

Registration of PD 99035 Germplasm Line of Cotton

B. T. Campbell,* O. L. May, D. S. Howle, and D. C. Jones

ABSTRACT

PD 99035 (Reg. No. GP-902, PI 653111) is a noncommercial breeding line of cotton (*Gossypium hirsutum* L.) jointly released by the USDA-ARS, the Clemson University Experiment Station, and Cotton Incorporated in 2007. PD 99035 was selected from a cross of PD 93043 and 'DPL 5409'. PD 99035 possesses outstanding fiber-quality properties, significantly better than several commercial cultivars. Specifically, PD 99035 possesses outstanding fiber strength and length potential, while also maintaining micronaire values lower than commercial cultivars. PD 99035 possesses mid- to late maturity and produces lint yield similar to or just below commercial cultivars. PD 99035 is best adapted within the southeastern United States, although our data also suggest it has broad adaptation across the U.S. Upland cotton production region. The combination of longer fiber length, stronger fiber strength, lower micronaire, and acceptable lint yield potential makes PD 99035 a valuable genetic resource to cotton breeding programs.

PD 99035 (Reg. No. GP-902, PI 653111) is a noncommercial breeding line of cotton (*Gossypium hirsutum* L.) jointly released by the USDA-ARS, the Clemson University Experiment Station, and Cotton Incorporated in 2007. PD 99035 was derived from a cross of PD 93043 and 'DPL 5409'. PD 93043 was derived from a cross between the experimental germplasm line PD 5265 and PD 5576 (May and Howle, 1997; Green et al., 1991). PD 93043 combined high yield potential and acceptable fiber quality. DPL 5409 is a cultivar developed by Delta and Pine Land Company (Scott, MS) and derived from a cross between 'DPL 50' and 'DPL Acala 90'. PD 99035 was released because it possesses superior

fiber quality and acceptable yield potential in a range of environments.

Methods

PD 99035 was developed using the generalized procedures outlined by May (2001). Approximately 15 F_1 plants were self-pollinated at the ARS winter nursery in Tecoman, Mexico, and the F_2 seed bulked. On the basis of its yield performance, an F_2 bulk was advanced to the F_3 for single plant selection. F_3 plants were selected for plant type, fiber properties, and lint percentage and advanced to F_4 progeny rows. PD 99035 was derived from a single $F_{3,4}$ progeny row visually selected for yield potential. Bulked F_5 seed from the $F_{3,4}$ progeny row was designated PD 99035 and used in replicated yield tests beginning at the F_5 stage.

From 2004 through 2006, PD 99035 was compared to 'DPL 493', 'FM 989', 'DPL 555BR', 'DPL 444BR', 'FM 960BR', and/or 'ST 5599BR' in six replicated field tests at two Clemson University ARS sites in South Carolina. Test sites included the Pee Dee Research and Education Center at Florence, SC, and the Edisto Research and Education Center at Blackville, SC. In 2006, PD 99035 was also tested in the Regional Breeders Testing Network (RBTN) and the South Carolina Official Variety Trial (SC OVT). The RBTN consisted of nine locations across the U.S. Upland cotton area, including Tallahassee, AL, Florence, SC, Rocky Mount, NC, Tifton, GA, Alexandria, LA, Stoneville, MS, Maricopa, AZ, Lubbock, TX, and Keiser, AR. The RBTN trials allowed for comparisons to 'DPL 393', 'FM 958', and 'SG 105'. The SC OVT consisted of five locations across South Carolina, including Darlington, Lee, Dillon, Barnwell, and Dillon counties. The SC OVT allowed for comparisons to DPL 555BR, FM 960BR, and ST 5599BR. Each field trial was arranged in a randomized

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Abbreviations: RBTN, Regional Breeders Testing Network; SC OVT, South Carolina Official Variety Trial.

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complete block design with four replications. Each entry was grown in a two-row plot from 9 to 15 m long with 76 to 102 cm spacing between rows, depending on the location of the trial. Plots were managed conventionally and followed the established local practices.

Each plot was harvested with a mechanical cotton picker that harvested both rows of each plot, and total seed cotton weight was recorded. For each trial except RBTN trials, a “grab” lint sample was obtained from the mechanical picker after harvesting each plot to determine lint percentage and fiber-quality properties. For the RBTN trials, a 25- or 50-boll sample was obtained from each plot before harvest to determine lint percentage and fiber-quality properties. Samples were ginned on a laboratory gin, and lint percentage was determined by dividing the weight of the lint sample after ginning by the weight of the lint sample before ginning. Lint yield was calculated by multiplying the lint percentage by the seed cotton yield. A portion of the lint sample was sent to the Cotton Incorporated Fiber Testing Laboratory (Cary, NC) for determination of fiber length, fiber strength, uniformity index, fiber elongation, micronaire, and short fiber content by high volume instrument analyses. Data for each trait were analyzed for normality by PROC UNIVARIATE, and an ANOVA was conducted in each of the three groups of trials within and across locations using PROC GLM to test significant differences among genotypes (SAS Institute, 2002). The least significant difference ($p = 0.05$) was calculated in each ANOVA to test specific differences between the check cultivars and PD 99035.

Characteristics

PD 99035 displays a mid- to full-season maturity, while combining excellent fiber-quality potential and acceptable

yield potential. Table 1 provides mean comparisons of PD 99035 and several commercial check cultivars resulting from on-station trials in 2004, 2005, and 2006. In 2004, PD 99035 produced fiber length higher than FM 989 and DPL 493 and fiber strength higher than DPL 493 but similar to FM 989. PD 99035 produced micronaire, uniformity index, and elongation similar to FM 989 and DPL 493, while producing lint percentage similar to FM 989 but lower than DPL 493. Averaged over two on-station trials conducted in 2005, PD 99035 produced higher fiber length, higher uniformity index, and similar short fiber content compared with DPL 555BR, ST 5599BR, and FM 960BR. PD 99035 produced fiber strength higher than DPL 555BR and similar to ST 5599BR and FM 960BR, while also producing micronaire similar to ST 5599BR and FM 960BR but lower than DPL 555BR. PD 99035 produced elongation similar to ST 5599BR but higher than DPL 555BR and FM 960BR. Also, PD 99035 produced lint percentage similar to FM 960BR but less than DPL 555BR and ST 5599BR. Averaged over two on-station trials conducted in 2006, PD 99035 produced higher fiber length and elongation and lower short fiber content compared with DPL 555BR, ST 5599BR, and FM 960BR. PD 99035 produced higher fiber strength than DPL 555BR and ST 5599BR but similar to FM 960BR, while producing lint percentage and lint yield lower than DPL 555BR, ST 5599BR, and FM 960BR. PD 99035 also produced micronaire similar to FM 960BR and lower than DPL 555BR and ST 5599BR.

PD 99035 was tested in the 2006 South Carolina Official Variety Trials. Table 2 provides a summary of data combined over all locations of the variety trials. PD 99035 produced significantly higher fiber length values, higher uniformity index, and lower micronaire than DPL 555BR, ST 5599BR, and FM 960BR. PD 99035 also produced

Table 1. Lint yield, lint percentage, and fiber-quality (high volume instrument) performance of cotton line PD 99035 and check cultivars, averaged across replicated tests conducted at Florence, SC, and Blackville, SC, in 2004, 2005, and 2006.[†]

Year	Entry	Lint yield	Lint percent	Micronaire	Length	Strength	Uniformity index	Elongation	Short fiber content
		kg ha ⁻¹	%	units	mm	kN m kg ⁻¹		%	
2004 [‡]	PD 99035	1626	41.8	4.2	29.55	288	82.6	5.6	8.8
	FM 989	1145	42.5	4.1	27.94	281	82.0	6.0	10.3
	DPL 493	1508	45.3	4.4	27.94	274	82.5	6.2	10.9
	LSD _{0.05}	NS	1.9	0.3	0.90	13	1.1	0.8	NS
2005	PD 99035	1062	40.0	4.3	29.49	300	83.9	5.8	5.2
	DPL 555BR	1154	44.4	4.6	27.87	277	82.0	4.8	5.2
	ST 5599BR	1236	42.6	4.4	28.45	295	82.6	5.8	4.5
	FM 960BR	1081	40.6	4.2	28.23	307	82.8	4.4	5.2
	LSD _{0.05}	NS	1.3	0.1	0.49	9	0.8	0.3	1.4
2006 [§]	PD 99035	1696	39.1	4.7	29.59	300	83.3	5.4	7.5
	DPL 555BR	1994	42.7	5.0	28.00	283	81.9	4.8	9.2
	ST 5599BR	2057	41.3	5.1	28.19	289	82.1	4.7	8.8
	FM 960BR	2003	40.0	4.9	27.53	302	82.1	4.3	8.9
	LSD _{0.05}	218	0.8	0.2	0.59	8	NS	0.2	0.4

[†]Data extracted from replicated trials of 32 entries for 2004 and 40 entries for 2005 and 2006. LSD values are from the replicated trial data for each year, respectively.

[‡]Data for 2004 were collected for the Florence, SC, location only.

[§]Data for lint yield include the Florence, SC, location only.

significantly higher fiber strength values than DPL 555BR and ST 5599BR, while producing lower fiber strength values than the high fiber strength check FM 960BR. PD 99035 produced lower lint yield and lint percentage values than DPL 555BR, ST 5599BR, and FM 960BR.

PD 99035 was also tested in nine locations across the Upland cotton growing area as part of the 2006 RBTN. Table 3 provides a summary of data for PD 99035 combined over all nine locations and over southeastern U.S. locations. Considering the complete dataset, PD 99035 produced fiber length values significantly greater than the commercial check cultivars DPL 393 FM 958, and SG 105. PD 99035 produced greater fiber strength values than SG 105 but also was lower than the high fiber strength check FM 958. PD 99035 produced micronaire equivalent to FM 958 and lower than DPL 393 and SG 105. Uniformity index and short fiber content values for PD 99035 did not differ from any of the commercial checks. PD 99035 produced lower fiber elongation than each of the commercial checks. Lint yields for PD 99035 were equivalent to FM 958 but lower than DPL 393 and SG 105. Lint percentage for PD 99035 was similar to SG 105 but lower than DPL 393 and FM 958. When considering southeastern U.S. environments only, PD 99035 produced significantly higher fiber length values than DPL

393, FM 958, and SG 105, while producing fiber strength values higher than DPL 393 and SG 105. PD 99035 produced lower short fiber content than SG 105, DPL 393, and FM 958. PD 99035 did not differ from the commercial checks for uniformity index or lint yield but produced lower fiber elongation. PD 99035 produced lower micronaire values than each of the commercial checks. PD 99035 produced lint percentages equivalent to SG 105 but lower than DPL 393 and FM 958.

Overall, PD 99035 represents an excellent source of fiber quality and acceptable lint yield potential. PD 99035 is best adapted and competitive with commercial cultivars within the southeastern United States. However, our data also suggest that PD 99035 has broad adaptation across the U.S. Upland cotton production region that warrants its use in regions other than the southeastern United States.

Availability

Small quantities (20 g) of PD 99035 seed may be obtained for breeding purposes from the corresponding author. It is requested that appropriate recognition of the source be given when this germplasm line contributes to the development of a new breeding line, hybrid, or cultivar.

Table 2. Lint yield, lint percentage, and fiber-quality (high volume instrument) performance of cotton line PD 99035 and commercial cultivars, averaged across replicated tests conducted in the 2006 South Carolina Official Variety Trials.[†]

Entry	Lint yield kg ha ⁻¹	Lint percent %	Micronaire units	Length mm	Strength kN m kg ⁻¹	Uniformity index %
PD 99035	963	37.7	4.3	29.67	321	83.2
DPL 555BR	1320	42.8	4.5	28.50	288	82.2
ST 5599BR	1211	39.5	4.8	28.65	301	82.5
FM 960BR	1137	39.6	4.5	28.70	325	82.8
LSD _{0.05}	50	0.4	0.1	0.15	3	0.2

[†]Data extracted from the larger, 29 entry trials. LSD values are from the 29-entry, replicated test.

Table 3. Lint yield, lint percentage, and fiber-quality (high volume instrument) performance of cotton line PD 99035 and check cultivars, averaged across replicated tests conducted in the Regional Breeder's Testing Network (RBTN) at Tallassee, AL, Florence, SC, Rocky Mount, NC, Tifton, GA, Alexandria, LA, Stoneville, MS, Maricopa, AZ, Lubbock, TX, and Keiser, AR, in 2006.[†]

Location	Entry	Lint yield kg ha ⁻¹	Lint percent %	Micronaire units	Length mm	Strength kN m kg ⁻¹	Uniformity index %	Elongation %	Short fiber content
All locations	PD 99035	1079	37.0	4.9	28.92	316	83.6	5.3	7.3
	DPL 393	1174	40.0	5.1	28.19	311	83.8	6.4	7.3
	FM 958	1051	38.6	5.0	28.45	336	83.7	4.0	7.5
	SG 105	1167	37.9	5.1	28.24	304	83.7	5.7	7.5
	LSD _{0.05}	77	0.5	0.1	0.38	6	0.5	0.2	0.3
Southeastern USA [‡]	PD 99035	950	38.4	5.1	28.61	317	83.3	4.9	7.8
	DPL 393	1007	42.2	5.4	27.69	315	83.7	6.2	7.9
	FM 958	942	40.3	5.4	27.94	344	83.4	3.4	8.3
	SG 105	885	38.5	5.3	28.07	309	84.0	5.2	8.4
	LSD _{0.05}	86	0.5	0.1	0.37	6	0.6	0.2	0.4

[†]Data extracted from a larger, 24 entry RBTN trial. LSD values are from the 24-entry, replicated test.

[‡]Data from Florence, SC, Rocky Mount, NC, Tifton, GA, and Tallassee, AL, extracted from the RBTN trial.

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