## PERFORMANCE OF VARIOUS COTTON VARIETIES IN REPLICATED LARGE-PLOT AND SMALL-PLOT RESEARCH TRIALS IN SOUTH CAROLINA Michael A. Jones Clemson University, Pee Dee Research & Education Center Florence, SC

## **Rationale and Background**

Variety selection is the first and perhaps the most important management decision a grower makes each season. Variety decisions are now more complex due to the fact that many new varieties are now offered for sale with fewer years of public testing than most growers, consultants, and university personnel need for proper evaluation. One way to increase the confidence in variety choice decisions is to increase the number of locations within a given year a variety is evaluated. Increasing the number of locations within a given year will expose a new cotton variety to as many different growing conditions, management inputs, soil types, and environmental stresses as possible, and hopefully expose any problems associated with the performance of a variety before it reaches growers' fields. In recent years, growers have expressed to industry leaders a desire to have more information to help them make better seed purchase decisions Questions exist among cotton researchers and their clientele on which method of variety testing is best. Therefore, large-plot and small-plot replicated variety trials were conducted to compare variety testing methods and to determine the best method to evaluate cotton varieties in South Carolina.

## **Materials and Methods**

Small- and large-plot replicated variety trials were established at four separate locations during the 2012 and 2013 growing seasons. Trial locations were selected based on historical and projected cotton acreage in a given area and differences in soil types and management inputs. Trial locations planted were Dillon (Minturn, SC), Florence (PDREC, Florence, SC), Lee (Elliott, SC), and Calhoun (St. Matthews, SC) counties. Large-plot trials consisted of 10 popular commercial varieties planted in a randomized complete block design with 4 replications. Large-trial plot size consisted of 2 to 4 rows (38 or 40 inch rows) per variety x 350 to 500 feet long. Small-plot trials consisted of 48 to 50 varieties that were split into early and late-maturity trials (20 to 28 varieties/trial). Experimental design of the small-plot trials was a randomized complete block with 4 replications and plot size consisted of 2 rows (38 or 40 inch) x 40 feet long. Large- and small-plot replicated trials were planted on the same day with the same planter in adjoining areas in the same field. Both small- and large-plot trials were managed by cooperators with the same production practices and inputs. All plots in both small- and large-plot trials were harvested with a case 1822 plot picker within the same week and seedcotton was ginned on a 10-saw gin to determine gin turnout.

Despite increases gained in the precision of the replicated variety trials when plot size was increased, there were few overall differences in the relative lint yield rankings of the 10 varieties evaluated in both the large- and small-plot trials over the two years (**Table 4**). Phytogen 499WRF was the highest yielding variety in both the large-plot replicated trials and the small-plot early- and late-maturity trials compared to the other varieties evaluated (**Tables 1** to 4). Most of the varieties that were high-yielding in the large-plot trials also had high lint yields in the small-plot trials as shown by the similar lint yield rankings in **Tables 1 to 4**. Likewise, most of the varieties that were lower yielding in the large plot trials also had lower yields in the small-plot trials (**Tables 1 to 4**).

Table 1. Li	nt Yield and Rela	tive Yield Ran	k of Early	-Maturing (	Cotton V	arieties Eva	luated i	n Small-Plot	Replic	ated OVTs in	1		
South Caro	lina during the 2	013 Growing S	eason. C	Only Varietie	s Grown	at all Five I	ocation	is Are Inclu	ded in '	This Table.	M. Jones		
		Calhoun County		Florence County		Lee County		Dillon Co	Dillon County		Florence County		
		Early-ma	turity	Early-maturity		Early-maturity		Early-maturity		Early-maturity		5-location	
Variety		Dryland	Trial	Dryland	Trial	Dryland	Trial	Dryland	Trial	Irrigated	l Trial	Awera	ıge
		Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield
		(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank
DPL 11371	B2RF	2072	1	1976	6	1715	7	1269	8	1233	4	1653	5.2
PHY 499W	RF	1950	9	1897	9	1843	1	1167	13	1329	1	1637	6.6
PX 444414W	WRF	2019	2	2262	1	1746	5	1034	18	1179	8	1648	6.8
BX 1347GL	B2	2004	3	1992	5	1656	12	1165	14	1223	6	1608	8.0
PX 3122R40	WRF	1757	18	2220	2	1694	10	1337	6	1187	7	1639	8.6
NG1511B2	2RF	1859	14	2056	4	1708	8	1274	7	1104	13	1600	9.2
DPL 1321B2	2RF	1774	17	1841	11	1764	3	1386	3	1095	14	1572	9.6
ST 6448GI	LB2	2003	4	1837	12	1696	9	981	20	1261	3	1556	9.6
FM 1944G	LB2	1810	15	1879	10	1636	14	1499	1	1157	9	1596	9.8
PHY 339W	'RF	1976	5	2091	3	1633	15	1239	11	1039	16	1596	10.0
DPL 09121	B2RF	1669	20	1783	14	1793	2	1179	12	1309	2	1547	10.0
DPL 1311B2	2RF	1876	13	1774	15	1747	4	1266	9	1127	10	1558	10.2
PHY 375W1	RF	1975	6	1916	7	1690	11	1253	10	987	19	1564	10.6
PX 300310W	VRF	1959	8	1825	13	1596	16	997	19	1230	5	1521	12.2
PHY 575W	<b>RF</b>	1975	6	1904	8	1558	18	1079	16	922	22	1488	14.0
MON 12R2	24B2RF	1935	10	1662	19	1542	19	1418	2	986	21	1509	14.2
PX 443327W	WRF	1880	12	1558	23	1573	17	1352	5	1066	15	1486	14.4
PX 443325W	VRF	1896	11	1707	18	1377	20	1354	4	987	19	1464	14.4
ST 4946GLI	B2	1738	19	1633	21	1733	6	1114	15	1107	12	1465	14.6
NG 5315B2	RF	1785	16	1763	16	1654	13	1056	17	1007	18	1453	16.0
Trial Mean		1895		1837		1668		1221		1097		1544	
Varieties Te	ested	20		24		20		20		24		22	
LSD (0.05)		261		349		227		260		254		270	
C.V. (%)		12		13		10		15		16		13	
Variation in	hold ware also a	walnoted in las	a nlat n	anlighted tri	1a in 20	12 at a ama la	antion						

Varieties in bold were also evaluated in large-plot replicated trials in 2012 at same locations.

Table 2. Lint Yield and Re	elative Yield F	Rank of I	Late-Maturir	ng Cotto	n Varieties Ev	aluated	in Small-Plot	Replic	ated OVTs in	n			
South Carolina during the	2013 Growin	g Seaso	n. Only Var	ieties Gro	own at all Five	e Locatio	ons Are Incl	uded in	This Table.	M. Jones			
	Dillon Co	Dillon County		Florence County		Calhoun County		Lee County		Florence County			
	Late-maturity		Late-maturity		Late-maturity		Late-maturity		Late-maturity		5-location		
Variety	Dryland	Dryland Trial		Dryland Trial		Dryland Trial		Dryland Trial		Irrigated Trial		Average	
	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	
	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	
MON 12R242B2RF	1261	2	2251	3	1687	9	2036	2	1532	1	1753	3.4	
MON 13R352B2RF	1116	6	2303	1	1682	10	2231	1	1460	4	1758	4.4	
PHY499WRF	1075	10	2254	2	1723	8	1840	9	1479	3	1674	6.4	
PX 444414WRF	1058	12	2107	7	1808	5	1905	5	1296	12	1635	8.2	
DPL 1048B2RF	1098	8	1999	15	1824	4	1731	13	1505	2	1631	8.4	
DPL 1137B2RF	1037	15	2104	9	1780	6	1799	11	1418	6	1628	9.4	
BX 1347GLB2	1043	14	2011	14	1944	1	1706	15	1439	5	1629	9.8	
PX 553840WRF	1059	11	2169	4	1453	20	1910	4	1292	13	1577	10.4	
NG 5315B2RF	967	20	2166	5	1679	11	1836	10	1325	11	1595	11.4	
PX 3122402RF	882	23	2100	10	1830	3	1709	14	1337	8	1572	11.6	
DPL 1034B2RF	1057	13	2108	6	1622	14	1928	3	1100	23	1563	11.8	
DPL 1252B2RF	1102	7	2069	11	1558	15	1866	6	1157	20	1550	11.8	
DPL 1133B2RF	1309	1	1532	23	1862	2	1614	19	1206	18	1505	12.6	
PHY 339WRF	984	19	2107	7	1454	19	1752	12	1329	10	1525	13.4	
PHY 575WRF	997	17	2036	12	1534	16	1842	8	1235	16	1529	13.8	
NG1511B2RF	1078	9	2015	13	1528	17	1628	18	1243	15	1498	14.4	
FM1944GLB2	1126	5	1817	19	1649	12	1650	17	1146	21	1478	14.8	
PX 443327WRF	993	18	1958	17	1637	13	1454	23	1332	9	1475	16.0	
ST 6448GLB2	1012	16	1849	18	1415	21	1547	20	1411	7	1447	16.4	
PX 443325WRF	1228	3	1752	20	1486	18	1464	22	1178	19	1422	16.4	
DPL 1044B2RF	1130	4	1717	21	1374	22	1400	24	1285	14	1381	17.0	
PX 554010WRF	836	24	1966	16	1358	23	1856	7	1228	17	1449	17.4	
PHY 375WRF	891	22	1448	24	1760	7	1673	16	1091	24	1373	18.6	
PX 540301WRF	906	21	1668	22	1270	24	1546	21	1101	22	1298	22.0	
Trial Mean	1052		1979		1622		1747		1297		1539		
Varieties Tested	24		24		24		24		24		24		
LSD (0.05)	223		403		316		258	-	378		316		
C.V. (%)	15		14		14		10		21		15		
Variatias in hold ware also	avaluated in	larga n	lot raplicate	t trials in	2012 at same	location	26						

Varieties in bold were also evaluated in large-plot replicated trials in 2012 at same locations.

ative Yield Ra	ank of Co	otton Varieti	es Evalu	ated in Larg	e-Plot R	eplicated O	VTs in	South Caroli	na
ason. M. Jo	ones.								
Florence County		Calhoun County		Dillon County		Lee County		4-location	
Dryland I fial		Lint Viald Viald		Dryland I rial		Dryland Irial		Average	
Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield	Lint Yield	Yield
(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank	(lb/acre)	Rank
1288	3	1533	6	1514	2	1167	5	1376	4.0
1274	5	1512	7	1350	4	1292	1	1357	4.3
1237	7	1544	5	1620	1	1160	6	1390	4.8
1281	4	1546	4	1289	8	1242	3	1340	4.8
1248	6	1617	1	1313	6	1153	9	1333	5.5
1369	1	1498	9	1452	3	1149	10	1367	5.8
1186	8	1502	8	1348	5	1262	2	1325	5.8
1153	10	1608	2	1291	7	1175	4	1307	5.8
1289	2	1405	10	1208	10	1160	6	1266	7.0
1181	9	1549	3	1230	9	1154	8	1279	7.3
1250		1531		1362		1191		1334	
10		10		10		10		10	
154		160		175		144		158	
10		9		9		10		9	
	ative Yield R ason. M. Jo Florence ( Dryland Lint Yield ( <i>lb/acre</i> ) 1288 1274 1237 1281 1248 <b>1369</b> 1186 1153 1289 1181 1250 10 154 10	ative Yield Rank of Co eason. M. Jones. Florence County Dryland Trial Lint Yield Yield ( <i>lb/acre</i> ) Rank 1288 3 1274 5 1237 7 1281 4 1248 6 <b>1369 1</b> 1186 8 1153 10 1289 2 1181 9 1250 10 154 10	ative Yield Rank of Cotton Varieties   ative Yield Rank of Cotton Varieties   ation M. Jones.   Florence County Calhoun G   Dryland Trial Dryland G   Int Yield Yield Lint Yield G   (Ib/acre) Rank (Ib/acre)   1288 3 1533   1274 5 1512   1237 7 1544   1281 4 1546   1248 6 1617   1369 1 1498   1186 8 1502   1153 10 1608   1289 2 1405   1181 9 1549   1250 1531 10   10 10 10   154 160 10	Antive Yield Rank of Cotton Varieties Evalue   ason. M. Jones.   Calhoun County   Dryland Trial   Florence County Calhoun County   Dryland Trial Dryland Trial   Lint Yield Yield Lint Yield   Itan Yield Yield Lint Yield Yield   Itan Yield Yield Lint Yield Yield   Itan Yield Yield Lint Yield Yield   Itan Yield Rank (Ib/acre) Rank   Itan Yield Yield Lint Yield Yield   Itan Yield Yield Lint Yield Yield   Itan Yield Sattern Itan Yield Rank   Itan Yield Sattern Itan Yield Sattern   I	ative Yield Rank of Cotton Varieties Evaluated in Largerson. M. Jones.   Calhoun County Dillon County   Florence County Calhoun County Dillon County   Dryland Trial Dryland Trial Dryland   Lint Yield Lint Yield Lint Yield Lint Yield   Int Yield Yield Lint Yield Yield Lint Yield   1288 3 1533 6 1514   1274 5 1512 7 1350   1237 7 1544 5 1620   1281 4 1546 4 1289   1248 6 1617 1 1313   1369 1 1498 9 1452   1186 8 1502 8 1348   1153 10 1608 2 1291   1289 </td <td>Native Yield Rank of Cotton Varieties Evaluated in Large-Plot R   ason. M. Jones.   Calhoun County Dillon County   Dillon County Dillon County   Florence County Calhoun County Dillon County Dillon County   Dryland Trial Dryland Trial Dryland Trial Dryland Trial   Lint Yield Lint Yield Lint Yield Lint Yield Lint Yield Pield   (lb/acre) Rank (lb/acre) Rank (lb/acre) Rank (lb/acre) Rank   1288 3 1533 6 1514 2   1274 5 1512 7 1350 4   1237 7 1544 5 1620 1   1288 3 1533 6 1514 2   1281 4 1546 4 1289 8   1281 4 1546 4 1289 8   1284 6 1617 1 1313 6   1369 1 1498 9 1452</td> <td>ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated O   ason. M. Jones. Image: Statusted in Large-Plot Replicated O   ason. M. Jones. Image: Statusted in Large-Plot Replicated O   Florence County Calhoun County Dillon County Lee County   Dryland Trial Dryland Trial Dryland   Int Yield Yield Lint Yield Yield Lint Yield (<i>lb/acre</i>) Rank (<i>lb/acre</i>)   Int Yield Yield Lint Yield Yield Lint Yield (<i>lb/acre</i>)   Int Yield Yield Lint Yield (<i>lb/acre</i>) Rank (<i>lb/acre</i>)   Int Yield Lint Yield Yield Lint Yield   Int Yield Jient Yield Lint Yield Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan="4"&gt;Colspan= 4   Int Yield Lint Yield Lint Yield Lint Yield Lint Yield Lint Yield   Int Yield Int Yield Int Yield</td> <td>ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated OVTs in reson. M. Jones.   Image: Second M. Jones.   Distribution of the second M. Jones.   Dimatheneree M.</td> <td>ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated OVTs in South Caroli   ason. M. Jones.   Image: South Caroli   ason. M. Jones.   Florence County Calhoun County Dillon County Lee County 4-locati   Dryland Trial Dryland Trial Dryland Trial Dryland Trial Avera   Lint Yield Yield Lint Y</td>	Native Yield Rank of Cotton Varieties Evaluated in Large-Plot R   ason. M. Jones.   Calhoun County Dillon County   Dillon County Dillon County   Florence County Calhoun County Dillon County Dillon County   Dryland Trial Dryland Trial Dryland Trial Dryland Trial   Lint Yield Lint Yield Lint Yield Lint Yield Lint Yield Pield   (lb/acre) Rank (lb/acre) Rank (lb/acre) Rank (lb/acre) Rank   1288 3 1533 6 1514 2   1274 5 1512 7 1350 4   1237 7 1544 5 1620 1   1288 3 1533 6 1514 2   1281 4 1546 4 1289 8   1281 4 1546 4 1289 8   1284 6 1617 1 1313 6   1369 1 1498 9 1452	ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated O   ason. M. Jones. Image: Statusted in Large-Plot Replicated O   ason. M. Jones. Image: Statusted in Large-Plot Replicated O   Florence County Calhoun County Dillon County Lee County   Dryland Trial Dryland Trial Dryland   Int Yield Yield Lint Yield Yield Lint Yield ( <i>lb/acre</i> ) Rank ( <i>lb/acre</i> )   Int Yield Yield Lint Yield Yield Lint Yield ( <i>lb/acre</i> )   Int Yield Yield Lint Yield ( <i>lb/acre</i> ) Rank ( <i>lb/acre</i> )   Int Yield Lint Yield Yield Lint Yield   Int Yield Jient Yield Lint Yield Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan="4">Colspan= 4   Int Yield Lint Yield Lint Yield Lint Yield Lint Yield Lint Yield   Int Yield Int Yield Int Yield	ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated OVTs in reson. M. Jones.   Image: Second M. Jones.   Distribution of the second M. Jones.   Dimatheneree M.	ative Yield Rank of Cotton Varieties Evaluated in Large-Plot Replicated OVTs in South Caroli   ason. M. Jones.   Image: South Caroli   ason. M. Jones.   Florence County Calhoun County Dillon County Lee County 4-locati   Dryland Trial Dryland Trial Dryland Trial Dryland Trial Avera   Lint Yield Yield Lint Y

Table 4. Comparison	of Selected Va	arieties Grown	n in Both Sm	all-Plot Replica	ated OVTs and	l Large-plo	
Replicated OVTs duri	ing the 2012 ar	nd 2013 Grow	ing Seasons	in South Caro	lina. M. Jone	s.	
	Smal	ll Plot	Sma	ll Plot			
	Early-N	Aaturity	Late-N	Aaturity	Large	Plot	
Variety	Replicated OVTs		Replica	ted OVTs	Replicated OVTs		
	Yield	Rank	Yield	l Rank	Yield Rank		
	2012	2013	2012	2013	2012	2013	
PHY 499WRF	3.4	6.6	3.6	6.4	2.3	4.8	
DPL 1252B2RF	*	*	6.8	11.8	3.8	4.3	
NG 1511B2RF	6.6	8.6	9.4	14.4	4.3	4.8	
DPL 1137B2RF	*	5.2	6.0	9.4	5.0	5.8	
DPL 1050B2RF	*	*	5.8	*	6.0	5.5	
FM 1944GLB2	11.6	9.8	16.8	14.8	6.5	4.0	
ST 5458B2RF	*	*	11.8	*	4.8	*	
DPL 0912B2RF	16.6	10.0	*	*	5.5	5.8	
PHY 339WRF	*	10.0	*	13.4	*	5.8	
ST 6448GLB2	*	9.6	*	16.4	*	7.0	
PHY 575WRF	*	12.2	*	13.8	*	7.3	
PHY 375WRF	20.8	*	23.8	*	7.3	*	
PHY 565WRF	*	*	21.8	*	9.8	*	
Varieties Tested	25	22	26	24	10	10	
Trial Mean	1573	1544	1675	1539	1304	1334	
LSD (0.05)	240	270	240	316	174	158	
C.V. (%)	11	13	11	15	9	9	

## Summary

- The overall lint yield for the ten separate small-plot replicated trials averaged 1573 and 1675 lbs/acre in 2012, and 1544 and 1539 lbs/acre in 2013 for the early- and late-maturity trials, respectively (**Table 4**). This average lint yield was several hundred pounds/acre higher than the average lint yield for the eight separate large-plot replicated trials, which averaged 1304 lbs/acre in 2012 and 1334 lbs/acre in 2013 (**Table 4**). Prior to planting, each small-plot trial was initially placed on highly productive, uniform locations in the field in order to optimize yields and reduce soil variability. Large-plot trials were also placed in highly productive locations in the field prior to planting, but often crossed several different soil types and productivity levels due to their large plot size. Also, it appears small-plots trial yields may have benefitted from the inclusion of end row plants from the numerous alleys needed to plant and harvest the trials. In most cases, these numerous end row plants were larger and produced more bolls than other plants in their respective row and may have contributed to the slightly higher yields with the small-plot trials compared to the large-plot trials.
- 2) The overall variability of the trials appeared to decrease with increased plot size. The replicated large-plot trials had lower CV(%) and LSD values compared to the small-plot replicated trials (Table 4). Since large-plot replicated trials cover a larger area of land compared to small-plot trials, the inclusion of lower yielding plants from areas of the field associated with soil variability may have been less important to the overall yields and the precision of the trial compared to the inclusion of lower yielding plants and areas in small-plot trials.
- 3) The number of varieties researchers evaluated in large-plot trials was greatly reduced (10 varieties) compared to the 20 to 24 varieties evaluated in each small plot trial location (Tables 1 to 4), and the amount of seed, labor, time, and money invested in these trials was significantly increased when conducting large-plot replicated trials compared to small-plot replicated trials.