

NOTICE OF RELEASE OF THREE NECTARILESS ARKOT GERMPLASM LINES OF COTTON

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The Arkansas Agricultural Experiment Station announces the release of three noncommercial, nectariless breeding lines of cotton, *Gossypium hirsutum* L., designated Arkot 9406ne, Arkot 9605ne, and Arkot 9631ne. The lines were developed using the generalized procedures outlined by Bourland (2004), and resulted from crossing three nectaried lines developed in the University of Arkansas cotton breeding program with three nectariless lines developed by other breeding programs. Jenkins and Wilson (1996) reviewed articles indicating that the absence of nectarines on leaves and flowers confer some resistance to tarnished plant bug (*Lygus lineolaris* (Palisot de Beauvois)).

Arkot 9406ne was derived from a 1994 cross between La. 850082FN (Calhoun et al., 1994) and Ark 8726-22-01, a high glanding (possessing gossypol glands in calyx lobes) breeding line developed from the cross of La. HG-063 (Jones et al., 1988) by Miscot 8506 (Bourland et al., 1997). Within F₂ populations grown at Southeast Branch Station at Rohwer, AR, in 1996, bolls from visually superior individual plants were harvested and bulked. Plants derived from F₃ seeds were selected using general procedures of Bird (1982) to produce seeds for F₄ progeny rows grown in 1997. A progeny designated as 9406-15 was among the ones promoted and tested in replicated strain tests in 1998 and 1999. Individual plant selections from the F₆ generation of 9405-15 were evaluated as progenies in 2000. One of these selections was Arkot 9406ne (tested as 9406-15-04). Arkot 9406ne was evaluated in 19 replicated strain tests in Arkansas, Georgia, and Mississippi from 2001 through 2004. The replicated tests included 'PSC 355' and either 'SG 747' or 'SG 105' as checks.

Arkot 9605ne was derived from a 1996 cross between Ark 8604-01-13 and NLBG8PD23S-1-93, a nectariless breeding line developed by Texas A&M University. Ark 8604-01-13 is a breeding line developed from a cross of Miscot 7918 (Bourland and White, 1989a) and Miscot 7803-52 (Bourland and White, 1989b). Arkot 9631ne was derived from a 1996 cross between Arkot 8110 (Bourland et al., 1997) and MD51ne (Meredith, 1993). Individual plants were selected from the respective F₂ populations grown at the Northeast Research and Extension Center at Keiser, AR in 1998. Seed from individual plant selections were evaluated as progenies (designated as 9605-17 and 9631-19) in 1999, 2000, and 2001 at Keiser and Rohwer. Seed from a second cycle of individual plant selections (made from the F₅ generation of these two progenies grown at Keiser in 2001) were evaluated in 2002. Two of these selections produced Arkot 9605ne (tested as 9605-17-06) and Arkot 9631ne (tested as 9631-18-07). The two lines were compared to PSC 355 and SG 105 in 10 replicated strain tests in Arkansas, Georgia, and Mississippi in 2003 and 2004.

Lint yields of Arkot 9406ne were comparable to at least one check cultivar in the tests conducted in Arkansas (Table 1), Georgia and Mississippi (Table 2). Within Arkansas test sites, Arkot 9406ne yielded relatively higher in Mississippi County (northeast Arkansas) sites than in central and south Arkansas sites (data not shown). However, the relative yields of Arkot 9406ne in the two 2004 tests conducted near Leland, MS, suggest that it may also be adapted to certain south delta locations. In comparison to SG 105, lint yields of Arkot 9631ne were similar to Arkot 9406ne and tended to be greater than yields of Arkot 9605ne (Table 3).

Table 1. Performance of three nectariless Arkot cotton lines within years (2001 through 2004) at five Arkansas sites¹ [Manila (b), Keiser (k), Clarkedale (c), Marianna (m), and Rohwer (r)].													
Year & Locs.	Line	Lint yield	Lint fract.	Ht	Seed Ind.	Lt. Ind.	Seed/ acre	Fiber/ seed	Fiber properties				
									Mic	Len	Uni	Str	Elo
		lb/a	%	cm	g	g	mil.	no.		in.	%	g/tex	%
01m	9406-15-04	803	37.1	.	10.9	6.5	5.697	16586	4.1	1.19	85.6	27.4	8.5
01m	PSC355	979	37.9	.	10.0	6.2	7.373	14176	4.7	1.14	84.4	28.9	8.8

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01m	SG747	945	38.8	.	10.2	6.6	6.542	13862	4.5	1.16	84.3	27.7	8.6
01m	LSD 0.10	113	2.5	.	0.9	0.60	0.798	1503	0.3	0.4	1.5	1.8	0.3
02kcmr	9406-15-04	1006	34.5	111	10.5	5.8	7.687	14900	4.0	1.16	84.4	29.4	4.6
02kcmr	PSC355	1058	35.9	111	10.5	6.1	7.687	13590	4.6	1.15	85.4	30.1	5.6
02kcmr	SG105	1022	34.8	109	10.5	5.7	8.447	13942	4.1	1.18	85.6	30.6	4.8
02kcmr	LSD0 .10	74	1.7	5	0.4	0.4	0.575	961	0.2	0.02	0.6	0.9	0.3
02kcmr	Pr.Loc*Str	<.01	0.52	0.03	0.18	0.45	0.01	0.57	0.22	0.57	0.03	0.05	0.10
02kcmr													
02kcmr	9406-15-04	763	39.0	94	11.4	7.4	4.931	16532	4.7	1.15	83.8	31.4	8.0
02kcmr	PSC355	961	39.9	103	11.2	7.6	5.777	16150	4.9	1.15	84.2	32.0	8.8
02kcmr	SG105	764	39.7	100	11.1	7.4	4.791	15804	4.8	1.15	84.3	31.3	8.3
02kcmr	LSD0 .10	70	1.0	5	0.4	0.3	0.436	1056	0.2	0.02	0.7	1.1	0.3
02kcmr	Pr.Loc*Str	<.001	0.11	0.31	0.46	0.09	0.004	0.71	0.44	0.10	0.56	0.76	0.39
03kr	9605-17-06	1040	36.3	101	10.6	6.3	7.493	15079	4.2	1.16	85.0	30.1	7.4
03kr	9631-19-07	1004	37.7	102	9.6	5.9	7.596	13422	4.7	1.13	83.6	30.6	7.5
03kr	PSC355	135	38.8	101	10.6	6.9	8.858	14647	4.7	1.17	85.2	31.1	8.4
03kr	SG105	1156	37.9	100	10.1	6.3	8.030	14746	4.7	1.14	84.4	32.3	7.9
03kr	LSD0 .10	162	1.3	6	0.7	0.6	1.145	1537	0.4	0.04	1.1	2.0	0.4
03kr	Pr.Loc*Str	<0.001	<0.001	0.20	0.30	0.18	0.01	0.32	0.45	0.01	0.26	0.08	0.39
04bkcmr	9406-15-04	1195	38.2	84	10.4	6.6	8.194	15365	4.5	1.15	84.9	29.5	4.4
04bkcmr	9605-17-06	1098	37.2	93	10.9	6.8	7.355	15979	4.5	1.14	84.3	31.0	3.7
04bkcmr	9631-19-07	1317	39.2	86	9.5	6.3	9.495	13789	4.9	1.11	84.1	30.2	4.4
04bkcmr	PSC355	1273	39.1	93	10.3	6.8	8.509	13636	5	1.16	85.8	31.4	5.8
04bkcmr	SG105	1367	39.3	89	10.2	6.9	9.062	14774	4.6	1.18	85.8	32.0	4.9
04bkcmr	LSD0.10	76	0.8	4	0.5	0.2	0.51	1053	0.3	0.02	0.5	1.1	0.3
04bkcmr	Pr.Loc*Str	<0.001	0.02	0.20	0.04	<.01	<.001	0.94	0.01	0.80	0.42	0.73	0.46
¹ The three lines were in same test in 2004, but in different tests in 2003.													

Table 2. Performance of three Arkot nectariless cotton lines at Tifton, GA (2003 and 2004) and two tests near Leland, MS (2004).

Test	Line	Lint yield	Lint fract.	Mic	Len	Uni	Str	Elo
		lb/a	%					
2003 GA	9406-15-04	829	39.7	4.8	1.05	83.6	27.3	.
2003 GA	PSC355	929	41.3	5.1	1.12	85.2	29.0	.
2003 GA	SG105	793	40.1	5.2	1.08	84.8	30.6	.
2003 GA	LSD0.10	135	1.0	NS	0.03	NS	1.3	.
2004 GA	9406-15-04	971	39.6	4.9	1.09	83.9	28.6	4.6
2004 GA	9605-17-06	1045	40.1	4.8	1.10	84.6	28.5	4.0
2004 GA	9631-19-07	967	40.4	5.4	1.04	81.5	28.6	4.2
2004 GA	PSC355	1218	40.7	5.2	1.11	84.1	29.4	5.4
2004 GA	SG105	1173	40.2	5.3	1.15	84.1	30.5	4.5
2004 GA	LSD0.10	110	1.5	0.3	0.04	1.1	1.9	0.6
2004 MS 1	9406-15-04	1292	40.2	4.4	1.13	85.3	28.5	4.5
2004 MS 1	9605-17-06	1034	39.7	4.1	1.16	83.8	30.8	3.6
2004 MS 1	9631-19-07	1244	40.3	4.3	1.11	83.6	28.2	4.8

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2004 MS 1	PSC355	1274	41.1	4.5	1.10	85.1	29.7	6.2
2004 MS 1	SG105	1158	40.3	4.6	1.17	85.3	29.7	5.3
2004 MS 1	LSD0.10	157	1.2	0.3	0.03	ns	1.4	0.7
2004 MS 2	9406-15-04	1710	41.4	4.8	1.13	84.1	28.7	4.5
2004 MS 2	9605-17-06	1171	39.8	4.4	1.12	83.0	31.6	3.3
2004 MS 2	9631-19-07	1489	40.6	4.8	1.12	83.8	29.8	4.6
2004 MS 2	PSC355	1458	41.4	5.0	1.15	85.1	30.2	6.5
2004 MS 2	SG105	1672	42.0	5.1	1.16	85.5	30.9	5.2
2004 MS 2	LSD0.10	154	1.1	0.4	0.05	1.4	1.2	0.6

Table 3. Performance of three nectariless cotton lines over years in Arkansas (A), Georgia (G) and Mississippi (M) test sites.

Year & Locs.	Line	Lint yield lb/a	Lint fract. %	Ht cm	Seed Ind. g	Lt. Ind. g	Seed/ acre mil.	Fiber/ seed no.	Fiber properties				
									Mic	Len in.	Uni %	Str g/tex	Elo %
01-04 A ¹	9406-15-04	974	37.4	95	10.8	6.6	6.805	15711	4.4	1.16	84.4	30.0	5.9
01-04 A	% of SG	93.2	97.9	96.6	102.0	98.8	93.1	105.9	97.2	98.9	99.2	96.3	94.8
01-04 A	SG105	1046	38.2	99	10.6	6.7	7.306	14835	4.5	1.17	85.1	31.1	6.3
03-04 G,M	9406-15-04	1200.5	40.2	.	.	.	.	.	4.7	1.10	84.2	28.3	4.5
03-04 G,M	% of SG	100.1	99.0	.	.	.	.	.	93.6	96.5	99.2	92.9	90.7
03-04 G,M	SG105	1199	40.7	.	.	.	.	.	5.1	1.14	84.9	30.4	5.0
01-04all ³	9406-15-04	1022	38.0	.	.	.	.	.	4.5	1.14	84.4	29.6	5.7
01-04all ²	% of SG	94.8	98.2	.	.	.	.	.	96.5	98.4	99.2	95.6	94.3
01-04all ²	SG105	1078	38.7	.	.	.	.	.	4.6	1.16	85.1	31.0	6.0
03-04 A ⁴	9605-17-06	1081	36.9	95	10.8	6.7	7.394	15722	4.4	1.15	84.5	30.7	4.8
03-04 A	% of SG	82.8	95.0	103.4	106.3	98.9	84.3	106.5	95.4	98.0	98.9	95.8	82.6
03-04 A	9631-19-07	1228	38.8	91	9.5	6.2	8.952	13684	4.8	1.12	84.0	30.3	5.3
03-04 A	% of SG	93.9	99.7	98.3	93.7	91.9	102.1	92.7	105.6	95.5	98.3	94.5	91.8
03-04 A	SG105	1307	38.9	92	10.2	6.7	8.767	14766	4.6	1.17	85.4	32.1	5.8
04 G,M ⁵	9605-17-06	1083	39.9	.	.	.	.	.	4.4	1.13	83.8	30.3	3.6
04 G,M ⁵	% of SG	81.2	97.6	.	.	.	.	.	88.7	97.1	98.6	99.8	72.7
04 G,M ⁵	9631-19-07	1233	40.4	.	.	.	.	.	4.8	1.09	83.0	28.9	4.5
04 G,M ⁵	% of SG	92.4	99.0	.	.	.	.	.	96.7	94.0	97.6	95.1	90.7
04 G,M ⁵	SG105	1334	40.8	.	.	.	.	.	5.0	1.16	85.0	30.4	5.0
03-04all ⁶	9605-17-06	1082	37.8	.	.	.	.	.	4.4	1.14	84.3	30.6	4.4
03-04all	% of SG	82.3	95.8	.	.	.	.	.	93.2	97.9	98.9	97.0	79.9
03-04all	9631-19-07	1229	39.3	.	.	.	.	.	4.8	1.11	83.7	29.9	5.1
03-04all	% of SG	93.5	99.5	.	.	.	.	.	102.1	95.0	98.1	94.6	91.7
03-04all	SG105	1315	39.5	.	.	.	.	.	4.7	1.17	85.3	31.6	5.5

¹ Means of 15 Arkansas test sites (compared to SG747 in 2001 and SG105 in 2002-2004).

² Means of 2003 and 2004 tests Tifton, GA, and two 2004 tests near Leland, MS.

³ Means of 19 test sites: 15 in AR, 2 in GA, 2 in MS; (compared to SG747 in 2001 and SG105 in 2002-2004).

⁴ Means of seven Arkansas test sites in 2003 and 2004.

⁵ Means of one 2004 test at Tifton, GA, and two 2004 tests near Leland, MS.

⁶ Means of 10 test sites (7 in AR, 1 in GA, 2 in MS) in 2003 and 2004.

Lint fraction, plant height, and fiber properties (except for lower fiber elongation) of the three nectariless lines were similar to SG 105 (Table 3). Compared to SG 105, Arkot 9406ne and Arkot 9605ne tended to produce fewer seed per area and more fiber per seed while the opposite trend was found for Arkot 9631ne. According to Lewis et al. (2000), the combination of yield components associated with Arkot 9406ne and Arkot 9605ne should contribute to more stable yield production.

Open boll ratings in 2004 indicated that Arkot 9605ne and Arkot 9631ne reached maturity earlier than did Arkot 9406ne and the check cultivars (Table 4). Leaf pubescence of the lines was visually rated based on a rating scale of 1 (smooth leaf) to 7 (very hairy) (Bourland et al., 2003). Arkot 9406ne and Arkot 9605ne both displayed an average leaf pubescence rating of 1.0, while leaf pubescence of Arkot 9631ne (rating of 1.9) was equal to SG 105. Marginal bract trichome density of the three nectariless lines was similar to SG 105 and significantly less than PSC 355. Bract size (circumference and length) of Arkot 9406ne and Arkot 9631ne were similar to PSC 355 while bract size of Arkot 9605ne was similar to SG 105. Total marginal bract trichomes of each of the three lines were significantly less than either check cultivar.

Line	Open bolls ¹	Leaf pubescence ²			Bract measurements ³			
		02 prog.	2002	2004	Tri. den.	Circum.	Len.	Tot. tri.
	%				#/cm	cm	cm	no.
9406-15-04	73	.	1.0	1.0	20.5	31.6	5.1	649
9605-17-06	83	1.0	.	1.0	20.3	36.4	5.3	737
9631-19-07	78	1.3	.	2.5	21.6	27.1	5.1	588
PSC355,ck	70	7.0	7.0	7.0	32.1	30.0	5.1	967
SG105,ck	72	1.3	2.1	2.5	23.8	42.1	5.9	1001
LSD0.10	4	.	2.2	0.9	5.9	3.7	0.3	20

1/ Open bolls near time of defoliation at Manila (B), Keiser (K), Clarkedale (C), and Rohwer (R) in 2004.
 2/ Leaf pubescence visually rated from 1 (smooth leaf) to 7 (very hairy) at Keiser.
 3/ Bracts evaluated in tests at Keiser in 2004 for trichome density, circumference, maximum length and total trichomes (density * circumference).

The three nectariless lines displayed measurable resistance to tarnished plant bug and multiple diseases. As indicated by fewer damaged flowers in a 2004 field test, all three lines were more resistant to tarnished plant bug than SG 105 and susceptible checks (Table 5). In a 2004 greenhouse test, the three lines were equal to or more resistant to seedling disease (caused by *Rhizoctonia solani* Kuehn) than SG 105 and PSC 355. As indicated by more wilted plants in a 2004 field test, all three lines appeared to be more susceptible to Verticillium wilt (caused by *Verticillium dahliae*, Kleb.) than was SG 105. In the 2002 National Cotton Fusarium Wilt Test at Tallassee, AL, response of Arkot 9406ne to fusarium wilt [caused by *Fusarium oxysporum* Schlecht. F. sp. *vasinfectum* (Atk.) Snyder & Hans.] was equal to the resistant check (Glass et al., 2002). During selection, the three lines were screened for resistance to multiple races of *Xanthomonas campestris* pv. *malvacearum* (Smith) Dye, the causal agent of bacterial blight. Resistance to the multiple races conveys resistance to all known U.S. races of this pathogen. In subsequent tests, neither line exhibited symptoms of bacterial blight even after field inoculations with the pathogen

Line	Damaged flowers ¹		04 Greenhouse ²		Verticillium wilt ³		Fus ⁴
	2003	2004	index	Dead	2002	2004	wilt
9406-15-04	50	34	6.0	22	29	83	28
9605-17-06	.	30	4.5	17	.	80	.
9631-19-07	.	30	5.9	26	.	69	.
PSC355,ck	50	29	6.1	25	29	69	.

SG105,ck	51	40	5.5	17	24	61	.
Frego bract #1	80	90	.	.	.	.	.
Frego bract #2	91	89	.	.	.	.	.
M-315	.	.	.	.	.	.	10
Rowden	.	.	.	.	.	.	70
LSD0.10	10	9	1.2	ns	ns	12	20
¹ Tarnished plant bug (tpb) test: 6 reps of 2-row plots planted between rows of mustard. Ten white flowers per plot examined for heavy, light, or no discoloration of anthers. Anther damage = (heavy *8) + (light *3) / no. flowers; Damaged squares = (heavy + light) / no. of flowers.							
² Rhizoctonia test, 3 reps in inoculated greenhouse beds. Index based on ratings of seedlings from 1 (no discoloring of roots) to 9 (dead). Damping-off = % of seedlings that died.							
³ Verticillium wilt: ca. % of plants showing symptoms of Verticillium wilt estimated at Clarkedale.							
⁴ Fusarium wilt: % dead plants at National Fusarium Wilt Test at Tallassee, AL in 2002.							

The combinations of yield adaptation, fiber properties, and specific host plant resistance traits along with the nectariless trait make these lines valuable to cotton breeding programs. Development of the two lines was supported in part by funding from Cotton Incorporated. Small quantities of Arkot 9406ne, Arkot 9605ne, and Arkot 9631ne seed may be obtained for breeding purposes from F.M. Bourland, P.O. Box 48, Northeast Research and Extension Center, Keiser, AR 72351. Unless specifically approved by the Arkansas Agricultural Experiment Station, the lines may not be used as recurrent parents in a breeding program.

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