YIELD STABILITY OF OLDER AND NEWER COTTON VARIETIES IN TENNESSEE

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Abstract

Research-based information on yield stability of cotton varieties is helpful to Tennessee producers in selecting cultivars to plant. Relatively stable yields allow producers to plan their crop budgets more accurately. This study assessed the relative yield stability of older and newer cotton varieties, and investigated possible relationships between varietal yield stability, yield potential, and earliness of maturity. Earliness was measured as the percent of total yield that was spindle-picked at first harvest. Data on lint yield and earliness of varieties were compiled from replicated variety trials conducted at three West Tennessee locations (Milan, Jackson, and Ames Plantation) from 1991 through 1999. All trials were planted in loess-derived silt loam soils in terrace or creek bottom settings. Supplemental irrigation was used at one location. Balanced data for varieties tested during successive 3-year intervals (1991-93, 1994-96, and 1997-99) were analyzed by a stability variance procedure, SAS-Stable (Magari and Kang, 1997). It is based on the principle that varieties that contribute relatively little to genotype-environment interaction (GxE) are relatively stable. Stability variance (σ^2_{GE}) estimates the magnitude of varietal contributions to GxE, and z-tests categorize varieties by significance of their contributions. Varieties differed in σ^2_{GE} for each 3-year period in this study. Of 24 varieties tested in 1991-93, two (Delcot 344 and MD 51ne) did not contribute significantly to GxE. They were categorized as relatively stable (Table 1). Four varieties made highly significant (P<0.001) contributions to GxE in 1991-93, and were categorized as relatively unstable. The remaining varieties were intermediate in yield stability. All 13 varieties evaluated in 1994-96 contributed to instability (Table 2). Of these, five were highly significant (P<0001), and were categorized as relatively unstable. Of 9 varieties common to the 1997-99 tests, four did not contribute significantly to GxE. They were categorized as relatively stable (Table 3). Yield stability was not significantly correlated with yield potential or earliness of maturity of older or newer cultivars, but there were weak correlations between σ^2_{GE} and earliness in 1991-93 and 1997-99 (Table 4). These trends were more attributable to instability of a few late maturing varieties than to higher levels of stability in early maturing cultivars. These results demonstrate that both older and newer varieties can be categorized in terms of relative yield stability. There is no indication from these data, however, that newer varieties are less stable than those grown in the early 1990s. Because of the difficulty of predicting yield stability from yield potential or earliness data, producers may find σ^2_{GE} useful to consider alongside yield and earliness when selecting varieties to plant.

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References Cited

Magari, R. and M.S. Kang. 1997. SAS-STABLE: Stability analyses of balanced and unbalanced data. Agron. J. 89:929-932.

Table 1. Yield and stability variance of 24 cotton varieties tested at three Tennessee locations from 1991 through 1993, listed by stability rank.

Variety	Mean Lint Yield lb/ac	Stability Variance σs^2_{GE}	Prob. Level P	
Delcot 344	907	2272	0.076	ns
MD 51 ne	906	2288	0.074	ns
DES 119	900	2662	0.037	*
Deltapine 51	952	2730	0.033	*
Hyperformer HS-23	868	2824	0.027	*
Terra C-40	936	2828	0.027	*
Deltapine 20	965	2958	0.021	*
Deltapine 50	935	2981	0.020	*
Sure-Grow 1001	920	3022	0.018	*
Chembred 1135	935	3200	0.012	*
Terra 207	842	3255	0.011	*
Deltapine 5690	887	3260	0.011	*
Hyperformer HS-46	915	3345	0.009	**
Chembred 333	947	3431	0.007	**
Deltapine Acala 90	873	3510	0.006	**
Stoneville 907	873	3573	0.005	**
Acala 1517-88	855	3690	0.004	**
Chembred 407	918	4037	0.002	**
Stoneville LA 887	895	4101	0.001	**
Stoneville 132	909	4222	0.001	**
Stoneville 453	940	4693	0.000	***
Paymaster HS-26	817	4754	0.000	***
Deltapine 5415	947	5158	0.000	***
PD 3	900	5561	0.000	***

ns = no significant contribution to GxE, indicating relatively stable yields.
* = significant contribution to GxE at P<0.05, indicating less stable yields than those preceding.
** = significant contribution to GxE at P<0.01, indicating less stable yields than those preceding.
*** = significant contribution to GxE at P<0.001, indicating relatively unstable yields.

Table 2. Yield and stability variance of 13 cotton varieties tested at three Tennessee locations from 1994 through 1996, listed by stability rank.

Variety	Mean Lint Yield lb/ac	Stability Variance σ^2_{GE}	Prob. Level P	
Deltapine 50	1080	2674	0.038	*
Paymaster H1215	1200	2841	0.028	*
Deltapine 5409	1155	2962	0.022	*
Sure-Grow 404	1103	3078	0.017	*
Deltapine 20	1054	3292	0.011	*
Terra C-40	983	3322	0.010	**
Sure-Grow 125	1071	3959	0.002	**
Stoneville 132	1163	3960	0.002	**
Sure-Grow 501	1023	4633	0.000	***
Deltapine 51	1072	4859	0.000	***
Paymaster H1220	1193	5434	0.000	***
Stoneville 474	1162	5745	0.000	***
Paymaster H1244	1138	8257	0.000	***

*see footnotes to Table 1.

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Table 3. Yield and stability variance of 9 cotton varieties tested at three Tennessee locations from 1997 through 1999, listed by stability rank.

Variety	Mean Lint Yield lb/ac	Stability Variance σ^2_{GE}	Prob. Level *P*	
Stoneville BXN 47	971	1405	0.106	ns
Sure-Grow 125	939	1461	0.093	ns
Stoneville 474	1037	1480	0.088	ns
Paymaster 1220 BG/BR	1075	1504	0.083	ns
Deltapine 20	891	1833	0.035	*
Terra 292	868	1875	0.031	*
Paymaster 1220 RR	1004	1883	0.030	*
Deltapine 5409	994	1899	0.029	*
Stoneville 373	985	2471	0.004	**

*see footnotes to Table 1.

Table 4. Linear correlations between lint yield and stability variance, and between earliness and yield stability variance of varieties tested in Tennessee during three 3-year periods.

Interval	Degrees of Freedom	Lint Yield (X) vs. Stability Variance (Y) r	Percent First Harvest (X) vs. Stability Variance (Y) r
1991-93	22	-0.132 ns	-0.380 ns ‡
1994-96	11	0.212 ns	0.156 ns
1997-99	7	-0.202 ns	-0.462 ns ‡

ns = non-significant correlation (*P*>0.05).

‡ weak correlation in the range of 0.20>*P*>0.05.