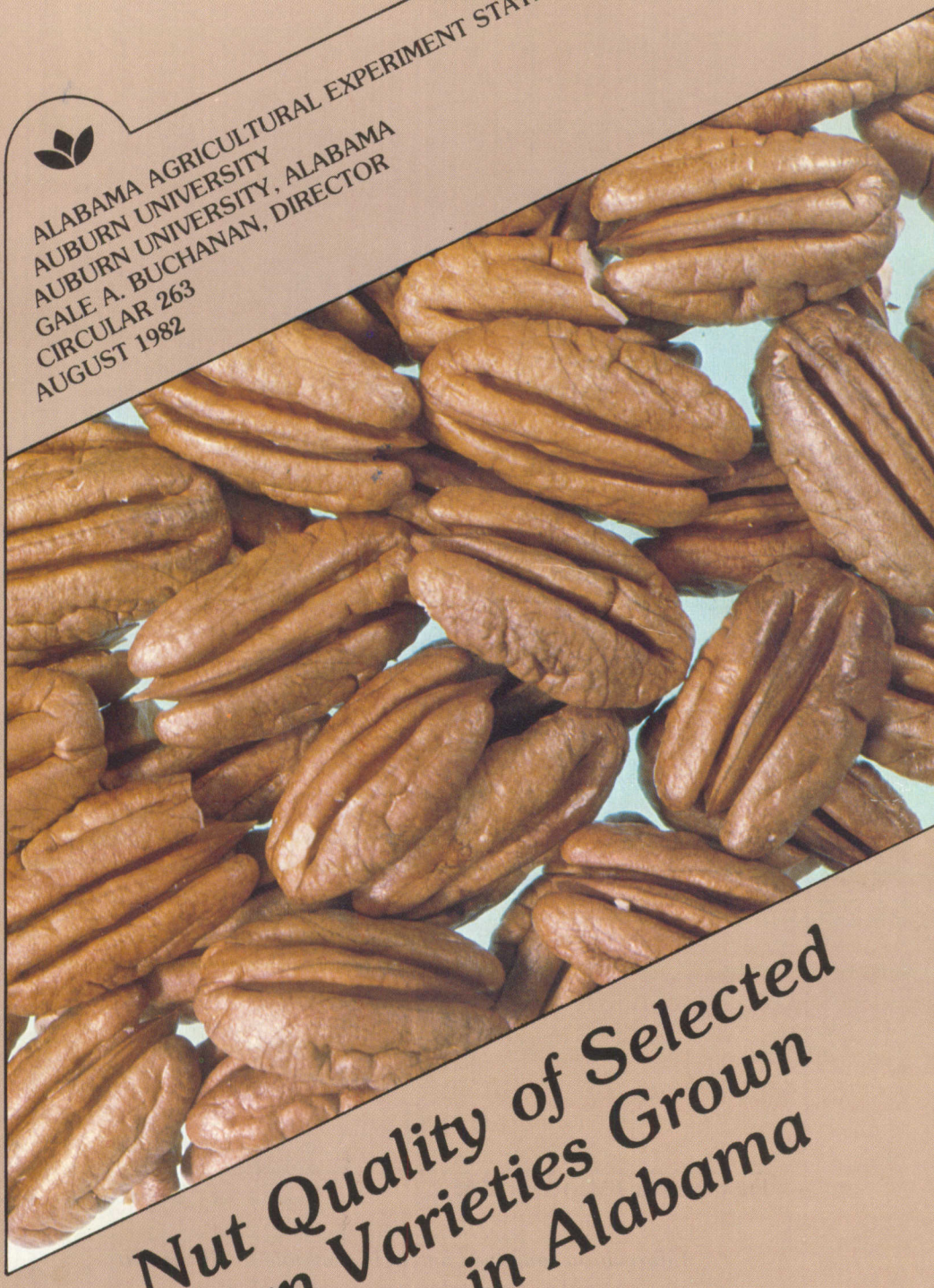
ALABAMA AGRICULTURAL EXPERIMENT STATION
AUBURN UNIVERSITY
AUBURN UNIVERSITY, ALABAMA
GALE A. BUCHANAN, DIRECTOR
CIRCULAR 263
AUGUST 1982



Nut Quality of Selected Pecan Varieties Grown in Alabama

CONTENTS

Page

EXPERIMENTAL PROCEDURES AND RESULTS 4
Procedures 4
Results 5

DISCUSSION 19

APPENDIX 21
Origin and Observations of Varieties and Selections 21

FIRST PRINTING 6M, AUGUST 1982

Nut Quality of Selected Pecan Varieties Grown in Alabama

HARRY J. AMLING, JACKIE SNELL, EMMETT CARDEN,
and N. RONALD McDANIEL[1]

ALABAMA RANKS near the top in total pecan production each year among the nation's pecan producing states[2]. 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. Since that time, however, physiological forms of the pecan scab fungus developed that were able to infect these varieties, first Schley and then Success, and in recent times Stuart and Desirable. As a result, fungicide applications for scab control are now necessary to achieve commercially accepted crops.

A pecan variety testing program was begun by the Alabama Agricultural Experiment Station in 1960 to evaluate new selections and varietal releases in comparison with those currently recommended. Based on this research, nine varieties are currently recommended for commercial planting in Alabama: Stuart, Desirable, Elliott, Cheyenne, Kiowa, Cape Fear, Choctaw, Forkert, and Sumner[3].

Success and Schley are no longer recommended for commercial planting in Alabama. Success does not 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.

---

[1]Respectively, Professor and Research Associate, Department of Horticulture, and Superintendent and Associate Superintendent, Gulf Coast Substation.

[2]USDA AGRICULTURAL STATISTICS. 1978. U.S. Government Printing Office, Washington, D. C.

[3]HAGLER, BEN, HARRY AMLING, JOHN EVEREST, AND JOHN MCVAY. 1982. Pecan Production. Cir. ANR-54. Cooperative Extension Service, Auburn University.

An objective of the current testing program is to measure nut and kernel characteristics of pecan varieties and selections having acceptable production potential for Alabama. This report presents these results.

EXPERIMENTAL PROCEDURES AND RESULTS

Procedures

Nut samples used for quality determinations were obtained primarily from trees grown at the Gulf Coast Substation, Fairhope. 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 mechanical trunk shaking and hand harvesting. Repeated harvests were required for most varieties. The first harvest was made when approximately 30 to 50 percent of the shucks had split.

Nut quality determinations were made on 1-pound, single-tree composite samples representing all harvests. 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 constant weight. Color quality was reduced by this curing process.

Nut volume data represent average water displacement 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 data were obtained by extracting the kernels, weighing the total kernel fraction, and dividing by the nut 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[4]. 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 of an equal volume of 100 percent filled nuts to obtain the corresponding standard kernel weight per cubic centimeter for a 100 percent filled nut. This value was divided into sample kernel weight per cubic centimeter to give calculated percent

[4]ROMBERG, L. D. 1952. Measurement of the Filling of Pecan Nuts. Pro. Texas Pecan Growers Assoc. 31:36-42.

fill estimates. The amount of space available for potential filling is the interior volume within the shell. 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 cause a shrinkage of the kernel before harvest. 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. Average 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 determined. The percentage of nuts in each diameter classification was determined by measuring the diameter in 1/16-inch increments of each nut in a sample and then calculating what percent of the whole sample was in each increment size. Length of each nut in a sample was measured to the nearest millimeter.

Results

FIRST HARVEST. 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. In this category were 48-15-3, Starking, Shoshoni, Cherokee, Chickasaw, Barton, Mohawk, Wichita, Caddo, 45-3-3, and 53-11-139. Eleven varieties and selections were harvested before Elliott, the earliest ripener among currently recommended varieties. The earliest ripener was a numbered selection, 48-15-3, table 1. 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 new introductions it would now be so classified.

Degree of shuck split was used as a measure of maturity, and an index was made of varieties and numbered selections that fruited for the first time in 1981, using Cheyenne as a reference, table 2. The USDA selection, 61-6-67, was as early as

TABLE 1. DATE OF FIRST HARVEST OF VARIETIES AND SELECTIONS UNDER EVALUATION DURING THE PERIOD 1970-74, 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

TABLE 2. INDEX OF DEGREE OF SHUCK SPLIT OF SELECTED VARIETIES TAKEN ON OCTOBER 7, 1981, GULF COAST SUBSTATION, FAIRHOPE

Variety	Degree of shuck split[1]
Cheyenne	+++
61-6-67	+++
Kiowa	++
Choctaw	+
Forkert	+
53-9-1	+
49-20-112	–
Jackson	–
Melrose	–

[1] + + + harvestable; + + moderate splitting; + slight splitting; – no splitting evident.

Cheyenne according to shuck split ratings made October 7. Kiowa, Choctaw, 53-9-1, and Forkert exhibited sufficient splitting to be classified mid-season ripeners, while 49-20-112, Jackson, and Melrose were considered late maturing varieties.

NUT VOLUME. Mohawk had the largest volume and nut size, being considerably larger than Desirable, the variety currently being used for giant mammoth halves, tables 3 and 4. Twenty-one of the 34 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.

PERCENT KERNEL. With the exception of Hastings and Tejas, all varieties and selections evaluated had a higher percent of kernel than did Stuart, table 3. 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 3. Kernodle, Hastings, 45-10-23, Barton, GraBohls, 45-3-3, Chickasaw, and Tejas appear to have the least capacity in this regard, whereas Shawnee, Cape Fear, 61-4-35, Cheyenne, Wichita, Caddo, Elliott, Starking, and 48-15-3 consistently had the greatest degree of fillings. Cape Fear and Shoshoni had a high capacity to fill their nuts as young trees, but this capacity dropped consistently as the trees aged.

NUT DENSITY. Nut density varied among varieties, table 3. In general, the greater the nut density the higher the calculated fill.

NUT WEIGHT. Mohawk, Kernodle, Mahan-Stuart, 53-9-1, 61-6-67, and Kiowa were the only varieties with heavier nuts than Desirable, the largest of the recommended varieties. Starking, 48-15-3, Chickasaw, and 53-11-139 had lower individual nut weights than Elliott, the smallest recommended variety.

KERNEL WEIGHT. Kernel weight of Mohawk, Forkert, Kiowa, Mahan-Stuart, and 53-9-1 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.

NUTS PER POUND. Mohawk, 53-9-1, and Kiowa were the largest nuts evaluated with 37, 39, and 40 nuts per pound in contrast to 83, 78, and 78 nuts per pound for 48-15-3, Chickasaw, and 53-11-139. Elliott, the smallest recommended vari-

TABLE 3. 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	Percent 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
1975	16.4	59.2	61.9	.623	10.2	6.0
1977	14.9	59.3	54.2	.563	8.4	5.0
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
1975	15.8	58.0	69.0	.683	10.8	6.2
1976	18.1	56.0	65.8	.669	12.1	6.8
1977	16.9	59.2	62.4	.629	10.6	6.3
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
1975	13.9	42.2	33.7	.467	6.5	2.8
1976	16.7	49.2	47.4	.557	9.3	4.6
1977	15.5	48.5	45.0	.539	8.3	4.1
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
1975	14.3	60.7	73.9	.708	10.1	6.2
1976	15.0	55.6	68.1	.688	10.3	5.7
1977	15.3	53.7	57.6	.615	9.5	5.1
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
1975	12.3	50.4	63.3	.676	8.3	4.2
1976	14.6	51.8	73.3	.743	10.8	5.6
1977	15.8	53.0	55.8	.606	9.6	5.1
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
1975	10.9	51.9	53.7	.595	6.5	3.4
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
1975	12.1	46.3	63.9	.703	8.5	3.9
1977	11.4	48.6	72.7	.754	8.6	4.2

Continued

TABLE 3 *(Continued)*. 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	Percent kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
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
1975	11.9	48.0	48.9	.576	6.8	3.3
1977	10.8	49.9	44.9	.530	5.8	2.9
61-6-96						
1973	11.6	61.1	79.0	.741	8.6	5.3
1975	13.2	57.1	72.8	.715	9.5	5.4
61-4-35						
1974	10.7	57.7	96.4	.866	9.3	5.3
1975	11.0	59.2	86.3	.798	8.8	5.2
45-3-3						
1974	10.6	57.1	96.4	.628	6.7	3.8
1975	10.1	53.6	64.0	.666	6.7	3.6
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
1975	10.0	57.4	77.7	.720	7.2	4.1
1976	10.0	55.4	75.3	.738	7.4	4.1
1977	9.8	56.7	69.4	.685	6.6	3.8
1981	9.8	54.7	75.8	.743	7.3	4.0
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
1975	10.1	59.1	88.8	.814	8.2	4.8
1976	10.2	59.5	75.1	.720	7.3	4.4
1981	10.2	58.9	93.7	.845	8.61	5.1
Cherokee						
1974	9.0	51.9	69.8	.717	6.5	3.4
1975	8.8	57.2	82.6	.773	6.8	3.9
1977	—	54.1	71.5	.719	6.7	3.6
1981	8.2	43.8	53.1	.635	5.2	2.3
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
1975	9.2	56.1	75.3	.736	6.7	3.8
GraBohls						
1973[3]	11.1	55.9	61.4	.669	7.5	4.2
1974	13.1	58.9	67.5	.667	8.7	5.1
1977	13.4	58.7	58.6	.601	8.0	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
1975	11.8	55.1	69.2	.697	8.3	4.6
1976	11.6	53.7	62.9	.658	7.7	4.1

Continued

TABLE 3 *(Continued)*. 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	Percent kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
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
1977	13.6	52.2	63.8	.672	9.2	4.8
1981	11.4	50.6	63.5	.678	7.7	3.9
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
1975	10.2	48.3	54.1	.614	6.3	3.1
1977	14.2	55.8	57.4	.606	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
1975	9.5	53.7	72.2	.725	6.9	3.7
1976	10.9	55.6	72.2	.719	7.9	4.4
1977	11.7	53.4	66.1	.684	8.0	4.3
Elliott						
1971	8.2	53.7	83.4	.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
1975	7.7	49.9	69.5	.725	5.6	2.8
1977	9.0	51.5	71.2	.729	6.5	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
1977	6.2	54.0	68.7	.700	4.4	2.4
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
1975	10.5	56.6	60.4	.624	6.6	3.7
1977	10.2	50.5	52.3	.591	6.0	3.0
1981	7.95	50.4	59.2	.647	5.1	2.6
53-11-139						
1974	6.9	53.7	77.8	.764	5.3	2.8
1975	8.2	52.2	67.0	.696	5.7	3.0
1976	8.3	54.0	69.2	.704	5.8	3.2
1977	8.2	54.0	72.1	.724	5.9	3.2
Tejas						
1975	9.4	49.4	58.0	.642	6.0	3.0
1977	10.5	46.4	63.1	.698	7.3	3.4

Continued

TABLE 3 *(Continued)*. 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	Percent kernel	Calculated fill[1]	Nut density[2]	Nut weight	Kernel weight
	cc	*Pct.*	*Pct.*		*Grams*	*Grams*
Choctaw						
1981[3]	12.5	52.2	77.1	.766	9.6	5.0
Forkert						
1981[3]	12.9	61.8	82.9	.765	9.9	6.1
53-9-1						
1981	14.7	56.6	83.5	.789	11.6	6.6
Kiowa						
1981	15.0	58.2	79.1	.753	11.3	6.6
Melrose						
1981[3]	10.8	54.6	81.0	.781	8.5	4.6
Sumner						
1981[3, 4]	9.0	56.5	83.0	.787	7.1	4.0
61-6-67						
1981	12.9	52.4	81.9	.796	10.3	5.4
49-20-112						
1981	11.4	52.9	69.1	.707	8.1	4.3

[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.
[4]Nuts collected at Auburn.

ety, had a range of 67 to 82 nuts per pound depending on year harvested. Twenty-four of the 34 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. All varieties and selections showed yearly differences in percentage of nuts in various diameter sizes, table 4. Year-to-year fluctuations in soil moisture availability during the rapid fruit growth period prior to shell hardening may account for most of these differences. Over 50 percent of Mohawk, Mahan-Stuart, Desirable, Stuart, Hastings, Kiowa, Choctaw, Forkert, Shoshoni,


DESIRABLE
FARLEY
KERNODLE
MAHAN - STUART
MOHAWK
SHOSHONI
CAPE FEAR
CHICKASAW
WICHITA
STUART

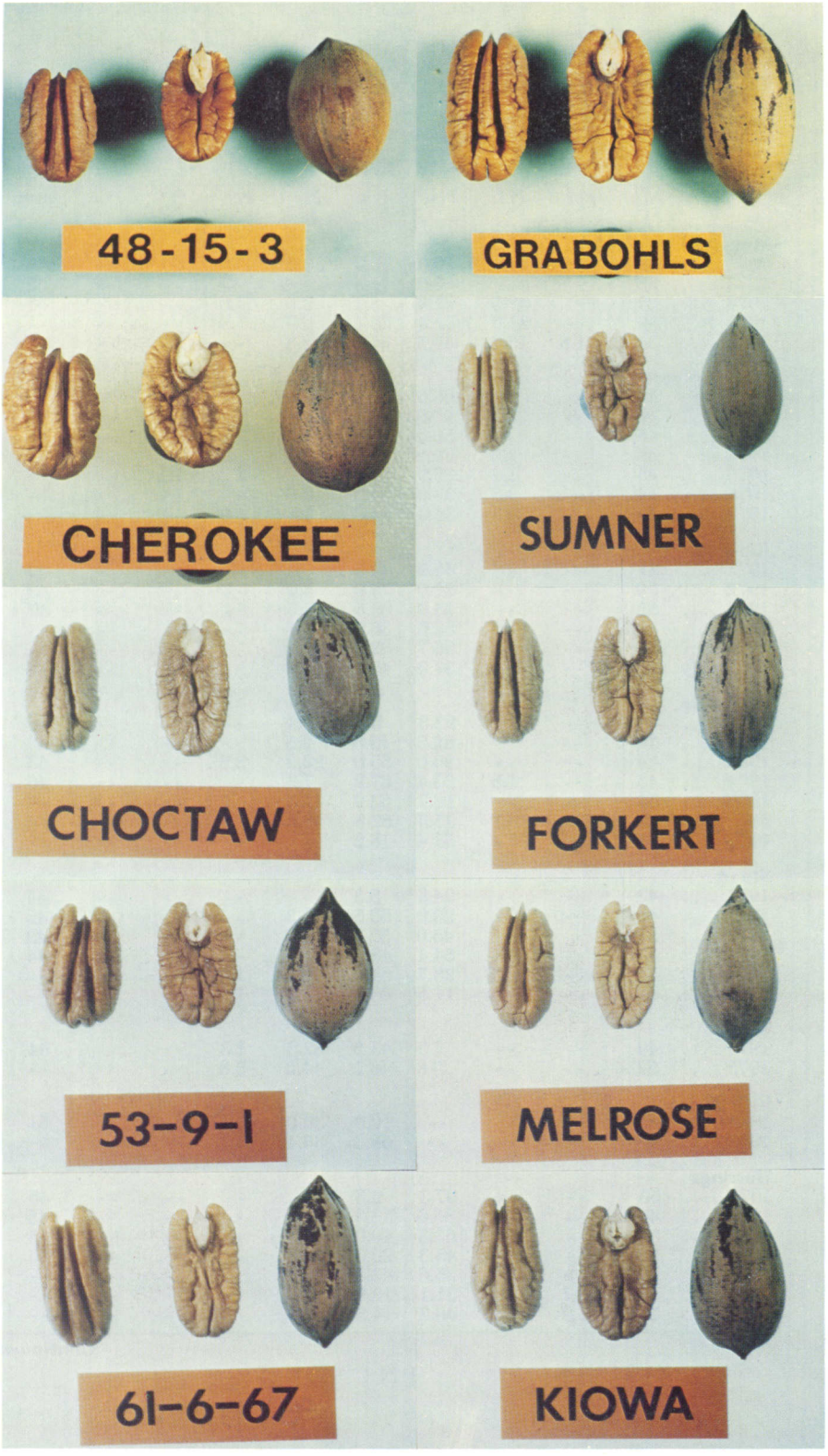

48-15-3
GRABOHLS
CHEROKEE
SUMNER
CHOCTAW
FORKERT
53-9-1
MELROSE
61-6-67
KIOWA

TABLE 4. 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
		18/16	17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*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
1975	49	--	21.6	42.4	29.1	6.0	.9	--	--	--
1977	54	1.8	15.7	44.5	35.2	2.8	--	--	--	--
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	.4	--	--	47
1975	45	--	1.2	39.9	53.5	2.2	2.2	1.1	--	--
1976	44	--	3.8	30.0	56.3	10.0	--	--	--	--
1977	49	--	19.6	54.9	22.8	1.8	.9	--	--	--
Kernodle										
1971	41	--	--	56.9	42.3	.6	--	--	--	49
1972	39	--	--	20.0	75.0	5.0	--	--	--	49
1973	52	--	--	15.0	82.5	2.5	--	--	--	47
1975	42	--	11.0	52.5	36.0	.5	--	--	--	--
1976	38	--	4.2	56.7	32.3	6.9	--	--	--	--
1977	43	--	6.9	37.3	45.1	10.8	--	--	--	--
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
1975	55	--	--	18.7	62.9	17.5	.9	--	--	--
1976	42	--	3.1	37.3	52.8	6.2	.6	--	--	--
1977	48	1.0	23.4	57.4	18.2	--	--	--	--	--
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
1975	54	--	.5	25.7	64.0	8.8	1.0	--	--	--
1977	53	--	--	11.5	80.8	5.8	1.9	--	--	--
61-4-35										
1974	49	--	--	2.3	43.2	52.3	2.3	--	--	44
1975	52	--	--	3.8	46.2	44.2	5.8	--	--	--
61-6-96										
1973	53	--	--	--	10.0	30.0	60.0	--	--	51
1975	48	--	--	--	58.3	35.4	6.3	--	--	--
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
1975	70	--	13.8	35.6	43.5	6.6	.5	--	--	--
1976	49	8.7	47.3	31.1	12.9	--	--	--	--	--
1977	55	7.0	29.3	46.2	14.5	3.0	--	--	--	--

Continued

TABLE 4 *(Continued)*. 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
		18/16	17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
Shoshoni										
1973[1] ...	57	--	--	100.0	--	--	--	--	--	33
1974	48	--	66.7	28.9	4.4	--	--	--	--	40
1977	50	--	57.5	31.9	8.5	2.1	--	--	--	--
1981	59	11.9	18.6	30.5	37.3	1.7	--	--	--	41
Shawnee										
1972[1] ...	50	--	--	--	--	--	100.0	--	--	51
1973	57	--	--	--	25.0	70.0	5.0	--	--	48
1974	52	--	--	.3	34.0	61.0	4.7	--	--	51
1975	55	--	--	--	2.0	34.6	59.1	4.3	--	--
1976	60	--	--	--	1.0	24.3	61.4	13.3	--	--
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
1975	70	--	--	--	--	7.0	67.6	25.4	--	--
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	.4	.4	44
1975	74	--	--	5.4	47.3	35.8	9.9	1.6	--	--
1977	53	--	27.5	48.7	23.8	--	--	--	--	--
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	--	--	.9	43.3	51.5	3.9	.4	--	38
1975	66	--	--	.4	21.2	58.3	19.8	.4	--	--
1976	58	--	--	1.9	33.1	50.0	15.0	--	--	--
1977	57	--	4.7	45.1	37.6	11.0	1.7	--	--	--
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
1975	67	--	--	--	19.8	66.9	13.3	--	--	--
1977	80	--	--	--	23.4	65.0	11.6	--	--	--
GraBohls										
1973[1] ...	61	--	--	--	16.6	33.3	33.3	16.6	--	46
1974	52	--	--	20.4	57.1	22.4	--	--	--	48
1977	56	--	--	24.1	51.7	20.7	--	--	--	--
Wichita										
1972	63	--	--	--	--	10.0	80.0	10.0	--	47
1973	59	--	--	--	--	50.0	50.0	--	--	50
1974	53	--	--	--	.6	34.1	57.2	7.9	.3	49
1975	56	--	--	--	.3	23.6	64.3	10.5	1.3	--
1976	62	--	--	--	--	4.9	61.8	33.3	--	--
1981	53	--	--	--	45.2	49.1	5.7	--	--	--

Continued

TABLE 4 *(Continued)*. 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
		18/16	17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
Cheyenne										
1972	57	--	--	--	10.0	80.0	10.0	--	--	40
1973	61	--	--	--	30.0	60.0	10.0	--	--	40
1974	66	--	.2	.2	33.3	56.0	8.5	1.8	--	41
1975	63	--	--	1.8	37.4	49.7	8.1	3.0	--	--
1976	63	--	--	.8	34.1	36.3	27.2	1.6	--	--
1977	70	--	--	1.5	69.8	27.2	1.5	--	--	--
1981	62	--	--	6.8	52.7	37.0	3.5	--	--	--
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
1975	67	--	--	--	--	11.9	83.6	4.5	--	--
45-3-3										
1974	68	--	--	--	1.7	61.7	35.8	.8	--	45
1975	69	--	--	--	1.0	22.6	66.9	8.5	1.0	--
Cherokee										
1974	70	--	--	--	--	100.0	--	--	--	38
1975	67	--	--	--	4.4	43.0	43.4	9.2	--	--
1977	68	--	--	--	16.5	54.4	29.4	--	--	--
Elliott										
1971	69	--	--	10.8	81.1	7.4	.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	.4	--	35
1975	81	--	--	.4	36.6	53.6	9.4	--	--	--
1977	70	--	--	4.5	72.6	18.2	4.7	--	--	--
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
1977	104	--	--	--	.5	31.7	62.1	5.7	--	--
Chickasaw										
1972[1] ...	91	--	--	--	--	--	100.0	--	--	36
1974	77	--	--	--	5.5	80.8	13.7	--	--	39
1975	69	--	--	.8	31.3	63.7	4.2	--	--	--
1977	76	--	--	.7	45.9	48.7	4.7	--	--	--
1981	88	--	--	--	29.5	61.4	9.1	--	--	--
53-11-139										
1974	86	--	--	--	--	10.4	58.9	29.9	.8	36
1975	79	--	--	--	--	58.1	41.9	--	--	--
1976	78	--	--	--	--	7.0	78.6	14.4	--	--
1977	77	--	--	--	--	49.4	49.3	1.3	--	--

Continued

TABLE 4 *(Continued)*. 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
		18/16	17/16	16/16	15/16	14/16	13/16	12/16	11/16	
	No.	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*Pct.*	*mm*
Tejas										
1975	75	--	--	--	--	4.3	71.7	24.0	--	--
1977	62	--	--	--	--	57.4	42.6	--	--	--
Choctaw										
1981[1] ...	47	--	3.6	60.7	35.7	--	--	--	--	42
Forkert										
1981[1] ...	46	--	6.5	64.5	29.0	--	--	--	--	50
53-9-1										
1981	39	59.0	41.0	--	--	--	--	--	--	45
Kiowa										
1981	40	10.0	42.5	47.5	--	--	--	--	--	49
Melrose										
1981[1]....	53	--	--	12.5	68.7	18.8	--	--	--	51
Sumner										
1981[1,2]...	64	--	--	--	18.6	65.2	16.2	--	--	41
61-6-67										
1981	44	--	--	6.8	88.7	4.5	--	--	--	50
49-20-112										
1981	56	--	--	16.1	76.8	7.1	--	--	--	43

[1]Data taken from nut sample of limited size.
[2]Nuts collected at Auburn.

and 53-9-1 were 1-inch in diameter or larger. In contrast, over 50 percent of Shawnee, Wichita, Caddo, Starking, Chickasaw, Tejas, 48-15-3, 45-10-20, 61-6-96, 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 4. 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, Forkert, Melrose, and GraBohls stood out as having bright meats, table 5. Cherokee, Wichita, and Sumner

TABLE 5. OBSERVATIONAL RATINGS OF KERNEL COLOR OF VARIETIES AND SELECTIONS EVALUATED

Variety	Kernel color[1]
Barton	3
48-15-3	3
Caddo	3
Choctaw	3
Elliott	4
Farley	3
Forkert	3
Cape Fear	4
Kernodle	4
Kiowa	3
Mohawk	3
Melrose	3
Shawnee	4
Shoshoni	3
Cheyenne	4
Chickasaw	3
Stuart	3
Sumner	2
Desirable	3
45-10-23	3
Tejas	3
Wichita	2
Cherokee	1
GraBohls	4
Hastings	3
Mahan-Stuart	3
Starking	3
61-6-67	3
61-6-96	3
61-4-35	3
53-9-1	3
53-11-139	3
45-3-3	3
49-20-112	3

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

were substantially darker than Stuart, even though this is not apparent in the color plates.

The illustrations (center fold) reflect characteristic nut and 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 trunk shaking. 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. Melrose, Jackson, and Sumner may also fall in this classification.

Varieties and selections having nut diameters smaller than 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, GraBohls, 61-6-96, 61-4-35, 49-20-112, Wichita, Farley, Melrose, and Cheyenne did not appreciably differ 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 selection can have considerable economic impact. For example, differences as great as 2.0 grams (0.07 ounce) per kernel occurred for Cape Fear between years 1972 and 1975. Such differences could amount to a per acre kernel yield difference of about 345 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 (0.17 ounce), 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 74 nuts to the pound count, or a 3.1-gram (0.10 ounce) average kernel weight. This would result in only 12.8 pounds of kernel being produced by the same tree, a difference of 8.3 pounds per tree. When applied to a high density planting of trees spaced 35 x 30 feet (41.5 trees to the acre), this difference would amount to 345 pounds of kernel per acre. Uncontrolled drought stresses, whether due to insufficient rainfall or excessive orchard floor vegetation, or both, can therefore readily reduce the marketable yield of any variety.

Of the varieties and selections evaluated over a 3-year or longer period, only Stuart, Elliott, Caddo, Wichita, Farley, 48-15-3, 53-11-139, and Cheyenne had a capacity to fill nuts consistently year after year. In comparison, Mohawk, Mahan-Stuart, Desirable, Kernodle, Hastings, 45-10-23, Barton, Shoshoni, Chickasaw, GraBohls, Shawnee, Cape Fear, and Hastings 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 and Cherokee, had kernel percentages generally in excess of 50 percent, their kernels could be characterized as being thin rather than plump. 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 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 the late C. A. Reed, USDA. Brooks × Alley cross made in 1922 or 1923, tested as Philema 1175. Difficult to shell without 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 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 of 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, intro-

duced 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 a resilient shell that is somewhat difficult to crack. Shells out intact halves readily. A good possibility for the early inshell as well as shelling trade if filling could be maintained as trees grow older.

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 resembles 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, 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, 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 of unknown parentage, 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, 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.

Sumner. Chance seedling found in Tift County, Georgia, and named in late 1930's.

Tejas. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Mahan × Risien #1 cross made in 1944, tested as 44-10-293, introduced by G. Madden in 1973. Has bright kernels, medium size, and is susceptible to scab.

Choctaw. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Success × Mahan cross made in 1946, tested as 46-15-276, introduced in 1959. A large nut, the shell of which may crack at harvest time.

Forkert. Originated near Ocean Springs, Mississippi, by C. Forkert. Cross made in early 1900's, parentage now unknown, sister cross of Jackson.

53-9-1. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Mahan × Odom cross made in 1953. Very large nut and precocious in bearing.

Melrose. Originated in the John Crow Orchard near Hanna, Louisiana. Chance seedling tested as C.S. 23 and as L 15, released as a named selection in 1979 by W. A. Young and W. A. Meadows. A medium to large nut, late in maturing, and currently exhibiting resistance to scab.

61-6-67. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Mohawk × Starking cross made in 1967. Large nut, bright kernels, early maturing, scab resistant.

49-20-112. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Brake × Candy cross made in 1949. Late maturing, medium size nut.

Kiowa. Originated in Brownwood, Texas, by L. D. Romberg, USDA Pecan Field Station. Mahan × Odom cross made in 1953, tested as 53-9-191, released in 1976 by G. Madden. A large nut with plump kernels. Recommended as a pollinator for Cheyenne in high density plantings.