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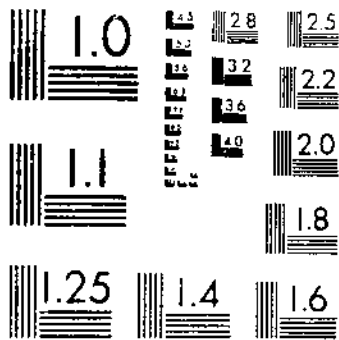
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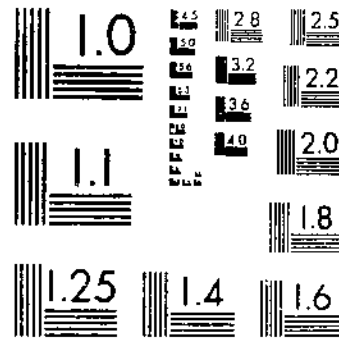
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NATIONAL BUREAU OF STANDARDS-1963-A



UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D. C.

## AN ECONOMIC STUDY OF THE PECAN INDUSTRY

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### INTRODUCTION

Pecans are an important source of farm income in many districts in the Southern States. During the five years ending with 1930 the farm value of pecans averaged about \$9,600,000 per year. Pecan trees have been planted in large numbers in the last decade and increasing market supplies are indicated. In this period of expansion it is important that facts relating to the trend in production and costs of production and information on the long-time outlook for marketing be available for the guidance of those interested in the production or marketing of pecans.

This bulletin presents the results of an economic study of the pecan industry, conducted by the Bureau of Agricultural Economics, United States Department of Agriculture, in cooperation with various State agencies. The study was made during the period 1928-1930. Its purpose is to supply basic economic information which will assist in the sound development of the pecan industry.

There are three phases of the study: (1) Production, which includes estimates of the size of the pecan crop, the survey of the num-

ber of pecan trees by age groups and geographic distribution, varieties grown, and related topics; (2) cost of production, which deals with practices and costs in the development of pecan orchards of improved varieties and in the operation of bearing orchards; and (3) marketing, which includes a description of marketing practices in producing areas and in the markets, and a presentation of price and distribution data. The survey also includes information on pecan-marketing conditions from the view point of the retailer and consumer and a discussion of the competition of pecans with other nuts.

## PRODUCTION

### GEOGRAPHIC DISTRIBUTION OF PECAN TREES

The native range of the pecan covers a large area, extending from the valleys of the lower Ohio and Missouri Rivers and their tributaries, such as the Wabash, Illinois, and Osage, through the broad alluvial flood plains and delta lands of the Mississippi and its tributaries southward to the Gulf, and thence westward to the borders of the highlands of western Oklahoma and Texas. To the southwest the native trees are abundant in the valleys of all of the west Gulf rivers, such as the Trinity, Colorado, and Brazos down to the Rio Grande. Native seedling trees are occasionally seen as far east as western Alabama. Throughout this area, roughly 2,000 miles in length and from 200 to 600 miles in breadth, these trees, often of impressive size, have for ages shed their crops—food for man and beast.

Supplementing this area of natural pecan growth there has been a phenomenal expansion of the range of this valuable tree, especially during the last 50 years, through plantings of improved varieties on a large scale, in orchards for commercial production as well as around homes, throughout the entire east Gulf and South Atlantic coastal plains and the lower piedmont areas, from Mississippi to southern Virginia. Plantings have long been made in limited sections of California, but commercial production in that State has not thus far been significant. In restricted sections in Arizona recent plantings are thriving. West of the Mississippi, in the areas to which the pecan is native, progress in the planting of improved varieties, and especially in the top working of trees in native groves to improved varieties, has been rapid.

### LOCATION OF PECAN-PRODUCING DISTRICTS

The location of pecan-producing districts shown in Figure 1 is approximate, based upon the evidence of the special 1929 pecan survey supplemented by census figures. In Texas the distribution shown is based largely upon the record of car-lot shipments out of the different counties and probably gives undue prominence to counties with important shipping points as contrasted with those lacking such shipping points. The improved pecans—that is, those from grafted, budded, and top-worked trees—come mostly from the States east of the Mississippi River and the seedling or wild nuts from the native pecan belt lying along the Mississippi River and the alluvial bottoms of the streams west of the Mississippi. The lower Ohio and Illinois bottoms and those of the streams of western Kentucky and Tennessee

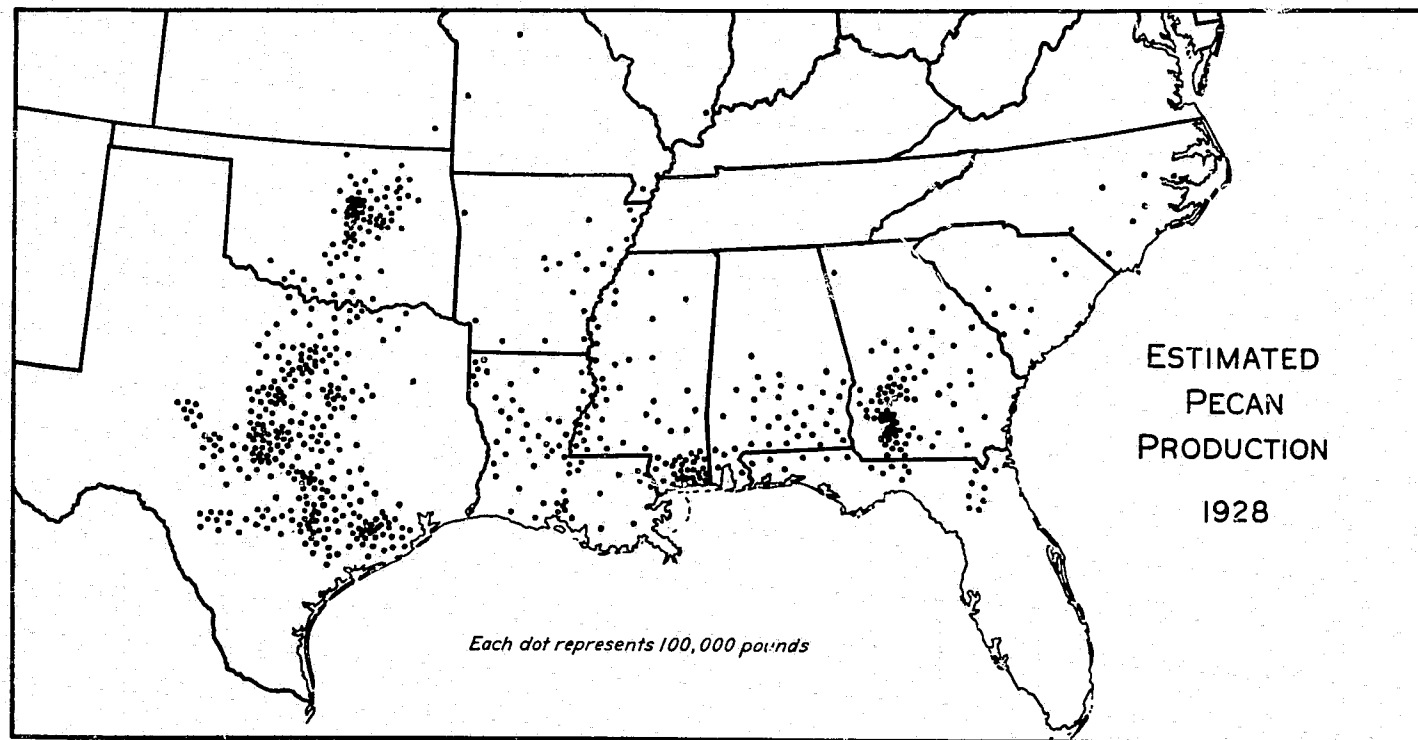


FIGURE 1.—The improved varieties of pecans are grown mostly in the States east of the Mississippi River, whereas the seedling or wild nuts are produced in the native pecan belt along the Mississippi River and farther west. The production of improved varieties in the native pecan belt is increasing

supply a relatively small production of wild pecans, and there is a considerable production in the Yazoo bottoms of Mississippi and in the lowlands of the southwestern corner of that State. On the other hand, a considerable production of improved pecans is found in southern Louisiana and considerable plantings of improved nuts are beginning to come into bearing in Louisiana, Texas, and Arkansas, although the production of these is as yet relatively insignificant there compared with production of the native seedling trees.

In the areas of native growth from Mississippi and Louisiana westward the pecan is found mainly in the river valleys and flood plains rather than upon the higher lands. Figure 1 does not always clearly indicate this fact, production being shown rather on the county basis and without strict localization. In the Southeastern States, where plantings have been by human design rather than by the operation of natural laws, this limitation to lowlands does not apply, although the pecan appears to do best in valley types of soils and in locations in which it has access to supplies of subsoil moisture.

### PRODUCTION OF PECANS

The 1929 survey showed that the previous estimates of the United States Department of Agriculture on production of pecans, which had been based largely on the census of 1920 with allowance for subsequent increase, were much too low. The production of 1919 in the 12 States was (according to the census) 31,443,800 pounds on more than 100,000 holdings. The 11,000 groves and holdings included in the 1929 survey produced approximately 14,000,000 pounds of pecans. As judged from the survey and from the study of rail movement and other means of disposal, the total production of these 12 States in 1928, originally estimated at 42,000,000 pounds, was actually about 67,000,000 pounds. The original census deficiency was no doubt considerably greater in the native pecan belt, where a large proportion of the production is from wild trees not closely observed by the owners and often harvested by others, than in the East, where most of the trees are in orchards or around homesteads. Of the total census production of pecans in 1919, about 19 per cent was credited to the Eastern States, where a large proportion of the nuts are of improved varieties; whereas the survey and other checks show over 32 per cent of the pecan crop of 1928 to have been produced in that area. Of the total production in 1928, it is estimated that approximately 17,680,000 pounds were of improved varieties and about 49,620,000 pounds were of seedling and wild varieties.

Table 1 shows the census figures on production in 1919 and the estimates for 1928 based upon the survey in the spring of 1929 and subsequent checks of rail shipments and other information.

The revised estimates of total production of pecans for the years 1919-1931 appear in Table 2.

TABLE 1.—Production of pecans by States and sections, census, 1919, and estimate by type, 1928

State and section	Production, 1919 (census)	Estimated production, 1928		
		Improved varieties	Seedlings and wild	Total
	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>	<i>Pounds</i>
North Carolina.....	149,753	440,000	250,000	690,000
South Carolina.....	525,783	550,000	180,000	730,000
Georgia.....	2,545,000	7,400,000	1,000,000	8,400,000
Florida.....	1,025,673	1,500,000	500,000	2,000,000
Alabama.....	1,180,000	2,783,000	720,000	3,500,000
Mississippi.....	1,692,177	3,250,000	3,250,000	6,500,000
Eastern.....	7,014,386	15,920,000	5,900,000	21,820,000
Illinois.....	182,347		30,000	30,000
Missouri.....	555,181	5,000	295,000	300,000
Arkansas.....	348,382	95,000	1,655,000	1,750,000
Louisiana.....	2,242,859	820,000	4,680,000	5,500,000
Oklahoma.....	4,286,642	40,000	8,360,000	8,400,000
Texas.....	16,804,900	800,000	28,700,000	29,500,000
Western.....	24,420,414	1,760,000	43,720,000	45,480,000
Total.....	31,443,800	17,680,000	49,620,000	67,300,000

TABLE 2.—Production of pecans, by States and sections, 1919-1931

[In thousands of pounds, i. e., 000 omitted]

State and section	1919	1920	1921	1922	1923	1924	1925
North Carolina.....	240	130	150	260	450	560	330
South Carolina.....	600	220	800	360	680	770	550
Georgia.....	3,200	1,550	4,500	1,500	6,600	3,600	6,400
Florida.....	1,300	440	1,200	880	1,600	1,300	1,916
Alabama.....	1,400	600	1,800	1,360	2,500	1,086	2,200
Mississippi.....	2,600	715	2,700	1,700	3,400	1,932	5,094
Eastern.....	9,240	3,655	11,150	5,450	14,260	9,848	16,490
Illinois.....	230	210	155	105	200	200	23
Missouri.....	1,000	250	350	750	350	500	600
Arkansas.....	2,000	280	1,500	180	1,500	1,000	1,570
Louisiana.....	5,000	700	5,000	600	4,250	1,750	5,530
Oklahoma.....	15,000	3,000	9,000	2,000	10,000	11,000	14,700
Texas.....	35,000	2,000	19,000	2,000	20,000	12,500	12,000
Western.....	58,230	6,440	35,605	5,695	42,300	26,950	34,423
Total.....	67,470	10,095	46,755	11,145	56,560	36,798	60,913

State and section	1926	1927	1928	1929	1930	1931
North Carolina.....	780	660	690	664	640	1,050
South Carolina.....	1,300	750	730	585	920	950
Georgia.....	9,400	5,000	8,400	4,000	4,700	8,500
Florida.....	1,516	1,144	2,600	1,000	1,150	2,350
Alabama.....	3,100	1,260	3,500	1,620	2,730	4,000
Mississippi.....	5,500	3,200	6,500	2,300	5,700	5,500
Eastern.....	21,596	12,014	21,820	10,164	15,540	22,350
Illinois.....	315	80	30	150	200	250
Missouri.....	1,500	400	300	900	600	1,800
Arkansas.....	3,000	1,500	1,750	1,000	1,500	2,800
Louisiana.....	6,000	2,250	5,500	2,500	8,000	6,000
Oklahoma.....	19,700	8,900	8,400	14,800	13,000	11,500
Texas.....	41,900	9,600	29,500	20,000	12,500	32,000
Western.....	72,415	22,740	45,480	39,450	35,800	54,350
Total.....	94,011	34,754	67,300	49,614	51,640	76,700



The production of pecans is difficult to estimate. There are little or no data in most States for measuring the degree of the incompleteness of the United States census of pecan trees and production. The estimates given herewith are based upon rail, water, and truck shipments, State records and surveys, for States for which these are available, with conservative allowances above the census figures in other States. They are subject to a considerable margin of error, especially for years prior to 1924. They do present a rough approximation of relative production as between States and for successive years.

The largest pecan crop of record was that of 1926, production being estimated at 94,011,000 pounds. This was a year of maximum production in all sections of the belt. The next greatest pecan year of the last 13 years for which definite estimates have been made was 1931, with an estimated production of about 76,700,000 pounds, and the estimates for 1919 and 1928 each exceed 67,000,000 pounds. The years of smallest production during the period were 1920 and 1922, with crops estimated at about 10,096,000 and 11,145,000 pounds, respectively. No other year of the period produced a crop estimated at less than about 35,000,000 pounds.

TABLE 3.—*Production of pecans, by type, and by States and sections, 1919–1931*

[In thousands of pounds, i. e., 000 omitted]

IMPROVED VARIETIES							
State and section	1919	1920	1921	1922	1923	1924	1925
North Carolina.....	120	66	80	140	260	310	190
South Carolina.....	330	120	470	220	430	300	370
Georgia.....	2,100	1,050	3,100	1,070	5,000	2,900	5,200
Florida.....	600	230	650	400	930	780	1,200
Alabama.....	810	370	1,150	900	1,700	1,180	1,600
Mississippi.....	1,070	315	1,100	480	1,100	900	2,400
Eastern.....	5,060	2,151	6,610	3,300	9,420	6,570	10,990
Missouri.....	10	2	4	8	4	5	6
Arkansas.....	20	3	20	3	20	25	40
Louisiana.....	600	80	750	50	600	250	830
Oklahoma.....	40	10	30	10	70	50	75
Texas.....	250	20	120	20	200	125	130
Western.....	920	115	924	121	904	455	1,081
Total.....	5,980	2,265	7,534	3,421	10,324	7,025	12,041

## SEEDLING AND WILD PECANS

North Carolina.....	120	64	70	120	220	250	140
South Carolina.....	270	100	330	140	250	270	180
Georgia.....	1,100	500	1,400	430	1,600	700	1,200
Florida.....	600	210	550	390	670	520	710
Alabama.....	560	230	650	450	800	500	600
Mississippi.....	1,530	400	1,540	620	1,300	1,032	2,694
Eastern.....	4,180	1,504	4,540	2,150	4,840	3,278	5,530
Illinois.....	230	210	155	165	200	200	23
Missouri.....	960	348	340	742	346	495	594
Arkansas.....	1,080	277	1,450	177	1,470	975	1,530
Louisiana.....	4,400	650	4,850	530	3,650	1,500	4,700
Oklahoma.....	14,960	2,600	3,970	1,990	15,930	10,950	14,625
Texas.....	34,750	1,980	18,890	1,980	19,800	12,375	11,870
Western.....	57,310	6,325	34,681	5,574	41,308	20,495	33,342
Total.....	61,400	7,829	39,221	7,724	46,236	29,773	38,872

TABLE 3.—*Production of pecans, by type, and by States and sections, 1919-1931—*  
Continued

(In thousands of pounds, i. e., 000 omitted)

## IMPROVED VARIETIES

State and section	1926	1927	1928	1929	1930	1931
North Carolina.....	450	350	440	430	420	735
South Carolina.....	900	550	550	450	750	800
Georgia.....	7,900	4,400	7,400	3,600	4,300	7,820
Florida.....	1,030	500	1,500	750	900	1,880
Alabama.....	2,320	950	2,750	1,340	2,330	3,520
Mississippi.....	2,650	1,570	3,250	1,200	2,450	3,000
Eastern.....	15,250	8,680	15,020	7,770	11,150	17,755
Missouri.....	15	5	5	15	10	35
Arkansas.....	90	60	95	60	80	170
Louisiana.....	750	350	320	375	1,200	950
Oklahoma.....	100	40	40	70	70	115
Texas.....	840	100	800	550	300	950
Western.....	1,705	645	1,760	1,070	1,650	2,240
Total.....	17,045	9,325	17,680	8,840	12,810	19,995

## SEEDLING AND WILD PECANS

North Carolina.....	330	280	250	234	220	315
South Carolina.....	400	200	180	130	170	150
Georgia.....	1,500	600	1,000	400	400	680
Florida.....	485	344	500	250	250	470
Alabama.....	780	280	720	280	400	480
Mississippi.....	2,850	1,630	3,250	1,400	3,250	2,500
Eastern.....	6,345	3,334	5,900	2,394	4,690	4,595
Illinois.....	315	90	30	150	200	250
Missouri.....	1,455	395	295	885	590	1,765
Arkansas.....	2,910	1,450	1,655	940	1,420	2,030
Louisiana.....	5,250	1,900	4,650	2,125	5,800	5,040
Oklahoma.....	19,600	8,360	8,360	14,830	12,930	11,385
Texas.....	41,060	9,410	28,700	19,450	12,200	31,040
Western.....	70,620	22,095	43,720	38,380	34,140	52,110
Total.....	76,966	25,429	49,620	40,774	38,830	56,705

Texas is the largest single producer of pecans, the crop usually amounting to from 30 to 50 per cent of the total production in the United States. Texas has occasional years of near failure, however, in which the State production has dropped to less than 20 per cent of the United States total. The next State in volume of total production is Oklahoma, producing ordinarily from 15 to 30 per cent of the crop. Of the States east of the Mississippi River, Georgia leads in production, with usually about 10 per cent of the total crop.

Table 3 shows the production of seedling and improved types of pecans separately for the years 1919 to 1931.

From 60 per cent to 80 per cent of the seedling nuts ordinarily come from Texas and Oklahoma and most of the remaining seedling nuts come from the States bordering the lower Mississippi. About one-tenth of the seedling nuts ordinarily come from the eastern group of

pecan States. On the other hand, the eastern group usually furnishes close to 80 per cent of the nuts from improved trees and the lower Mississippi Valley States furnish most of the remainder, Texas and Oklahoma producing only a small percentage of improved varieties. Georgia ordinarily supplies about 40 per cent of the nuts from improved trees, Mississippi and Alabama coming next, with from 10 to 20 per cent each of the improved varieties.

#### NUMBER OF PECAN TREES

The number of pecan trees both of the improved and seedling types is shown in Table 4.

TABLE 4.—Number of pecan trees by type, and by States and sections, census, 1925, estimate, 1929

State and section	Total		Improved <sup>1</sup>	Seedling or wild, 1929 <sup>1</sup>		
	1925 (census)	1929 (estimate)	1929 (estimate)	Total	Bearing age	Nonbear- ing age
North Carolina.....	103,844	320,000	279,000	41,000	31,000	10,000
South Carolina.....	500,407	360,000	336,000	25,000	28,000	2,000
Georgia.....	2,367,000	3,305,000	3,415,000	10,000	70,000	20,000
Florida.....	521,006	600,000	625,000	65,000	50,000	15,000
Alabama.....	760,070	910,000	893,000	17,000	42,000	5,000
Mississippi.....	580,402	983,000	634,000	350,000	211,000	118,000
Eastern.....	4,486,310	6,808,000	6,181,000	627,000	457,000	170,000
Missouri.....	174,051	150,000	5,000	445,000	208,000	170,000
Arkansas.....	76,707	801,000	251,000	550,000	400,000	150,000
Louisiana.....	360,432	812,000	251,000	531,000	354,000	177,000
Oklahoma.....	1,038,018	2,900,000	700,000	2,400,000	1,820,000	680,000
Texas.....	2,418,543	6,660,000	600,000	6,000,000	4,460,000	1,540,000
Western.....	4,068,711	11,620,000	1,607,000	9,926,000	7,280,000	2,646,000
Total.....	8,555,000	18,431,000	7,878,000	10,553,000	7,737,000	2,816,000

<sup>1</sup> Improved trees are those that have been grafted, budded, or top-worked with scions or buds of improved varieties. Seedling trees are those grown from the seed, including native wild trees.

The number of native seedling trees can never be known accurately and it is difficult to make a satisfactory estimate of them. The Federal census enumerates only trees reported on farms. Great numbers in woods and on unoccupied lands not included in farms are not enumerated, and probably many trees which might properly be included in a farm enumeration are overlooked. The census of 1925 reported 4,069,000 pecan trees in Oklahoma, Texas, Arkansas, Louisiana, and Missouri. The greater number in these States are known to be seedlings, although in Arkansas and Louisiana a considerable number are reported in planted orchards. The 1929 survey, including over 11,000 holdings, indicated that the number of trees in this group of 5 States, including about 1,700,000 trees of improved varieties, was about 11,600,000 trees. The number of trees of improved varieties can be estimated more accurately. The 1925 census showed 4,486,000 trees in the 6 leading pecan States east of the Mississippi, most of which were improved varieties. Other evidence at that time supported larger figures, and the survey of 1929 indicated that numbers of trees in these 6 States had increased between 1925 and 1929 by almost 50 per cent. The total number of pecan trees in the entire country in 1929, judging by the survey, was

about 8,000,000 trees of improved types and more than 10,500,000 seedling and wild trees, or a total of more than 18,000,000 of all types. These figures do not take into account young trees in nurseries or the thickets of young saplings in the native pecan territory, and probably understate the number of wild pecan trees in the native pecan belt.

AGES OF IMPROVED PECAN TREES

The data in Table 5 refer to planted trees; the figures are significant as showing the rapid increase in plantings during recent years. Based upon study of ages for over 2,000,000 trees of improved varieties reported in the survey, about 5.4 per cent of the total were planted in 1929, and 36.8 per cent during the four years 1925-1928. Approximately 36 per cent of all were 10 years old and over and about 58 per cent were 5 years and over. Probably at least half of the total plantings of improved trees, therefore, were not yet of bearing age in 1929.

TABLE 5.—Number of pecan trees of improved varieties, by age groups, and by States and sections, 1929

NUMBER OF TREES										
State and section	Planted in 1929	1-4 years old	5-9 years old	10-14 years old	15-19 years old	20-24 years old	25-29 years old	30 years old and over	Total 10 years old and over	Total 5 years old and over
North Carolina.....	22,300	131,100	47,400	33,500	30,700	7,300	6,100	600	78,200	125,600
South Carolina.....	10,000	157,000	6,000	44,000	30,000	13,000	10,000	7,000	104,000	168,000
Georgia.....	100,000	1,014,000	919,000	697,000	482,000	130,000	51,000	13,000	1,373,000	2,292,000
Florida.....	12,000	150,000	175,000	119,000	60,000	75,000	25,000	3,000	282,000	457,000
Alabama.....	49,000	250,000	232,000	143,000	188,000	15,000	9,000	4,000	362,000	594,000
Mississippi.....	23,400	206,000	142,300	121,300	80,000	21,300	11,100	15,600	262,300	404,600
Eastern.....	225,700	1,914,100	1,579,700	1,167,800	870,700	267,600	112,200	43,200	2,461,500	4,041,200
Arkansas.....	30,400	143,800	31,700	20,800	14,500	3,500	3,400	2,900	45,100	76,800
Louisiana.....	9,280	87,350	46,307	33,743	56,518	32,899	8,717	6,186	138,063	184,370
Oklahoma.....	100,000	305,000	30,000	5,000	-----	-----	-----	-----	5,000	35,000
Texas.....	63,400	385,000	67,300	28,400	101,000	10,000	900	3,000	143,300	210,600
Western.....	203,080	982,150	175,307	87,943	172,018	46,399	13,017	12,086	331,463	506,770
Total.....	428,780	2,890,250	1,755,007	1,255,743	1,042,718	313,999	125,217	55,286	2,792,963	4,547,970

PERCENTAGE OF STATE TOTAL

North Carolina.....	8.0	47.0	17.0	12.0	11.0	2.6	2.2	0.2	28.0	45.0
South Carolina.....	3.9	46.9	19.1	13.1	8.9	3.9	3.0	2.1	31.0	50.1
Georgia.....	3.2	29.7	28.0	20.4	14.1	3.8	1.5	.4	40.2	67.1
Florida.....	2.6	25.0	28.0	19.0	6.6	12.0	4.0	.5	45.1	73.1
Alabama.....	5.5	28.0	36.0	16.0	21.0	2.0	1.0	.5	40.5	66.5
Mississippi.....	3.7	32.5	22.4	20.7	12.6	3.8	1.8	2.5	41.4	63.8
Eastern.....	3.7	30.9	25.6	18.9	11.1	4.3	1.6	.7	39.8	65.4
Arkansas.....	12.1	57.3	12.6	8.3	5.8	1.4	1.3	1.2	18.0	30.6
Louisiana.....	3.3	31.1	16.5	12.0	20.1	11.7	3.1	2.2	49.1	65.0
Oklahoma.....	29.0	73.0	6.0	1.0	-----	-----	-----	-----	1.0	7.0
Texas.....	0.6	68.5	10.2	4.3	15.3	1.4	.2	.5	21.7	31.9
Western.....	12.0	58.9	10.4	5.2	10.2	2.7	.8	.7	10.5	20.8
Total.....	5.4	36.8	22.3	16.0	13.2	4.0	1.6	.7	35.5	57.8

1 Estimate based upon age distribution shown by 1929 survey supplemented by numbers of bearing age and nonbearing age reported by the census of 1925. Does not include estimates by age groups of the 5,000 improved trees estimated for Missouri in 1929.

## TREND OF FUTURE PRODUCTION

It would seem that increase in production will be rather rapid during the next few years, but this will depend largely upon the attention received by the orchards and the extent to which insects and diseases are controlled. As with other crops, these difficulties tend to increase with concentration of production. There will probably be a considerable loss of trees planted during the five years ended in 1929, in accordance with usual mortality of young plantings, and some loss of older trees. Even assuming a mortality of 40 per cent in these young plantings and 15 to 20 per cent in older trees, the number of planted trees of bearing age would increase about 25 per cent by 1940, even if we include in those of bearing age in 1929 all trees 5 years of age or older. Although many trees reach bearing age later than 10 years, most of the improved trees 10 years and older in 1929 were then of bearing age. A large proportion of those in the group 5 to 9 years in 1929 had probably reached bearing age by 1932. In addition to this, in orchards in which the trees are properly spaced, the increasing bearing surface developed by the 16 per cent of trees from 10 to 14 years of age and the 13 per cent ranging from 15 to 19 years will by 1940 have contributed a further material increase to production.

The extent of increased production of improved varieties from these causes—that is, the increase in number of bearing trees and increase of bearing surface of trees now in production—might easily amount to 50 per cent or more within the decade. Increase from wild trees, if any, seems likely to be moderate. An increase even up to 100 per cent in production from improved trees would without allowing for any increase in seedling and wild nuts, increase the total production of pecans by only 25 to 30 per cent.

## PRINCIPAL VARIETIES OF PECANS

Data on varieties are incomplete. Table 6 shows the varietal distribution so far as it could be estimated from the survey.

TABLE 6.—Percentage of certain varieties of pecan trees grown in specified States and sections, 1929

State and section	Stuart	Schley	Success	Money-maker	Van De-man	Miscellaneous improved <sup>1</sup>	Seedling or wild
North Carolina.....	40.0	18.8	3.6	1.8	.....	23.0	12.8
South Carolina.....	44.4	34.5	2.2	.....	2.8	8.0	6.9
Georgia.....	30.4	28.9	2.5	4.4	2.9	28.3	2.6
Florida.....	14.8	10.3	3.9	5.8	.....	55.8	9.4
Alabama.....	14.0	4.8	.....	.....	.....	76.2	5.0
Mississippi.....	31.1	4.5	15.6	.....	.....	10.7	36.1
Eastern.....	28.1	20.0	4.2	3.0	1.6	33.9	9.2
Missouri.....	.....	.....	.....	.....	.....	1.1	98.9
Arkansas.....	10.9	3.4	4.0	3.0	.....	11.2	68.6
Louisiana.....	19.4	2.5	3.0	1.0	.9	7.8	65.4
Oklahoma.....	3.0	.8	.7	.....	.....	12.9	82.8
Texas.....	1.6	1.2	1.2	.....	.....	5.9	90.1
Western.....	3.9	1.2	1.4	.3	.1	7.8	85.4
Total.....	12.8	8.2	2.4	1.3	.6	17.5	57.2

<sup>1</sup> Miscellaneous includes other named and unnamed varieties of improved trees and may include small percentages of the named varieties shown in the other columns; in Georgia, 2.5 per cent Pabst, 3.6 per cent Frotcher, 2.2 per cent Techo, 1.4 per cent Mobile, 4.0 per cent Alley, 2.0 per cent Johns, 1.9 per cent Curtis; in Florida it includes 0.7 per cent Curtis, 9.6 per cent Moore, 1.0 per cent Frotcher, 7.3 per cent Techo, 0.9 per cent Pabst, and 0.8 per cent President; in Mississippi, 2.2 per cent Hale, 1.3 per cent Bass; in Oklahoma, 0.8 per cent Hubert and 0.5 per cent Burkett; in Texas, 1.8 per cent Burkett. Data for varieties are less complete than for other items of the survey.

## SIZE OF PECAN HOLDINGS

The number of separate holdings of pecan trees in 11 producing States is placed in the United States census of 1925 at 215,185. This enumeration probably missed many trees on small holdings and is especially likely to have been deficient in sections in which there are many native trees in the fields or woods.

The number of holdings in these 11 States for 1929 is estimated at 266,727. (Table 7.) Most of the holdings are small, many consisting of only a few trees, but there is a considerable number of the larger holdings and these include by far the larger proportion of all pecan trees.

TABLE 7.—Number of holdings of pecan trees, 1925 and 1929, and number of trees in holdings of stated sizes in 1929

State and section	Total holdings		Number of trees in holdings of stated sizes, 1929 <sup>1</sup>					
	1925 (census)	1929 (esti- mate)	1-19 trees	20-49 trees	50-99 trees	100-499 trees	500-1,999 trees	2,000 trees and over
North Carolina.....	15,030	19,241	115,000	54,000	50,000	56,000	29,500	15,500
South Carolina.....	14,703	20,250	130,000	35,000	33,000	60,000	37,000	65,000
Georgia.....	40,849	51,200	472,000	170,000	208,000	965,000	650,000	1,040,000
Florida.....	12,947	16,000	84,000	70,000	75,000	210,000	113,000	138,000
Alabama.....	26,181	29,000	180,000	115,000	115,000	320,000	150,000	60,000
Mississippi.....	21,538	24,300	111,000	76,500	99,700	318,400	172,900	214,000
Eastern.....	132,148	159,991	1,092,000	520,500	550,700	1,929,400	1,152,400	1,532,500
Missouri.....	4,776	6,000	30,000	30,000	43,000	122,000	150,000	75,000
Arkansas.....	5,789	13,400	56,500	99,000	112,500	165,000	184,000	184,000
Louisiana.....	18,192	23,700	128,000	114,000	84,000	180,000	122,000	186,000
Oklahoma.....	18,362	26,300	140,000	160,000	159,000	717,000	845,000	867,000
Texas.....	35,958	37,326	160,000	230,000	280,000	1,180,000	1,850,000	2,960,000
Western.....	83,037	100,736	518,500	630,000	678,500	2,364,000	3,151,000	4,272,000
Total.....	215,185	266,727	1,610,500	1,159,500	1,259,200	4,293,400	4,303,400	5,804,500

<sup>1</sup> There are no positive data on number of holdings of different sizes, the census material not having been tabulated in form to show this information. These estimates are based upon a study of distribution by size for a number of representative counties in the important producing States.

Native groves in the western group of States, particularly in Texas and Oklahoma, commonly comprise the holdings of an individual along the course of a stream and sometimes in a broader forested area. The stand of timber is made up of varying proportions of pecans interspersed with trees of other species. Single holdings may extend for many miles along a stream and its branches. Along the larger streams where the lowlands spread widely from the water-course the pecan trees may be scattered over a rather broad area, but in many cases they form only a narrow fringe along the bank of the stream. In the valleys of the Mississippi River and its tributaries the pecan is found scattered among the forest trees covering the broad areas of the alluvial flood plains. East of the Mississippi River lowlands the trees are mostly planted in orchards that often number many thousands of trees. Most of the extensive orchards are found on the lower coastal plains area, although smaller orchards are found scattered throughout the lower piedmont area.

It is estimated that in 1929 the holdings containing over 2,000 trees included a total of about 5,800,000 trees, or 32 per cent of the total; that holdings of 500 to 1,999 trees had a total of 4,300,000 trees,

or 23 per cent; holdings of 100 to 499 trees, a total of 4,300,000 trees, or 23 per cent; and holdings of less than 100 trees, a total of 4,000,000 trees, or 22 per cent.

Groves numbering over 2,000 trees in Texas contained 44 per cent of its huge total of 6,660,000 trees. Georgia and Oklahoma have about 30 per cent of their orchards or groves of this size, and Louisiana, Mississippi, and Florida 20 per cent or more.

The proportion of trees in holdings of different sizes has been estimated on the basis of rather scanty data, and the figures given in Table 7 should be considered as only rough approximations.

#### TREND IN PECAN PLANTINGS AS INDICATED BY CENSUS FIGURES

The center of pecan production has been definitely moving eastward, with an increasing proportion of the total crop made up of cultivated types. But the increase in the western part of the pecan section in the proportion of young trees as reported in the census of 1925, is significant of awakened interest and progress in that section. The trend in production is indicated by the following statement:

The census enumerations show the following numbers of pecan trees: In 1910, 3,203,000; in 1920, 4,806,000; in 1925, 8,555,000. Trees of bearing age were 48.3 per cent of the total number in 1910, 53.8 per cent in 1920, and 49.9 per cent in 1925.

Texas and Oklahoma had, in 1910, 77 per cent of the trees of bearing age; in 1920, 56 per cent; and in 1925, 48 per cent; whereas the States east of the Mississippi River had in these years, 17, 36, and 45 per cent of the bearing trees, respectively.

Of the trees not of bearing age, Texas and Oklahoma in 1910 had 41 per cent; in 1920, 25 per cent; and in 1925, 33 per cent. The States east of the Mississippi River had 51 per cent of the nonbearing trees in 1910, 68 per cent in 1920, and 60 per cent in 1925.

The increase in plantings in the eastern section since 1925 has continued at a rapid pace but in the western section, the native home of the pecan, increasing attention has been given to the planting of orchards of improved varieties of trees and to the top-working of native trees to improved varieties. Owners of western pecan lands are ceasing to cut large producing pecan trees for timber and are saving the native young growth by protecting the trees and thinning the stand of other timber. Under these conditions production of the ordinary native seedling nuts is likely to be maintained for a long time.

#### PECAN CONDITION REPORTS AND FORECASTS

Table 8 shows condition figures monthly from July 1 to October 1 by States and for the United States, from 1920 to 1930 as reported by producers to the Bureau of Agricultural Economics. Condition is in comparison with a normal or full-crop promise for the month stated. The November figures show reported production as a percentage of a full crop.

TABLE 8.—Pecan condition stated as a percentage of a full-crop promise each month, July-October, and for November, the reported production as a percentage of a full crop, by States, 1919-1931

State and month	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931
<b>North Carolina:</b>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>	<i>P. ct.</i>
July.....	65	59	76	75	75	82	71	80	71	74	71	83	74
August.....				67	67	77	62	77	67	72	66	62	73
September.....	68	60	46	67	66	78	48	78	66	66	64	54	75
October.....				72	75	45	83	63	63	64	60	54	70
November.....		35	32	50	78	80	45	80	65	66	57	54	73
<b>South Carolina:</b>													
July.....		92	81	72	81	65	72	69	66	73	58	61	70
August.....				65	65	72	67	70	61	60	54	62	68
September.....	80	56	80	48	70	60	60	70	64	60	46	60	67
October.....				77	66	45	80	63	65	45	56	66	64
November.....		33	81	42	65	75	47	80	57	55	41	60	61
<b>Georgia:</b>													
July.....	70	34	79	45	80	76	77	78	56	76	62	53	71
August.....				83	83	65	67	73	54	73	44	46	70
September.....		34	80	36	78	52	62	75	52	70	36	46	75
October.....				78	50	59	77	50	62	30	44	70	70
November.....		31	70	22	77	42	61	70	46	68	33	30	64
<b>Florida:</b>													
July.....		30	62	77	86	76	87	76	53	74	54	55	72
August.....				83	83	65	80	70	49	75	42	46	75
September.....	70	40	70	55	83	60	80	72	52	70	48	48	72
October.....				80	80	50	80	61	52	63	44	52	77
November.....		32	63	50	75	60	80	60	41	68	40	44	76
<b>Alabama:</b>													
July.....		60	78	65	86	76	80	80	50	77	52	61	72
August.....				72	60	68	72	37	70	44	56	56	70
September.....	85	50	74	55	66	64	68	74	43	69	43	57	75
October.....				65	60	60	60	35	60	45	58	58	75
November.....		29		50	71	55	62	70	30	70	36	55	70
<b>Mississippi:</b>													
July.....	65	60	80	83	78	70	83	72	50	71	53	60	74
August.....				62	63	75	64	47	71	49	48	48	71
September.....		28	75	39	62	44	75	68	47	72	45	53	67
October.....				61	46	70	60	44	72	38	57	65	65
November.....		15	75	28	60	38	73	65	40	78	30	60	63
<b>Arkansas:</b>													
July.....				75	65		65	78	60	73	66	59	74
August.....				60	72	63	71	60	60	60	57	42	73
September.....	77	26	64	21	60	60	85	78	56	62	48	41	75
October.....				60	67	78	58	64	64	45	46	46	71
November.....	60	17	70	12	64	60	58	84	54	61	38	53	70
<b>Louisiana:</b>													
July.....		22	72	50	70	70	75	71	66	72	52	61	69
August.....				62	4	60	72	50	65	46	52	66	66
September.....	66	33	71	25	58	44	70	64	45	67	42	56	69
October.....				63	37	70	62	40	70	42	66	66	67
November.....		13	75	11	64	29	74	66	35	66	35	67	65
<b>Oklahoma:</b>													
July.....	97	65	50	70	77	82	65	69	64	48	61	50	61
August.....				63	68	59	67	58	40	52	43	53	53
September.....		20	46	36	57	60	58	58	54	44	48	41	48
October.....				67	50	58	70	51	34	50	44	47	47
November.....		15	47	9	68	46	56	13	40	33	51	48	40
<b>Texas:</b>													
July.....		30	51	34	66	66	44	64	43	50	60	40	65
August.....				53	52	25	33	35	50	53	35	60	60
September.....	86	30	44	9	51	40	20	60	35	62	40	33	58
October.....				50	35	25	63	32	56	40	32	56	56
November.....		8	45	6	49	30	29	72	23	30	42	27	58
<b>United States:</b>													
July.....	83.2	38.5	50.3	53.4	72.6	71.5	58.6	68.3	50.4	57.4	58.3	50.5	60.9
August.....				60.7	60.7	57.4	44.7	66.6	43.4	55.1	61.0	41.2	62.8
September.....		31.0	51.2	27.7	58.0	47.2	41.3	68.4	42.1	65.7	42.7	40.3	61.6
October.....				58.8	58.8	43.5	42.0	66.8	39.2	55.7	41.0	41.1	56.6
November.....		10.0	52.2	15.3	57.3	37.7	45.1	71.2	31.6	57.4	40.0	39.0	59.7



These figures have a relation to the final size of the crop, but it is not a close relationship in the early months. (Fig. 2.) The condition figure tends to approach closer each succeeding month to the November figure on percentage of full crop produced. The November figure itself usually fails to reflect the full extent of the variation from year to year in the actual production as finally estimated. Uncertainty lessens as the season develops. The condition figures tend to be too low in very good years and too high in bad years, but the tendency in most years is to be too high. Decreases are seen to be greater than increases. This is logical, as the crop has a limited possibility of improvement but might be almost totally lost under very adverse conditions.

Reports issued by the Department of Agriculture ordinarily show only condition on the first of the months of July to October, in per-

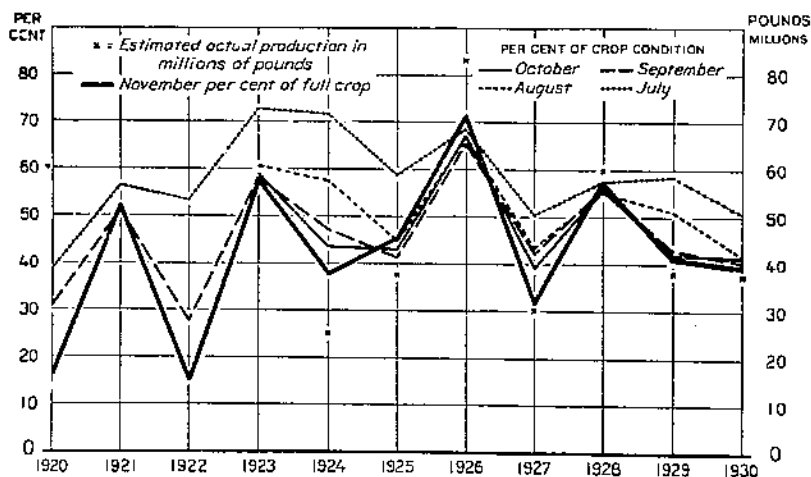


FIGURE 2.—Pecan reports for the United States, 1920-1930.

The relation between condition and production tends to become closer each month. The tendency in most years is for the early figures to be too high. Production was not estimated prior to 1924. (X represents preliminary estimates of absolute production. Revised estimates are shown in Table 2.)

centage of a full-crop promise, in comparison with previous months and years. Later in the season, forecasts and estimates may be made, based on study of the current reports of the crop condition in comparison with condition and final production in past years, on the reports of correspondents concerning production on their own farms, and on the personal investigations of agricultural statisticians of the United States Department of Agriculture in the different States. These are the principal available indications of production that can be used while the crop is still being marketed and until shipment records become available.

### COST OF PRODUCTION

The cost-of-production data presented in this bulletin were obtained in the spring of 1929 by personal interviews with pecan growers in the leading pecan-producing districts of Georgia, Florida, Alabama, Mississippi and Louisiana. The data refer to improved varieties only.

The practices and expenditures in terms of physical quantities and money are based on the most common method of orchard development and management as now practiced by pecan growers. Methods and practices in the development of young pecan orchards and in the care of bearing orchards have undergone many changes during recent years, changes natural for an industry as young as the pecan industry. The old idea that it was necessary only to plant a pecan tree and let nature care for it until it came to bearing age has been proved a fallacy. Many growers now realize that pecan trees require as much care and attention as do other horticultural crops. Perhaps the greatest improvements have been in better cultural practices, better fertilization, including the use of cover crops, and more suitable planting distances for young orchards. Even though these improvements are rather widely known, many orchards at present receive such indifferent care that the owners do not realize a profit.

Cost estimates are shown for orchards that have received reasonably good care, but not necessarily the best care. Notwithstanding great variations in methods and practices, each district has a general predominating method of orchard management on which the cost estimates are based.

Where field crops were grown in the orchard for harvest, only a part of the cost of such items as preparation of the land and cultivation of the total orchard acreage and of the cost of taxes and of interest on the investment was charged to the pecan orchard. The basis for such charges was the extent of the land area used by the trees. This method assumes that the growing of interplanted cash and feed crops reduces the cost of certain items involved in developing the trees and in producing the nuts, in proportion to the land area used by crops grown in the orchard. This is an arbitrary and not altogether satisfactory basis for distributing these costs, but is the best that could be used under the existing circumstances. The costs as shown are based on prices paid for labor, materials, and other items, in 1928.

The cost of developing pecan orchards for the first 10 years was used to represent the cost of bringing an orchard into bearing age. No credit was given for the value of nuts produced during this period. In some districts some production before the eleventh year can be anticipated, especially from early-bearing varieties, but such production from most varieties is not of commercial importance.

The cost of operating bearing pecan orchards is shown for orchards of 15 to 19 years of age. The majority of the bearing orchards surveyed were of this age.

#### EXPLANATION OF ITEMS

*Labor and power rates.*—Charges for man labor are based on prevailing local rates for labor hired by the day in 1928. Rates for horse work are based on the estimated cost of keeping work stock. Charges for use of tractors are based on the estimated cost of operating tractors.

*Supervision.*—Supervision refers to the labor of a general supervisory nature performed by the owner or hired manager. This labor was charged at double the rate for ordinary labor.

*Materials.*—Such items as trees, commercial fertilizer, manure, cover-crop seed, and spray materials were charged at cost when purchased, and at farm value when produced on the farm.

*Orchard sanitation.*—Orchard sanitation includes such operations as knocking off scab-infested leaves and nut shucks in the winter, disposing of girdled twigs and limbs, destroying web worms, etc.

*Rate of work per day.*—The term "rate of work per day" refers to the amount of work done per day on the basis of the entire orchard acreage and accounts for the relatively large number of "orchard acres" covered a day for such operations as cultivating tree rows and applying fertilizer around trees, where only a portion of the actual orchard space is covered.

*Reserve for orchard depletion.*—A charge for depletion of the orchard based on its bearing life is usually included in a study of orchard costs. As the production of improved varieties of pecans has been under way for so short a time that no one knows the bearing life of an improved pecan orchard, no charge for orchard depletion is included in this study. There are records, however, of seedling pecan trees over 100 years of age which are still bearing. If improved varieties have as long a period of bearing life as seedlings, this charge would obviously be so small as to be almost negligible.

*Overhead.*—Overhead includes a charge for such items of general farm maintenance expenses as building and fence repairs, general farm insurance, and miscellaneous cash and labor items used in operating the farm. In this study overhead was estimated as amounting to 15 per cent of the cost of labor, power, and materials used in pecan production.

*Interest.*—During the development period, interest was figured for a specific year at prevailing rates on the previous year's development costs and on the original value of the land occupied by the trees and on the value of the machinery used in developing the orchard. The interest charge for bearing orchards was figured on the total computed cost of developing an orchard into bearing, plus interest on the value of the land occupied by the trees and on the value of machinery used in operating the bearing orchard. For orchards purchased, interest should be computed on the price paid. Orchards in some districts may sell for more than the cost per acre as computed in this study.

*Use of machinery.*—Machinery costs include depreciation and repairs for tillage implements and other machinery used in handling orchards, excluding tractors. The charge for tillage implements was estimated at 3.75 cents per horse hour used. Sprayer charges were estimated at 65 cents an hour of use.

*Taxes.*—The tax charge is a pro rata share of the 1928 land tax; the part charged to pecans is in proportion to the value of the land used by the pecan trees. In general, young pecan orchards are assessed at the same value as land of the same grade without trees.

#### FARMS STUDIED

Records were obtained on a total of 222 pecan farms located in nine important pecan-producing districts. (Fig. 3.) In all, 408 blocks of trees, each block representing a separate planting, were included in the study. In all these districts small orchards were found, but a number of the pecan farms studied had several hundred acres, which require the full-time services of the owner or manager and a corps of assistants. Some of the larger pecan farms are operated by companies or individual caretakers who care for the orchards of absentee owners. The holdings of these absentee owners are usually small, 5-acre tracts being

the most common size. In this study a group of these holdings under one management was considered as one farm. (Table 9.) Because of this fact these farms can not be said to be typical of individual holdings, so far as size of orchards is concerned. It should also be borne in mind that selection of these farms was necessary because of the desirability of interviewing men who had cared for their orchards for some time and because of the necessity of collecting facts on orchards that were in the developmental stage and on others that were of bearing age. The age of these orchards varied from less than 1 year to over 30 years, but in selecting a group on which to base an estimate of the cost of operating bearing orchards, those from 15 to 19 years of age were used. The majority of the bearing orchards surveyed were of this age.

Yield records obtained in the field were supplemented by information from a mailed questionnaire survey conducted by the Division of Crop and Livestock Estimates.

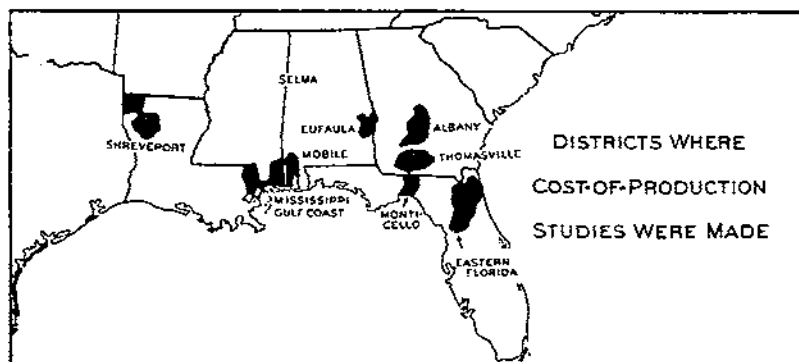


FIGURE 3.—Cost-of-production studies were made in nine of the principal districts producing improved varieties of pecans

TABLE 9.—Number of farms studied, by States, and by acreage in pecans, 1928.<sup>1</sup>

Acres in pecans	Georgia		Florida		Alabama			Mississippi—Gulf coast	Louisiana—Shreveport
	Albany	Thomasville	Monticello	Eastern	Mobile	Selma	Eufaula		
	Number	Number	Number	Number	Number	Number	Number	Number	Number
25 and under	3	0	18	23	5	3	3	22	1
26-50	4	2	6	7	3	3	4	4	2
51-75	1	1	1	5	1	1	1	6	3
76-100	3	2	0	4	1	3	1	2	2
101-125	1	1	3	2	0	1	0	0	1
126-150	1	1	0	1	1	1	1	0	1
151-175	4	2	0	0	0	0	0	3	0
176-200	4	0	1	1	0	0	0	1	2
Over 200	19	1	2	1	2	2	4	2	4
Total	40	10	31	44	13	14	14	40	16

<sup>1</sup> Many of the farms listed with large acreages are made up of small individual holdings (usually 5-acre tracts) under the same management.

Small individual holdings under one management are found most frequently in the Albany district of Georgia. This district represents one of the most extensive districts now producing improved varieties of pecans. Fifty-eight per cent of the farms studied had all of their

crop acreage in pecans; 42 per cent had only a part of their crop acreage in pecans, the remainder being planted to such crops as cotton, corn, peanuts, and hay. Usually cash and feed crops are produced among the trees of the young pecan acreage in this district. It is on the northern fringe of the Albany district that pecan orchards are operated in connection with the production of cotton and other field crops. In the central and southern part of the district pecan production is more specialized.

On the farms studied in the Thomasville district of Georgia the entire crop acreage was usually planted to pecans, although on a few farms the production of crops on land not in orchard was of some importance and consisted mainly of corn and hay. In the young orchards, the usual practice is to grow field crops for harvest.

In the two Florida districts crops are usually grown in the pecan orchard in the early stages of tree growth. On many of the pecan farms in these districts, such crops as corn, hay, cotton, peanuts, and melons are grown on land not in orchard. On other farms the entire crop acreage is planted to pecans. A large proportion of the pecan farms studied are relatively small.

On many of the pecan farms in the Mobile district of Alabama, Satsuma oranges are interplanted with the pecan trees and additional small acreages of cotton, corn, and hay are grown.

TABLE 10.—Percentage distribution of blocks of pecan trees by age group, and by number of trees set per acre<sup>1</sup>

Number of trees set per acre	Under 10 years of age			Number of trees set per acre	20 years of age and over		
	Under 10 years of age	10 to 19 years of age	20 years of age and over		Under 10 years of age	10 to 19 years of age	20 years of age and over
	Per cent	Per cent	Per cent		Per cent	Per cent	Per cent
Under 9.....	0.2	3.2	3.8	21-23.....	3.5	6.9	6.4
9-11.....	4.2	3.7	2.6	24-26.....	2.1	.5	6
12-14.....	30.3	21.8	14.1	27-29.....	3.5	12.8	21.8
15-17.....	35.9	31.9	28.2	Over 29.....	.7	4.3	6.0
18-20.....	10.6	14.9	11.1				

<sup>1</sup> Based on 408 blocks of trees, each block representing a separate planting. (Table 11.)

In the Eufaula and Selma districts of Alabama and in the Shreveport district of Louisiana the majority of the pecan farms studied not only had crops in the young orchards, but they also contained a considerable additional acreage of cotton and corn, and in many instances, of oats, hay, and peanuts. In the Shreveport district crops are generally grown in the bearing orchards. Generally the acreage of field crops outside of the orchard exceeded the acreage devoted to pecans. It may be said that these districts represent the type of farming where pecans are produced in a more or less general farming system with cotton and corn the major farm enterprises.

Many of the pecan farms studied in the Mississippi Gulf coast district are relatively small. Although a few pecan growers plant truck crops and Satsuma oranges in the orchard, the general practice is not to intercrop the orchard. Many of the growers have additional small acreages for feed crops.

## PLANTING DISTANCES OF PECAN TREES

In the early days of the pecan industry there was a tendency to set trees more closely together than has been the practice during recent years. Of 408 blocks of trees, more than 50 per cent of those that are 20 years of age and over were set at the rate of 18 or more trees to the acre; of those under 10 years of age only 20 per cent have as many as 18 trees to the acre and 44 per cent have 14 or fewer trees to the acre. (Table 10.) The square method of planting is the one most commonly used.

The variation in number of trees set per acre in the orchards studied is from 4 to 50. (Table 11.) However, 121 blocks of trees were set 50 by 50 feet, or 17 to the acre, and 82 were set 60 by 60 feet, or 12 to the acre. These are the two most common planting distances observed.

TABLE 11.—Distribution of blocks of pecan trees by age group, and by number of trees set per acre <sup>1</sup>

Number of trees set per acre	1 to 4 years	5 to 9 years	10 to 14 years	15 to 19 years	20 to 24 years	25 to 29 years	30 years and over
	Number	Number	Number	Number	Number	Number	Number
50				1			
48				2	2		
36				1	1	1	1
35		1	2				
32				1			
31			1				1
29					1		
27	2	3	10	14	12	2	2
24		3		1			
22			1	1			
21	3	2	5	6	4	1	
20	2	6	11	14	7		2
19	2	2	1		1		
18	2	1	1	1	1		
17	20	25	21	34	12	7	2
16	2	2	2				
15		2	1	2	1		
14	2	1	4	3		1	
13	1	1					
12	15	23	18	16	8	2	
11			2	3			
10	2	4	2		1	1	
9	1	3	1	1	1		
8	1	2					
7	1	2					
6	1	2	1				1
5	2			1			
4		1	2		1		
Total	58	61	86	102	54	15	9

<sup>1</sup> A total of 408 blocks of trees, each block representing a separate planting.

The age at which pecan trees begin to crowd each other depends on the variety and to a large extent on the fertility of the soil. With reference to this point a published report <sup>1</sup> based on an orchard of the Frotcher variety at Thomasville, Ga., gives the information in the following paragraph.

Trees of the Frotcher variety in this section are vigorous growers and wide spreaders and crowd each other at an earlier age than do trees of some other varieties. At about 12 or 13 years of age trees of this variety set 50 by 50 feet, or about 17 to the acre, were very symmetrical and uniform in shape and had attained a growth which,

<sup>1</sup> PARKER, C. S. PROPER DISTANCE FOR TREES IN A PECAN GROVE. Natl. Pecan Growers Assoc. Proc. 1922: 48, 1922.

in many instances, allowed the limbs from adjacent trees to touch each other. During the next two years the lower limbs, with few exceptions, died, thereby greatly reducing the bearing surface of the trees. Later, the even numbers from the first row and the odd numbers from the second row (and so on) were removed, leaving the trees that remained at about 71 by 71 feet, or about 9 trees to the acre. Since the removal of the excess trees, the remaining trees have flourished and are again developing their rounded forms.

During the first few years of the bearing life of a pecan orchard, or up to the time the trees begin to crowd, a greater production per acre can be anticipated from trees set fairly close together. Notwithstanding the possibility of a greater yield for the first few years it is doubtful if this added production will more than offset the cost of carrying the excess trees through the development period and the cost of removing them when they begin to crowd. If the trees are set close together they should be so spaced that those remaining, after some have been removed, will be in a fairly symmetrical arrangement.

If the excess trees are not removed when they begin to crowd, nature will come to the aid of the trees in their search for sunlight and air and cause the lower limbs to die so that a large amount of valuable bearing surface will be lost. As there is always the danger that the removal of excess trees will be delayed too long, perhaps the safest course to pursue is to set the trees a greater distance apart. Table 11 shows that, as many of the recent plantings are set too close for the future well-being of the mature orchard, some of these trees should be removed after a few years of bearing life.

#### CONTROL MEASURES FOR PECAN SCAB INFESTATION

Some of the fungus diseases affecting the pecan are the brown leaf spot, blotch, downey-spot, and scab. Of all of these, pecan scab is of the most economic importance. This disease affects the leaves, twigs, and nuts of the pecan tree with by far the greatest injury to the nuts. It is most serious in districts of high humidity, high temperature, and frequent summer rains. Until recently pecan scab was not of great economic importance except in the southeastern United States within a distance of from 50 to 100 miles from the coast. Scab infestation has continued to spread, however, until it is fairly well distributed over the pecan belt except in the drier districts of the Southwest.

#### TOP-WORKING

Formerly many cultivated varieties of pecans were thought to be practically immune to scab infestation. The Teche, Curtis, Money-maker, Russell, Stuart, and Frotscher were considered highly resistant. Of the cultivated varieties most susceptible to scab Delmas, Georgia, Alley, Van Deman, Schley, Pabst, Mobile, Success, and Moore may be classified in the order named.<sup>2</sup> Recent observations, however, indicate that the scab fungus is becoming of economic importance on the so-called highly resistant varieties.

As the effective control of this disease is a matter of great importance to the pecan industry the practice, widely followed, of top-working susceptible varieties to so-called nonsusceptible varieties may need

<sup>2</sup> DEMAREE, J. B. PECAN SCAB WITH SPECIAL REFERENCE TO SOURCES OF THE EARLY SPRING INFECTION. Jour. Agr. Research 28: 321-330, illus. 1921.

to be abandoned and other methods of control adopted. The cost of top-working to so-called nonsusceptible varieties and the time required for the top-worked tree to come into commercial bearing again are important items for consideration. So many factors enter that a reasonable estimation of this cost is difficult. Estimates indicate that the total cost of top-working including necessary care following will approximate \$1 for each inch in diameter of the top-worked tree. The length of time before top-worked trees come into bearing again depends on a number of conditions but it is safe to state that the new top will begin bearing in from 2 to 5 years and will yield a commercial crop in 6 to 8 years.<sup>3</sup>

#### COST OF SPRAYING AND DUSTING

In humid regions where scab is prevalent, spraying or dusting susceptible varieties may be essential to save the pecan crop. With indications of a heavy crop set in the spring, spraying or dusting these varieties may mean the difference between no crop and a full crop. The impression prevails in some sections that the cost of spraying and dusting is prohibitive. The estimates of the cost of these operations (shown in Table 12 for the year 1928) should serve to disprove this assumption.

TABLE 12.—Comparative cost per acre per season of spraying, and dusting 16-year-old pecan trees set 12 to the acre according to a common method and at cost rates prevailing in 1928

Item	Spraying		Dusting	
	Quantity	Cost	Quantity	Cost
Materials used, per acre:	<i>Gallons</i>	<i>Dollars</i>	<i>Pounds</i>	<i>Dollars</i>
Bordeaux mixture 3-4-50.....	900	4.80		
20-80 copper-lime dust.....			240	14.40
Applications.....	<i>Number</i>		<i>Number</i>	
Usual crew:				
Men.....	3		4	
Horses.....				
Cost per acre:	<i>Hours</i>		<i>Hours</i>	
Man labor.....	15.3	2.65	2	.38
Horse work.....	10.2	1.28	2	.25
Sprayer use.....	5.1	3.83	1	.75
Total.....		12.62		15.78

On the basis of 16-year-old trees set at 60 by 60 feet, or 12 to the acre, the cost per acre of three applications of a standard 3-4-50 Bordeaux mixture is about \$12.60, while the cost per acre of four applications of a 20-80 copper-lime dust is about \$15.80. Based on the recommended number of applications of wet spray and of dust (three and four, respectively) these figures show a somewhat higher cost per acre for dusting than for spraying. On a tree basis, the cost per season is \$1.05 for spraying and \$1.32 for dusting. With pecans selling at 30 cents a pound, about 3½ pounds of nuts per tree would pay for a season's spraying and 4½ pounds would pay for a season's dusting.

<sup>3</sup> BLACKMON, G. H. TOP-WORKING PECAN TREES. Fla. Agr. Expt. Sta. Bul. 170: 187. 1924.



On the farms visited in 1928 neither the practice of spraying nor that of dusting was commonly followed. Considering the increased yield that normally may be expected in humid districts, as a result of spraying or dusting varieties susceptible to scab, it appears that these control measures may be practiced to advantage.

A sprayer of sufficient power and capacity for effective work in old pecan orchards costs about \$1,250, whereas a suitable duster costs about \$500. To justify the purchase of a sprayer a grower should have not less than 25 acres of pecan orchard and for the purchase of a duster probably not less than 10 acres. Some pecan growers with small acreages may find it advantageous to own this equipment in partnership with neighbors.

#### CONTROL MEASURES FOR PECAN INSECTS<sup>4</sup>

Among the various insects which attack the pecan and cause damage, the pecan leaf case-bearer, the pecan nut case-bearer, the black pecan aphid, and the hickory shuckworm are of major economic importance; in limited localities the obscure scale and the pecan weevil are also of considerable importance.

The pecan leaf case-bearer occurs in very injurious numbers in orchards in the southern portion of the pecan-growing area, extending from Florida to Texas. This insect does not attack the nuts directly, but it destroys many blossom buds in the spring. As the initial activity of the larvæ of this insect in the spring is confined to the terminal and lateral buds after differentiation has taken place, the damage they do plays an important part in reducing the yields.

Pecan growers annually use considerable quantities of calcium arsenate in the control of this insect. This insecticide is used at the rate of 1 pound to 50 gallons of 3-4-50 Bordeaux mixture. Under no circumstances should calcium arsenate be used without Bordeaux mixture, as more or less serious injury to the foliage or nuts is likely to result if the mixture is not used. Only one thorough spraying is necessary to control this pest. This spraying should take place at the time of the last Bordeaux application for pecan scab, leaf blotch, or brown leaf spot—about July 15.

The pecan nut case-bearer has often been reported as destroying from one-third to three-fourths of the total crop of wild pecans in various localities in Texas. It is also present in Florida, Georgia, Alabama, Mississippi, and Louisiana, where it occasionally becomes a serious pest. Serious destruction in most of these localities occurs, on an average, in only one year out of five. Considerable study has been devoted to the problem of controlling the pecan nut case-bearer, but because of the peculiar habits of the pest no satisfactory practical control measure has yet been devised.

The black pecan aphid, like all other plant lice, feeds upon the sap which is sucked up through the beak thrust into the tissues of the leaf. The damage caused by this insect is difficult to estimate. In times of a severe infestation there is undoubtedly a drain which interferes with the proper functioning of the tree. Coupled with this, the premature defoliation resulting from the feeding of the aphids has a tendency to result in unfilled and undeveloped nuts. Owing to the fact that it takes considerable spray material properly to spray large

<sup>4</sup> For further information on pecan insects and their control see Farmers' Bulletin 1654, *Insects of the Pecan and How to Control Them*.

pecan trees, growers are rather reluctant to use nicotine sulphate 40 per cent, which is at present recommended, but a considerable quantity of this insecticide is used each season in controlling the aphid.

The hickory shuckworm occurs in practically every section of the pecan belt. Mining or tunneling of the shucks often results in the improper development of the nut kernels and prevents the natural separation of the shucks from the nutshells. Nuts infested by the shuckworm are often undersized and are usually later in maturing than are those that are free from this pest. The damage is not restricted entirely to the matured nuts, for in the spring and early summer the larvæ destroy the small, green nuts by eating out the interior. Injury of this type is not so noticeable as that caused in the fall, but it should not be minimized, since investigations have shown that it plays no small part in the reduction of the nut crop. Since the insects pass the winter as larvæ in the shucks, one means of aiding control is to gather and destroy all shucks during or immediately after harvest. Some pecan growers use sheets for harvesting their crop; in so doing the shucks are conveniently piled on the sheet and are later removed from the grove and destroyed. As yet no satisfactory spraying method for shuckworm has been devised.

#### YIELD OF PECANS

Economical yields are the basis of successful crop production and should be the goal of every orchardist. Unlike annual crops, pecan trees can not be taken on trial and then easily discontinued if the results do not meet expectations. Since a pecan orchard represents a considerable investment and requires a number of years of care before giving any return, it is especially important that it be so set and cared for that it will produce enough nuts to return a profit to the grower. Pecan yields, however, are so highly uncertain that the grower may have serious financing problems.

There has been, and still is, much misunderstanding about the yields reasonably to be expected from pecan orchards. The phenomenal yield from some individual tree is frequently used in estimating the potential returns from a prospective orchard. For example, individual old trees, having the advantage of unusually favorable growing conditions, have been known to yield in excess of 500 pounds of nuts in a single year. The enthusiastic planner, hearing of such yields from a single tree, is prone to think that an extensive commercial orchard, producing nuts in proportion to the model tree according to its age, would be a good thing to own. As trees planted in orchards rarely yield in proportion to isolated trees under higher favorable environment, one should not be misled by taking such individual tree records as a basis for estimating probable returns from commercial plantings. Rather, a person who contemplates setting out a pecan orchard and who wishes to estimate his potential returns should note, if possible, the results being obtained from well-cared-for orchards of fairly good size in the community in which he contemplates planting.

There is a wide range in yields, not only between orchards of different ages but also between orchards falling in the same age group. (Table 13.)

TABLE 13.—Distribution of blocks of pecan trees by age, and by yield per acre, 1928<sup>1</sup>

Range in yield per acre (pounds)	Distribution of blocks of trees—														
	5-9 years old			10-14 years old			15-19 years old			20-24 years old			25 years old and over		
	Number	Per cent	Acres	Number	Per cent	Acres	Number	Per cent	Acres	Number	Per cent	Acres	Number	Per cent	Acres
No yield.....	7	21.9	375	1	2.3	2	2	2.7	83						
1-10.....	9	28.1	3,275	1	2.3	45									
11-60.....	7	21.9	1,130	12	27.9	961	11	14.7	1,051	1	3.4	3	2	11.7	47
61-110.....	6	18.8	266	10	23.3	1,406	10	13.3	260	2	6.0	303			
111-160.....				5	11.6	192	9	12.0	1,893	3	10.4	82	1	5.9	135
161-210.....	1	3.1	47	4	9.3	283	11	14.7	250	3	10.4	31	1	5.9	29
211-260.....	1	3.1	10	2	4.7	58	5	6.7	154	3	10.4	13			
261-300.....	1	3.1	12	3	7.0	23	0	8.0	540	5	17.2	754	2	11.8	212
301-400.....				4	9.3	64	8	10.6	152	2	6.9	70	2	11.8	32
401-500.....							4	5.3	73	5	17.2	53	1	5.9	1
501-600.....							5	6.7	50						
601-700.....							1	1.3	9	1	3.4	(?)	4	23.5	68
701-800.....				1	2.3	6	1	1.3	2	1	3.4	110	1	5.9	38
801-960.....															
961 and over.....							2	2.7	3	3	10.4	14	3	17.6	15
Weighted average yield per acre.....	Pounds 12			Pounds 101			Pounds 145			Pounds 320			Pounds 330		

<sup>1</sup> For a total of 169 blocks of trees on which data were complete.

<sup>2</sup> Less than 1 acre.

Pecan trees may bear a few nuts when 3 to 5 years of age but, generally speaking, orchards do not come into commercial bearing until they are at least 10 years old. With proper care the trend in yields is then upward as the orchard increases in age. This increase is by no means a fixed ratio, as yields depend not only on the age of the trees but on the soil, climatic conditions, variety, planting distance, and system of orchard management followed.

TABLE 14.—Yield per acre of 38 individual pecan orchards for which data were complete for either four or five years, 1924-1928<sup>1</sup>

State, and district	Orchard	Trees set per acre	Age of orchard in 1928	Yield per acre					Average
				1928	1927	1926	1925	1924	
Georgia:									
Albany.....	1	20	18	167	150	165	185	80	140
Do.....	2	20	15-19	90	48	207	260	0	121
Do.....	3	20	18-20	279	126	407	36	0	170
Do.....	4	20	16	147	101	53	108	0	82
Thomasville.....	5	17	18	191	91	62	16	16	76
Florida:									
Monticello.....	6	12	15	72	11	111	81	56	67
Do.....	7	17	15	100	100	150	110	(?)	115
Do.....	8	17	18	400	720	640	600	560	506
Do.....	9	17	15-19	35	120	48	112	100	86
Eastern.....	10	17	16	200	17	117	50	67	90
Do.....	11	27	16	504	562	125	250	(?)	383
Do.....	12	27	16-20	188	112	225	125	150	100
Do.....	13	18	17	571	143	280	143	143	257
Do.....	14	21	15-18	88	53	70	41	12	51
Do.....	15	17	18	260	200	500	400	300	334
Do.....	16	17	15	205	135	77	132	(?)	187
Do.....	17	17	15	83	27	40	67	53	54
Do.....	18	21	15	400	40	100	100	200	180
Alabama:									
Mobile.....	19	20	15-18	302	0	0	225	(?)	132
Do.....	20	17	18	438	0	0	225	(?)	168
Do.....	21	15	15	320	0	0	82	44	90
Do.....	22	22	18	665	0	0	425	75	217
Selma.....	23	17	15	211	107	236	164	(?)	180
Do.....	24	12	18	220	20	500	70	(?)	202
Do.....	25	17	18-19	67	3	0	0	(?)	18
Do.....	26	8	16	114	80	71	57	34	72
Mississippi:									
Gulf coast.....	27	17	17	32	0	0	20	(?)	15
Do.....	28	12	18	620	0	20	200	(?)	210
Do.....	29	17	15-19	35	0	0	140	0	35
Do.....	30	17	15	17	0	0	6	(?)	6
Do.....	31	17	16	130	56	6	3	(?)	140
Do.....	32	15	18	220	80	11	160	(?)	122
Do.....	33	18	16	1,825	50	0	750	(?)	656
Do.....	34	17	18	125	0	0	75	90	58
Do.....	35	17	15	52	1	0	111	(?)	41
Do.....	36	12	18	553	0	344	31	344	254
Louisiana:									
Shreveport.....	37	14	19	20	40	30	6	8	21
Do.....	38	12	16	70	0	290	63	90	104
Average.....				268	84	130	150	105	

<sup>1</sup> The 1928 yields of pecans for a majority of these selected orchards were considerably higher than the average yield of all orchards studied.

<sup>2</sup> Data not available.

<sup>3</sup> 4-year average.

<sup>4</sup> Average of 23 orchards for which data were available.

Yields per acre of 38 individual pecan orchards for the years 1924-1928 are shown in Table 14. Although the quality of most of these orchards was decidedly better than average, the yield figures serve as illustrations of variations in production from orchard to orchard and from year to year. The variation in yield of a single orchard over a period of years may be as wide as the variation between individual orchards during a single year. Although few of the orchards shown had consistently high yields, a large proportion had relatively good

production over a period of years. The extent to which the use of better cultural practices may eliminate the uncertainty of obtaining uniformly good yields still remains to be seen.

#### COST OF DEVELOPING PECAN ORCHARDS AND COST OF OPERATING BEARING ORCHARDS, BY DISTRICTS

The general practice of orchard development is somewhat similar in all districts, in so far as the growing of interplanted field crops for harvest is concerned, except in the Gulf coast district of Mississippi and the Mobile district of Alabama. Interplanted crops are grown for feed and for the purpose of deriving some cash income from the orchard while the trees are still in the development stage. In the Mobile district a filler crop of Satsuma oranges is common. Along the Mississippi Gulf coast interplanted crops for harvest are not commonly grown in young orchards.

After the pecan orchard comes into commercial bearing the interplanting of field crops for harvest is discontinued in most districts and pecan production is then given the entire consideration. The exceptions are the Mobile district of Alabama, where the growing of Satsuma oranges is commonly continued in the bearing orchards, and the Shreveport district of Louisiana, where interplanted farm crops for harvest are commonly grown in bearing orchards.

The total cost of developing a pecan orchard into bearing shows considerable variation as between districts. This variation is due to a number of factors such as wages of man labor, horse-work rates, and use of fertilizer. The greatest single factor in the following cost figures is the amount of the joint costs that are charged to pecans. The cost of bringing a pecan orchard into bearing along the Mississippi Gulf coast, the one district where interplanted crops for harvest are not common, was much higher than in any other district.

The pecan tree requires a fertile, productive soil; if intercropping is practiced to offset to some extent the expense during the development period, a proper rotation of crops with frequent use of legumes should be followed, together with the use of generous applications of commercial fertilizer. The idea is not only to maintain the fertility of the soil, but also gradually to build it up and put it in condition to produce large yields of pecans.

The ultimate object is a healthy, normal orchard, and if this development is not unduly hindered by growing interplanted crops for harvest, and if a pecan grower is in a position to use to advantage the products produced in the orchard, or if he can find a ready sale at a profit for these products, he may well reduce production costs to a minimum by following the practice during the first few years or until the additional space is needed for the future well-being of the orchard.

The present tendency to set pecan trees greater distances apart than was the practice during the early years of the industry is a further reason why interplanting during the development period may be practiced without serious detrimental effects. Care should be exercised in not growing other crops too close to the pecan trees.

Cost of production per acre previous to harvest is a more stable figure than the cost of production per pound of nuts. Irrespective of whether a crop is produced, the orchard receives a certain amount of care, which in many cases does not differ materially from year to

year. Provided the general system of management remains constant, the cost per acre previous to harvest will differ only slightly from year to year except as changes occur in the prices paid for labor, power, and materials.

The total cost of production per acre and per pound takes into consideration the cost of harvesting and delivering the nuts to the shipping point and varies largely with the yield. During the year of this study (1928) conditions were relatively favorable for pecan production. Obviously the yields for that year do not represent a fair basis in all cases for calculating production costs per pound of nuts. Nor was it possible to obtain reliable yield data for a series of years for all orchards. For these reasons the cost figures given are on an acre basis; with them are given the yields that are necessary to pay production costs, if the nuts are sold at State average prices received by growers in 1928.

The following text and tables briefly summarize practices and costs of developing a pecan orchard to commercial bearing age and the annual cost of operating an orchard of bearing age, for each of the districts studied. In considering these costs, the reader should keep in mind that a considerable portion of the cost of developing an orchard and of producing pecans may not represent an actual out-of-pocket cost. In many instances, much of the labor is performed by the pecan grower and his family. On farms where there are enterprises other than pecans, much of the additional labor and use of implements and work stock, made necessary because a pecan orchard is being developed, and later is cared for in its bearing stage, represents additional use of these things not provided for by other farm enterprises and hence is not additional actual cost to the farmer. The purchase price of the land itself is, of course, to be considered as a significant part of the initial cost of development and operation of bearing pecan orchards.

These considerations are of prime importance to those who contemplate the development of a pecan orchard. In most cases the man who can develop and operate an orchard to best advantage and at lowest significant cost is the one who does it as a part of his own farming business. The contrary is true of orchards under the management of caretakers where the operations are commonly performed at contract rates. In such cases, the total cost of developing and operating the orchard, aside from the use of land, normally represents an actual cash outlay.

#### GEORGIA

##### ALBANY DISTRICT

The majority of the orchards studied in the Albany district of Georgia are in Dougherty County; others studied are in the counties of Lee and Mitchell. In this district farm crops for harvest are usually interplanted in young orchards, but a free space is allowed on each side of the tree rows. These tree-row spaces have a total width of approximately 12 feet for the first 4 years and 20 feet for the next 6 years and are cultivated independently of the interplanted crop. In the spring the tree-row space is plowed. The remainder of the orchard acreage is plowed and planted to field crops. Following an application of fertilizer in the spring, the tree rows are clean

cultivated about six times during the remainder of the season. One-horse cultivators are used for cultivating close to the trees. The rest of the tree-row space is cultivated with disk harrows. Although cover crops are used in some of the young orchards in the district, the practice is not common. Little spraying or dusting is done. Horses or mules are usually used to furnish motive power in orchards that are intercropped. During the first 10 years of growth a total of about 132 man hours and 119 horse hours are used to plant and fertilize the trees, cultivate the tree-row spaces, and prune and care for the trees. At rates prevailing in 1928, the labor and power cost for the first 10 years amounted to about \$31 an acre. (Table 15.)

TABLE 15.—Georgia, Albany district: Labor and power cost per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Per-centage charged to pecans	Charged to pecans		Cost
		Men	Horses				Man labor	Horse work	
		Number	Number				Hours	Hours	
Plow	First to fifth	1	2	2	1	25	5.0	10.0	1.02
	Fifth to tenth	1	3	2	1	42	12.6	25.2	4.10
Plant:									
Lay off rows	First	1	1	30	1	100	.3	.3	.07
Set stakes	do	3		35	1	100	.0	.0	.11
Dig holes	do	1		1.5	1	100	6.7		.84
Set trees	do	7	2	12	1	100	5.8	1.7	.90
	First and second	3	2	30	1	100	2.0	1.4	.39
	Third	3	2	24	1	100	1.2	.8	.23
	Fourth	3	2	20	1	100	1.5	1.0	.28
	Fifth and sixth	3	2	17	1	100	3.5	2.4	.68
	Seventh to tenth	3	2	14	1	100	8.4	5.6	1.01
Apply fertilizer around trees	First to tenth	1	1	30	6	100	20.0	20.0	4.50
	First to fourth	1	3	30	3	100	4.0	12.0	1.70
	Fifth to tenth	1	3	18	3	100	10.2	30.6	4.34
	First and second	1		20	2	100	2.0		.25
	Third to fifth	1		18	2	100	3.3		.41
	Sixth to tenth	1		15	2	100	6.5		.81
Prune	Second to tenth	1				100	5.7		.71
Remove pruned wood	Sixth to tenth					100	3.2	3.2	.72
Supervision	First to tenth					100	22.0		5.50
Miscellaneous <sup>2</sup>	do					100	7.0	4.5	1.32
Total							131.8	118.7	31.10

<sup>1</sup> Trees set 46½ by 46½ feet, or 20 to the acre. Tree-row spaces have a total width of about 12 feet for the first 4 years and 20 feet for the next 6 years. Tree-row spaces cultivated independently, rest of space cropped in cotton or other cultivated crop for harvest.

<sup>2</sup> Includes manuring, spraying, seeding cover crop, orchard sanitation, and replacing missing trees.

In 1928 pecan-orchard land was valued at about \$30 an acre. Trees for planting 46 feet 8 inches each way cost \$12 an acre (20 trees at 60 cents each). The cost of trees, labor and power, fertilizer, taxes, interest, and other items chargeable to the trees plus the value of land on which the trees were set amounted to about \$52 an acre for the first year. After the first year, the annual cost increased from about \$7 an acre in the second year to almost \$20 an acre in the tenth year. At the end of 10 years, the total cost, including interest on the investment compounded annually, and \$30 for land amounted to \$166.32 an acre. (Table 16.)

TABLE 16.—*Georgia, Albany district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928*

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Fertilizer..... pounds	40	60	80	120	160	160	200	200	200	200
Labor and power:										
Man labor..... hours	21.7	9.0	9.4	11.2	12.1	12.6	13.2	13.4	13.0	13.2
Horse work..... do.	10.5	8.5	8.5	9.8	12.8	13.5	13.6	13.0	13.7	13.9
Labor and power:										
Man labor <sup>1</sup> ..... Dollars	3.60	1.31	1.38	1.64	1.76	1.83	1.93	1.95	1.90	1.93
Horse work at 10 cents per hour	1.05	.85	.85	.98	1.28	1.35	1.36	1.39	1.37	1.39
Total.....	4.65	2.16	2.23	2.62	3.04	3.18	3.29	3.34	3.27	3.32
Materials:										
Trees at 60 cents each.....	12.00									
Fertilizer at \$10 per ton.....	.60	.90	1.20	1.80	2.40	2.40	3.00	3.00	3.00	3.00
Miscellaneous <sup>2</sup> .....	.46	.92	.92	.19	.49	.52	.91	1.17	2.08	3.09
Total.....	13.06	1.82	2.12	1.99	2.89	2.92	3.91	4.17	5.08	6.09
Other costs:										
Taxes <sup>3</sup> .....	.31	.31	.31	.31	.52	.52	.52	.52	.52	.52
Use of machinery <sup>4</sup> .....	.39	.32	.32	.37	.48	.51	.51	.59	.51	.52
Overhead <sup>5</sup> .....	2.60	.60	.65	.69	.88	.92	1.08	1.13	1.25	1.41
Total.....	3.30	1.23	1.28	1.37	1.88	1.95	2.11	2.24	2.28	2.45
Total cost, exclusive of interest.....	21.07	5.21	5.63	5.98	7.72	8.05	9.31	9.75	10.63	11.86
Interest at 6 per cent <sup>3</sup> .....	.57	1.94	2.27	2.76	3.62	4.31	5.05	5.95	6.85	7.91
Total cost.....	21.64	7.05	7.90	8.74	11.34	12.36	14.36	15.70	17.48	19.77
Cost of development at end of each year <sup>3</sup> .....	51.04	58.69	66.59	75.33	86.67	99.03	113.30	129.00	146.57	166.34

<sup>1</sup> Ordinary labor charged at 12½ cents per hour, supervision at 25 cents per hour.

<sup>2</sup> Includes manure, spray material, cover-crop seed, replants, and other materials.

<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First 4 years, 25 per cent, next 6 years, 42 per cent.

<sup>4</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>5</sup> Total cost including interest plus initial value of land, at \$30 an acre.

The growing of field crops for harvest in the orchard is usually discontinued when the young orchards come into commercial bearing, and more attention is given to soil improvement through the use of cover crops. In bearing orchards of the Albany district a winter cover crop, usually Austrian winter peas, is seeded in the fall. This is plowed under during the following spring. Commercial fertilizer is then spread around the trees and worked in with a disk harrow. A summer cover crop of velvetbeans is then drilled, but enough free space is left on each side of the tree rows to permit cultivation next to the trees. This space is gone over with a disk harrow during the summer. The velvetbeans are disked under in the fall, thus clearing the land for harvest and preparing the soil for the winter cover crop.

The care of an acre of bearing orchard in the Albany district usually takes slightly more than an equivalent of two days of man labor per year, and the necessary motive power for performing the field operations. Since field crops are not commonly grown in bearing orchards, and the pecan acreage under one management is usually large, tractors are well adapted for use in this district.



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TABLE 17.—Georgia, Albany district: Annual labor and power cost per acre, of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horses	Tractor						
	Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Prune.....	2			12	1	1.7			0.21
Remove pruned wood.....	2			30	1	.7			.16
Orchard sanitation.....		2				4.7	0.7		.67
Plow.....		2		2	1	5.0	10.0		1.62
Apply fertilizer around trees.....	5			20	1	2.5	1.0		.41
Disk barrow.....	1			25	1	.3		0.4	.55
Seed summer cover crop.....	1			50	1			.3	.41
Cultivate tree rows (disk barrow).....	1			50	2	.4		.4	.55
Disk under summer cover crop.....	1			30	2	.7		.7	.96
Seed winter cover crop.....	1			30	1	.3		.3	.41
Supervision.....						3.5			.88
Miscellaneous <sup>3</sup> .....						1.0	.6		.19
<b>Total</b> .....						<b>21.2</b>	<b>13.1</b>	<b>2.1</b>	<b>7.02</b>

<sup>1</sup> Trees set 46 $\frac{1}{4}$  by 46 $\frac{1}{4}$  feet, or 20 to the acre, of which 3 per cent were missing, 86 per cent were in bearing, and 11 per cent not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 12 $\frac{1}{2}$  cents an hour, supervision at 25 cents, horse work at 10 cents and use of tractor at \$1.25.

<sup>3</sup> Includes hoeing, applying manure, spraying, and miscellaneous operations.

The cost of labor, materials, etc., per acre in 1928 is shown in Tables 17 and 18.

TABLE 18.—Georgia, Albany district: Annual cost per acre of operating pecan orchards 15 to 19 years old,<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
<b>Labor and power prior to harvest:</b>		
Man labor.....	Hours 21.2	Dollars 3.09
Horse work.....	13.1	1.31
Tractor work.....	2.1	2.62
<b>Total</b> .....		<b>7.02</b>
<b>Materials:</b>		
Fertilizer, at \$30 per ton.....	Pounds 388.0	5.82
Summer cover crop, velvetbeans, at \$1.50 per bushel.....	Bushels 0.75	1.12
Winter cover crop, Austrian winter peas, at 3 cents per pound.....	Pounds 30.00	2.70
Miscellaneous <sup>2</sup> .....		1.65
<b>Total</b> .....		<b>11.29</b>
<b>Other costs:</b>		
Taxes.....		1.25
Use of machinery, not including tractor <sup>3</sup> .....		.62
Overhead <sup>4</sup> .....		2.75
<b>Total</b> .....		<b>4.62</b>
<b>Total cost, exclusive of interest</b> .....		<b>22.93</b>
Interest at 6 per cent <sup>5</sup> .....		10.18
<b>Total cost</b> .....		<b>33.11</b>
Quantity of nuts, at 28 cents per pound, <sup>6</sup> required to cover cost, including harvesting:		
Exclusive of interest.....	93	
Inclusive of interest.....	133	

<sup>1</sup> Trees set 46 $\frac{1}{4}$  by 46 $\frac{1}{4}$  feet or 20 to the acre, of which 3 per cent were missing, 86 per cent were in bearing, and 11 per cent not in bearing—mainly replants.

<sup>2</sup> Includes manure, spray material, and other materials.

<sup>3</sup> See page 16 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 State average farm price. Harvesting costs includes picking, grading, and delivery to local shipping point and are based on pecans sold through a cooperative association.

Harvesting costs in 1928 ranged from about \$2 to \$4 per hundred pounds of nuts, depending largely on the yield.

The 1928 pecan yields in Georgia were considerably above the average for other seasons (Table 8), but many of the orchards 15 to 19 years of age in the Albany district did not have yields sufficient to cover costs as computed in this bulletin. Production records obtained through personal visits and through the use of mailed questionnaires furnished yield information on a tree basis for 36 orchards, representing a total of 72,832 trees 15 to 19 years of age. The distribution of orchards according to the average tree yield in 1928 is shown below:

Yield per tree, in pounds	Number of orchards	Yield per tree, in pounds	Number of orchards
1-3.9 .....	9	20-23.9 .....	0
4-7.9 .....	12	24-27.9 .....	0
8-11.9 .....	5	28-31.9 .....	1
12-15.9 .....	4	32-35.9 .....	2
16-19.9 .....	2	36 and over .....	1

The exceptionally high-yielding orchards are relatively few in number. The majority of the orchard owners reported yields under 8 pounds a tree, as indicated in the distribution shown. On an acre basis, allowing 20 trees to the acre and assuming that 86 per cent of the trees are in production, approximately 53 per cent of the entire group of orchards failed to produce enough nuts in the good season of 1928 to cover the costs, including harvesting and interest charges. (Table 18.) Excluding interest, 36 per cent of the orchards did not have yields sufficient to cover costs.

Orchard management is an especially important factor in the Albany district because of the large holdings under the management of individuals. The test of successful orchard management is measured by ability to realize profitable yields in return for the outlay of capital and labor and the use of land. Some of the orchards studied produced profitable yields in 1928, while others did not.

Either singly or in combination, several factors other than management may affect yields adversely. A mistaken impression of the length of time required for a young orchard to come into commercial bearing has often resulted in inadequate provision being made at the outset for financing the enterprise, with a consequent neglect of the orchard during the later part of the development period. In some cases it has been difficult to overcome this imposed handicap, except at the expense of a delayed bearing period or even partial replanting of portions of the orchard.

Location of the orchard with respect to the ability of the soil to meet, or be made to meet economically, the plant-food requirements of pecan trees is one of the most essential factors in determining the future profitableness of the orchard. The turning under of leguminous cover crops and the use of commercial fertilizers have been profitably practiced in many of the more successful, established orchards.

#### THOMASVILLE DISTRICT

The orchards studied in the Thomasville district are in Thomas and Grady Counties, with the majority in the former county. The common system of orchard development is similar to that of the Albany district. Field crops for harvest (principally cotton, corn, and pea-

nuts) are usually interplanted in the young orchards during the entire development period. Cultivated spaces are provided on each side of the tree rows. These tree-row spaces have a total width of approximately 16 feet for the first five years of the development period and 24 feet for the next five years, and are cultivated independently of the interplanted crop.

In the spring the orchard acreage is plowed and planted to field crops for harvest, except the spaces along the tree rows. Fertilizer is applied around the trees and is worked in with disk harrows. During the summer, the tree rows are given clean cultivation. Cover crops are planted in strips along the tree rows in some of the orchards, but the practice is not common. Little spraying or dusting is done. Horses or mules are the common source of motive power in developing young orchards in this district chiefly because of the common practice of growing row crops for harvest.

The costs during the development period are shown in Table 19.

TABLE 19.—Georgia, Thomasville district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans		Cost
		Men	Horses				Man labor	Horse work	
		Number	Number	Orchard acres	Number		Hours	Hours	Dollars
Plow	First to fifth	1	2	1.5	1	27	9.0	18.0	3.60
Plant:	Sixth to tenth	1	2	1.5	1	40	13.5	27.0	5.40
Set stakes	First	3		24	1	100	1.2		.18
Dig holes	do	1		3	1	100	3.3		.50
Set trees	do	3	2	12	1	100	2.5	1.7	.50
	do	3	2	45	1	100	.6	.4	.14
	Second	3	2	40	1	100	.8	.5	.18
Apply fertilizer around trees	Third and fourth	3	2	35	1	100	1.8	1.2	.42
	Fifth and sixth	3	2	30	1	100	2.0	1.4	.48
	Seventh	3	2	25	1	100	1.2	.8	.28
	Eighth and ninth	3	2	20	1	100	3.0	2.0	.70
	Tenth	3	2	18	1	100	1.7	1.1	.39
Cultivate tree rows	First to fifth	1	3	25	5	100	10.0	30.0	5.25
	Sixth to tenth	1	3	20	5	100	12.5	37.5	6.56
	First	1		25	2	100	.8		.12
	Second	1		20	2	100	1.0		.15
	Third and fourth	1		18	2	100	2.2		.33
Hoed around trees	Fifth	1		16	2	100	1.2		.18
	Sixth and seventh	1		15	2	100	2.6		.39
	Eighth	1		14	2	100	1.4		.21
	Ninth and tenth	1		12	2	100	3.2		.48
Prune	First to tenth					100	4.9		.74
Remove pruned wood	Sixth to tenth					100	3.5	3.5	.96
Supervision	First to tenth					100	20.0		6.00
Miscellaneous <sup>2</sup>	do					100	15.0	8.3	3.42
Total							119.8	131.4	37.65

<sup>1</sup> Trees set 50 by 50 feet, or 12 to the acre. Tree-row spaces have a total width of 16 feet for the first 5 years and 24 feet for the next 5 years. Tree-row spaces are cultivated independently; rest of space is cropped in cotton or other cultivated crop for harvest.

<sup>2</sup> Includes spraying, seedling winter and summer cover crop, orchard sanitation, and replacing missing trees.

The distance of planting pecan trees as well as the practice of interplanting field crops for harvest in the orchards may well be discussed in conjunction with soil fertility. The planting of trees at distances of 46½ by 46½ feet, or 20 trees to the acre, is a common practice in the area. The consensus of opinion among the better orchardists at present, based on their past experience, is that a smaller number of

trees per acre would permit a better growth of the individual trees, with a better future development of the orchard. A greater opportunity also would be given to realize an income from interplanted crops pending the development of the young orchard into commercial bearing. With the interplanting of crops for harvest, especial attention should be given to the maintenance and possibly the upbuilding of soil fertility to provide for the plant-food requirements of the trees and the interplanted crop.

Choice of suitable varieties should be given careful consideration at planting time in obviating, in so far as possible, the expensive necessity of top-working the trees later. Top-working is not only expensive in itself, but it also seriously curtails yields for six to eight years.

Some grazing of orchards is done in the area, but the returns from orchards so handled do not equal those from orchards in which a well-planned system of soil management is practiced and measures taken to control insects and diseases.

Much of the discussion of factors that affect yields applies with equal force to the other districts included in this study. In the ensuing discussions of the separate districts, then, only the factors that are of particular importance in each district are discussed.

In 1928 pecan orchard land was valued at about \$40 an acre. At the end of 10 years the total cost, including interest compounded annually and \$40 for land, amounted to \$176 an acre. (Table 20.)

TABLE 20.—Georgia, Thomasville district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Fertilizer..... pounds.....	24	36	60	60	84	84	96	120	120	120
Labor and power:										
Man labor..... hours.....	15.7	8.3	8.5	9.8	9.0	11.8	12.5	14.3	15.0	14.9
Horse work..... do.....	12.2	10.5	10.0	11.6	10.7	14.9	14.9	15.8	15.9	16.1
Labor and power:										
Man labor..... Dollars.....	2.75	1.45	1.49	1.71	1.58	2.07	2.19	2.50	2.62	2.61
Horse work at 12½ cents per hour.....	1.53	1.31	1.32	1.48	1.31	1.86	1.86	1.98	1.99	2.01
Total.....	4.28	2.76	2.81	3.19	2.92	3.93	4.05	4.48	4.61	4.62
Materials:										
Trees at \$1 each.....	12.00									
Fertilizer at \$30 per ton.....	.36	.54	.90	.90	1.26	1.26	1.44	1.80	1.80	1.80
Miscellaneous.....	.60	.75	.92	.88	.65	.70	.91	1.17	2.06	2.12
Total.....	12.96	1.29	1.82	1.78	1.91	1.96	2.35	2.97	3.86	3.92
Other costs:										
Taxes.....	.34	.34	.34	.34	.34	.50	.50	.50	.50	.50
Use of machinery.....	.46	.39	.46	.44	.40	.56	.56	.59	.60	.60
Overhead.....	2.59	.61	.69	.75	.72	.88	.96	1.12	1.27	1.28
Total.....	3.39	1.34	1.49	1.53	1.46	1.94	2.02	2.21	2.37	2.38
Total cost, exclusive of interest.....	20.63	5.39	6.06	6.50	6.29	7.83	8.42	9.66	10.54	10.92
Interest at 6 per cent.....	.79	2.65	2.50	3.03	3.58	4.54	5.28	6.11	7.06	8.13
Total cost.....	21.42	7.44	8.56	9.53	9.87	12.37	13.70	15.77	17.60	19.05
Cost of development at end of each year.....	61.42	68.56	77.42	86.95	96.82	109.19	122.89	138.66	156.55	175.61

<sup>1</sup> Ordinary labor charged at 15 cents per hour, supervision at 30 cents per hour.

<sup>2</sup> Includes spray material, cover-crop seed, replants, and other materials.

<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First 5 years, 27 per cent; next 5 years, 40 per cent.

<sup>4</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>5</sup> Total cost including interest plus initial value of land, at \$40 an acre.

Growing of interplanted crops for harvest is not common in bearing orchards of this district, more attention being given to soil improvement through the use of cover crops. In the fall a cover crop, usually Austrian winter peas and rye, is drilled in. The following spring, fertilizer is broadcast by hand on top of the cover crop around the trees and is then plowed under. During the summer, clean cultivation is given with a disk harrow; the last cultivation serves to clear the land for harvest and to prepare the soil for the winter cover crop. Spraying or dusting and the planting of a summer cover crop of velvetbeans are done in a few of the orchards but these operations are not common. The practice of clean cultivation in bearing orchards is a large factor in making tractors adapted for tillage operations in this district. The labor and power cost, at prevailing rates in 1928, not including harvest, amounting to about \$12 an acre is shown in Table 21.

TABLE 21.—*Georgia, Thomasville district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method and at cost rates prevailing in 1928<sup>2</sup>*

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horse	Tractor						
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Orchard acres</i>	<i>Number</i>	<i>Hours</i>	<i>Hours</i>	<i>Hours</i>	<i>Dollars</i>
Prune.....	2			10	1	2.0			0.30
Remove pruned wood.....	2	2		18	1	1.1	1.1		.30
Orchard sanitation.....						2.0	1.1		.44
Apply fertilizer around trees.....	4	2		18	1	2.2	1.1		.47
Plow.....	1	3		1.5	1	6.7	13.4		2.08
Cultivate.....									
Disk-harrow, double cut.....	1		1	15	3	2.0		2.0	2.80
Disk-harrow, single cut.....	1		1	28	3	1.1		1.1	1.54
Drill winter cover crop.....	1		1	15	1	.7		.7	.98
Supervision.....						4.1			1.23
Miscellaneous.....						2.6	3.5	.2	1.08
Total.....						24.5	20.2	4.0	11.82

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 6 per cent were missing, 90 per cent were in bearing, and 4 per cent were not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 15 cents an hour, supervision at 30 cents, horse work at 12½ cents, and use of tractor at \$1.25.

<sup>3</sup> Includes applying manure, hoeing, spraying, hauling fertilizer, and miscellaneous operations.

The total 1928 operating cost is shown in Table 22. Harvest costs varied from \$1.50 to \$3.50 per hundred pounds of nuts, depending largely on the yield obtained.

The bearing orchards from which cultural practices and production data were secured reported yields which were more than sufficient to cover the costs of production indicated in Table 22. The yields reported from orchards 15 to 19 years of age in 1928 ranged from 157 pounds to 543 pounds to the acre, with higher yields reported for older orchards. These favorable yields may be attributed primarily to the system of orchard management practiced in the area.

Enlarging the area under consideration by the inclusion of yield data obtained from southwest Georgia, of which the Thomasville district is a part, indicates that comparably favorable yields were not obtained in 1928 from any great portion of the more numerous orchards included in the broader area. This phase of the survey shows that 396,040 trees of improved varieties, 10 years old and over,

produced an average of 6.78 pounds of pecans a tree. On the basis of 12 trees to the acre, of which 10.8 are assumed to be in bearing, this would represent a yield of approximately 73 pounds of nuts an acre. In considering the wider area in its entirety, the average yields obtained, selling at 1928 prices, were not sufficient to cover operating costs, including interest and harvesting charges, computed on the basis of the most common practices followed in the district. This was in a year when pecan yields were relatively high. (Table S.)

TABLE 22.—Georgia, Thomasville district: Annual cost per acre of operating pecan orchards 15 to 19 years old,<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
Labor and power prior to harvest:		
Man labor.....	Hours	Dollars
Horse work.....	24.5	4.29
Tractor work.....	20.2	2.53
	4.0	5.00
Total.....		11.82
Materials:		
Fertilizer, at \$30 per ton.....	Pounds	
Winter cover crop, Austrian winter peas, at 8 cents per pound.....	338.0	5.07
	20.0	1.60
Rye, at \$2.50 per bushel.....	Bushel	
Miscellaneous <sup>2</sup> .....	0.5	1.25
Total.....		9.11
Other costs:		
Taxes.....		1.25
Use of machinery, not including tractor <sup>3</sup> .....		.89
Overhead <sup>4</sup> .....		3.14
Total.....		5.28
Total cost exclusive of interest.....		26.21
Interest, at 6 per cent <sup>5</sup> .....		10.82
Total cost.....		37.03
Quantity of nuts, at 28 cents per pound, <sup>6</sup> required to cover cost including harvesting:		
Exclusive of interest.....	Pounds	
Inclusive of interest.....	105	
	145	

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 6 per cent were missing, 90 per cent were in bearing, and 4 per cent were not in bearing—mainly replants.

<sup>2</sup> Includes spray material, paint, manure, and other materials.

<sup>3</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 State average farm price. Harvesting costs include picking, grading, and delivery to local shipping points, and are based on pecans sold through a cooperative association.

A consideration of the natural factors of soils, topography, and climate does not indicate that the Thomasville district enjoys a greater comparative advantage in pecan production than the larger area of which it is a part, therefore the grouping of the orchards studied in the Thomasville district into the higher-yield range may be attributed largely to the greater degree of uniformity in successful orchard management practiced on these orchards.

Yield data from older orchards in the area indicate the possibilities resulting from the application of orcharding principles which take into consideration the fundamental factors affecting successful production. This may be illustrated by outlining briefly the system used on, and the results obtained from, an orchard 21 years old. The greater proportion of the trees were of the Frotsher, Money-maker, and Stuart varieties. The cultural practices followed were similar, in the main, to those outlined in Table 21, with the exception

that a cover crop of velvetbeans was usually turned under in the late summer of each year. Over a period of five years, from 1924 to 1928, this orchard produced an annual average yield of approximately 420 pounds of pecans an acre. The average yield per acre for each year, beginning in 1924, was 191, 336, 473, 291, and 811 pounds an acre.

These yields are considerably above the average for the orchard yields from the district and are used here to indicate the possible benefits resulting from an intelligently planned and well-executed system of orchard management adapted to the area. Such a system takes into consideration the suitable location of the orchard with respect to soil and topography, the choice of varieties adapted to the area, and the adoption of cultural practices which, in conjunction with soil upkeep and the control of diseases and insect pests, are most likely to result in the securing of economic yields.

FLORIDA  
MONTICELLO DISTRICT

The orchards studied in the Monticello district of Florida are all in Jefferson County. The management in this district varies from pasturing livestock in the orchards and leaving the orchards for the most part uncultivated to giving them reasonably good care. Although perhaps a majority of the orchards are receiving indifferent care the cost estimates are for those that are receiving reasonably good attention.

TABLE 23.—Florida, Monticello district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans		Cost
		Men	Horses				Man labor	Horse work	
		Number	Number				Orchard acres	Number	
Plow (spring)	(First to sixth)	1	2	1.5	1	30	12.0	24.0	4.20
	(Seventh to tenth)	1	2	1.5	1	40	10.8	21.6	3.78
Harrow (disk)	(First to sixth)	1	2	8	1	30	2.4	4.8	.84
	(Seventh to tenth)	1	2	8	1	40	2.0	4.0	.70
Plant:									
Set stakes	First	3		20	1	100	1.0		.15
Dig holes	do.	2		7	1	100	2.9		.44
Set trees	do.	5	2	14	1	100	3.6	1.4	.68
Cultivate tree rows (disk harrow)	(First to sixth)	1	2	20	7	100	21.0	42.0	7.35
	(Seventh to tenth)	1	2	15	7	100	18.8	37.6	6.58
Plow (fall)	(First to fifth)	1	2	1.5	1	30	10.0	20.0	3.50
	(Sixth to tenth)	1	2	1.5	1	40	13.5	27.0	4.72
Sow cover crop	(First to fifth)	1		15	1	30	1.0		.15
	(Sixth to tenth)	1		15	1	40	1.5		.22
Disk in cover crop	(First to fifth)	1	2	8	1	30	2.0	4.0	.70
	(Sixth to tenth)	1	2	8	1	40	2.5	5.0	.85
Supervision	First to tenth					100	27.0		8.10
Miscellaneous <sup>2</sup>	do.					100	29.2	11.4	5.52
Total							161.2	202.8	48.51

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre. Tree-row spaces have a total width of about 18 feet for the first 6 years and 24 feet for the next 4 years. Tree-row spaces are cultivated independently; rest of space is cropped in corn or other cultivated crop for harvest.

<sup>2</sup> Includes application of fertilizer and manure, spraying, orchard sanitation, pruning, hoeing, and replacing missing trees.

In this class of orchards, farm crops for harvest are grown among the young trees. The common practice is to allow a free space on each side of the tree rows. These tree-row spaces have a total width of approximately 18 feet for the first six years and 24 feet for the next four years and are cultivated independently of the interplanted crop. A winter cover crop usually of oats, rye, Austrian winter peas, or vetch may be planted in the fall and turned under in the spring. During the summer, the tree-row spaces are given clean cultivation with a disk harrow. Neither spraying nor dusting is commonly practiced. Many of the orchards are small and tractor power is not commonly used in this district. The total labor and power cost for the first 10 years are shown in Table 23 and other development costs in Table 24.

TABLE 24.—Florida, Monticello district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1938

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Labor and power:										
Man labor..... hours.....	19.7	15.0	14.8	14.9	14.2	15.5	16.8	10.8	10.7	16.8
Horse work..... do.....	18.2	18.0	17.9	18.0	17.0	19.7	23.2	23.2	23.3	23.4
Labor and power:										
Man labor.....	Dolls. 3.45	Dolls. 2.62	Dolls. 2.59	Dolls. 2.61	Dolls. 2.49	Dolls. 2.72	Dolls. 2.94	Dolls. 2.94	Dolls. 2.93	Dolls. 2.94
Horse work at 10 cents per hour.....	1.82	1.80	1.79	1.80	1.79	1.97	2.32	2.32	2.33	2.34
Total.....	5.27	4.42	4.38	4.41	4.28	4.69	5.26	5.26	5.26	5.28
Materials:										
Trees at \$1 each.....	12.00									
Cover crop seed.....	.30	.30	.30	.30	.30	.30	.40	.40	.40	.40
Miscellaneous <sup>2</sup> .....	.33	2.41	2.31	2.32	2.15	2.38	2.31	2.46	2.47	2.60
Total.....	12.63	2.71	2.64	2.82	2.45	2.68	2.71	2.86	2.87	3.00
Other costs:										
Taxes <sup>3</sup> .....	.06	.06	.06	.06	.06	.06	.08	.08	.08	.08
Use of machinery <sup>4</sup> .....	.68	.74	.74	.74	.66	.65	.76	.76	.76	.82
Overhead <sup>5</sup> .....	2.68	1.07	1.05	1.05	1.01	1.19	1.20	1.22	1.22	1.21
Total.....	3.42	1.87	1.85	1.85	1.73	1.81	2.04	2.06	2.06	2.14
Total cost, exclusive of interest.....	21.32	9.00	8.57	9.11	8.46	9.15	10.01	10.18	10.19	10.42
Interest at 4 per cent <sup>3</sup> .....	.65	2.00	2.69	3.35	4.09	4.98	5.87	6.82	7.84	8.85
Total cost.....	21.97	11.00	11.53	12.46	12.55	14.16	15.88	17.00	18.03	19.37
Cost of development at end of each year <sup>3</sup> .....	36.97	57.97	69.50	81.96	94.51	109.67	124.55	141.55	159.58	178.95

<sup>1</sup> Ordinary labor charged at 15 cents per hour, supervision at 30 cents per hour.

<sup>2</sup> Includes commercial fertilizer, manure, spray material, trees for replanting, and other materials.

<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First 6 years, 30 per cent; next 4 years, 40 per cent.

<sup>4</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>5</sup> Total cost including interest plus initial value of land, at \$25 an acre.

The practice of growing interplanted crops for harvest is usually discontinued when the young orchards come into commercial bearing. A winter cover crop of oats was used on approximately one-third of the bearing-orchard acreage surveyed. This crop is plowed under in the spring and, following the preparation of the soil with a disk harrow, a summer cover crop of velvet beans is planted in 4-foot rows. This crop, together with the pecan trees, is cultivated during the summer, and just previous to harvest in the fall the summer cover crop is plowed under. The turning under of the summer cover crop



serves as the first step in the soil preparation for the winter cover crop. The labor and power cost, not including harvesting the crop, in the care of a bearing orchard is shown in Table 25 and the total 1928 operating cost in Table 26.

TABLE 25.—*Florida, Monticello district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method and at cost rates prevailing in 1928<sup>2</sup>*

Operation	Size of crew		Rate of work per day	Times done	Percentage charged to pecans	Charged to pecans		
	Men	Horses				Man labor	Horse work	Cost
	Number	Number	Orchard acres	Number	Per cent	Hours	Hours	Dollars
Prune.....	1		5	1	100	2.0		0.30
Remove pruned wood.....		1	10	1	100	1.0	1.0	.25
Plow.....	1	2	1.5	1	100	0.7	13.4	2.34
Harrow (disk).....	1	2	8	1	100	1.2	2.4	.42
Plant velvetbeans (4-foot rows).....	1	1	7	1	100	1.4	1.4	.35
Cultivate tree rows and beans.....	1	1	5	2	100	4.0	4.0	1.00
Plow (fall).....	1	2	1.5	1	33	2.2	4.4	.77
Sow cover crop <sup>3</sup> .....			15	1	33	.2		.03
Disk in cover crop.....	1	2	8	1	33	.4	.8	.14
Supervision.....					100	4.4		1.32
Miscellaneous <sup>4</sup> .....					100	2.9	1.5	.60
Total.....						26.4	29.0	7.52

<sup>1</sup> Trees set 60 by 60 feet or 12 to the acre, of which 2 per cent were missing, 80 per cent were in bearing, and 15 per cent were not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 15 cents an hour, supervision at 30 cents, and horse work at 10 cents.

<sup>3</sup> Approximately one-third of the orchard acreage received a winter cover crop of oats.

<sup>4</sup> Includes hoeing, spraying, orchard sanitation, applying manure and commercial fertilizer.

TABLE 26.—*Florida, Monticello district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs*

Item	Quantity	Cost
Labor and power prior to harvest:	Hours	Dollars
Man labor.....	26.4	4.62
Horse work.....	29.0	2.90
Total.....		7.52
Materials:	Bushel	
Summer cover crop, velvetbeans, at \$2.50 per bushel.....	0.25	.62
Winter cover crop, oats, at \$1 per bushel.....	1.00	1.35
Miscellaneous <sup>2</sup> .....		3.98
Total.....		4.93
Other costs:		
Taxes.....		1.30
Use of machinery <sup>3</sup> .....		1.28
Overhead <sup>4</sup> .....		1.87
Total.....		4.45
Total cost exclusive of interest.....		16.90
Interest at 6 per cent <sup>5</sup> .....		11.15
Total cost.....		28.05
Quantity of nuts at 31 cents per pound <sup>6</sup> required to cover costs, including harvesting:	Pounds	
Exclusive of interest.....	62	
Inclusive of interest.....	101	

<sup>1</sup> Trees set 60 by 60 feet, or 12 per acre, of which 2 per cent were missing, 80 per cent were in bearing, and 15 per cent were replants and not in bearing.

<sup>2</sup> Based on a winter cover crop of oats used on approximately one-third of the orchard acreage.

<sup>3</sup> Includes spray material, fertilizer, manure, and other materials.

<sup>4</sup> See p. 16 for methods of computing machinery, overhead, and interest charges.

<sup>5</sup> The 1928 Stat coverage farm price. Harvesting costs include picking, grading, and delivery to local shipping point, and are based on pecans sold to buyers by express.

Harvest costs in 1928 ranged from \$1.50 to \$4 per hundred pounds of nuts. The cost per pound of producing pecans will vary not only with the system of management, but also with the yields obtained. Of the orchards 15 to 19 years of age from which production records were obtained in 1928, over 50 per cent did not have yields sufficient to pay costs, including interest charges and harvesting costs. The other orchards had yields ranging up to 500 pounds an acre. This was in a year considerably above the average from a standpoint of yields. By enlarging the sample by the inclusion of other yield data obtained by the questionnaire method a comparable variation in yields is shown, with a large proportion of the orchards not producing yields sufficient to cover the yearly costs. On the basis of 12 trees to the acre, of which 80 per cent are in bearing, two-thirds of the orchards 15 to 19 years old did not have yields sufficient to pay costs, including interest and harvesting charges, based on the practices shown in Table 26.

Several factors in the Monticello district may operate, singly or in combination, in bringing about low yields. Failure to select a suitable site for the orchard with respect to soils and topography has often resulted in the planting of trees where it is difficult to secure economic yields. Inadequate financing of the enterprise at the outset may account for the neglect and resultant low yields caused by failure to provide for soil fertility and for the control of diseases and insect pests. Repeated top-working of trees to new varieties by some growers in an attempt to control scab accounts in part for the yield variations in that the entire orchard may not be in bearing at one time, with the degree of yielding capacity dependent on the length of time that the top-working has been done.

Individual orchards of well-chosen varieties have proved successful in those cases in which leguminous cover crops have been used, supplemented by commercial fertilizers and proper cultural practices, and diseases and insect pests have been controlled.

#### EASTERN DISTRICT

The orchards studied in the eastern district of Florida are in Alachua, Bradford, and Duvall Counties, the majority being in the first two counties. In this district it is a common practice to grow certain intercrops such as truck crops, corn, and occasionally cotton, in young orchards during the development period. For the first three or four years these crops are usually planted up to the trees, the orchard receiving the same cultivation as that given the intercrop. For the remainder of the development period, a free space on each side of the tree rows is cultivated independently. Cover crops are used in some of the orchards, but the practice is not common.

The tractor work is generally confined to disking the land. At rates prevailing in 1928, the total labor and power cost for the first 10 years to bring the orchard to bearing age is given in Table 27. The total cost, including interest compounded annually, plus land at \$30, amounted to \$168 an acre. (Table 28.)

TABLE 27.—Florida, eastern district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew			Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans			Cost
		Men	Horses	Tractor				Man labor	Horse work	Tractor work	
		Number	Number	Number	Orchard acres	Number	Per cent	Hours	Hours	Hours	Dollars
Plow	First to tenth	1	2		2	1	6-40	11.4	22.8		3.99
Harrow (disk)	do	1		1	15	1	6-40	1.9		1.0	2.66
Plant:											
Set stakes	First	2			20	1	100	1.0			.15
Dig holes	do	1			2	1	100	5.0			.75
Set trees	do	5	2		10	1	100	5.0	2.0		.95
	First and second				25	1	100	1.6	1.0		.40
	Third				20	1	100	1.0	1.0		.25
Apply fertilizer around trees	Fourth				16	1	100	1.2	1.2		.30
	Fifth and sixth				14	1	100	2.8	2.8		.70
	Seventh to tenth	2	2		10	1	100	8.0	8.0		2.00
Cultivate	First to fourth	1	1		4	3	6-12	2.7	2.7		.67
Cultivate tree rows	Fifth to seventh	1	2		20	3	100	4.5	0.0		1.58
	Eighth to tenth	1	2		15	3	100	6.0	12.0		2.10
	First to third	1			12	2	100	5.1			.77
	Fourth	1			11	2	100	1.8			.27
	Fifth and sixth	1			10	1	100	2.0			.30
Hoe around trees	Seventh	1			8	1	100	1.1			.16
	Eighth	1			8	1	100	1.2			.18
	Ninth	1			8	1	100	1.4			.21
	Tenth	1			7	1	100	1.7			.26
Supervision	First to tenth							18.7			5.61
Miscellaneous <sup>2</sup>	do							26.5	10.5		5.03
Total								111.6	73.0	1.9	29.29

<sup>1</sup> Trees set 50 by 50 feet or 17 to the acre. Interplanted crops grown up to and including the tree rows for the first 4 years. Tree-row spaces have a total width of about 12 feet for the following 3 years and 20 feet for the next 3 years. Tree-row space is cultivated independently from the fifth to tenth years; rest of space cropped in corn or other cultivated crop for harvest.

<sup>2</sup> Charges for land preparation prorated to pecans as follows: First year, 6 per cent; second year, 8 per cent; third year, 10 per cent; fourth year, 12 per cent; fifth to seventh year, 25 per cent; and eighth to tenth year, 40 per cent. Percentage charges to pecans for cultivations are the same as for land preparation for the first four years and 100 per cent from the fifth to tenth years.

<sup>3</sup> Includes applying manure, pruning, spraying, orchard sanitation, and replacing missing trees.

The practice of growing intercrops for harvest is usually discontinued when the young orchards come into commercial bearing. The majority of the bearing orchards are given clean cultivation. The practice of spraying or dusting and the use of cover crops are not common. Following the spring plowing, the bearing orchard is given clean cultivation with a disk harrow, the number of cultivations depending somewhat on weather conditions. The care of an acre of bearing orchard in eastern Florida usually involves slightly more than three days of man labor per acre and the necessary motive power for performing the field operations. Tractor-drawn disks are commonly used for cultivating. The labor and power cost in 1928, not including harvesting the crop, is shown in Table 29 and the total operating cost in Table 30. Harvesting costs in 1928 varied from \$1.50 to \$3.50 a hundred pounds of nuts.

TABLE 28.—Florida, eastern district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1923

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Fertilizer.....pounds..	34	51	68	102	119	136	153	170	170	170
Labor and power:										
Man labor.....hours..	19.2	8.4	8.5	8.2	10.1	9.0	9.5	12.4	13.6	12.7
Horse work.....do....	4.3	3.1	4.1	4.3	7.8	7.9	8.2	11.2	11.4	11.2
Tractor work.....do....	.1	.1	.1	.1	.2	.2	.2	.3	.3	.3
Labor and power:										
Man labor <sup>1</sup> .....Dolls.	3.36	1.47	1.48	1.44	1.77	1.57	1.66	2.17	2.38	2.22
Horse work at 10 cents per hour.....Dolls.	.44	.31	.41	.43	.78	.79	.82	1.12	1.14	1.12
Tractor work at \$1.25 per hour.....Dolls.	.13	.13	.13	.13	.25	.25	.25	.38	.38	.38
Total.....Dolls.	3.93	1.91	2.02	2.00	2.50	2.61	2.73	3.67	3.90	3.72
Materials:										
Trees at \$1 each.....Dolls.	17.00									
Fertilizer at \$40 per ton.....Dolls.	.68	1.02	1.36	2.01	2.38	2.72	3.01	3.40	3.40	3.40
Miscellaneous <sup>2</sup> .....Dolls.	.33	.75	.77	.80	.97	1.06	.80	1.33	1.80	1.89
Total.....Dolls.	18.01	1.77	2.13	2.84	3.35	3.78	3.06	4.73	5.29	5.29
Other costs:										
Taxes <sup>3</sup> .....Dolls.	.65	.10	.12	.15	.31	.31	.31	.50	.50	.50
Use of machinery <sup>4</sup> .....Dolls.	.16	.13	.17	.19	.32	.32	.33	.46	.47	.46
Overhead <sup>4</sup> .....Dolls.	3.29	.55	.62	.73	.92	.96	1.00	1.26	1.38	1.35
Total.....Dolls.	3.53	.78	.91	1.07	1.55	1.59	1.64	2.22	2.35	2.31
Total cost, exclusive of interest.....Dolls.	25.47	4.46	5.06	5.91	7.70	7.98	8.32	10.62	11.54	11.32
Interest at 6 per cent <sup>4</sup> .....Dolls.	.16	1.73	2.15	2.63	3.42	4.09	4.81	5.92	6.92	8.02
Total cost.....Dolls.	25.63	6.19	7.21	8.54	11.12	12.07	13.13	16.54	18.46	19.34
Cost of development at end of each year <sup>5</sup> .....Dolls.	55.63	61.82	69.03	77.57	88.60	100.76	113.89	130.43	148.89	168.23

<sup>1</sup> Ordinary labor charged at 15 cents per hour, supervision at 30 cents per hour.  
<sup>2</sup> Includes replants, spray material, and manure.  
<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First year, 6 per cent; second year, 8 per cent; third year, 10 per cent; fourth year, 12 per cent; fifth to seventh years, 25 per cent; eighth to tenth years, 40 per cent.  
<sup>4</sup> See p. 10 for method of computing machinery, overhead, and interest charges.  
<sup>5</sup> Total cost, including interest plus initial value of land at \$30 an acre.

TABLE 29.—Florida, eastern district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old <sup>1</sup> up to harvest time, according to a common method, and at cost rates prevailing in 1923 <sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horses	Tractor						
	Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Prune.....	1			5	1	2.0			0.30
Remove pruned wood.....	1	2		12	1	.8	1.6		.28
Orchard sanitation.....						2.4	1.0		.45
Flow.....	1	1		1	1	10.0	10.0		2.50
Apply fertilizer around trees.....	2	2		8	1	2.5	2.5		.62
Cultivate (disk harrow).....	1		1	15	2	1.3		1.3	1.82
Supervision.....						5.2			1.56
Miscellaneous <sup>3</sup> .....						7.0	4.1	.3	1.84
Total.....						31.2	19.2	1.6	9.38

<sup>1</sup> Trees set 50 by 50 feet, or 17 to the acre, of which 3 per cent were missing, 95 per cent were in bearing, and 2 per cent were not in bearing—mainly replants.  
<sup>2</sup> Ordinary labor at 15 cent an hour, supervision at 30 cents, horse work at 10 cents, and use of tractor at \$1.25.  
<sup>3</sup> Includes hoeing, applying manure, spraying, sowing cover crop, and miscellaneous operations.

TABLE 30.—*Florida, eastern district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs*

Item	Quantity	Cost
<b>Labor and power prior to harvest:</b>		
Man labor.....	<i>Hours</i> 31.2	<i>Dollars</i> 5.46
Horse work.....	19.2	1.92
Tractor work.....	1.8	2.00
Total.....		9.38
<b>Materials:</b>		
Fertilizer at \$10 per ton.....	<i>Pounds</i> 330	6.60
Miscellaneous <sup>2</sup> .....		2.68
Total.....		9.28
<b>Other costs:</b>		
Taxes.....		1.25
Use of machinery, not including tractor <sup>3</sup> .....		1.24
Overhead <sup>4</sup> .....		2.80
Total.....		5.29
Total cost exclusive of interest.....		23.95
Interest at 6 per cent <sup>5</sup> .....		10.55
Total cost.....		34.50
<b>Quantity of nuts at 31 cents per pound<sup>6</sup> required to cover cost including harvest:</b>		
Exclusive of interest.....	86	
Inclusive of interest.....	123	

<sup>1</sup> Trees set 50 by 50 feet, or 17 to the acre, of which 3 per cent were missing, 95 per cent were in bearing, and 2 per cent were not in bearing—mainly replants.

<sup>2</sup> Includes spray material, cover-crop seed, manure, and other materials.

<sup>3</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 State average farm price. Harvesting costs include picking, grading, and delivery to local shipping point and are based on pecans sold to buyers by freight.

The range of yields reported in the district reveals that many orchards did not have a yield sufficiently high to cover costs, while others showed a sizable margin of profit. A few of the orchards reported practically no yields, others had varying yields, the highest running up to 594 pounds an acre.

Although variations in yields between orchards are affected largely by differences in ages of plantings, a wide range in yields also exists between orchards classed in the same age group. Of the group of orchards 15 to 19 years old from which production records were obtained, 33½ per cent did not have yields sufficient to pay costs computed on the basis of the common method of operating orchards in the district. (Table 29.) The care given some of the orchards would not entail a per-acre cost as high as that shown in Table 30, but the returns in most cases were correspondingly lower.

The principal factors affecting pecan yields in this district are similar to those outlined in the discussion of conditions in the Monticello district. An especially important factor in this district is the selection of a suitable site for the orchard with respect to fertility of soil. This is especially important in sections where intercrops are to be used. Failure to recognize this fundamental principle has resulted in many cases in placing orchards in which there is apparently small prospect of ever obtaining profitable yields.

## ALABAMA

## MOBILE DISTRICT

The orchards studied in the Mobile district are all in Mobile County. Pecan and Satsuma orange trees are commonly planted in the same

orchard at the rate of 8 orange trees to 1 pecan tree, making 12 pecan and 96 Satsuma trees to the acre. Since the general system of orchard development and management is concerned with a combination pecan-orange orchard, any computation of the costs chargeable to pecans must apportion those costs common to both. Certain operations, such as planting, pruning, and fertilizing, are done on one or the other of the two kinds of trees and are therefore chargeable directly to the trees for which performed. Other operations, such as plowing, cultivating, and seeding cover crops, are chargeable to both and have been apportioned accordingly.

These estimates of cost prorations were based on the relative orchard area occupied by each kind of tree. As the pecan trees increased in size and occupied relatively more of the orchard space, they were charged with a greater proportion of those cost items common to both. The portion of the joint expenses chargeable to pecans for each year of the development period is shown in the footnotes to Tables 31 and 32.

TABLE 31.—Alabama, Mobile district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, with Satsuma oranges set as fillers,<sup>1</sup> and at cost rates prevailing in 1923

Operation	Years operation is performed	Size of crew			Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans			Cost
		Men	Horses	Tractors				Man labor	Horse work	Tractor work	
		Number	Number	Number	Orchard acres	Number	Per cent	Hours	Hours	Hours	Dollars
Plow	First to tenth	1		1	4	1	10-20	2.9		2.9	4.28
Harrow (disk)	First	1		1	15	1	10	.1		.1	.15
Plant:											
Set stakes	do	3			25	1	100	1.2			.27
Dig holes	do	3			7	1	100	2.9			.65
Set trees	do	3			14	1	100	3.6	1.4		1.02
	do	3			50	1	100	.6	.4		.19
	do	3			40	1	100	.8	.5		.25
	Second	3			34	1	100	.9	.6		.29
	Third	3			28	1	100	1.1	.7		.35
	Fourth	3			24	1	100	1.2	.8		.39
	Fifth	3			22	1	100	1.4	.9		.45
	Sixth	3			20	1	100	1.5	1.0		.49
	Seventh	3			18	1	100	1.7	1.1		.55
	Eighth	3			16	1	100	3.8	2.4		1.22
	Ninth and tenth	3			15	7	10-20	6.0		6.0	8.85
Cultivate (disk harrow)	First to tenth	1		1	15	7	10-20	6.0		6.0	8.85
	First to fourth	1			15	4	100	10.8			2.43
	Fifth and sixth	1			12	1	100	1.8			.36
	Seventh and eighth	1			10	1	100	2.0			.45
Hoe around trees	Ninth and tenth	1			8	1	100	2.4			.54
Seed cover crop	Second to tenth	1	2		10	1	10-20	1.2	2.4		.63
Prune	do						100	12.0			2.83
Remove pruned wood	Sixth to tenth						100	3.3	3.3		1.24
Supervision	First to tenth						100	15.1			6.50
Miscellaneous	do						100	11.7			2.63
Total								90.4	15.5	9.0	37.31

<sup>1</sup> Pecan trees set 60 by 60 feet, and Satsumas as fillers—about 12 pecan trees and 96 Satsuma trees per acre. No interplanted crop grown for harvest during development period.

<sup>2</sup> Charges for land preparation, cultivation, and seeding of cover crop charged to pecans as follows: First five years, 10 per cent; sixth year, 11 per cent; seventh year, 13 per cent; eighth year, 15 per cent; ninth year, 17 per cent; and tenth year, 20 per cent.

<sup>3</sup> Includes treatment for borers, spraying, applying manure, and replacing missing trees.

TABLE 32.—Alabama, Mobile district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Fertilizer.....pounds.	24	48	72	96	120	144	168	192	216	240
Labor and power:										
Man labor.....hours.	14.3	9.1	8.3	7.3	6.6	7.7	8.5	9.0	10.0	10.2
Horse work.....do.	1.8	.7	.8	.9	1.0	1.7	1.8	2.2	2.3	2.3
Tractor work.....do.	.8	.7	.7	.7	.7	.8	.9	1.1	1.2	1.4
Labor and power:										
Man labor.....Dolla.	3.75	2.30	2.18	1.91	1.55	2.02	2.23	2.36	2.63	2.68
Horse work at 15 cents per hour.....	.27	.10	.12	.14	.15	.25	.27	.33	.34	.34
Tractor work at \$1.25 per hour.....	1.00	.88	.88	.88	.88	1.00	1.12	1.37	1.50	1.75
Total.....	5.03	3.37	3.18	2.93	2.61	3.27	3.62	4.00	4.47	4.77
Materials:										
Trees at 75 cents each.....	0.00									
Fertilizer at \$7.50 per ton.....	.45	.90	1.35	1.80	2.25	2.70	3.15	3.60	4.05	4.50
Cover crop seed (vetch) at 12 cents per pound.....		.24	.24	.24	.24	.26	.31	.36	.41	.48
Miscellaneous.....	.28	.54	.28	.15	.08	.08	.10	.08	.08	.08
Total.....	9.73	1.68	1.87	2.19	2.57	3.01	3.56	4.04	4.54	5.06
Other costs:										
Taxes.....	.04	.04	.04	.04	.04	.04	.05	.06	.07	.08
Use of machinery.....	.07	.02	.03	.03	.04	.06	.07	.08	.09	.09
Overhead.....	2.21	.76	.76	.77	.78	.95	1.08	1.22	1.35	1.47
Total.....	2.32	.82	.83	.84	.86	1.05	1.20	1.36	1.51	1.64
Total cost, exclusive of interest.....	17.08	5.87	5.88	5.96	6.04	7.36	8.35	9.46	10.82	11.47
Interest at 6 per cent.....	.20	1.22	1.65	2.10	2.59	3.13	3.80	4.57	5.45	6.46
Total cost.....	17.28	7.09	7.53	8.06	8.63	10.49	12.18	14.03	15.97	17.93
Cumulative cost.....	17.28	24.37	31.00	39.06	48.59	59.08	71.26	85.25	101.26	119.19

<sup>1</sup> Ordinary labor at 22½ cents per hour, supervision at 45 cents per hour.

<sup>2</sup> Includes trees for replanting, spraying, manuring, and other items.

<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First 5 years, 10 per cent; sixth year, 11 per cent; seventh year, 13 per cent; eighth year, 15 per cent; ninth year, 17 per cent; and tenth year, 20 per cent.

<sup>4</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>5</sup> Includes interest on the value of the proportion of an acre of land occupied by pecan trees. The initial value of the land, \$30 per acre, is not included.

During the development period a winter cover crop of vetch is turned under in the spring and the pecan trees are fertilized independently of the orange trees. The entire orchard is then given clean cultivation during the growing season. Neither spraying nor dusting of pecan trees is practiced to any extent. Comparatively large orchards with rather level surface and the practice of clean cultivation are factors favoring the use of tractor-drawn implements for such operations as plowing, disking, and cultivating. An acre of land of the character set to pecan and orange trees is valued generally at about \$30 an acre.

The combination of orange and pecan trees is maintained in bearing orchards, and the same general system of orchard practice is followed as for young orchards. In orchards 15 to 19 years of age crowding has not yet been serious enough to necessitate any change in the original arrangement. The proportionate share of the joint expenses of operation chargeable to pecans is shown in Tables 33 and 34. It is probable that with increasing age and size of the trees it may become necessary to thin the orchard to prevent detrimental overcrowding.

Present plans call for the removal of some of the orange trees when this becomes necessary.

Tractors are the usual source of motive power for plowing and cultivating. For the pecan trees, the cost of labor and power, not including harvesting the crop, is shown in Table 33. The total 1928 operating cost chargeable to pecans, excluding harvesting costs, is given in Table 34. Harvest costs in 1928 varied from \$1.50 to \$3 per hundred pounds of nuts, depending largely on the yield obtained.

TABLE 33.—Alabama, Mobile district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method, and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Per-centage charged to pecans	Charged to pecans				
	Men	Horses	Trac-tors				Man labor	Horse work	Trac-tor work	Cost	
	Num-ber	Num-ber	Num-ber				Orchard acres	Num-ber	Per cent	Hours	Hours
Prune.....	1			1.25	1	100	8.0				1.80
Remove pruned wood.....	2	2		10	1	100	2.0	2.0			.75
Plow.....	1		1	4	1	35	.9		0.9		1.33
Apply fertilizer around trees.....	5	2		25	2	100	4.0	1.6			1.14
Cultivate (disk harrow).....	1		1	15	6	35	1.4		1.4		2.06
Seed cover crop.....	1	2		10	1	35	.4	.8			.21
Supervision.....						100	4.3				1.94
Miscellaneous.....						100	5.0	4.1			1.74
Total.....							26.0	8.5	2.3		10.97

<sup>1</sup> Based on Autumn oranges set as fillers in the pecan orchard. One acre of orchard when planted with pecan trees, 8 ft 60 by 60 feet, and Satsumas as fillers, contains about 12 pecan trees and 96 Satsuma trees. Ninety per cent of the pecan trees were in bearing, 5 per cent missing, and 5 per cent not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 22½ cents per hour, supervision at 45 cents, horse work at 15 cents, and use of tractor at \$1.25.

<sup>3</sup> Includes orchard sanitation, spraying, mowing weeds, and other operations.

Yields in the Mobile district were exceptionally favorable in 1928, compared with other seasons. (Table 8.) Of the orchards from which production records for 1928 were secured by personal visits, yields from orchards 15 to 19 years of age averaged 323 pounds an acre. All orchards studied showed yields that were more than sufficient to cover the cost of production computed on the basis of the common method of operating pecan orchards in the district. (Table 34.) Production ranged from 277 pounds an acre for the orchard reporting the lowest to 585 pounds an acre for the orchard reporting the highest yield.

The orchards studied yielded practically nothing during the two years preceding 1928. These two crop failures were attributed by orchardists largely to a severe storm in the latter part of 1926 which damaged the trees considerably. In 1925 when relatively normal conditions prevailed compared with other years, yields averaged 180 pounds an acre. Production ranged from 69 pounds an acre for the orchard having the lowest yield to 425 pounds an acre for the orchard having the highest. The effect of conditions during the preceding years on the yields obtained in the area in 1928 is problematical. These conditions are mentioned here, however, to give a better perspective than is afforded when results secured in any one year are viewed. The yields obtained from some individual orchards in the Mobile district for a period of years are shown in Table 14.



TABLE 34.—Alabama, Mobile district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
<b>Labor and power prior to harvest:</b>		
Man labor.....	<i>Hours</i> 26.0	<i>Dollars</i> 6.82
Horse work.....	8.5	1.28
Tractor work.....	2.3	2.87
Total.....		10.97
<b>Materials:</b>		
Fertilizer at \$37.50 per ton.....	<i>Pounds</i> 570	10.69
Winter cover crop, vetch at 12 cents per pound.....	20	1.84
Miscellaneous <sup>2</sup> .....		.60
Total.....		12.13
<b>Other costs:</b>		
Taxes <sup>3</sup> .....		.14
Use of machinery, not including tractor <sup>4</sup> .....		.90
Overhead <sup>5</sup> .....		3.48
Total.....		4.50
Total cost, exclusive of interest.....		25.60
Interest at 6 per cent <sup>6</sup> .....		8.14
Total cost.....		33.74
<b>Quantity of nuts at 30 cents per pound<sup>7</sup> required to cover cost including harvest:</b>		
Exclusive of interest.....	102	
Inclusive of interest.....	132	

<sup>1</sup> Trees set 60 by 60 feet, with Satsuma oranges as fillers, or 12 pecan trees and 96 Satsuma trees to the acre. Five per cent of the pecan trees were missing, 90 per cent were bearing, and 5 per cent were not in bearing—mainly replants.

<sup>2</sup> 35 per cent of the cost of cover-crop seed and taxes and interest was charged to pecans.

<sup>3</sup> Includes spray, paint, and other materials.

<sup>4</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>5</sup> The 1928 State average farm price. Harvesting costs include picking, grading, and delivery to local shipping point and are based on pecans sold to local dealers.

## SELMA DISTRICT

The orchards studied in the Selma district of Alabama are in Dallas and Lowndes Counties, the majority being in Dallas County. With few exceptions, the development of a pecan orchard in this district is incidental to the production of field crops for harvest. Cotton and other field crops for harvest are interplanted up to the trees during the entire development period. Cotton is usually interplanted for four successive years, alternating with corn, potatoes, or some other crop for harvest the fifth year. Spraying or dusting is not commonly done in young orchards. The use of tractor-drawn implements is not common in the development of young orchards largely because of the interplanting of row crops, mostly cotton, grown mainly by share labor.

The total labor and power cost for the first 10 years is shown in Table 35. At the end of the tenth year the total cost, including interest compounded annually, plus the value of the land at \$25, amounted to about \$104 an acre. (Table 36.)

TABLE 35.—Alabama, Selma district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans		Cost
		Men	Horses				Man labor	Horse work	
		Number	Number	Orchard acres	Number	Per cent	Hours	Hours	Dollars
Plow.....	First.....	1	2	1.5	2	5	0.7	1.4	0.21
	(Second to tenth).....	1	2	1.5	1	15-22	7.9	15.8	2.37
Harrow.....	First.....	1	4	10	1	5	.1	.4	.05
	Plant:								
Set stakes.....	do.....	3		25		100	1.2		.12
Dig holes.....	do.....	1		3.5		100	2.9		.29
Set trees.....	do.....	3	2	12		100	2.5	1.7	.42
Harrow.....	First to tenth.....	1	1	7	1	5-22	1.8	1.8	.36
	First.....	2	2	10	1	100	2.0	2.0	.40
Strike trees.....	First.....	1	1	3.5	(?)	5-22	18.2	18.2	3.64
	Cultivate.....	1		25	3	100	2.4		.24
Hoe around trees.....	First and second.....	1		20	3	100	3.0		.30
	Third and fourth.....	1		18	3	100	1.7		.17
	Fifth.....	1		15	3	100	6.0		.60
	Sixth to eighth.....	1		12	3	100	5.0		.50
Prune.....	Ninth and tenth.....					100	5.0		.50
	Second to tenth.....					100	1.6	3.2	.48
Remove pruned wood.....	Seventh to tenth.....					100	16.4		3.28
Supervision.....	First to tenth.....					100	20.5	8.5	2.90
Miscellaneous <sup>4</sup> .....	do.....								
Total.....							98.9	53.0	10.81

<sup>1</sup> Trees set 60 feet by 60 feet, or 12 to the acre. Cotton, usually planted for four successive years and alternated with corn or some other cultivated crop for harvest the fifth year, interplanted up to and including the tree rows during the entire development period.

<sup>2</sup> Charges for land preparation and cultivation prorated to pecans as follows: First year, 5 per cent; second year, 5 per cent; third year, 7 per cent; fourth year, 9 per cent; fifth year, 11 per cent; sixth year, 13 per cent; seventh year, 15 per cent; eighth year, 17 per cent; ninth year, 19 per cent; tenth year, 22 per cent.

<sup>3</sup> Pecan trees cultivated the same as the interplanted crop for harvest on the basis of six cultivations for cotton and three for corn and other cultivated crops for harvest.

<sup>4</sup> Includes the application of commercial fertilizer and manure, spraying, and replacing missing trees.

Crops for harvest are usually not grown in bearing orchards. In the fall, a winter cover crop, usually vetch, is sowed by hand at the rate of 20 pounds to the acre. Harrowing in the seed with a disk harrow also serves to clean the ground for harvest. In the spring commercial fertilizer is applied on top of the cover crop around the trees, and both crop and fertilizer are turned under with a double-cut disk harrow. Clean cultivation is practiced during the summer. Little spraying or dusting is done in orchards of bearing age. The care of an acre of bearing orchard in the Selma district usually requires about 13 hours of man labor plus the necessary motive power to perform the field operations. Tillage and the work in connection with a winter cover crop are usually done with tractor-drawn implements. The power requirements per acre amounted to slightly less than 4 tractor hours and about 4.5 horse hours. (Table 37.) The total 1928 operating cost is shown in Table 38. Harvesting costs in 1928 varied from \$1.50 to \$3.50 per hundred pounds of nuts.

TABLE 36.—Alabama, Selma district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928

Item	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth
	year	year	year	year	year	year	year	year	year	year
<b>Labour and power:</b>										
Man labor.....hours.....	15.0	5.0	6.2	7.9	7.8	9.6	11.3	11.2	12.5	12.4
Horse labor.....do.....	7.0	2.0	2.9	3.5	3.3	5.2	6.6	6.9	8.1	7.5
<b>Labor and power:</b>										
Man labor.....	Dolls. 1.74	Dolls. 0.58	Dolls. 0.72	Dolls. 0.92	Dolls. 0.91	Dolls. 1.12	Dolls. 1.32	Dolls. 1.31	Dolls. 1.46	Dolls. 1.45
Horse work at 10 cents per hour.....	.70	.20	.29	.35	.33	.52	.66	.69	.81	.75
Total.....	2.44	.78	1.01	1.27	1.24	1.64	1.98	2.00	2.27	2.20
<b>Materials:</b>										
Trees at \$1 each.....	12.00									
Stakes for young trees at 6 cents each.....	1.44									
Miscellaneous.....	.80	1.40	.75	1.50	1.20	1.08	1.80	1.80	2.00	1.95
Total.....	14.24	1.40	.75	1.50	1.20	1.08	1.80	1.80	2.00	1.95
<b>Other costs:</b>										
Taxes.....	.04	.04	.05	.07	.08	.10	.11	.13	.14	.16
Use of machinery.....	.28	.08	.11	.13	.12	.20	.25	.26	.30	.28
Overhead.....	2.50	.33	.26	.42	.37	.41	.57	.57	.64	.62
Total.....	2.80	.45	.42	.62	.57	.71	.93	.96	1.08	1.06
<b>Total cost, exclusive of interest.</b>	19.48	2.63	2.18	3.39	3.01	3.43	4.71	4.76	5.35	5.21
Interest at 6 per cent.....	.15	1.28	1.55	1.81	2.15	2.51	2.91	3.40	3.94	4.53
Total cost.....	19.63	3.91	3.73	5.20	5.16	5.94	7.62	8.16	9.29	9.74
<b>Cost of development at end of each year.....</b>	14.63	18.54	52.27	57.47	62.63	68.57	76.19	84.35	93.64	103.38

1 Ordinary labor charged at 10 cents per hour, supervision at 20 cents per hour.  
 2 Includes fertilizer, manure, replants, spray material, and other materials.  
 3 Charges for taxes and interest prorated to pecan trees as follows: First year, 5 per cent; second year, 5 per cent; third year, 7 per cent; fourth year, 9 per cent; fifth year, 11 per cent; sixth year, 13 per cent; seventh year, 15 per cent; eighth year, 17 per cent; ninth year, 19 per cent; tenth year, 22 per cent.  
 4 See p. 16 for method of compiling machinery, overhead, and interest charges.  
 5 Total cost including interest plus initial value of land, at \$25 an acre.

TABLE 37.—Alabama, Selma district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method, and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horses	Tractors						
	Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Prune.....	1			10	1	1.0			0.10
Remove pruned wood.....	2	2		25	1	.8	0.8		.16
Apply fertilizer around trees.....	1	2		20	1	2.0	1.0		.30
Disk under water cover crop.....	1		1	15	2	1.3		1.3	1.70
Cultivate (disk harrow).....	1		1	25	6	2.4		2.4	3.21
Orchard sanitation.....	2	2		30	1	.7	.7		.14
Sow winter cover crop.....	1			20	1	.5			.05
Disk in cover crop seed.....	1		1	15	1	.7	.7		.14
Supervision.....						2.1			.42
Miscellaneous.....						1.2	1.2		.24
<b>Total.....</b>						12.7	4.4	3.7	6.55

1 Trees set 60 by 60 feet, or 12 to the acre, of which 8 per cent were missing, 85 per cent were in bearing, and 7 per cent were not in bearing—mainly replants.  
 2 Ordinary labor at 10 cents an hour, supervision at 20 cents, horse work at 10 cents, and use of tractor at \$1.25.  
 3 Includes manuring, hoeing, spraying, and miscellaneous operations.

TABLE 38.—Alabama, Selma district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity		Cost
	Hours	Pounds	
<b>Labor and power prior to harvest:</b>			
Man labor.....	12.7		1.48
Horse work.....	4.4		.44
Tractor work.....	3.7		4.03
Total.....			6.55
<b>Materials:</b>			
Fertilizer, basic slag at \$10 per ton.....	275		1.38
Winter cover crop, vetch at 12 cents per pound.....	20		2.40
Miscellaneous.....			2.27
Total.....			6.05
<b>Other costs:</b>			
Taxes.....			.75
Use of machinery, not including tractor.....			.50
Overhead.....			1.89
Total.....			3.04
Total cost, exclusive of interest.....			15.54
Interest at 6 per cent. <sup>2</sup> .....			6.48
Total cost.....			22.02
<b>Quantity of nuts at 30 cents per pound<sup>4</sup> required to cover cost including harvesting:</b>			
Exclusive of interest.....	50		
Inclusive of interest.....	82		

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 3 per cent were missing, 85 per cent were in bearing, and 7 per cent were not in bearing—mainly replants.

<sup>2</sup> Includes spray material, manure, and other materials.

<sup>3</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 average State farm price. Harvesting costs include picking, grading, and delivery to local shipping point and are based on pecans sold through a cooperative association.

On the orchards of 15 to 19 years of age in this district from which production records were obtained by means of personal visits, yields in 1928 ranged from 16 pounds an acre for the orchard having the lowest yield to 375 pounds an acre for the orchard having the highest. Approximately 43 per cent of the orchards did not have yields sufficient to cover the costs of operation, including interest charges and harvesting costs, computed on the basis of the most common practices followed in the district. This was in a year when yields in Alabama were relatively high compared with those of other seasons. (Table 8.)

Consideration of other production data for Alabama reveals a somewhat comparable variation in yields obtained from pecan orchards over the State. The relative degree of success achieved by orchardists, from a yield standpoint, may be noted from the distribution of pecan orchards on the basis of the average yield per tree in 1928. The 86 orchards of improved varieties 15 to 19 years of age for which production data are shown consisted mainly of Stuart, Schley, Success, and Frotcher varieties, with smaller numbers of trees of other varieties.

Yield per tree, in pounds	Number of orchards	Yield per tree, in pounds	Number of orchards
0-4.9	17	40-44.9	4
5-9.9	16	45-49.9	0
10-14.9	14	50-54.9	0
15-19.9	12	55-59.9	1
20-24.9	8	60-64.9	1
25-29.9	5	65-69.9	1
30-34.9	2	70 and over	5
35-39.9	0		

An active interest in the production of pecans to supplement the income from cotton has led to a considerable expansion of plantings in the Selma district. As in most of the other districts included in this study, however, there has been considerable misapprehension in the Selma district as to the amount of care and attention required by pecan trees. As a result, many of the young orchards have been neglected to some extent, with a consequent development of some orchards that are severely handicapped in their ability to produce economic yields.

Successful orchardists have recognized the necessity of planting the trees only on fertile land and maintaining that fertility to meet the requirements of the growing trees and the intercrops. In connection with this, other factors, which must be considered as contributory to ultimate success and which are applicable to pecan orchards in all areas, have been pointed out in the discussions of pecan production in other districts. The most important factors in this district are the choice of suitable varieties adapted to the area; planting the trees at distances that will permit a good development of the orchard, and following the necessary orchard practices of cultivation, pruning, and control measures for insects and diseases, with a view to obtaining the maximum production compatible with sound economy.

#### EUFULA DISTRICT

The orchards studied in the Eufaula district are all in Barbour County. In this district the majority of the young orchards are interplanted with field crops for harvest during the entire development period. Crops are planted up to the trees without allowing any free space for the independent cultivation of the trees. Cotton is usually alternated with corn or some other crop for harvest. During the first few years, stakes are used around the trees to prevent injury during cultivation. Although crops are planted up to the trees, because of shading very little or no production is expected from the area immediately around the trees. This shaded area increases in size with the age and size of the trees.

The total labor and power cost for the first 10 years is shown in Table 39. In 1928 pecan orchard land was valued at about \$25 an acre. The cost of development for 10 years, plus the value of the land on which the trees were set, is shown in Table 40.

TABLE 39.—Alabama, Eufaula district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Percentage charged to pecans	Charged to pecans		Cost
		Men	Horses				Man labor	Horse work	
		Number	Number	Orchard acres	Number	Per cent	Hours	Hours	Dollars
Plow.....	First to tenth.....	1	2	1.5	1	15-22	8.2	18.4	3.08
Harrow.....	do.....	1	1	8	1	15-22	1.0	1.0	.40
Plant:									
Set stakes.....	First.....	3		25	1	100	1.2		.15
Dig holes.....	do.....	1		3	1	100	3.3		.41
Set trees.....	do.....	3	2	10	1	100	3.0	2.0	.62
Stake trees.....	do.....	2	2	10	1	100	2.0	2.0	.50
	First.....	3	2	45	1	100	.7	.4	.14
	Second.....	3	2	40	1	100	.8	.5	.18
	Third and fourth.....	3	2	35	1	100	1.8	1.2	.38
	Fifth and sixth.....	3	2	30	1	100	2.0	1.4	.42
	Seventh.....	3	2	25	1	100	1.2	.8	.25
	Eighth and ninth.....	3	2	20	1	100	3.0	2.0	.62
	Tenth.....	3	2	18	1	100	1.7	1.1	.35
Cultivate.....	First to tenth.....	1	1	3	(2)	15-22	18.0	18.0	4.50
	First.....	1		25	2	100	.8		.10
	Second.....	1		20	3	100	1.0		.12
	Third and fourth.....	1		18	3	100	2.2		.28
	Fifth.....	1		16	3	100	1.2		.15
	Sixth and seventh.....	1		15	2	100	2.7		.34
	Eighth.....	1		14	2	100	1.4		.18
	Ninth and tenth.....	1		12	2	100	3.3		.41
Prune.....	Second to tenth.....					100	4.9		.61
Remove pruned wood.....	Fifth to tenth.....					100	2.1	4.2	.79
Supervision.....	First to tenth.....					100	16.7		4.18
Miscellaneous <sup>4</sup> .....	do.....					100	15.3	17.0	4.04
Total.....							100.1	68.6	23.18

<sup>1</sup> Pecan trees set 60 by 60 feet or 12 to the acre. Cotton usually rotated with corn or some other cultivated crop for harvest, interplanted up to and including the tree rows during the entire development period.

<sup>2</sup> Charges for land preparation and cultivation prorated to pecans as follows: First year, 5 per cent; second year, 5 per cent; third year, 7 per cent; fourth year, 0 per cent; fifth year, 11 per cent; sixth year, 13 per cent; seventh year, 15 per cent; eighth year, 17 per cent; ninth year, 19 per cent; tenth year, 22 per cent.

<sup>3</sup> Pecan trees cultivated the same as the interplanted crop for harvest on the basis of six cultivations for orchard and three for corn and other cultivated crops for harvest.

<sup>4</sup> Includes manuring, spraying, seeding cover crop, orchard sanitation, and replacing missing trees.

After the orchard has come into commercial bearing the interplanting of field crops for harvest is usually discontinued. A winter cover crop, usually vetch, is sowed broadcast by hand in the fall at the rate of 18 pounds to the acre and is worked in with a disk harrow. The following spring, commercial fertilizer is scattered over the surface of the cover crop around the trees and is turned under with a disk plow. During the growing season about six cultivations are given the orchard with a disk harrow.

The care of an acre of bearing orchard in the Eufaula district usually requires slightly less than 1.5 days of man labor and the necessary motive power for performing the field operations. The operations commonly performed with tractor-drawn implements are plowing, cultivating, and drilling in winter cover-crop seed. The labor and power cost, not including harvesting the crop, is shown in Table 41. The total 1928 operating cost is shown in Table 42. Harvesting costs in 1928 ranged from \$1.50 to \$3 per hundred pounds of nuts.

TABLE 40.—Alabama, Eufaula district: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
Fertilizer.....pounds..	24	36	60	60	84	84	96	120	120	144
Labor and power:										
Man labor.....hours..	15.2	4.6	6.1	5.8	14.6	8.5	10.7	9.8	13.0	11.8
Horse work.....do.....	6.3	2.5	3.9	3.6	11.2	6.5	8.3	7.4	9.9	9.0
Labor and power:										
Man labor <sup>1</sup> .....	Dolla. 2.21	Dolla. 0.68	Dolla. 0.89	Dolla. 0.85	Dolla. 2.12	Dolla. 1.21	Dolla. 1.56	Dolla. 1.42	Dolla. 1.90	Dolla. 1.73
Horse work at 12½ cents per hour.....	.79	.31	.49	.45	1.40	.81	1.01	.93	1.24	1.12
Total.....	3.00	.99	1.38	1.30	3.52	2.05	2.60	2.35	3.14	2.85
Materials:										
Trees at \$1 each.....	12.00									
Stakes for young trees at 6 cents each.....	1.44									
Fertilizer at \$28 per ton.....	.34	.50	.84	.81	1.18	1.18	1.31	1.68	1.68	2.02
Miscellaneous <sup>2</sup> .....	.93	.91	.48	.41	1.97	1.14	.88	.84	.82	.80
Total.....	14.73	1.41	1.32	1.25	3.15	2.32	2.22	2.52	2.50	2.82
Other costs:										
Taxes.....	.01	.01	.05	.07	.08	.10	.11	.13	.14	.16
Use of machinery <sup>3</sup> .....	.24	.09	.15	.14	.42	.24	.31	.28	.37	.34
Overhead <sup>4</sup> .....	2.66	.36	.40	.38	1.00	.69	.72	.73	.85	.85
Total.....	2.91	.49	.60	.59	1.50	1.00	1.14	1.14	1.36	1.35
Total cost, exclusive of interest.....	20.07	2.89	3.30	3.14	8.17	5.37	5.96	6.01	7.00	7.02
Interest at 6 per cent <sup>5</sup> .....	.15	1.35	1.05	1.95	2.40	3.01	3.56	4.16	4.82	5.57
Total cost.....	20.22	4.21	4.95	5.12	10.57	8.38	9.52	10.17	11.82	12.50
Cost of development at end of each year <sup>6</sup> .....	45.82	50.06	55.01	60.13	70.70	79.08	88.60	98.77	110.59	123.18

<sup>1</sup> Ordinary labor charged at 12½ cents per hour, supervision at 25 cents per hour.  
<sup>2</sup> Includes manure, spray material, cover-crop seed, replants, and other materials.  
<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First year, 5 per cent; second year, 5 per cent; third year, 7 per cent; fourth year, 9 per cent; fifth year, 11 per cent; sixth year, 13 per cent; seventh year, 15 per cent; eighth year, 17 per cent; ninth year, 19 per cent; tenth year, 22 per cent.  
<sup>4</sup> See p. 18 for method of computing machinery, overhead, and interest charges.  
<sup>5</sup> Total cost including interest plus initial value of land, at \$25 per acre.

TABLE 41.—Alabama, Eufaula district: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method, and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horses	Tractors						
	Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Prune.....	1			10	1	1.0			0.12
Remove pruned wood.....	2	2		25	1	.8	0.8		.20
Apply fertilizer around trees.....	2	2		10	1	2.0	2.0		.50
Plow cover crop under.....	1		1	5	1	2.0		2.0	2.75
Cultivate (disk narrow).....	1			25	6	2.4		2.4	3.30
Seed winter cover crop.....	1			15	1	.6			.08
Disk in cover crop seed.....	1		1	25	1	.4		.4	.55
Supervision.....						2.4			.60
Miscellaneous <sup>3</sup> .....						2.8	2.0		.60
Total.....						14.4	4.8	4.8	8.70

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 5 per cent were missing, 63 per cent were in bearing, and 2 per cent were not in bearing—mainly replants.  
<sup>2</sup> Ordinary labor at 12½ cents an hour, supervision at 25 cents, horse work at 12½ cents, and tractor at \$1.25.  
<sup>3</sup> Includes muzzing, hoeing, spraying, orchard sanitation, and miscellaneous operations.

TABLE 42.—Alabama, Eufaula district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
<b>Labor and power prior to harvest:</b>		
	<i>Hours</i>	<i>Dollars</i>
Man labor.....	14.4	2.10
Horse work.....	4.8	.60
Tractor work.....	4.8	6.00
Total.....		8.70
<b>Materials:</b>		
	<i>Pounds</i>	
Fertilizer at \$28 per ton.....	285	3.99
Winter cover crop, vetch at 12 cents per pound.....	18	2.16
Miscellaneous <sup>2</sup> .....		1.35
Total.....		7.50
<b>Other costs:</b>		
Taxes.....		.75
Use of machinery, not including tractor <sup>3</sup> .....		.18
Overhead <sup>4</sup> .....		2.43
Total.....		3.36
Total cost, exclusive of interest.....		19.56
Interest at 6 per cent <sup>5</sup> .....		7.44
Total cost, including interest.....		27.00
Quantity of nuts at 30 cents per pound <sup>6</sup> required to cover cost including harvesting:		
Exclusive of interest.....	74	
Inclusive of interest.....	100	

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 5 per cent were missing, 93 per cent were bearing, and 2 per cent were replants and not in bearing.

<sup>2</sup> Includes manure, spray material, paint, and other materials.

<sup>3</sup> See p. 16 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 State average farm price. Harvesting costs include picking, grading, delivery to local shipping point, and are based on pecans sold through a cooperative association.

Conditions affecting pecan yields in the Eufaula district are similar to those outlined in the discussion of the Selma district, with a comparable degree of variation in yields obtained from different orchards in 1928. Yields reported for orchards 10 to 19 years of age ranged from 14 to 300 pounds an acre. One-half of these orchards from which production records were obtained by personal visits did not have yields sufficient to cover costs, including interest charges and harvesting costs, computed on the basis of the common method of operating pecan orchards in the district. As in the Selma district, and for the State of Alabama as a whole (Table 8), the 1928 yields in the Eufaula district were relatively favorable compared with those of other seasons.

Cotton has long been, and still is, the chief cash crop in the district centering around Eufaula. With decreased cotton yields, caused by the advent of the boll weevil and in some cases by the depletion of soil fertility, considerable attention is being given to pecan planting with a view to supplementing the income from cotton, or in some cases as a major commercial enterprise intended to furnish all or a large part of the farm income in the future.

Here, as in the other districts, it is well to remember that conditions that handicap one crop may also militate against any new crop introduced. It is fully realized by most farmers that pecan trees, like cotton, are affected by diseases, insect pests, and adverse weather conditions, but many persons fail to realize that soil fertility is just as important for growing successful pecan orchards as for the successful production of cotton or other crops. The location of some



orchards in this district, as well as in other districts, without giving due consideration to soils, has resulted in the development of trees that are now severely handicapped in their ability to produce economic yields. The leadership of the more successful orchardists in the area may well be followed in adopting practices which, in conjunction with proper location, will be more likely to result in profitable yields. These practices may have to be modified to meet conditions existing in different orchards. The profitable yields obtained in the better managed orchards in the district are proof of the possibilities of a well-planned system to meet the requirements of pecan trees.

MISSISSIPPI  
GULF COAST DISTRICT

The orchards studied in the Gulf coast district of Mississippi are about equally divided between Harrison and Jackson Counties. This district is the only one studied in which interplanted crops for harvest are not commonly grown in young orchards. Truck crops and filler crops of Satsuma oranges are interplanted in only a few orchards. Because of other competing industries and, in part, the close proximity of the Gulf coast resort section, wages for man labor are relatively high. These two factors (no interplanted crop for harvest and high wages) cause a relatively high total cost of developing orchards into bearing in this district. The entire orchard is usually plowed in the spring; fertilizer is scattered around the trees and disked in with the first cultivation. Only tree rows are cultivated. The centers are allowed to grow weeds which are turned under with the spring plowing. The tree rows are cultivated about four times during the summer. Spraying and the use of cover crops are not common.

TABLE 43.—Mississippi, Gulf coast: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew			Rate of work per day	Times done each year	Man labor	Horse work	Tractor work	Cost
		Men	Horses	Tractors						
		Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Plow	First	1	2		1.5	1	6.7	13.4		3.52
	Second to tenth	1			4	1	22.5		22.5	33.19
Harrow (disk)	First	1		1	15	1	.7		.7	1.03
Plant:										
Set stakes	do	3			25	1	1.2			.27
Dig holes	do	2			7	1	2.9			.65
Set trees	do	5	2		14	1	3.0	1.4		1.02
	First and second	3	2		50	1	1.2	.8		.39
	Third	3	2		40	1	.8	.5		.25
	Fourth	3	2		32	1	.9	.6		.29
Apply fertilizer around trees.	Fifth	3	2		28	1	1.1	.7		.35
	Sixth	3	2		24	1	1.2	.8		.39
	Seventh	3	2		22	1	1.4	.9		.45
	Eighth	3	2		20	1	1.5	1.0		.49
	Ninth	3	2		18	1	1.7	1.1		.55
	Tenth	3	2		16	1	1.9	1.2		.61
Cultivate tree rows (disk harrow)	First to tenth	1		1	40	4	10.0		10.0	14.75
Prune	Second to tenth						8.5			1.91
Remove pruned wood.	Fifth to tenth						3.1	6.2		1.63
Supervision	First to tenth						10.5			8.78
Miscellaneous <sup>2</sup>	do						27.5	25.9		10.07
Total							117.9	54.5	33.2	80.59

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre. No interplanted crop for harvest during the development period.

<sup>2</sup> Includes spraying, seeding cover crop, orchard sanitation, and replacing missing trees.

The fact that row crops are not generally grown in pecan orchards in this district accounts in a large measure for the use of tractor-drawn equipment for plowing, harrowing, and cultivating the orchards. At rates prevailing in 1928 the total labor and power cost for the first 10 years was about \$80 an acre. (Table 43.)

During the first year of development the cost of labor and power, trees, commercial fertilizer, spray, cover-crop seed, taxes, interest, and other items chargeable to the trees, plus the value of the land on which the trees were set, amounted to approximately \$84 an acre. At the end of the tenth year the total cost, including interest compounded annually, plus the value of the land at \$50 an acre, amounted to about \$312 an acre. (Table 44.)

TABLE 44.—Mississippi, Gulf coast: Cost per acre of developing a pecan orchard for the first 10 years, by years, according to a common method and at cost rates prevailing in 1928

Item	First year	Sec-ond year	Third year	Fourth year	Fifth year	Sixth year	Sev-enth year	Eighth year	Ninth year	Tenth year
Fertilizer.....pounds..	24	24	36	60	84	108	132	156	180	204
Labor and power:										
Man labor.....hours..	24.1	8.6	3.2	3.2	10.4	11.8	12.1	11.9	11.5	10.1
Horse work.....do..	19.9	1.6	1.6	2.1	4.4	5.8	6.2	5.0	4.5	3.4
Tractor work.....do..	1.7	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Labor and power:	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>	<i>Dolls.</i>
Man labor.....	6.32	2.25	2.41	2.16	2.72	3.11	3.17	3.13	3.02	2.66
Horse work at 15 cents per hour.....	2.99	.24	.24	.32	.66	.87	.93	.75	.68	.51
Tractor work at \$1.25 per hour.....	2.12	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37
Total.....	11.43	6.86	7.02	6.85	7.75	8.35	8.47	8.25	8.07	7.54
Materials:										
Trees at \$1 each.....	12.00									
Fertilizer at \$37 per ton.....	.41	.44	.67	1.11	1.55	2.00	2.44	2.89	3.33	3.77
Miscellaneous.....	1.54	1.37	.31	1.32	1.70	1.65	2.01	3.49	2.91	2.78
Total.....	13.98	1.81	.98	2.43	3.34	3.65	4.45	6.38	6.24	6.55
Other costs:										
Taxes.....	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Use of machinery.....	.77	.10	.11	.18	.65	.96	1.21	.71	.88	.32
Overhead.....	3.81	1.30	1.20	1.30	1.66	1.80	1.94	2.19	2.15	2.11
Total.....	5.58	2.40	2.34	2.57	3.31	3.76	4.15	3.90	4.03	3.43
Total cost, exclusive of interest.....	30.99	11.07	10.34	11.85	14.40	15.76	17.07	18.53	18.34	17.52
Interest at 6 per cent.....	3.24	5.99	6.07	7.08	8.41	9.91	11.59	13.06	15.04	16.79
Total cost.....	34.23	16.16	16.41	18.93	22.81	25.67	28.63	31.59	33.38	34.31
Cost of development at end of each year.....	84.23	106.39	116.80	135.73	158.54	184.21	212.84	244.43	277.81	312.12

<sup>1</sup> Ordinary labor charged at 22½ cents an hour and supervision at 45 cents an hour.

<sup>2</sup> Includes spray material, cover-crop seed, trees for replanting, and other materials.

<sup>3</sup> See p. 18 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> Total cost including interest plus initial value of land, at \$50 per acre.

As previously stated, the general practice of not growing interplanted crops for harvest during the development of the young orchard is a large factor in causing the relatively high cost per acre of developing young orchards in this district compared with costs in other districts. A large number of the orchards are owned by persons who derive the main portion of their incomes from other sources, and who can not always devote the time and attention, or the supervision, that would be required by the interplanted crops, mainly

truck crops, which are adapted to the district. Cotton, which would require less attention, is not favored by the soil and climatic conditions near the Gulf coast. Many of the orchards are owned by absentee landlords and are operated by caretakers for a fee. These orchards are not usually interplanted to commercial crops.

In general, the cultural system commonly followed for bearing orchards is much the same as for the development of young orchards. The entire tract is plowed in spring. Usually, about three cultivations with a disk harrow are given during the summer. The use of cover crops or spray is not common. Rather heavy applications of commercial fertilizer are made, usually following the spring plowing and just preceding the first disking.

The care of an acre of bearing orchard in the Gulf coast district usually requires slightly more than 2.5 days of man labor and the necessary motive power to perform the field operations. Tractor-drawn implements are commonly used for plowing and cultivating. The labor and power cost, not including harvesting the crop, was \$14.40 an acre. (Table 45.) The total 1928 operating cost, exclusive of harvesting costs, is shown in Table 46. Harvest costs in 1928 varied from \$1.50 to \$3.75 per hundred pounds of nuts.

TABLE 45.—Mississippi, Gulf coast: Annual labor and power cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> up to harvest time, according to a common method, and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew			Rate of work per day	Times done	Man labor	Horse work	Tractor work	Cost
	Men	Horses	Tractors						
	Number	Number	Number	Orchard acres	Number	Hours	Hours	Hours	Dollars
Prune.....	1			1.5	1	6.7			1.51
Remove pruned wood.....	2	2		10	1	2.0	2.0		.75
Plow.....	1		1	4	1	2.5		2.5	3.69
Apply fertilizer around trees.....	3	2		14	1	2.1	1.4		.68
Cultivate (disk harrow).....	1		1	15	3	2.0		2.0	2.95
Supervision.....						4.4			1.98
Miscellaneous <sup>3</sup> .....						6.6	3.2	.7	2.84
Total.....						26.3	6.6	5.2	14.40

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 5 per cent were missing, 88 per cent were in bearing, and 7 per cent not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 22½ cents, supervision at 45 cents, horse work at 15 cents, and use of tractor \$1.25.

<sup>3</sup> Includes applying manure, harrowing, mowing weeds, hoeing, seeding cover crop, spraying, and miscellaneous operations.

TABLE 46.—Mississippi, Gulf coast: Annual cost per acre of operating pecan orchards 15 to 19 years old,<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
<b>Labor and power prior to harvest:</b>		
Man labor.....	<i>Hours</i> 20.3	<i>Dollars</i> 6.91
Horse work.....	6.6	.99
Tractor work.....	5.2	6.50
Total.....		14.40
<b>Materials:</b>		
Fertilizer at \$37 per ton.....	<i>Pounds</i> 400	7.40
Miscellaneous <sup>2</sup> .....		4.00
Total.....		11.40
<b>Other costs:</b>		
Taxes.....		1.00
Use of machinery, not including tractor <sup>3</sup> .....		1.08
Overhead <sup>4</sup> .....		3.87
Total.....		5.95
Total cost, exclusive of interest.....		31.75
Interest at 6 per cent <sup>5</sup> .....		19.18
Total cost.....		50.93
Quantity of nuts at 30 cents per pound <sup>6</sup> required to cover cost including harvesting:		
Exclusive of interest.....	118	
Inclusive of interest.....	186	

<sup>1</sup> Trees set 60 by 60 feet, or 12 to the acre, of which 5 per cent were missing, 88 per cent were in bearing, and 7 per cent not in bearing—mainly replants.

<sup>2</sup> Includes spray, manure, cover-crop seed, and other materials.

<sup>3</sup> See p. 18 for method of computing machinery, overhead, and interest charges.

<sup>4</sup> The 1928 State average farm price. Harvesting costs include picking, grading, and delivery to local shipping point and are based on pecans sold to buyers by express.

Pecan yields obtained in Mississippi in 1928 were considerably above the average for other years, as indicated by the November 1 crop-condition reports obtained for a period of years. (Table 8.) However, the information obtained by means of personal visits and by questionnaires indicates a wide range in yields from different orchards in the Mississippi Gulf-coast district. Yield information for 1928 was obtained from 43 orchards 15 to 19 years of age, including 16,037 trees. The range in yields from these orchards is shown in the distribution of the orchards classified according to the average yield secured per tree.

Yield per tree in pounds	Number of orchards	Yield per tree in pounds	Number of orchards
0.5-4.49.....	12	32.5-36.49.....	4
4.5-8.49.....	6	36.5-40.49.....	2
8.5-12.49.....	3	40.5-44.49.....	3
12.5-16.49.....	2	44.5-48.49.....	1
16.5-20.49.....	2	48.5-52.49.....	0
20.5-24.49.....	0	52.5-56.49.....	2
24.5-28.49.....	3	56.5-60.49.....	2
28.5-32.49.....	1		

Approximately 28 per cent of the orchards yielded less than 4.5 pounds of pecans a tree and 42 per cent yielded less than 8.5 pounds of pecans a tree. On the basis of 12 trees to the acre, of which 10.6

are in bearing, approximately 56 per cent of the pecan orchards 15 to 19 years of age did not have yields sufficient to pay costs in 1928, including harvest costs and interest charges, based on the common method of operating bearing orchards in the district. With costs computed on the same basis, but not including interest as a charge, approximately 48 per cent of the orchards did not have yields sufficient to pay costs. On the other hand, comparatively high yields were reported from some of the orchards, as indicated in the upper ranges of the yield distribution shown.

The most common reasons given for the low yields obtained on some of the orchards were the use of varieties unsuited to the district; lack of soil fertility; poor drainage; uncontrolled insect pests and fungus diseases; trees planted too close; and neglect of the orchard during the development period. Although these and other factors discussed for the other districts must be given due consideration, differences in orchard sites with respect to soil fertility and surface features are one of the most important factors contributing to the wide range in pecan yields in this district. The soils vary widely in their ability to produce profitable pecan crops. The flat, poorly drained gray soils are of low agricultural value. In other sections of the district, the red, waxy clay subsoil, often nearly impervious, is too close to the surface to permit easy cultivation. The most successful orchards in the district are on well-drained sandy-loam soils having subsoils of friable yellow or reddish sandy or fine sandy clays.

#### LOUISIANA

##### SHREVEPORT DISTRICT

The orchards studied in the Shreveport district of Louisiana are in Caddo, Bossier, and Natchitoches Parishes, the majority being in the first two parishes. Development of pecan orchards in this district is usually in conjunction with the production of field crops for harvest. The usual practice is to interplant field crops between the trees up to and including the tree rows. Although corn, hay, and vegetables are sometimes used, cotton is the usual crop. Cotton is commonly interplanted for four successive years, alternating with some other crop the fifth year. The interplanted crop is given the usual cultivation just as if the pecan trees were not present. The cultivation given the pecan trees, then, is incidental to that given the interplanted crop. The general practice of interplanting row crops, grown by share labor in orchards during the development stage as well as in bearing orchards, is a large factor in the choice of horses or mules as the common source of motive power for orchard work in this district.

To protect the young trees from injury while cultivating the interplanted crops, two stakes are set, one on each side of the young trees. These stakes are left for four or five years, or until the young trees are not so susceptible to injury. Some growers use screening or burlap wrapping around the lower part of the tree trunks to prevent rabbits from injuring and possibly killing the young trees by girdling them, but this practice is not common.

The proportionate share of the joint costs chargeable to pecans for each year of the development period is shown in the footnotes to Tables 47 and 48. The total labor and power cost for the first 10 years is shown in Table 47, and the total cost, exclusive of the cost or value of the land and the interest thereon, in Table 48.

TABLE 47.—Louisiana, Shreveport district: Labor and power costs per acre of developing a pecan orchard during the first 10 years, according to a common method<sup>1</sup> and at cost rates prevailing in 1928

Operation	Years operation is performed	Size of crew		Rate of work per day	Times done each year	Percentage charged to pecans		Cost	
		Men	Horses			Man labor	Horse work		
Plow	First to tenth	1	2	1.5	1	15-18	6.8	13.6	2.38
Narrow	do.	1	1	7	2	15-18	2.9	2.9	.73
Plant:									
Set stakes	First	3		30	1	100	1.0		.15
Dig holes	do.	1		3.5	1	100	2.9		.44
Set trees	do.	7	2	24	1	100	2.9	.5	.82
Stake trees	do.	2	2	6	1	100	2.5	2.5	.82
Cultivate:									
First to tenth	First to tenth	1	1	3.5	(?)	15-18	15.8	15.8	3.95
First and second	do.	1		30	4	100	4.0		.60
Third	do.	1		18	2	100	1.1		.16
Fourth	do.	1		18	4	100	2.2		.33
Fifth and sixth	do.	1		17	4	100	4.8		.72
Seventh	do.	1		16	4	100	2.5		.38
Eighth	do.	1		16	2	100	1.2		.18
Ninth and tenth	do.	1		15	4	100	5.4		.81
Prune	Second to tenth					100	5.8		.87
Remove pruned wood	Fifth to tenth					100	2.8	5.6	.98
Supervision	First to tenth					100	18.3		5.49
Miscellaneous <sup>2</sup>	do.					100	27.2	7.0	4.78
<b>Total</b>							<b>110.1</b>	<b>48.2</b>	<b>24.09</b>

<sup>1</sup> Trees set 66 by 66 feet, or 10 to the acre. Cotton usually rotated with corn or some other cultivated crop for harvest, interplanted up to and including the tree rows during the entire development period.  
<sup>2</sup> Charges for land preparation and cultivation charged to pecans as follows: First year, 5 per cent; second year, 5 per cent; third year, 6 per cent; fourth year, 7 per cent; fifth year, 9 per cent; sixth year, 10 per cent; seventh year, 12 per cent; eighth year, 14 per cent; ninth year, 16 per cent; tenth year, 18 per cent.  
<sup>3</sup> Pecan trees cultivated the same as the interplanted crops for harvest on the basis of six cultivations for cotton and three for corn and other cultivated crops for harvest.  
<sup>4</sup> Includes fertilizing, spraying, seeding cover crop, orchard sanitation, and replacing missing trees.

TABLE 48.—Louisiana, Shreveport district: Cost per acre of developing a pecan orchard for the first 10 years, by years, at cost rates prevailing in 1928

Item	First year	Second year	Third year	Fourth year	Fifth year	Sixth year	Seventh year	Eighth year	Ninth year	Tenth year
<b>Labor and power:</b>										
Man labor.....hours	18.8	7.2	6.5	8.0	9.4	10.4	11.8	9.8	13.6	14.3
Horse work.....do.	5.4	2.1	2.5	3.4	3.5	4.2	5.8	5.4	7.4	8.2
<b>Labor and power:</b>										
Man labor <sup>1</sup> .....Dolls.	3.28	1.26	1.19	1.40	1.65	1.82	2.07	1.71	2.39	2.51
Horse work, at 10 cents per hour.....do.	.54	.21	.25	.34	.35	.42	.58	.54	.74	.82
<b>Total</b> .....Dolls.	3.82	1.47	1.43	1.74	2.03	2.24	2.65	2.25	3.13	3.33
<b>Materials:</b>										
Trees, at \$1.10 each.....Dolls.	11.00									
Stakes for young trees, at 6 cents each.....do.	1.20									
Miscellaneous <sup>2</sup> .....do.	1.10	1.07	.27	1.61	.29	1.12	2.16	.40	.44	1.24
<b>Total</b> .....Dolls.	13.30	1.07	.27	1.61	.29	1.12	2.16	.40	.44	1.24
<b>Other costs:</b>										
Taxes <sup>3</sup> .....Dolls.	.08	.08	.09	.10	.14	.15	.18	.21	.24	.27
Use of machinery <sup>4</sup> .....do.	.20	.08	.09	.13	.14	.16	.22	.20	.28	.31
Overhead <sup>4</sup> .....do.	2.47	.38	.20	.50	.35	.50	.72	.40	.54	.69
<b>Total</b> .....Dolls.	2.85	.54	.44	.73	.63	.81	1.12	.81	1.06	1.27
<b>Total cost, exclusive of interest</b> .....Dolls.	19.97	3.08	2.14	4.08	2.95	4.17	5.93	3.46	4.63	5.84
Interest at 6 per cent <sup>1</sup> .....do.	.51	1.70	2.08	2.44	3.01	3.47	4.12	4.90	5.60	6.41
<b>Total cost</b> .....Dolls.	20.48	4.78	4.22	6.52	5.96	7.64	10.05	8.36	10.23	12.25
<b>Cumulative cost</b> .....Dolls.	20.48	25.26	29.48	36.00	41.96	49.60	59.65	68.01	78.24	90.49

<sup>1</sup> Ordinary labor charged at 15 cents an hour, supervision at 30 cents an hour.  
<sup>2</sup> Includes fertilizer, cover-crop seed, spray material, trees for replanting, and other materials.  
<sup>3</sup> Charges for taxes and interest prorated to pecan trees as follows: First year, 5 per cent; second year, 5 per cent; third year, 6 per cent; fourth year, 7 per cent; fifth year, 9 per cent; sixth year, 10 per cent; seventh year, 12 per cent; eighth year, 14 per cent; ninth year, 16 per cent; tenth year, 18 per cent.  
<sup>4</sup> See p.18 for method of computing machinery, overhead, and interest charges.  
<sup>5</sup> Does not in this case include any sum for initial value of land.

At the end of the first year of the development period the cost of labor and power, trees, commercial fertilizers, cover-crop seed, spray, and other items chargeable to the trees was about \$20 an acre. At the end of the tenth year the "cumulative cost," including interest compounded annually, amounted to approximately \$90 an acre. (Table 48.) Land values in this district are higher than in the other districts studied. The rich alluvial soil produces especially good yields of cotton not only during the development stage of the orchard but also in orchards of bearing age. Such land as is usually used for pecan orchards is commonly valued at \$150 an acre.

Field crops are usually interplanted in bearing orchards. A few growers leave tree-row spaces which are cultivated independently of the intercrops. The most common method, however, is to interplant crops up to the trees in orchards 15 to 19 years of age. The trees receive the same cultivation that is given the intercrops. The system is the same as that used in young orchards. Bearing trees, however, require more space and therefore shade out more of the intercrop than do young trees. Little or no production is expected from intercrops near the trees, although the entire space, up to the trees, is cultivated in the same way. Cotton is the chief field crop.

The labor and power cost, chargeable to pecans, not including harvesting the crop, is shown in Table 49, and the total 1928 operating cost chargeable to pecans, in Table 50.

TABLE 49.—Louisiana, Shreveport district: Annual labor and power cost per acre of operating pecan orchards, 15 to 19 years old, up to harvest time, according to a common method<sup>1</sup> and at cost rates prevailing in 1928<sup>2</sup>

Operation	Size of crew		Rate of work per day	Times done	Percentage charged to pecans	Charged to pecans		
	Men	Horses				Man labor	Horse work	Cost
	Number	Number				Hours	Hours	Dollars
Prune.....	2		10	1	100	2.0		0.30
Remove pruned wood.....	2	2	20	1	100	1.0	1.0	.25
Orchard sanitation.....				1	100	1.0		.20
Plow.....	1	2	1.5	1	35	2.3	4.6	.60
Harrow.....	1	1	7	2	35	1.0	1.0	.25
Cultivate.....	1	1	3.5	6	35	6.0	6.0	1.50
Hoe.....	1		8	2	100	2.5		.38
Supervision.....					100	4.2		1.26
Miscellaneous.....					100	5.4	4.7	1.23
Total.....						25.4	17.8	6.22

<sup>1</sup> Trees set 66 by 66 feet, or 10 to the acre, of which 5 per cent were missing, 88 per cent were in bearing, and 6 per cent were not in bearing—mainly replants.

<sup>2</sup> Ordinary labor at 15 cents an hour, supervision at 30 cents, horse work at 10 cents, and use of tractor at \$1.25.

<sup>3</sup> Includes seeding cover crop, spraying, applying fertilizer and manure, and miscellaneous operations.

TABLE 50.—Louisiana, Shreveport district: Annual cost per acre of operating pecan orchards 15 to 19 years old<sup>1</sup> according to a common method and at cost rates prevailing in 1928, and yield required to cover costs

Item	Quantity	Cost
Labor and power prior to harvest:	Hours	Dollars
Man labor.....	25.4	4.44
Horse work.....	17.8	1.78
Total.....		6.22
Materials: Miscellaneous <sup>2</sup> .....		2.25
Other costs:		
Taxes <sup>3</sup> .....		.52
Use of machinery, not including tractor <sup>4</sup> .....		.79
Overhead <sup>5</sup> .....		1.27
Total.....		2.58
Total cost, exclusive of interest.....		11.05
Interest at 6 per cent <sup>3</sup> .....		5.80
Total cost.....		19.55
Quantity of nuts at 27 cents per pound <sup>6</sup> required to cover cost, including harvesting:	Pounds	
Exclusive of interest.....	48	
Inclusive of interest.....	83	

<sup>1</sup> Trees set 66 by 66 feet, or 10 to the acre, of which 8 per cent were missing, 88 per cent were in bearing, and 8 per cent were replants and not in bearing.

<sup>2</sup> Includes cover-crop seed, spray material, fertilizer, and manure.

<sup>3</sup> 35 per cent of the charges for taxes and interest is charged to pecans.

<sup>4</sup> See p. 16 for method of computing machinery, overhead and interest charges.

<sup>5</sup> The 1928 State average farm price. Harvesting costs include picking, grading, and delivery to local shipping point and are based on pecans sold to local dealers.

Harvesting costs in 1928 ranged from \$1.50 to \$3.50 per hundred pounds of nuts.

In orchards 10 to 19 years of age for which production records were obtained, yields ranged from 54 to 126 pounds an acre. Approximately 50 per cent of these orchards did not have yields sufficient to cover costs, including interest and harvesting costs, as shown in Table 50.

The 1928 yield of pecans in Louisiana was above the average for the State during the 10-year period 1920-1929. Yields reported for that year in the Shreveport district, however, were somewhat lower than anticipated in many of the orchards from which production records were obtained by personal visits. These low yields may be attributed largely to poorly filled nuts.

Most of the orchards included in this study are on cotton plantations or on farms on which cotton is the main, and in some cases the only other, cash crop of importance. The production of pecans, being incidental to the production of cotton even after the orchard has attained bearing age, may not receive the attention that would be accorded a crop that enjoys a more prominent place in the farming system. Yields of pecans for many orchards in the district, therefore, have been somewhat low.

The alluvial soil of the area, on which the larger number of the orchards studied are located, is well adapted to cotton. The normally favorable cotton yields have resulted in a relatively high evaluation of the land. The investment is such, then, that it is particularly desirable that some income be derived from the land pending the development of pecan trees. The planting of fewer trees to the acre not only permits the interplanting of field crops in the orchard during



the development period but also allows a continuation of this practice until the size of the trees prevents a profitable production of such crops. This point in most cases has not been reached in orchards of from 15 to 19 years of age. When the size of trees becomes such that it is no longer advisable to grow an interplanted crop of cotton the sole income from the land, of an initial value of \$150 an acre, will be from pecans.

It is an open question whether pecans can successfully compete with cotton on land of this value. The small quantity of nuts required to pay costs as shown in Table 50, represents orchards in which the trees have not attained a size that prohibits the growing of cotton in the orchard and in which the cotton crop is charged with the major share of the joint costs. The general system of orchard management followed, with the yields secured, on an orchard of 30 years of age is outlined briefly as an indication of a system of management followed on older orchards in the district in which cotton is no longer interplanted.

The cultivation of this orchard consists of plowing strips, 15 feet wide, on each side of the tree rows during winter. Beginning in the spring, these strips are gone over with a disk cultivator about every other week until the latter part of July. The middles are allowed to grow up in sweet clover, mostly *Melilotus indica*, which reseeds itself annually. This leguminous growth is disked in during the first part of July, and the entire orchard is usually given two more diskings between that time and harvesting. The sweetclover from one-fourth of the orchard acreage is harvested for hay each year. Fertilizing and spraying are done only irregularly and may not be classed as yearly operations.

During the 5-year period 1924 to 1928 the orchard produced an average annual yield of about 163 pounds of nuts an acre. This was an average yield of 23.6 pounds of pecans a tree, counting all trees originally planted as bearing trees. The orchard was originally planted at the rate of 6.9 trees to the acre, but it was estimated that approximately 28 per cent of the trees were missing and approximately 5 per cent were nonbearing replants. The trees actually in bearing, therefore, produced an annual average of 35.2 pounds of nuts a tree during the 5-year period. The large proportion of missing trees and the consequent lower yield on an acre basis may largely be attributed to neglect of the orchard during the development period. With a full stand of but 7 trees to the acre, the orchard would probably not be crowded for space when 30 years old and with careful consideration given to the maintenance of soil fertility, it is not unreasonable to assume that yields of 30 to 35 pounds normally might be obtained a tree.

## MARKETING

In discussing pecan marketing it is important to keep in mind that the so-called improved varieties, under present conditions, are handled in a manner that is different from the manner in which the native seedling crop is handled. Most of the pecans grown under cultivation are of the improved or named varieties which have been selected from the native seedling stock because of size or other desirable qualities. The average size of native seedling nuts is smaller than of the improved varieties.

Improved varieties of pecans are largely marketed and distributed in the unshelled state to consumers. Some seedlings, particularly the largest sizes, are also marketed in this way, but the larger portion of the native seedling crop is sold to commercial shellers. In so far as practicable, therefore, the marketing of improved varieties is discussed separately from the marketing of the native seedling crop.

The marketing information in this bulletin is based on the findings of a survey made in 1928-29. With the assistance of the Federal Farm Board, the National Pecan Marketing Association, a cooperative sales agency, was organized in July, 1930. Pecan-marketing conditions may be affected materially by this organization.

### SHIPPING-POINT PRACTICES

Various methods have been used by growers of improved pecans during recent years in disposing of their crops. These include selling through a cooperative association; selling to one of a number of large shippers or to a small local buyer; consigning to a city dealer or retailer; and selling direct to city dealers, retailers, or consumers. Some growers and small shippers have made a practice of selling direct to consumers and shipping by parcel post or express. Most of the sales by large shippers are on an f. o. b. shipping-point basis.

Seedling or native pecans, which are produced chiefly in Texas, Oklahoma, and neighboring States, are usually shelled commercially, although some unshelled seedlings reach the consuming public, principally in mixed nuts. The crop is assembled through country merchants, dealers, and representatives of shellers. The shellers usually buy the nuts ungraded and grade them before cracking.

The methods of disposal of the 1928 pecan crop by growers as reported in the survey are shown in Table 51.

TABLE 51.—Disposition growers made of the pecan crop, by States, 1928

State and section	Pro- duction	Deliv- ered to coop- erative selling associa- tion	Shipped to outside buyers by—			Sold locally to—		Cracked on farms for sale of kernels	Con- sumed on farm	Not dis- posed of when report was made	Total crop
			Freight	Ex- press	Parcel post	Deal- ers	Con- sum- ers				
	1,000 lbs.	Per cent.	Per cent.	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
North Carolina.....	690	5.6	2.0	7.0	8.0	17.0	16.0	1.0	40.0	3.4	100
South Carolina.....	730	15.0	5.0	11.0	0.0	19.5	12.0	.5	25.0	3.0	100
Georgia.....	5,400	24.3	15.8	11.1	4.1	25.9	5.1	.2	12.5	1.0	100
Florida.....	2,000	24.0	15.0	14.0	4.0	21.0	5.0	.5	15.0	1.5	100
Alabama.....	3,500	31.3	7.0	15.0	3.0	16.7	10.0	.2	15.0	1.8	100
Mississippi.....	6,500	7.5	18.0	13.0	3.0	24.0	11.0	.5	10.0	3.0	100
Eastern.....	21,820	19.5	14.2	12.4	3.9	25.8	8.2	.4	13.7	1.9	100
Missouri.....	300	.5	3.0	.2	1.3	63.0	28.7	-----	12.7	.6	100
Arkansas.....	1,750	1.0	1.0	15.0	3.0	49.0	11.0	2.0	15.0	4.0	100
Louisiana.....	5,500	1.0	18.0	2.0	.3	60.0	5.0	.3	10.0	3.4	100
Oklahoma.....	8,400	-----	13.0	1.0	2.0	64.0	8.5	.5	16.0	1.0	100
Texas.....	29,500	2.0	7.0	1.5	2.0	67.0	11.0	3.5	5.0	1.0	100
Western.....	45,450	1.4	0.2	2.0	1.8	64.8	9.9	2.5	7.0	1.4	100
Total.....	67,270	7.3	10.8	5.4	2.5	52.1	9.4	1.8	9.1	1.6	100

In 1928 handling by cooperative selling associations was largely confined to the States east of the Mississippi. Very few nuts were so handled in any of the States west of the Mississippi and none, so far as reported, in Arkansas and Oklahoma. The most important marketing channel used by growers has been through the local buyers or dealers who are estimated to have handled more than half the crop.

A few growers and small shippers have been successful in marketing pecans by parcel post, but in general it has been difficult to dispose of large quantities successfully in this way. Objections are that the purchaser who is usually a consumer does not have an opportunity to inspect the nuts prior to their receipt and shippers have in some instances suffered losses when payment was not required in advance on parcel-post shipments. Pecans are becoming more generally available through the retail stores, and the trend in prices has been downward. These conditions are not conducive to an increased volume of sales through parcel-post channels.

Methods of disposal vary considerably in the different States, depending upon the degree of concentration of the industry. Sales for local consumption, for instance, amounted to as much as one-fourth of the crop in at least one State and more than one-tenth in several others, while it fell to one-twentieth in Georgia, Florida, and Louisiana. Consumption on the farm where produced is also relatively high in districts in which the crop is grown to only a limited extent, being 25 per cent and over in the Carolinas, but falling to 5 per cent in Texas where a large proportion of the crop is not gathered by the owner. Growers' shipments by express are highest in the States east of the Mississippi that produce improved types of nuts, and are negligible in Louisiana, Oklahoma, and Texas.

The rate on less than carload lot freight shipments of unshelled pecans from Albany, Ga., to Chicago, Ill., in June, 1931, was reported as \$1.51 per hundredweight, and on car-load shipments 97 cents per hundredweight. These rates are subject to change and are stated here only as an illustration of approximate transportation costs.

Pecans sold cooperatively or to large shippers in the districts that produce chiefly improved varieties have been sized, graded, and packed at houses operated by the association or by shippers. Of the nuts handled cooperatively or by large shippers in the 1928 season, approximately 50 per cent were packed in 100-pound double-ply burlap sacks, 38 per cent in 50-pound boxes, 9 per cent in 25-pound boxes, and the remainder in barrels, small sacks, and cartons. Reports indicate that somewhat less than one-half of the 1928 crop shipments of unshelled pecans from the improved pecan area were in carloads. The remainder were sent to market chiefly in l. c. l. (less than carload lot) freight shipments although some were moved by express, parcel post, and motor truck.

General grading methods for improved varieties or large seedlings have been recommended by the National Pecan Association, but they have not been applied uniformly by all shippers.<sup>5</sup> Each of the important shipping organizations has operated under its own brands, which represent various varieties or mixtures of varieties, and its own standards of quality and size. In marketing, the Schley variety, which brings a premium in price, is not mixed with other varieties.

<sup>5</sup> Official grading standards for unshelled pecans (Improved varieties and large seedlings—not shelling stock) were issued by the Bureau of Agricultural Economics, U. S. Department of Agriculture, in October, 1930, and were recommended by the National Pecan Association at its annual meeting in 1930.

The so-called standard varieties other than Schley, as Stuart, Success, Van Deman, Alley, Pabst, Frotscher, and others of similar appearance and character, are usually sold in mixtures of varieties but in some instances as individual varieties.

Usually pecans from the current season's crop can not be placed on the market in quantity, until after the first of November. In years of heavy production a considerable percentage of the crop has been carried over in cold storage and marketed during the next season. In view of the fact that the pecan crop arrives on the market too late for the October and early November trade it would appear to be sound practice to carry over, under proper cold-storage conditions, a limited quantity to take care of the early fall demand for unshelled pecans. Particularly in years of heavy production a carry-over of moderate size to the next season should relieve the marketing situation.

A large crop usually has been followed the next year by a medium or small-sized crop which facilitates the sale of nuts held over from a large crop. The marketing situation may, of course, be materially weakened if there is an excessive carry-over in the hands of shippers or city dealers. In some years the uncertainty of the quantity carried over, either in the producing area or in scattered holdings in the markets, has been an unsettling factor in the price situation.

#### SHIPPING-POINT PRICES

Average f. o. b. prices for the crops produced during the period 1925 to 1930 as computed from reports by shippers in the southeastern area are shown in Table 52. The figures for all sales are supposed to represent the average prices for the crops specified, including in some instances returns on nuts carried over and sold during the next fall. The relation between supply and price during these years is difficult to determine. The relatively small crop of improved varieties in 1925 sold at the highest price received in any of the six years, but the large crop of 1926 apparently averaged more per pound than did the light crop of 1927. Considerable quantities of the 1926 crop, however, were not sold until the fall of 1927. The large 1928 crop (exclusive of nuts carried over until the fall of 1929), according to reports, averaged slightly higher in price than did the 1927 crop. The smaller 1929 crop influenced by the carry-over from 1928 averaged about the same in price as the crop sold the previous season.

If full and accurate information were available to shippers at the beginning of each marketing season regarding the size of the current crop and the quantity carried over from the previous season at shipping points and in the markets, it should be possible to determine a scale of prices at which the current crop, or a certain percentage, would move into consumption. Less uncertainty as to the price situation would materially benefit the industry as a whole.

The premium in price of Schley over other standard varieties has ranged from 12 to 18 cents per pound during the period 1925 to 1930. For the 1928 crop the relative quantities of the varieties or groups shown in Table 52 based on the reports covering about 6,000,000 pounds of the improved crop were: Schley, 13 per cent; other standard varieties, 53 per cent; miscellaneous (including some standard varieties), 28 per cent; seedlings, 3 per cent; culls and crackers, 3 per cent.

TABLE 52.—Approximate prices per pound of pecans (f. o. b. basis) by classes, as reported by shippers in the area east of the Mississippi River, 1925-1930<sup>1</sup>

Crop	Schley	Other standard varieties <sup>2</sup>	Miscellaneous varieties <sup>3</sup>	Seedlings <sup>4</sup>	Culls	All sales
	Cents	Cents	Cents	Cents	Cents	Cents
1925.....	54	36	31	20	15	35
1926.....	44	32	25	16	19	32
1927.....	41	31	23	17	15	30
1928.....	48	32	28	13	14	31
1929.....	45	33	27	15	7	31
1930.....	43	29	24	13	6	28

<sup>1</sup> Prices were computed by combining reports and estimates from shippers in the area producing mostly improved varieties. Minor arbitrary adjustments were made in a few instances. They are presented as approximations of the weighted average f. o. b. prices. It was impracticable to obtain weighted average prices for various gradations of quality and size reported by the different shippers. The 1929 figures are influenced by some carry-over from the 1928 crop included in the report of sales.

<sup>2</sup> Standard varieties other than Schley, include Stuart, Alley, Pabst, Van Deman, Success, Frotzcher, Delmas, and possibly others. Some nuts of these varieties may be included with "miscellaneous varieties."

<sup>3</sup> Seedlings as here reported include only relatively small quantities reported by shippers who handle chiefly improved varieties.

The reader should keep in mind that the prices shown in Table 52 are the selling prices at shipping point for pecans from the southeastern area. The costs of assembling at shipping points and of grading and packing, and incidental costs, are charges which must be deducted from f. o. b. prices in ascertaining the prices received by growers of these nuts. These costs vary and may range from a few cents to as much as 7 or 8 cents per pound.

Growers throughout the entire pecan belt, who are pecan correspondents of the Division of Crop and Livestock Estimates, were asked to report the prices received for pecans, under the classification of improved varieties and seedlings. These prices, and the total value of the crop by States for the period 1925 to 1931, are shown in Table 53. The prices which growers reported they received for improved varieties are slightly higher than would be indicated by the f. o. b. shipping-point prices reported by shippers. (Table 52.) The reports of growers, however, include sales by parcel post and express and small-lot sales in which the prices received were probably higher than in the case of sales made to dealers or through associations.

The higher price of the improved varieties is noticeable, being usually from two to three times as much as received for the seedling nuts. Seedling nuts from some sections that produce nuts of exceptionally good size and character bring considerably better prices than the average shown for seedling nuts, and some of course bring less; the difference in size and quality of seedling nuts is quite as great as among improved varieties.

Table 53 also shows the total value of the crops of improved and seedling pecans for the years 1925 to 1931 inclusive. It will be seen that Texas derives a larger income from pecans than any other State. The value of pecans in that State, which produces in average years close to one-half of the total crop, ranges from about \$1,000,000 to almost \$5,000,000. Georgia comes second, with an income ranging from \$1,000,000 to almost \$3,000,000 annually. Mississippi and Oklahoma have incomes from pecans of around \$1,000,000 or more in average years. Alabama and Louisiana usually receive from \$500,000 to \$1,000,000 each.

TABLE 53.—Average price per pound of pecans received by pecan growers, and total value of the crop, 1925-1931

PRICE PER POUND

State	Improved varieties							Seedling varieties						
	1925		1926		1927		1928		1929		1930		1931	
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.
North Carolina	45	44	40	30	34	33	20	30	26	27	22	20	18	14
South Carolina	45	28	35	33	35	28	17	30	21	23	17	20	18	11
Georgia	37	31	34	28	31	30	12	25	15	17	13	15	14	9
Florida	37	30	33	31	33	29	14	22	14	17	16	17	17	8
Alabama	40	34	37	30	30	25	14	25	10	20	13	16	12	8
Mississippi	39	37	38	30	32	27	14	23	18	19	14	17	12	7
Arkansas	34	35	35	22	35	30	15	18	15	15	14	12	12	6
Louisiana	32	32	38	27	31	24	16	17	14	16	10.7	15	12	7.5
Oklahoma	35	30	35	35	39	30.5	19	15	10	13	11	10.2	9.1	5
Texas	31	30	35	35	32	27	17	17	11	15	11.7	11	11	5.3
Illinois								17	17	14	15	15	14	8
Missouri	35	32	48	35	30	20	15	16	16	20	16	13	12	8
United States	37.8	32.5	35.4	29.6	31.7	27.8	13.8	17.3	11.8	15.4	11.9	11.4	10.8	6.8

VALUE OF CROP

	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.	dolls.
North Carolina	86	108	152	153	146	139	147	42	82	76	55	47	40	44	
South Carolina	167	232	182	182	158	210	136	54	94	46	31	26	31	16	
Georgia	1,024	2,449	1,486	2,072	1,116	1,200	938	300	225	102	130	60	56	41	
Florida	444	369	351	405	248	261	263	153	68	58	80	42	42	35	
Alabama	640	789	363	824	402	682	403	150	148	56	94	45	48	38	
Mississippi	935	989	637	975	354	662	420	620	513	310	455	187	390	175	
Arkansas	14	32	21	30	24	24	26	275	436	210	232	113	170	158	
Louisiana	266	246	133	221	116	288	154	799	735	304	501	319	816	378	
Oklahoma	26	36	14	14	27	21	22	194	1,660	1,592	1,020	1,513	1,177	569	
Texas	44	252	66	280	176	84	163	2,018	4,517	1,506	3,358	2,140	1,342	1,645	
Illinois	2	5	2	2	4	2	5	107	238	79	47	115	71	141	
Missouri															
United States	4,448	5,536	3,300	5,233	2,795	3,560	2,767	6,721	9,060	3,918	5,907	4,622	4,211	3,293	

DISTRIBUTION OF THE 1928 IMPROVED CROP

Reports from shippers on the primary distribution of about 6,000,000 pounds of unshelled pecans of the 1928 crop from Georgia, Mississippi, Alabama, Florida, Louisiana, North Carolina, and South Carolina indicate that approximately 27 per cent of the shipments went to the North Atlantic States including New England, New York, New Jersey, and Pennsylvania. Primary distribution is shown in Table 54. The primary distribution shows in a general way where the improved pecan crop is consumed (fig. 4), but it must be kept in mind that large quantities are redistributed from such important centers as Cincinnati, Chicago, and New York.

The reports indicate that more than half of the shipments of improved varieties are consumed in the North Central States from Ohio to Kansas, Nebraska, and the Dakotas, but consumption of improved varieties grown east of the Mississippi River is small in Kansas, Nebraska, Minnesota, and in States farther west. That southern pecans are reaching consumers on the Pacific coast to an appreciable extent is shown by the fact that California received 68,000 pounds which is 1.1 per cent of the quantity on which primary destinations were reported. Shipments were reported to 39 States in addition to the District of Columbia and the New England group.

TABLE 54.—Primary destination of unshelled pecans, by State and division, crop of 1928<sup>1</sup>

Destination	Quantity	Percentage of total reported	Destination	Quantity	Percentage of total reported
<b>North Atlantic States:</b>	<i>Pounds</i>	<i>Per cent</i>	<b>South Central States:</b>	<i>Pounds</i>	<i>Per cent</i>
New England.....	202,299	3.3	Kentucky.....	62,345	1.0
New York.....	1,053,855	18.0	Tennessee.....	92,615	1.5
New Jersey.....	24,785	.4	Alabama.....	41,360	.7
Pennsylvania.....	300,792	4.9	Mississippi.....	500	.....
<b>Total.....</b>	<b>1,623,692</b>	<b>26.6</b>	Arkansas.....	3,000	.....
<b>North Central States:</b>			Louisiana.....	4,950	.1
Ohio.....	1,531,855	25.1	Oklahoma.....	42,494	.7
Indiana.....	211,019	3.5	Texas.....	100,202	1.7
Illinois.....	800,087	13.2	<b>Total.....</b>	<b>347,606</b>	<b>5.7</b>
Michigan.....	244,190	4.0	<b>Far Western States:</b>		
Wisconsin.....	76,493	1.3	Montana.....	1,850	.....
Minnesota.....	51,405	.9	Wyoming.....	50	.....
Iowa.....	23,857	.4	Colorado.....	10,672	.2
Missouri.....	384,599	6.3	Arizona.....	4,325	.1
North Dakota.....	3,300	.1	Utah.....	5,600	.1
South Dakota.....	1,050	.....	Washington.....	14,775	.2
Nebraska.....	81,140	1.3	Oregon.....	12,200	.2
Kansas.....	8,520	.1	California.....	68,371	1.1
<b>Total.....</b>	<b>3,424,415</b>	<b>56.2</b>	<b>Total.....</b>	<b>117,843</b>	<b>1.9</b>
<b>South Atlantic States:</b>			<b>Foreign countries:</b>		
Delaware.....	400	.....	Cuba.....	3,750	.1
Maryland and District of Columbia.....	210,075	3.4	Canada.....	12,680	.2
Virginia.....	31,774	.5	England.....	500	.....
West Virginia.....	16,577	.3	<b>Total.....</b>	<b>16,930</b>	<b>.3</b>
North Carolina.....	20,845	.5	<b>Grand total.....</b>	<b>6,096,010</b>	<b>100.0</b>
South Carolina.....	8,200	.1			
Georgia.....	180,124	3.0			
Florida.....	91,126	1.5			
<b>Total.....</b>	<b>565,224</b>	<b>9.3</b>			

Compiled from shippers' reports on 6,096,010 pounds.

<sup>1</sup>Pecans from the area producing principally improved varieties. Many shipments to points such as Cincinnati, New York, and Chicago were probably redistributed to cities and towns in near-by States.

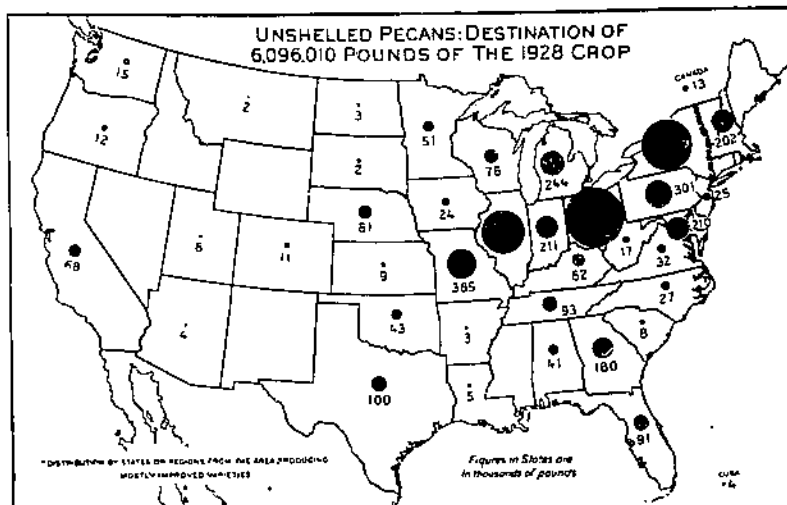


FIGURE 4.—The principal consuming territory for pecans marketed unshelled is in the North Central and North Atlantic States according to reports showing primary destinations of shipments from the southeastern pecan-producing area. (Table 54)

Lack of information on final destinations makes it impossible to ascertain whether distribution is fairly uniform within the various regions shown in Table 54. Information from various sources suggests that the pecan is practically unknown in many small towns and villages in the North.

#### CITY MARKET SURVEY

Representatives of the Bureau of Agricultural Economics interviewed pecan brokers, wholesalers or jobbers, and retailers in 22 cities, including Boston in the East and Omaha in the West during the period from December, 1928, to March, 1929. The purpose of this market survey was to ascertain the opinions of the wholesale and retail trade on pecan-marketing problems, to collect information on marketing methods and practices, and to receive suggestions for improvement. Two sets of questionnaire forms were used in interviewing city dealers, one for brokers and wholesalers or jobbers (using these last two terms synonymously), and one for retailers.

Information obtained from brokers, wholesalers, and jobbers included data on the quantity and grade of pecans and other nuts handled; origin and jobbing price of pecans; period of year when pecans and other nuts are usually on the market; percentage of sales made during the holiday period; channels of trade; trade preferences as to type of package; methods of transportation and grading; adjustment of disputes concerning quality of receipts; advertising; competition with other nuts; storage; comparison of demand for shelled and unshelled nuts; and direct shipments from producing districts to retailers and consumers. Opinions as to possibility of expanding the markets and of increasing pecan consumption, and suggestions for improving marketing conditions were obtained.

Similar information was obtained by interviews with retailers both in chain organizations and independents in the cities visited. Retailers were also asked questions relating to display practices, consumers' preferences, size of consumers' purchases, and retail prices.

#### ATTITUDE OF TRADE TOWARD PECANS

For the marketing territory as a whole, brokers, wholesalers, and retailers were practically unanimous in expressing optimism as to the possibility of increasing the consumption of pecans. It was the general feeling that domestic-market outlets could be developed to take care of an increasing annual production. The pecan is recognized by those who are familiar with it as a nut of high merit. Its movement into consumption has not been stimulated by advertising and organized sale policy to the extent that the movement of certain other nuts has been speeded up by these means.

The principal suggestions for improving marketing conditions for unshelled pecans according to this trade survey during the 1928-29 season included: (1) Greater organization and cooperation among pecan growers and shippers (as a result, other means of advancing the welfare of the industry could be carried out more effectively); (2) advertising to acquaint consumers and retailers with the merits of the pecan; (3) improving grading practices, particularly among small shippers, so as to prevent poorly filled and defective nuts from reaching the markets and the consumers; (4) greater control of distribution so as to reduce the quantity of consignments and miscellaneous small



shipments which tend to unsettle prices; and (5) stabilization of prices in relation to the season's supply. Most of the trade believes that if the price margin between pecans and comparable grades of Persian (English) walnuts were narrowed the demand for pecans would be greatly stimulated.

#### CHANNELS OF MARKET DISTRIBUTION

The principal market receivers of unshelled pecans are wholesale grocers, jobbers, and chain merchandising organizations. The chain stores sometimes buy through jobbers as well as direct from shippers. Large independent retailers often buy from shippers or growers with whom they have established contacts, but the smaller independent retailers buy from the wholesale grocers and jobbers. Considerable quantities have been received on consignment by city jobbers or dealers. These consignments have been mostly from growers or small shippers and sometimes have been received by commission merchants on the fruit and vegetable markets who have not had a regular trade in nuts and have been at a disadvantage in selling such shipments at the price level prevailing in transactions by dealers who handle nuts regularly. The greater part of the crop, however, has been bought on an f. o. b. shipping-point basis. In many instances purchases have been made through brokers who represent shippers in the markets. In some districts consumers who have contacts in the producing areas receive pecans direct by parcel post or in small freight or express shipments. Brokers and the wholesale trade in various cities serve a considerable area in the city's trade territory. In many small towns and villages, however, pecans are little known.

#### PREFERENCES AND OPINIONS OF THE WHOLESALE TRADE

Large-to-medium sized thin-shelled pecans are preferred by the trade. Although most unshelled pecans that reach the market are of improved varieties, considerable quantities of seedlings are marketed in the shell mostly for use in mixed nuts during the holidays. Reports from wholesalers or jobbers and brokers stating the poundage of improved varieties, and seedlings handled unshelled in the 1928 season, show that 18 per cent of the quantity reported was seedlings. Many of these seedlings came from Texas and Oklahoma. Relatively large quantities of seedlings were reported by dealers in the New England receipts.

In regard to wholesale packages for unshelled pecans it was found that of wholesalers and large retailers canvassed, 35 per cent preferred the 50-pound box, 27 per cent preferred the 25-pound box, and 38 per cent preferred other packages including the 100-pound sack. Arguments in favor of the box were that it gives better protection from damage and pilfering than the sack, and that 25 or 50 pounds is a more suitable quantity for many retailers than is a larger package.

Over 80 per cent of the wholesalers stated that they found it as profitable to handle pecans as other nuts.

There were some complaints from dealers in various markets regarding the grade and quality of some shipments. Some poorly filled pecans, and some improperly cured at the beginning of the shipping season, were reported. Many of these nuts were consignments or receipts from small shippers.

Many handlers in the markets find the large number of brands from various shippers confusing, and believe that greater standardization of grading practices would be to the advantage of the industry. On account of the large number of pecan varieties many dealers believe the practice of mixing varieties of similar characteristics into one lot in marketing is more satisfactory than to keep each variety separate. Some dealers voiced an objection to this practice, however, stating that inferior varieties may easily be included in a mixture or blend.

Disputes which occur between shipper and receiver are mostly settled by private adjustment.

Most members of the wholesale or jobbing trade, and most brokers, believed there will be some narrowing of the price differential between pecans and walnuts or almonds. It was generally felt that if the price differential of 10 or 12 cents a pound were reduced the demand for pecans would be greatly stimulated and an increasing supply could be absorbed by the markets.

#### RETAIL OUTLETS AND PRACTICES

Observations and answers to inquiries among independent and chain grocery stores in various cities throughout the northern marketing region indicate that, as a general estimate, about one-half of the stores carried unshelled pecans during the 1928 holiday season or for a longer period. Large quantities are handled by chain drug stores and nut specialty stores, and some are handled by department stores. Bulk window display has been used by some stores as an effective means of speeding up pecan sales. Of the managers of chain and independent retail stores interviewed, who carried unshelled pecans, over half reported carrying them for less than three months in the fall and winter. Others carried them four to six months and a few carried them all year. Many retailers reported carrying English walnuts (nuts of *Juglans regia* are meant throughout this discussion) all year. Personal interviews with retailers indicated that from 70 to 85 per cent of the unshelled pecans were sold during November and December. A large majority of the retailers who handled shelled pecans reported them on sale all year, with only about one-third of the annual volume of sales made in November and December.

The majority of retailers interviewed expressed an opinion that the demand for shelled pecans was increasing more rapidly than the demand for unshelled pecans. No definite conclusion, however, could be reached as to whether it would pay shippers to market a considerable part of the improved varieties as shelled stock. The cost of shelling, yield of kernels, and price obtainable would decide whether such a policy would be practical. About two-thirds of the consumers who replied to the survey questionnaire expressed a preference for buying pecans unshelled.

In the city districts which could be classed as medium-to-wealthy, pecans were much more generally used than in the poorer districts. In fact the pecan was generally referred to as a "luxury" nut.

About 50 per cent of the retailers interviewed stated that the average size of consumers' purchases of unshelled pecans is 1 pound. A considerable number of retailers reported from 1 to 5 pounds as the usual sale and some reported one-fourth to 1 pound. For shelled pecans many retailers reported sales of one-fourth pound as the usual quantity.

Seventy per cent of the retailers interviewed, including chain-store managers, stated that they bought pecans more than once during the season. A common practice with retailers is to display unshelled pecans in the original sack or box, or in a bin in bulk. Practically all retailers said that their trade preferred to buy pecans from bulk rather than in a closed package. The 50-pound and 25-pound boxes seemed to be the wholesale packages most popular with retailers. Most retailers stated that only a few consumers recognized any varieties of pecans, and none recognized brands. Size and thickness of shell are the principal factors considered by the average consumer in purchasing pecans.

Retail prices observed in various cities during the 1928-29 season generally ranged from 60 to 90 cents per pound on medium-to-large Schley pecans. A few quotations below and above these figures were noted. Prices on other standard varieties ranged generally from 40 to 60 cents, with an average close to 50 cents. Some medium-to-large seedlings were being offered at 30 to 45 cents. Shelled pecans were observed on sale at the rate of 90 cents to \$1.50 per pound.

Prices of nuts have been fairly stable during most seasons according to the majority of retailers. During the winter and spring, however, some retailers as well as wholesalers reduce prices, particularly in years when large supplies are on hand.

The majority of retailers interviewed thought the demand for pecans would be equal to or greater than the demand for English walnuts and almonds if the price of pecans per pound were the same as the price of these other nuts. Nearly all retailers stated that pecan consumption among their customers is increasing. Retailers in general thought that advertising in magazines, newspapers, or by radio and the free distribution of recipe pamphlets to customers would show practical results in stimulating demand.

#### PECAN MARKETING CONDITIONS IN CERTAIN LARGE MARKETS

Pecan marketing practices and conditions which prevailed in certain large markets during the 1928 season are here described:

##### NEW YORK, N. Y.

Practically all brokers, jobbers, and retailers in New York City agreed that there is an upward trend in pecan consumption and that there are excellent possibilities of increasing the quantity of pecans used in the city and near-by points.

The greater part of the improved pecans used in the New York district come from Georgia, although there are some receipts from other States. Some carloads of seedlings from Texas and Mexico are received for use in mixed nuts and a few carloads for shelling.

Pecans are bought by the jobbers, wholesale grocers, and large retailers either through brokers or direct from shippers. Most of the small retailers buy unshelled pecans in small quantities from local jobbers. Wholesale grocers are instrumental in distributing both unshelled and shelled nuts throughout the city's trade territory. The bulk of New York's pecan supply arrives in l.c.l. shipments, although some full carloads are received. Some pecans are shipped on consignment to fruit and vegetable commission men in New York who do not make a practice of handling nuts. This is generally conceded to be unsatisfactory, for dealers who do not have an established

nut trade frequently have to sacrifice these receipts at low prices. Such consignments thus have a tendency to unsettle prices. Some pecans are received by independent retailers direct from shippers but as compared with the quantity handled through jobbers, wholesale grocers, and chain stores, this quantity is relatively small.

Most of the grocery stores in the sections occupied by people of medium and large incomes carry unshelled pecans during the late fall months, but in the sections where the poorer population lives the pecan is not well known.

Managers of chain grocery stores in the New York district, operating 4,012 retail units, were interviewed. Of these, 1,356 retail units or about one-third were reported as carrying unshelled pecans at some time during the 1928-29 season. An average of about 60 pounds per store was reported for the chain retail units that handle pecans in the shell. The stores located in the more prosperous districts handle many more pecans per store than do those in the poorer districts.

A survey of small independent grocery, fruit, and delicatessen stores in one of New York's poorer districts disclosed the fact that the poorer classes are not familiar with pecans. In the district from Ninetieth Street to One hundred seventh Street and from First Avenue to Third Avenue, of 100 such stores which carried nuts of some kind, only 3 carried unshelled pecans; 2 others had pecans in the mixed-nut stock. Seventy-five of these 100 stores displayed English walnuts; 51 had almonds; 41, filberts; 29, chestnuts; and 16, Brazil nuts. Considering the independent grocery stores in the city as a whole probably about the same proportion of them as units of chain stores handled pecans—that is, one-third.

Pecans were found on sale in some department stores, some 5-and-10-cent stores, and some drug stores. Where conspicuously displayed as specialties in these stores an excellent demand and large turnover were reported. There are several small chains of stores in New York City that make nuts a specialty and handle no other commodity. These stores, which use volume display of nuts both shelled and unshelled, are a decided factor in bringing nuts to the attention of the public.

Most of the New York retail stores reported that they carry unshelled pecans only from October to March and that a large majority of the annual sales are made during the holiday season. Many wholesalers and retailers reported that over 75 per cent of their sales of unshelled pecans were made in November and December.

The proportion of the season's business on shelled pecans handled during these months was reported as less than 50 per cent. Stores that carry shelled pecans usually have them on sale during the whole year.

Practically all stores that sell pecans also sell other kinds of nuts such as walnuts and almonds. For unshelled nuts, the quantity of walnuts handled by retail stores was practically always reported as larger than the quantity of pecans handled. The quantity of almonds was usually larger. The retail price of pecans was usually 10 to 25 cents per pound higher than the retail price of walnuts or almonds. Most wholesalers and retailers expressed the opinion that if the price of pecans were on a level with that of walnuts or almonds, at least as large a quantity of pecans could be sold as of any of these other nuts.

There was some difference of opinion as to whether the demand was increasing more rapidly for shelled or unshelled pecans. The majority of retailers thought the demand for shelled pecans was increasing more rapidly.

As to type of package preferred for unshelled pecans, many New York dealers and retailers mentioned the 25-pound box as being desirable.

Improved varieties were observed to retail in New York in December, 1928, mostly at 39 to 59 cents a pound. Some smaller pecans were retailing as low as 29 cents a pound and in the more prosperous districts large-sized Schley nuts retailed at 75 to 95 cents a pound. Pecan kernels were handled by some retail grocery stores mostly in tin cans of about 3-ounce or 8-ounce capacity or in 5-pound cartons. Retail prices for pecans in these containers ranged approximately from 90 cents to as high as \$1.75 a pound.

There were complaints from a few New York dealers regarding the quality and grading of pecans. On the whole, however, the quality and grading were reported as fairly satisfactory.

The consensus of opinion of retailers was that consumers do not generally know varieties or brands of pecans.

Some dealers make a practice of carrying unshelled pecans over in cold storage for use early in the fall before the current season's crop is available.

Jobbers stated that sales are sometimes made by slippers direct to retailers at prices several cents below that at which the jobber could sell and claimed this practice caused them to lose interest in handling pecans.

It was generally felt that various forms of advertising would help to stimulate the demand for pecans and that some lowering in the price level of pecans as compared with other nuts would greatly increase the demand.

#### CINCINNATI, OHIO

Opinion was unanimous among those interviewed that the Cincinnati district can be further developed as a pecan market. Cincinnati is an important distributing center for a wide territory, and a rapid increase in the quantity of pecans handled was indicated by reports from merchandizing organizations.

Buying from shippers direct by retailers is an important market factor and caused many wholesalers or jobbers in Cincinnati not to stock pecans. The quantity received by consumers direct from shippers was estimated as very small. Most of the unshelled pecans were reported as coming from Georgia.

Two local chains of grocery stores handled pecans in all of their 30 stores. These stores averaged 175 pounds per store of unshelled pecans during the season to January, 1929. Twenty-seven of these stores carried one grade of pecans which they sold at 49 cents per pound. Three stores carried three varieties at three prices: Schley at 80 cents per pound, Stuart at 60 cents, and Moneymaker at 50 cents. These same 30 stores sold an average of about 365 pounds of English walnuts per store for the season to January, 1929. Only 3 of the 30 stores sold almonds; they averaged about 333 pounds each.

Three stores of this group handled shelled pecans and sold a total of 3,500 pounds for the season. Their sales of walnut kernels totaled 2,800 pounds, and of shelled almonds, 200 pounds.

In a canvass of 39 stores in the downtown district of Cincinnati in January, 1929, including stores of 3 national chains and 2 local chains, 17 carried pecans in some form; unshelled pecans were found in 16 stores, and shelled pecans in 11 stores. These stores all catered to customers of moderate means.

A member of one chain of 5-and-10-cent stores carried pecans both shelled and unshelled. This store sold 600 pounds of unshelled pecans during November and December, 1928, at a price of 49 cents per pound, and 150 pounds of shelled pecans at a retail price of \$1.30 per pound. It stocks shelled pecans from October to April, selling one-half of the total volume during November and December. No department stores in Cincinnati reported selling pecans, either shelled or unshelled. One chain of drug stores handles unshelled pecans, using them as a specialty and featuring window displays in volume. The manager stated that he planned to handle more in the future. Various soda fountains and news stands carried salted pecan halves in small packages which sold at 10 cents each.

The chain stores as a whole are probably representative of all the stores in Cincinnati, but the ones consulted were probably above the average in quantity handled when all stores are considered. Most of the stores consulted were those catering to people of moderate to liberal means.

Retail grocery stores had pecans on sale over varying periods, ranging from two months to all year. Drug stores handled them only during the holiday season. The 5-and-10-cent store interviewed reported all its sales as occurring during November and December.

Shelled pecans were carried all year by most of the stores handling them. The soda fountains reported a light all-year business; the 5-and-10-cent stores reported sales from October to April.

Retailers are divided in opinion as to the most suitable size of package for pecans, although the majority favor the 50-pound box. Two stated that 100-pound sacks are satisfactory. A local chain-store manager said that a 10-pound package would be most suitable for his needs if a package smaller than 100 pounds were used, otherwise he would prefer a 100-pound sack or a 180-pound barrel. For shelled pecans, all preferred a bulk package, several specifying a 50-pound package containing ten 5-pound cartons.

It appears that the customer prefers to buy from bulk, both shelled and unshelled stock. One man reported success with a 1-pound cloth bag of unshelled pecans but stated that he found it necessary to keep one or two open to allow examination by customers.

There was no agreement as to whether the demand is increasing more rapidly for shelled than for unshelled pecans. The manager of the drug-store chain, (who handled only unshelled stock) reported his belief that the demand for unshelled pecans was increasing more rapidly. The official of the 5-and-10-cent store, who handled both, stated that shelled pecans were being favored. One local chain-grocery manager who handles a large volume thought the demand for shelled stock was increasing more rapidly. The buyer for a large chain with stores outside Cincinnati as well as in the city said the demand for unshelled pecans was leading by a narrow margin.

There were a number of complaints regarding poorly filled nuts, and one complaint of rancid pecans in the shell.

That chain stores carry pecans and that local drug stores make displays with prices posted doubtless have had their effect in stabilizing

retail prices of unshelled pecans. Shelled pecans showed a rather wide range in price for the same quality, selling from 90 cents to as high as \$1.50 a pound.

All local store managers stated that advertising would help increase consumption; one suggested that advertising in local newspapers and offering recipe books to customers would help. On the whole, the storekeepers appeared doubtful of the value of recipe pamphlets.

#### CHICAGO, ILL.

Chicago is one of the most important pecan markets. Brokers estimated that about 1,000,000 pounds of improved varieties of unshelled pecans came into the Chicago district during the 1928-29 season. It was estimated that more than 200,000 pounds, including some seedling stock, came into the South Water fruit and vegetable market on consignment. Those well acquainted with the industry expressed the belief that there is abundant opportunity for developing and increasing pecan consumption in the Chicago district.

Much of the pecan distribution in Chicago is handled through brokers, although some large users buy direct from shippers. Parcel-post and small freight or express shipments to retailers and consumers form a considerable item.

The majority of the retail stores in Chicago handled some unshelled pecans in the 1928-29 season, but stores in the poorer sections were visited which did not handle them at any time during the year. Most of the retail stores handled shelled pecans. Intelligent opinion was that many stores in the small towns in the Chicago district do not carry unshelled pecans even during the holidays.

A large chain-grocery organization with stores in and around Chicago reported an average sale of about 50 pounds of improved varieties of unshelled pecans per store during the 1928 season and about 65 to 75 pounds of kernels per store. The unshelled nuts were on sale only from the middle of November until after the holidays. The buyer for this concern thought it best to emphasize nuts during this period and not carry them through a long season. He believed, however, that a limited quantity might be carried over in cold storage to advantage and put on the market earlier than usual in the fall. Most stores of this chain handled some pecans both in the shell and shelled. The shelled pecans were sold during the entire year.

Walnuts are sold in much larger quantities than are pecans, and more almonds are sold than pecans. If prices of pecans were more nearly on a parity with prices of these nuts, most handlers think the demand would at least equal the demand for these other nuts.

Some retail prices observed in March, 1929, in Chicago, were 40 to 45 cents per pound for improved varieties other than Schley and 59 cents per pound for Schley. Earlier in the season prices were somewhat higher. Fancy pecan halves from improved varieties were retailing in March from \$1 to \$1.98 per pound. Seedling halves could be bought at retail for 85 cents to \$1.10 per pound.

There was a considerable quantity of spotted and poorly filled stock on the Chicago market from the 1928 crop. Dealers said that it would benefit the industry to have pecan grades defined by the Department of Agriculture and used by the trade. The large quantity

of pecans coming into the market on consignment and often sold at reduced prices was pointed out as a weakness in the pecan-marketing situation.

Large quantities of seedling pecans are shelled in Chicago

ST. LOUIS, MO.

St. Louis is recognized as one of the greatest pecan centers in the world. Several of the largest shellers in the industry are located there. The pecan is by far the most popular and best known nut in this trade district, and practically all dealers and retailers believe that the quantity used will continue to increase. Considerable quantities of unshelled seedlings and of improved varieties are retailed, but the improved varieties are gradually replacing the seedlings. Probably more shelled pecans are sold at retail in St. Louis than pecans in the shell. Commission merchants receive a considerable quantity of unshelled pecans.

Many of the improved pecans come into St. Louis in l. c. l. freight lots, although some car lots are received. It was generally thought that the parcel post and small express business in this district was not large enough to figure much in the marketing situation.

Practically every retail grocery store in St. Louis carries unshelled pecans during the holiday season and many carry them during the winter months. Few Schley pecans are used. It was stated that the small towns in the St. Louis neighborhood still use seedlings chiefly. Most stores carry shelled pecans the year round. They are usually put up in 5-pound cartons and sold loose. Chain and independent store managers representing 1,200 to 1,300 units in and around St. Louis stated that practically all stores handle pecans. Reports from certain groups of chain stores indicated average sales for the season of about 30 pounds of unshelled pecans per store and about 60 pounds of shelled pecans. Perhaps 80 per cent of the pecans in the shell and 50 to 60 per cent of the shelled pecans retailed in this district were sold during the fall. One important nut retail store in St. Louis sold 15,000 to 20,000 pounds of improved varieties of pecans during the 1928 season. This illustrates what can be accomplished by specializing, and by bulk display. The manager of this store stated that it does not pay to operate the year round as the natural season for nuts is limited to the fall and winter months. Some of the drug stores and department stores handle pecans.

Retail prices in St. Louis for Stuart and other improved varieties, (except Schley) ranged mostly from 39 to 49 cents per pound for the 1928 crop. Seedling halves retailed mostly at 69 to 75 cents in the spring of 1929. In March, 1929, retail prices observed in a nut specialty shop were as follows: Pecans in the shell (large Schley), 75 cents per pound; English walnuts, 40 cents; almonds, 30 cents; Brazil nuts, 35 cents; filberts, 30 cents. For shelled nuts the prices were: Pecans (seedling halves), 75 cents per pound; pieces, 70 cents; large salted and roasted pecan halves, \$1.25; English walnuts, 95 cents; almonds, 75 cents; almonds (salted), \$1.25; Brazil nuts, 95 cents; black walnuts, 95 cents.

Some dealers expressed dissatisfaction with the grading of pecans. They stated that many poorly filled nuts of certain varieties are received. Miscellaneous consignments and sales by small shippers and growers were mentioned as factors that often weaken the marketing situation.



## CHAIN-STORE AND CONSUMER SURVEY BY MAILED QUESTIONNAIRES

To ascertain conditions existing in the retail trade and the retailers' opinions regarding marketing pecans and other nuts, and as a check against information obtained by interviews with retailers, questionnaires were mailed to local chain-grocery stores or branches of national chains in cities in all sections of the country. Replies covering all or part of the questions were received from 73 organizations representing 9,325 stores.

To ascertain the consumers' preferences, the uses made of pecans and other nuts, prices paid, and other pertinent information, questionnaires were mailed out to 6,000 persons whose names were obtained from directories in about 60 cities of various sizes throughout the United States. Only about 350 replies were received from this inquiry, but the answers to most of the questions were in close agreement, so it is believed the results give a fair picture of certain phases of pecan marketing from the consumers' point of view. It is probable that many of those who failed to answer the consumers' questionnaire were those who were not very familiar with pecans or other nuts. Those who replied probably used more than the average quantity.

Information regarding retail prices, period during which nuts are on sale, and other phases of marketing was also obtained through these mail inquiries from the chain stores and the consumers. The replies to chain-store and consumer questionnaires will be discussed separately. The replies to some questions were tabulated by geographical sections to indicate differences that may exist in different sections of the country.

## RESULTS OF CHAIN-STORE SURVEY BY MAIL

In answer to the question as to whether there was any pronounced upward trend in pecan consumption among their customers, 45 chain-store organizations replied that there was, and 17 that there was not. Fifty-one chain-store organizations stated that pecan consumption per capita was decidedly higher in the wealthy districts of their cities than in the poorer districts. Seven stated that it was not.

As to the method used in purchasing pecans, 34 chain-store organizations reported that they usually bought in l. c. l. lots f. o. b. shipping points; 19 reported that they bought in l. c. l. lots on a delivered basis; whereas 9 reported car-lot purchases either f. o. b. or delivered.

Of those answering the question as to size and type of package preferred, 9 favored the 100-pound bag; 12, the 50-pound box; and 6, the 25-pound box.

Preference for large-sized pecans was expressed by 29 chain organizations compared with 18 that prefer medium-sized pecans. Preference for cartons as a container for pecan kernels was expressed by 12 organizations, compared with 14 preferring tins, and 4 preferring glass jars.

Thirty-nine chain organizations believed the demand was increasing more rapidly for shelled than for unshelled pecans; 16 believed it was not.

Reporting the composition of mixed nuts they handled, 23 out of 32 chain-store firms stated that pecans were included.

In response to requests for comments on marketing pecans and other nuts with suggestions for improvement, 7 replies from chain stores suggested advertising as a method of increasing sales; 10 suggested improvement in grading practices; 2 suggested lengthening the selling season; and 3 expressed the opinion that the price level has been too high.

An average of the poundage handled per store of various nuts in the shell, reported by chain stores during the 1928 season, was obtained. These averages were computed by dividing the poundage reported for each kind of nut by the number of stores handling that particular kind. The averages were as follows: Improved varieties of pecans, 50 pounds; almonds, 118 pounds; English walnuts, 322 pounds; filberts, 67 pounds; Brazil nuts, 140 pounds; mixed nuts, 149 pounds. (Table 55.) There was considerable variation in the quantity reported per store in various geographical areas. For example, in the South Atlantic States the average per store was 87 pounds of improved pecans, whereas in the far Western States the average reported was 28 pounds. If all chain stores, including those which did not handle these nuts, were included, the average poundage of each kind of nut per store would be considerably less than here indicated. A few stores reported sales of more than 1,500 pounds of improved pecans per store.

TABLE 55.—Average quantity of specified kinds of unshelled nuts reported sold by each chain store during the season, 1928

Region from which reports were received	Pecans (Improved varieties)	Almonds	English walnuts	Filberts	Brazil nuts	Mixed nuts
	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
North Atlantic.....	51	63	354	56	102	126
North Central.....	48	92	280	71	105	162
South Atlantic.....	87	131	315	69	127	166
South Central.....	36	164	192	63	114	213
Far Western.....	28	141	467	87	250	77
Average.....	50	118	322	67	140	149

<sup>1</sup>The States from which replies were received as grouped in this and other tables relating to chain-store and consumers' questionnaires are as follows: North Atlantic—Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania; North Central—Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, North Dakota, South Dakota, Iowa, Nebraska, Missouri, Kansas; South Atlantic—Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida; South Central—Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, Texas; far Western—Montana, Wyoming, Idaho, Colorado, Utah, Nevada, New Mexico, Arizona, Washington, Oregon, California.

The period during which nuts are offered for sale during the season is an important factor in marketing. Reports from chain stores indicated that 83 per cent of the season's sales of improved pecans and 86 per cent of the unshelled seedlings were sold during October, November, and December, whereas only 56 per cent of the shelled stock was sold during these months. (Table 56.) For certain other unshelled nuts the percentages sold during these months were reported as follows: Almonds, 89 per cent; English walnuts, 80 per cent; filberts, 92 per cent; Brazil nuts, 90 per cent; mixed nuts, 96 per cent. For shelled almonds the percentage reported as sold during these months was 64, and for English walnuts 57.

TABLE 56.—Average quantity of specified nuts reported sold by chain stores during October, November, and December, 1928, as a percentage of the season's sales

Classification of nuts	Pecans	Pecans	Almonds	English walnuts	Filberts	Brazil nuts	Mixed nuts
	(improved)	(seedling)					
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Unshelled.....	83	86	89	80	102	90	96
Shelled.....		36	64	57			

It is evident that most of the sales of unshelled nuts are made during the late fall. For pecans the greater part of the year's sales are made during the six weeks from the middle of November to the end of the year. Sales of shelled nuts are distributed to a larger extent over the whole year. This fact would lend some weight to the argument that more of the improved varieties should be marketed as shelled nuts.

Retail prices during the 1928 season for pecans and certain other nuts in the shell as reported by chain stores were tabulated by geographic regions, and averages of these regional prices were also obtained. Variations in prices among the different regions were not large, as shown in Table 57. The figures indicate that improved pecans sold about 20 cents per pound higher than walnuts and almonds in chain stores. Seedlings sold considerably below these other nuts.

TABLE 57.—Average retail price per pound, of specified unshelled nuts, as reported by chain stores, 1928 season

Region from which reports were received	Pecans		Almonds	English walnuts	Filberts	Brazil nuts	Mixed nuts
	Improved varieties	Seedlings					
	Cents	Cents					
North Atlantic.....	51	26	34	35	24	28	29
North Central.....	51	22	29	31	24	27	26
South Atlantic.....	48	25	34	35	25	27	23
South Central.....	53	21	28	32	22	27	25
Far Western.....	52	28	30	30	24	27	30
Average.....	52	24	31	33	24	27	28

## RESULTS OF CONSUMER SURVEY BY MAIL

To ascertain the trend in the use of pecans, consumers were asked if their families used more pecans during the 1928 season than four or five years previous: 206 replied "yes," and 128 "no." (Table 58.) In all sections of the country except the far West an increased consumption was indicated. In the far West those answering in the affirmative and the negative to this question were about equally divided.

TABLE 58.—Consumers' replies as to whether their families used more pecans in the 1928-29 season than four or five years previous

Region from which replies were received	Number answering—	
	Yes	No
North Atlantic.....	53	31
North Central.....	60	41
South Atlantic.....	37	33
South Central.....	34	17
Far Western.....	22	23
All regions.....	200	128

Consumers were asked whether they preferred to buy nuts in the shell or shelled. The majority preferred to buy them in the shell. (Table 59.) Preference for unshelled nuts was indicated in each region. The principal reasons mentioned by consumers who preferred to buy nuts in the shell were: They are fresher and have better flavor; they are more sanitary; they will keep better; they are more desirable for table use. The chief reasons advanced by those who favored buying shelled nuts were: It is more convenient and saves the trouble of cracking and extracting the kernels; the purchaser can see the kernels and is better able to judge the quality; more perfect kernels can be obtained, as many kernels break when the nuts are cracked at home; waste due to defective nuts and parts of kernels remaining in the shell is eliminated when shelled nuts are purchased. "It is more economical" was given as a reason by both those who preferred nuts in the shell and those who preferred shelled nuts.

TABLE 59.—Consumers' reported preference for shelled or unshelled nuts

Region from which replies were received	Number expressing preference for nuts—	
	Unshelled	Shelled
North Atlantic.....	55	25
North Central.....	57	49
South Atlantic.....	41	19
South Central.....	35	12
Far Western.....	29	16
All regions.....	220	103

Consumers were asked to name, in order of importance, the ways in which they used pecans and almonds. This question was not asked separately for nuts in the shell and shelled. One hundred and seventeen stated that "out of hand" was of first importance; 60 mentioned use in desserts; 59, baking purposes; and 59, use in salads. (Table 60.) "Use in salads" received the highest number of votes for both second and third choice. An important home use of nuts is in candy making, which some probably classed with "baking purposes" in replying to this questionnaire.

TABLE 60.—Uses of pecans and almonds as reported by consumers in order of importance

Order of importance	Number reporting uses of pecans and almonds <sup>1</sup>							
	Pecans				Almonds			
	Desserts	Baking purposes	Salads	Out of hand	Desserts	Baking purposes	Salads	Out of hand
First.....	60	59	59	117	29	45	29	116
Second.....	51	67	81	49	32	49	47	27
Third.....	39	23	38	38	29	13	21	16

<sup>1</sup> A considerable number mentioned that they used nuts in making candy. Some probably included this use under "baking purposes."

To learn something about the time of year consumers buy nuts, the question was asked as to whether they purchased nuts at any time except during October, November, and December. This question was asked separately for nuts in the shell and shelled. As an average for all regions 39 per cent stated that they buy unshelled nuts only during these three months; 29 per cent stated that they buy shelled nuts only during these months. (Table 61.) A large part of the nuts pass into consumption during these months as shown by reports from the wholesale and retail trade, but these consumer replies indicate that there is a considerable demand for nuts in other months. It is probable that this "off season" demand could be developed further. It should be kept in mind that the consumers replying to this questionnaire are larger users of nuts and probably use them over a longer season than does the average family.

TABLE 61.—Percentage of consumers stating that they buy nuts only during October, November, and December<sup>1</sup>

Region from which replies were received	Unshelled	Shelled
	Per cent	Per cent
North Atlantic.....	31	25
North Central.....	42	27
South Atlantic.....	31	39
South Central.....	57	41
Far Western.....	37	18
All regions.....	39	29

<sup>1</sup> The total number of replies was 327.

To gain some idea of consumers' preferences for various nuts they were asked to state their choice, assuming pecans, almonds, English walnuts, filberts, and Brazil nuts sold at the same price. These replies indicate that the pecan is highly favored among nut consumers. (Table 62.) In comparing effective demand, the higher prices which pecans have commanded must be considered. The pecan leads in popularity by a wide margin in the regions in which it is well known as the South Atlantic and South Central regions.

TABLE 62.—Consumers reporting first choice of specified nuts, assuming the price of all kinds to be the same

Region from which replies were received	Number reporting as first choice				
	Pecans	Almonds	English walnuts	Filberts	Brazil nuts
	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>	<i>Number</i>
North Atlantic.....	50	7	26	1	3
North Central.....	63	9	13	1	10
South Atlantic and South Central.....	76	9	11	0	3
Far Western.....	29	7	17	1	2
All regions.....	218	32	75	3	18

Consumers were asked to report the average prices paid during the 1928 season for pecans, almonds, and English walnuts, both in the shell and shelled. In the case of pecans, some purchases of seedling as well as of improved varieties were probably included in the purchases on which prices were reported. According to these reports, consumers of unshelled nuts paid about 12 cents per pound more for pecans than for English walnuts in the 1928 season. In the South Central region a comparatively low price of 34 cents per pound was reported for pecans. In this region relatively large quantities of seedlings are used which would lower the average price for the region. On the whole, however, the price variations among different regions can not be considered as large. (Table 63.)

TABLE 63.—Average purchase price per pound reported by consumers during 1928 crop season

Region from which replies were received	Pecans		Almonds		English walnuts	
	Unshelled	Shelled	Unshelled	Shelled	Unshelled	Shelled
	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>	<i>Cents</i>
North Atlantic.....	50	112	47	102	30	82
North Central.....	43	96	33	83	37	80
South Atlantic.....	48	96	39	108	37	85
South Central.....	34	83	31	91	33	82
Far Western.....	51	112	36	95	34	71
Average.....	47	101	35	95	35	80

These prices are in fairly close agreement with the retail prices reported by chain stores (Table 57), which have been discussed. The chain-store report showed prices of 52 cents for unshelled improved pecans and 24 cents for seedlings as compared with the consumers' report of 47 cents for all purchases including both improved varieties and seedlings. The chain-store averages were 33 cents and 31 cents for English walnuts and almonds, respectively, compared with 35 cents and 36 cents reported by consumers. This may indicate that the average of nut retail prices for all stores is slightly higher than the average reported by chain stores.

The average price of shelled pecans was reported by consumers as \$1.01 compared with 80 cents reported for English walnuts and 95 cents for almonds. On account of the various containers in which nut kernels are retailed and the difficulty of converting prices paid

to a per-pound basis, it is likely that less dependence can be placed on the prices reported for shelled nuts than on those reported for nuts in the shell.

As a means of learning whether pecans and almonds were generally available to consumers they were asked whether the grocery store that they generally patronized carried these various nuts at any time during the 1928 season. (Table 64.) The replies indicated that in the cities circularized pecans and almonds both in the shell and shelled were available to a majority of city consumers. The figures do not necessarily mean that a large majority of grocery stores carried pecans; only one store out of several in a community may have carried them. The replies may not be representative of the poorer districts.

TABLE 64.—Number of consumers who stated whether the grocery stores they generally patronized sold pecans or almonds during the 1928 crop season, and whether their purchases of mixed nuts included pecans in the mixture

Region from which replies were received.	Number reporting that their grocery stores, during the 1928 crop season, did or did not sell—								Number stating whether mixed nuts they purchased contained pecans	
	Pecans				Almonds					
	Unshelled		Shelled		Unshelled		Shelled		Yes	No
	Yes	No	Yes	No	Yes	No	Yes	No		
North Atlantic.....	53	17	47	18	59	5	44	16	49	15
North Central....	85	5	77	10	77	3	63	13	53	18
South Atlantic....	47	1	37	1	41	0	31	1	27	10
South Central....	43	2	38	3	33	4	22	9	31	7
Far Western.....	34	7	27	10	49	1	29	6	24	11
All regions.....	202	32	226	43	258	13	192	45	199	61

Pecans, particularly seedlings, are widely used in mixed nuts. About three-fourths of the consumers who reported buying mixed nuts stated that pecans were included in the mixture, and the other one-fourth stated that pecans were not included. (Table 64.)

To determine how familiar consumers are with pecans they were asked the following questions: Do you know where pecans are grown? Do you know by name any of the larger thin-shelled varieties of pecans? Two hundred and forty-one persons stated that they knew where pecans are grown compared with 88 who did not. Since these replies were from persons who were sufficiently interested in the use of nuts to fill in a questionnaire it is evident that if the entire population were considered a much smaller percentage would be shown to know where pecans are grown. Two hundred and forty-three persons stated that they did not know the names of any of the larger thin-shelled varieties of pecans as compared with 70 who stated that they did.

Three hundred and four persons answered that they would like to receive recipe pamphlets for pecans, almonds, or other nuts if issued free by shippers or growers. Twenty replied that they would not be interested in such pamphlets.

The question was asked: Do you personally find that nuts are a healthful food? Of those replying, 97 per cent answered in the affirmative.

Consumers were asked to state any complaints they might have as to the quality of pecans or almonds, or any comments regarding their use or marketing. Only about one-third of those filling in the questionnaire made complaints or comments in answer to this inquiry. Those relating to pecans included the following: "Too expensive"; "some offered for sale especially in mixed nuts are too small and hard shelled"; "pecans are sometimes dry and of inferior quality"; "old dry nuts are sometimes mixed with new-crop nuts"; "it is difficult to extract kernels of some varieties without loss"; "some pecans are not well filled or carefully graded"; "high-quality pecans are not easy to find"; "display cases in some stores are not dust proof."

#### THE SHELLING INDUSTRY

A relatively few large shellers handle most of the crop. Important shelling centers are St. Louis, San Antonio, Chicago, and New Orleans. Smaller quantities are shelled at various points throughout this area and the Southeast.

The pecans are cracked mechanically, and the kernels are picked out by hand in the shelling plants. The kernels are often classified according to the approximate number of halves per pound, generally ranging from 750 for the small size to 400 for the large, with some very large ones as low as 220 halves per pound. The pieces of kernels are usually sold separately from the halves. Containers in which many kernels are sold include barrels, 50-pound boxes, 5-pound cartons, 8-ounce cans, 3 to 4-ounce cans. The small cans are vacuum packed. Some glass jars are used.

The poundage of unshelled nuts handled in the 1928 season by shellers replying to an inquiry by the Bureau of Agricultural Economics totaled about 4,000,000 pounds which probably represents less than 10 per cent of the total quantity shelled. The replies received indicate that less than 0.5 per cent of the pecans shelled by these firms were improved varieties. A few nuts were cracked but not shelled and were sold to the retail trade in this way. This quantity was less than 1 per cent of the total. According to the reports the kernels obtained in shelling averaged 38.8 per cent of the unshelled poundage. Of the shelled stock 66.4 per cent was halves, and 33.6 per cent pieces. Average wholesale prices reported by shellers for various sizes of kernel halves for the 1928 season were as follows: 750's, 52.5 cents; 600's, 56.4 cents; 500's, 57.8 cents; 400's, 59.3 cents; pieces, 51.7 cents.

Large quantities of pecan kernels are sold to confectioners. They are also used by the baking trade, ice-cream trade, and salters. Wholesale grocers and chain stores take large quantities for distribution through the retail stores.

#### COMPETITION OF PECANS WITH OTHER NUTS

Some of the nuts that compete with pecans on the markets are English walnuts, almonds, Brazil nuts, filberts, peanuts, chestnuts, and black walnuts. A number of other nuts (mostly imported) are of considerable importance.

For the 6-year period 1924-1929, the United States annual production of English walnuts averaged about 64,000,000 pounds, compared with about 21,000,000 pounds of almonds, and about 56,000,000 pounds of pecans including both improved varieties and



seedlings. During this period peanut production in the United States (including only nuts which were gathered) averaged about 792,000,000 pounds. Considerable quantities of these peanuts do not reach nut consumers.

Average annual imports of certain nuts for the 6-season period ended June 30, 1930, in round numbers were as follows: Brazil nuts, 30,000,000 pounds;<sup>a</sup> chestnuts, 21,000,000 pounds; English walnuts, unshelled, 19,000,000 pounds; shelled, 20,000,000 pounds; almonds, unshelled, 3,000,000 pounds; shelled, 18,000,000 pounds; filberts, unshelled, 10,000,000 pounds; shelled, 5,000,000 pounds. The imports of pecans, which originate in Mexico, averaged less than 1,000,000 pounds. Most of these were unshelled and were of the small native seedling type. During this period the pecan imports ranged between 2,900,000 pounds for the year ended June 30, 1925, and 124,000 pounds for the year ended June 30, 1930.

Pecans now form a relatively small portion of the total quantity of nuts consumed in the United States. The approximate supply of certain nuts per capita population of the United States is shown in Table 65. In preparing this table production and foreign trade have been considered, but carry-over has been ignored. Shelled nuts have been converted to the unshelled basis. For the five years ended June 30, 1929, the total supply of peanuts including some used for purposes other than human food has averaged about 7 pounds per capita for this period. For the last 5-year period ended in 1929 the per capita supply of almonds, Brazil nuts, filberts, and foreign chestnuts has shown some decrease from the previous 5-year period. The per capita supply of English walnuts has increased slightly.

TABLE 65.—Annual per capita supply of specified nuts (unshelled basis) in the United States, 1899-1900 to 1929-30

Period	Pecans	Almonds	English walnuts	Brazil nuts	Filberts	Chestnuts	Total
Average:	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds	Pounds
1899-1900 to 1903-04.....	(*)	0.30	0.41	0.15	0.10	.....	.....
1909-10 to 1913-14.....	(*)	.52	.71	.29	.14	0.13	.....
1919-20 to 1923-24.....	0.37	.87	1.00	.33	.25	.19	3.01
1924-25 to 1928-29.....	.49	.73	1.08	.26	.20	.19	2.95
1919-20.....	.55	1.02	1.17	.23	.33	.12	3.52
1920-21.....	.11	.52	.73	.44	.15	.21	2.13
1921-22.....	.43	.96	1.11	.35	.24	.20	3.20
1922-23.....	.13	.85	1.03	.35	.25	.18	2.82
1923-24.....	.51	.90	.99	.39	.26	.24	3.29
1924-25.....	.35	.79	1.14	.28	.18	.25	2.97
1925-26.....	.44	.69	1.20	.25	.22	.20	3.06
1926-27.....	.80	.72	.89	.36	.18	.22	3.17
1927-28.....	.29	.71	1.26	.11	.22	.09	2.68
1928-29.....	.55	.74	.91	.31	.20	.17	2.89
1929-30.....	.40	.62	1.04	.21	.13	.14	2.54

Division of Statistical and Historical Research.

NOTE.—In preparing this table, production, imports, and exports were considered but carry-over was not considered. Imports of shelled nuts were converted to the unshelled basis using the following factors: English walnuts, 42 per cent; almonds, 30 per cent; filberts, 45 per cent. The year extends from July 1 to June 30. Domestic production of chestnuts is not included as figures are not available. The total supply of peanuts, including imports, has averaged 6.97 pounds per capita during the 5-year period 1924-25 to 1928-29. This does not mean that 6.97 pounds per capita were used for human food as some peanuts were used for other purposes. For detailed statistics on exports and imports of various nuts, those interested are referred to the following: GRIES, C. G. FOREIGN TRADE OF THE UNITED STATES, ANNUAL, 1900-1929. NUTS; DOMESTIC EXPORTS, IMPORTS, REEXPORTS AND NET BALANCE, QUANTITY AND VALUE. U. S. Dept. Agr., Bur. Agr. Econ. Rpt. F. S. 51, 35 p., illus. 1930. [Micrographed.]

<sup>a</sup> Not available.

<sup>b</sup> During the year 1928-29, more than 1,000,000 pounds and in 1929-30 more than 4,000,000 pounds of shelled Brazil nuts were imported and are included in obtaining the average shown.

Various factors may influence the situation with respect to competition among pecans and other nuts but the future position of the pecan in the American markets appears to be good.

### SUMMARY

Pecan trees are native to the South Central States. They are found growing abundantly in the alluvial flood plains and delta lands of the lower Mississippi and its tributaries and along the courses of all of the west Gulf rivers. Wild trees are found as far north as the lower Ohio and Missouri Rivers, westward to the margin of the highlands of western Oklahoma and Texas, and southward far into Mexico. Plantings of improved varieties of pecans have been made on a large scale throughout the east Gulf and South Atlantic coastal plains, a large portion of these being in commercial orchards containing thousands of trees each. Trees of improved varieties are now being planted extensively in the native pecan belt where many of the wild seedling trees are being top-worked with scions from improved varieties.

Total production of pecans from 1919 to 1931 has ranged from 10,000,000 to 94,000,000 pounds. Production of improved varieties, coming mostly from planted trees in the Southeastern States, has ranged from 2,000,000 to 20,000,000 pounds. Nuts from seedling and wild trees come mostly from the States west of the Mississippi, and production has ranged from 8,000,000 to 77,000,000 pounds. The eastern pecan States have produced 85 per cent or more of the improved varieties each year since 1919. Georgia frequently supplies about two-fifths of the improved varieties. Texas and Oklahoma together usually produce from a half to four-fifths of the seedling nuts. Texas produces usually from a fourth to a half of the total United States crop of pecans.

The estimated total number of pecan trees in 1929 was about 18,500,000, of which more than 10,000,000 were seedling and almost 8,000,000 were improved type. Of the seedling type about three-fourths were of bearing age. For most improved varieties, trees over 10 years old are considered of bearing age. Of the improved trees about 36 per cent were 10 years old or over in 1929, 22 per cent were from 5 to 9 years old, and about 42 per cent under 5 years.

The most popular improved variety appears to be the Stuart, representing about 30 per cent of all improved pecan trees. The Schley comes next with 19 per cent. Of the total trees reported, 43 per cent were of improved varieties and 57 per cent were seedling or wild.

Production has tended to shift eastward during the last 20 years. Texas and Oklahoma had approximately 77 per cent of the bearing trees in 1910, 56 per cent in 1920, and 48 per cent in 1925. The States east of the Mississippi River had 17 per cent of the bearing trees in 1910, 36 per cent in 1920, and 45 per cent in 1925. Much activity has been shown during late years, both in the Southeast and in the native pecan sections of the Southwest, in the planting of improved varieties.

In view of this heavy planting of young trees and of the increasing bearing surface of the rapidly growing trees 10 to 20 years of age, increase in production should be rather rapid during the next few years, but the amount of the increase will depend upon the attention given the orchards and the extent to which insect pests and diseases

are controlled. Even assuming a mortality as great as 40 per cent in trees under 6 years of age, an increase of about 25 per cent in number of planted trees of bearing age seems likely by 1940. Increase in total production of improved nuts might be as much as 50 or even 100 per cent within the next decade. No material increase in seedling and wild nuts is anticipated. The increase in production of improved and seedling nuts combined during the next decade might amount to as much as 25 or 30 per cent.

Pecan-condition reports, published monthly from July to October, show in the early months no close relationship to the size of the crop, but the relation improves from month to month until in November the reported percentage of a full crop tends to give a rather good indication of the probable size of the crop. Variations in actual production tend to be greater than the condition reports would indicate. The forecasts of probable production published by the United States Department of Agriculture in the fall months, based largely upon reports of correspondents concerning expected production on their own farms, and upon interpretation of the condition reports in the light of the relation of condition to production in previous years, are the best indication of production available while the crop is still being marketed.

Methods and practices in the development of pecan orchards of improved varieties and in the care of bearing orchards have undergone many improvements during recent years. Even though these improvements are rather widely known a considerable portion of the orchards are receiving such indifferent care that the owners can not expect to realize a profit.

In the districts studied, pecan orchards in general are developed in connection with an interplanted cash or feed crop for harvest. The method of cost analysis used assumes that the growing of these intercrops for harvest reduces the cost of certain items required in developing the trees and in producing the nuts in proportion to the land acreage used by the crops grown in the orchard. The evidence would seem to prove that it is good economy to grow intercrops in the young orchard until the space occupied by these crops is needed for the well-being of the mature orchard. Interplanted annual crops for harvest, during the development period, are grown in all districts studied except the Mississippi Gulf coast district and the Mobile district of Alabama. In the latter district, a filler crop of Satsuma oranges is common both in young orchards and in those of bearing age. In the Shreveport district of Louisiana, the practice of growing intercrops is continued in orchards of bearing age.

An analysis in the several districts studied shows considerable variation. The cost of operating bearing orchards of improved varieties, including interest charges, varied among districts from about \$20 to \$50 per acre. The pounds of pecans required to pay costs, including interest charges, ranged from approximately 80 to 185 pounds per acre. These cost differences are due to a number of reasons, such as wages of man labor, horse-work rates, use of fertilizer, amount of the joint costs that are chargeable to pecans, and the like. The latter is the greatest cost factor. A considerable portion of these costs, however, does not represent actual cash. This is particularly true on farms on which there are enterprises other than pecans. On farms of this class much of the man labor and use of implements and work stock

on the pecan enterprise represents additional use of these things not provided for by the other farm enterprises and therefore should not be classed as additional actual costs to the farmer. In the case of orchards under the management of caretakers, where all the operations are normally hired, the out-of-pocket costs are materially greater.

Pecan trees may bear a few nuts when 3 to 5 years old. Generally speaking, however, they do not come into commercial bearing until about the eleventh year. Yields of pecans have been disappointing even in a favorable year such as 1928. In that year the yield from a great many bearing orchards 15 to 19 years of age in many of the districts studied was not sufficient to cover costs. Among the chief factors that have apparently tended to curtail yields are: Neglect at some portion of the development period; the planting of varieties not adapted to the locality; and selection of a poor site with respect to the ability of the soil to meet the plant-food requirements of the tree. Other contributing factors are improper planting distances and the damaging effect of insect pests and fungous diseases.

Many plantings are set too close for the future welfare of the mature pecan orchard, and some of the trees will need to be removed after a few years of bearing life of the orchard. It is now generally conceded that pecan trees should not be set at the rate of more than 12 to the acre.

Of the fungous diseases affecting pecans, scab is of chief economic importance. Recent observations indicate that the scab fungus is becoming of economic importance on varieties that were formerly thought to be highly resistant, so that the widely followed practice of top-working susceptible varieties to so-called nonsusceptible varieties, may need to be abandoned, and systematic spraying or dusting of varieties subject to scab may need to be adopted.

The so-called improved varieties are largely marketed and distributed unshelled to consumers. The native seedlings are mostly shelled commercially. Improved pecans are sold by growers in various ways such as through a cooperative association, to independent shippers, through commission merchants, to buyers in the markets, or direct to consumers.

Prices of pecans f. o. b. shipping points in the area east of the Mississippi River have varied with varieties and quality and have averaged from 28 to 35 cents a pound for the crops of the period 1925 to 1930.

Reports from shippers indicate that in the 1928 season approximately 27 per cent of shipments from States that grow mostly improved varieties went to the North Atlantic States, 56 per cent to the North Central States, 9 per cent to the South Atlantic States, 6 per cent to the South Central States, and 2 per cent to the far West.

It was the general opinion of brokers, wholesalers, and retailers that domestic outlets could be developed to take care of an increasing annual production. Factors which were suggested as a means of improving pecan marketing conditions were: Greater organization and cooperation among growers and shippers; advertising; improvement of grading practices; greater control of distribution and a reduction in the quantity of miscellaneous consignments; and stabilization of prices in relation to the season's supply.

Improved varieties of unshelled pecans have, according to the 1929 survey, commanded a higher price in the markets than have other

nuts including walnuts and almonds. Most brokers and dealers believed that there will be some narrowing of this price differential.

The survey of pecan-marketing conditions in large cities and the chain-store and consumer survey indicated that the pecan is on sale much more generally in the well-to-do sections than in the poorer sections. Pecans are popular with consumers who are familiar with them. For the area covered in the survey probably less than half of the grocery stores handled pecans in the 1928 crop season. The greater number of the year's retail sales of unshelled pecans are made during the six weeks from the middle of November to the end of the year. The size of consumer purchases is frequently 1 pound. Retail prices of standard varieties other than Schley averaged close to 50 cents a pound in 1928-29.

Pecans that are shelled commercially are used by confectioners, bakers, ice-cream manufacturers, and salters in addition to being retailed to consumers direct. Shellers reported that the average yield of kernels as compared with the weight of the whole nuts is about 38 per cent.

The per capita supply of pecans in the United States (unshelled basis) for the five seasons ended in 1929 averaged 0.49 pound, compared with 1.08 pounds for English walnuts, and 0.73 pound for almonds.

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