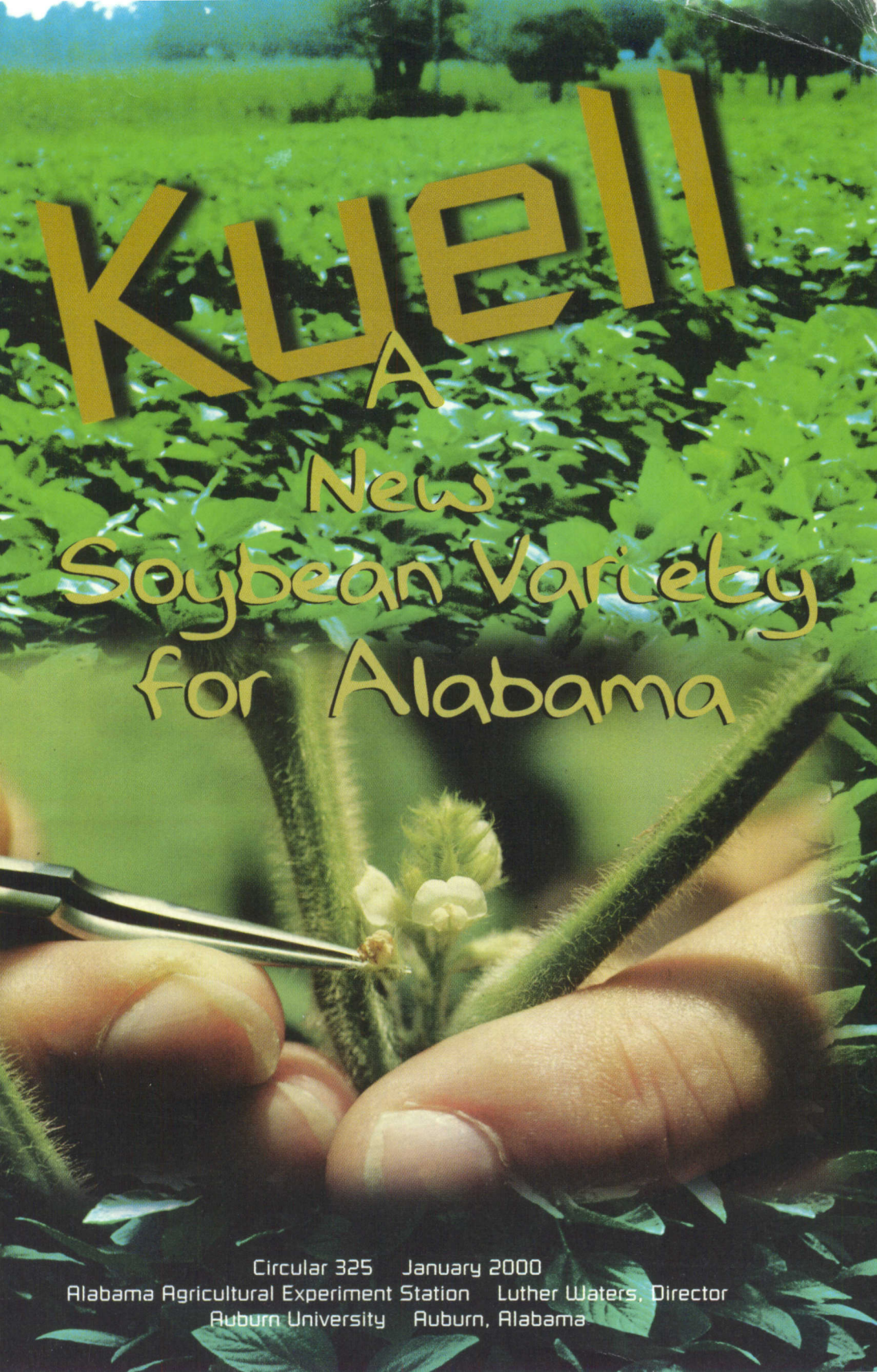

Circular 325 January 2000
Alabama Agricultural Experiment Station Luther Waters, Director
Auburn University Auburn, Alabama

First printing 2M, January 2000

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Kuell: A New Soybean Variety for Alabama

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KUELL IS A NEW SOYBEAN [*Glycine max* (L.) Merr.] variety released by the Alabama Agricultural Experiment Station (AAES) in 1999. It was released primarily to give Alabama soybean growers a Maturity Group 8 variety with a combination of high yield, good vegetative growth characteristics, and good resistance to nematodes and foliar diseases. Kuell was selected as the cultivar name after Kuell Hinson, USDA soybean breeder stationed in Gainesville, Florida, from about 1955 to 1996. Dr. Hinson developed the cultivars Bragg, Cobb, Braxton, and Kirby, all of which had a tremendous impact on southern soybean production. In addition he was a mentor for many graduate students and younger soybean breeders. Dr. Hinson passed away in 1996 soon after retirement.

Kuell originated from the cross N85-492 x Co85-483, and was composited in the F_6 generation. N85-492 is from the cross N77-179 x Johnston, and Co85-483 is from the cross Coker 368 x (Coker 317 x D77-6103). N77-179 is a selection from N70-1549 x N72-3213. The original cross was made at the Plant Breeding Unit (PBU), Tallassee, in 1988. The F_1 generation was grown during the winter of 1988-1989 in Belize, Central America, and the F_2 generation was grown at the PBU during the summer of 1989. The F_3 and F_4 generations were advanced from the F_2 by single-seed descent, and were grown in Belize during the winter of 1989-1990. F_5 seed (each tracing back to a different F_2 plant) were planted at the PBU in the summer of 1990.

Approximately 80 F_5 plants were harvested, threshed individually, and grown in F_5-derived F_6 rows in 1991. Twenty $F_{5:6}$ lines were selected, and yield testing was begun on selected $F_{5:6}$ rows in 1992. Kuell was tested under the experimental designation Au91-13 from 1992 until its release. Yield tests in Alabama consisted of four-row plots and three replications at the PBU in 1992 (preliminary test). Advanced tests were grown in 1993 at the PBU; Monroeville Experiment Field, Monroeville; and the Gulfcoast Research and Extension Center, Fairhope.

In 1994, Kuell was entered (as Au91-13) into the Southern Regional Preliminary Group 8 of the USDA Uniform Soybean Tests. It was evaluated for yield and disease and nematode resistance characteristics at four locations across the Southeast. Kuell was advanced to the Uniform Group 8 Tests for similar evaluation at 13 locations across the Southeast in 1995, 1996, and 1997. Included in these were eight late-planted environments, where planting was delayed until after June 15 to simu-

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late double-cropping. In addition to these yield test evaluations, Kuell was tested in the greenhouse for resistance to Southern root-knot nematode (*Meloidogyne incognita*), peanut root-knot nematode (*Meloidogyne arenaria*), races 3 and 14 of the soybean cyst nematode (*Heterodera glycines*), and stem canker (caused by *Diaporthe phaseolorum* f.sp. *meridionalis*). Resistance to frogeye leafspot (caused by *Cercospora sojina*) was evaluated in field plots at locations where the disease occurred naturally and in the greenhouse. Additional evaluation for seed quality, protein and oil content, and seed size was done during testing in the USDA Uniform Tests. Kuell has been evaluated in replicated yield trials across the Southeast in a total of 43 environments.

Kuell yielded greater than Stonewall (a high-yielding check cultivar released in 1988 by AAES) and Cook (a high-yielding check cultivar released in 1991 by the Georgia Agricultural Experiment Station) in Alabama tests in 1993 (table 1). Plant height was greater and maturity was later than either of the check cultivars. In the USDA Preliminary Group 8 test the following year, Kuell yielded two bushels per acre more than Cook (table 2). Kuell was lower in protein and higher in oil than the check cultivars. Seed size and lodging scores were comparable to the checks. Plants of Kuell were taller than the check cultivars. In the USDA Uniform Group 8 tests in 1995, Kuell yielded slightly over one bushel per acre more than Cook and Maxcy, was again taller than the checks, with seed size and lodging scores comparable to the checks (table 3). In the USDA Uniform 8 tests in 1996, yield of Kuell was slightly lower than Cook (table 4). In 1997 in the USDA Uniform 8 tests, Kuell yielded more than the check cultivars, was taller with higher oil and lower protein, and comparable for seed size and lodging (table 5). On average, in a total of 39 environments from 1995 through 1997, Kuell yielded 0.3 bushel per acre more than Cook and 0.9 bushel per acre more than Maxcy (table 6). Maturity ranged from three to five days later than the checks. Plant height and oil content were greater, and protein was lower. Seed size and lodging were comparable to the checks.

Yield performance of Kuell in late-planted tests is summarized in table 7, and indicates the yield superiority of Kuell in late-planted environments. Kuell averaged 2.5 bushels per acre more yield than Cook and 2.6 bushels per acre more than Maxcy. At least a portion of this yield superiority can be attributed to the greater plant height of Kuell. Factors related to vegetative growth, including plant height at maturity, have been identified in several studies as having a direct effect on seed yield of late-planted soybeans.

Disease and nematode resistance, as evaluated in the USDA Preliminary and Uniform Group 8 Tests during 1994 through 1997, showed Kuell has good resistance to races 3 and 14 of soybean cyst nematode, and good resistance to Southern root knot nematodes (tables 8, 9, 10, and 11). Greenhouse inoculation tests showed Kuell to be resistant to frogeye leaf spot, with an average of 1.2 % leaf area showing lesions compared to 15% leaf area with lesions for the susceptible Lee (data not shown). Kuell combines resistance to prevalent races of soybean cyst nematode, one species of root-knot nematode, and frogeye leaf spot with good yielding ability. Kuell is moderately susceptible to stem canker, however, and is not recommended for planting in fields that have a history of stem canker.

Kuell has determinate stem termination, purple flowers, gray pubescence, and brown pod walls. Seeds are yellow with light buff hila and dull seed coats. Breeder seed of Kuell will be maintained by the Alabama Agricultural Experiment Station. Seed should be available for commercial plantings beginning in 2001.

TABLE 1. AGRONOMIC PERFORMANCE OF KUELL AND CHECK CULTIVARS IN ALABAMA DURING 1993 AT TALLASSEE, MONROEVILLE, AND FAIRHOPE, AL

Line	Seed yield *bu/a*	Maturity date	Height *in*	Lodging[1] *score*
Kuell	38.0	10/23	42	1.5
Stonewall	33.7	10/17	28	1.0
Cook	33.2	10/15	34	1.0
LSD (0.05)	**4.4**			

[1]Lodging rated on a scale of 1 to 5, where 1 = all plants erect and 5 = all plants down.

TABLE 2. AGRONOMIC PERFORMANCE AND SEED COMPOSITION OF KUELL AND CHECK CULTIVARS IN THE USDA PRELIMINARY GROUP 8 TESTS (FOUR LOCATIONS[1]) DURING 1994

Line	Seed yield *bu/a*	Maturity date	Height *in*	Oil *—percent—*	Protein	Seed size *g/100 seed*	Lodging *score*
Kuell	45.9	10/22	41	21.1	41.4	15.0	1.6
Cook	43.9	10/24	38	20.3	44.2	15.6	1.9
Maxcy	42.8	10/22	36	20.2	44.9	14.9	1.3
Braxton	42.2	10/22	38	20.4	44.8	16.8	1.4
LSD (0.10)	**6.5**			**0.6**	**1.4**		

[1]Beaumont, TX; Plains, GA; Quincy, FL; and Tallassee, AL.

TABLE 3. AGRONOMIC PERFORMANCE AND SEED COMPOSITION OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS (13 LOCATIONS[1]) DURING 1995

Line	Seed yield *bu/a*	Maturity date	Height *in*	Oil *—percent—*	Protein	Seed size *g/100 seed*	Lodging *score*
Kuell	36.3	11/02	35	20.9	40.8	14.3	2.4
Cook	35.2	10/28	32	20.4	41.8	14.7	2.1
Maxcy	35.1	10/29	32	20.4	41.9	14.6	2.4
LSD (0.10)	**1.5**						

[1]Athens, GA (two tests); Baton Rouge, LA; Fairhope, AL; Jay, FL; Quincy, FL; Plains, GA; Tifton, GA; Beaumont, TX; Tallassee, AL; Florence, SC; Blackville, SC (two tests).

TABLE 4. AGRONOMIC PERFORMANCE AND SEED COMPOSITION OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS (13 LOCATIONS[1]) DURING 1996

Line	Seed yield *bu/a*	Maturity date	Height *in*	Oil *—percent—*	Protein	Seed size *g/100 seed*	Lodging *score*
Kuell	42.7	10/26	39	21.4	41.3	14.1	2.2
Cook	44.8	10/22	37	20.6	43.6	15.4	1.7
Maxcy	42.1	10/23	36	21.1	42.8	14.5	2.0
LSD (0.10)	**1.7**						

[1]Athens, GA (two tests); Baton Rouge, LA; Fairhope, AL; Jay, FL; Plains, GA; Beaumont, TX; Tallassee, AL (two tests); Florence, SC; Blackville, SC; Clemson, SC; Jackson Springs, NC.

TABLE 5. AGRONOMIC PERFORMANCE AND SEED COMPOSITION OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS (13 LOCATIONS[1]) DURING 1997

Line	Seed yield *bu/a*	Maturity date	Height *in*	Oil *—percent—*	Protein	Seed size *g/100 seed*	Lodging *score*
Kuell	38.6	10/31	40	20.9	40.8	13.7	2.0
Cook	36.6	10/24	37	19.5	42.6	14.4	2.0
Maxcy	37.6	10/28	37	20.0	41.4	13.5	2.0
LSD (0.10)	**2.1**						

[1]Athens, GA (two tests); Baton Rouge, LA; Fairhope, AL; Jay, FL; Plains, GA; Beaumont, TX; Tallassee, AL (two tests); Florence, SC; Blackville, SC; Clemson, SC; Jackson Springs, NC.

TABLE 6. AGRONOMIC PERFORMANCE AND SEED COMPOSITION OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS (39 ENVIRONMENTS) DURING 1995-1997

Line	Seed yield *bu/a*	Maturity date	Height *in*	Oil *—percent—*	Protein	Seed size *g/100 seed*	Lodging *score*
Kuell	39.2	10/30	38	21.1	41.2	14.0	2.2
Cook	38.9	10/25	35	20.2	42.7	14.8	1.9
Maxcy	38.3	10/27	35	20.5	42.0	14.2	2.1

TABLE 7. SUMMARY OF YIELD OF LATE-PLANTED TESTS, USDA UNIFORM GROUP 8 TESTS, EIGHT ENVIRONMENTS.[1]

Line	1995	1996	1997	Mean
Kuell	39.7	39.1	40.1	39.6
Cook	36.2	37.8	37.4	37.1
Maxcy	35.8	35.5	41.0	37.0
LSD (0.10)	**2.8**	**1.8**	**3.5**	**1.5**

[1]Athens, GA (1995-1997); Blackville, SC (1995-1997); Quincy, FL (1995); Tallassee, AL (1996). Data are included in Tables 3, 4, and 5.

TABLE 8. SEED QUALITY AND PEST RESISTANCE TRAITS OF KUELL AND CHECK CULTIVARS IN THE USDA PRELIMINARY GROUP 8 TESTS DURING 1994[1]

Line	Seed quality	*Meloidogyne arenaria*	*Meloidogyne incognita*	*Heterodera glycines* –race3–	*Heterodera glycines* –race14–	Stem canker
	score					
Kuell	1.8	1.1	1.0	1.0	2.4	2.0
Cook	1.8	1.3	1.0	5.0	5.0	1.0
Maxcy	1.9	2.0	1.1	1.0	5.0	4.0
Braxton	2.2	1.0	1.0	5.0	5.0	1.0

[1]Seed quality is rated on a 1 to 5 scale where 1 = excellent quality and 5 = very poor quality, based on a visual rating. Seed quality is determined by a variety of disease and environmental factors. *Meloidogyne arenaria* and *M. incognita* are the causal agents of Southern root-knot nematode and peanut root-knot nematode, respectively, and are rated on a 1 to 5 scale where 1 = no galling and 5 = severe galling in greenhouse tests. *Heterodera glycines* is the causal agent of soybean cyst nematode and is also rated on a 1 to 5 scale based on nematode reproduction. Stem canker is caused by *Diaporthe phaseolorum* f. sp. *meridionalis* and is rated on a 1 to 6 scale based on lesion development after toothpick inoculation in the field at Stoneville, MS.

TABLE 9. SEED QUALITY AND PEST RESISTANCE TRAITS OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS DURING 1995[1]

Line	Seed quality	*Meloidogyne arenaria*	*Meloidogyne incognita*	*Heterodera glycines* –race3–	*Heterodera glycines* –race14–	Stem canker
	score					
Kuell	1.6	4.5	1.3	1.0	1.0	3.4
Cook	1.6	2.8	2.5	4.5	1.0	1.0
Maxcy	1.6	4.0	3.0	1.6	2.8	3.1

[1]Seed quality is rated on a 1 to 5 scale where 1 = excellent quality and 5 = very poor quality, based on a visual rating. Seed quality is determined by a variety of disease and environmental factors.*Meloidogyne arenaria* and *M. incognita* are the causal agents of Southern root-knot nematode and peanut root-knot nematode, respectively, and are rated on a 1 to 5 scale where 1 = no galling and 5 = severe galling in greenhouse tests. *Heterodera glycines* is the causal agent of soybean cyst nematode and is also rated on a 1 to 5 scale based on nematode reproduction. Stem canker is caused by *Diaporthe phaseolorum* f. sp. *meridionalis* and is rated on a 1 to 6 scale based on lesion development after toothpick inoculation in the field at Stoneville, MS.

TABLE 10. SEED QUALITY AND PEST RESISTANCE TRAITS OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS DURING 1996[1]

Line	Seed quality	*Meloidogyne arenaria*	*Meloidogyne incognita*	*Heterodera glycines* –race3–	*Heterodera glycines* –race14–	Stem canker
	score					
Kuell	1.6	3.5	1.0	2.9	1.4	S
Cook	1.6	3.0	1.0	4.8	4.9	R
Maxcy	1.6	3.3	2.5	1.3	4.6	S

[1] Seed quality is rated on a 1 to 5 scale where 1 = excellent quality and 5 = very poor quality, based on a visual rating. Seed quality is determined by a variety of disease and environmental factors.
Meloidogyne arenaria and *M. incognita* are the causal agents of Southern root-knot nematode and peanut root-knot nematode, respectively, and are rated on a 1 to 5 scale where 1 = no galling and 5 = severe galling in greenhouse tests.
Heterodera glycines is the causal agent of soybean cyst nematode and is also rated on a 1 to 5 scale based on nematode reproduction.
Stem canker is caused by *Diaporthe phaseolorum* f. sp. *meridionalis* and is rated R (resistant) or S (susceptible) based on lesion development after toothpick inoculation in the field at Stoneville, MS.

TABLE 11. SEED QUALITY AND PEST RESISTANCE TRAITS OF KUELL AND CHECK CULTIVARS IN THE USDA UNIFORM GROUP 8 TESTS DURING 1997[1]

Line	Seed quality	*Meloidogyne arenaria*	*Meloidogyne incognita*	*Heterodera glycines* –race3–	*Heterodera glycines* –race14–
	score				
Kuell	2.0	5.0	1.0	2.9	1.8
Cook	2.0	4.8	1.0	4.3	4.1
Maxcy	2.0	5.0	3.8	1.0	3.9

[1] Seed quality is rated on a 1 to 5 scale where 1 = excellent quality and 5 = very poor quality, based on a visual rating. Seed quality is determined by a variety of disease and environmental factors.
Meloidogyne arenaria and *M. incognita* are the causal agents of Southern root-knot nematode and peanut root-knot nematode, respectively, and are rated on a 1 to 5 scale where 1 = no galling and 5 = severe galling in greenhouse tests.
Heterodera glycines is the causal agent of soybean cyst nematode and is also rated on a 1 to 5 scale based on nematode reproduction.