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ASSOCIATIONS OF VARIOUS VARIETAL CHARACTERISTICS WITH YIELD IN STRIPPER COTTONS

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Abstract

Data were compiled from the internal testing program over 11 years of Bayer CropScience Stripper Cotton Breeding Program in Lubbock, Texas. Correlation was performed on each location between lint yield and several varietal characteristics. Gin turnout and visual were the only two characteristics that showed high positive correlation. Lint percent showed a weaker association. Maturity, storm resistance and the fiber characteristics of length, strength and micronaire had little or no association with lint yield.

Introduction

It often seems to cotton breeders that lint yields are negatively associated with other desirable characteristics, especially those of fiber quality. Numerous studies have investigated these associations and opinions about them have been reported in various media. Most of this information concerns picker varieties with less attention having been paid to either stripper varieties or their areas of adaptation.

The Bayer CropScience Stripper Cotton Breeding Program is headquartered at Lubbock, Texas. It is a continuation of the breeding program initiated by SEEDCO in the 1980s with germplasm obtained from several stripper breeding efforts, including that developed by Delta and Pine Land Co and Coker Pedigreed Seed Co. in West Texas.

Extensive data have been generated through the years from small plot yield tests conducted at numerous locations throughout the stripper cotton growing areas, including the High Plains and the Rolling Plains areas of West Texas. This paper summarizes data from 88 yield tests conducted over the 11 year period, 1991-2001. These data are used to obtain insights concerning associations of yield with the following eight characteristics: gin turnout, lint percent, maturity, visual, storm resistance, fiber length, fiber strength, and micronaire values.

Materials and Methods

Data were compiled from internal variety tests including all three levels of experimental testing: advanced, intermediate, and preliminary. Test locations ranged from Aiken, TX in the North to Lamesa, TX in the South. Table 1 shows the number of tests included from each year. Each data point compiled is a mean of at least three replications at each location (except for the fiber data that was taken from one replication per test location).

Gin turnout is the percentage of lint weight in the stripped sample (stripped sample includes burrs and sticks). Lint percent is the percentage of lint weight from the seed cotton. Visual is a 1 to 9 rating, 1 being poor and 9 being excellent, that is taken at harvest time. It is based on yield, however plant morphology and storm resistance can affect the rating. Storm resistance is a rating of how well the cotton stays in the boll, and is taken at harvest. It is a 1 to 9 rating, 1 being very loose and 9 having a very tight boll. Maturity is the percent of cotton open on a date a few weeks prior to harvest. The fiber characteristics length, strength and micronaire are measured by HVI testing at the International Textile Center in Lubbock, TX.

Correlation was run between yield and the characteristics mentioned above on the whole data set using Excel. The environmental influences masked any correlation that may have existed, therefore covariant analysis, and normalization by overall key check and test key check were investigated. Each of these methods by definition would alter the original data and might create false correlation or mask real correlation. Therefore, correlation and regression were performed on each test and then summarized in table format (Tables 2-9). This seemed to give the best overall picture of this data set.

Results and Discussion

As shown in Table 2, of the 85 correlations generated, 74 (27+44+3) were positive and highly significant, indicating a close and positive association between the two variables. This indicates that gin turnout could be effectively used as a preliminary screen for yield of experimental stripper varieties.

The next characteristic reported is lint percent with the number of tests showing various correlations being shown in Table 3. Of the 88 determinations, 44 (30+7+7) were positive and significant indicating a general trend of higher yielding varieties to have higher lint percents. Even higher correlation between lint percent and lint yield have been reported in picker cotton varieties (Keim, 2002). However, this trait was not as strongly associated with yield as was gin turnout.

There were only 44 tests in which maturity notes were taken (Table 4). The maturity ratings showed little association with yield with 12 of the correlations being significantly positive and 7 being significantly negative while 25 were non significant. During the eleven year period the heat units reported at Lubbock, Texas for that time period were at or above normal levels. This coupled with primarily May planting dates may explain low correlation between maturity and lint yield.

Visual rating results are shown in Table 5 and in 67 of the 85 tests reported the ratings were positive and significant. This was somewhat surprising since it often seems that the varieties that appear productive in the field are not the ones that produce the highest yields. These data show a stronger association between a visual rating and yield than those earlier reported (Calhoun, 2002).

Storm resistance is a very important characteristic of stripper cotton varieties since both wind and rain storms are often encountered prior to harvest. Table 6 contains some information concerning the association between this trait and yield of stripper varieties. This association appears to be very weak as only a few tests showed significant correlations and some of these were positive while others were negative. Early generation selection for storm resistance results in limited variability within this data set and may account for the low number of significantly correlated tests.

Data in Table 7 indicate that the association of fiber length with yield is not as strong as generally believed. These data do not confirm the findings of Dr. Meredith in 2002 where increase in fiber length is associated with decrease in yield. Of the 88 correlations, only 7 were significant with 2 being positive and 5 being negative. This suggests that progress can be made in increasing fiber length without a simultaneous reduction of yield.

Fiber strength (Table 8) also shows little association with yield, indicating that stronger fiber varieties can be developed without sacrificing lint yield.

The general perception that higher yielding varieties have higher micronaire is not supported by the data shown in Table 9 since most of the correlation coefficients fell near zero and were non-significant. Keim also saw this trend of low correlation between micornaire and lint yield in years analyzed.

Summary

Of the eight characteristics that have been measured in a Lubbock, Texas based stripper cotton breeding program over the 11 year period from 1991 through 2001, only gin turnout and visual ratings tended to be highly associated with lint yield. Lint percent showed a weaker association. Maturity, storm resistance and the fiber properties of length, strength, and micronaire had little or no association with lint yield.

References

Calhoun, Steve D., J.B. Riney. 2002. Non-replicated testing in the real world. Proc. Beltwide Cotton Prod. Conf. Atlanta, GA. 8-12 January, Natl. Cotton Council, Memphis, TN.

Keim, Don L. 2002. Breaking the yield-fiber quality barrier. Proc. Beltwide Cotton Prod. Conf. Atlanta, GA. 8-12 January. Natl. Cotton Council, Memphis, TN.

Meredith, W. R. Jr. 2002. Factor that contribute to lack of genetic progress. Proc. Beltwide Cotton Prod. Conf. Atlanta, GA. 8-12 January. Natl. Cotton Council, Memphis, TN.

Table 1. Number of test per year.

Year	Tests
1991	2
1992	2
1993	4
1994	5
1995	7
1996	9
1997	10
1998	9
1999	12
2000	13
2001	15

Table 2. Number of tests showing various levels of association between lint yield and gin turnout.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	-0.31 to –0.60	–0.60 to –1	Total
Significant(p>.05)	27	44	3	0	0	0	74
Non Significant	1	1	8	0	1	0	11
Total							85

Table 3. Number of tests showing various levels of association between lint yield and lint percent

Ranges of r	1 to 0.61	0.60 o 0.31	0.30 to 0	0 to –0.30	–0.31 to -0.60	–0.60 to –1	Total
Significant(p>.05)	7	30	7	1	0	0	45
Non Significant	1	4	31	5	2	0	43
Total							88

Table 4. Number of tests showing various levels of association between lint yield and maturity.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to–0.30	–0.31 to –0.60	-0.60 to –1	Total
Significant(p>.05)	0	9	3	2	5	0	19
Non Significant		0	11	14	0	0	25
Total							44

Table 5. Number of tests showing various levels of association between lint yield and visual productivity ratings.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	–0.31 to –0.60	–0.60 to –1	Total
Significant(p>.05)	25	37	5	0	0	0	67
Non Significant	0	1	14	2	0	1	18
Total							85

Table 6. Number of tests showing various levels of association between lint yield and storm resistance.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	-0.31 to –0.60	-0.60 to –1	Total
Significant(p>.05)	2	8	2	1	3	0	16
Non Significant	1	3	36	28	1	0	69
Total							85

Table 7. Number of tests showing various levels of association between lint yield and fiber length.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	-0.31 to –0.60	-0.60 to –1	Total
Significant(p>.05)	0	0	2	1	4	0	7
Non Significant	0	2	33	42	4	0	81
Total							88

Table 8. Number of tests showing various levels of association between lint yield and fiber strength.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	-0.31 to –0.60	-0.60 to –1	Total
Significant(p>.05)	0	2	0	2	5	1	10
Non Significant	0	1	30	43	2	2	78
Total							88

Table 9. Number of tests showing various levels of association between lint yield and fiber micronaire.

Ranges of r	1 to 0.61	0.60 to 0.31	0.30 to 0	0 to –0.30	-0.31 to –0.60	-0.60 to –1	Total
Significant(p>.05)	1	10	4	0	1	0	16
Non Significant	0	0	46	25	1	0	72
Total							88