2006 Beltwide Cotton Conferences, San Antonio, Texas - January 3 - 6, 2006

NOTICE OF RELEASE OF THREE ARKOT S23 GERMPLASM LINES OF COTTON

Don C. Jones
Cotton Incorporated
Cary, NC
Fred Bourland
University of Arkansas
Keiser, AR

The Arkansas Agricultural Experiment Station announces the release of three noncommercial breeding lines of cotton, *Gossypium hirsutum* L., designated as Arkot S23-1, Arkot S23-2, and Arkot S23-4. The primary breeding objective associated with these lines was to develop near-commercial lines from a non-traditional germplasm source.

The three lines were derived from a mixed population of germplasm developed by J. M. Stewart. A synthetic allotetraploid was made by hybridization of *G. arboreum* A2-026 and *G. armourianum* followed by doubling of the chromosome number with colchicine. The synthetic allotetraploid was crossed with *G. hirsutum* 'Hancock' and the trispecies hybrid was self-pollinated. Various morphological selections and open-pollinated bulk populations were grown for eight generations in a genetic nursery at Fayetteville, AR (area with high outcrossing). During the 8-year period the nursery contained other cultivars of *G. hirsutum*, multiple selections from the trispecies hybrid, and other interspecific hybrid combinations, especially involving *G. herbaceum.* Genetic diversity within a line was maintained each year by bulk harvesting a boll from each plant without selection. Beginning in 1995 seeds from nine lines derived from the original trispecies hybrid were bulked, and one-cycle of mass selection was performed on an isolated population at the Main Experiment Station at Fayetteville, AR. A second-cycle was employed in a planting at Southeast Branch Station at Rohwer, AR (area with low outcrossing) in 1996. Bolls were only harvested from plants possessing plant stature, fruiting, and lint color characteristics consistent with commercially grown cotton. Forty individual plants (designated at S1 through S40) were selected from the segregating population at Rohwer in 1997, and evaluated as progeny rows at two Delta locations in 1998. Nineteen of the 40 were selected and evaluated as advanced progeny in 1999 and 2000. In 2000, 54 individual plant selections were made from four (S03, S08, S21 and S23) of the progeny. Arkot S23-1, Arkot S23-2, and Arkot S23-4 were three of the 15 plants selected from the S23 progeny.

The three lines were included in nine replicated field tests from 2002 through 2004 at four Arkansas Agricultural Research Station sites in the Mississippi River Delta and compared to 'PSC 355' and 'SG 105' (Table 1). Over all tests, lint yields of the three Arkot S23 lines were intermediate between the two check cultivars. All three lines tended to have higher lint fraction, higher lint index, but poorer fiber quality (higher micronaire readings, shorter fiber length, lower fiber length uniformity, and weaker fiber strength) than the two checks.

Table 1. Performance of Arkot S23 cotton lines in 2002 (2 loc.), 2003 (5 loc.), and 2004 (2 loc.) in Arkansas.

Yr.	Strain	Lint yield	Lint fract.	Ht.	Seed Index	Lt. Ind.	Seed/ acre	Fib./ seed	Fiber properties				
									Mic	Len	Uni	Str.	Elo
		lb/a	%	cm	g	g	mil.	no.		In.	%	g/tex	%
02	S23-1	1306	38.4	109	10.4	6.7	8.759	14345	5.0	1.11	85.0	28.0	4.9
02	S23-2	1299	40.1	111	9.8	6.8	8.688	15536	4.7	1.09	84.6	26.3	5.7
02	S23-4	1249	40.2	109	9.9	7.0	8.015	16734	4.7	1.08	83.7	27.2	4.5
02	PSC355	1453	37.6	108	10.9	6.8	9.638	15093	4.7	1.15	85.0	29.2	5.1
02	SG105	1106	36.9	106	9.7	6.0	8.567	15186	4.0	1.16	85.1	29.2	5.2
02	LSD 0.10	236	2.7	7	0.6	0.7	1.610	1595	0.5	0.04	1.0	1.7	0.6
02	Pr.loc*str	>.001	0.54	0.03	0.110	0.83	<0.01	0.85	0.33	0.48	0.27	0.16	0.04
03	S23-1	892	40.9	108	11.1	7.9	5.31	16200	5.3	1.12	83.4	30.0	8.4
03	S23-2	964	43.0	98	10.4	8.0	5.41	17437	5.3	1.06	82.0	28.8	9.0
03	S23-4	931	43.0	100	10.6	8.1	5.27	17895	5.3	1.06	82.0	27.2	8.5

03	PSC355	920	39.9	100	11.3	7.6	5.52	15729	5.1	1.13	83.8	32.4	9.2
03	SG105	833	39.3	97	11.2	7.3	5.21	15524	4.9	1.15	84.3	30.8	8.7
03	LSD 0.10	71	1.2	5	0.6	0.4	0.46	940	0.2	0.02	0.6	1.0	0.2
03	Pr.loc*str	<0.001	0.785	0.03	0.1	<.01	<.01	0.09	0.13	0.48	0.32	0.27	0.07
04	S23-1	1204	40.6	106	10.5	7.2	7.574	14260	5.2	1.15	85.6	31.1	4.9
04	S23-2	1265	43.0	102	10.1	7.8	7.394	16688	5.1	1.1	83.9	27.7	6
04	S23-4	1236	43.8	98	10.5	8.3	6.816	17136	5.2	1.1	84.4	26.2	6.3
04	PSC355	1265	40.5	102	10.3	7.1	8.180	14544	4.9	1.16	86	30.7	5.6
04	SG105	1304	40.4	98	10.7	7.3	8.077	15520	4.6	1.2	85.5	31.9	5
04	LSD 0.10	113	0.8	8	0.6	0.3	0.741	1003	3.0	0.04	1.1	1.3	0.5
04	Pr.loc*str	0.18	0.01	0.58	0.07	0.00	0.02	0.19	0.09	0.62	0.23	0.04	0.09
All	S23-1	1053	40.3	108	10.8	7.5	6.582	15357	5.2	1.12	84.2	29.8	6.8
	H,E,L[1]	*2,5,2*	*1,8,0*	*2,7,0*	*1,7,1*	*2,7,0*	*0,6,3*	*0,8,1*	*4,5,0*	*0,6,3*	*1,6,2*	*1,7,1*	*0,8,1*
	H,E,L[2]	*1,7,1*	*2,7,0*	*2,7,0*	*1,6,2*	*4,4,1*	*0,8,1*	*2,7,0*	*2,7,0*	*1,6,2*	*1,6,2*	*1,2,6*	*2,3,4*
All	S23-2	1105	42.4	102	10.2	7.7	6.578	16848	5.1	1.08	83.0	28.0	7.6
	H,E,L[1]	*4,5,0*	*7,2,0*	*1,8,0*	*0,5,4*	*5,4,0*	*2,5,2*	*2,7,0*	*5,2,2*	*0,4,7*	*0,5,4*	*1,4,4*	*3,4,1*
	H,E,L[2]	*2,6,1*	*6,3,0*	*2,4,3*	*0,4,5*	*3,6,0*	*1,7,1*	*2,7,0*	*3,3,3*	*1,2,6*	*0,4,5*	*1,1,7*	*2,4,3*
All	S23-4	1069	42.6	102	10.4	7.9	6.223	17468	5.1	1.07	82.9	27.0	7.1
	H,E,L[1]	*2,7,0*	*7,2,0*	*0,9,0*	*0,7,2*	*6,3,0*	*1,6,2*	*2,7,0*	*4,5,0*	*0,2,7*	*0,4,5*	*1,1,7*	*1,7,1*
	H,E,L[2]	*2,5,2*	*7,2,0*	*3,3,3*	*0,6,3*	*5,4,0*	*1,5,3*	*2,6,1*	*2,7,0*	*0,3,6*	*0,6,3*	*0,2,7*	*1,4,4*
All	PSC355	1115	39.5	102	11.0	7.3	7.025	15324	5.0	1.14	84.6	31.3	7.5
All	SG105	998	39.0	99	10.8	7.0	6.591	15448	4.6	1.16	84.7	30.7	7.1
[1] H,E,L = no. of tests that line was significantly higher (H), equal to (E) and lower (L) than SG105.													
[2] H,E,L = no. of tests that line was significantly higher (H), equal to (E) and lower (L) than PSC355													

Yield and fiber traits of Arkot S23-2 and Arkot S23-4 were highly similar (Table 1). Both tended to have higher lint fraction, shorter plant height, lower seed index, higher lint index, more fibers per seed, shorter fiber length, lower length uniformity, and weaker fiber strength than Arkot S23-1. Seed index and fibers per seed of Arkot S23-1 were similar to the two check cultivars. In contrast, Arkot S23-2 and Arkot S23-4 had lower seed index and more fibers per seed than the check cultivars.

Yield component traits of Arkot S23-2 and Arkot S23-4 included a relatively high lint index, high number of fibers per seed, and small seed index (Table 1). Compared with the check cultivars, yield production of Arkot S23-2 and Arkot S23-4 appears to be relatively more dependent on increased lint per seed than on increased number of seed per area. According to Lewis et al. (2000), this combination of yield components should contribute to more stable yield production.

Plant heights of Arkot S23-2 and Arkot S23-4 tended to be similar to the check cultivars, while Arkot S23-1 tended to be taller than the other lines (Table 1). Open boll ratings in 2003 and 2004 indicated that Arkot S23-2 and Arkot S23-4 were earlier maturing than the check cultivars (Table 2). Over three tests, leaves of Arkot S23-2 (rating = 4.2) were more hirsute than leaves of Arkot S23-1 (rating = 2.7) and Arkot S23-4 (rating = 2.8), based on a rating scale of 1 (smooth leaf) to 7 (very hairy) (Bourland et al., 2003). Arkot S23-1 displays yellow pollen, while the other two lines have cream pollen.

In 2004, the three lines were more resistant to tarnished plant bug (*Lygus lineolaris* (Palisot de Beauvois)) than the susceptible frego-bract check and equal to the check cultivars (Table 2). In a 2004 greenhouse study, all three lines were more resistant to *Rhizoctonia solani* Kuehn (a major seedling disease pathogen) than SG 105.

Table 2. Single location measurements on Arkot S23 lines in 2003 and 2004

	03 Roh.	04 Kei.	04 Mar.	2004 Keiser, tpb test[2]		2004 Rhizoctonia test[3]	
Strain	**Open bolls[1]**	**Open bolls[1]**	**Open bolls[1]**	**Anther damage**	**Damaged squares**	**Index**	**Damping-off**
	ca. %	%	%	%	%		%
S23-1	60	53	76	13	31	6.2	34
S23-2	73	81	75	10	25	6.2	32
S23-4	70	78	79	18	38	6.6	40
PSC355,ck	50	60	75	14	33	7.1	45
SG105,ck	53	66	74	19	41	7.6	72
Frego bract #1	.	.	.	51	89	.	.
Frego bract #2	.	.	.	44	81	.	.
LSD0.10	10	9	6	5	9	1.2	23

[1] % open bolls were rated at Rohwer (2003), Keiser (2004) and Marianna (2004) near time of defoliation.

[2] 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.

[3] 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.

The three Arkot S23 lines provide an untraditional breeding material, which expresses good yielding ability. Yield components of the lines tended to be superior to the cultivar checks, but fiber quality traits are less desirable than the cultivar checks. Development of the two lines was supported in part by funding from Cotton Incorporated. Small quantities of Arkot S23-1, Arkot S23-2, and Arkot S23-4 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.

References

Bourland, F. M., J. M. Hornbeck, A. B. McFall, and, S. D. Calhoun. 2003. A rating system for leaf pubescence of cotton. J. Cotton Sci. 7:8-15.

Lewis, H., L. May, and F. Bourland. 2000. Cotton yield components and yield stability. p. 532-536. *In* Proc. Beltwide Cotton Conf., San Antonio, TX. 4-8 Jan. 2000. Natl. Cotton Counc. Am., Memphis, TN.