Choosing the Right Cotton Variety

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The choice of which varieties to plant is a major decision each grower must make. Although the dollars invested with this decision are small — from about $8 to $14 per acre including seed treatment — many more dollars are influenced in yield, maturity, quality and pest susceptibility of the crop. While growers make this decision based on experience, their first impressions of a new variety come from variety tests. The subject of this newsletter is how to evaluate these tests for selection of appropriate varieties for your farm.

Public, private and grower variety tests are conducted throughout the Cotton Belt to aid growers and researchers in making variety decisions. Often growers place great emphasis on which variety leads the test in yield without regard to other factors involved in the testing procedure. While these tests are excellent for general variety comparisons, growers need to look beyond the printed yield results to make the best decision for their management operations.

Why Do Test Yields Seem So High?

To reduce testing costs and permit evaluation of as many varieties as possible, most researchers use “shortcuts.” For example, researchers often use hand picked boll samples (generally trash free) to estimate the gin turnout. Since boll sample lint-percentages are about 40% and the true gin turnout is about 35%, the procedure of using boll samples for gin turnout overestimates yield by about 15%.

If all varieties have about the same trash content, then the comparison of varieties using boll sample lint-percentages instead of gin turnout is a valid indicator of relative yield. While this is the usual case, some varieties do vary in their trash content, especially hairy vs. smoothleaf varieties. Average trash contents taken from 4 tests varied from 8.3% for a hairy variety to 6.7% for a smoothleaf variety (Anthony, 1990). Assuming equal seed cotton yields of 3000 lbs/acre, the trash content would range from 249 to 201 lbs/acre. The increased trash in the hairy leaf variety translates into an apparent, but erroneous 48 lb advantage when boll sample lint-percentages are used to estimate yield.

Another reason test yields are high is the end-of-plot effect, similar to the skip-row effect. A plot size of 54 feet has an end-of-plot effect that increases yield by about 6%. Since most varieties have about the same end-of-plot effect, the bias for any one variety is small. However, with both the end-of-plot effect and boll-sample lint-percentage, test plots can overestimate field yields by 22%.

Competition between tall and short varieties is another source of error in tests where no border rows are used. Tall, full-season varieties tend to shade shorter, earlier-maturing varieties, thus decreasing their yield. In a similar manner, yields of okra leaf cottons are suppressed when grown adjacent to normal leaf varieties which, in turn, are benefitted.

Variety Rankings Change with Locations

Variety comparisons change from one environment to another. This phenomenon is termed a variety-by-environment interaction. The following figures illustrate that this interaction is large for yield and small for fiber quality (Hoskinson, 1989 to 1991).

It is impossible to choose the best variety for 1992 based on this example due to variety-by-environment interaction. Most interactions are caused by weather or management and usually are related to varietal differences in maturity. For a true test, each variety should be evaluated with the management system that optimizes that variety’s performance. Obviously, a researcher evaluating 20 varieties cannot have 20 separate management systems for his test, but chooses one management treatment that is considered a norm. This management system favors some varieties and disfavors others, and is part of the reason why each breeder’s own varieties tend to yield better in his or her own trials — breeders know from experience how to best manage their own varieties. Some of the management factors that impact varietal rankings in trials are planting date, irrigation and defoliation timing. A 1991 trial in Mississippi demonstrates the strong influ-
ence defoliation date has on variety test results. In this
trial comparing DES119 with a longer season variety,
DPL5415, some of the plots were defoliated earlier. The
early defoliation date (Sept. 16) resulted in higher
yields for DES119; the later date (Sept. 24) reversed the
ranking. This is the reason producers should place
greater importance on well run, low Least Significant
Differences (LSD) trials conducted near their farm, and
not on trials 2 states away. If varieties with different
maturities are being considered, look closely at how
each trial was managed. When the trial is situated in a
commercial field, the planting of a short or full season
cotton in the rest of the field will tell a lot about the
management system.

Statistics

Growers should check the statistical precision of va-
riety tests. Statistics are usually reported with yield
data and present a general overview of the uniformity
of the test conditions (soil type, cultural practices, in-
sert damage etc.). Tests with large LSD’s, such as 200
lbs of lint/acre, generally offer growers little useful in-
formation, because of non-uniform conditions. Tests
should have LSDs of about 100 lbs of lint or less before
the test is of much use in selecting a variety. The
smaller the LSD, the more precise are the test results.

The LSD also can be used to evaluate whether dif-
fferences between varieties are significant or due to ran-
don variation. Only with varieties that differ by more
than 100 lbs, when the LSD was 100, would growers
have much assurance regarding which variety per-
formed better in the trial. If none of the varieties dif-
fered by more than the LSD, results from that trial are
considered “non-significant” or “NS” for short. Due to
the variety-by-environment interaction, a grower
needs the results from several significant tests to deter-
mine which varieties consistently yield well.

How to Conduct Your Own Trials.

Considering the potential yield and quality to be
gained by selecting the best varieties, it is obvious why
many producers conduct yield trials on their own
farm. Producers know that if they are to rely on infor-
mation for decisions, it must be good information.
Here are some suggested ways to accurately evaluate
varieties on the farm.

- Plant alternate strips of 2 varieties with similar ma-
  tuties across a field, keeping trailers and modules
  for each variety separate. If all cultural practices are
  the same, except the seed, this evaluation can be
  highly reliable. With 12 or more strips, differences of
  5% can be meaningful.

- To evaluate 2 varieties with different maturities that
  may have conflicting defoliation or cultural require-
  ments, split a field into 4 or more blocks, planting al-
  ternate blocks in the same variety. Manage and
  harvest each variety to maximize profit, keeping
  track of inputs, yield and quality for each block. If all
  the blocks from one variety produce more profit
  than the other blocks, differences are probably mean-
  ingful.

- Where more than 2 varieties need to be compared,
  conduct a small replicated and randomized trial. Twen-
ty or more plots (for example, 5 varieties and 4
  replications) can produce significant results if the
  field is uniform. Each plot should be large enough to
  build one module or put in one trailer, so weights
can be obtained and used to run simple statistical
  programs such as AGSTATS, a program designed
  for county agents and growers with MS-DOS com-
  puters. This program is available from Extension
  Crop Science, Crop Science Bldg, Rm 131, Oregon
  State U., Corvallis, OR 97331-3002. For a copy, send
  either $5 or a formatted disc and return self-stamped
  mailer. Get your local Extension Service involved in
  designing and analyzing the trial.

- Do not rely on adjacent fields to compare varieties.
  From any farm’s records, it is evident that yield vari-
  ability exists from field to field even when planted to
  the same variety. Information gained in this manner
  has very low credibility.

How To Evaluate Quality from Tests.

Variatel comparison for most fiber properties are
consistent. Notice in the previous figure how the dif-
fERENCE in strengths is constant, regardless of the year-to-
year variability. Thus, selecting varieties for fiber
properties is much simpler than selecting varieties for
yield. However, most variety tests do not estimate
grade (color or trash content).

Smoothleaf or Hairy Varieties?

Compare the benefits of each. Smoothleaf varieties
generally have less trash than hairy varieties thus their
yields in variety tests are frequently underestimated. It
also is well known that smoothleaf varieties can pro-
duce better grades. Furthermore, smoothleaf varieties
show a tolerance to whiteflies. Now the case for hairy
varieties: Many growers consistently obtain good
grades (31 or 41) with hairy varieties, so it can be done.
Also, hairy varieties tend to be more stable in yield and
produce higher yields under stress conditions (cold,
hot or drought).

Should Varieties be Selected for Premiums?

In recent seasons, interest in higher strength cottons
has grown significantly. Both the loan and the spot
market exhibited strength premiums in 1991, with the
loan returning the higher premium. Some of the spot
market premium was influenced by sales arrange-
ments entered into between growers and buyers which
specified high strength varieties as well as certain
growing and ginning practices. The size of strength
premiums and discounts in the future will depend
very largely on fundamental supply and demand rela-
tionships. If the supply of high strength varieties is
relatively abundant in relation to demand, the premi-
ums are likely to be smaller than if supply is tight in relation to demand. If a grower makes a variety decision
based on strength premium expectations, that premi-
un expectation should be sufficient to offset any
lower yield that might be expected with the higher
strength variety.
Within one geographical area, most cotton varieties do not vary in their level of disease tolerance. It is either excellent or none, and thus the level of disease tolerance is rarely a consideration in cotton variety selection. One exception that does exist is in the San Joaquin Valley where Verticillium wilt tolerance varies widely. During the 1980's, SJV variety results could be explained largely by differences in wilt tolerance and the fields level of infestation.

### Varieties for Narrow Row

Cotton breeders have made tremendous gains in varietal improvement. On average, varietal improvement has contributed 8 to 10 lbs of lint per year to our steady increase in yields during the last 50 years. These gains have come by selecting plants that yield well under conventional row widths. Only within the past 5 years have breeders turned their attention to selecting varieties under narrow row widths. This means that our current varieties are not best suited for 30-inch rows, however, it also means that further yield increase with narrow rows is expected when varieties are specifically adapted. At this time, trial results indicate the best advice for selecting a narrow row variety is to plant what has worked well in conventional row cotton. If you have a choice between several well-suited varieties, consider the smaller variety if it will save cost for growth regulators when planting on vigorous soil. Eventually, narrow plant types with leaves that let more light down into canopy may be developed for narrow row cotton.

### How To Use Variety Test Results?

- Review as many public and private tests within your growing area as possible.
- Check the statistical reliability of each test.
- Determine the management system used in each test.
- From several valid tests, select the top 5 or 6 consistent yielding varieties that produce the desired strength.
- If possible, conduct your own farm or community variety tests.
- Plant the bulk of the acreage in at least 2 to 3 different proven varieties with a track record of success on the farm. This will protect from weather that adversely affects any one variety. For future years, plant several promising varieties on limited acreage, ideally a full field to simplify management. Do not be in a hurry to make major changes in varieties, especially in a year of tight profit margins.

### Strength Premiums and Discounts in Points

<table>
<thead>
<tr>
<th>grams/tex</th>
<th>1991 loan</th>
<th>91/92 spot market</th>
<th>market yield equivalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.5 &amp; above</td>
<td>300</td>
<td>144</td>
<td>2.4%</td>
</tr>
<tr>
<td>29.5 - 30.4</td>
<td>250</td>
<td>116</td>
<td>2.0%</td>
</tr>
<tr>
<td>28.5 - 29.4</td>
<td>200</td>
<td>90</td>
<td>1.5%</td>
</tr>
<tr>
<td>27.5 - 28.4</td>
<td>150</td>
<td>66</td>
<td>1.1%</td>
</tr>
<tr>
<td>26.5 - 27.4</td>
<td>100</td>
<td>43</td>
<td>0.7%</td>
</tr>
<tr>
<td>25.5 - 26.4</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24.5 - 25.4 base</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23.5 - 24.4 base</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22.5 - 23.4</td>
<td>-50</td>
<td>-35</td>
<td>-0.6%</td>
</tr>
<tr>
<td>21.5 - 22.4</td>
<td>-100</td>
<td>-77</td>
<td>-1.3%</td>
</tr>
<tr>
<td>20.5 - 21.4</td>
<td>-150</td>
<td>-113</td>
<td>-1.9%</td>
</tr>
<tr>
<td>19.5 - 20.4</td>
<td>-200</td>
<td>-168</td>
<td>-2.9%</td>
</tr>
<tr>
<td>18.5 - 19.4</td>
<td>-250</td>
<td>-241</td>
<td>-4.1%</td>
</tr>
<tr>
<td>18.4 &amp; below</td>
<td>Ineligible for the Loan</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

To illustrate the point, the average spot market price during August, 1991-February, 1992 was 58.86 cents/pound. The loan strength premium for 28.5 to 29.4 grams/tex was 200 points; the spot market reportedly paid 90 points premium for strength in this range. So, in 1991, a yield loss of 1.5% (the spot market yield equivalence) would have offset the spot market premium for cotton averaging 28.5 To 29.4 grams/tex. The spot market price and strength premium is more important in this kind of return analysis than the loan and loan strength premium. The loan premiums and discounts have more relevance to harvest-time cash flow than to net returns since the loan repayment (whether by producer or by purchaser of equity) must also reflect any premium or discount. Also remember that the schedule of loan premiums and discounts is computed annually by averaging the previous year's loan and spot market premiums and discounts. Indications are that strength premiums in the 1992 loan will be approximately 25% lower.

Supply/demand fundamentals determine the price (including the component for strength premiums and discounts). Therefore, variety selection should also attempt to avoid strength-related discounts. At least a couple of points are relevant in this regard. First, as the supply of high strength cottons increases in relation to demand, discounts for lower strength cottons can be expected to be larger. And, second, varieties that typically produce strengths marginally above base can slip into the discount category in bad weather years, such as 1990.

Similar attention should be given to the trade-off between yields and premiums and discounts for grade, staple and micronaire. There is no perfect variety and no single variety that is best for all areas or management systems. Fortunately for producers and the entire cotton industry, seed companies are now providing varieties that produce both high quality and high yields.
Cotton seedlings emerge due to the build up of turgor (water pressure) in the hypocotyl (shank), that region between the cotyledons and the root. As the seedling soaks up water through the expanding root, cells in the hypocotyl swell just like balloons, causing the hypocotyl to thicken and elongate. This water moves into hypocotyl cells due to the generally higher "salt" content inside the cells. The "salt" content of the cell is composed of nutrients, such as K+, and small organic compounds, such as sugars and acids. Any condition that increases the salt content of the soil water or decreases the ability of the cell to build these organic salts will decrease turgor and thus adversely affect emergence. Growers see visual evidence of this in cotton’s slow emergence in saline (salty) soils. Emergence in saline soils often is so slow that seedling disease wreaks havoc with the stand. Likewise with either low vigor seed (low cool germ) or when the soil is cool, the plant’s ability to synthesize sugars and acids is slowed and we see a delay in emergence. Healthy seedlings in warm, moist, non-saline soil will have the greatest ability to build turgor and push against a crust. We recognize this strong push by the thick hypocotyl of a healthy seedling successfully pushing hard through a crust.

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