PHYSIOLOGY TODAY

Newsletter of the Cotton Physiology Education Program — NATIONAL COTTON COUNCIL

February 1992, Volume 3, Number 4

Choosing the Right Cotton Variety

Bill Meredith, Kater Hake and Mark Lange

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%.

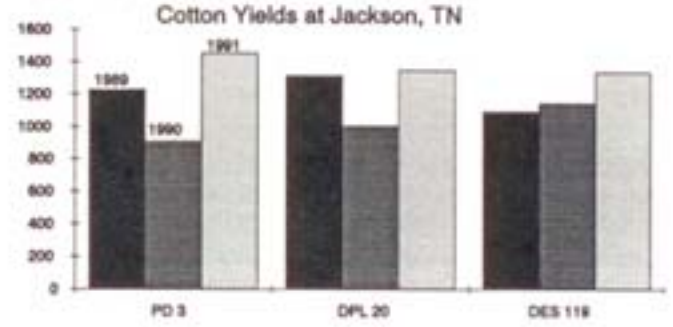
If all varieties have about the same trash content, then the comparison of varieties using boll sample lint-percentages instead of gin turnout is a valid indicator of relative yield. While this is the usual case, some varieties do vary in their trash content, especially hairy vs. smoothleaf varieties. 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.

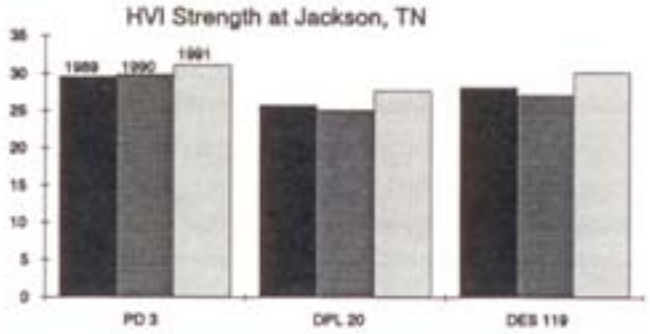
Another reason test yields are high is the end-of-plot effect, similar to the skip-row effect. A plot size of 4 feet has an end-of-plot effect that increases yield by about 6%. Since most varieties have about the same end-of-plot effect, the bias for any one variety is small. However, with both the end-of-plot 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 variety tests. Statistics are usually reported with yield data and present a general overview of the uniformity of the test conditions (soil type, cultural practices, insect damage etc.). Tests with large LSD's, such as 200 lbs of lint/acre, generally offer growers little useful information, 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 differences between varieties are significant or due to random variation. Only with varieties that differ by more than 100 lbs, when the LSD was 100, would growers have much assurance regarding which variety performed better in the trial. If none of the varieties differed 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 determine 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 information 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 maturities 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 requirements, split a field into 4 or more blocks, planting alternate 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 meaningful.
- Where more than 2 varieties need to be compared, conduct a small replicated and randomized trial. Twenty 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 t 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 computers. 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 variability 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.

Varietal comparison for most fiber properties are consistent. Notice in the previous figure how the difference 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 produce 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 arrangements 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 relationships. If the supply of high strength varieties is relatively abundant in relation to demand, the premiums are likely to be smaller than if supply is tight in re lation to demand. If a grower makes a variety decisio based on strength premium expectations, that premium expectation should be sufficient to offset any lower yield that might be expected with the higher strength variety.

Strength Premiums and Discounts in Points

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

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.

Disease Tolerance

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.

Cotton Comics

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 throught 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.

Are You a Member?

National Cotton Council programs are funded on a voluntary basis by our members. All U.S. cotton producers, ginners, warehousemen, merchants, seed crushers, cooperatives and textile manufacturers are eligible for membership in NCC; supporting industries also can become a partner in U.S. cotton's central organization via The Cotton Foundation. If you are unsure about your membership status or would like to join NCC or the Foundation, contact the Council's Field Services Department at 901-274-9030 for assistance. Thank you, Kater Hake.

The Cotton Physiology Education Program is supported by a grant to The Cotton Foundation from BASF Agricultural Products, and brought to you as a program of the National Cotton Council in cooperation with the State Extension Service.

National Cotton Council of America
Post Office Box 12285 • Memphis, Tennessee 38182-0285
901-274-9030