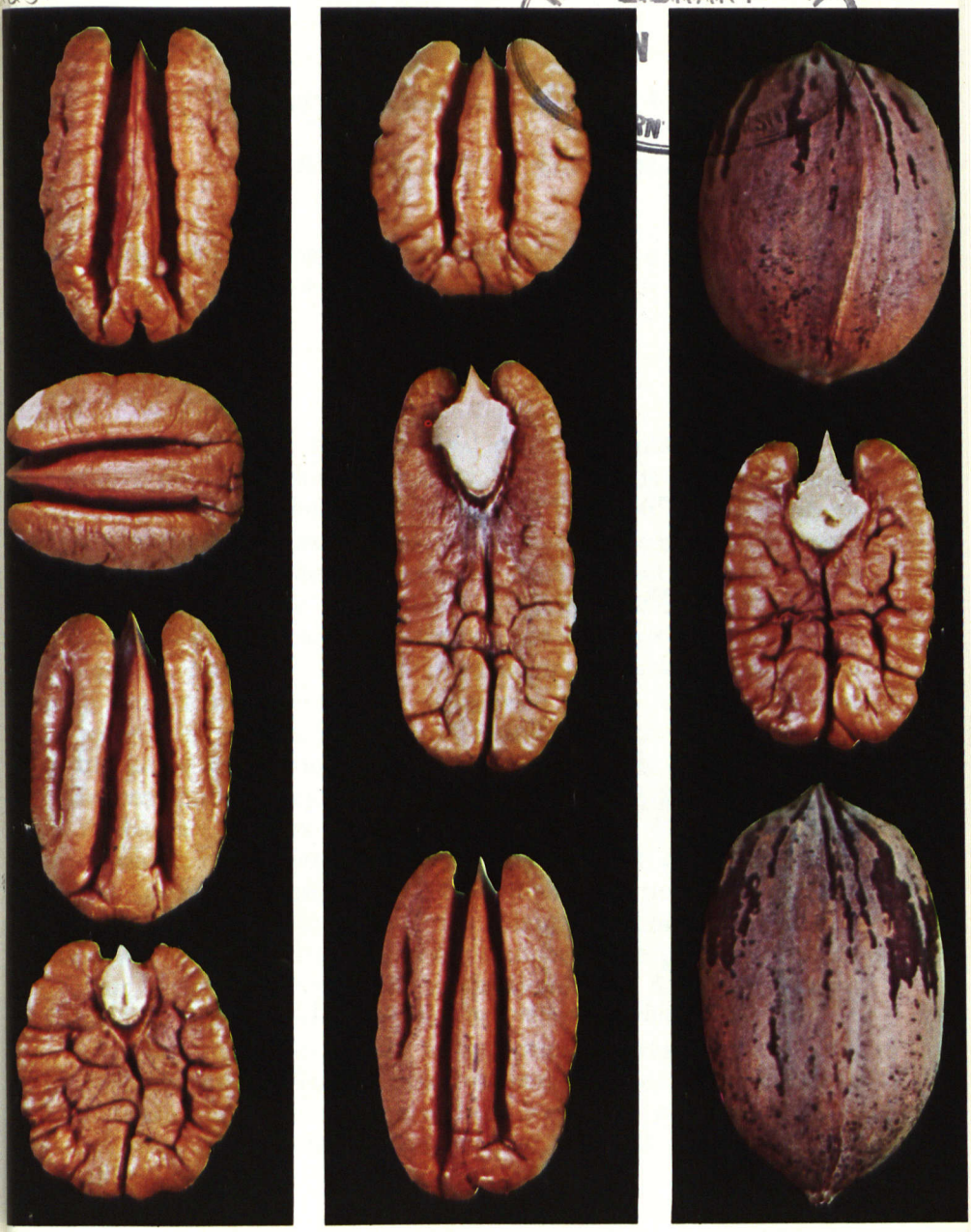


Nut Quality of Selected Pecan Varieties Grown in South Alabama

GRICULTURAL EXPERIMENT STATION / AUBURN UNIVERSITY
Dennis Rouse, Director Auburn, Alabama

CONTENTS

FIRST PRINTING 5M, NOVEMBER 1975

Nut Quality of Selected Pecan Varieties Grown In South Alabama

HARRY J. AMLING, KAREN A. MARCUS, JAMES E. BARRETT, and N. RONALD McDANIEL*

ALABAMA RANKS THIRD in total pecan production among the Nation's pecan producing states[1]. Production is primarily from named varieties rather than seedlings. Varieties that contribute most to Alabama production are Stuart, Success, Schley, and Desirable. These varieties, chance seedlings introduced in the late 1880's and early 1900's, were considered immune or highly resistant to pecan scab when introduced and first planted. Since that time, however, specific physiological forms of the pecan scab fungus have developed – first with Schley and Success and in recent times with Stuart and Desirable – that dictate the use of fungicide applications to achieve commercially accepted crops.

Success and Schley are no longer recommended for planting in Alabama. Success is unable to consistently fill nuts as trees grow older, even under intensive fertilizer and spray programs. Schley, although possessing a fine quality kernel, produces insufficient yields to justify further planting. For these reasons Success and Schley have been omitted from the present study.

Four varieties are currently recommended in Alabama: Stuart, Desirable, Elliott, and Farley[2].

A continuing pecan variety testing program was begun in 1960 to evaluate new selections and varietal releases in comparison with those currently recommended. New and more precocious pecan varieties available and intense cultural methods make possible higher yield per acre.

---

* Respectively, Professor and Research Associate, Department of Horticulture, and Superintendent and Assistant Superintendent, Gulf Coast Substation.

[1] USDA Agricultural Statistics. 1974. U.S. Government Printing Office, Washington, D.C.

[2] BAGBY, JOHN. 1970. Pecan Production. Cir. P-28. Cooperative Extension Service, Auburn University.

An objective of this testing program is to measure nut and kernel characteristics of pecan varieties and selections having potential for Alabama. This report presents results of these quality evaluations.

EXPERIMENTAL PROCEDURES AND RESULTS

Procedures

Nut samples used for quality determinations were obtained from trees grown at the Gulf Coast Substation. These trees were maintained under a complete fertilization and disease, insect, and weed control program as recommended by Auburn University. Harvesting was accomplished primarily by trunk shaking and hand harvesting. Repeated harvests were required for most varieties, with first harvest made when approximately 30 to 50 percent of the shucks had split.

Nut quality determinations were made on single-tree composite samples representing all harvests, using 1-pound samples where possible. Yearly data presented represent the average from all trees of a given variety or selection. Prior to evaluations, samples were cured at room temperature for 4 to 6 weeks until they had reached approximate constant weight.

Nut volume represents average water displacement (cubic centimeters) per nut. This value was determined by measuring the cubic centimeters of water displaced by a nut sample and dividing by the number of nuts in that sample. Percent kernel was obtained by extracting the kernels, weighing the total kernel fraction, and dividing by the nut sample weight.

Calculated percent fill is a measurement of the degree to which the interior volume of nut shell is filled by the kernel. These estimations were computed using standards and procedures described by Romberg[3]. These procedures involved determining (1) nut volume, (2) shell weight per cubic centimeter of nut volume, and (3) kernel weight per cubic centimeter of nut volume. Shell weight per cubic centimeter of the sample was matched with a standard shell weight per cubic centimeter for 100 percent filled nuts to obtain the corresponding standard kernel weight per cubic centimeter for a 100 percent nut. This value was divided into sample kernel weight per cubic centimeter to give calculated percent estimates. The amount of space available for potential filling is the interior volume within the shell.

[3] Romberg, L. D. 1952. Measurement of the Filling of Pecan Nuts. Proc. Texas Pecan Growers Assoc. 31:36-42.

Theoretically, complete filling of this space by a developed kernel would result in 100 percent filling. This is not true, however, because kernel moisture contents change between developing and mature stages. Kernels are in a hydrated state when developing and filling the shell, but moisture losses during normal ripening of the nut prior to harvest causes a shrinkage of the kernel. The result is a fill less than 100 percent. Nuts having a calculated fill value of 75 percent and over were considered to be well filled.

Nut density was obtained by dividing nut sample weight by nut sample volume as measured by volume of water displaced at total immersion. Average individual nut and kernel weights were determined by dividing the sample nut and kernel weight by the number of nuts in the sample. The number of nuts per pound was calculated by dividing the average weight of a nut in each sample into 454 grams and rounding the resulting figure off to the nearest whole number. The percent of nuts according to diameter was determined by measuring the diameter of each nut in a sample in 1/16-inch increments, and then calculating what percent of the whole sample each increment size represented. Length of each nut in a sample was measured to the nearest millimeter, then averaged.

Results

FIRST HARVEST. Eleven varieties and selections could be harvested before Elliott, the earliest ripener of currently recommended varieties. The earliest was 48-15-3, Table 1. Fifteen could be harvested before Desirable. Stuart, Farley, and Hastings consistently matured their nuts later than all others. Varieties and selections were considered early maturing if the bulk of their harvest could be completed by October 1. Fitting this category were 48-15-3, Starking, Shoshoni, Cherokee, Chickasaw, Barton, Mohawk, Wichita, Caddo, 45-3-3, and 53-11-139. Midseason ripeners were considered those that could have the bulk of their crop harvested during October. Elliott, 61-4-35, GraBohls, 45-10-23, Shawnee, Cape Fear, 61-6-96, Cheyenne, Kernodle, Mahan-Stuart, and Desirable made up this group. Prior to this investigation Stuart was not considered a late maturing variety. However, in comparison with newer introductions it would now be so classified.

NUT VOLUME. Mohawk had the largest volume and nut size, being considerably larger than Desirable, the variety currently

TABLE 1. DATE OF FIRST HARVEST OF VARIETIES AND SELECTIONS UNDER EVALUATION DURING THE PERIOD 1970-1974, GULF COAST SUBSTATION, FAIRHOPE

Variety	Harvest dates
48-15-3	September 1-9
Starking	September 7
Shoshoni	September 17
Cherokee	September 27
Chickasaw	September 27
Barton	September 27-October 1
Mohawk	September 27-October 1
Wichita	September 28-October 1
Caddo	September 28-October 1
45-3-3	October 1
53-11-139	October 1
Elliott	October 1-9
61-4-35	October 6-14
GraBohls	October 7-14
45-10-23	October 9-16
Shawnee	October 9-18
Cape Fear	October 9-18
61-6-96	October 16
Cheyenne	October 16-19
Kernodle	October 16-31
Mahan-Stuart	October 16-27
Desirable	October 16-31
Stuart	October 16-November 7
Farley	October 31-November 12
Hastings	November 6-12

being used for giant mammoth halves, Table 2. Seventeen of the 24 varieties and selections evaluated had nut volume smaller than Stuart. Starking, 48-15-3, Chickasaw, and 53-11-139 had nut volumes smaller than Elliott.

AMOUNT OF KERNEL. With the exception of Hastings, all varieties and selections evaluated had a higher percentage of kernels than did Stuart, Table 2. Mohawk, Kernodle, Wichita, Starking, 61-9-96, Shawnee, and Cheyenne averaged in excess of 58 percent kernel.

CALCULATED PERCENT FILL. The ability of varieties and selections to consistently fill nuts varied considerably, Table 2. Kernodle, Hastings, 45-10-23, Barton, GraBohls, 45-3-3, and Chickasaw appear to have the least capacity in this regard, whereas Shawnee, Shoshoni, Cape Fear, 61-4-35, Cheyenne, Wichita, Caddo, Elliott, Starking, and 48-15-3 consistently had the greatest degree of filling.

NUT DENSITY. Nut density varied among varieties, Table 2. In general, the greater the nut density the higher the calculated fill.

TABLE 2. YEARLY AVERAGE MEASUREMENTS OF SELECTED NUT AND KERNEL CHARACTERISTICS OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and year	Nut volume	Amount of kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
Mohawk						
1972	13.9	61.4	85.1	0.782	10.9	6.7
1973	17.2	56.8	69.0	.685	11.9	6.7
1974	17.1	59.4	74.3	.715	12.2	7.3
Average	16.1	59.2	76.2	.727	11.7	6.9
Kernodle						
1971	15.2	60.2	75.7	.721	11.0	6.6
1972	15.6	57.3	77.9	.749	11.7	6.7
1973	13.7	60.6	65.1	.641	8.8	5.3
Average	14.8	59.4	72.9	.703	10.5	6.2
Hastings						
1971	15.9	50.6	46.7	.542	8.6	4.4
1972	14.2	46.4	57.0	.651	9.2	4.3
1973	14.1	56.0	54.0	.575	8.1	4.6
1974	14.5	51.6	52.7	.587	8.6	4.4
Average	14.7	41.2	52.6	.588	8.6	4.4
Mahan-Stuart						
1971	13.3	59.0	83.3	.780	10.4	6.1
1972	14.9	53.6	76.6	.756	11.3	6.1
1973	13.3	60.5	79.7	.748	9.9	6.0
1974	13.9	54.7	72.2	.720	10.0	5.5
Average	13.9	57.0	78.0	.751	10.4	5.9
Desirable						
1971	13.6	53.6	75.1	.747	10.3	5.5
1972	14.3	51.6	80.5	.774	11.3	5.8
1973	12.1	54.6	68.7	.703	8.5	4.7
1974	13.6	53.1	78.9	.773	10.6	5.6
Average	13.5	53.2	75.8	.749	10.2	5.4
45-10-23						
1971	13.3	55.5	68.2	.689	9.2	5.1
1972	13.7	54.1	67.7	.705	9.5	5.1
1973	11.3	52.8	57.4	.620	7.0	3.7
Average	12.8	54.1	64.4	.671	8.6	4.6
Stuart						
1971	13.9	47.6	74.4	.770	10.7	5.1
1972	12.1	46.2	75.2	.781	9.5	4.4
1973	12.3	50.3	68.3	.714	8.8	4.4
1974	13.3	50.3	80.1	.800	10.6	5.3
Average	12.9	48.6	74.5	.766	9.9	4.8
Barton						
1971	12.0	53.2	61.7	.651	7.8	4.2
1972	14.0	53.6	75.0	.744	10.4	5.6
1973	11.1	51.1	51.1	.577	6.4	3.3
Average	12.4	52.6	62.6	.657	8.2	4.4
61-6-96						
1973	11.6	61.1	79.0	.741	8.6	5.3

Continued

TABLE 2 *(Con't.)*. YEARLY AVERAGE MEASUREMENTS OF SELECTED NUTS AND KERNEL CHARACTERISTICS OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and year	Nut volume	Amount of kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
GraBohls						
1973[3]	11.1	55.9	61.4	0.669	7.5	4.2
1974	13.1	58.9	67.5	.667	8.7	5.1
Average	12.1	57.4	64.5	.668	8.1	4.7
Shawnee						
1972[3]	11.3	64.3	90.3	.806	9.1	5.9
1973	10.7	58.8	78.5	.747	8.0	4.7
1974	11.5	56.4	78.7	.751	8.7	4.9
Average	11.2	59.8	82.5	.768	8.6	5.2
Shoshoni						
1973[3]	9.1	51.3	94.9	.879	8.0	4.1
1974	12.9	54.5	74.8	.740	9.5	5.2
Average	11.0	52.9	84.9	.809	8.8	4.7
Cape Fear						
1971	10.6	58.3	82.9	.779	8.3	4.8
1972	12.0	52.7	86.1	.809	9.7	5.1
1973	9.8	58.4	71.9	.700	6.9	4.0
1974	12.0	54.5	82.6	.784	9.4	5.1
Average	11.1	56.0	80.9	.768	8.6	4.8
Farley						
1971	11.1	51.7	68.3	.708	7.8	4.1
1972	11.2	50.5	79.9	.793	8.9	4.5
1973	10.0	54.6	77.1	.754	7.5	4.1
1974	10.2	55.3	80.0	.772	7.9	4.4
Average	10.6	53.0	76.3	.756	8.0	4.3
61-4-35						
1974	10.7	57.7	96.4	.866	9.3	5.3
45-3-3						
1974	10.6	57.1	61.2	.628	6.7	3.8
Cheyenne						
1972	10.5	62.2	82.1	.758	8.0	5.0
1973	9.3	58.6	85.6	.795	7.4	4.4
1974	9.4	58.5	75.7	.729	6.9	4.0
Average	9.7	59.8	81.1	.760	7.4	4.5
Wichita						
1972	9.1	55.6	84.3	.799	7.3	4.0
1973	10.2	62.5	82.0	.753	7.7	4.8
1974	10.4	61.9	92.9	.830	8.6	5.3
Average	9.9	60.0	86.4	.794	7.9	4.7
Cherokee						
1974	9.0	51.9	69.8	.717	6.5	3.4
Caddo						
1972	8.9	56.5	87.7	.817	7.2	4.1
1973	7.5	61.3	87.1	.795	6.0	3.7
1974	9.7	55.7	81.7	.781	7.6	4.2
Average	8.7	57.8	85.5	.797	6.9	4.0

Continued

TABLE 2 *(Con't.)*. YEARLY AVERAGE MEASUREMENTS OF SELECTED NUTS AND KERNEL CHARACTERISTICS OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and year	Nut volume	Amount of kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
Elliott						
1971	8.2	53.7	83.4	0.801	6.6	3.5
1972	8.0	53.1	90.4	.846	6.8	3.6
1973	7.1	53.7	78.9	.771	5.5	3.0
1974	8.4	52.5	82.2	.797	6.7	3.5
Average	7.9	53.3	83.7	.803	6.4	3.4
Starking						
1973	7.8	59.5	86.6	.798	6.2	3.7
48-15-3						
1972	7.2	46.8	80.3	.774	6.6	3.1
1973	7.2	57.7	84.8	.793	5.7	3.3
1974	....	55.6	....	....	5.8	3.2
Average	7.2	53.4	82.6	.783	6.0	3.2
Chickasaw						
1972[3]	7.0	58.6	72.6	.706	5.0	2.9
1974	9.3	52.6	59.4	.636	5.9	3.1
Average	8.2	55.6	66.0	.671	5.5	3.0
53-11-139						
1974	6.9	53.7	77.8	.764	5.3	2.8

[1] Calculated percent fill is the percent of the interior space of a nut that was filled by the kernel.
[2] Density was obtained by dividing nut weight by nut volume as measured by volume of water displaced at total immersion.
[3] Data taken from nut sample of limited size.

NUT WEIGHT. Mohawk, Kernodle, and Mahan-Stuart were the only varieties with heavier nut weight than Stuart and Desirable, the largest of recommended varieties. This indicates excellent inshell usage potential for them. Starking, 48-15-3, Chickasaw, and 53-11-139 had lower individual nut weights than Elliott, the smallest recommended variety.

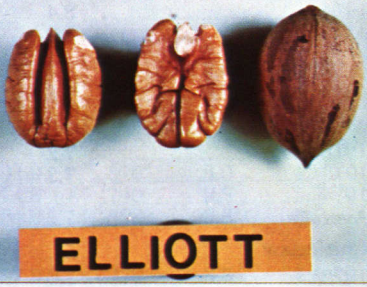
KERNEL WEIGHT. Mohawk and Mahan-Stuart kernel weights exceeded that of Desirable, indicating the potential of these varieties for producing giant mammoth halves for the shelling trade. Kernodle, although large, lacked sufficient development for such use, as indicated by calculated fill data.

Low kernel weights exhibited by 45-3-3, Cherokee, and Chickasaw reflect both insufficient kernel development and small size, whereas kernel weights of Starking, 48-15-3, and 53-11-139, although smaller than Elliott, indicate that kernels were well developed.

BARTON

CADDO

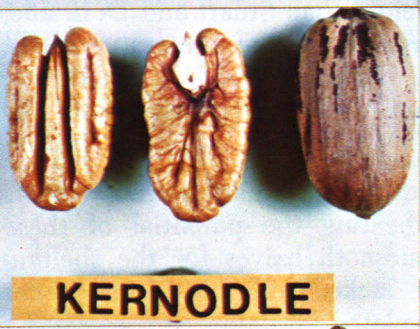
DESIRABLE



ELLIOTT

FARLEY

HASTINGS

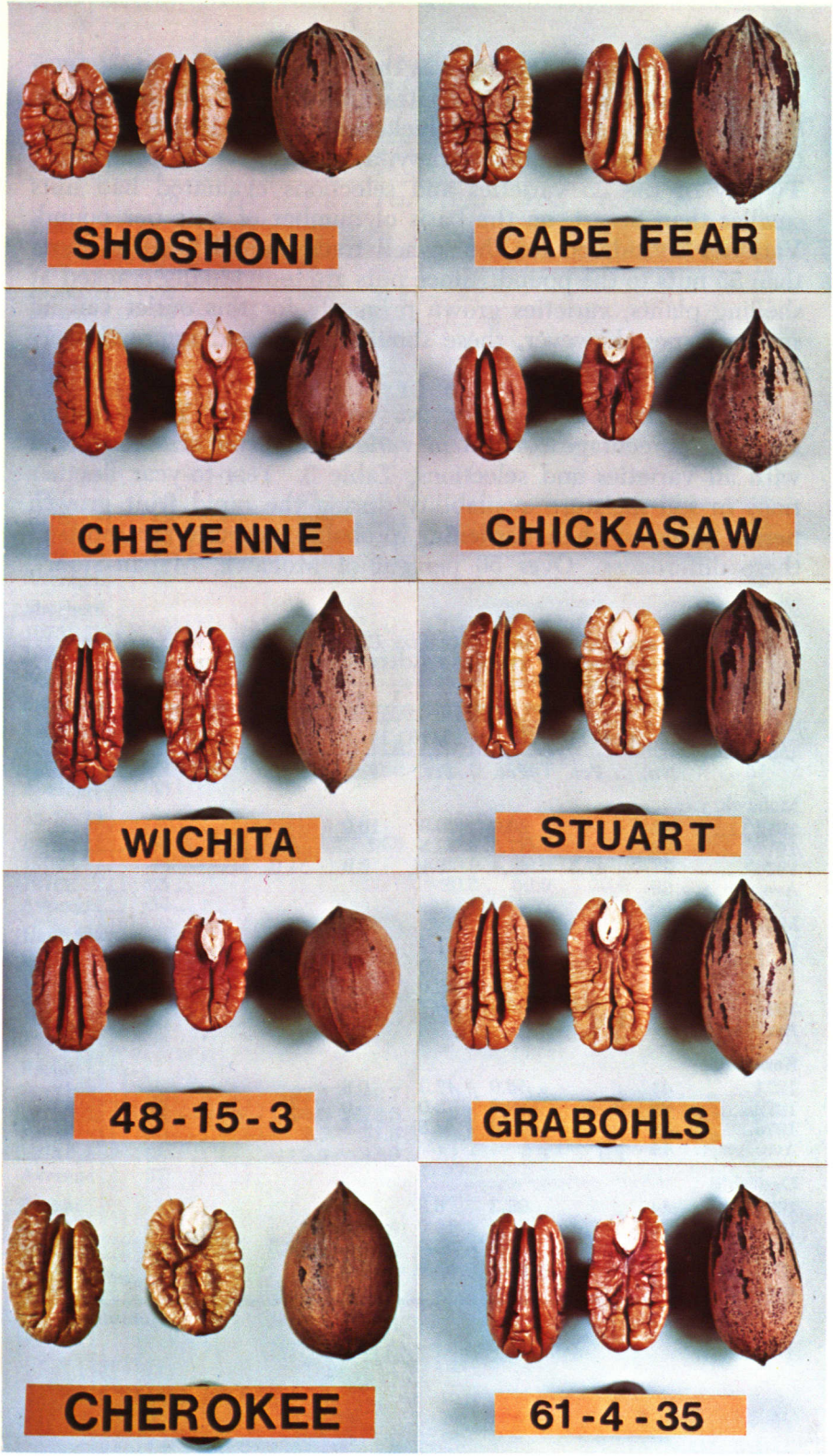


KERNODLE

MAHAN-STUART

MOHAWK

SHAWNEE


SHOSHONI
CAPE FEAR
CHEYENNE
CHICKASAW
WICHITA
STUART
48-15-3
GRABOHLS
CHEROKEE
61-4-35

NUTS PER POUND. Mohawk was the largest nut evaluated, averaging 39 nuts per pound in contrast to averages of 76, 84, and 86, respectively, for 48-15-3, Chickasaw, and 53-11-139. Elliott, the smallest recommended variety, averaged 72 nuts per pound. Twenty of the 25 varieties and selections evaluated had nuts smaller than Stuart, on the basis of number of nuts per pound. Varieties considered for the inshell trade should have no more than 55 nuts to the pound. Since nuts are individually cracked at shelling plants, varieties grown primarily for this outlet can be smaller types; however, these should not exceed approximately 75 nuts per pound.

SAMPLE PERCENTAGE ACCORDING TO DIAMETER. Yearly differences in percentage of nuts in various diameter sizes occurred with all varieties and selections, Table 3. Year-to-year fluctuations in soil moisture availability during the rapid fruit growth period prior to shell hardening probably account for most of these differences. Over 50 percent of Mohawk, Mahan-Stuart,

TABLE 3. YEARLY AVERAGES OF NUT SIZE DATA OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and vear	Nuts per pound	Percent of sample according to diameter (inches)							Nut length
		17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
Mohawk									
1972	42		20.0	70.0	10.0				48
1973	38		87.5	12.5					52
1974	37	47.5	41.4	8.1	2.0	1.0			51
Average	39								50
Mahan-Stuart									
1971	44		66.6	31.1	2.2				47
1972	40		95.0	5.0					47
1973	46		50.0	35.0	15.0				46
1974	45	2.0	30.6	58.7	8.3	0.4			47
Average	44								47
Kernodle									
1971	41		56.9	42.3	0.6				49
1972	39		20.0	75.0	5.0				49
1973	52		15.0	82.5	2.5				47
Average	44								49
Desirable									
1971	44		92.3	6.8	3.4				44
1972	40		82.5	15.0	2.5				45
1973	53		20.0	55.0	22.5	2.5			43
1974	43	1.5	23.4	67.9	7.2				46
Average	45								45

Continued

TABLE 3 *(Con't.)*. YEARLY AVERAGES OF NUT SIZE DATA OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and year	Nuts per pound	Percent of sample according to diameter (inches)							Nut length
		17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
Stuart									
1971	43		94.6	5.3					44
1972	48		20.0	66.6	13.3				42
1973	52		45.0	52.5	2.5				42
1974	43	2.5	54.4	43.1					44
Average	47								43
61-4-35									
1974	49		2.3	43.2	52.3	2.3			44
61-6-96									
1973	53			10.0	30.0	60.0			51
Hastings									
1971	53		97.3	2.6					45
1972	49		86.6	13.3					45
1973	56		63.3	10.0					45
1974	53	34.7	45.3	20.0					46
Average	53								45
Shoshoni									
1973[1]	57		100.0						33
1974	48	66.7	28.9	4.4					40
Average	53								37
Shawnee									
1972[1]	50					100.0			51
1973	57			25.0	70.0	5.0			48
1974	52		0.3	34.0	61.0	4.7			51
Average	53								50
45-10-23									
1971	50			13.5	40.5	45.9			58
1972	48				60.0	40.0			59
1973	65				20.0	50.0	30.0		55
Average	54								57
Cape Fear									
1971	55		48.7	48.1	3.1				41
1972	47		30.0	60.0	10.0				43
1973	66		2.5	47.5	45.0	2.5			41
1974	48	3.0	24.0	56.5	14.0	1.8	0.4	0.4	44
Average	54								42
Farley									
1971	58		27.2	49.7	19.5	3.5			39
1972	51		20.0	72.5	7.5				39
1973	60		2.5	57.5	32.5	7.5			38
1974	58		0.9	43.3	51.5	3.9	0.4		38
Average	57								39
Barton									
1971	58		7.7	69.8	22.4				46
1972	43		40.0	45.0	15.0				48
1973	71			15.0	70.0	15.0			47
Average	57								47

Continued

TABLE 3 (*Con't.*). YEARLY AVERAGES OF NUT SIZE DATA OF PECAN VARIETIES UNDER EVALUATION AT THE GULF COAST SUBSTATION, FAIRHOPE

Variety and year	Nuts per pound	Percent of sample according to diameter (inches)							Nut length
		17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
GraBohls									
1973[1]	61			16.6	33.3	33.3	16.6		46
1974	52		20.4	57.1	22.4				48
Average	57								47
Wichita									
1972	63				10.0	80.0	10.0		47
1973	59				50.0	50.0			50
1974	53			0.6	34.1	57.2	7.9	0.3	49
Average	58								49
Cheyenne									
1972	57			10.0	80.0	10.0			40
1973	61			30.0	60.0	10.0			40
1974	66	0.2	0.2	33.3	56.0	8.5	1.8		41
Average	61								40
Caddo									
1972	63				50.0	50.0			46
1973	76					90.0	10.0		45
1974	60			5.0	66.7	25.0	3.3		48
Average	66								46
45-3-3									
1974	68			1.7	61.7	35.8	0.8		45
Cherokee									
1974	70				100.0				38
Elliott									
1971	69		10.8	81.1	7.4	0.4			36
1972	67			53.3	46.6				36
1973	82			36.6	50.0	13.3			34
1974	68		3.6	75.8	18.6	1.6	0.4		35
Average	72								35
Starking									
1973	73				30.0	60.0	10.0		39
48-15-3									
1972	69				10.0	85.0	5.0		34
1973	79			5.0	70.0	25.0			35
1974	79				58.1	39.2	2.7		34
Average	76								34
Chickasaw									
1972[1]	91					100.0			36
1974	77			5.5	80.8	13.7			39
Average	84								38
53-11-139									
1974	86				10.4	58.9	29.9	0.8	36

[1] Data taken from nut sample of limited size.

Desirable, Stuart, Hastings, and Shoshoni nuts were 16/16 inch in diameter or larger. In contrast, over 50 percent of Shawnee, Wichita, Caddo, Starking, Chickasaw, and 53-11-139 nuts were 13/16 inch in diameter or smaller.

NUT LENGTH. Varieties and selections that had distinctly long and narrow nuts were 61-4-35, 61-6-96, 45-10-23, Shawnee, Barton, and Wichita, Table 3. Those with more rounded nuts were Chickasaw, 48-15-3, Elliott, Cheyenne, and Shoshoni. Kernels in exceptionally long nuts frequently fail to develop the entire length. This was particularly characteristic of the selection 45-10-23.

KERNEL COLOR. Elliott, Cape Fear, Kernodle, Shawnee, Cheyenne, and GraBohls stood out as having bright meats, Table 4. Cherokee and Wichita were substantially darker than Stuart, even though this is not apparent in the color plates. Bright colored kernels command higher prices than standard and amber ones.

The illustrations (pages 10-11) reflect characteristic nut and

TABLE 4. OBSERVATIONAL RATINGS OF KERNEL COLOR OF VARIETIES AND SELECTIONS EVALUATED

Variety	Kernel color[1]
Barton	3
48-15-3	3
Caddo	3
Elliott	4
Farley	3
Cape Fear	4
Kernodle	4
Mohawk	3
Shawnee	4
Shoshoni	3
Cheyenne	4
Chickasaw	3
Stuart	3
Desirable	3
45-10-23	3
Wichita	2
Cherokee	1
GraBohls	4
Hastings	3
Mahan-Stuart	3
Starking	3
61-6-96	3
61-4-35	3
53-11-139	3
45-3-3	3

[1] Kernel color rating: 1 = dark; 5 = very bright.

kernel shapes, shell markings, and kernel surface texture patterns. Comparable size differences between varieties and selections are also shown. The nuts and kernels are shown at approximately 65 percent of natural size.

Lighter colored shells of varieties and selections such as GraBohls and Mohawk are more attractive than darker shells. A kernel defect caused by the packing tissue adhering to seed coat of the kernel, referred to as fuzziness or adherence, is readily observable with Hastings and Barton.

Color rendition in these plates reflects actual appearance, except that Cherokee appears lighter than natural.

DISCUSSION

Early maturing varieties allow for movement of nuts into marketing channels generated by the Thanksgiving and Christmas holidays the same year they are harvested. Another advantage of early ripening is that machine harvesting is more efficient and greatly facilitated if carried out prior to appreciable leaf fall. However, varieties that ripen mid-October and earlier present a particular problem in the trunk shaking portion of the harvest operation. Cambium activity is still in progress at this time and bark slippage readily occurs during shaking. This bark slippage injury may result in partial to nearly complete girdling of the tree. Consequently, these early and mid-season ripening varieties may require limb shaking instead of trunk shaking to circumvent this problem.

The varieties Farley and Hastings were considered excessively late in maturing nuts.

Varieties and selections having nut diameters below 15/16 inch were prone to bird depredation, particularly if they were extremely early or late maturing varieties. Much of this depredation occurred prior to the time when nuts could be shaken down.

Most varieties and selections evaluated were smaller inshell (as indicated by nut volume, diameter, nuts per pound, and nut weight) than Stuart, which is considered a large size nut. Despite their smaller inshell size, however, kernel weight of Cape Fear, Shawnee, Shoshoni, GraBohls, 61-6-96, 61-4-35, Wichita, and Cheyenne did not appreciably differ on a per kernel weight basis from that of Stuart. This may be attributed to the greater percent kernel in nuts of these varieties and selections.

Year-to-year kernel weight differences with a variety or selec-

tion can have considerable economic impact. For example, differences as great as 1.1 grams per kernel occurred for Cape Fear between years 1972 and 1973. Such differences could amount to a per acre kernel yield difference of about 200 pounds, as shown by the following computation: A Cape Fear tree that yields 40 pounds of nuts with a 47 nuts to the pound count has matured approximately 1,880 nuts. If the resulting kernels extracted from these nuts averaged 5.1 grams, the yield of that tree would amount to about 21.1 pounds of kernel. If the same tree were subjected to untimely drought stresses, these 1,880 nuts could have a 66 nuts to the pound count, or a 4.0-gram average kernel weight. This would result in only 16.3 pounds of kernel being produced by the same tree, a difference of 4.8 pounds per tree. When applied to a high density planting of trees spaced 35 × 30 feet (41.5 trees to the acre), this difference would amount to 199.2 pounds of kernel per acre. Uncontrolled drought stresses, whether due to insufficient rainfall and/or excessive orchard floor vegetation, can therefore readily reduce the marketable yield of any variety.

Of the varieties and selections evaluated for 2 years or longer, Shawnee, Shoshoni, Cape Fear, Cheyenne, Wichita, Caddo, Elliott, and 48-15-3 had the greatest capacity to fill nuts consistently year after year. The ability of Mohawk, Mahan-Stuart, Desirable, Stuart, and Farley to fill nuts was only slightly less. In comparison, Kernodle, Hastings, 45-10-23, Barton, and Chickasaw appear to be lacking in this ability to consistently fill nuts, particularly in large crop years. Even though these latter varieties, with the exception of Hastings, had kernel percentages in excess of 50 percent, the kernel could be characterized as being thin rather than the desired plump state. Stuart's ability to consistently fill in high crop years and its large size probably explain the variety's long standing popularity.

Ripening date and nut and kernel characteristics are only a part of the overall considerations that must be evaluated in identifying successful commercial varieties. Such aspects as the degree of prolificness, productivity, scab resistance, and adaptability to high density plantings also must be considered and may override the less objectionable nut and kernel qualities.

APPENDIX

Origin and Observations of Varieties and Selections

Barton. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Moore × Success cross made in 1937, tested as USDA T-15, introduced in 1953. Heavy crop set on trees severely reduces kernel yield and quality.

Caddo. Originated in Philema, Georgia, by late C. A. Reed, USDA. Brooks × Alley cross made in 1922 or 1923; tested as Philema 1175. Difficulty encountered in shelling in respect to damaging kernel shoulders.

Desirable. Originated in Ocean Springs, Mississippi. Chance seedling of Success selected about 1903; introduced in 1930. Shellers use this variety to obtain mammoth halves.

Elliott. Originated in Santa Rosa County, Florida. Parentage unknown, discovered about 1915, introduced about 1925. A round nut that consistently is well filled. Shells readily into intact halves.

Farley. Originated in Jackson County, Florida, parentage unknown. Discovered about 1918, introduced about 1925. Difficult to harvest at Gulf Coast Substation before extensive bird predation. A squarish shaped nut considered too late in maturity for commercial plantings.

Hastings. Originated in Monticello, Florida. Open-pollinated seedling of Stuart selected about 1945, introduced as a patented variety in 1955. Large oval nuts with thin shell. Packing tissue within shell adheres to kernel, kernels tend to be hollow. Hastings has consistently been the poorest quality variety evaluated.

Kernodle. Originated in Camp Hill, Alabama, by late Julius A. Kernodle. Chance seedling discovered in 1948, introduced in 1957, patented in 1958. A large flat nut; lacks ability to fill in heavy crop years. Kernels have attractive appearance and can be cracked into halves readily, but show some tendency to exhibit dark markings on kernel surface.

Mahan-Stuart. Originated in Monticello, Florida. Mahan × Stuart seedling selected in 1948, introduced in 1956 as a patented variety. A large elongated oval nut with good kernel quality.

Mohawk. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Success × Mahan cross made in 1946, selected in 1954, tested as 46-15-195. Introduced in 1965. A large nut having good inshell and potential shelling possibilities for the commercial grower.

Shawnee. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Schley × Barton cross made in 1949, tested as 49-17-166, introduced in 1968. Excellent quality nut.

Shoshoni. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Odom × Evers cross made in 1944, tested as 44-15-59, released in 1972 by G. Madden. A large, early maturing nut possessing resilient shell making cracking somewhat difficult. Shells out intact halves readily. A good possibility for the early inshell as well as shelling trade.

Cape Fear. Originated at the Coastal Plain Branch Station of the North Carolina Experiment Station, Willard, North Carolina. Open-pollinated seedling of Schley planted in 1912, introduced in 1941. Inshell nut re-

sembles Stuart but has brighter kernels and higher percent kernel. Just slightly smaller inshell than Stuart.

Cheyenne. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Clark × Odom cross made in 1942, tested as 42-13-2, introduced by G. Madden in 1970. Has bright kernels, high percent kernel. Has ability to fill in years of high crop load. This variety considered most adaptable for high density plantings in Alabama.

Chickasaw: Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Brooks × Evers cross made in 1944. Tested as 44-4-101, released in 1972 by G. Madden. A small nut that may not fill satisfactorily in years of high crop loads.

Wichita. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Halberg × Mahan cross made in 1940. Tested as 40-9-193 and released in 1959. Has ability to fill nuts in years of heavy crop loads. Kernel color deteriorates rapidly.

Stuart. Chance seedling transplanted from Mobile, Alabama, to Pascagoula, Mississippi, in 1874. Nursery trees offered for sale about 1892 by a Colonel Stuart. Lowest percent kernel of varieties evaluated.

45-10-23. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Moore × Mahan cross made in 1945. An elongated nut that does not fill sufficiently. Not illustrated.

Starking. Originated in Brunswick, Missouri, by G. James. Chance seedling, parentage unknown, discovered in 1947, introduced in 1954, patented in 1955. A small nut having no apparent commercial attributes.

48-15-3. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Major × Evers cross made in 1948. The earliest maturing selection evaluated. A small nut that readily cracks into intact halves.

61-6-96. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Mohawk × Starking cross made in 1961. A large, attractive, inshell nut. Not illustrated.

GraBohls. Originated near Austin, Texas, by the late H. C. Bohls. Possibly a Mahan × Odom cross made in the 1940's. Originally named Mary. Introduced in 1973, patented in 1974. This variety has not exhibited the ability to fill its nuts even under light fruit set.

Cherokee. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Schley × Evers cross made in 1948; tested as 48-22-27 and released in 1971 by G. Madden. Kernel color is normally darker than desired.

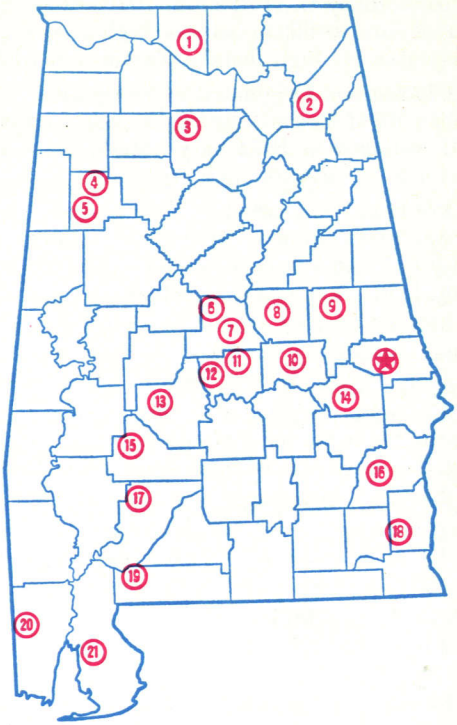
53-11-139. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Moore × Stuart cross made in 1953. Smallest selection evaluated. Not illustrated.

45-3-3. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Brake × Georgia No. 1004 cross made in 1945. Selection did not exhibit ability to fill in this evaluation. Not illustrated.

61-4-35. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Schley × Starking cross made in 1961. Medium size, well filled.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

★ Main Agricultural Experiment Station, Auburn.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Thorsby Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. Tuskegee Experiment Field, Tuskegee.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Ornamental Horticulture Field Station, Spring Hill.
21. Gulf Coast Substation, Fairhope.