2003 BELTWIDE COTTON CONFERENCES, NASHVILLE, TN – JANUARY 6-10

VARIETY PERFORMANCE COMPARISON BETWEEN COMPANY AND UNIVERSITY TRIALS

Tom Kerby, Janet Burgess, Constance Garcia, and Kevin Howard
Delta and Pine Land Company
Scott, MS
Ken Lege
Delta and Pine Land Company
Centre, AL
Dave Albers and Tom Speed
Delta and Pine Land Company
Lubbock, TX

Abstract

Delta and Pine Land Company (D&PL) conducts an aggressive field variety development program. Varieties at early stages of development are widely tested in small plot, but during the last several years of evaluation they are simultaneously evaluated in large scale on farm trials as well as University Official Variety Tests (OVT's). Company grower cooperators manage Agronomic Service Trials (AST's) according to their typical management practices. D&PL has built a proprietary Agronomic Information System data base that contains both OVT and AST data and uses both sources of information for variety evaluation, positioning, and marketing. This manuscript will describe the degree of agreement between the two sources of information. The Mid-South and Southeastern states all have aggressive OVT testing programs, thus we concentrated our comparisons to these regions. Texas has aggressive but distinct OVT testing programs. Our goal was to avoid direct comparisons to individual state OVT's and to make the comparisons more geographically general. Hence, this manuscript will deal with comparisons where OVT results include two or more university programs. Variety least square mean values were established within a region as a percentage of the grand test mean for both OVT and AST data. The degree of agreement between variety performance over a four year period (1998 to 2001) ranged between R^2 = 0.67 to 0.76. Additionally, variety stability charts for standard varieties indicated both sources of data appeared to be from a common population.

Introduction

State Universities make significant investment of time and resources to conduct variety trials and make this unbiased source of data available to the cotton industry. D&PL likewise makes a substantial investment in variety development work with the goal of identifying superior research germplasm and eliminating and obsolescing older germplasm. While company data may not be considered unbiased by some, it is critical for a company to have variety performance data that represents the marketplace. On the opposite side, there are some who recognize OVT's do not have an intended bias, but they are small plots that in some cases are not managed with typical grower inputs. These differences in size and management philosophy would be expected to create some differences in variety response. Since both sources of data represent significant investments of resources, it is hoped that both provide useful information to both the company and the customer.

Materials and Methods

D&PL developed a proprietary Agronomic Information System (AIS) that stores all cotton variety trial data. It can be retrieved by source, state, and various other designations. Since only partial data was available for 2002 at the time of this writing, we decided to use the previous four years data to compare variety performance in a region by sources of data. The Mid-South and Southeastern are represented by four data regions that have the most data, and multiple state University OVT's are represented in each data region. These four were selected to make comparisons between varieties over the four year period according to source of data (OVT or AST). The North Delta Region represents all of TN and MO and the northern areas of AR and MS and Northwest AL. The South Delta Region represents all of LA, and the central and southern areas of AR and MS. The Southern Southeast Region represents all of FL and GA, central and southern AL, and southern SC. The Northern Southeast Region represents northern SC and all of NC and VA. Data region description and relative quantity of data by source are given in Table 1.

Varieties within a data region between 1998 and 2001 were selected that had a high frequency of representation in both the OVT's and AST's. The variety group selected varied slightly according to region. They are listed in alphabetical order along with the number of tests they were present in by data source (Table 2). In total, there were 978 test locations for AST data and 399 OVT locations in these four regions over the four- year period. While there were more AST locations, there are generally more varieties present in OVT's. Some varieties have more locations of AST data, while others have more locations of OVT data. The two data sets are not perfectly balanced, but varieties were included in the analysis where both sources of data had an adequate number to make a reasonable variety least square mean estimate for lint yield. It is understood that variation

in number of locations for varieties, especially across sources of data can contribute to variation in variety ranking between OVT and AST data.

Within a region variety least square means were generated by each data source using a SAS general linear model. The variety regional mean was then converted to a percentage of the regional grand variety mean. Individual variety yield as a percentage of the grand mean was then compared between data sources using AST means as the dependent variable and OVT means as the independent variable.

The two sources of data are also used to construct stability charts for a variety. The approach of using this type of stability analysis has been previously described (Eberhart and Russell, 1966; Kerby et al., 2001). The varieties selected within a region represent either a standard or it is a variety with a high number of data points in both AST's and OVT's. In calculating stability charts for a variety the variety yield was compared as the independent variable to the average of all varieties at that test location as the dependent variable across all locations that included that variety within a four-year period in the data region. The mean of all varieties at all locations would by definition have an intercept of zero and a slope of 1.0. Variety response from low to high yield environments can be determined by intercept and slope. Consistency of performance is reflected in R^2. This provides a relative measure of variety performance. If genetic improvement in varieties occurs, the more years a variety is tested, either the intercept and / or the slope will decline. For comparisons between sources of data, stability analysis of significant varieties represents a good method to compare AST and OVT results.

Results

The number of varieties compared in AST's and OVT's are given in Table 2 by data region. If a variety differs by 5 % or more in the ranking between the two data sources, it was identified for discussion. For the North Delta Region relative performance of ST 4892BR was the only variety that varied by 5 % between sources of data. Here the performance of the variety was relatively better in OVT data than in AST data. General agreement between AST's and OVT's were reasonably good with an R^2 of 0.69. In the South Delta Region, PM 1220 BG/RR and PM 1220 RR had performance in the OVT's that was higher than in the AST's. There was good agreement between AST and OVT variety rankings (R^2 = 0.71). In the Southern Southeast Region, SG 821 and SG 747 both had superior relative performance in OVT's than in AST's. Agreement between data sets was similar to other regions (R^2 = 0.67). The Northern Southeast Region had the highest degree of agreement between AST and OVT data (R^2 = 0.76). In this region, all varieties were within 5 % agreement in relative performance between the two sources of data.

Table 3 contains the stability measure summaries by data source and region. In the North Delta data region both PM 1218 BG/RR and DP 451 B/RR have been widely planted and widely tested in both OVT and AST trials. Both sources of data indicate performance for PM 1218 BG/RR that is above the grand region variety average (109.5 % for AST and 108.7% for OVT). Slope and intercepts are in reasonable agreement. R^2 is lower in OVT data than in AST data. For DP 451 B/RR, the two sources of data are nearly identical in yield as a % of the grand regional average (AST = 98.0 % and OVT = 97.3%) and in R^2. However, AST data suggests a lower intercept and higher slope compared to OVT data.

PM 1218 BG/RR and NuCOTN 33B were compared by data source in the South Delta Region. Both data sources show yield at the same level (AST = 111.0% and OVT = 110.1 % of the grand regional variety mean) and a similar R^2 value (Table 3). There is one AST test location where PM 1218 BG/RR was well below the test average at that location, probably due to Bronze Wilt. While the average yield was similar, response from to low to high yield environments was not identical for both data sets. In AST data, the intercept was higher and the slope lower compared to OVT data. This difference is likely accounted for by the one very low data point in a high yield environment previously mentioned (data graph not shown). The two sources of data reflected nearly identical information for average yield as a % of the grand mean, intercept, slope, and R^2 of NuCOTN 33B.

The two varieties with the most data in the Southern Southeast are DP 458 B/RR and DP 655 B/RR. Both OVT and AST data are in close agreement for average yield (AST = 102.6 % and OVT = 100.8%) and R^2 (Table 3). AST data has a higher intercept and lower slope than what is shown by OVT data. Data for DP 655 B/RR are in close agreement. Yield as a percentage of the grand regional mean was 97.8 % for AST and 97.6 for OVT data. R^2 is similar and slope and intercept are close.

Number of variety comparisons is less in the Northern Southeast data region than the other three regions compared above. PM 1218 BG/RR and SG 105 are the two varieties selected for data source comparison of stability measures because they are among the varieties tested most widely and have a reasonable balance in number of AST and OVT trials. SG 105 averaged 104.0 % of the grand mean in AST trials compared to 104.5 % in OVT trials. Intercept, slope, and R^2 were also very similar for the two data sources. PM1218 BG/RR averaged 108.6% of the grand average in AST trials compared to 105.6 % in OVT trials. R^2 for the variety was similar in both data sets (Table 3). The data sets were substantially different in intercept and slope with AST data having a higher intercept and lower slope. This was the same trend difference as in other regions, but was more pronounced in the Northern Southeast data region.

When the sample size is small, a few test locations with data points well outside the average response can cause intercept and slope to vary. To get a clearer picture of degree of general agreement between OVT and AST data, we compared stability parameters for DP 458 B/RR (Fig 1.), DP 451 B/RR (Fig. 2), and PM 1218 BG/RR (Fig. 3) across all data regions for data in the AIS from 1998 through 17 December of 2002. All values are very close for DP 458 B/RR and DP 451 B/RR. PM 1218 BG/RR across regions has the same difference noted by region, that being AST data has a larger intercept and flatter slope than in the OVT data.

Conclusions

There is substantial agreement between D&PL AST data and that generated in University OVT's. Relative performance of varieties by data source (AST or OVT) was similar within and across data regions (R^2 ranged from 0.67 to 0.76 for regions). Stability analysis likewise indicated similar response curves for the reference varieties within a region. Specifically, there was no appearance of a general company bias (AST versus OVT performance) regarding performance of company owned varieties compared to other varieties. In fact, when averaging over all regions, DP 458 B/RR averaged 100.2 % of the grand average in AST trials compared to 103.1 % in OVT trials. DP 451 B/RR averaged 99.2 % of the grand average in AST trials compared to 98.5% in OVT trials. PM 1218 BG/RR averaged 104.6 % of the grand average in AST trials compared to 106.5 % in OVT trials. Company data has actually placed the performance of two of these three varieties slightly lower in company trials that did the University in OVT trials. D&PL had the objective of using aggressive field-testing to provide data that represents what our customers on average would find in their fields. Since our customers rely on both AST and OVT data to make business decisions, it was our goal to see that company testing provided data of similar value. These data suggest our goals have been met and that both AST and OVT data provide useful information to our customers and to us as a company for making variety decisions.

Acknowledgements

The authors wish to express appreciation to our Technical Service Agronomists who have generated all the AST data and to our many grower cooperators who have provided acreage and time in helping us determine variety performance in a commercial setting.

References

Eberhart, S.A. and W.A. Russell. 1966. Stability parameters for comparing varieties. Crop Sci. 6:36-40.

Kerby, Tom, Marc Bates, Janet Burgess, Ken Lege, and Dave Albers. 2001. Fiber quality stability of significant Delta and Pine Land varieties. pp. 410-413. *In.* P. Dugger and D.A. Richter (eds). Beltwide Cotton Conf. Nat'l Cotton Council, Memphis, TN.

Table 1. Regional designation for D&PL AIS data and distribution of data by region and source (OVT = dark portion of bars and AST = lighter portion of bars).

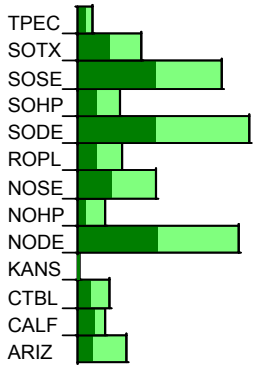
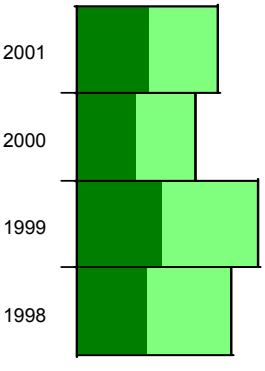
Data Region	Abbreviation	Data Distribution by Region	Year Distribution of Data
Trans-Pecos	TPEC		
South Texas	SOTX		
Southern Southeast	SOSE		
Southern High Plains	SOHP		
South Delta	SODE		
Rolling Plains	ROPL		
Northern Southeast	NOSE		
Northern High Plains	NOHP		
Northern Delta	NODE		
Kansas	KANS		
Central Texas Blacklands	CTBL		
California	CALIF		
Arizona	ARIZ		

Table 2. Regional alphabetical listing of varieties used in data source comparisons. Total number of test locations as well as the number of tests that had the variety present. In some cases a variety name may be slightly different that the commercial designation. Variety names are as they are coded into the AIS database.

North Delta			South Delta			Southern Southeast			Northern Southeast		
	AST	OVT		AST	OVT		AST	OVT		AST	OVT
# Test Loc.	300	116	# Test Loc.	292	114	# Test Loc.	218	113	# Test Loc.	168	56
Variety	N	N	Variety	N	N	Variety	N	N	Variety	N	N
BXN47	28	74	BXN47	34	61	DELTAPEARL	47	39	DP388	30	24
DP20B	57	57	DP20B	79	66	DP425R	53	60	DP422BR	34	22
DP388	42	48	DP388	54	39	DP428B	46	55	DP425R	50	31
DP422BR	59	42	DP422BR	69	39	DP436R	58	52	DP428B	25	19
DP425R	83	64	DP425R	74	42	DP451BR	109	57	DP436R	66	31
DP428B	49	56	DP428B	74	57	DP458BR	154	78	DP451BR	91	28
DP436R	115	73	DP436R	89	58	DP5415R	82	75	DP458BR	67	23
DP451BR	143	61	DP451BR	137	56	DP565	46	25	DP51	28	40
DP5111	35	39	DP458BR	116	58	DP5690R	57	60	DP5111	26	16
NUCOTN33B	63	50	DP5415R	74	42	DP655BR	85	70	DP5415R	51	32
PM1199R	66	25	FM832	30	59	DP675	48	27	DP5690R	36	18
PM1218BR	119	69	FM989	38	53	DP90	33	58	DP655BR	41	22
PM1220BR	54	44	NUCOTN33B	117	107	FM832	23	42	FM989	20	34
PM1220R	39	39	PM1218BR	107	70	FM989	41	69	NUCOTN33B	37	18
PM1560B	67	70	PM1220BR	46	35	NUCOTN33B	94	93	PM1199R	24	13
PSC355	51	77	PM1220R	39	30	NUCOTN35B	56	58	PM1218BR	42	31
SG105	47	70	PM1560B	77	77	PM1560B	51	71	PM1560B	26	23
SG125	40	52	PM1560BR	58	41	PM1560BR	52	44	PM1560BR	35	20
SG125BR	81	50	PSC355	48	85	SG125BR	66	48	SG105	30	30
SG215BR	77	25	SG105	50	57	SG501BR	99	56	SG125BR	47	23
SG501	34	36	SG125	46	47	SG747	41	77	SG215BR	36	10
SG501BR	101	53	SG125BR	70	37	SG821	46	62	SG501BR	61	23
SG521R	59	29	SG215BR	64	32	ST474	88	49	SG747	54	30
SG747	89	93	SG501BR	97	58	ST4892BR	66	63	ST474	78	36
ST474	91	90	SG747	112	109				ST4793R	24	22
ST4793R	54	48	SG821	44	52				ST4892BR	45	23
ST4892BR	86	48	ST474	143	102						
			ST4892BR	85	52						

Table 3. Stability parameter measures for various varieties by data source within a region and over regions for the period 1998 to 2001.

Region	Variety	Data Source	Intercept	Slope	R^2
North Delta	PM 1218 BG/RR	OVT	98	1.008	0.829
North Delta	PM 1218 BG/RR	AST	118	0.953	0.916
North Delta	DP 451 B/RR	OVT	107	0.864	0.890
North Delta	DP 451 B/RR	AST	-4	0.988	0.918
South Delta	PM 1218 BG/RR	OVT	35	1.075	0.888
South Delta	PM 1218 BG/RR	AST	131	0.946	0.848
South Delta	NuCOTN 33B	OVT	-33	1.010	0.903
South Delta	NuCOTN 33B	AST	-9	1.004	0.937
Southern Southeast	DP 458 B/RR	OVT	-2	1.020	0.913
Southern Southeast	DP 458 B/RR	AST	120	0.888	0.908
Southern Southeast	DP 655 B/RR	OVT	48	0.933	0.913
Southern Southeast	DP 655 B/RR	AST	80	0.878	0.921
Northern Southeast	PM 1218 BG/RR	OVT	-44	1.091	0.878
Northern Southeast	PM 1218 BG/RR	AST	294	0.788	0.868
Northern Southeast	SG 105	OVT	79	0.970	0.927
Northern Southeast	SG 105	AST	85	0.931	0.922
All Regions	DP 458 B/RR	OVT	21	0.982	0.901
All Regions	DP 458 B/RR	AST	-3	1.004	0.932
All Regions	DP 451 B/RR	OVT	18	0.967	0.917
All Regions	DP 451 B/RR	AST	38	0.952	0.943
All Regions	PM 1218 BG/RR	OVT	7	1.057	0.853
All Regions	PM 1218 BG/RR	AST	111	0.932	0.890

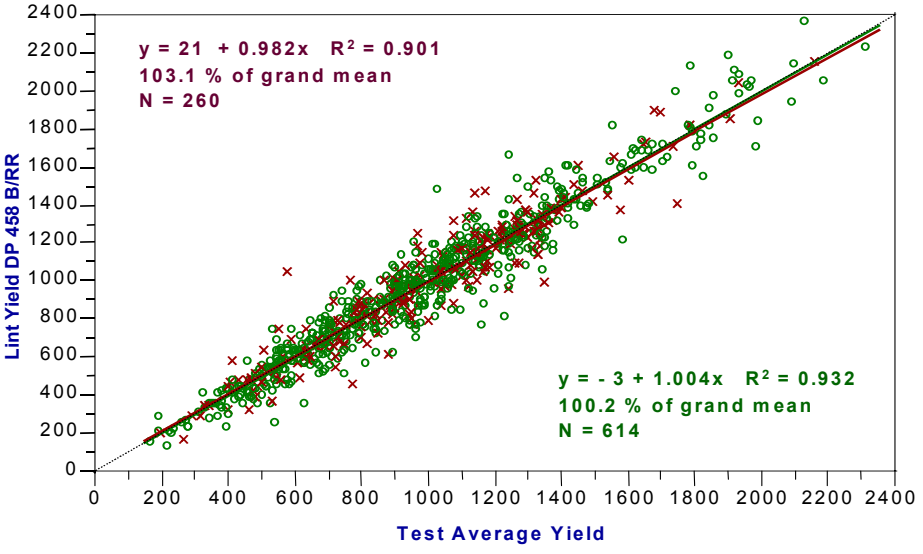


Figure 1. Stability of DP 458 B/RR by OVT (upper left values and data with x) and AST (lower right values and data with a circle.

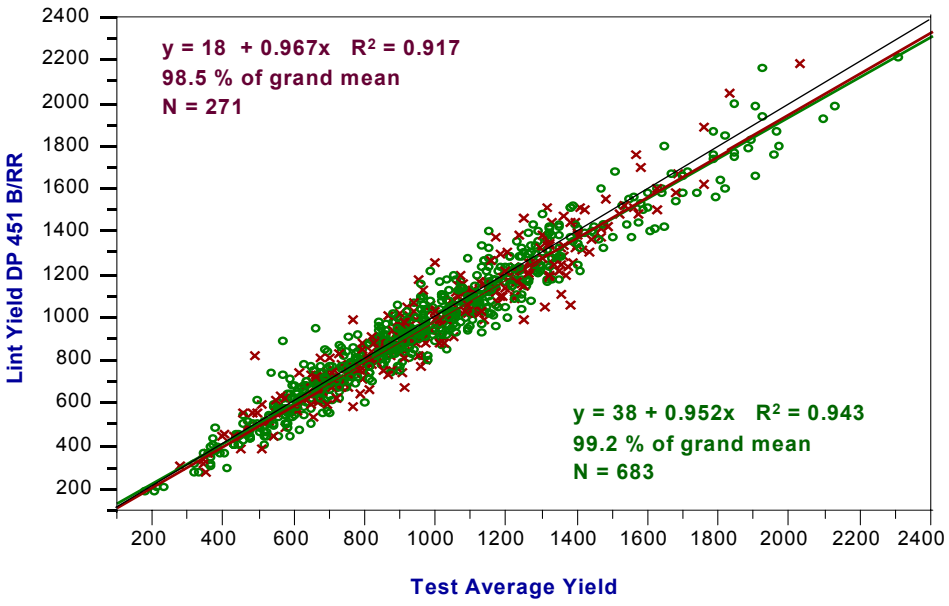


Figure 2. Stability of DP 451 B/RR by OVT (upper left values and data with x) and AST (lower right values and data with a circle.

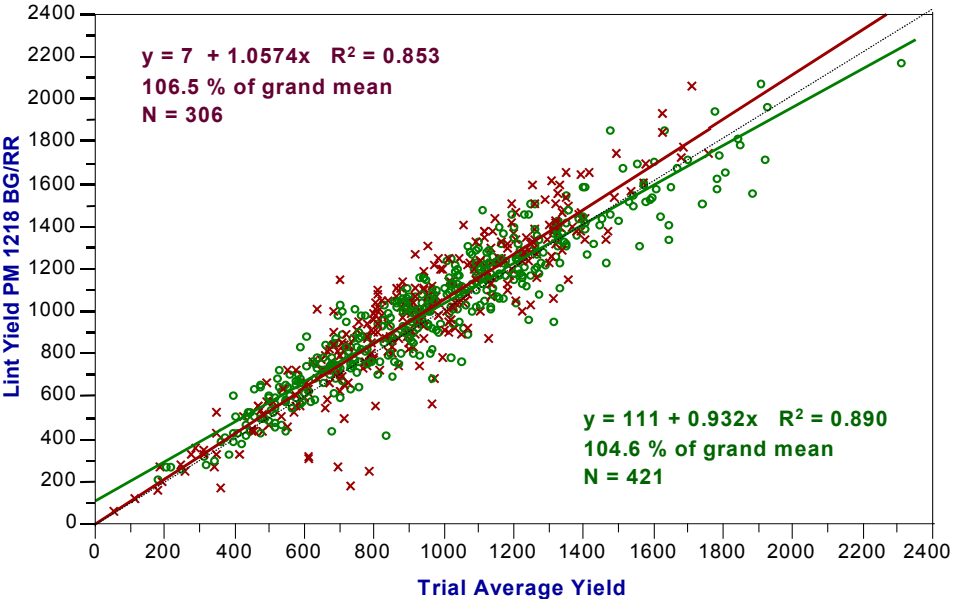


Figure 3. Stability of PM 1218 BG/RR by OVT (upper left values and data with x) and AST (lower right values and data with a circle.