or unreplicated demonstration plots. The data from this testing program are published and distributed each year to cotton producers throughout the state, to cotton researchers and Extension personnel, and to other interested parties.

General Considerations

To choose cotton varieties highly adapted to his growing conditions, the producer should use the data from the variety test (or tests) which most nearly corresponds to the characteristics of his farm(s). Location in the state is important. Obviously, a test closer to his area will be more meaningful to a producer than will one farther away. A variety that consistently does well in such a test will also likely do well on his farm. If his area is intermediate between two test locations, a variety that consistently does well in both tests will also likely do well on his farm. For Oklahoma producers, tests from closely surrounding areas in Texas (specifically on the Rolling Plains) are of considerable value. High Plains conditions are sufficiently different from those in Oklahoma that variety test results from that area have a lesser value.

Whether the test was irrigated or dryland is also important. Cotton varieties which do better than others under irrigation may not do so on dryland and vice versa. Except for years with unusually early freezes, irrigated cotton (regardless of the variety) will normally yield higher and be more consistent in yield than will dryland cotton; however, some varieties can more efficiently utilize that extra water than can others. Similarly, some cotton varieties can escape or tolerate the stresses of dryland production more readily than can others. A few cotton varieties do relatively well under both conditions. How a cotton variety will perform under irrigation or on dryland simply cannot be known until it has been tested under those conditions. The producer who irrigates should examine irrigated test results, whereas the producer who has limited or no irrigation should investigate the data from dryland tests.

The producer should consider how the cotton varieties in a test performed relative to one another. A variety's performance for a trait (such as yield) in isolation from other varieties is meaningless. It takes on value only when compared to other varieties in the same experiment(s). Large differences between varieties for a particular trait are likely to be at least partially genetically based; small differences may not be.

The producer is cautioned that some traits of cotton are more sensitive to environmental differences than are others. Such traits are said to display more "variety by environment interactions." As a consequence, the "perfect" cotton variety over all environments does not exist. Environmentally sensitive traits in cotton include lint yield and fiber fineness/maturity (i.e., micronaire). Results from a single experiment for such traits can be, and often are, misleading. More reliable comparisons among varieties can be obtained for such traits in tests averaged over years and/or locations. Differences

[1] Research in this report was conducted under Oklahoma Agricultural Experiment Station Project S-714 (Evaluation of Cotton Varieties for Oklahoma).

among cotton varieties in other traits such as fiber length and strength are more consistent over environments, and data from only one or two tests will normally give a good indication of their relative performance.

If his cotton acreages are substantial, the producer is advised to grow more than one variety. Unforeseen circumstances can occasionally cause a variety to perform below its usual level. Growing more than one variety will tend to moderate those losses, if and when they occur.

Lint Yield

Lint yield is the most important factor the cotton producer should consider when deciding which varieties to grow. It is not unusual in an experiment for one cotton variety to yield 50 to 100% more lint than another treated the same way throughout the entire growing season. At the same level of production costs, higher lint yields translate into greater net returns. This is a strong argument for buying cotton planting seed by variety name (as certified seed).

Seed yield is also important. However, seed in Oklahoma are only 10 to 20% of the value of the cotton crop, whereas lint accounts for 80 to 90%. Lint and seed yield are very highly and positively related. As one tends to increase, so does the other. However, this relationship is not perfect; therefore, selections should be based on yield of lint (the more valuable component) rather than on seed (the less valuable). Selections should not be based on yield of seed cotton (a confounded measure of lint and seed) because in a sample of seed cotton, the seed normally weigh about twice as much as the lint, and a 1 to 2% variation in yield of seed (the less valuable component) can obscure a 2 to 4% variation in yield of lint (the more valuable).

Lint Percent

Lint percent (used to estimate "gin turnout") influences cotton harvesting and ginning costs. It may be calculated upon a picked or a pulled basis. Picked lint percent is the percent lint in a sample of seed cotton while pulled lint percent is the percent lint in a sample of snapped cotton. Producers who harvest with mechanical pickers should compare picked lint percents while those who harvest with strippers should examine pulled lint percents. As the price of cottonseed increases, the importance of a high lint percent declines. In addition, a variety with high lint yield per acre (but with a moderate lint percent) often gives higher net returns than does a lower yielding variety with a higher lint percent. Differences in lint yield are considerably more important in terms of net returns than are differences in lint percent.

Maturity

Early maturity of cotton varieties is important in Oklahoma because of the state's comparatively short growing season for the crop. Also, earliness provides some escape from late-season diseases such as verticillium wilt and boll rot and from late-season insects such as the boll weevil and bollworm/budworm. Under irrigation in Oklahoma, extreme earliness (or determinacy) is not as critical for maximum performance as it is under dryland conditions. Under irrigation, a moderate degree of earliness is sufficient. Historically, earliness was commonly estimated in experiments with two (or more) harvests as percent first harvest. The value was calculated by dividing the lint weight from the first harvest by the total lint yield and expressing the result as a percentage. Likewise, the percentage of open bolls could be estimated. In more recent times, the "sharp knife" and "nodes above cracked boll" techniques have proven useful in predicting crop maturity.

Fiber Properties

Fiber properties are determined by High Volume Instrument (HVI) measurements made in USDA cotton classing offices and in selected laboratories. Fiber length, micronaire, and strength are the three properties commonly reported which partially determine the price per pound the producer receives for his lint. Fiber length uniformity and elongation are important in the manufacturing process, but at present, little or no price incentives are received for either. Grades influence price, but are not routinely determined in this type of research because grades are influenced more by environment, cultural practices, and handling than by varietal differences. One exception is the smooth-leaf trait, a varietal character. Varieties with smooth leaves generally give higher grades than do those with normally or densely hairy leaves.

Longer, stronger, more uniform fiber with higher grades and greater elongation is generally more desirable than the alternatives. Micronaire is acceptable anywhere within the "base" range of 3.5 to 4.9 units inclusive. The "premium" range is between 3.7 and 4.2 inclusive. If the fiber is too fine (below 3.5) or too coarse (above 4.9), the price per pound of lint is reduced. Because the penalties are more severe for micronaires below 3.5, the producer should probably choose varieties with micronaire values toward the upper end of the range.

Boll and Plant Type

Varieties differ in boll and plant type which influence method of harvest, i.e., mechanical picking vs. stripping. Varieties with the open-boll type are typically harvested with pickers; those with stormproof bolls with strippers; and those with storm-resistant bolls may be harvested with either machine. If the proper boll type is chosen to match the producer's harvest method, plant type normally will not be a problem. Cotton breeders strive, more or less successfully, to combine the appropriate characters together into the same plant for a particular harvest method. In general, the plants of varieties adapted to picker harvest will be taller, be more open, have longer side branches, have longer internodes, have open bolls borne well off the ground, and be medium to late in maturity. Conversely, the plants of stripper varieties tend to be shorter, be more compact, have shorter side branches (may even be cluster or semicluster in form), have shorter internodes, have stormproof or storm-resistant bolls borne closer to the ground, and be medium to early to very early in maturity.

Disease Resistance

Plant diseases cause serious limitations to cotton production in Oklahoma. Greatest lint yield losses in the state have been attributed to the early-season seedling disease complex followed in order by late-season verticillium wilt (on heavier soils, especially under irrigation), the fusarium wilt—root-knot nematode complex (prevalent on sandy soils), bacterial blight (under hard driving rains or sprinkler irrigation), ascochyta blight (in wet weather), the late-season boll rot complex, miscellaneous leaf spots (late in the season), and phymatotrichum root rot (on highly calcareous soils in counties immediately north of the Red River). Growing an early-maturing variety will provide some escape from late-season diseases. Resistant cotton varieties are available for fusarium wilt—nematodes and bacterial blight, as are tolerant varieties for verticillium wilt. When one or more of those diseases are detected in his fields, the producer should consider growing resistant and/or tolerant varieties adapted to the area. Doing so is generally considered more effective and more economical than cultural methods. By not waiting until the disease reaches epidemic proportions, serious losses may be averted. (Some varieties are advertised as possessing tolerance to the seedling disease complex and/or to phymatotrichum root rot. Such claims may eventually be proven true, but they are not universally accepted at this time.)

Insect Resistance

Early-maturing cotton varieties provide some escape from late-season insects. Such varieties have been grown in Oklahoma for many years. A few varieties now have characters such as nectariless, smooth leaf, or okra leaf which confer tolerance to some insects, but not others. Growing adapted varieties with such characters could reduce the number of insecticide applications required or, in some instances, eliminate them entirely. On the other hand, glandless varieties are more vulnerable to attack by some insects, but not others. If grown, they should be monitored even more closely than normal and sprayed promptly when insect populations reach economic levels of infestation.

Producers with bollworm/budworm infestations year after year may choose to grow varieties with the Bollgard gene (*Bt* cottons). Because of the additional expense involved, such varieties are considered more feasible economically under irrigation than on dryland in Oklahoma. If insect populations are very high, some insecticide applications may still be necessary even with such varieties.

Herbicide Tolerance

Producers with infestations of weeds that are controllable using Roundup Ultra may wish to grow cotton varieties tolerant to that herbicide. Several such "Roundup Ready" varieties that can be sprayed over the top as very young seedlings (see label) are now available. Older plants, however, must not be sprayed over the top, or severe yield reductions will occur. These varieties (like the *Bt* cottons) have a technology fee and several restrictions on their use. Most annual grasses and broadleaf weeds are effectively controlled by Roundup Ultra. It's especially effective for johnsongrass; however, at approved over-the-top rates, it's less effective for many other perennial weeds. Varieties with Buctril resistance are also now available, but that herbicide controls broadleaf weeds only. Varieties with tolerance to 2,4-D or other herbicides may become available in the future.

New Variety Releases

Cotton producers should not be content to grow the same varieties year after year. In general, newer releases have higher yield potential, better fiber qualities, improved disease resistance, etc. than do previous releases. Maintaining the status quo on varieties prevents producers from taking advantage of those breeding advances and restricts their ability to compete in the marketplace. On the other hand, producers should not make wholesale changes in a capricious manner. Planting a previously untested variety on a few acres can be informative. Planting the same variety on one's total acreage is a risky business.

Producers might use the following method, or a similar one, for making their decisions:

1. Use data from variety tests and replicated demonstration plots to narrow down the list of potential candidate varieties.
2. Buy a bag of seed for each variety of interest.
3. Plant those varieties on the producers' farms in strips adjacent to each other and to the varieties they normally grow. The varieties should be planted at the same seeding rate (number of seed per linear foot of row) on the same day, be treated the same way throughout the growing season, and be compared using actual performance data, especially for lint yield. (Visual estimates of yield are difficult to make and are often highly misleading, especially between different boll types.)
4. Grow those varieties which did well (relative to their standard varieties) on increased acreage in subsequent years. Drop those which did not.
5. Repeat the cycle every few years to stay reasonably current.

A good general rule of thumb is that no matter how well a cotton variety performs, after five years, it's beginning to be obsolete. After 10 years, it almost certainly should be replaced by another.

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